PROCEEDINGS

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TORONTO,

BEING A CONTINUATION OF "THE CANADIAN JOURNAL OF SCIENCE, LITERATURE AND HISTORY."

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1887.

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1885–'86.

FIRST MEETING.

The First Meeting of the Session 1885-'86, being an open meeting and Conversazione, was held on Saturday, 21st November, 1885, the President in the Chair.

The President delivered an address, in which he announced the union of The Natural History Society with the Canadian Institute. He was followed by Mr. Brodie, President of The Natural History Society.

Mr. David Boyle read the following paper, entitled

THE ARCHÆOLOGICAL OUTLOOK.

Mr. President, Ladies and Gentlemen :

I take it that the purpose of the Council in asking me to write this paper was rather that I should lay before you what the Institute has done and proposes to do by way of recording archæological data and forming a collection illustrative thereof, than to attempt anything like a disquisition on the subject in its widest sense.

Still, it may be well to understand clearly just where we stand at the outset, and perhaps I can scarcely do better than tell you wha in my opinion, the study of archæology is *not.*

It is not merely the collecting of arrow-points, tomahawks, pipe-heads and pottery, at so much or at nothing apiece from farmers and other persons. It is not even the actual digging up of such objects

2

from the last resting places of Indian braves, nor is it the knowledge of where the largest number of specimens may be found. To do and to know these things is little more than stepping upon the verge of the study, and to prosecute work of this kind it is only necessary to possess a mania for bric-a-brac, some persistence, and a little money.

Persons who so conduct the work are collectors, and collectors only, and it is extremely doubtful whether their services are always of unmixed good. In so far as they further the preservation of specimens which otherwise might be lost, they answer a useful purpose, but when these people (forgetful of "ne sutor ultra crepidam,") undertake to ransack, to spoliate, to desecrate the graves of the Indians, for the purpose of satisfying a craving for curiosities, then their labors are not to be commended.

It is true that archæology includes the collection of illustrative specimens—without these the study would be somewhat devoid of interest, and the Canadian Institute aims at the formation of as large and as choice a collection as it is possible to make.

But archæology can only be said to possess any genuine public interest in so far as it is a handmaid to its elder sister, history, and it is the purpose of the Institute so to prosecute its researches in this line that its records and specimens may be mutually instructive.

If we take the whole Dominion as a field, the magnitude of the undertaking is too great either for our Society or for any similar organization to entertain for a single moment, and when it is clearly understood how much is involved in the prosecution of the task, it may be doubted whether even our own Province is not more than we can hope to work to the best advantage. I have no hesitation in saying, for my own part, that I think it is, and as it is not improbable that every other member of the Institute is of the same opinion, the question naturally arises, Why, then, undertake so much? The reply is twofold, but brief: First, because hitherto absolutely nothing has been done methodically or scientifically; and second, because the opportunities for doing anything are rapidly passing away, thousands having already gone for ever.

As I have already stated, it is not enough that we collect specimens. It is required in the first place that we make as full and complete a record as possible of every spot in the Province that gives or has given any indication of having been in any way identified with the life-history of our aborigines, and that with these should be collated every passage in the narratives of our early travellers for the purpose of identifying, as nearly as possible, those localities that are most intimately associated with the historical exploration of the country. Every mound, every village site, every camping-ground, every battle-field, every burial-pit, and every place upon which has been conducted the manufacture of clay vessels, pipes, arrow-points, or other articles, should be accurately measured, sketched, thoroughly explored and fully described.

Here, I may take the opportunity to express my pleasure in the knowledge that Mr. Arthur Harvey, a gentleman most deeply read in Canadian historic lore, and who takes more than a warm interest in our project, agrees with me that all such places as those named should be declared public property, and be made inviolate to all bric-a-brackers and pot-hunters until examined by some competent person appointed for that purpose.

I am afraid, however, that although this proposition is theoretically sound, and agrees with what has been done in Great Britain for the preservation of historical monuments, there would be too many opportunities and too many temptations to set such an enactment at defiance in this country, for us to expect much assistance by means of any legislation having this object in view.

Reports of progress should be made from time to time, and if we could afford to imitate our American cousins in their issue of beautifully illustrated documents, we might, as a matter of course, expect to arouse a much livelier interest among the people than if we present them with what they will be likely to regard as something akin to parliamentary blue-books.

Besides all this, the preservation and proper display of the illustrative objects will prove a matter of no small importance. These must be arranged in suitable cases and be properly classified for the purpose of comparing one with the other.

This, ladies and gentlemen, is, in brief, something like what we ought to do, or like what ought to be done, through one agency or another.

As already mentioned, the Canadian Institute has felt impelled to take action simply for the reason that no other organization or party seemed to evince any similar desire.

To prosecute the work in the way it should be prosecuted would necessitate the expenditure of from $5,000 to $6,000 annually for four or five years, and twice either of these sums might be employed to good advantage.

In April of the current year we issued a circular asking for information relative to this subject, in response to which many letters have been received, some expressive of sympathy with the project, some giving information regarding specimens, some promising assistance, and others extending hearty invitations to explore in promising localities.

In accepting one of these invitations from the Rev. T. T. Johnstone of Ancaster, I went, accompanied by Messrs. James Bain and Arthur Cox, F.R.S.A., to that township, which, from an aboriginal point of view, may almost be called *classic*—the township of Beverley. Here we collected a number of valuable relics, but owing to the ground having been seeded down we were unable to do more than examine the surface. Mr. Cox kindly sketched, on the spot, two of the most interesting localities, and I have been peculiarly fortunate in securing the services of an artistic friend to enlarge Mr. Cox's sketches for our use this evening, and I am sure you will agree with me that for the purpose in view the work has been admirably done.

On the farm of Mr. James Rae we were taken over a field of about five acres from which there have been collected since the time it was cleared no fewer than 200 iron tomahawks. Of course these are of European manufacture, but are of the type used by the early French and British occupiers to befool the red man in exchange for his peltries, or, it may be, simply for liberty to traverse the country unmolested.

In proof of the statement made by Mr. Rae regarding the number of tomahawks turned up here, we found by actual count more than 70 of these uncouth but murderous looking weapons mounted picturesquely along the top of the pickets forming one side of his garden fence. Under the stump of a tree in the field referred to, we unearthed several pieces of pottery, and as the tree itself (judging from an examination of the stump), must have been at least 150 years old, we have an approximation to a date which would correspond very closely with the appearance of the French in these western wilds. Why the tomahawks were left upon the ground by their possessors, is just one of these problems which, if capable of solution at all, we may hope to solve only by the aid of the cognate studies, history and archæology. The settlers in the neighborhood appear to have theorized a good deal about the question, the opinions, so far as we could gather, being pretty evenly divided between a great battle and a great epidemic.

What adds to the mystery is that only the other day I had a communication from a gentleman who formerly lived in the same township, and who informed me that within a few miles of the locality in question he had found, when clearing his farm, the most indubitable evidences of a formerly existing palisaded village upon the site of which he had picked up at least 300 of these iron tomahawks. It would be interesting to compare the weapons found on each place if only for the purpose of discovering whether they are of the same manufacture—both French, or, English and French respectively.

Three miles from Mr. Rae's farm we were driven to that of Mr. James Dwyer, where we were told there was an extensive ossuary. This was pointed out to us by Mr. Dwyer almost on the crest of a hill, forming the highest ground in the neighborhood for many miles all round, and within a few rods of the farm buildings. We found the dimensions of the pit, so far as could be ascertained by surface indications, to be about 25 feet in length and nearly half as wide. For the reason already assigned no examination could be made, but I visited the same place again this fall, my friend, the Rev. Mr. Johnstone, being also present, he having engaged the services of four stout men to handle spades and shovels. Nearly twice as many more hands came as volunteers, and in the course of the day we succeeded in exhuming a large number of valuable relics, including an almost perfect clay cup, four perfect clay pipes, a small, neatly-carved human head in stone, about one thousand pieces of white wampum, and many other specimens, all of which are on exhibition here this evening.

I should not omit to mention that at the foot and in the rear of the hill on which this burial-pit or ossuary is situated there is a large piece of freestone which has evidently been used by the Indians for grinding and polishing purposes. The proprietor has promised to present it to our museum.*

For other valuable contributions we are indebted to the generosity of Mr. Baldwin Jackes, Druggist, 351 Yonge street, Mr. Andrew Elvins, Tailor, Arcade, Mr. Loughead, of the township of Sunnidale,

* Since presented to us.

and to the York Pioneers. This Society has just made the Institute custodian of a good collection of several hundreds of specimens, and now the demand is for cases in which to preserve all that is in our possession.

Although we have to deplore that no records have been kept of numerous historic sites, the very traces of which have become wholly obliterated by the plough and otherwise, it is not yet too late to do *something.* From the letters I have received during the summer, it appears that there are still many localities that it would be of immense importance to explore before either the farmer or the curiosity-man thinks it desirable, for his own purposes, to begin the work of levelling or burrowing.

A recent communication to the *Mail* points out that in the valley of the Rainy River there is a series of mounds, few of which have as yet been disturbed. The writer, Mr. Chas. N. Bell, of Winnipeg, urges the expediency of having these scientifically treated with all convenient promptitude, but the probability is that nothing will be done until Tom, Dick and Harry, with all their relatives, have so disfigured the landscape and despoiled the deposits as to render any intelligent examination an impossibility.

To my mind these monuments, forming, as in all likelihood they do, the very outposts of the territory occupied by the Mound Builders, possess more than ordinary interest. We know their southern limit and their central range, and who can say that the exploration of those in the extreme north may not prove, like a third term in proportion, what is a necessity, by way of enabling us to arrive at a solution of the problem—the problem in this case being: Who were the people that erected these immense earth heaps, and did they move from the north southwards or *vice versa* ?

At the very least we should have a survey made of these ancient works, with ground-plans, perspective drawings, and accurate descriptions.

Near St. Thomas there is said to be another mound, and I have no doubt, if I may judge from letters in my possession, that there are several other similar structures in various parts of the country. So far as private collections are concerned we have reason to be thankful that a few good ones exist, and it is not improbable that *some* of them at any rate may be secured for a provincial museum as soon as it is within our power to purchase.

To conclude, ladies and gentlemen, let me repeat that the work to be done is of such magnitude that without a considerable expenditure of time and money it will be quite out of the question to perform it in anything like a thorough or satisfactory manner. It should be either aided or wholly executed by the Dominion or Provincial Government. There can be no doubt that under the auspices of the former there would be immense and peculiarly advantageous opportunities, but in that case the collection formed would centre at Ottawa, which can scarcely be pronounced the educational or literary capital of the Dominion.

We shall hail with delight any efforts made towards the prosecution of archæological research, from a really national standpoint, but when we regard our own Province (and so regard it we must) as the most important of these colonies, and when we recognize the even more apparent fact that Toronto is the principal literary and scientific city in the Province, if not in the whole confederation, we naturally and quite unselfishly desire to see the outcome of public effort placed where it will do the most good.

But quite independent of any Dominion scheme that may or may not be consummated, Ontario owes it to herself as the richest, most populous, and most advanced Province, to work her own territory to the best advantage in this respect, and to form an archæological museum in the City of Toronto—the Queen City—the City of Schools—that will not only redound to our credit as an intelligent people, but that will attract students from distant lands, and enable the scientific investigator of the future to thank heaven for the somewhat tardy foresight that has provided for him, (figuratively speaking) a feast of fat things.

SECOND MEETING.

The Second Meeting was held on Saturday, 28th November, 1885, the President in the Chair.

It was moved by Dr. E. A. Meredith, seconded by Dr. George Kennedy,

"That the members of the Canadian Institute cannot allow this, their first meeting since the death of John Milne Buchan, M.A., to pass without placing on record the expression of their deep regret at the loss which the Society has sustained in his removal from amongst them, in the prime of life, and when, apparently, he had before him many years of honorable and useful work. They gratefully remember the marked progress which the Institute made during the two years of his Presidency, the earnest and active interest which he took in all its proceedings, and the kindliness and sympathy which characterized all his relations with his fellow-workers in the Institute. They desire also to express their sincere and heartfelt sympathy with Mr. Buchan's widow and family, in their great and sudden bereavement."

The President, in declaring the motion carried, expressed his deep sense of the loss which had befallen the Institute, and his personal sympathy with the words of the resolution.

The following list of donations and exchanges received since the annual meeting was read :

I.—CANADIAN.

1. Valuation Tables at Compound Interest, by Walter S. Andrews. (From the author.)
2. Monthly Weather Review, Dominion of Canada, April, May, June, July, August, September and October, 1885—7 Nos.
3. Proceedings and Transactions of the Nova Scotia Institute of Natural Science, Vol. VI., Part II., 1883-84.
4. Proceedings and Transactions of the Royal Society of Canada, Vol. II., 1884.
5. The Canadian Entomologist, Vol. XVII., Nos. 4, 5, 6, 7, 8, 9, 10—7 Nos.
6. The Canadian Practitioner, Vol. X., Nos. 6, 7, 8, 9, 10, 11, June—Nov., 1885—6 Nos.
7. Monthly Health Bulletin of Ontario, for March and April, May, July, 1885—3 Nos.
8. Geological and Natural History Survey of Canada :
   (1) Report of Progress for 1882-83-84.
   (2) Maps to accompany the above Report—4.
   (3) Ten Sheets Geological Map of New Brunswick, Quebec and Prince Edward Island.
   (4) Twenty-four Sheets Geological Map of Cape Breton.
9. The Extinct Cuttle-Fish of the Canadian North-West, by A. McCharles.
10. Statutes of Ontario, 48th Victoria, 1885.
11. In Memoriam—George Etienne Cartier. Presented by the author. G. W. Wicksteed, Esq., through Dr. E. A. Meredith.
12. Number and Nature of the Vowel Sounds, by M. L. Rouse, Esq.
13. The Canadian Record of Science, Vol. I., Nos. 3 and 4.

14. Fifteenth Annual Report of the Entomological Society of Ontario.
15. Collections of the Nova Scotia Historical Society, Vol. IV., 1884.
16. Ancient Rock Inscriptions on the Lake of the Woods, by A. C. Lawson, M.A.
17. Le Naturaliste Canadien, Vol. XV., Nos. 1, 3, 4, 5.
18. Sessional Papers relating to the Canadian Pacific Railway, 1882–83.
19. Toronto Water Works—Annual Report of the City Engineer and Manager for 1883–84.
20. The Innervation of the Heart of the Slido Terrapin (Pseudemys Rugosa) by T. Wesley Mills, M.A.
21. The Secretion of Oxalic Acid in the Dog under a varying diet, by the same.
22. Memorial Volume—Toronto Past and Present, 1834—1884. From the Mayor and Corporation.
23. Catalogue of Books presented to the Toronto Public Library by John Hallam. Esq. From the Public Library Board.
24. Annual Report of the Bureau of Industries, Province of Ontario, 1884, by Mr. A. Blue.

Total Canadian, 48 numbers and 38 maps.

II.—UNITED STATES EXCHANGES.

1. The School of Mines Quarterly, Columbia College, New York.
   Vol. III., Nos. 2, 3, 4.
   " IV., " 2, 3, 4.
   " V., " 1, 2, 3, 4.
   " VI., " 1, 2, 3, 4.
   " VII., No. 1.
2. The American Journal of Science, for May, June, July, August, Sept., Oct., Nov., 1885.
3. Science, Vol. V., Nos. 118, 119, 120, 121, 122, 123, 124, 125. Vol. VI., Nos. 126—146, 147.
4. Journal of the New York Microscopical Society, Vol. I., Nos. 4—7.
5. Proceedings of the American Academy of Natural Sciences of Philadelphia, Parts I. and II., 1885.
6. Memoirs of the Boston Society of Natural History, Vol. III., No. XI.
7. Proceedings of the Boston Society of Natural History, Vol. XXIII., Part I.
8. From the U. S. Geological Survey:
   (1) The Copper-Bearing Rocks of Lake Superior, by Prof. R. D. Irving.
   (2) Third Annual Report of the U. S. Geological Survey, 1881–82, by the Director, J. W. Powell.
   (3) Geology of the Comstock Lode and the Washoe District, by George F. Becker.
   (4) Atlas to accompany the same.
   (5) Contributions to the Knowledge of the Older Mesozoic Flora of Virginia, by William Morris Fontaine.
   (6) Silver-Lead Deposits of Eureka, Nevada, by Joseph Story Curtis.

(7) Palaeontology of the Eureka District, by Charles Doolittle Walcott.

(8) Fourth Annual Report of the U. S. Geological Survey, 1882-83.

9. Harvard University Bulletin, Vol. IV., Nos. 31 and 32.

10. The Pennsylvania Magazine of History and Biography, Vol. IX., Nos. 1, 2, 3.

11. Proceedings of the Worcester Society of Antiquity, Nos. XXI. and XXII.

12. Annals of the New York Academy of Sciences, Vol. III., Nos. 5—8. (3)

13. (1) Historical Collections of the Essex Institute, Vol. XXI., Nos. 7—12 ; Vol. XXII., Nos. 1—3. (3)

(2) Bulletin of the Essex Institute, Vol. XVII., Nos. 1—3.

14. Catalogue of the Library of the Peabody Institute of the City of Baltimore, Part II., D.—G.

15. Journal of Speculative Philosophy, Vol. XVIII., No. 4 ; Vol. XIX., Nos. 1, 2.

16. Journal of the Franklin Institute, for June, July, August, Sept., Oct., Nov., 1885.

17. Bulletin of the Brockville Society of Natural History, No. 1.

18. (1) First Biennial Report of the Secretary of the State Board of Agriculture of the State of Michigan, from Sept. 1st, 1880, to Sept. 30, 1882.

(2) Twenty-second Annual Report of the same from Oct. 1st, 1882, to Sept. 30, 1883.

19. Transactions of the American Society of Civil Engineers, April, May, June, July, and August, Sept., Oct., 1885.

20. Eighteenth Annual Report of the Peabody Institute, of the City of Baltimore.

21. Appleton's Literary Bulletin, Vol. IV., May to October—3 Nos.

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26. Bulletin of the Museum of Comparative Zoölogy at Harvard College, Vol. XI., No. 11 ; Vol. XII., No. 1.

27. The International Standard, July, 1885.

28. Transactions of the Sixteenth and Seventeenth Annual Meetings of the Kansas Academy of Science, 1883-84, Vol. IX.

29. The Geological and Natural History Survey of Minnesota, 1872—1882, Vol. I. Geology, by N. H. Winchel, assisted by Warren Upham.

30. Bulletin of the Minnesota Academy of Natural Sciences, 1880-82, Vol. II., No. 5.

31. (1) Bulletin of the Illinois State Laboratory of Natural History, Vol. II., Article III., Part I.

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(3) Fourteenth Report of the State Entomologist of the Noxious and Beneficial Insects of the State of Illinois. S. A. Forbes. 1884.

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34. (1) The Public Domains, with Statistics, U. S. A.
 (2) Land Laws of the United States, Local and Temporary, 2 Vols.
 (3) Existing Land Laws. (From the Hon. the Secretary of the Interior, Washington, D. C.
35. (1) Smithsonian Report for 1876.
 (2) Smithsonian Contributions to Knowledge, Vol. XXIV. and XXV.
36. Historical Fallacies regarding Colonial New York. (From the Oneida Historical Society.
37. (1) Proceedings of the Rhode Island Historical Society, 1883-84; 1884-85.
 (2) Same, New England Almanac, by Amos Perry. (Providence.)
38. From the Bureau of Steam Engineering, Navy Department, Washington, D. C.:
 (1) Extract from Annual Report of the Chief of Bureau of Steam Engineering, 1869.
 (2) Report made to the Bureau, Nov. 5, 1880.
 (3) " " " Aug. 9, 1882.
 (4) " " " March 3, 1883.
 (5) " " " April 6, 1883.
 (6) Annual Report for 1884.
39. Bulletin of the American Museum of Natural History, Central Park, New York, Vol. I., No. 6.
40. Johns Hopkins University Circulars, Vol. IV., 42; Vol. V., 43, 44.
41. Magazine of American History, Nov. and Dec., 1885.
42. Proceedings and Collections of the Wyoming Historical and Geological Society, Vol. II., Part 1.
43. Journal of the Cincinnati Society of Natural History:
 Vol. III., Nos. 1, 3, 4.
 " IV., V., VI., VII.
 " VIII., Nos. 1, 2, 3.
44. Bulletin of the American Geographical Society, 1885, No. 1.
45. Proceedings of the American Association for the Advancement of Science:
 Vol. 31, Parts 1, 2; Vol. 32.
 " 33, " 1, 2, 1882-83-84.
46. Abstract of Proceedings of the New York Academy of Anthropology for 1884.
47. Intimate Connection between Gravitation and the Solar Parallax, by Thomas Bassnett. (Per Mr. M. L Rouse.)
48. Transactions of the Kansas State Historical Society, Vols. I. and II.
49. Proceedings of the Colorado Scientific Society, Vol. 1.—1883 and 1884.
50. From the Georgia Historical Society:
 (1) Reply to Resolution of Georgia Historical Society, by Rt. Rev. Stephen Elliott—Feb. 12, 1866.
 (2) Eulogy of Rt. Rev. Stephen Elliott—1867.
 (3) Reminiscences of Service with the First Volunteer Regiment of Georgia, in Charleston Harbour—1863.

(4) & (5) Constitution and By-Laws of Georgia Historical Society—1871 ; ditto, 1883.

(6) Wilde's Summer Rose, by A. Barclay—1871.

(7) In Memoriam—Edward Jenkins Harden—1873.

(8) Dedication of Hodgson Hall, Feb. 14, 1876.

(9) Sergeant William Jasper, Jan. 3, 1876.

(10) The Georgia Historical Society—Fits oundertrno,andaPs Friends, Feb. 14, 1881.

(11) A Suggestion to the Origin of the Plan of Savannah, Sept. 7, 1885.

51. The American Naturalist, Vol. XIX., No. 11, for Nov., 1885. (From the publishers.)

52. The Library of Cornell University, Vol. I., No. 12.

Special Lists—No. I. Mathematics.

Total United States, 189 numbers.

III.—GREAT BRITAIN AND IRELAND.

1. (1) Minutes and Proceedings of the Institution of Civil Engineers, Vols. LXXIX., LXXX., LXXXI., LXXXII.

(2) Charter By-Laws and List of Members of the Institution of Civil Engineers, June 3, 1885.

(3) Heat and its Mechanical Applications. Lectures, I. C. E., 1883–84.

(4) Brief Subject—Index.—I. C. E. Vol. LIX. to LXXXII. ; Sessions 1879–80 to 1884–85.

2. Journal of the Transactions of the Victoria Institute, Vol. XVIII., No. 72 ; Vol. XIX., Nos. 73, 74.

3. (1) Report and Transactions of the Birmingham Natural History and Microscopical Society, for 1883.

(2) The Midland Naturalist, (N.S.) Vol. VII., Nos. 73—84 ; Jan.—Dec., 1884 ; Vol. VIII., Nos. 85—95 ; Jan.—Nov., 1885.

(3) Report and Transactions of the Birmingham Natural History and Microscopical Society, Nos. 3, 4, 5, for 1880, 1881, 1882.

4. Archæologia Aeliana, Part 29, Vol. X., No. 3 ; Part 30, Vol. XI., No. 1.

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6. Proceedings of the Royal Geographical Society, (N.S.) Vol. VII., Nos. 5, 6, 7, 8, 9, 10, 11. May to Nov., 1885.

7. Transactions and Proceedings of the Botanical Society of Edinburgh, Vol. XVI., Part 1.

8. Journal of the Anthropological Institute of Great Britain and Ireland, Vol. XIV., No. 4 ; Vol. XV., Nos. 1, 2.

9. Trübner's American, European and Oriental Literary Record, Nos. 209—212, 215—216.

10. Journal of the Linnean Society of London :

(1) Botany, Vols. XX. and XXI., Nos. 130—137.

(2) Zoölogy, " XVIII. and XIX., Nos. 101—108.

(3) Proceedings of the Linnean Society of London. March—Oct., 1883.

(4) List of the Linnean Society of London, 1883, 1884, 1885.

11. Proceedings of the Royal Colonial Institute, Vol. 16, 1884–85.

12. Journal of the Royal Microscopical Society, Ser. II., Vol. V., Pts. 3, 4, 5.

13. (1) Proceedings of the Cambridge Philosophical Society, Vol. V., Parts 1, 2, 3.
    (2) Transactions of the Cambridge Philosophical Society, Vol. XIV., Part 1.
14. (1) Proceedings of the Royal Society of Edinburgh, Vols. XI. and XII., 1881—83.
    (2) Transactions of the Royal Society of Edinburgh, Vol. XXX., Parts 2 and 3 ; Vol. XXXII., Part 1.
15. Transactions of the Manchester Geological Society, Vol. XVIII., Parts 8, 9, 10.
16. Quaritch's Catalogues, Nos. 362, 363, 364.
17. Proceedings of the London Mathematical Society, Nos. 237—249.
18. Journal of the Quekett Microscopical Club, Ser. II., Vol. II., Nos. 12, 13.
19. Ocean and Air Currents, by Thomas D. Smellie.
20. Proceedings of the Royal Physical Society of Edinburgh :

Vol.	I., Part 2.	(1856–58.)
"	IV., Parts 1, 2, 3.	(1874–78.)
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"	VI.,	(1880–81.)

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22. Annual Report of the Leeds Philosophical and Literary Society for 1884–85.
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24. Proceedings of the Philosophical Society of Glasgow :

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"	III.,	"	1—6.
"	IV.,	"	1, 2.
"	IX.,	"	1, 2.
"	XI.,	"	2.
"	XIII.,	"	1.
"	XV.		

25. Transactions of the Edinburgh Geological Society, Vol. IV., Part III. ; Vol. V., Part 1.
26. Proceedings of the Royal Society, Vols. XXXVI.—XXXVIII., Nos. 228—238.
27. (1) Scientific Proceedings of the Royal Dublin Society, Vol. IV. (N. S.) Parts 5 and 6.
    (2) Scientific Transactions of the Royal Dublin Society, Vol. III. (Series II.) Parts 4, 5, 6.
28. (1) Transactions of the Geological Society of Glasgow :

Vol.	I.,	Parts	1, 2.
"	II.,	"	2, 3.
"	III.,	"	1, 2.
"	IV.,	"	2, 3.
Vol.	V.,	Part	1.

Vols. VI. and VII, 1876—'84.
Palæontological Series, Part I.

    (2) Catalogue of the Western Scottish Fossils.

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Total Great Britain and Ireland, 178 numbers.

IV.—BRITISH COLONIES, (EXCLUSIVE OF CANADA.)

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   (2) Journal of the Asiatic Society of Bengal, (N.S.) Vol. LIII., Part 1, Special Number.

   Part II., No. III., 1884.

   Vol. LIV., Part I., Nos. 1 and 2, 1885.

2. Papers and Proceedings of the Royal Society of Tasmania, for 1883 and 1884.
3. (1) Memoirs of the Geological Survey of India.

   Palæontologia Indica :

   Series IV., Vol. I., Part 4.

   " X., " III., Parts 4, 5 and 6.

   " XIV., " I 3, Part 4.

   (2) Records of the Geological Survey of India, Vol. XVIII,, Parts 2 and 3, '85.
4. Transactions and Proceedings of the New Zealand Institute, Vol. XVII., 1884.
5. Journal and Proceedings of the Royal Society of New South Wales, for 1883, Vol. XVII.
6. Proceedings of the Royal Society of Queensland, Vol. I., Parts 1—4, 1884-85.

Total British Colonies, 23 numbers.

V.—FOREIGN EXCHANGES.

1. Bulletin de la Société d'Anthropologie de Paris, Tome Huitieme (III Série), Fascicules, 1, 2, 3, Janvier à Juillet, 1885.
2. Cosmos di Guido Cora, Vol. VIII., No. 1—7, 1884.
3. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, Novembre et Décembre, 1884 ; Janvier, Février, Avril, Mai et Juin, 1885.
4. Verhandlungen des Vereins für Naturwissenschaftliche Unterhaltung zu Hamburg, 1878—1882. Band V., 1883.
5. Bulletin de la Société Géologique de France :

   3 Série, Tome I., No. 1.
   " " III., " 3.
   " " IV., " 6.
   " " V., " 7.
   " " VII., " 3, 7, 8, 9, 10, 11.
   " " IX., " 7.
   " " XI., " 2.
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9. (1) Sitzungsberichte und Abhandlungen der Naturwissenschaften Gesellschaft, Isis in Dresden, 1884. Juli bis December.

(2) Festschrift der Natur. Gesell. Isis, 14 Mai, 1885.

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11. (1) Verhandlungen der K. K. Geologischen Reichsanstalt, 1884, Nr. 1 bis 18.

(2) Jahrbuch der K. K. Geologischen Reichsanstalt, 1884, XXXIV. Band, 4 Heft; XXXV. Band, 1 Heft, 1885.

(3) Verhandlungen, 1885, Nr. 1—7. (Wien.)

12. Bulletin de la Société Royale Belge de Géographie, 1884. Nos. 3, 4, 5, 6.

13. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusts Universität zu Göttingen, 1884. No. 1—13.

14. (1) Sitzungsberichte der mathematisch-physikalischen Classe der k. b. Akademie der Wissenschaften zu München, 1884, Hefte I., II., III., IV.

(2) Sitzungsberichte der philosophisch-philologischen und historischen Classe der k. b. Akademie der Wissen, zu München, 1884, Hefte I., II., III., IV., V., VI.

(3) Gedachtnissrede auf Theodor L. W. von Bischoff.

(4) Rudolph Agricola.

(5) Franz von Kobell.

(6) Almanach der k. b. Akademie der Wissen. zu München für 1884.

15. Annales des Mines, Huitiéme Série, Tome VII., 1, 2, 3, Livraisons de 1885.

16. Correspondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, XVI. Jahrgang, Nr. 4, 5, 6, 7, 8, 9. April bis September, 1885.

17. Mittheilungen der deutschen Gesellschaft für Natur. und Volkerkunde Oestasiens 32, 33, Hefte Mai, u. August, 1885.

18. Acta Universitatis Lundensis, Tome XIX. to XX., 1882–83, 1883–84.

(1) Theologi.

(2) Philosophi, Språkvetenskap och Historia.

(3) Rätts och Statsvetenskap.

(4) Mathematik och Naturvetenskap. (8 numbers.)

(5) Lunds Universitets—Bibliotek Accessions Katalog, 1884.

19. Le Globe, 4e Sèrie, Tome IV.

Bulletin No. 2.

20. Boletin de la Academia Nacional de Ciencias en Córdoba. (Republica Argentina), Tomo VII., Entrega 4a.

21. Annaes da Escola de Minas de Ouro Preto, Nos. 1 and 2.

22. Sur la Valeur Morphologique de la Trompe d'Eustache par M. le Professeur Paul Albrecht, Bruxelles.

Two other pamphlets by the same.

23. Schriften der physikalisch-ökonomischen Gesellschaft i Pr. fünfundzwanzigster Jahrgang, erste und Zweite Abtheilungen.
24. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, Sitzungen, 12, 17 Januar, 21 Februar, 21 März, 18 April, 16 Mai.
25. Annuaire Gèologique Universel et Guide du Gèologique, 1885.
26. Forhandlinger i Videnskabs-Selskabet i Christiania, 1884.
27. Memoirs of the University of Tokio, No. 11. A System of Iron Railroad Bridges for Japan, by J. A. L. Waddell, C.E , in 2 Vols.
28. Publications de la Société d'Ethnographie, Paris.
29. Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig, Mathematisch-Physische, Classe 1884 and 1885, I., II.
30. Bulletin de la Société Royale de Botanique de Belgique, Tome 24me. Fas. 1er, 1885.
31. Archivio per l'Antropologia e la Etnologia, Quindicesimo Volume. Fas. Primo, Firenze.
32. Magnetische und Meteorologische Beobachtungen an der K. K. Sternwarte zu Prag, 1884. 45 Jahrgang.
33. Archives Néerlandaises des Sciences Exactes et Naturelles. Tome XIX. Nos. 3, 4, 5 ; Tome XX., 1, 2.
34. Verhandlungen der K. K. zoologisch-botanischen Gesellschaft in Wien, XXXIV. u. XXXV., Bände.
35. Anales del Museo Nacional de México, Tomo III., Entrega 7*a*, 1885.
36. Bijdragen tot de Dierkunde, Nos. 10, 11, 12, from La Société Royale de Zoologie "Natura Artis Magistra."
37. Mittheilungen der k. k. Geographischen Gesellschaft in Wien, XXXVII. Band.
38. Bulletin de la Société Royale Belge de Géographie Nos. 4, 5, 6, 1884. Juillet–Octobre.
39. Bulletin de l'Académie Royale de Copenhague, 1884, Nos. 2, 3 ; 1885, No. 1.
40. 24 und 25 Bericht über die Thätigkeit des Offenbacher Vereins für Naturkunde, vom 4. Mai, 1882, bis 11 Mai, 1884.
41. (1) Jaarboek van de K. Akademie van Wetenschappen, 1883.
    (2) Verslagen en Mededeelingen der K. Akademie van Wetenschappen, Deel XIX. Stuk 1, 2, 3.
    (3) Naam en Zaakredgister of de Verslagen en Mededeelingen. Deel 1—XX.
42. (1) Kongliga Svenska Vetenskaps-Akademiens Handlingar, 3 Vols., Bd. 18, 19-1-d 2, 1880-1881.
    (2) Bihang Bd. 6. 1, 2 ; 7 : 1, 2 ; 8 : 1, 2 ; 1880—1883. 6 Vols.
    (3) Ofversigt af K. Vetenskaps Akademiens Forhandlingar, 38, 39, 40.
    (4) Lefnadsteckningar 5, Band 2, Häfte 2.
    (5) Beskyddare, 1882, 1883, 1884.
43. (1) Sitzungsberichte der k. k. Gesellschaft der Wissenschaften zu Prag, 1882, 1883, 1884.
    (2) Kalousek Geschichte, I.
    (3) Studnicka Bericht, I.
    (4) Generalregister, 1874—1884.
    (5) Verzeichniss der Mitglieder.

44. Arbók hins Islenza Fornleifafélags, 1884–85, Reykjavik.
45. Yahrbücher der K. K. Central Anstalt für Meteorologie und Erdmagnetismus, Wien, 1883. XX. Band.
46. Bullettino della Sezione Fiorentina della Societá Africana d'Italia, Volume I., Fascicoli 1, 2, 3, 4.

Total Foreign, 207 numbers.

Summary Compared with the Number Received During the Same Period of Last Year.

	1884.	1885.
Canadian	36	48 and 38 maps.
United States	75	189
Great Britain and Ireland	63	178
British Colonies, exclusive of Canada	20	23
Foreign	93	207
Total	287	645
Increase		358

The following were elected members :—F. T. Shutt, B.A., J. H. Cameron, B.A., J. H. McGeary, B.A., Edward Farrar, Esq., W. S. Andrews, Esq., Dion C. Sullivan, LL.B., G. A. Dickson, M.A.

The President presented the following paper, by Professor Hutton, entitled

CLASSICAL NOTES.

In Demosthenes' first speech against Aphobus occur the following words (815) :

"*εἰς γὰρ τὴν συμμορίαν ὑπὲρ ἐμοῦ συνετάξαντο κατὰ τὰς πέντε καὶ εἴκοσι μνᾶς πεντακοσίας δραχμὰς εἰσφέρειν.*"

Compare the second speech, 836, 837, 838 ·

"*ἡγεμόνα με τῆς συμμοριάς καταστήσας οὐκ ἐπὶ μικροῖς τιμήμασιν ἀλλ' ἐπὶ τηλικούτοις ὥστε κατὰ τὰς πέντε καὶ ἔικοσι μνᾶς πεντακοσίας εἰσφέρειν . . . . οὐδὲ ταῦτα ἀποφαίνοντες ἐξ ὡν τιμησάμενοι τὰς ἐισφορὰς εἰσεφέρετε . . . . . ἀλλὰ μὴν ἐκ γε τῆς οἰκίας καὶ τῶν τεττάρων κὰι δέκα ἀνδραπόδων καὶ τῶν τριάκοντα μνῶν τὴν εἰσφορὰν οὐχ οἷον τε γενέσθαι τοσαύτην, ὅσην ὑμεῖς συνετάξασθε πρὸς τὴν συμμορίαν.*"

In all these passages *εἰσφορὰ* and *εἰσφέρειν* mean *not* a special property tax and the payment of such, which is their usual meaning, but the taxable value of property and the return of such to the commissioners. "They agreed to return as taxable 500 drachmæ (or five minæ) for every twenty-five minæ": *i. e.*, they agreed to return the property as taxable upon one-fifth of its amount, *i. e.*, as belonging to the first class.

The five hundred drachmæ therefore is not the amount paid, but the amount returned as taxable out of every twenty-five minæ: the amount actually paid out of every twenty-five minæ would be, of course, a fraction much smaller than this one-fifth: (probably not more, as a general thing, than five per cent. on this fifth, or one per cent. on the whole. See Kennedy's Demosthenes, Vol. I., Appendix 4, p. 309, note).

These passages are fully explained by Boeckh (Public Economy of Athens, Vol. II., pp. 285–288, and again 316). Schaefer, however, reduces them to nonsense by taking *εἰσφέρειν* in its ordinary sense, of paying a property tax. Kennedy, of course, translates correctly; but he does not notice the difficulty. The school edition of Penrose is correct, and gives the reference to Boeckh; but, unless its readers turn up Boeckh for themselves, they will not find that the force which Demosthenes attaches to *εἰσφέρειν* and *εἰσφορὰ* here is merely anomalous, and due apparently to carelessness and the desire for brevity. Liddell and Scott (the last edition included) have missed these passages, and recognize the two words only in their ordinary sense.

Plato, Republic IX., chap. 9, 583 B.

"*ταῦτα μὲν τοίνυν οὕτω δύ' ἐφεξῆς ἂν εἴη καὶ δὶς νενικηκὼς ὁ δίκαιος τὸν ἄδικον· τὸ δὲ τρίτον ὀλυμπικῶς τῷ σωτῆρι τε καὶ τῷ Ὀλυμπίῳ Διὶ ἄθρει ὅτι καὶ κ.τ.λ.*"

The common explanation of this passage in Stallbaum and Bekker is satisfactory enough. The first libation at the Greek banquet was to Olympian Zeus; the second to the heroes or to Earth; the third to Zeus the Saviour. But the champion at Olympia would naturally couple with his last libation the double title of Zeus—the Olympian no less than the Saviour—for the omen's sake.

In the same way for Plato's just man, who is compared to an athlete of Olympia contending in three contests against his rival, the third libation poured by his friends is poured to Olympian Zeus.

To the references given in Stallbaum and Bekker it is worth while to add a very close parallel which they have overlooked. In

Pindar's fifth Isthmian ode (the sixth according to the other arrangement) occurs an exact counterpart:

> "εἴη δὲ τρίτον
> σωτῆρι πορσαίνοντας Ὀλυμπίῳ Αἴγιναν κάτα
> σπένδειν μελιφθόγγοις ἀοιδαῖς." (10-12).

"May it be mine to offer a third bowl to Olympian Zeus the Saviour, and pour over the land of Ægina a libation of honey-sweet song."

Pindar has sung one ode (Nem. V.) for one member of his hero's family; and this is the second and celebrates an Isthmian victory. There remains therefore yet to be won victory at Olympia. Accordingly the poet prays that it may be his lot to pour a third libation-ode, in honour of Zeus, "Saviour and Olympian." "Saviour" because to Zeus by this title the third libation is poured. "Olympian" because the victory which he hopes to celebrate is to be won at Olympia.

NOTES ON JUVENAL AND HORACE

Juvenal, Sat. XIV., 281–283.

> Grande operae pretium est, ut tenso folle reverti
> Inde domum possis tumidaque superbus aluta
> Oceani monstra et juvenes vidisse marinos.

Such is the form in which this passage appears in the first edition of Mr. Mayor, and in the editions of Jahn, Heinrich, Ruperti, Häckermann, Stocker, and Lemaire; and in the second edition of Mr. Escott.

Of these editors the last two only have translated the passage: the former correctly, the latter, misled by the punctuation, quite wrongly. Lemaire paraphrases "operae pretium est vidisse . . . unde redeant," making *vidisse* depend on *operae pretium est.* Mr. Escott translates, "you have an ample reward *in that* you are able to return home with swelling purse," etc. The others pass by the passage in silence. In whatever sense they took it, their punctuation, at any rate, is indefensible.

Better is the punctuation of Achaintre's and of the Delphin edition, which place commas at *est, possis, aluta,* and *monstra*; and better still the text of Mr. Simcox, who punctuates at *est, possis,* and *aluta* only. But, even so, the construction is obscured by the punctuation; and the Delphin editor seems to have missed it: he paraphrases "magnum quid fecisse putas si dives redeas," and again, "si videas et redeas," as though *reverti* and *vidisse* were co-ordinate, and both dependent on *possis*. The punctuation of Mr. Macleane (a comma at *possis* only) seems to point yet more directly to this misunderstanding.

The true construction is obvious enough after a glance. The whole clause from *ut* to *aluta* is parenthetic and should stand by itself: *vidisse* is the subject of *operae pretium est.*

> Grande operae pretium est —— ut tenso folle reverti
> Inde domum possis tumidaque superbus aluta ——
> Oceani monstra et juvenes vidisse marinos.

"A precious reward this for all your trouble, to have faced the monsters of the deep and the mermen, and all for the sake of returning home with full purse and the pride of stuffed money-bags."

i. e. It is not worth your while to face the great leviathan for the sake of a full purse.

In his second edition Mr. Mayor has altered his punctuation correctly and introduced a comma at *aluta*; but his notes are still silent. Yet the fact that previous to this only one edition, and that the most modest of all, the school edition of Mr. Prior, had printed the passage correctly (Prior also added a correct translation), seems to show that a note is not unnecessary.

Horace, Epistle I., 1, lines 13–19.

> Ac ne forte roges quo me duce quo lare tuter,
> Nullius addictus jurare in verba magistri
> Quo me cunque rapit tempestas deferor hospes.
> Nunc agilis fio et mersor civilibus undis,
> Virtutis verae custos rigidusque satelles:
> Nunc in Aristippi furtim praecepta relabor
> Et mihi res non me rebus subjungere conor.

The difficulty of the passage lies in the last two lines. What is the connection between them? The most natural and, I believe, the correct interpretation makes the last an amplification of the line before, and a definition at once of "Aristippi praecepta," and of the Stoic creed contained in lines 16 and 17.

"At one time," says Horace, "I am all for action, and I plunge into the ocean of public life the guardian and stiff-necked champion of straight-laced righteousness; at another time I fall away unconsciously to Aristippus' maxims, and try to make the world serve me, instead of serving it."

That is to say, Horace is contrasting the Stoic, who is a missionary and lives not for himself but for the world, and who accordingly is a man of action and of affairs, with the Cyrenaic voluptuary, who sacrifices everything for himself, and who regulates his dealings with the world by the amount of pleasure to be extracted for himself therefrom. The latter also, if it so chance, will be a man of action and affairs; but if he is, it is only because he gets more enjoyment from the life of action than from the quietist's life. Like the Christian, but in a very different sense, the Cyrenaic is "in the world but not of it."

So understood the passage is coherent and simple. Unfortunately a good deal of misplaced ingenuity has been spent upon it till its simplicity has been obscured. Meineke and others even wished to transpose lines 19 and 17, and read:

> Et mihi res non me rebus subjungere conor
> Virtutis verae custos rigidusque satelles,
> Nunc in Aristippi, etc.,

while Dobree secured the same result awkwardly, though with less violence, by changing *non* to *nunc*. They could not understand how a Stoic, whose aim was to be independent of the world, could be said to submit himself to it. And even Orelli escapes the same conclusion only by denying that the last line contains any reference to Stoicism: the last line, he seems to say, is added to qualify and minimize the preceding. Horace proclaims himself a Cyrenaic, but hastens to add that, though he does not despise the good things of this world, he is yet no slave to them. Interpreted to refer to Stoicism, the last line is (he says) inconsistent with one of the articles of the Stoic creed: *οὐ δεῖ προσθήκην αὐτον τῶν ἐκτὸς γίγνεσθαι ἀλλ' ἐκεῖνα αὐτῷ προσθεῖναι* (Epict: 1, 4, 49). The inconsistency that Orelli sees here is imaginary. Epictetus is saying that the Stoic is not dependent upon worldly advantages or the creature of them: Horace is saying that the Stoic works for the world's good and not for his own pleasure; the two propositions are perfectly compatible. The only quotations concerning the Stoic creed which are to the point here are the well known—

> Non sibi sed toti genitos se credere mundo
> (Lucan 2, 383, quoted by Obbar.)
>
> Nec sibi tantum sed universis singulisque consulendum.
> (Seneca de clem.: 2, 5—Obbar.)

and "*πολιτεύεσθαι τὸν σοφόν.*"

But even Obbar, who has explained satisfactorily the significance of the last line, has introduced confusion into the passage by regarding the phrase *me rebus subjungere* as synonymous with the cardinal doctrine of the Stoic's ὁμολογουμένως τῇ φύσει ζῆν. This, as Orelli says, is far-fetched and unnatural. The φύσις referred to is primarily the abstract laws of life ; on the other hand, "*rebus*" here seems to denote concrete human beings and human needs and interests. The connexion between the two exhortations is at the most by distant implication. The Greek exhortation means simply "Live according to nature," the Latin, "Live for others."

Finally, against the conjecture—

"Nec mihi res sed me rebus," etc.

which has found favour at different times, a conclusive argument is supplied by the Cyrenaic phrase "ἔχω ἀλλ' οὐκ ἔχομαι," words which, though used by Aristippus in a special context, express happily, in a nutshell, his relation to all external advantages. (Diog. Laert: 2, 8, 75). Obbar furnishes another text scarcely less to the point (id. sect. 95) τὸν σοφὸν ἑαυτοῦ ἕνεκα πάντα πράξειν. Both quotations furnish a description of Cyrenaic practice precisely parallel to Horace's *et mihi res non me rebus subjungere conor.*

SPONTANEITY IN NATURE ACCORDING TO EPICURUS.

Quare in seminibus quoque idem fateare necesse est,
Esse aliam praeter plagas et pondera causam
Motibus, unde haec est nobis innata potestas,
De nilo quoniam fieri nil posse videmus.
Pondus enim prohibet ne plagis omnia fiant
Externa quasi vi : sed ne mens ipsa necessum
Intestinum habeat cunctis in rebus agendis
Et devicta quasi hoc cogatur ferre patique,
Id facit exiguum clinamen principiorum
Nec regione loci certa nec tempore certo.

Lucretius II. : 284-293.

A considerable part of Mr. Masson's very interesting study of Lucretius' Atomic Theory * is taken up with an examination of this passage. M. Guyau † sees here the doctrine of free-will and contingency in matter ; the reign of law in nature, therefore, so far from being a cardinal tenet of the Epicurean system is, according to him,

* The Atomic Theory of Lucretius, by John Masson, M.A., London.—George Bell & Sons, 1884.
† La Morale d'Epicure, par M. Guyau, 2me edit.—Paris : Librairie Germer Baillière et Cie, 1881.

expressly denied by Epicurus, or, to speak more correctly, limited: there are certain bounds beyond which no created thing can pass, but within these bounds it possesses a modified freedom and moves in this direction or in that, developes or degenerates. In the same spirit Mr. Benn* represents the Lucretian system as grasping only the negative side of natural law: Lucretius recognizes "the limiting possibilities of existence" rather than an omnipresent and unbending law: nature possesses only a right of veto, and is no longer the potter moulding passive clay.

Against all this Mr. Masson argues at length; he conceives the free-will of the Lucretian atoms to cease altogether in the world of inanimate nature, and also apparently in the brute creation: only in man is this free-will still operative. And Mr. Masson gives reasons why this conception is natural and easy:

(*a*) The free wills of the different atoms of matter, he says, would counteract each other.

(*b*) The force of gravity from within resists change.

(*c*) The pressure from without has the same effect.

(*d*) The atoms forming gross matter are in themselves heavier and slower of movement than others, and the gross matter they form is therefore of the same character.

(*e*) Finally M. Guyau's theory proves too much: it changes Epicurus into a Greek Hans Andersen, in whose creations the impulse of animism is supreme, and sticks and stones are conscious beings.

It is difficult to reconcile these arguments of Mr. Masson with other parts of his own book, with his quotations from M. Guyau, and with Lucretius.

Thus his first argument (*a*) is forcible enough, but it applies equally strongly to the Lucretian conception of free-will in man; and is no proof, therefore, that Lucretius denied free-will to nature. The difficulty seems to be analogous to that presented by the sense of personality: out of the various instincts derived from our common human nature and from our special parents rises yet a sense of a single personality.

(*b*) This is true, though in a less degree, of man also; and it

* The Greek Philosophers, by Alfred William Benn.—London: Kegan Paul, 1882.

should modify, but not destroy—on Lucretius' principles—the free-will of nature.

(*c* and *d*) These arguments also tend only to limit the extent of free-will that Lucretius can have attributed to nature: not to cast doubts on its existence.

(*e*) It is very difficult to understand how Mr. Masson can urge this objection. He has himself shown the similarity of Lucretius' (or, as he calls it, M. Guyau's) doctrine of spontaneity in nature to Schopenhauer's doctrine of will (p. 232), to Gassendi's doctrine of consciousness (p. 140), and to Professor Clifford's doctrine of mind-stuff (pp. 132 *seq.*); and we may add to the list the cognate theories of Zöllner (Lange's History of Materialism, vol. ii., p. 328), and of Czolbe (*id.*, p. 291), (comp. vol. i., p. 13, note). If these speculations are on a level, in respect of truth, with Andersen's fairy tales, then the same may be said of M. Guyau; not otherwise. No doubt there is a resemblance up to a point, but the question of degree is everything.

According to M. Guyau, Lucretius conceives that in nature as in man each thing has, so to speak, its tether (*foedera naturae, fati fines, foedera fati*, Lucretius V. 309-310, II. 254); when it has reached the end of its tether it stops necessarily; and practically, as with man, it stops short of this. This *finita potestas*, as Lucretius calls it (I., 76, 77), does not, says Mr. Masson, mean "limited power," but "fixed power" (p. 223, note); but the very next words, *atque alte terminus haerens*, "and the deep-set goal," make for M. Guyau's view, and are naturally interpreted by him to mean what Mr. Benn means by "the limiting possibilities of existence."

Why is it more difficult to reconcile the two—the law which tethers and the free-will which gives an area of freedom within that law, in the case of nature than in the case of man? No one denies free-will just because he cannot rid himself of the legacies received from human nature and the nature of his ancestors; and, conversely, no one argues that the believer in free-will substitutes for human life in this world Andersen's fairy-world.

It is an old suggestion that the so-called "waste" in nature, and the sacrifice of countless seeds and lower lives, is but the expression of the same freedom which in human life makes evil possible, and causes so much waste there also. If M. Guyau be right, Lucretius says no more than this.

Again, M. Guyau observes that this spontaneity does not disturb natural order, but works along the same lines. Mr. Masson (p. 224) thinks this an arbitrary assumption; but does not the same analogy apply once more? Free-will does not mean freedom to will arbitrarily, but freedom to act upon the highest law of our being; and the will is most free when most obedient to this law. In the same way then, in proportion to the worth and development of anything, will be its approximation to the highest law of its nature. The inner desire, the true will, of each thing moves in this one direction: *βούλησις*, in Aristotelian phrase, is always *τοῦ ἀγαθοῦ*.

In this sense spontaneity, human or not, may justly be said to work along the lines of nature. It appears to us—obscure though the connection may look—that the acutest defender of miracles, Canon Mozley, meant something of the same kind when he represented miracles as quickening merely, not resisting, the processes of nature. His theory seems to imply an elasticity in nature which Lucretius describes as free-will.

Mr. Masson shows, it is true, that the ascription of consciousness to matter is against the express testimony of Lucretius (Lucr. II. 972); but his own quotation from Gassendi (p. 220) proves that M. Guyau is not the only student of Epicureanism that has been more logical than Epicurus and Lucretius. It is inevitable that here, as in other speculations, there should be a "development" of doctrine. The ascription to matter of will without consciousness is, as Mr. Masson observes (p. 220), illogical. The spirit of the system in spite of the letter seems to require this assumption: the defect here is in Epicurus and Lucretius, not in the French critic.

After all, the *onus probandi* lies with Mr. Masson. Lucretius says that the atoms originally have free-will. He does not say that this free-will ceases for that majority of them which meet to form gross matter, and survives only in the minority which form the human soul.

The original free-will of nature is a necessary part of the Epicurean system; for without it the origin of the world is inexplicable. The permanence of such free-will in nature, if in one sense unscientific, in another recommends itself to science; for it establishes the "solidarity" of man and nature; and Epicurus, at any rate, believed in human free-will.

Finally, the visionariness and mysticism that undoubtedly attach to it do not seem sufficient, when it is compared with similar speculations of science of recent date, to warrant its off-hand rejection.

Mr. Alfred S. Johnson, M.A., Fellow of University College, Toronto, read the following paper on

THE LAW OF HABIT.

Habit, more than any other principle of nature, may be said to be the *governing principle of life*. All the phases of our existence, conscious and unconscious, physical, psychical, moral, social, are under its control. Occasionally, it is true, there come into men's lives experiences of an exceptional character, elevating, ennobling, or depressing, which ever afterward in retrospection stand alone like mountain-peaks towering above the monotonous plain of common life. Occasions like these, however, are the exception. The vast majority of the actions and experiences of life are on a level plain; at every point the sway of habit obtains, and the general appearance which the plain presents is determined by the habits which have predominated in the individual life.

An instance or two, taken from different parts of our nature, will here suffice to show the wide spread influence of habit. The muscular movements of a very young child are generally performed at random, being the outcome of mere inborn spontaneous energy. If any co-ordinated movements are found, they are instinctive, or due to reflex processes, and not primarily under control of the will, though capable within certain limits of being brought into subjection. To trace the steps in the development of voluntary power of co-ordinated movement, *e.g.*, in learning to walk, is merely to show the influence of habit upon the physical part of our nature. Gradually, through the susceptibility of the child's organism to the plastic influence of repetition, the motions of its limbs become *co-ordinated*, linked together after a regular manner, and the necessity for strenuous attention and voluntary effort at every step dies away. Similarly, in learning to play upon a musical instrument. The great difficulty felt at first in making the movements of the fingers follow one another correctly is lessened by patient practice, the customary motion becomes easier, until a stage is reached where the mere act of sitting down to the instrument, or commencing the series of movements involved in playing, seems capable of bringing on the whole connected train, without further attention on the player's part.

Leaving for the present our physical nature, we note that our intellectual life also owns the sway of habit. No idea ever arises in the mind except through association, and one of the conditions of the strength of association is habit or repetition. The customary thoughts which hold possession of the mind, the customary emotions which the individual feels, and which are often his most striking peculiarities, the ordinary methods adopted by men in working out the problems and aiming at the ends of life, the forms of speech, the various degrees in power of attention, deliberation and resolution, all exhibit to us the workings of this great formative law of nature.

Turning now to our moral nature, we find in the growth of character, the building up or the pulling down of the virtues or vices, the same dominion of habit. Witness the teaching of a child the duty of unselfishness. The sacrifice so painful at first, after a few trials, becomes easier ; the tendencies opposing are gradually weakened and dissipated, those favorable are gradually increased, until finally there may even be developed a tendency to over-do the unselfish act, when care has to be taken lest unselfishness should exceed the limits within which alone it is a virtue.

These few instances are sufficient to give some idea of the extensive power enjoyed by habit. But not only is its influence far-reaching and wide-spread, its offices and effects also vary in the different spheres that come under its action. There is, perhaps, no principle of our nature characterized by greater variety in this direction. No other can to such an extent control and modify our physical constitution, accustoming it to strange uses and adapting it to its environment ; no other has such power, without changing our psychical nature, to alter the whole method and drift of our intellection ; nor is any other fraught with more important practical lessons, for it is only through consolidation of habits that moral character is placed upon a fixed and reliable foundation, and only through development in accordance with the law of habit can we ever hope to attain that destiny for which conscious life and morality were bestowed upon us. It is the greatest of all the appointed means to this end.

In spite, however, of the inestimable importance of the functions of habit, strangely enough, when we turn to the history of psychoogical speculation, throughout its range we can find perhaps no part of our nature which has been more unsatisfactorily treated. For a full exposition of the manifestations of habit, or a clear understanding of the purposes which they serve, we must look away from professed works upon the subject.

It may not be uninteresting to inquire into the causes of this deficiency of treatment. They may probably be reduced to three :—

(*a*) The failure to bring the subject under discussion, a defect common to many works on psychology, may have been in some cases the result of mere oversight.

(*b*) It may have been from despair of ability to remove difficulties in the way of explanation ; for some of the questions involved have appeared to distinguished writers inexplicable. For example, Dr. Reid says : "I see no reason to think that we shall ever be able to assign the physical cause either of instinct, or of the power of habit;" and Dugald Stewart, in the second volume of his works, speaking of the fact that while in some cases the muscles, under the law of habit, are increased in strength through repeated exercise, they yet become more and more obedient to the will, says : "This is a fact of which it is probable that philosophy will never be able to give any explanation."

(*c*) But the failure of adequate treatment in cases where the phenomena of habit have not been overlooked is mainly owing to the fact that certain important phases have entirely escaped detection, which, if their significance had been recognized, would probably have shown the inadequacy of the methods that had previously been adopted in explanation. Thinkers have a common tendency to forget (particularly when dealing with mental phenomena), that while a science remains stationary at a certain point, and until its advancement beyond this point is made possible through the acquisition of a more comprehensively detailed *knowledge of particulars*, of concomitant phenomena and conditions, the ordinary methods of classification and generalization, while their validity remains untouched, may yet prove in the strictest sense useless and inapplicable, and the facts may show themselves amenable only to a higher method.

It is proposed in the present paper to maintain that this is precisely the case in regard to the phenomena under discussion. By the bringing in of particular instances it will be shown that the ordinary definitions and explanations which have been given are inadequate. It is not maintained that the ordinary scientific methods must *forever* here be inapplicable, but that *with the present extent of knowledge* they are so; and that until there is acquired a more comprehensive knowledge of the conditions that govern mental phenomena, which light may possibly come through the researches of physiological psychology as to the correlation of psychical and organic processes, these ordinary methods must remain so. The facts of habit are, in the present state of knowledge of the conditions of mental phenomena, explicable by that philosophy alone which refers them all to *final causes.* These alone shed light upon the varied facts of habit, and in the light that comes from them must these facts be seen and rendered. It will be shown that the effects of habit upon different portions of our nature are marked by the greatest variety, and by apparent confusion and contradictoriness. The known facts of habit are heterogeneous and incongruous. Though occurring in the midst of apparently similar circumstances, they yet refuse to take classification together, or to show themselves resolvable into different manifestations of one and the same law; in fact refuse to be treated by any of the ordinary methods of science, for the simple reason that amidst their heterogeneity no homogeneity, other than merely hypothetical, has yet been found. There may be, in all probability there is, some quantum (which we may designate by x) which further research may reveal, perhaps some modification of nervous organism concomitant alike with all the varied forms of habit, through which their variety may be reduced to unity, and in terms of which it may in all cases, be expressed. The discovery of the value of this x would make the ordinary methods applicable in treatment of the phenomena of habit; would eliminate from them the appearance they now present of opposition and incongruity, would make, in fact, that apparent contrariety of manifestation, the naturally to be expected, nay—the surely predictable result. It is maintained, however, that, even if this quantum should be at any time discovered, the ultimate necessity of an appeal to final causes would not be done away with. Explanation by physical causes, though quite legitimate, does not exclude, nor even render useless, explanation by final causes. The fact would still confront us that x, rëacting in its environment, in the midst of circumstances that are in all cases materially similar, presents us with the greatest diversity of results; and this variety of function must forever remain inexplicable, except as the result of chance (to which to refer it is no real explanation) unless it be recognized as preconditioned and predetermined, and thus, in some sense at least, *caused* by that end to which it is so well adapted as a means.

To the above-mentioned three causes we may in all probability trace the inadequacy of the discussion which our subject has heretofore received. We find it formally examined, with greater or less minuteness as to detail, by most of those who profess to study with any method or precision the conduct of men and the laws of human nature ; but nowhere have we a final settlement of the points involved. We can nowhere find a definition of habit comprehensive enough to embrace the whole field of its energies ; there is nowhere to be found any logically complete and exact analysis of its phenomena ; of their manifold variety we find seldom attempted any systematic classification ; psychology, even though associated with physiology, has not yet philosophically unfolded the law by revealing any general fact or uniformity through which all specific varieties of manifestation may be reduced to system.

There is no general tendency to ignore or underrate the importance of the law of habit. But although the word is in very common use, and the significance attached to it familiar to the experience of everyone, and although writers and thinkers are aware of the importance of the law, and recognize its bearings upon the stability of character, it is yet true that they are unable to dispose of the varied facts which confront them, and do not know how to make provision for them.

It will be our duty, before making further advance, to define precisely that field of study into which the foregoing remarks have to some distance led us. This will best be done, in the first place, by excluding from our discussion all treatment of topics which are irrelevant, the handling of which, unfortunately in different works, has been incorporated with the remarks concerning habit. We note, accordingly, that a strict line of demarcation must be laid down in discussion between our subject on the one hand, and *natural instincts* and *appetites* on the other. True, there is an intimate connection between habits and these latter. An instinct or an appetite may furnish us with an impulse, continued obedience to which will lead to the formation of a habit, and one of the results of habitual action in a certain direction may be the creation of an appetite, as happens in the cases of the libertine and the drunkard. This close connection between the phenomena referred to has been the cause of some confusion in their study. For example, Macvicar, in his work "On

Human Nature," not only allows the treatment of habit to grow out of his remarks upon instinct and appetite, but even goes so far as to say that "the genesis of habits is fully explained by the existence of natural appetites and instincts." But we must not forget that, while the connection between them is confessedly intimate, it is no closer than that which exists between habit and any of the other tendencies or impulses of our nature, for each of these, equally with our instinctive or appetitive tendencies, will lead, if exercised, to the formation of a habit. Besides, however close the relation subsisting between the phenomena indicated may be, it yet remains that habit is neither instinct nor appetite. The word "appetite" is properly used only as referring to those impulsive states of feeling which are characterized by periodicity. They may be primitive and natural, such as hunger, thirst, sleep, &c., or they may be induced through continued indulgence, *e. g.*, the appetite for tobacco; but whatever their variety or origin, our appetites are merely states of feeling produced by the periodically recurring wants and necessities of our bodily or organic life, and which prompt to action for their gratification or alleviation.

Instincts, on the other hand, differ from appetites in that they are always primitive in the individual, never acquired. An instinct is the ability in any individual to perform actions involving complicated muscular adjustments, particularly such actions as are useful, which ability is untaught, and due to no steps of development or exercise through which the individual has passed. This, however views may differ as to the explanation to be given of these primitive facts, is a statement of the essential features of instinct. Individuals do, as a matter of fact, without any course of training, and without any causes that can be pointed out in their own experience, possess the ability to perform actions, which, in degree of complexity of the muscular movements involved, rank as high as many actions usually attained only after a process of development has been for some considerable time at work. We may note in passing, that upon this fact of primitive instinctive ability for complicated action great light is thrown by the modern doctrine of Evolution. To return, however. In neither of the above classes of phenomena do we find the essential features that mark our habits. What peculiarly belongs to habit as distinguished from instinct and appetite, is that *the word draws particular attention to the effects of repeated exercise*, and throughout the present discussion we limit ourselves strictly to this field. We shall consider alone the effects which repetition of an experience or of an action produces, the "Law of Habit" meaning merely that principle according to which repeated experience or exercise produces its effect. And, as before indicated, it will be maintained that the known effects of repetition, in different spheres of its action, are so apparently diverse and incongruous, that the principle which alone, with the present reach to which means of investigation have attained, shows itself to be the governing principle of the facts, is that which regards them all as predetermined, and thus in some sense caused, by that end, as means to the attainment of which they, in their variety, are so strikingly adapted.

We might, at this point, guard ourselves against a peculiar view held by Mr. John Stuart Mill. According to this distinguished writer, habit is virtually the *annihilation of motive*, is a principle of action altogether incompatible with motive. Actions are in all cases originally done from some motive or other; but when through repeated exercise a certain course of conduct has become habitual, Mr. Mill thinks that the actions have ceased to be done from motive. His statements in this connection are made in the "Utilitarianism," Chap. IV., and in the "Logic of the Moral Sciences," Chap. II., Section IV. In the former, after laying down the thesis that pleasure (including its negative, freedom from pain,) is the sole motive to action, and attempting to reconcile this with his belief in the possibility of a purely disinterested act, Mr. Mill, apparently conscious of his weakness, has recourse to a further argument, the substance of which is briefly as follows:—Men perform actions in many cases toward ends which are either perfectly indifferent, or are positively hurtful in their tendencies. This being so, it might seem as if some other end than pleasure were capable of constituting a motive to action. However, instances of such action prove nothing contrary to my thesis that pleasure is the sole motive to action, for when men thus, in the course of repeated action, come to pursue ends which are indifferent, or even hurtful, they have ceased to act from motive, and are under the dominion of habit. "Many indifferent things which men originally did from a motive of some sort, they continue to do from habit. Sometimes this is done unconsciously, ... at other times with conscious volition, but volition which has become habitual, and is put into operation by the force of habit." Now, it would be irrelevant to our subject to discuss the force of Mr. Mill's arguments in proof of his thesis as to the ultimate motive to action, and its consistency with the possibility of disinterestedness. It could easily be shown that, whatever possible construction be placed upon his statements, they involve an inconsistency. We are concerned, at present, only with his opinions regarding the nature of the state at which a man has arrived when we say that his action has become habitual. And while it is not denied that the force of habit may set up the standard of absolute dominion, and man may be its slave, "bound hand and foot," we nevertheless maintain that even in such a case a man's actions are done from motive, and the sway of habit is but the triumph of some particular motive over all opposing forces. For why is anything called a motive? Because, as it is in the mind's view, it stimulates to action. Why, even, do men say that pleasure is a motive? For no reason other than that pleasure is an end, to the attainment of which men direct their energies. To whatever extent views may differ as to the relation between motives and volitions, the general statement will not be disputed, that of motive no other account than that above indicated can be given, namely, as the end aimed at, which, as contemplated by the mind, stimulates to action. A motive is constituted whenever an end definitely in the mind's view is considered in some respect desirable. Well then, when a man by continued indulgence has so enslaved himself that from sheer force of habit he continues to pursue some end of action which has long ceased to give him pleasure, and which may even reap for him a "harvest of pain," are there not present all the elements requisite to constitute a motive? Does not the desire of attaining the end at which he actually aims stand to his action in the same relation in which the desire of pleasure stood, and is it not thus the motive of his action in precisely the same sense in which the desire of pleasure was the motive where pleasure was the end sought? It is not true that as we proceed in the formation of habits we cease to act from motive. Our motives may in the course of such development change, and permanently change, certain ends of action may forever lose their charm, and thus be stripped of their prompting or stimulating power, ceasing in this way to be motives, but they die only in giving way to stronger forces. The formation of a habit is not the disappearance of motive, it is rather the setting of some motive upon a throne, it having acquired such power as to operate on all ordinary occasions on which its exercise could be looked for. Indulgence of lower appetite, *e. g.*, may have become so habitual that all the claims of moral law may practically have ceased to make their voice heard in the presence of immediate empirical instigation. But this is not the annihilation of motive; it is the usurpation by one motive of the sceptre and dominion that rightfully belong to another.

The attempt to find some single universal principle, under which all the various manifestations of habit may be brought, brings us face to face with the question so freqently discussed as to the relation in which the law of habit stands to the *association of ideas.* The views which have hitherto generally prevailed divide into two classes the diametrical opposites of one another. One class of writers contend that the law of habit is an ultimate original principle of our nature, incapable of analysis into simpler elementary constituents, or of subsumption under any wider law from which it may be deduced, or of which it may be regarded as a special case, and they resolve the association of ideas into the principle of habit. Of Dr. Reid it cannot, as a general thing, be said, as has been said of Mr. James Mill by one of his connotators, that his desire to avoid unnecessary multiplication of fundamental laws in exposition or explanation of mental phenomena has often led him into the error of resolving into different manifestations of the same law phenomena which are governed by laws really and fundamentally distinct. On the contrary, in general, there seems to be an absence of all such desire on the part of Dr. Reid. Occam's "razor" is a tool which he seldom uses. With a little more careful scrutiny he might easily have seen that principles which he regards as ultimate and original are not so, but are capable of resolution into, or at least of subsumption under, simpler and wider laws. However, the desire mentioned has certainly influenced Dr. Reid in his speculations on the point with which we are now concerned. He says: "I believe that the original principles of the mind of which we can give no account but that such is our constitution are more in number than is commonly thought. But we ought not to multiply them without necessity. That trains of thinking, which by frequent repetition have become familiar, should spontaneously offer themselves to our fancy seems to require no other original principle but the power of habit." And this view is not without its adherents at the present day, for Dr. Noah Porter, in his elaborate work entitled "The Human Intellect," contends that "the law of association rests upon the same original principle which explains the law of habit," and even says "the law of mental suggestion or association is only a special form of this general law or principle."

The other class of writers, of which Dugald Stewart may be taken as an example, bring the principle of habit under the laws of association of ideas. It is, however, wisely remarked by Stewart, that the extension of the term "idea" must be widened so as to include every operation of mind, and we might note that a still wider application of the term is necessary in order to give the slightest plausibility to the theory, which will make it include not only every psychical, but also every corporeal effect capable of entering into conjunction with others. That philosophers should be so diametrically opposed in their views on such a question is perhaps, at first sight, a little surprising; but the variety of opinion is no greater than that which exists on all questions of a similar nature, where the point at issue is largely as to the meaning of a term. The discussion of the question involves distinctions which are to a great extent, if not altogether, merely verbal. It is not on that account, however, unimportant, for there is a wrong as well as a right use of words. Language has a use to serve, and its functional efficacy is destroyed by abuse; and expediency in its employment requires that, unless in very exceptional cases to subserve a higher use, words shall not be wrested from their ordinary meaning, nor be deprived of any of the associations that attach to them in the world's ordinary discourse. Now, keeping the above precept as to the use of words in view, it will readily be apparent that the merit, if any merit rest in the discussion at all, cannot lie with that class of writers typified by Dr. Reid, for association of ideas cannot be explained from habit, or resolved into the same, without at least depriving the expression of a part of its denotation, a very large part, and one of the greatest importance. It has been remarked by Sir Wm. Hamilton that "we can as well explain habit by association as association by habit," and we shall shortly give our reasons for thinking the remark probably true, if by "association" the principle of contiguity alone be referred to. But to restrict the expression thus is to wrest it from its ordinary and legitimate use, which makes it include in addition the principle of association by similarity. We certainly require a word to denote the working of this principle, the importance of whose influence cannot be over-estimated. The word "association" has been handed down in this express use, and no valid reason can be given why it should not be continued in that meaning, which makes it include every principle whereby one mental or bodily state or action suggests another. These principles comprise similarity as well as contiguity. (For present purposes, as not relevant, we may leave out of consideration the principle of contrast.) Now, if the expression "association of ideas," allowing to the word "idea" the necessary widening of its application before referred to, be still used as ordinarily, the association of ideas cannot be resolved into or explained by the power of habit, for association by similarity cannot be so explained or resolved. It stands alone as a distinct and ultimate principle of our nature. Its working, though inextricably intermingled with that of contiguity, is logically prior to it. The absolute and indelible distinction between this principle of association and the power of habit is seen in the fact that association by similarity is primitive, whereas habit has express reference to the moulding power of repetition. Only after repetition can a habit be formed; but similarity may produce its effects at once. It is possible to cite instances of its working where there has been no previous experience, and therefore no possibility of the formation of any result through repetition, as *e.g.* in the identification hit upon by Franklin of the similarity in nature between lightning in the sky and the phenomena of electricity.

Evidently then association of ideas cannot be resolved into habit, unless *at least* the principle of similarity be left out of consideration. The question then remains :—Can we bring habit in under association of ideas as but a phase of the working of the principle of contiguity? We answer : Yes, in all probability. The hypothesis that all the varied manifestations of habit can ultimately be shown to be essentially similar in the working of contiguous association, is that which, in the present state of knowledge of the facts, most commends itself to our acceptance. We note, however, that it yet remains a mere hypothesis, not having been brought to the test of a complete scientific induction. We accept it, therefore, in the meantime only provisionally, awaiting complete verification from further research. Its commendation rests, in brief, on the following considerations :—

(*a*) Habit and contiguous association alike have express reference to the plastic power of repetition. Both recognize its necessity as a condition of the growth and strength of tendencies in any direction. This fact is at least a finger-post, though admittedly fallible, pointing to similarity in the nature of both.

(*b*) Many of the results of habit are apparently completely resolvable into manifestations of contiguous association. Thus, in the case of the so-called "secondarily automatic" actions, as when an accomplished pianist commences playing, and the customary trains of muscular movement are kept up without the arising in consciousness of their mental concomitants, there is apparently no necessity of recognizing anything else as involved than the mere linking together by contiguous association of a series of muscular movements which have been frequently performed in regular succession, in such a way that the appearance of the first link tends to call up the rest.

(*c*) There are no phenomena of habit which are positively known to be incapable of reduction to the outcome of contiguous association, the utmost that can be said being that in some cases we cannot from direct evidence affirm the applicability of the principle of contiguity in explanation.

(*d*) Where this inability exists it seems to be accounted for by the empirical limitations upon our knowledge of the facts possibly concerned in the case. For example:—Repetition of exercise on the one hand increases the efficacy of some of our perceiving powers; the eye becomes more sensitive to shades of color, the ear more acute to apprehend distinctions of sound. But on the other hand, certain of our primary susceptibilities suffer a deadening effect from repetition of affection. Thus the sensibility to heat and cold, to the glare of sunlight, and to hard and rough contact with rude and pungent and hurtful agents, lessens under exposure to them. A similar apparently contradictory variety of effects is seen in the case of our emotions. Love, fear, pride, and other emotions are stimulated by exercise; but grief, by indulgence, in the healthily constituted nature gradually dies away. Now, it seems difficult to represent these diverse and apparently opposite results as in reality merely different manifestations of the working of some one law, such as the principle of contiguity. There is nothing illegitimate, however, in our setting up this account of them as a scientific hypothesis awaiting verification. It is quite possible that all such seemingly opposite directions of the energies of habit may have some common physical basis which further research into the correlation of mental and organic processes may reveal. It is to be noted, however, that even if this physical basis, which we have before spoken of as a quantum x, should be discovered, and all forms of habit through it be shown reducible to energies of contiguous association: this would be no ultimate explanation; it would be merely to resolve one set of phenomena into another, which is to explain neither the one nor the other; it would be merely to employ different words to express at bottom one and the same identical fact. The need of belief in design would not be dispensed with, an appeal to final causes would still be demanded by the number and co-ordinated action of the facts of our nature concerned in the case, explicable in no other way than this, unless regarded as a chance co-incidence, in which explanation, however, the mind refuses to rest.

Omitting now further discussion of our subject in its aspect as related to association, we proceed to a brief exposition of the ultimate results attained by those who have heretofore given it careful thought. These writers we might in this aspect separate into two classes. Those of one class attempt to set forth in express definitions the main facts and principles of habit, and in this way would be very explicit in their treatment. We shall find, however, that it is precisely these authorities, these who strive most to be definite in exposition, who have really been the most inaccurate. The other class, not professing to offer definitions as explanations, endeavor by use of different forms of expression and the drawing of analogies, to present a comprehensive and systematic view of the principles of habit. Their expositions, however, are in all cases open to the serious objection either of vagueness, or of entire want of meaning.

Wherever definition has been attempted, we find a striking amount of agreement in the use of words. In these cases all the manifestations of habit have appeared to be comprehended under the notions "*facility*" and "*impulsiveness.*" For example, Dr. J. D. Morell in his "Mental Philosophy" takes the following ground:—In many cases, even though volition be put forth, the desired movement of muscle fails to follow, and in order to bring about the result aimed at, no mere effort of volition is sufficient, a practical training is required; and "when by such training new *facility* is acquired, the power thus formed is termed the power of habit." Habit is thus merely facility of bodily action acquired through exercise. Dr. Reid too tells us: "Habit is commonly defined, a *facility* of doing a thing acquired by having done it frequently." But, conscious that the notion of facility is not all-comprehending, and unable to do more than confess the weakness of the above definition, he supplements it by saying: "This definition is sufficient for habits of art, but the habits which may with propriety be called principles of action" (namely, our moral habits and acquired appetites) "must give more than a facility, they must give an *inclination* or *impulse* to do the action." To Dr. Noah Porter also the conception of facility appears to comprehend the main facts of habitual exercise. The following sentences indicate his position:—"Habit, Latin *habitus*, Greek ἕξις, is literally a way of being held, or of holding one's self. Thus defined it must denote a permanent state of rest which has been reached as the result of action or growth, or a permanent form of activity, or of *readiness* or *facility* for any kind of activity."

However, an attentive study of the specific differences in the energies of the law of habit will show us that, if put forth as all-embracing definitions of habit, these notions of *facility* and *proneness* or *impulsiveness* are lamentable failures, for they will be found to be false and inapplicable in as many cases as they are true, and for subserving any systematic purpose they are totally useless. In order to avoid these difficulties thus merely indicated, the other class of writers resort to various forms of expression which, however, are either possessed of no meaning at all, or leave the subject still upon our hands with none of its hard and rough points smoothed down, none of its difficulties explained away. The lexicographers, *e.g.* Webster, commonly tell us that habit is "a *disposition* or *condition* of the mind or body acquired by custom, or the frequent repetition of the same act." The embarrassment common to the lexicographers we find also among the psychologists. Upham in his "Mental Philosophy," in a section entitled, "Of the Effects of Habit in giving Strength to the Will," says: "We often see its results in the case of the vicious man whose unholy propensities go on *strengthening* and *strengthening* under its influence, till they assume the stubbornness and inflexibility of iron. . . . It is the result of the principle of habit that every act of the will . . . gives *vivacity* and *strength* to the succeeding act." We might cite here, too, in virtue of certain statements of his, the name of Dr. Morell before mentioned. He has recourse to the use of a word which, like the word "property" or "quality," is offered as an explanation, but amounts only to a re-statement in different words of the fact or facts to be explained. It occurs in the following passage:—"The power of habit may be traced to the operation of a certain law of our nature by which every time we perform a given action a *residuum* is left in the mind which renders the facility of performing it again, and the tendency to do so, greater." This word "residuum" explains nothing. Finally, Macvicar regards habit as the psychical expression of a special "myo-cerebral" rhythm. Such a rhythm, or organic binding together of parts, is produced "by practice or exercise." "And," says he, "if anything occur or is presented to the senses which commences that rhythmical state, the organism will tend, perhaps with insatiable or invincible force, to complete its act." This view, however, is given without any attempt at philosophical deduction, thus amounting, with the other views we have just cited, merely to the use of more or less convenient forms in which to express, without explaining, facts patent to observation. The treatment of the question in general at the hands of psychologists, is characterized by Dr. Chalmers as "an obscure and profitless speculation." Certainly little result has so far come of it, and its inadequacy we in some instances find confessed.

It is the extreme variety to be met with in the offices and manifestations of habit that renders so difficult a comprehension or a definition wide enough to embrace all the facts, and this for the reason that nothing can yet be definitely shown common to all the forms of this variety. This difficulty, betrayed or confessed by systematic thinkers, is likewise apparent when we look at the proverbs or maxims which express popular views of this subject. For example, we often hear the expression "Practice makes perfect." But, as if knowing that this was untrue when taken as an universal proposition, and needed correction, another proverb tells us "While habit *strengthens* reason, it *blunts* feeling." This latter view has been contended for philosophically. It appears to have been Bishop Butler's conception, and he cites it as an incentive to active virtue, pointing out that while habit comes to our aid in *action*, increasing the tendencies and facilities for the performance of work, it has a deadening effect upon our *passive* susceptibility.

Another adage tells us, referring to a wider operation of the law, "Habit is a second nature," this being allied to the view of Lord Bacon, "Custom alone doth alter and subdue nature." And still another maxim, recognizing the moral importance of the law, says "Man is a bundle of habits." In these maxims there is recognized a variety of functions greater than belongs to any other law of our nature, namely: the power of habit to train and develop the intellectual and voluntary powers of mind and body; its different effects upon the reason and some of the emotions and simple feelings; and the great power which it has, while leaving untouched our intrinsic nature, to alter our whole moral character and mental tendencies and method. Maxims as a general thing embody the practical wisdom of mankind; and for all ordinary purposes of the world's business these maxims regarding habit are a sufficient practical philosophy. But, while the common and unwrought notions of customary experience do, only because they must, furnish that philosophy which serves the ordinary uses and necessities of life; yet for highest and ultimate truth we have to look away from these to science which proceeds upon some settled principle, and endeavors to reduce all facts of possible investigation to some precise, definite, and symmetrical system.

The defects common both to the ordinary popular and the studied and systematic views of this principle of habit will be easily apparent, if we notice now some of the specific varieties to be found in the manifestations of this great law of our manifold life. The following, presented without special regard to order, might be noted :—

Repetition of exercise strengthens and quickens our *external senses*. The eye is rendered more sensitive, the ear more acute to apprehend minute distinctions, and the same is true of the other senses. The sum total of the effects of previous impressions appears to be in every case re-instated, giving additional strength to the effect of present stimulation. Thus, in what appears to the landsman a mere speck upon the distant horizon, the practised eye of the sailor can read sufficient to enable him to tell the nation, size, character, and bearing of some outward or homeward bound vessel. Similar instances might be cited in connection with the senses of hearing, taste, and smell, and the history of the sense of touch and the muscular sense abounds with examples, as in the case of the blind.

Our *ideal representations* also are increased in intensity and vividness, in fulness and minuteness. While the pleasure or the pain of the pristine shock abates under repetition within certain limits, yet for intellectual purposes the value of an impression increases with every subsequent experience, and accordingly the ideal representations of memory and imagination, in degree of vivacity and minuteness of detail, under the influence of habit, may rise very near their originals. Habit, too, develops our *acquired perceptions*, and the accuracy of the judgments to which it leads is often most remarkable. For example, the eye originally, and of itself, receives nothing but impressions of colour; but through habit we may acquire a wonderful degree of accuracy in judging by sight of the distances, forms, and magnitudes of objects; and these judgments may be framed so readily that to ordinary observation they appear immediate, and the intricate processes really at work are hidden from view. It is, however, curious to note that upon certain of our primary susceptibilities, *e. g.* the susceptibility to cold and heat, and the rough contact of hard or injurious stimuli with the sensitive surfaces both of the skin and intestinal passages, the effect of habit is directly the reverse of that which was found in our previously cited instances. There is no fact more familiar to everyone's experience, than that exposure lessens sensibility to pain. While the eye is increased in value as an instrument of mind by repeated impressions upon the visual nerve, while it becomes ever more and more sensible of those qualities of external objects which constitute its peculiar province, it at the same time becomes more and more insensible to hurtful impressions by exposure to them. The glare of sunlight and excessive heat are gradually stripped of their power to injure. In the same way the tongue and palate may become accustomed to the most pungent fluids and solids so as to bear them with impunity, while at the same time their power of appreciating minute distinctions of taste may regularly improve, as, for example, in the cases of the wine-tester and the gourmand. Here we find alongside of one another, nerves which have been subjected to the same action, on the one hand quite callous to the pungent and fiery effects of alcohol and strong spices, and, on the other, having such a delicacy of discriminating power as might seem impossible to an individual accustomed to plain diet. The general statement, then, that habit blunts feeling, is most inaccurate, for we find that even among our simple primary feelings there are cases which flatly contradict it. The effect of habit upon some is deadening, but upon others quickening. Still more inadequate is the notion shown by consideration of our complex states of feeling which we call emotions. Here, too, we find the same apparent contradictoriness in the effects of habit. As Dr. Bain points out, "our emotions may be steadily increased by culture." Fear or flurry may be rendered the customary thing by habituation. Habit does not blunt the feelings of pride, of self-esteem, of the pleasures of benevolence, of paternal love, and motherly devotion and tenderness, but quickens and strengthens them. With all regular exercise these emotional tendencies grow in vigor; but, on the other hand, grief, and remorse, and shame, are gradually exhausted by being indulged.

In the same way frequency or persistency of exercise vary in their effects upon the different faculties of our moral nature. In short, the conclusion is established, with every degree of probability, that the effects of custom, or habit, or frequency of repetition (it matters not by what name we group together the influences at work), vary with every variety in the nature of the capacities exercised.

We note again, that not only do the effects of habit vary when different powers are subjected to it; but also that its energies may be exerted in strangely different directions within the sphere of each separate power. For example, let us compare the results developed by exercise of the power of voluntary muscular control in the following cases:—

(*a*) Of the accomplished pianist;

(*b*) Of the blacksmith, or the porter;

(*c*) Of the professional boxer, or the ballet-dancer.

In the first, exercise of the voluntary muscles gives extreme facility of movement without any proportionate increase of strength. In the second, it develops strength, massive power and endurance, without any corresponding increase in facility of rapid movement. In the third, the effect seems to be due to a combined action of the previous modes of increase, the muscles developing at the same time a surprising degree of rapidity of action and robust energy. Though greatly increased in strength, they are yet more and more brought under dominion of the will.

Our intellectual faculties, under habit, exhibit to us a similarly varied scene. Here, on the one hand, we find readiness and dexterity of thought and quickness of combination, as in the power of extempore speaking. There, on the other hand, is found massive power and plodding endurance. And yet again we find that exercise may develop energy and agility in unison, as in legal and parliamentary debate, and in the higher styles of poetry. In such cases as these, while the notion of increased facility or force, or both, is sufficient to serve all ordinary purposes, yet, as has already been evident, as a scientific definition, it is not definite enough even where most applicable; and when regarded as a general apprehension, it is fallacious.

But still more than those instances which we have already mentioned, there are certain phases of the working of habit apparently not hitherto noticed, which render evident the essential defects in the treatment and explanation offered. The phases referred to are the following:—In relation to the will, the increased obedience of our thinking and voluntary powers of mind and body, and at the same time the increased resistance offered by another portion of our nature, including our emotional and impulsive tendencies, whether appetitive or instinctive. It is in reality just at this point that the difficulties, to Reid and Stewart, appear insuperable; but it is precisely here that, both for speculative and practical purposes, the greatest need becomes felt of a true and comprehensive philosophy of the facts. Our rational or thinking powers, as well as those directly under control of the will—the perceptive and reasoning faculties, the voluntary muscles—while their strength grows by frequent exercise, become continually more prompt in submission to the mandates of the will; but on the other hand our affectional and appetitive tendencies, by being indulged grow more and more ungovernable by the will acting under the law of reason. Fear, lust, anger, for example, may be cultivated until they become absolute rulers of the individual, until under them one loses all power of rational action, being tossed about hither and thither, like a cork upon the waves, by forces over which he cannot exercise the least control. This forfeiture of liberty, due to procedure along certain lines of habit, is something that demands the student's careful consideration. It is fraught with lessons of immense practical importance, and a thorough understanding of its conditions is necessary; but it is in vain to look for light to the history of psychological and ethical speculation. We are taught by Holy Writ in many ways that whoso committeth sin *enslaveth* himself, but philosophy has nowhere yet comprehensively seized upon this great fact.

A review of the phenomena resulting from the law of habit has now been given sufficient to show how inadequate the Inductive Method of philosophy as laid down by Lord Bacon must prove for purposes of explanation, so long as our knowledge of the facts possibly concerned remains as it is. The object of Induction is to unravel the great complexity of nature, to point out in the grand uniformity apparent amidst this complexity the particular uniformities that exist regarding special facts. Bacon himself thought that all other methods would be superseded by that which consists in the systematic classification and arrangement of facts. The foundation for all advancement to truth must be laid in the instances and facts of experience; man must begin by observing nature, then interrogating her, subjecting her to a critical observing and experimental investigation. He must then *ascend* from a clear and distinct knowledge of facts and particulars thus acquired to those general laws or principles on which they depend. The order of procedure, never to be reversed, is *upward* from particulars to classes, thence upward still from class to higher class or wider class, as from circle to circle, until the most general fact of all, which reveals to us the law, is reached at the central point and summit of the ascending series. The successive inductions are merely more general facts rising out of those more particular, until the process ends in the most general of all, the law or essential principle sought.

But clearly this method must fail of applicability in treatment of the now known facts of habit, facts which are incongruous and incoherent, which, occuring in the midst of apparently similar circumstances, nevertheless refuse to take classification together. This method, as has been beautifully said, "cannot march and countermarch upon the same plane in its route to results." One set of instances points toward a general law, but the next says "right about turn." We can find underlying the known phenomena of habit no general fact broad enough to embrace all specific varieties. In some cases we find that repetition or persistency of an action or impression gives *increase* of facility, or strength, or both; but we cannot thence infer a general law or construct a definition because, in turning to the very next set of instances, we find that similar repetition or continuance of action or impression gives *diminution* of strength or facility. No class of phenomena could be better chosen than the phenomena of habit to illustrate the weakness of the Baconian method. It collapses here in utter helplessness and unfitness. It can find no common centre for facts so eccentric; it cannot bring together lines so little convergent that the point at which they meet lies far beyond the utmost boundary of its vision. It might be noted in passing that Bacon himself was rather timid and reserved in the application of his method to psychological investigations. As might naturally be expected, "with a boy's fondness for a name and a banner," Bacon carried his method, which though perhaps not to be called new, yet had been raised by him into a principle, beyond its legitimate province, and claimed for it an exaggerated power, and a range broader than its birthright; but, in relation to psychological and ethical speculations, he admits "it must be bounded by religion, else it will be subject to deceit and delusion."

It constitutes, perhaps, Mr. J. S. Mill's chief glory as a logician, that he showed the insufficiency of the Inductive method as laid down by Bacon. Bacon allowed only one order of procedure, namely, upward from particulars to generals, and thence still upward, this order never being reversed. But the greatest triumphs of science since Bacon's time have come (nor could they otherwise have come) through a method in which this order of procedure is directly reversed. Bacon failed to make room in his system for the Deductive Method of Inductive investigation, and it is clearly shown by Mill that this was the grand defect in Bacon's inductive philosophy. Subsequent history shows us the Deductive Method, that of *verified hypothesis*, to be the universally accredited method of modern science. It would, of course, be foreign to our subject to set forth the features of this inductive philosophy as amplified and extended by Mill. Suffice it to say here that the only laws it is capable of revealing are the laws of physical causes. Of final causes, such as those demanded by co-ordinated action of laws, it takes no cognizance. "The only notion of a cause, which the theory of induction requires" (if experience can give any *notion* at all) "is such a notion as can be gained from experience." To the consideration of such causes the province of scientific induction is strictly limited. It seeks not to penetrate beyond the sphere where phenomena are linked together according to definite and fixed rules by mechanical necessity. In short, physical causes are the sole objects of inductive science; and in dealing with the facts our reasoning cannot be too rigidly mathematical. Now, the same rules of careful observation, the same precautions against error, which are employed in physical science, are to be adopted when the phenomena of mind are the subject of investigation; the methods of analysis and classification that are available within the sphere of physical science also hold within the domain of mental science; and there is profound truth in the saying of Prof. Huxley: "On whatever ground we term physiology science, psychology is entitled to the same appellation; and the method of investigation which elucidates the true relations of the one set of phenomena will discover those of the other." As facts given us for study, psychical facts are to be treated under the same rules of observation and analysis as those of physics; instances are to be brought in to establish conclusions, and must be ascertained by similar laws of evidence and with equal precision. But it should never be forgotten that in the region of mind, and when the laws and purposes of mental phenomena are in question, we are working in a region that in many ways transcends the physical, transcends it in the complexity of processes concerned, in the obscurity of many of its conditions, and the difficulty of available means of inquiry; and, at least in a certain stage of our advancement to truth, omitting here the question whether it must not always be the case, a higher mode of explanation than the merely physical is that which alone satisfies. It is only while psychical facts remain, as it were, upon the dissecting table, or are subjected to rëagents in the laboratory, and only while thus they stand before us on the same footing with the facts of physiology or of chemistry, and we have, or may have, a thorough knowledge of the conditions affecting any particular experiment, that these facts are at all amenable to the methods that for scientific purposes prove sufficient within the spheres of speculation referred to. When they rise into the realm of rational life, and we attempt to philosophize upon them, and seek to discover the presuppositions they involve and to lay bare their governing purposes, the mind rests only when answer and illustration are given in the ends toward which they point.

Even the explanations offered by physical science shed no light upon the inner working of nature. What is called explanation is, as Mr. Mill admits, "but substituting one mystery for another, and does nothing to render the general course of nature other than mysterious; we can no more assign a *why* for the more extensive laws than for the partial ones." It might even be contended that until scientific methods take cognizance of final causes, they are not true to that principle of causality upon which they all alike rest; for until they do so the phenomenon of repeated co-incidence and co-ordinated action of causes remains unexplained. Even then within the range of inductive science want is felt of some higher explanation. The realm of matter points us to mind, matter being only a means and a slave, with all its functions and references significant only in a region above and beyond itself. It acts and moves only as it is impelled ; its laws are physical causes, and its expositor that philosophy which deals with facts of mathematical or mechanical necessity. But when we leave the merely material, or even the organic, and come to the world of psychical and rational life, we find that the ruling principle cannot be expressed as an impelling force, but as a moral purpose, and only through the thought of highest ends can the mysteries that involve us fade away into the light of intelligent solution.

Directed by the principles indicated, we will now note the most important facts and purposes of the working of habit.

It is a law of universal life obtaining in the vegetable, animal and rational kingdoms. It is a law not only of intellectual and moral faculties, but even of animate textures. It is a law of growth and development ; only through it are those faculties educated and enlarged whose perfection is intended in the creature's existence. And, as a subsidiary to this end, it hedges the individual round with a protection against all *hurtful increase* of those feelings and tendencies whose indefinite enlargement would hinder the attainment of the end designed.

The influence of the law of habit varies in the different spheres of its action, and its effect upon the different faculties subjected to it are more or less remarkable according to the rank of importance which these faculties severally occupy in a scheme of our constitution. Their respective relative importance determines their rate of development. Its effects within the vegetable kingdom are easily noticeable. We find, for instance, that vegetables, within a narrow range, may become inured to strange climates. Still more apparent are the influences of habit upon animal organizations. Animals are adaptable to foreign climates ; and, under training, surprising facility is developed for taking on new modes of muscular adjustment. But it is when we come to the higher emotions and intellectual and moral powers of man that we discover the greatest energy of the law. The capacities of development and of strength and stability of character to be acquired through habit are here quite indefinite. And it is to be noticed that the powers which illustrate here the greatest energy of habit are precisely those powers whose highest development is a condition *sine qua non* of the attainment of the ultimate destiny of the creature, as being involved in that attainment. These powers under habit exhibit to us agility and strength combined. Through habit power which has been obtained is rendered permanent, just as through memory knowledge is treasured up, leaving open the way for further development; just as money put out at interest will add each year to the ever-growing principal that which, being blended therewith, will yield further interest. If there be a destiny whose ultimate attainment is in the design of the creature, some such powers of acquisition and expansion are obviously necessary. Only through their means are growth and progress possible. If there were no such means provided there could be no life in the universe; vitality would be reduced to mechanism, for only growth and progress distinguish it therefrom. This necessity of some powers of development as a condition *sine qua non* of real life itself did not escape the notice of Dr. Reid, and is clearly and beautifully expressed by him as follows:—"As without instinct the infant could not live to become a man, so without habit man would remain an infant through life, and would be as helpless, as unhandy, as speechless, and as much a child in understanding at three-score as at three."

The adage which tells us that habit *blunts* feeling is true, as we have already seen, only of certain of our feelings, its effects upon others being quite the reverse. And a fact which renders our argument for final causes still more conclusive, is that between those sensibilities whose powers are exalted and those which suffer a diminishing effect, no known difference can be pointed out capable of explaining the diversity and contradiction seen in the workings of habit, except the difference of their respective ultimate purposes or ends. Those whose highest growth and enlargement are necessary to the creature's perfection, are precisely those which receive at the hands of habit the strongest impetus; while those whose indefinite increase would hinder such perfection are, through the influence of the same law, stripped of their power to injure. In the degree in which they are beneficial and helpful they are allowed free indulgence; however, the moment they overstep this boundary, the moment their further enlargement would be an aggravation, that moment the law of habit interferes to turn aside and disarm the threatened danger. In this way habit is a law of protection and defence, aiding that development and that only whose completion was intended in the design of the creature by its Author. For example, our bodily organs of sense and movement are instruments through use of which the mind exerts itself to accomplish its ends. Imperfection or injury of an instrument will lower its utility; and consequently, if the body is faithfully to fulfil its functions, it must be preserved from external injury and internal irregularity. But, as man is empirically situated, his organism is not so nicely adjusted to its environment as to be absolutely secure from harm. On the contrary it is necessarily exposed to many harmful affections, and even to much abuse of its own functions.

From these injuries, pain and fatigue, by a provision that reveals the wisdom of an all-wise Creator, are commissioned to protect and warn us. This they do by reproof, and by attaching penalties to continued or repeated indulgence; and, while their voice is likely to be heard, they cease not to exert it. But just as soon as their further continuance would be in the necessity of the case useless, or itself injurious, at that point they are destroyed or counteracted by the working of another provision of our nature equally beneficent with the former. We necessarily meet with some hurtful agents at least. No one can escape them. In such a case, if the result of habit, or of repeated impression, were to increase the organic sensitiveness in the same way as it increases the powers of perception and the voluntary powers, then protection against necessary injuries would be to us a dream. Through necessary exposure we would soon possess such extraordinary capacities of suffering that every feeling would be an agony, every offensive smell would become an intolerable stench, every touch would sharpen into a sting, and every ray of light would quicken into burning fire. Against such evil as this habit comes to our aid as an angel of protection, abating our sensibility to excessive heat and cold, and the painful effects of other hurtful agents. This it does as nicely and as exactly as the exigency could require, as accurately as if some beneficent and all-wise director superintended the working out of results. What we cannot avoid we are enabled to endure, habit kindly throwing the protection of its insensibility over our suffering sense. It is in the same way that certain of those pains of emotion, unavoidable in the ordinary run of life, are restrained and prevented from injurious excess. They are allowed to continue to a certain degree, namely, as long as they are regulating and beneficial; but just as soon as their further indulgence would be injurious the voice of habit interferes to prevent that growth which would without it be unavoidable. And thus we find that our bitter disappointments and anxieties are after a while calmed down, through the beneficent operation of laws that enter into our very constitution, and in such manner as even to render greater our appreciation of after enjoyments. And in the same way, even those bitter bereavements which come to us through loss of some object of tender affection, which must for a time run their course in paroxysms of grief, are gradually abated in the healthy constitution until, after lingering for a while, grief and lamentation give way to cherished memory, and the most cruel anguish shades gradually into a tender melancholy that has even its element of pleasure. Grief fades away, but the "pleasures of memory" are still ours, and the love remains unchangeable, and the ordinary interests of life come back, and its duties take on again their customary attractiveness, bringing at last a joy which at first would have seemed a mockery. In this way the tears of the mourner are wiped away, while the affections of his heart are still true; he is preserved true to affection, and yet capable of duty; and those unavoidable accidents of bereavement are deprived of their power to destroy through the very sensibilities which most feel their influence.

It remains to treat of the law of habit in relation to our moral nature. Its importance in this connection cannot be over-estimated, When its energies are directed in the line of virtue, it is as an army of power to aid in withstanding temptation. It strengthens and makes sure our resistance, and it renders comparatively easy of acceptance the most arduous commands of duty. This it does by adding to the virtuous tendency and weakening opposing forces, each victory helping to further conquests. He who has made a practice in his daily life of preferring the higher to the lower, he who steadily repels the base promptings of the lower impulses, will in time find that they will cease to rise in opposition, and may even be brought into helpful agreement with the promptings of his better nature. Issuing victorious from the hard conflict in the beginning, he goes on without limit to greater and more important deeds and sacrifices, gives to life itself one grand and inspiring purpose, and finally forms a character that will last eternally. His frequent victories in time instil into his whole character their accumulating and permanent consequences. The stability of virtue is thus founded upon the principle of habit. However, the principle is as powerful for evil as it is for good. Through it the tendency to evil may grow, and become fixed, and vice may become the absolute despot of the soul. Abuse of our faculties may become their only use. The growth of moral good and evil depends upon the operation of one and the same law, which, in virtue of our freedom, gives into our own hands the regulation of our life and character. The spirit of the outcast and abandoned has been developed through exercise as well as that of the saintly and pure. Man, as he comes from the hand of the Creator. is endowed with powers. In their actual use he is free and unconstrained. Through this law of habit, which rivets the consequences of action indissolubly upon the agent, he is the "architect of his own destiny." The proverbs which tell us "Practice makes perfect." and "Habit is a second nature," contain a vein of deepest truth, namely, the recognition of the stability and assurance that habit gives to moral tendencies. Without this assurance we could have no confidence in character, and without this confidence in character, this faith in human nature, the very foundation would be withdrawn from the institutions of society. For example, without it men would not become parties to any schemes except such as bring immediate results. The medium of exchange would lose its value ; business agreements would be mere shams ; in fact all the apparatus of commerce would become paralyzed and useless. In the same way everything belonging to men as constituting societies, distinguished from men as merely individuals, would be deprived of that upon which it could alone rest. It is this confidence in the special direction of tendencies due to previous exercise therein that causes a man's reputation to be accepted in legal courts as evidence of his innocence or guilt, a man's reputation being but his own shadow projected upon his pathway by the light of his past life. And it is this experience of the abiding character of the results of habitual action which constitutes the foundation of all our trust that the training which we give the present will develop in the future the results desired. Men will live, in fact *must* live, as they have learned to live ; what men choose continually they finally become, just as unchangeably and as certainly as if the Creator had originally made them so.

This law of habit, in this way, warns us of the terrible fact that the tendency to evil, through continued practice, shall grow and finally be confirmed, that abuse of our moral faculties shall, through indulgence, become at last their only use; that our lower blind and animal propensities shall become, if allowed freedom from restraint, irresistible; and that in fact whosoever committeth sin selleth himself into *slavery*. If this were not the case; if continued practice of evil produced no abiding consolidation of results in character, then the basis and stability of our virtues would to the same extent be shaken, for they rest upon the same foundation. We may not be cognizant of the growth of these results. Consciousness fails to reveal it, just as it fails to reveal organic growth. We fail to recognize the end toward which we are drifting. We do not realize that the moments we spend carry us forward silently but irresistibly to death. We cannot see that each successive day is marked by steps either in our growth or decay. These facts are revealed and certified, however, by observations taken at distant points in time. In the same way, through the "robust consciousness of liberty," we are deluded into believing that we shall always be able to govern ourselves, and that although the path of reckless indulgence may have been trodden for years we shall, after they have lapsed, be as free to choose our course as we were before that path was entered upon. We are confident that our strength of soul will remain unbroken, and that at any time we choose we can quell the surging tide of passion by a word. But we forget that sin is truly bondage, and those faculties whose very life and health consist in their freedom, will remain in spite of everything with all this slavery of habit bound upon them.

> "Never let man be bold enough to say,
> Thus and no farther let my passions stray;
> The first crime past compels us on to more,
> And guilt proves fate which was but choice before."

The wisdom of the provision by which these abiding consequences of good or evil are attached to conduct is as apparent in its adaptibility for highest purposes as that seen in the power of growth with which the intellectual powers and voluntary powers of movement are endowed. The springs of moral action in man are subject to the same law of development as these other powers, in virtue of his nature as a free and responsible agent, in order that a man may reap whatsoever he has sown, that reward may be given unto every man according to his works, that men may by their own free use or abuse of powers build up the fabric of their own destiny.

Our powers of instinct, passion, and emotion, and the power of will whereby we choose ends of action, are given in our constitution; open possibilities of good or evil lie before us; the working and development of these powers are in the hands of each individual for himself, and, under this nicely adapted law of habit, the permanent consequences of his conduct attach to each individual as his due reward. This court of justice differs from our ordinary tribunals. These are fallible, they are liable to the error of implicating the innocent with the guilty; they are inadequate to meet all cases demanding redress; they keep records, which may be lost, and attach penalties according to the standard of a written law, which may be misinterpreted; their decrees are never instantly carried into execution, but are generally delayed. This law of habit, however, is liable to no such imperfection in its application. It is infallible, as being prescribed by the primary source of all law. Before it the innocent, the guilty, "all men are equal." Its decrees cannot be reversed by appeal, they are carried out instantly upon the act. It immediately rivets into the constitution of every responsible creature the consequences of his action, recording his deeds neither against nor for him, but engraving them in him, in such a way that in the condition of his ultimate attainment may be read not only the just outcome, but also the infallible index of his life.

If the above apprehensions of the subject of habit be correct, some important consequences follow, among which might be mentioned the following:—If the stability and assurance of tendencies rest upon and are proportioned to their exercise, immediate conversions and unpremeditated changes of opinion cannot give a stability, purity, truth and strength of character such as is induced by long-continued practice in well-doing; and, as a reliable criterion for estimating character, a man's professed creed falls far below his habitual attitude of life.

These considerations suggest to us most important practical lessons, which the educator, whose function it is to train men, intellectually or morally, should never for a moment forget. The nature of *education* can be read in the etymology of the word; it consists of *drawing out* the powers, causing them to be energized, and directing them aright; and all our faculties, intellectual, moral or physical, are developed through the same law. It has been said that we may learn the whole secret of education in a gymnasium. Every organ to be trained is put into faithful exercise, and brought to the state desired, by being vigorously and frequently exerted. The powers of our higher nature are trained in the same way. Our emotional tendencies, our reasoning powers, our virtues, are developed through faithful exercise. Character itself is nothing other than the general result brought about by the course of action an individual has habitually chosen. A weak character, a strong character, a good or bad character, all these express merely different states of development which an individual has reached through habitual action. Each of the conquests, as also each of the failures made by him, stamps itself indelibly upon him, and the tendency at every step is toward a final fixed and immovable state. "The Battle of Life" has become almost a proverb, and its truth comes home to every heart in the consciousness of the inner struggle of contending forces, on the one hand the lower empirical instigations of the flesh, and on the other the moral ideal. In spite of all intelligent perception of the excellency of the moral law, in spite of approval, determination, and endeavour toward the right, the sorry absurdity of good opinions and bad life is often seen.

The rebellious organism and the insurgent passions may defeat all virtuous resolution. Knowledge alone is not sufficient. Theory and doctrine, and the inculcation of precepts, are no doubt well enough, they are in fact necessary in their place, but they are of no use unless supplemented by a practical training. They can never of themselves lead to the uniform habit of right action, and, unless aided by the practice of virtue, will be totally barren of results. There are many who approve of one course, and yet follow another. Their lives are truly battle fields where the struggle of opposing tendencies is still going on, and the struggle will cease only when frequent victory on either side has weakened and dissipated the resisting force, or brought it into regular submission. This necessity of a practical training in order to the attainment of the fixed state (ἕξις), called a virtuous character, is clearly expressed by Aristotle in the second book of the Nicomachean Ethics, where he speaks of men learning to be virtuous by practising virtue, just as they learn to build houses by building them, and to play on the harp by playing thereon.

The education of our voluntary powers of virtuous or vicious action is certainly of far greater importance as determining the destiny of the individual, than the education of the intellect. It is by over-coming that we learn to overcome, by obeying reason and the dictates of the moral law we learn to obey; and one single act of ours, whether it spring from principles within, or from authority, precept, or example, has a greater direct influence upon the development of character than all the mere theory in the world.

THIRD MEETING.

The Third Meeting was held on Saturday, 5th December, 1885, the President in the chair.

The following were elected members:—Herbert C. Rudge, Esq., A. C. Lawson, B.A.

The President reported that the committee appointed for the purpose of arranging for the admittance of the Natural History Society as a section of the Institute had successfully finished its labors. On motion of Mr. Bain, seconded by Dr. Cassidy, Dr. Ellis, Dr. Brodie, Prof. Loudon, Mr. Pearce and the mover were appointed a committee for the purpose of revising the Constitution and By-Laws for the establishment of sections and for arranging the minor details necessary for this purpose.

The following list of Donations and Exchanges was read:—

1. Canadian Practitioner, December, 1885.
2. Proceedings of the American Society for Psychical Research, Vol. I., No. 1, July, '85.
3. The American Naturalist, December, '85.
4. Proceedings of the American Philosophical Society, Vols. XVI–XXII., Nos. 97–120, and 11 Pamphlets.
5. American Chemical Review, Nov. 28. '85.
6. Journal of the Franklin Institute, Dec., '85.
7. Bulletin of the United States Geological Survey, Nos. 7–14.
8. Bulletin of the Museum of Comparative Zoölogy at Harvard College, Vol. XII., No. 2.
9. American Journal of Science, Dec., '85.
10. Proceedings of the Institution of Mechanical Engineers for March, 1885, from C. S. Gzowski, Esq.
11. Mémoires et Comptes Rendus des Travaux de la Société des Ingénieurs Civils, Juillet, '85, 52 numbers.

Mr. Alan Macdougall, M. Inst. C. E., F.R.S.E., read a paper on " Aërial Navigation."

The paper was an exhaustive treatise on the history of ballooning, or aërial navigation, from the earliest days down to the latest experiments of MM. Krebs and Renard in 1885. The conclusion the reader came to was that, so far as any success had been attained, it was more in the scientific than the commercial solution of the problem. The number of lives which have been lost of late years is not compensated for by any progress made in the practical solution of aërial navigation.

FOURTH MEETING.

The Fourth Meeting was held on Saturday, 12th December, 1885, the President in the chair.

The following list of Donations and Exchanges was read:—

1. Le Naturaliste Canadien, Vol. XV., No. 2.
2. Twenty-fifth Annual Report of the Museum of Comparative Zoology at Harvard College, for 1884–'85.
3. Science, Vol. VI., No. 148.
4. Proceedings of the American Association for the Advancement of Science, 22 Vols.
5. The Iowa Historical Record, Vol. I., No. 4.
6. Proceedings of the Cambridge Philosophical Society, Vol. V., Part 4.
7. Transactions of the Institution of Engineers and Shipbuilders of Scotland, 29th Series, 1885-'86.
8. Proceedings and Transactions of the Natural History Society of Glasgow, Vol. I. (N. S.), Part 1, 1883-'84.
9. Transactions of the Manchester Geological Society, Vol. XVIII., Pt 11.
10. Papers read before the Manchester Association of Employers, Foremen, and Draughtsmen of the Mechanical Trades of Great Britain, 31st March, 1883—28th March, 1885, 18 Pamphlets.
11. Lotos Jahrbuch für Naturwissenschaft, Neue Folge, VI. Band, Prag.
12. Monatsblätter des Wissenschaftlichen Club in Wien. VII. Jahrgang, Nos. 1 and 2, Oct. 15—Nov. 15, '85.
13. Bulletin de la Société de Géographie de Paris, Nos. 1 and 2, 1885.
14. Comptes Rendus des Séances de la Société de Géographie, Nos. 1-17, '85.
15. Correspondenz-blatt der Deutschen Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, XVI. Jahrgang, No. 10, October, 1885.
16. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XII., Nos. 4, 5, 6, 7.
17. Sechster Jahresbericht der Geographischen Gesellschaft zu Hannover, 1884-'85.

18. Bollettino della Società Geografica Italiana, Ser. II., Vol. X., Novembre. 1885, Anni XIX., Fas. II., Roma.
19. Atti della Società Toscana di Scienze Naturali in Pisa, Memorie, Vol. VI., Fasc. 2, 1885.

Total, 74.

Mr. W. A. Douglass, B.A., read a paper on "Rent—a criticism of Professor Walker's work on that subject."

In this work the Professor explains what he believes to be the correct theory of rent and then criticizes the writings of Carey. Bastiat, Louis-Boileau and George on this subject. He proclaims himself a Ricardian of Ricardians. The general theory of the value of commodities as taught both by Ricardo and Walker teaches that value depends on two conditions—desirability and *scarcity*; but when they treat of land they both introduce a new theory of value, the conditions of which are desirability and *difference.* Why this additional theory is necessary neither explains, nor is such explanation possible, for the general theory, which makes rent or the value of land depend on desirability and scarcity, is quite sufficient. The Ricardian theory assumes that the best lands are first occupied, but as soon as population increases so that resort must be had to inferior lands, then the better lands yield as rent the difference between the productiveness of the superior over the inferior land. While this is true, the growth of land values in cities is due to another cause, viz., the increasing advantage of contiguity giving greater facilities for exchange and subdivision of labour. This force is unnoticed by Walker, and a most astonishing omission made by most writers on this subject is the enormous ground rents of large cities. Most writers confine their attention to rural districts, where the effect of rent as a factor in the distribution of wealth is least manifest. To discuss rent where it amounts to $5 per acre, and not notice it where it amounts to ten thousandfold that sum is one of the most remarkable oversights in the study of Economics.

When explaining the theory of rent Walker points out that while lands may differ much in productiveness, the portion of the product retained by the labourer will be equal on all qualities of land and will be the same as the product on the poorest lands cultivated. If competition be fully active between these locations the above statement may be accepted as correct. Here two considerations may be noticed: First—does not this give the clue to the correct doctrine of a wage fund ? Say lands vary in fertility from 15 bushels upwards, then 15 bushels will be the wages of labour not merely on the free lands, but also on the most productive soils, and rent will take all the product in excess of 15 bushels. Second—Suppose population increases so that society must take in a lower quality of land, say a 12 bushel tract, then wages would fall to 12 bushels while rent will be increased by three bushels. Here we may notice, as pointed out by Ricardo, a movement of antagonism—the reduction of production, labor getting out of that reduced production a reduced proportion while rents increase. And it may be further noticed that increased rents mean not increased wealth but diminished wealth.

After an examination and refutation of the teaching of Bastiat in his Economic Harmonies that rent is payment for service, and after showing that Carey's criticism of the Ricardian theory is founded largely on a misapprehension of that theory, he then proceeds to examine the proposal of George that ground rent should be appropriated by the State. Walker gives his ready concurrence to the proposal of Mill that all future increase of ground rent should go to the State, if it were practicable, but he does not believe that the attempt would pay ; but that the State should appropriate present rentals he repudiates as unjust. Here Walker seems to be inconsistent in his teaching. From his exposition of the Ricardian theory we see at once that to allow individuals to appropriate ground rents has the inevitable effect of dividing society into toilers and idlers, imposing the whole toil of the world on one part of the population and allowing the rest to enjoy lives of luxurious idleness; that it establishes an antagonism in society, an increase of population depressing the toilers and enriching the idlers; that it condemns the majority of mankind inevitably to lives of toil and poverty; that it places an everlasting barrier to the progress of a large majority of the race.

Dr. Meredith thought rent was the measure of the difference in productiveness of soils, but a soil near a city produces a greater rent than a soil of the same quality further off; the unearned increment is independent of the owner of the lands ; land differs from all other commodities in some respects, and society has a right to modify its tenure; in personalty value depends on the labour put into it, but it is otherwise with land.

Mr. Galbraith said labour is the source of all value, and money is the measure of value; Ricardo's metaphysical distinctions are of no use; in the market natural properties are worth nothing; it is the improvements that give value; the solution of the question as to land and value is to be found in the banking system; our banks convert capital into credit; capital and money are not the same thing.

Mr. Phipps could not see the difference between earning $100 and putting it at interest, and buying $100 worth of land and getting rent for it; it was payment for labour in both cases; he denied the reality of the unearned increment; we must allow men to accumulate property; this right is a security for society; without the desire to accumulate we would be savages.

The discussion was continued by Messrs. Bain, Browning, Marling, and others.

FIFTH MEETING.

The Fifth Meeting was held on Saturday, 19th December, 1885, the President in the chair.

The following list of Donations and Exchanges was read :—

1. Annual Report of the Bureau of Industries, Province of Ontario, for 1884.
2. Boulder Clays, by Dr. G. M. Dawson, Geological Survey of Canada.
3. The Canadian Entomologist for Nov. '85.
4. Monthly Weather Review, Dominion of Canada, for Nov. '85.
5. Science, Dec. 11, '85.
6. Appleton's Literary Bulletin, Vol. IV., No. 6.
7. The Hoosier Naturalist, Vol. I., No. 5, Valparaiso, Indiana, Dec. '85.
8. The West American Scientist, San Diego, California, Nos. 3, 4, 5, 6, 7, 8, 10, Feb.—Oct., '85.
9. The Iowa Historical Record, Vol. I., Nos. 1, 2, 3, Jan.—July, '85.
10. Collections of the Georgia Historical Society, Vols. 2, 3, 4 Savannah, 1842—1878.
11. Proceedings of the Physical Society of London, Vol. VII., Parts 1, 2, July and Oct., 1885.
12. Proceedings of the Royal Physical Society of Edinburgh, Vol. VIII., Part 2, Sessions 1884–85.

13. Proceedings of the Royal Geographical Society for Dec., '85.
14. Scottish Geographical Magazine, for Dec., '85.
    Report of the Council of the Scottish Geographical Society, Sessions 1884–85.
15. Reports of the "Ballad," "Chaucer," and "Early English Text" Societies.
16. Report and Proceedings of the Belfast Natural History and Philosophical Society for Sessions 1884–85.
17. Lectures on the Theory and Practice of Hydro-Mechanics, delivered at the Institution of Civil Engineers, London, Sessions 1884–85.
18. Archivio per l'Antropologia e la Etnologia, Quindicesimo Volume, Fascicolo Secondo, Firenze.
19. Cosmos di Guido Cora, Vol. VIII., Parts VIII., IX., 1884.
20. Electricité : Revue Hebdomadaire for 28 Nov., '85.
21. Naturhistorisches Museum zu Hamburg, Bericht, 1885.
22. Bollettino di Bibliographia e di Storia delle Scienze Matematiche e Fisiche, Tomo XVIII., Gennaio e Febbraio, 1885. Roma.
23. Compte Rendu des Séances de la Commission Centrale de la Société de Géographie, No. 18, Paris, '85.
24. Bulletin du Musée Royal d'Histoire Naturelle de Belgique, Tomes I., II., III., 1882, 1883, 1884–85. Bruxelles.
25. Mittheilungen der Anthropologischen Gesellschaft in Wien, XV., Band 1 Heft. 1885.
26. Catalogue Wisconsin State Historical Society, Vols. 1—6, 1873—1884. Wisconsin Historical Collections, Vol. IX., 1880—82.

Mr. George S. Hodgins was elected a member.

Mr. Wm. Houston, M.A., read a paper on "The Village Community in Modern Politics," of which the following is a summary :—

The term "Village Community" has now amongst writers on political science a well-understood meaning. The institution connoted by it is of very ancient origin, being traceable in its essential features as far back as investigations have yet been carried with anything like definite results. It is also very wide spread, being common to at least all the Aryan peoples. It would have been surprising if a social institution so ubiquitous and persistent had not left numerous traces of its influence on the modern political institutions of even highly civilized Aryan nations, and as a matter of fact it has done so. To call attention to some of the modern "survivals" of the Aryan village community is the purpose of this paper. The proper method of investigation in a matter of this kind would be the inductive one. Existing political institutions, especially such as are of a local character, should be analysed, and the history of their various essential features should be traced back until we arrive at the most original forms. But as this method cannot advantageously be applied within the limits of a single paper, I must begin at the other end of the series—that is, define the ancient* village community, and briefly point out some modern institutions that are clearly traceable to it.

A few words on the bibliography of this question. From a comparatively early period in the British occupation of India the village community was noticed by the East India Company's officers, but its essential features were not well understood, and this want of perception led to many disastrous blunders in their administration. Sir Henry Maine, one of the most eminent of English publicists and jurists, was the first to discern the real character of the organization of native Indian society. Prior to his Indian experience he had, through the investigations of Nasse and others, become acquainted with the traces left by the village community on the political and social institutions of the Teutonic countries of Europe, including England. With the eye of genius he soon discerned that the Indian "village" and the British and Teutonic "village" were in their essential features identical, and this at once suggested to him that they must have had a common origin. In a series of lectures on "Village Communities East and West," delivered at Oxford in the year 1871, he enunciated his theory and thus gave an entirely new and most fruitful impulse and direction to historical investigation and the science of comparative politics. Since that time the "Aryan village in India and Ceylon"—that is, the modern Aryan village as seen in those countries to-day—has been elaborately described by Sir John Phear. Seebohm, Gomme, Hearn, Coulanges, and others have followed the subject up comparatively and systematically, while various descriptive writers have incidentally thrown much light on the communal institutions of the countries described. The information contributed in the latter way by Mr. Wallace in his account of Russia was peculiarly valuable and timely, for the Russian "mir" delineated in his pages is beyond all question substantially identical with the English "township" and the German "village."

It is not easy to define, or even briefly describe, the "village com-

* The term "ancient" must not be understood absolutely in this connection, for to this day the village community exists in India, and even in some parts of Europe, in exceedingly primitive forms. Indeed the term "primitive" expresses more accurately than "ancient" the idea intended to be conveyed.

munity," for it took widely differing forms in different countries and at different periods in the history of each country. A comparative study of these forms, however, shows that a typical Ayran village is marked by several easily recognized features, of which the following are the most important: —(1) Community of land-holding, (2) customary law, (3) assembly-government in the community, (4) patriarchal authority (*patria potestas*) in the family, and (5) caste. Of these the last two may be passed over with a mere mention, for though they profoundly affect the constitution of modern society even in our own country they do so in ways that are not usually regarded as "political." A "village community," then, may be described as a composite political unit made up of a number of "households," each of which is presided over by a patriarch. The affairs of each household are managed by the household itself under the authority of the *paterfamilias*, no outsider having any right to so much as enter its precincts unbidden. The land included within the village boundaries is divided up amongst the households, each plot being held by the whole household in common, and individual ownership in land being unknown. An additional area of land outside is held by the households in common, no household owning any one portion, and the area being allotted and re-allotted from time to time in accordance with traditional customs, and under the collective authority of the heads of households. All affairs relating to the community as such are transacted under the same authority, for representative government is as absolutely unknown as individual property in land. There are no enacted laws, and no prescribed punishments. Custom is the only law, and assassination and "boycotting" are the only sanctions. If a member of a household resists the patriarchal authority, that authority is left to deal with him. If a member of the community violates its customs, he is put to death when the offence is serious enough, and in other cases is tabooed, or isolated, or "boycotted."

From the institution of the village community thus imperfectly outlined have been developed our modern municipal government, our administration of justice, and our various forms of land tenure. What institutions of a social kind preceded the village community need not concern us in this inquiry. We need not care whether the village was the result of the fissiparous division of a nomadic horde or of the aggregation into a group of a number of households. It is sufficient for our purpose to know that over Europe and a large part of Asia it was practically universal, and that in India, Russia, the Slavonic portions of Turkey in Europe, and some parts of Germany, it exists to the present day with its essential features well preserved. Even in Great Britain and Ireland some of these features are quite discernible. The folk-moots, allotments and re-allotments of land, commons, and other local institutions and customs in England: community of tenure of land in Scotland; the sept in Ireland, and the gavelkind in Kent are all survivals of the Aryan village community. The keen and persistent desire of the peasant to own a piece of land—the "land-hunger," as it has been well called—is not a desire of modern growth. It is rather a survival from a time when the peasant had a real share in the ownership of the land, when, though there was no part of it which he could claim permanently as his, there was no part of the common area in which he had not as much proprietary interest as his neighbor. Less than two hundred years ago there were large areas of commons scattered over England. Much of this land has been enclosed and handed over to private owners under the authority of Acts of Parliament. It is doubtful whether the people of the various localities, the real owners, were ever reimbursed for their loss; it is quite certain that the sense of their loss has never died out, and that this feeling is strong enough to give effect to the clamour for allotments, facetiously designated as a demand for "three acres and a cow." Even the practice of "boycotting," now so frequently resorted to in Ireland, is not a modern device, but a survival, telling us of a time when the ordinary method of punishing a man for practices obnoxious to his neighbors was to "send him to Coventry."

In the days of Charles I., the village community had more of its features in a state of sound preservation in England than it has now. Worthy of special notice is the government of local affairs by means of local assemblies of the people. This custom was transplanted to New England by the Puritan exiles, and on the virgin political soil it grew and flourished. The well-known New England "town meeting" is the direct offspring of the Old England folk-moot. In the Puritan colony each little district managed its own local affairs by means of public meetings in which each head of a family had the same authority as every other, and in many of them a portion of the public domain was held in common and occasionally, if not periodically, re-allotted. In course of time some of the "towns" grew so large as to be unwieldy under the general-assembly system, and administration of town affairs by "select-men" filled up the interval between the yearly meetings of the general assembly. At the time of the Revolution, Boston, with 50,000 of a population, was still an old-fashioned town, the leading spirit in its turbulent *rôle* at that time being "Sam Adams, the man of the Boston town-meeting." The transition from town-meeting to representative municipal government was, with a people remarkable for their ingenuity, natural and obvious, and municipal institutions thus organized spread rapidly over the middle and western states, being carried everywhere in embryo by the migrating New Englander, as the seeds of plants are carried by a variety of unconscious agencies. Nearly half a century ago they came into Canada also, and from that time to the present we have been developing this survival of the Aryan village, seldom taking a thought of the antiquity of its origin. Our public nomination of mayor in the municipal election is a "town-meeting," and our submission of money by-laws to a vote of the taxpayers is a relic of the practice of voting the appropriations for the year in a general assembly of the "town" house-holders.

In other ways modern Canadian institutions have been affected by the village community. The Mennonites who took up their abode a dozen years ago on the Manitoba plains brought with them their primitive village organization, and they have shown themselves reluctant to abandon it. A few years later, when the Manitoba legislature created a system of municipal government for that Province, the Mennonites would have nothing to do with it. Instead of each owner building a homestead on his own farm the dwellings were erected in groups, while the land, owned individually, was nevertheless farmed in common.* During the lifetime of the present generation, if not for a longer period, the Canadian student of comparative politics will be able to investigate the "village community" in a very primitive stage of development without leaving his own country.

When the French colonists settled in Quebec they brought with

* The community system seems to have received a fatal blow through a gross breach of faith on the part of one of the owners, on whose lot several people had built their homesteads. He lately claimed all their houses as his because they were on his land, and whether he succeeds in holding them or not each owner is likely to build hereafter on his own property. While the dishonesty is regrettable the impulse given to individualism is not.

them institutions and practices that were almost certainly an outgrowth of the "village community," modified by feudalism. The seigniories may be specified amongst the former; the practice of grouping their dwellings together on the river banks amongst the latter. I am not aware that community of ownership of land prevailed at any time to a large extent, but traces of it are clearly discernible in the French settlements in the Northwest. The right to cut hay and fuel on land not owned by any one individual was conceded to each member of the little settlement, while its internal affairs were managed to some extent at least on the old community plan. Without raising the question, whether the Metis were justified in their uprisings on the Red River and the Saskatchewan, there can be no doubt that each of these *émeutes* was due largely to the dislike of the simple villagers to the introduction of the square-lot system, and to their dread of interference with the river-front arrangement which suited so well alike their habits of life and their stage of political development.

Mr. VanderSmissen related from Immermann's Oberhof an incident showing the strong tenacity with which men cling to ancient institutions.

Mr. Browning, from his recent observation in the North-West, made some remarks on the ownership of land among the Indians. Not being agricultural, but nomadic, they did not exercise the right of proprietorship of the soil. The Crees were the only exception. He gave an account of the ceremonies he had witnessed at the adoption of an individual from another tribe. He then referred to the change made in Scotland by the expropriation of land by the landlords who from the heads of clans became feudal lords.

Mr. Livingston took exception to some of the statements made by Mr. Houston, and gave some instances that came under his observation of the serious trouble caused to settlers by the enforcement of the land regulations of the North-West.

Mr. Boyle replied to Mr. Livingston's remarks.

Mr. Rouse made enquiry respecting the village community in Russia.

Mr. Houston replied that Russia afforded the most perfect example of the existence of the village community.

Mr. Phipps corroborated Mr. Houston's statement respecting the village communities in Russia. He called attention to the absence of reference to the village communities in the documents of the reigns of Henry I., Stephen, and other early English kings; and made some observations on the changes of the tenure of land in Scotland owing to the rebellion of '45.

SIXTH MEETING.

The Sixth Meeting was held on Saturday, 9th January, 1886, the 2nd Vice-President in the chair.

The following list of Donations and Exchanges was read ·

I.—CANADA AND THE UNITED STATES.

1. Le Naturaliste Canadien, Dec., 1885.
2. The Canadian Practitioner, Jan., 1886.
3. Science, Vol. VI., Nos. 150, 151 ; Vol. VII., No. 152.
4. Transactions of the American Society of Civil Engineers, Nov., 1885.
5. Bulletin of the California Academy of Sciences, Nos. 1, 2, 3.
   Illustrations of the Zygænidæ and Bambycidæ of North America, by Richard H. Stretch, Vol. I., Parts 1—9.
   Four Pamphlets on Early Migration, by Charles Wolcott Brooks, 1876—'84.
   Proceedings of the California Academy of Sciences, 2 Pamphlets, 1880-81.
   Catalogue of the Pacific Coast Fungi, 1880.
6. Magazine of American History, Jan. 7, '86.
7. Johns Hopkins University Circular for December, 1885.
8. The Apparent Position of the Zodiacal Light, by Arthur Searle.
9. American Journal of Science, January, '86.
10. The American Naturalist, January, '86.
11. Essex Institute Historical Collections, Vol. XXII., Nos. 4, 5, 6.
12. Third Annual Report of the Bureau of Ethnology, 1881-82, Washington.
13. Journal of the American Chemical Society, Vol. VII., No. 9, Nov. 1885.
14. Journal of the Franklin Institute, January, 1886.

Total, 26 numbers.

II.—GREAT BRITAIN, IRELAND AND INDIA.

1. The Midland Naturarist, Dec. 1885.
2. Proceedings of the Royal Society, Vol. XXXIX., No. 239.
3. The Scottish Geographical Magazine, Vol. I, Nos. 1—3.
4. Monthly Notices of the Royal Astronomical Society, November, 1885.
5. Transactions of the Institution of the Civil Engineers of Ireland, Vol XV.
6. Transactions of the Institution of Engineers and Shipbuilders of Scotland, 29th Sess., 1885-86.
7. Journal of the Royal Microscopical Society, December, 1885.
8. Journal of the Transactions of the Victoria Institute, Vol. XIX., Part 3.
9. Proceedings of the London Mathematical Society, Nos. 250—252.
10. Proceedings of the Asiatic Society of Bengal, Nos. VI., VII., VIII., June—August, 1885.

    Journal of the Asiatic Society of Bengal, Vol. LIV., Part II., Nos. 1, 2. 1885.

Total, 14 numbers.

III.—FOREIGN.

1. Electricité, Vol. 9e. Nos. 49, 50, 51.
2. Annales de l' Ecole Polytechnique de Delft, 1re et 2me Livraison, 1884-5.
3. Annales des Mines, Tome VIII., Part 4.
4. Archives Néerlandaises des Sciences Exactes et Naturelles. Tome XIX. Liv. 3me. Tome XX., 3me Liv.
5. Bulletino della Sezione Fiorentina della Società Africana d' Italia. Anno I., Fasc. 5.
6. Actos de la Academia Nacional de Ciencias en Córdoba, Tomo V., Enta. 1, 2.
7. Cosmos, Nos. 46, 47, 1885.
8. Monatliche Mittheilungen des Naturwissenschaftlichen Vereins des Regierungsbezirkes Frankfurt an der Oder. 3 Jahrgang, Nos. 1—8. April—Nov., 1885.
9. Verhandlungen des Naturhistorisch-Medicinischen Vereins zu Heidelberg. Band III., Heft 4.
10. Commentari dell ' Ateneo di Brescia per l' Anno 1885.
11. Bollettino della Società Entomologica Italiana, 1883, 1884, 1885, 8 parts.
12. Bulletin de la Société de Geographie, 3e Trimestre, 1885.
13. Archivio di Letteratura Biblica ed Orientale. Anno VII., No. 1—11.
14. Journal des Sociétés Scientifiques. Nos. 50 et 51, 1885.
15. (1) Monatsblätter des Wissenschaftlichen Club in Wien, VII. Jahrgang No. 3.

    (2) Beiträge zur den Monatsblättern des Wissenschaftlichen Club in Wien, 15 Octr., 1885.
16. (1) Zeitschrift des Historischen Vereins für Niedersachsen, 1885.

    (2) Leibnizens Entwürfe zu seinen Annalen von 1691 und 1692.

    (3) Afrika auf der Ebsterfer Weltkarte.
17. Le Syllogue Littéraire Grec de Constantinople.

    Συγγραμμα Περιοδικον. Tomes 19'.

    Παρατηματα. 3 Nos., *του* T. 19'.

18. Bulletin du Musée Royal d' Histoire Naturelle de Belgique. Tome IV., No. 1.
19. Mémoires de la Société Nationale des Sciences de Cherbourg, Tome XXIX.

Catalogue 2 Partie, 3 Liv. 57.

Total 97 numbers.

The following were elected members: W. H. C. Kerr, M.A., Wm. H. Knowlton, James Goldie.

Mr. T. Nelson Dale read a Paper on "New England Upper Silurian."

Mr. Dale gave a general account of visits made by him to the well-known localities of Bernardston, Mass., and Littleton, New Hampshire, under the direction of Prof. Raphael Pumpelly of the North Atlantic Division of the U. S. Geological Survey.

At Bernardston, Mass., a bed of an impure crystalline crinoid limestone, associated with magnetite, garnets, chlorite, mica, pyrite and limonite, dips under a thin-bedded quartzite and a garnetiferous mica schist which are unconformably overlaid by the Triassic Sandstone of the Connecticut River Valley. The limestone has generally been regarded as Lower Upper Silurian or Upper Lower Silurian.

At Littleton, N. H., a more or less argillaceous crinoid limestone containing Favosites, Halysites, Pentamerus, etc., and associated with slates, some of which contain Trilobites, overlies a more or less schistose Protogene, and is followed by a metamorphic sandstone.

The fossils at this locality are sufficiently numerous to permit an exact determination of the age of the beds. They have usually been regarded as Lower Helderberg.

Both localities are remarkable for the presence of somewhat recent Silurian rocks associated with rocks or minerals showing a high degree of metamorphism; and it would seem that careful paleontological and stratigraphical investigations at these and similar localities ought to throw light on the age of many rocks which, on account of their crystalline character, have been classified as azoic or placed in an uncertain group at the base of the Lower Silurian.

In answer to an enquiry of Mr. J. H. Hunter, whether any specimens of organisms had been found in the gneissoid rocks of the United States, Mr. Dale replied that he was not aware of any having been found in gneissoid rocks, but trilobites had been found in mica-schist.

Dr. Ellis made some remarks on the occurrence of beds of iron ore with limestone, and wished to know whether geologists had formed any theory as to the origin of ferruginous deposits.

Mr. Dale stated, that some ferruginous deposits might be direct products of erosion, as in the case of the magnetite which frequently occurs in beach sand in the vicinity of crystalline rocks, but that they were probably more often of a largely chemical origin. Geologists usually concerned themselves more about the chemical questions involved in the formation and alteration of ferruginous deposits than with the physical ones.

In answer to a question from Mr. Boyle, Mr. Dale said he had not found any specimens of crinoids over two inches in length ; the greater number of the specimens were much less. As to the species, it was generally considered that they were Upper Silurian.

Mr. Livingston called attention to the remarkable boulder near Mount Washington.

Mr. Dale said that the size and shape of the boulders would naturally be determined by the joints of the rock from which they originated. He illustrated how the rock would be broken into blocks by an experiment with a box of clay subjected to hydraulic pressure.

The President read the Report of the Committee appointed to revise the Rules and Regulations of the Institute, and gave notice that at a special general meeting to be held on 23rd January, 1886, he would move that the Rules and Regulations be amended in accordance with the Report of the Committee.

SEVENTH MEETING.

The Seventh Meeting was held on 16th January, 1886, the President in the chair.

The following list of Donations and Exchanges was read:

1. The Canadian Record of Science, Vol. II., No. 1.
2. Science, Vol. VII., No. 153, Jan. 8th, '86.
3. Transactions of the New York Academy of Sciences, Vol. III., 1883–'84, Do., Vol V., No. 1, October, 1885.
4. Journal of the Cincinnati Society of Natural History, Vol. VIII., No. 4, Jan., '86.
5. Report of the U. S. Coast and Geodetic Survey for 1884.
6. The Magazine of Western History, Vol. III., Nos. 1 and 3, November, '85, and January, '86.
7. Transactions of the Sanitary Institute of Great Britain, Vol. XI., 1884–'85.
8. Cosmos, No. 48, Dec. 28, '85.
9. Electricité, No. 52, Dec. 26, '85.
10. Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche, Tomo XVIII., Marzo, 1885.
11. Compte Rendu de la Société de Géographie, Paris, Nos. 19, 20.
12. Journal des Sociétés Scientifiques, No. 52.
13. Bulletin de la Société Géologique de France, 3e Série, t. xiii., '85, No. 6.
14. Bulletin de la Société Géologique de Normandie, Tome IX., 1882.
15. Mémoires du Comité Géologique, Vol. II., No. 1, St. Petersburg.

Total, 17.

Mr. Arthur M. Stow was elected a member.

Mr. VanderSmissen, on behalf of Professor Campbell of Montreal, read a Paper entitled: "Etruria Capta." The First Part of this Paper has been published in Vol. III., p. 144; the Second Part is being revised by the author, and will appear in a subsequent issue.

After reading the paper and giving a brief resumé of the labours of Corssen, Lanzi, Bréal, Deecke and other leading Etruscologists, Mr. VanderSmissen proceeded to give illustrations of a few sepulchral inscriptions in the Etruscan character, to show the application of the key and the results produced, dwelling particularly on the translations of a few bilinguals, in which the Etruscan characters are accompanied by Latin ones.

Professor Campbell, however, not content with deciphering 101 brief inscriptions, also applied himself, in the second portion of his paper, to the Eugubine Tables, a document hitherto read as Umbrian, though written in the Etruscan character, and containing over 350 lines. This document was found to contain a long and complicated story of an Etruscan and Umbrian revolt, incorrectly related by Livy in the 36th chapter of book XXXIII. of his history of Rome. The remaining portion of these tables, also read as Umbrian, a dialect closely akin to Latin, but written in plainly legible Latin characters, was placed in the hands of Dr. McNish of Cornwall, whose attainments as a Celtic scholar were well known to the members of the Institute, and will shortly be presented to the world as the *oldest Celtic document* extant, being in a language closely connected with the Gælic. They deal with the same events as the Etruscan portions, and tell the same story from a different standpoint.

Mr. VanderSmissen then gave a brief estimate of the contents of the paper, and expressed strong confidence that Professor Campbell's method would ultimately establish itself as true.

In conclusion, Mr. VanderSmissen announced that Prof. Campbell had succeeded in reading, by the help of the same key, some Celt-Iberian inscriptions in a character which was but a variant of the Etruscan, and which had been sent to him by the Rev. Mr. Webster, of Bechienia, in the Basque country.

He regretted that he (Mr. VanderSmissen) had not been able, on account of his University work, to give the subject that attention its importance demands, but hoped to do so during the coming vacation and asked the co-operation of such members of the Institute as were interested in the subject.

EIGHTH MEETING.

The Eighth Meeting was held on 23rd January, 1886, being also a special general meeting pursuant to notice, the President in the chair.

The following list of Donations and Exchanges was read :

1. Monthly Weather Review, Dominion of Canada, Dec., 1885.
2. Report of the Committee, House of Commons, Canada, on Geological Surveys.
3. Science, Vol. VII., No. 154, Jan. 15, 1886.
4. Transactions of the New York Academy of Science, Vol. 5, No. 2, Nov. 1885.
5. University of Pennsylvania—Catalogue and Announcements, 1885-'86.
6. Bulletin of the American Geographical Society, No. 2, 1885, New York.
7. The Electrician and Electrical Engineer, New York, Vol. V., No. 49, Jan. 1886.
8. Electrical Review, Jan. 23, '86.
9. (1) Proceedings of the New Jersey Historical Society (Second Series), Vol. VIII., 1884-85.
   (2) New Jersey Archives (First Series), Vol. IX.
10. Journal of Speculative Philosophy for July, 1885.
11. West American Scientist, Vol, 1, Nos. 3 and 11.
12. Proceedings of the U. S. Naval Institute, Vol. XI., No. 4. (Annapolis, Md.)
13. The Illustrated Journal of Patented Inventions, Vol. I., Nos. 1—31. Nov. 28, 1884—June 26, 1885. Vol. II., Nos. 32—56, July 3, 1885—Jan. 8, 1886.
14. The Midland Naturalist, Vol. IX., Jan., '86.
15. Trübner's American, European and Oriental Literary Record, Nos. 217, 218.
16. Electricité, Vol. 10, No. 1.
17. Cosmos, No. 49.
18. Bollettino della Società Geografica Italiana, Ser. II., Vol. X., Fascicolo 12.
19. Crónica Cientifica, Barcelona. Año VIII., Num. 193.
20. Wochenschrift des Oesterreichischen Ingenieur und Architekten Vereines, XI. Jahrgang, No. 1, Wien.
21. Transactions of the Mathematical Society of Charkoff, 1885, Part I.

Total 78.

The Rules and Regulations, as revised by the special Committee, were then considered seriatim, and adopted as follows, to come into force at the next annual meeting :

REGULATIONS AND BY-LAWS OF THE CANADIAN INSTITUTE,

As amended at the Special General Meeting, January 23rd, 1886.

REGULATIONS.

SECTION I.

INCORPORATION.

The Canadian Institute is established under Royal Charter, granted November 4th, 1851.

SECTION II.

OBJECT.

The object of the Institute is the promotion of Pure and Applied Science.

SECTION III.

CONSTITUTION.

1. The Canadian Institute shall consist of Members and Associates.

2. There shall be three classes of members, *Ordinary*, *Life*, and *Honorary* members.

3. Ordinary members shall be persons whose pursuits or studies are connected with the Arts or Sciences, or who are desirous of forwarding the objects of the Institute.

4. Ordinary members may become life members by compounding their annual subscriptions by the payment of fifty dollars.

5. Honorary members shall be persons of high standing, who are eminent for their scientific attainments.

6. The number of honorary members shall be limited to twenty-five.

7. Associates shall have all the privileges of membership, except the right of voting, or taking part in the proceedings at meetings of the Institute or sections, or of receiving copies of the publications of the Institute.

8. For the promotion of the study of special branches of pure and applied science, the Institute shall be divided into such Sections as the Council shall from time to time determine subject to the subsequent approval of the Institute. Each Section shall frame its own regulations and by-laws subject to the approval of the Council.

9. The officers of the Institute shall be a President, a Vice-President, a Secretary, a Treasurer, an Editor, a Librarian, a Curator, and six members of Council, all of whom shall be elected annually by the members of the Institute.

SECTION IV.

THE ELECTION OF MEMBERS.

1. All persons desirous of being admitted into the Institute as members must be proposed at least one week before their election in accordance with a

form to be obtained from the Secretary, which form must be subscribed by at least two members of the Institute.

3. Honorary members must be recommended by at least three members, who shall certify that the candidate is a person eminent for his attainments in science.

3. Every recommendation of a candidate, as an honorary member, must be delivered to the Secretary, who shall submit the same to the Council for enquiry ; and when the recommendation of such candidate is approved by the Council, it shall be signed by the Chairman, and read at the first following ordinary meeting previous to the ballot being taken.

4. All elections of members shall be by ballot and the proportion of votes requisite for the election of any person shall be at least three-fourths of the ballot.

5. Whenever any person is elected a member, the Secretary shall immediately inform him of the same by letter ; and no person shall be considered a member of any class until he has signified his acquiescence in the election, and paid his first annual subscription.

6. If any complaint is brought against a member, the charge shall be considered by the Council in the first instance, and an opportunity shall be given to the accused to clear himself. If the Council consider it desirable, they shall call a special general meeting, of which, not less than a month's notice shall be given ; and in case two-thirds of the members present at that meeting are of opinion that such member should be expelled, the presiding officer at that meeting shall declare him to be expelled.

SECTION V.

THE ELECTION OF OFFICERS.

1. The President, Vice-President, Treasurer, Secretary, Editor, Curator, Librarian, and six other members of Council shall be elected annually by ballot from amongst the members of the Institute, at the general meeting, on the first Saturday in May, and if that day falls upon a holiday, then upon the following Saturday.

2. Nominations for these offices must be made at the ordinary meeting immediately preceding the annual general meeting, and only those shall be eligible who have been so nominated.

3. Any member nominated to an office and not elected thereto, shall be eligible as a member of the Council.

4. At the annual election the Chairman shall appoint two scrutineers, who shall receive the votes of the members, count them, and report to the presiding officer, who shall declare the result to the members.

5. A separate ballot shall be taken for the President, for the Vice-President, and for each of the other officers, except the Councillors ; and a ballot shall then be taken for the remaining six members of Council.

6. If in any case the votes are equal, the decision shall be by ballot.

7. Each section shall elect its own officers at the meeting of section preceding the annual meeting of the Institute.

8. The new Council shall enter upon their duties on the Saturday following their election.

9. Two Auditors shall be appointed at the ordinary meeting held on the third Saturday in March of each year; one by the members, the other by the Chairman.

SECTION VI.

MEMBERS' SUBSCRIPTIONS.

1. The annual subscription of each member residing in or within ten miles of the city of Toronto, shall be four dollars; and of each member residing elsewhere, two dollars. All subscriptions shall be due in advance on the first day of January, and all new members shall pay *pro rata* in advance until the thirty-first day of December next following the date of their election.

2. Every member shall receive a copy of the transactions and proceedings of the Institute published after his election so long as he shall continue in good standing.

3. Every member and associate shall be considered as belonging to the Institute, and, as such, liable to the payment of his annual subscription, until he has either forfeited his claim or has signified to the Secretary, in writing, his desire to withdraw, when his name shall be erased from the list of members.

4. No member or associate shall be entitled to any of the privileges of the Institute whose subscription shall be twelve months in arrear, and the name of any member whose annual subscriptions are two years in arrear may be erased from the list of members by the Council, and any member whose name is so erased shall cease to be a member of the Institute.

SECTION VII.

THE PRESIDENT, VICE-PRESIDENT, AND CHAIRMEN OF SECTIONS.

1. It shall be the duty of the President to carry into effect the regulations of the Institute. He shall preside at all meetings of the Institute at which he is present, and shall regulate and keep order in the proceedings.

2. In the absence of the President it shall be the duty of the Vice-President to preside at the meetings and regulate the proceedings. But in the absence of the President and Vice-President, the members present may elect one of their number to take the chair at such meeting.

3. The Chairmen of Sections shall preside at the meetings of their respective Sections.

SECTION VIII.

THE TREASURER.

1. The Treasurer shall keep an account of all the moneys of the Institute, and of all dealings therewith.

2. All moneys received for, or on account of the Institute, shall be paid over to the Treasurer, who shall deposit the same in one of the chartered

banks in the city of Toronto to the account and for the use of the Institute, unless otherwise ordered by the Council.

3. No money of the Institute shall be paid out except by order of the Council, and cheques shall be drawn in such manner as the Council shall from time to time direct.

SECTION IX.

THE SECRETARY.

1. The duty of the Secretary shall be to take minutes of all the proceedings of the Institute and of the Council, and enter them in the proper books ; to read at each meeting the minutes of the preceding meeting with a view to their verification, and subject to the direction of the Chairman, to bring before the meeting all business matters according to the order established by the by-law in that behalf. He shall also conduct the correspondence of the Institute.

2. The Secretaries of sections shall perform the functions of Recording and Corresponding Secretaries for their own Sections, unless the Section shall have appointed a Corresponding Secretary, in which case the Secretary of that Section shall perform the duties of Recording Secretary only.

3. The duties of the Assistant Secretary shall be defined from time to time by the Council.

SECTION X.

THE EDITOR.

The Editor shall have charge of the publication of the Proceedings of the Institute, in conjunction with an Editing Committee to be nominated by the Council from among its members at the first meeting thereof after the annual meeting. All papers or abstracts of papers read before the Institute and intended for publication shall be handed to the Editor at the close of the respective meetings at which they were read, or as soon as possible thereafter, and the decision as to the propriety or expediency of publishing any paper shall rest with the Editing Committee.

SECTION XI.

THE LIBRARIAN.

The Librarian shall have the care of all books, plans, drawings, and other documents, and shall have the general superintendence of the same, under the direction of the Council. He shall keep a list of all donations to the library in the order in which they are received, with the names of the donors.

SECTION XII.

THE CURATOR.

1. The Curator shall have charge of the museum, and of all models and specimens deposited therein, and shall have the general superintendence of the same, under the direction of the Council ; and he shall keep a list of a'l contributions with the names of the contributors.

2. The Assistant Curators shall be appointed by the Sections, and shall assist the Curator in the care of the museum and the specimens contained in it, so far as relates to their own departments.

SECTION XIII.
THE COUNCIL.

1. The Council shall consist of the President, Vice-President, the Chairmen of Sections, the Secretary and Secretaries of Sections, the Treasurer, the Editor, the Librarian, the Curator, and six other members, who shall have the direction and management of the affairs of the Institute.

2. The Council shall meet at least once a month during the session, or oftener if necessary, to conduct the business of the Institute.

3. Any two members of the Council may, by letter to the Secretary, require a special meeting to be called, and two days' notice of such meeting must be given to each member of the Council.

4. At any meeting of the Council five members thereof shall constitute a a quorum.

5. The Council shall have power to appoint Committees for special purposes, and such Committees shall report to the Council.

6. The Council shall present at the annual general meeting a report on the state of the Institute, in which shall be given an abstract of all the proceedings, and of the receipts and expenditures during the year ending March 31st next before such meeting.

7. In the event of any office becoming vacant before the annual general meeting, by death or otherwise, the Council shall have power to fill the vacancy; and in the event of any officer being unable to perform his duties, the Council shall have power to relieve him from the performance of such duties for the time being, and to appoint another member to act in his stead.

SECTION XIV.
THE AUDITORS.

The Auditors shall audit the accounts of the Institute for the year ending on March 31st next after their appointment, and they shall present their report to the Council at least one week before the annual general meeting.

SECTION XV.
THE ORDINARY MEETINGS.

1. The ordinary meetings of Sections shall take place at such times as may be agreed upon by the sections, subject to the approval of the Council.

2. The meetings of the Institute shall be at such times as the Council shall direct.

SECTION XVI.
SPECIAL GENERAL MEETING.

1. The Council may at any time call a special general meeting of the Institute on six days' notice in writing thereof to city members, which notice may be given either personally or transmitted by post to the last known address of the member.

2. It shall be the duty of the Council to call a special general meeting of the Institute at any time between October 1st and May 1st on being required in writing by at least twelve members to do so.

SECTION XVII.

THE ANNUAL GENERAL MEETING.

The annual general meeting of the Institute shall be held on the first Saturday in May of each year, at twenty o'clock (eight o'clock in the evening), for the purpose of receiving and considering the Report of the Council on the state of the Institute, and electing the officers and members of the Council for the ensuing year.

SECTION XVIII.

BRANCH SOCIETIES.

Members of the Institute residing at a distance of ten miles from the city of Toronto shall have power to form themselves into branch societies for the purpose of holding meetings and discussing subjects proper to the objects of the Institute, and such branch societies shall be governed by such by-laws as the Council may from time to time enact for such purposes.

SECTION XIX.

ALTERING THE REGULATIONS.

A motion to alter any by-law or regulation of the Institute may be made at the annual general meeting or a special general meeting called for the purpose, and not otherwise; and notice of the proposed alteration shall have been given at two consecutive ordinary meetings prior thereto.

SECTION XX.

THE PROPERTY OF THE INSTITUTE.

1. The whole of the property and effects of the Institute, of what kind soever, shall be vested in the Council of the Institute and subject to its control.

2. Every paper, map, or drawing, which may be presented to the Institute, shall be considered the property thereof, unless there shall have been some arrangement to the contrary, and the Council may publish the same in connection with their transactions, or, with the consent of the author, in any other form. No communication made to the Institute shall be published by any other person but the author without the previous consent of the Council.

3. Every paper presented to the Institute for publication shall be referred to an Editing Committee appointed by the Council. Notices or abstracts of all papers not published in full shall be prepared by the Editing Committee.

4. No papers, plans, maps, or other property belonging to the Institute, shall be taken out of the rooms thereof without the consent of the Council; but every member shall have a right to inspect the same at such hours as the Council may appoint.

SECTION XXI.

DONATIONS AND BEQUESTS.

1. The names of all persons who shall contribute to the library, or the general fund of the Institute, shall be read at the annual general meeting, and such persons shall be recorded as benefactors in the published transactions of the Institute.

2. Every person desirous of bequeathing to the Institute any manuscripts, books, maps, plans, drawings, instruments, geological, botanical, or other specimens, natural curiosities, works of art or manufacture, or personal property, is requested to make use of the following form in his will, viz.:—"I give and bequeath to the CANADIAN INSTITUTE, incorporated by Royal Charter, November 4th, 1851 (*here enumerate and particularize the effects or property intended to be bequeathed*), and I hereby declare that the receipt of the Treasurer of the said Institute for the time being shall be an effectual discharge to my executors for the said legacy."

BY-LAW.

At the ordinary meetings of the Institute, the following order of business shall be observed as closely as circumstances will admit:—

1. The minutes of the previous meeting shall be read and confirmed, and signed by the Chairman; and no entry shall be considered valid until this is done.

2. Nomination of candidates for admission.

3. Business arising out of the minutes.

4. Communications received since last meeting.

5. Donations received.

6. Communications from the Council.

7. New business.

8. Election of Candidates. A ballot shall be taken for the entire body of candidates proposed for admission; if one-fourth or more black balls appear, the ballot shall be taken for each individually; and any candidate shall be rejected against whom appear a number of black balls equal to one-fourth of the number of members voting.

9. The reading of papers.

Dr. Joseph Workman read a paper by Dr. Giuseppe Seppilli of Imola, Italy, on "Hypnotism." This paper has appeared in "The Alienist" for July, 1886.

Mr. VanderSmissen related various instances of hypnotism that had come under his observation, several of which were identical with those mentioned in the paper. The patients imagined themselves in the state suggested by the operator, and acted in character just as if the ideas were brought by the senses from without. Of the reality of the states thus induced there could be no doubt. He enquired whether it would cause death if it were suggested to the mind of the patient that prussic acid had been administered to him.

Dr. Workman thought that it would not. Other cases of hypnotism were related by members similar to those referred to in the paper.

Dr. Cassidy called attention to the curious phenomena exhibited by the Jumpers among the French Canadians, and related a case where a medical gentleman had tested a party of French Canadian "jumpers" in the State of Maine, from which it appeared that it was not necessary to be *en rapport* with the persons, but that simple suggestion on the part of any one was sufficient to produce the phenomena.

Mr. Rouse referred to the marks produced on the body by the action of the mind, as in the case of pregnant women, on whom the figures of fruit, as strawberries, of animals, as the face of a cat, &c., appear. Other instances were mentioned by some of the members. The stigmata on ecstatics were referred to in this connection, and instances given similar to those in the case of Francis of Assisi, Clara di Pugny, Louise Lateau and others, in ancient and modern times, the reality of which could not be doubted. They were supposed to be caused by the person being placed in a state of intense expectancy, the attention being strongly concentrated on some part of the bodily organization.

NINTH MEETING.

The Ninth Meeting was held on 30th January, 1886, the President in the chair.

Messrs. Notman and Bain were appointed representatives of the Institute on the Council of the Toronto Industrial Exhibition Association.

The following list of Donations and Exchanges was read :

1. Le Naturaliste Canadien, Janvier, 1886.
2. Science, Jan. 22, '86.
3. Transactions of the American Institute of Mining Engineers, Vol. XIII., February, 1884 to June, 1885.

4. Contributions from the E. M. Museum of Geology and Archæology of Princeton College, N. J., No. 1, Sept., 1878.
   Bulletin No. 3, May, 1883, Vol. I., No. 1, July, 1884.
   3rd and 4th Annual Reports, June, 1884 and June, 1885.
5. The American Naturalist, Feb. 1886.
6. Monthly Notices of the Royal Astronomical Society, Vol. XLVI., No. 2, Dec., '85.
7. Proceedings of the Royal Geographical Society, Vol. VIII., No. 1. Jan., '86.
8. Scottish Geographical Magazine, Vol. II., No. 1.
9. Historisches Jahrbuch der Görres-Gesellschaft, VII. Band, 1 Heft. München, 1886.
10. Electricité, 9 et 16 Janvier, 1886.
11. Wochenschrift des Oesterreichischen Ingenieur und Architekten-Vereines 8 Januar, '86.
12. Journal des Sociétés Scientifiques, 13 Janvier, 1886.
13. Archivio di Letteratura Biblica ed Orientale, Anno VII., No. 12, Dec., 1885.
14. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Sitzungen vom 20, 27 Juni und 18 Juli, 1885.
15. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XII . Nos. 8, 9, 10.
16. Correspondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, XVI. Jahrgang, Nr 11, Nov., 1885.
17. Transactions and Proceedings of the Technical Society of the Pacific Coast, Vols. I. and II., 1884 and 1885—14 Nos.

Total 39.

Mr. S. C. Duncan-Clark was elected a member.

Mr. J. Davies Barnett read a paper on "The Mechanical Value and Treatment of Hard and Soft Coal."

To-day wood fuel is so scarce, and in quality so inferior, that it cannot even in Canada be extensively used for industrial purposes. In the year 1851 experiments by the Pennsylvania Central Railway on the evaporation of water showed that one ton of best soft coal (Pittsburg) was only equal to $1\frac{3}{4}$ cords of best hard wood; but afterwards, as the use of coal became better understood, the accepted relative proportion was 2 to 1 ; and, of wood of the general average quality now attainable, it will take $2\frac{1}{4}$, and even $2\frac{1}{2}$, cords to do the work of one ton of good soft coal, if the coal is properly handled.

Our native peat—bulky and loose in texture—is out of the competition as a solid fuel ; due, primarily, to the short season in which it can be cured naturally, or to the extensive plant required, if cured artificially.

Possessing—as peat does—so large a proportion of volatile combustible matter, it will in Canada eventually be used by conversion on the spot into gaseous fuel, conveyed through pipes, and consumed where required in some form of regenerative furnace, or exploded in the cylinder of a gas-engine.

Therefore, the manufacturer's choice in fuel, this year, is between the two coals—anthracite (hard) and bituminous (soft); and the first question that arises is. What is their relative value as fuels, say for making steam? and does the larger percentage of carbon in hard coal justify its current high reputation and the top market price?

Our answer is no! certainly not; and the general opinion (sometimes strongly stated), that pound for pound hard coal is the better fuel, is due to a crude comparison of elementary assays, rather than to practical tests carried out under every-day working conditions.

Analysis shows as high as 94 per cent. of fixed carbon in American hard coal, in comparison with 70 to 80 per cent. of fixed and volatile carbon in soft coal; and, as the oxidation of this carbon is the main source of all furnace heat, there would seem to be a good basis of fact to support the common opinion.

Such inference, however, neglects to take into consideration the physical (molecular) condition of the coal.

Heat being vibration, the more dense and compact the atoms of the fuel, the greater is the percentage of the whole amount expended (commercially wasted) in raising the remainder to that state of freedom in which it can swing freely, or, in other words, the utilizable calorific value of carbon per unit weight varies inversely as its density. This holds good for every form of carbon, so that, as for instance in the diamond, the known condition in which molecular compression is greatest, its calorific value is very low.

Another reason why coal should not be valued and purchased on analysis as we would purchase metallic ore, is, that the law of union under which the various and variable substances forming coal originally united, and now separate—or recombine in distillation on the fire-grate,—is not seen clearly enough to permit of its power being gauged by simple analysis; and there are experiments that lead to the conclusion that C and H united as in some coals have higher calorific powers than when uncombined. This is so difficult to conceive—seeing that in combination they possess no apparent explosive power—that Messrs. Kestner and Meunier's experiments, extending from 1868 to 1871, with their uniform results proving either higher powers in combination, or the incorrectness of the generally accepted formula, are not accepted as reliable.

For information and figures, giving us the results of continued experiments, enabling comparison to be made between the evaporative duty of Pennsylvania hard and soft coals, our thanks are due to T. N. Ely, General Superintendent Motive Power, Pennsylvania Railway, and to F. E. Wootten, General Manager of Philadelphia and Reading Railway.

On the Pennsylvania Railway, for *local* passenger trains, it takes to haul one coach per mile, 10.44 lbs. of soft coal and 13.85 lbs. of hard coal, being an increased consumption of 30 per cent. of hard coal, to do exactly the same work.

On *through* passenger runs, per car mile, 8.64 lbs. of soft and 11.55 lbs. of hard, an increase in consumption of 29 per cent. These figures are reliable—under the given conditions, and with ordinary proportions of fire-grate—being averages covering four months' work, and on the through runs, with five engines burning each class of fuel.

If, however, the boiler is arranged so as to give several hundred per cent. increase in fire-grate area, the actual difference in duty performed has been reduced by Mr. Wootten to nine-tenths of a pound of water evaporated per pound of fuel, hard coal recording 6.1 lbs., and soft coal 7 lbs. Thus, it requires almost 15 per cent. more hard coal to do the same evaporative work, even with this excessive increase in grate surface.

It should not, in our consideration, be forgotten, that the first cost of the locomotive type of boiler to consume hard coal is increased from 10 to 25 per cent, dependent on the excess of grate area allowed; and its total lease of life, when using hard coal, is variously stated at from eight-tenths to six-tenths of that of a boiler using soft coal, but in all other respects doing similar daily work.

No doubt there are boilers in which hard coal will give a higher evaporative duty than in locomotive practice, as also will soft coal; but the circumstances controlling the test must always be fully considered in making any direct comparison of figures, and, if possible, the conditions made equal and similar, otherwise it is possible for peat, used under favouring circumstances, to give a higher evaporative result per pound than coal used under unfavourable conditions.

In the careful tests of native coal, made for the English Government by Sir H. de la Beche and Dr. (now Sir) Lyon Playfair, there were eleven examples of soft coal that gave higher evaporative results than the single good anthracite tested, although this particular hard coal, in addition to having the highest per cent. of carbon, had also 3.46 per cent of hydrogen, being about three-fourths of the average amount of hydrogen in the various soft coals tested. This was very much in its favour, as the calorific value of hydrogen—by weight—is more than four times that of carbon; however, its specific gravity was 1.375, being heavier than any other coal, native or foreign, then tested; and, it is, we think, only in the fact that its particles were so closely packed together, that the explanation of its comparatively low power can be found. A general average, taken over a large number of samples, shows American anthracites to weigh 400 lbs. per cubic yard heavier than British anthracites.

Outside of metallurgical operations, hard coal for manufacturing purposes has apparently nothing but its cleanliness to recommend it; and, presumably, it is for this benefit that the Toronto Water Works pays with satisfaction fuel bills that are unduly heavy.

Having thus narrowed our subject down to the consideration of the exclusive use of bituminous coal, we will briefly review the four different practices (which include the main modern theories) covering its economical combustion, using the names of the several advocates: Crampton, Mallett, Howden and Siemens, to identify their systems.

1st. Crampton.—For the easier understanding of this system, we will premise by stating that the known *forms* in which fuel exists are three:—First, solid, either as lumps or dust; second, fluid, as oils, either flowing or in the form of spray; and, third, gaseous, either simple or mixed, say with oxygen, so as to be more or less explosive.

When fuel is in the lump form, oxygen can come into contact with but a very limited portion, viz.: the outside, or surface of each piece. This, when the lumps are large, results in slow combustion, and the passage of a wasteful excess of cooling air through the furnace; hence, careful stokers (and careless ones, when in competition,) break the pieces small before putting coal on the fire, and for the same reason that we use chips in starting a fire, and choose small wood when a quick fire is required for an early breakfast. But if (as in the Crampton method) the coal is reduced to dust, then steadily and uniformly fed into the furnace, by blast, with the air supply limited to little more than that absolutely required for chemical combination —say 13 lbs. of air per pound of solid fuel—perfect and smokeless combustion and an intense heat are attained, with the additional advantage that a refuse fuel of low price can be utilized, with corresponding economy.

Even with this form of fuel, the oxygen has but surface contact with the dust, as with the lumps; but the surface, per unit weight, is increased so enormously that the speed of burning closely approaches that of explosion.

An increased evaporation of 22 per cent. has been obtained by the use of pulverized coal; in part due to the very small excess of air requiring to be warmed, and in part to the higher temperatures attained. Not only for the evaporation of water is high temperature an advantage, but, as the speed of heat transmission through metal plates increases (approximately) as the difference between the squares of the different temperatures on the fire and water sides of the plates, the speedier the transfer, the less is the amount of absorbent surface to be provided. Therefore, the dust-fuel system permits the construction of a smaller boiler to develop the same horse-power, but it has the disadvantage of requiring mechanical stoking and mechanical disintegration of fuel. Mr. T. Crampton very early took a long step in advance of current ideas and methods in the use of soft coal, and the limited adoption of his patent in daily practice is probably due to the little time so busy and successful an engineer could devote to its advocacy; and also to the fact that the working plant required was somewhat elaborate for small horse-powers, and for large establishments, a further step in advance of his practice was soon afterwards taken by Dr. W. Siemens, who converted coal waste, shales of low quality, and other low priced fuels at once into the gaseous form (carbonic oxide), using this gas—which, although not luminous, possesses large calorific power—as fuel for all industrial purposes. The gaseous form of fuel infinitely increases the possible surface and closeness of mechanical contact between fuel and oxygen before combustion, and readily permits the absolute control of the amount of air supplied.

2nd. Mallett.—Before more fully describing the recent "Siemens" developments, E. J. Mallett's theories and arguments deserve consideration, although comparative figures from practice are not attainable. Making a clear distinction between combustion of carbon (coke) and the formation of flame, he emphasizes the statement that heat is increased, while smoke and light are lessened, by the burning of any flame in an atmosphere at high mountain elevations, or—what amounts to the same thing—with air at less than normal barometric pressure, and asserts that one of the first requirements for perfect combustion is air at low tension; and to readily attain it at ordinary levels, he dispenses with chimney draught, and substitutes fan-suction at the forward end of the furnace or boiler.

Through tubes that form the furnace grate-bars air, partially warmed in its passage, is drawn by the fan-suction into the combustion chamber, in front of a perforated fire-brick wall (or septum) dividing the combustion chamber from the furnace proper; and large amounts of this warmed air are permitted to enter the chamber after each supply of fresh coal, the volatile matter of which at once undergoes rapid distillation on touching the incandescent coke, with the natural effect of cooling down the fire; but to avoid any additional cooling, and consequent formation of smoke, the supply of air usually flowing into the ash-pit, and thence through the fire-grate, is completely cut off; one lever, controlling the upper and lower damper slides, being so connected, that when a liberal supply of air is passing through the hollow grate-bars and diffusing itself forward of the septum wall, the ash-pit is sealed air-tight; the amounts of air delivered being steadily varied, and eventually reversed in relative quantity, as the lever is drawn over, fully opening the ash-pit damper when there is nothing but coke to burn on the grate.

Analogy, drawn from the Bunsen burner, is used as an argument for dividing and distributing the incoming warm air at numerous points; the openings in the septum wall being so arranged as to give at once the most complete intermixture of the liberated hydrogen and hydrocarbon gases, with the warmed air entering through the numerous hollow grate-bars.

The theory of his feedwater heater, or "Athermous Superheater"—although only indirectly connected with combustion—is of interest, and is based on Tyndal's statement, that dry air freely permits through itself the passage of radiant heat without loss of heat by absorption; whereas saturated or even moist air is a rapid and effective absorbent of radiant heat. Conversely, the radiating power of all gases—and this heat radiation is what we desire to utilize commercially—is increased proportionately to its absorbent power; therefore, to take all possible calorific value from the escaping gases, they are after leaving the boiler flues, moistened down to dew point by hot water-spray through a rose-jet, and also by admixture with the exhaust steam from the fan-engine, and then passed over a sufficient number of coils of metal pipe (heat absorbents) through which the feed water is moving on its way to the boiler.

It is claimed that the products of combustion, when thus saturated, part with their heat so completely that a portion of the feed water is converted into steam.

Mr. Mallett claims that he has arranged his system to meet locomotive requirements, the exhaust steam from the main cylinders, instead of educing blast, being used partially to warm fresh air for coach ventilation, and partially condensed in the tender tank, thus warming the feed water. We regret that experimental results cannot be given showing the practical value of this novel attempt at economical and smokeless combustion of soft coal.

3rd. Howden.—His method, as illustrated in a boiler of the single return-flue type, has the back head-sheet boxed up, forming a reservoir, through which all the air required is forced (under compression) by a fan, and it is warmed in its course past the head-sheet and around the smoke-flues that traverse this chamber from smoke-box to chimney. From this chamber the air exit is by passages leading both to the upper part of the furnace and to the ash-pit, with their actual amount of opening controlled and constantly varied by the stoker, through the movement of levers on the outside, thus giving him the independent control of the amount of compressed air supplied, either above the solid fuel or below it; air-tight doors preventing any escape from the inside except by way of the chimney, which need be but of short length.

Opening the furnace door to admit fresh coal automatically closes all these plenum air passages, thus preventing the excessive inflow of cold air, so destructive to seams and joints, when (as in those otherwise most successful crafts, the British torpedo boats,) there is air pressure in the closed boiler room. It may be well here to remark that all attempts at forced combustion are with the object of burning a greater number of pounds of fuel per square foot of grate; thus economizing space and developing the greatest horse-power from the smallest expenditure of capital in purchase of boiler.

Large consumptions per square foot of grate have not, until recently, proved economical in coal per horse-power developed, due principally to the choked air supply, natural furnace draught being unable to draw in sufficient to burn all the carbonic oxide evolved from the deep mass of hot carbon without the temperature in the chimney being so high as to waste the heat by throwing it out into the atmosphere unabsorbed, or a chimney of excessive elevation and cost was used.

Mr. Howden recently, before the Institute of Naval Architects, claimed to have secured per pound of Scotch coal an evaporation of 10 pounds of water (from 212°), consuming 30 pounds of coal per square foot of grate per hour. This, using a compound cylindered engine, developing a horse-power per 20 pounds of steam, gives 15 horse-power per square foot of grate, with but a fraction over two pounds of coal per one horse-power—a good showing.

4th. Siemens.—His system is by the partial combustion of cheap coal in detached converters (with insufficient supply of oxygen) to change this solid fuel into gaseous fuel (C_2O); conveying it thence by pipes to the different furnaces and boilers throughout the workshops or town, where combustion is completed, and it is burnt from oxide to acid (CO) by the addition of one more part of oxygen. The air ducts in his regenerative furnace, being so arranged that the heat otherwise wasted is utilized in raising the temperature of the inflowing air, before it reaches the mixing chamber, almost up to igniting point, and the absence of open grate, and control over the comparatively small amount of air required, results in the highest working temperature yet attained. When solid fuel is used and intense temperatures are required, comparatively small grates are necessary; therefore, in the earlier Siemens practice, it was inferred that in burning gaseous fuel (C_2O) a small combining chamber (with close walls and low roof) was also necessary, this having the natural result of bringing the flame into close contact with the walls, as well as with the material to be heated.

Later experiments have proved the complete fallacy of this idea, Mr. F. Siemens having discovered that by simple radiation from flame, and convection of the completely burnt products of combustion, the most intense temperatures can be transferred in all manufacturing processes, with surprising economy in fuel, with increased length of life in furnace, and in metallurgy and glass-making, &c., with a greater percentage of finished product per unit of crude material used.

This commercial success is obtained by making the combustion chamber or furnace so very large that the flame cannot touch either walls or material to be heated, and thus its activity is not quenched when but partial combustion has taken place, as is the case if it touches any solid substance, whatever be the temperature of that substance.

This is a complete reversal of the old-fashioned and still prevalent idea that, for instance, a boiler should be set as close to the fire as possible, so that the flame may inpinge directly on the evaporating surface, or on the material to be heated.

Mr. Siemens last year, at the Chester meeting of the Iron and Steel Institute, said: "The interruption of the process of combustion by "the interposition of solid bodies always tends to injure, or even "destroy them.

"But, besides the circumstance that solid bodies are injured by "flame, it can be easily shown that when flame is brought into con- "tact with any solid body, it is more or less quenched according to "the substance, size, and temperature of the body. A very simple "experiment in proof of this, and one which is familiar to most "people, is the following:—Take any ordinary illuminating gas "flame, such, for instance, as a bat's wing, and place a glass rod or "tube into the middle of it; the flame will immediately burn dull, "and a large quantity of lamp-black will be deposited on the piece "of glass. This action is most marked when the rod is cold, but "takes place, though in a less degree, at any temperature, for the "reason that the material to be heated is necessarily always at a "lower temperature than the flame, also owing to the disturbance "in the combustion caused by contact of the solid substance with "the flame."

His experiments "establish the following important fact, namely, "that a good flame, or, in other words, perfect combustion, can only "take place in an open space, or in one of sufficiently large size to "allow the gases to burn out of contact with solid material."

In conclusion, the author would note that these four methods, considered together, show that the problem of bituminous coal combustion is receiving its modern solution by the admission of air forward or above the grate; under control as to the amount delivered, to suit the needs of such an ever varying fuel as crude soft coal proves to be.

Thus, instead of combustion being confined to the fire-grate, or being a factor of grate surface, or style or proportion of grate (as implied in many patented and peddled nostrums for so-called "smoke-burning") a most effective use can be made of solid mineral fuel, as shown by Mr. Crampton, without *any* grate, or, as established by Mr. Siemens, if gaseous fuel is used, with the only grate required miles away from the combustion chamber.

It is now clearly recognized that coal is not a simple substance to be treated in a simple manner, and capable of but one or two combinations with oxygen, but that the air needed for its complete combustion is to be supplied in the ever varying proportions respectively demanded when hydrogen, the various hydro-carbons, carbonic oxide, and fixed carbon (coke) are being burnt; and that the air must be supplied at the different localities in the furnace or combustion chamber, where these products of the raw fuel are most effectively oxidized, and, other things being equal, the warmer the air supplied and the less in quantity it exceeds the minimum amount required, and the more freedom given for the flame to burn out free of all contact with solids, the higher will be the resultant industrial economy, and the less shall we be troubled with the smoke nuisance.

A brief discussion followed, in which Mr. Alan Macdougall made some remarks on the value of such knowledge from a sanitary point of view, as the incomplete combustion of coal as shown by the cloud of smoke that hangs over some of our towns, did not add to the public health.

The President, after expressing his interest in the subject, asked on what the statement was based that hydrogen and carbon combined as in coal seemed to have a higher calorific power than when uncombined.

In reply to Mr. Macdougall, Mr. Barnett pointed out how much easier it was to avoid smoke and soot from stationary boilers as used in towns than it was to get rid of the same nuisances in railway locomotive practice, the rapid combustion and large consumption per square foot of grate surface, amounting in some cases to as high as 80 or 90 lbs. per hour, made perfect combustion in the small fire-box of a locomotive a difficult end to obtain. However, the locomotive fire-boxes of Messrs. Wootten & Strong, with their, comparatively speaking, enormous grate surfaces and slow combustion, were a step in the right direction, time being necessary for perfect combination in combustion.

In reply to Dr. Ellis, he said the full details and results of Messrs. Kestner & Meunier's extended experiments that seem to contradict Dulong's formula, were to be found in the "Bulletin de la Société Industrielle de Mulhouse," 1868, 1869, 1871; in "The Annales de Chimie," 4th series XXX., 5th series II., XXI., 6th series II.; and in the "Comptes Rendus de l' Académie," 2me Série, 1869, and they were understood to have been carried out in the direct production of steam in a boiler and not in minute laboratory experiments.

M. L. Gruner had endeavoured to explain away the apparent anomaly between formula and experiment, and a partial translation and condensation of his paper from the French had been reproduced by R. P. Rothwell in the "Engineering and Mining Journal" of 1874.

Mr. M. L. Rouse then read a paper on "The Analogy between Consonants and Musical Instruments," of which the following is an abstract:

Taking pains to distinguish between a truly aspirated consonant and a consonant with *h* prefixed to it (the suffixing of *h* producing no blending at all), he showed that aspiration always consisted in bringing the lower organ of speech (tongue or lower lip) into the right position for uttering the simple sound, and then flattening it a little and breathing over it. And by this definition he added two aspirated consonants to the already received category—namely, the Continental rolling *r* and the Irish *l*, which is heard when a native Irishman utters the words *milk*, *help*, *hill*, &c., and is also prevalent among the French. Eliminating, then, all compound sounds, he arrived at the following table of consonants, which, save in the above respects, differs little from Morris's :—

	FLAT.		SHARP.		NASAL.
	UNASPIRATED.	ASPIRATED.	UNASPIRATED.	ASPIRATED.	
MUTES :					
LABIALS	b	v	p	f	m
DENTALS	d	‘d	t	‘t	n
BACK - PALATALS OR GUTTURALS ..	g	‘g	k	‘k	$\widetilde{\text{ng}}$
PHARYNGEAL	h				
SPIRANTS :					
LIQUIDS	r	‘r	l	‘l	
SIBILANTS	z	‘z	s	‘s	

NOTE.—‘d = *th* in *thine*; ‘t = *th* in *thin*; ‘g = *g* in *lough* (Ir.); ‘k = *ch* in *ich* (Ger.);* ‘r = Continental rolling *r*; ‘l = Irish *l* heard in *milk, help*, &c.; ‘z = *z* in *azure*; ‘s = *s* in *shine*; $\widetilde{\text{ng}}$ = *ng* in *ring*.

He then compared with this the natural classification of musical instruments, which he claimed to be as follows :

	FULL-TONED.	SLENDER-TONED.	REED.
BEATEN :			
WOOD	WOOD UPON WOOD, *Xylophone.*	METAL UPON WOOD, *Saw.*	WOODEN, *Clarionet, &c.*
METAL	WOOD UPON METAL, *Harmonicon.*	METAL UPON METAL, *Bells, Musical Box, &c.*	METAL, *Harmonium, &c.*
STRING	HAND UPON STRING, *Harp, Guitar, &c.*	STRING UPON STRING, *Violin, &c.*	STRING, *Æolian Harp.*
MEMBRANE	*Drum.*		
BLOWN :			
WOOD	BLOWN FROM THE SIDE, *Flute, &c.*	BLOWN FROM THE TOP, *Flageolet.*	
METAL	BLOWN FROM THE SIDE, *Organ.*	BLOWN FROM THE TOP, *Trumpet, &c.*	

NOTE.—The aspiration of consonants seems to correspond in its prolonging effect to the use of the pedal or swell.

In my lecture I classed the sound of *ch* in the Scotch *loch* with its sound in the German *ich*. But the criticism of Mr. VanderSmissen led me to see that in the former word it has the same pronunciation as the *gh* in *lough*, and, furthermore, that after the four deeper vowels, long and short, the flatter guttural is always given, while after the four higher ones the sharper guttural (cf.: *buch G., loch G., loch S., dach G., urgh ! E., pech G., bücher G., ich G.*).

A complete set of organ reed pipes would be a more typical metal reed instrument than a harmonium, since it would contain the beating reed, which strikes the sides of the apertures, whereas the harmonium contains the free reed which vibrates clear of the sides.

The best proof that an aspirated consonant does not consist of *h* prefixed to a plain one, is the fact that *h* may be actually uttered directly before an aspirated consonant. Thus, to impose silence, we may either exclaim gently *sh!* or more vigorously *hsh!* and in the game of draughts, or checkers, we may blow upon a removed piece with *f!* or with *hf!* our action, indeed, being called *huffing.*

TENTH MEETING.

The Tenth Meeting was held on 6th February, 1886 the President in the chair.

The following list of Donations and Exchanges was read :

1. The Canadian Practitioner, February, 1886.
2. The Canadian Entomologist, Dec., 1885.
3. The Electrical Review, Jan. 30 and Feb. 6, '86.
4. American Journal of Science, February, '86.
5. Johns Hopkins University Circular, Jan. '86.
6. Science, Vol. VII., No. 156.
7. Proceedings of the American Antiquarian Society, Vol. IV., Part I., N.S.
8. Mineral Resources of the United States, 1883-84.
9. Transactions of the New York Academy of Sciences, Vol. V., No. 3, Dec. '85.
10. Journal of the Franklin Institute, Feb. '86.
11. Electrician and Electrical Engineer, Feb. '86.
12. The American Catholic Quarterly Review, Jan. '86.
13. Sandberg on Rail-Joints and Steel Rails.
14. Proceedings of the Physical Society of London, Vol. VII., Part III., Jan. 1886.
15. Transactions and Proceedings of the Botanical Society of Edinburgh, Vol. XV., Part II.
16. Palestine Exploration Fund—Quarterly Statement, Jan. '86.
17. Illustrated Journal of Patented Inventions, No. 57, Jan. 22, 1886.
18. Trübner's American, European and Oriental Literary Record, Nos. 217, 218.
19. Imperial Federation, Vol. I., No. 1, Jan. 1, '86.

20. Cosmos, 18 Janvier, 1886.
21. Compte Rendu des Séances de la Commission Centrale de la Société de Géographie, No. 1, '86.
22. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, Août, 1885.
23. Bulletin de la Société Royale de Botanique de Belgique, Tome 24me Fascicule 2me, 1885.
24. Cronica Cientifica—Barcelona. Año IX., Num. 194.
25. Monatsblätter des Wissenschaftlichen Club in Wien, VII. Jahrgang, Nr. 4.
26. Wochenschrift des œsterreichischen Ingenieurs und Architekten-Vereines XI. Jahrgang Nr. 3.
27. Journal des Sociétés Scientifiques, 6 et 20 Janvier, 1886.
28. Jahrbücher der K. K. Central-Anstalt für Meteorologie und Erdmagnetismus 1884, N. F. XXI. Band, Wien.
29. Atti del Museo Civico di Storia Naturale di Trieste, Vol. VII., '84.

Total 31.

Mr. R. F. Stupart read the following paper on "The Eskimo of Stupart Bay:"

My paper this evening treats more especially of the Eskimo and their mode of life as observed by myself during a twelve months residence among them on the shores of Hudson's Straits, but, in addition, I have thought it advisable to give a brief outline of a portion of the cruise of the steamship *Neptune* in the summer of 1884, and also of a boat voyage made by myself and three men from Prince of Wales' Sound to Fort Chimo during the latter part of last August. The Canadian Hudson's Bay Expedition of 1884 and 1885 was, as you are all aware, sent out to report on the feasibility of establishing a commercial route to Europe from the Canadian North-West *via* Hudson's Straits. Six observing stations were established at different points along the shores of the Straits, the duties of observers being to watch the movements of the ice and tidal currents and to take meteorological observations. In addition to this, the ordinary work, I made a series of magnetic observations; I had two observatories, one in which I made absolute determinations of the declination, force, &c., while in the other were placed the differential instruments, which were read every four hours, and during days of much disturbance every five minutes. The discussion of results here obtained is, of course, foreign to my subject to-night.

The date of the earliest mention of the Eskimo is about 990 A.D., when some Icelanders exploring Greenland came across men with skin-boats. The Eskimo have therefore inhabited the Western

Continent for at least 1000 years. It has generally been supposed that they originally came across Behring Straits from Asia, but the race is one of which very little is known. Although scanty in numbers, they wander over a larger extent of territory than do any other people. They alone among savage races occupy both the old and the new world; they inhabit the shores of the Arctic Sea from Siberia to Greenland and Labrador, and throughout this vast extent of country the language, appearance and occupation of the natives are very similar. Of course their habits have at some points been modified by contact with the whites; it could scarcely be expected that the untutored savages who inhabit the shores of Hudson's Straits and the Arctic Coast line should entirely resemble the more favored portions of their race, who have been, to a certain extent, educated by the Moravian brethren on the Labrador coast or by the Danish missionaries in Greenland.

In appearance the Eskimo somewhat resemble the Chinese and Tartars; they are generally small in stature, the average height of a man being about 5 ft. 1 in. or 2 in., but I have seen a few who were as much as 5 ft. 9 in. or 10 in. Their features are broad and flat, the hair is very coarse, invariably jet-black and quite straight; few of them have much hair on the face, but there are exceptions. In color they are about as dark as the Indians, but the layer of dirt and oil, which as a rule covers both face and body, makes it rather hard to determine the exact shade.

Sir John Lubbock, in a treatise on the Eskimo, says that the language is akin to the North American Indian in structure. This may be the case, but the two languages are certainly different in sound. The opportunities afforded me of learning the language were very limited, as I and my men were dumped down at the post among the natives but a very short time after the interpreter was taken aboard the ship at Nachvach, on the north coast of Labrador. During the short time I spent with him I obtained the Eskimo words corresponding to certain English sentences, which I thought might come in useful; for instance, "What is the name of this?"—"shoo-now-nah," "Bring me some fox-skins," — "Terry-gyn-yer-mik-p-u-mo-ouma." By means of the former I was enabled to obtain from the natives themselves the names of a large number of things of which I made a vocabulary, and by first guessing at and afterwards asking the meaning of the sentences in most common use among them I was able, after a few months, to understand them and also to make myself understood.

The costume of an Eskimo usually consists of two suits, the inner always of deer-skin, with the hair next the body, and outer deer-skin in winter, and seal-skin in summer, with the hair out. The men and women dress much alike—a coat, trousers and seal-skin boots; the coat, or "Koalatuck," as they call it, is put on over the head; that of a man has a hood attached large enough to cover the head, if necessary, whilst the hood attached to the woman's coat does double duty, being used both as a covering for the head and as a place in which to carry the babies. The woman's coat has also a long narrow tail behind which ordinarily just touches the ground but is sometimes looped up.

Among the Eskimo, ornaments are not numerous, neither is there a great variety; the outer coat of both men and women occasionally has a border of white bear-skin, but is more often devoid of ornamentation. Sometimes the inner coat, which in the igloos and in warm dry weather is often alone worn, is trimmed with walrus teeth, which are sewn on, an inch or so apart, round the lower edge, or it is trimmed with a fringe made of deer-skin. Glass beads can be obtained from the Hudson's Bay Company at Ungava, and some of the women belonging to the richer Eskimo families are the happy possessors of necklaces and of strings of colored beads which are sewn on to the front part of the inner coat; other favorite ornaments are common metal spoons, with the handles cut off; these sometimes, to the number of seven or eight, are attached vertically at equal distances to the front part of the coat. Women are often, but not invariably, tattooed; a few lines are made on chin and forehead, the former diverging from the lower lip, the latter from the upper part of the nose.

The *Neptune* sailed from Halifax on July the 22nd, 1884. On her way north she touched at the Moravian Mission Station, Nain, on the coast of Labrador. Before the anchor was down we were boarded by the missionaries and many Eskimo. The former were, I fancy, somewhat disappointed at finding that we were not the mail steamer, as they were expecting news from home, but the natives were evidently much pleased at our arrival, and examined the steamer from stem to stern with delighted curiosity. The Eskimo population of Nain is about 200; they live in about 45 log and mud huts, which are clustered together on a small plateau near the mission buildings. Most of the people are small in stature, and my impression is they were quite as dirty as the completely uncivilized people I afterwards met to the northward, but it may be that a month later I was more accustomed to seeing dirty people. Our ship remained at Nain for a whole day, and as I spent the greater part of the time ashore, I was able to fully inspect the station and also to form some idea of the work performed by these missionary traders of the North. The natives living here are like all other residents of the Labrador coast, generally employed in trapping, hunting and fishing; all the furs, skins and oil they obtain they bring to the missionaries, who, in return, supply them with ammunition, tobacco, and a limited quantity of flour and pork. Attached to the station is a school-house, and be it said to the credit of the missionaries, almost all the natives of sufficient age can read and write in their own language. There is also a chapel, in which service is held every evening. The choir is composed of the families of the missionaries and of the natives, and is assisted by an old-fashioned organ and by eight or ten violins played by music-loving Eskimos. Although the sincerity of the evangelizing efforts of these Moravians has often been called in question, I think that any one witnessing one of the services in the quaint old chapel at Nain will confess that a good work is being done. The gardens are a most pleasing feature of the place; potatoes, turnips, lettuce, spinach and onions are grown, but require an immense amount of attention, as they all occasionally require to be artificially protected from frost.

On August 1st we touched at the Hudson Bay Station, Nachvach, 90 miles south of Cape Chudleigh. Here we obtained an interpreter, who subsequently proved of great value, when we got among the natives on the shores of the Straits. August 5th—We anchored in a little harbour just inside Cape Chudleigh, the Commander of the expedition having determined to here establish an observing station. Codfish were so abundant at this place that we actually, in a very short time, were tired hauling them into the boat. There was an Eskimo family living at a distance of 8 or 10 miles from where the ship was anchored, but I did not see them. Those of the expedition who did pay them a visit describe the tent and its occupants as being villainously dirty, and all seem to have considered it advisable not to venture too close. We left the harbour, called Port Burwell after

Mr. Burwell, the officer in charge, on August 8th, and steamed northward across the Straits. A little snow fell that evening. August 9th.—It was blowing too hard to effect a landing on Resolution Island, so in the afternoon we stood off shore hoping for a fair day on the morrow. The fates were, however, against us. Sunday, Aug. 10th.—At early morning it was blowing a gale from the eastward, and before noon the wind chopped round and blew still harder from the west, and during the remainder of the day we were lying too and making no headway. On Aug. 11th we passed through many miles of loose ice, but none of it was of sufficient size to seriously impede our progress. Late in the afternoon we entered a small inlet in the large Upper Savage Island, where it was decided to establish another station, the officer in charge being Mr. W. A. Ashe, of Quebec. We had scarcely entered the inlet when an Eskimo put out to us in a kyak. He told us, by means of the interpreter, that there were several families camping near by; they had shot two reindeer that day, and their headquarters were near an American trading station, which we knew existed some 30 miles to the westward. On the following day we were visited by about a dozen of the natives, who walked off to us on the ice which had closed in round us with the flood-tide. Some few of them could speak a little English, and possessed a few articles of European clothing. However, from what I saw of them, I should judge that, morally speaking, up to that time they had not benefited by their contact with the whites. Aug. 16th.—Early in the afternoon we left Ashe Inlet in a snowstorm, and steamed slowly south. About 6 p.m. we passed an enormous berg, probably from Fox Channel; it shewed about 50 feet out of water and was fully a quarter of a mile in length. At dark the engines were stopped, and we lay to until daylight, when we again started. At about 10 o'clock we entered a field of loose ice which extended almost to the coast; many walrus were seen playing about among the blocks of ice. Shortly before 1 o'clock we neared a long rocky point, and Lieut. Gordon proposed building my observatory on it if he could find anchorage in the bay beyond. Viewed from the ship the site certainly did not look inviting, but before long we were anchored in a small bay, open only to the S.E., from the end of which a valley, which at places looked green, extended far back into the country, bounded on either side by high rocky hills. After dinner I went ashore with my men to have a look around. I found a stream of good water and a first-rate site for a house, while, from the top of the rocks, a good view of the Straits could be obtained. We also found traces of reindeer, foxes and ptarmigan. On returning to my boat I found Lieut. Gordon, the officers of the ship and most of the men were ashore. Before long we saw a group of Eskimos, principally women, accompanied by dogs, approaching us over the brow of a hill; they were shouting "Chimo, Chimo," and were evidently very anxious to trade with us. They looked very good-natured and very dirty, and called "tobaccomik, tobaccomik." On obtaining some black tobacco and matches they howled with delight and hugged it. In a short time our interpreter, Lane, who had been down the coast in his kyak, put in an appearance and explained to the people that we were going to build a house; when they heard this they threw up their hands and fairly shrieked with delight.

During the stay of the *Neptune* at my station, which was from Sunday till Friday, the Eskimos were continually loitering about. There were at this time four families living in tents about two miles distant to the westward and several more families still further away. Sunrise each morning brought the majority of them to the place where our men were building the house; they generally had some small articles for trade, such as sealskin mittens and boots, for which they almost invariably wanted tobacco. Scarcely ever did they offer to assist in carrying up the material for the house or the coal, and if by chance any of them did lend a hand, they expected to be well paid with tobacco and matches. The sealskin tents (called by them "too-picks,") in which these people live from about the middle of May to the beginning of November, vary from about twelve to twenty feet in length; they are spread on a ridge and are further supported by several upright and slanting poles; the latter have, as a rule, been obtained from a long distance to the southward. I do not think any wood large enough for tent-poles can be obtained within 250 miles of Prince of Wales' Sound. The skins of which the tents are formed are those of the large harp-seal; the hair is scraped off, and they are stretched out in the sun by means of pegs driven into the ground. The beds are ordinarily laid in the inner end of the tent, but sometimes when there are many occupants also extend round the sides. A layer of dry moss is first spread on the ground and over this are spread deerskins and sealskins, which have been softened by working them with the hands and teeth. The Eskimo of Hudson Straits seem to have no method of tanning skins.

The ship left us Aug. 22nd, and we all settled down to work getting things into shape, I and my assistant, Mr. Bennett, adjusting the instruments, the men making the house as snug and comfortable as circumstances would admit of. During the latter part of August and early part of September the weather was generally unsettled, with a preponderance of easterly winds and a good deal of light snow. Aug. 23rd and 25th were the only really warm pleasant days we had; on these days there was bright sunshine, and the temperature rose to between 45° and 50°, but clouds of mosquitoes ("Kitorraya," the natives call them) rather interfered with the enjoyment of the fair weather. Until after the 6th of Sept. there was a good deal of drift ice off the coast, and whenever the wind was from the S. E. our little bay was quite blocked up with it. Almost every day we were visited by a large number of women and children, who continued bringing all sorts of things to trade for tobacco, but we saw but little of the men, who were generally out hunting in their kyaks.

On Sept. 23rd the *Neptune* returned from her trip across Hudson Bay. She remained a day and a half, and during the time she lay at anchor every man, woman and child who could possibly get there was either loitering about near the house or hovering round the ship in kyaks, calling out for tobacco and matches. From the time the ship left us, on the 24th Sept., until about the middle of November, we were not much troubled by the natives. They were still living in their toopicks, and I fancy that almost all of them having obtained a fair amount of tobacco from the men on board the ship were contented to leave us in peace for a time. On Oct. 24th the temperature fell to zero, and the Bay and Straits as far as I could see were frozen over.

Without seals and deer, the Eskimo could not exist. Their food is seal's meat and venison, both generally eaten raw but occasionally cooked; their dress is of the skins of seals and deer; their habitation is for at least a portion of the year formed of sealskin, and their boats are of the same material.

The kyak is a most ingenious contrivance, and, I believe, peculiar to the Eskimo. A framework of small wood is formed, from 15 to 20 feet long, about 18 inches broad in the middle, tapering to both ends, and not over a foot in depth; the whole is covered with sealskin with the exception of a space in the centre just large enough for a man to sit in. As to stability it would compare favourably with a small Indian birch-bark canoe. It is propelled by a double-bladed paddle, in fact in much the same manner as a Rob Roy canoe. I have often read that the Eskimo can, if capsized, right his kyak again; I have never seen it done, nor have I ever come across anyone who has seen it. Perhaps this skilful feat has been forgotten. I certainly think it would require an immense amount of practice, and I can scarcely imagine anyone, unless by accident, taking a bath in water of temperature near the freezing point. The "umiak," or woman's boat, is much larger than the kyak, and has a flat bottom. It is made of slender sticks fastened together with whalebone and covered over with seal-skins. It will sometimes hold as many as twenty or thirty people, is propelled by rudely made oars, and is steered with a rudder.

During November it became evident, from the number of new faces we saw, that the natives from other parts of the coast were congregating in our neighborhood. About the middle of the month my two men paid a visit to the encampment, and found that instead of five scattered tents there were about ten snow igloos, all close together. As each igloo is generally inhabited by from ten to twelve people, this meant a population of over a hundred. In building their snow igloos the Eskimos take advantage of the fact that, owing to the intense cold, with no thaws and continual drifting, the snow becomes quite hard and compact and can be cut into blocks and slabs. The igloos are generally built on the shore, not far from high water mark; a tolerably level spot where the snow is, say, about a foot and a half deep, is chosen. The builder first marks out a circle of about twelve feet in diameter; he then goes to work with a long knife, called by the Hudson Bay Co. a snow-knife, and hollows out the circle, cutting the snow into blocks about a foot square or of a rectangular shape of say $1 \times 1{\cdot}5$ feet, and from 4 to 6 inches thick. With the blocks thus obtained, together with others cut near by, a circular wall is built by putting one block on top of another. As the construction proceeds the wall is made to gradually curve inward until finally an almost perfect dome is formed of about 12 feet diameter and 8 feet high in the centre. The door, a hole about 2 ft. broad and 3 in height, always faces the southward. The inner half of the igloo is built up with blocks of snow to the height of about $2\frac{1}{2}$

feet, and on the raised part is spread a lot of dry moss and sea-weed to form the beds. Two smaller igloos are built to the south of that in which the people live and do double duty as porches and kennels for the dogs ; there is also generally a small igloo built with an opening into the porch, which is used as a storehouse for any surplus supply of meat they happen to have. The number of people inhabiting an igloo varies from about 8 to 14 ; it ordinarily comprises an elderly man—the head of the family—and his wife and one or two married sons with their wives and children. It seemed to me that the boys far exceeded the girls in numbers, but of this I cannot be certain.

The worldly possessions owned in common by the members of a family are not numerous. They ordinarily consist of a tent for summer use, a few small tin-pails, used for melting ice during the winter, one or more lamps, according to the number of women in the tent each grown-up woman having a lamp, a few stone dishes and pots, and some skins used as bed-covering. Each individual, as a rule, has two suits of clothing ; a man generally but not invariably owns a kyak, a muzzle-loading gun, obtained in trade with the Hudson Bay Co., together with caps, powder and bullets, knives and a spear, a lance-head with a long coil of walrus-line and a bladder used as a float for the harpoon-line, when a seal or walrus is struck. A woman has a semi-circular knife used for scraping skins, a few needles, some sinew for thread, a bone thimble, and, if lucky, some ornaments in the shape of beads. Belonging to each family is generally a team of from five to ten dogs and two sleighs, called by them commatiks, one of which, about 8 feet long, is used with all the dogs when moving their quarters, and the other, just large enough for one man, is drawn by two dogs and is used for hunting on the ice. The dogs are generally a trifle smaller in size than our English setter and in color vary almost from black to a dirty yellow ; they have sharp pointed snouts and bushy tails which curl over the back ; they are vicious and savage but, I think, great cowards. The Eskimo would be lost without dogs, all travelling is done by means of them, and they are good scavengers. An igloo and its vicinity is always filthily dirty, but were it not for the dogs it would be ten times worse.

The men spend the greater part of their time hunting. In summer they sleep but little ; in winter they often hunt during the short period of daylight, but they sleep a great deal. On the women devolve the cares of the household, they make all the clothes and boots, melt ice over their lamps and do whatever little cooking there is to be done. They all go in for some amusements, a sort of foot-ball is played on the ice; wrestling is a favourite amusement with the men. The children romp and play about, in fact have games very similar to those played by white children. It is quite marvellous the amount of cold these people can endure, they are inured to it from infancy. Many and many a time I have known women spend a whole day loitering about near the house with the temperature 10 and 20 below zero, their necks uncovered, nothing on their heads, and stark naked babies sprawling half out of the mother's hoods; how the children stand it I cannot tell, but that the poor little youngsters do feel the cold I am convinced, as they often cry most piteously. Both men and women sometimes are cold; they would often stand at my door and beg for admission saying they were cold. E-ke is their word for cold.

The marriage laws are very simple, in fact as far as I could learn the woman, without form or ceremony, takes up her abode in the igloo of her intended. Neither are the funeral obsequies elaborate, the body being carried to a distance from the tents and covered with stones. On top of the grave are placed the man's hunting implements together with a cup and a knife. This would seem to imply that they have some idea of a future state; but what their religion, if any, really is, I was unable either to discover from the natives or to learn from the Hudson's Bay Company, men who have lived among them for years.

Two days after Christmas I paid a visit to the Eskimo igloos; I and one of my men started at seven o'clock in the morning, long before daylight, and walked across the ice, following the path beaten by the natives in their daily visits to the house; the temperature was 23° below zero, and it was blowing fresh and drifting in our faces. After having walked about two miles we met two Eskimos; one of them, an old man named Pugweek, put his hand over my cheek, giving me to understand that it was freezing. In about a quarter of an hour we arrived at the snow houses, all of which were quite new, and removed about half a mile from those the natives occupied during the early part of the month. Let me describe some of the people. I first visited Pugweek's residence; stooping down and entering almost on hands and knees I found myself in a passage about twelve feet long, dogs were lying and running about in all directions and until quieted by their master seemed rather disposed to resent my intrusion. Having passed through the passage, I crawled through another hole and found myself in the dwelling of and among an Eskimo family. The stench was frightful. Cries of "Chimo," intermingled with those of "tobaccomik," greeted my entrance. On the right of the raised portion of the house squatted Pugweek's wife. She might have had on more clothing, but I presume she had not yet made her morning toilet. She was very ugly, astonishingly dirty, and had no teeth. I gave her half a plug of tobacco, for which she said Ne-cook-a-mik, and immediately asked for matches—"matchemik." Pugweek's sister, Polin-a-chuor, was squatting close by; she too set up a howl for tobacco and I gave her a piece. She proved the most inveterate beggar and greatest nuisance among the women. Children of all sizes were lying on the bed covered up with dirty skins, they too asked for tobacco, but did not get any.

I afterwards discovered in a very practical way that Pugweek was a great thief. I also discovered that about 1860 he had taken part in the massacre of a boat's crew. The Hudson's Bay Co.'s ship "Kitty" was wrecked near Cape Wolfstenholme; out of a crew of about seventeen, ten were killed by the Eskimo while endeavoring to land from the wreck, the remainder, escaping down the coast in a boat, were massacred while asleep by the Eskimo of Prince of Wales' Sound. Two others of the murderers besides Pugweek were my near neighbors, Cowjut and Ne-bo-cart. These men are not permitted to visit the Hudson's Bay post at Ungava.

The next igloo I went into was that belonging to Cowk-to-wayo, a quiet old man who had welcomed us when the steamer first arrived; we all then thought that he was a chief among his people, but I subsequently discovered that there is no chief; all members of a family to a limited degree owe obedience to the head of that family, but as far as I could learn no common chief is recognized by different families; the most successful hunters are as a rule the men who are most respected.

Cowk-to-wayo's igloo was very like that of Pugweek. The old man was sitting next to his wife, a very talkative little woman, who evidently thought that the one thing worth living for was smoking, and further that the whites having been sent to Hudson Straits to keep the Innuit (Eskimo) supplied with tobacco, it was my bounden duty to see that she was never in want of it. A son, Kish-a-watch-Kia, and his wife Poon-elly and several young children, besides two fairly good-looking daughters, aged 14 or 16, were living with the old man. I gave each a pipeful of tobacco. Poon-elly's baby, which was sprawling over its mother's shoulder, began to cry, and, I suppose by way of a treat, the mother took the short clay pipe from her own mouth and placed it in her baby's. I thought the poor little thing would have choked, but have no doubt that being now a year older, it can duly appreciate a whiff of tobacco smoke.

I visited all the igloos in turn, those of Cowjut, Padliat, Neecook, Owbrook, Ne-bo-cart, Eat-wor-buckeye, Atchick, and several others; last of all I paid a visit to the igloo of U-a-luck, a man whom I always called and considered to be my special friend. U-a-luck is a mighty hunter, very good looking and well built; height 5 feet, 7½ inches; very broad in the chest and a perfect Hercules as regards strength. From the very first he evinced a desire to imitate the whites (Cublunac) in every way possible. He tried to master English and learned many words. I have no doubt but that when he next visits Fort Chimo he will say, please—give—me—a—pipe, and receiving it, will say, thank-ou. U-a-luck's wife, Chi-u-cudelow, is a good-natured looking middle-aged woman; she has two children by her present husband and two by a former. U-a-luck also has a boy by a former wife. His mother and grandmother, together with a second wife and two children, complete the family. I was informed at Ungava that in the winter of 1883 Ualuck, after a visit to the post, when gone about twelve miles on his homeward journey, had found that his grandmother was a great inconvenience and straightway left her out in the snow. The Hudson's Bay Chief was informed of this and sent after Mr. Ualuck, telling him that he must take care of the old lady. In the spring Ualuck was the happy possessor of three shirts, a blue, a grey, and a white, all of different lengths; he generally wore these over all, the longest one underneath, by which means he could show a portion of each; later on he had five shirts and his costume then became ludicrous in the extreme.

Having completed my round of visits, Ualuck hitched up his dogs and drove me home, accompanied by half the population. Arrived at my shanty they all seemed to think that, they having entertained me in their houses, I ought to return the compliment, but I failed to see it in the same light as they.

In the beginning of February the Eskimo again moved their dwellings, Ualuck, Owbrook and Cowjut building close to my house, and the others at points not far distant. About the middle of the month three heavily laden commatiks arrived from about 150 miles, to the westward, the people wishing to trade. I told them to go to Ungava as I had but little powder and tobacco; they refused, however, to go, preferring rather to take small prices, and five temporary igloos were in the course of an hour erected close to the observatory. They remained five days and then departed.

During the winter I occasionally went seal hunting with the natives. We used to start out about nine in the morning with a commatik and five or six men. It was very cold work sitting round a space of open water watching for the seals, the temperature perhaps 25° below zero. With my little Ballard rifle I could often pick off a seal at two or three hundred yards; their guns were only good at a very short range, and they thought my breech-loading rifle a marvellous machine.

As the spring advanced, seals and walrus became scarce, and by the beginning of April many of the people began to show signs of hunger and came begging food from me.

On April 11th the first bird, a bunting, appeared. On April 12th Ualuck, Owbrook and Announshook left to hunt deer; in nine days they returned with three carcases. A few days afterwards they again went away and, in a fortnight's hunting, secured six deer. During May many families were thoroughly famine-stricken. On May 18th a man named Narluck tried to break open the storehouse; failing in that he began rolling away a barrel of pork which had been buried in the snow outside the house. Unfortunately for him one of our regular observations was always taken at 3 a.m., and one of my men on going out discovered what was taking place. We gave the man a thrashing, and I told him that if he tried to break my storehouse-lock again I would shoot him. He gave but little trouble after this, but always looked ripe for mischief. About this time, also, a woman and a boy arrived from the West; they could scarcely crawl along on account of weakness from starvation. They reported that out of seven in their igloo five had died of starvation. Our neighbors happened to have some venison, and the poor wanderers immediately began feasting. Early on the following morning, May 24th, I think it was, a man came to tell me that the boy was pu-une-i-acput, which means "no good." I went over to the igloo and found that the youngster had, after weeks of starvation, eaten enough for two or three boys; he died a few minutes after I arrived. No one seemed to care; another boy took the body on his back, carried it back about a quarter of a mile, put it down and covered it up with stones.

Towards the end of May, at a distance of about two miles from my house, was a snow igloo in which resided an old man and his wife, a son and his wife, a sister and three children. This was the poorest family I ever knew; their worldly possessions consisted of the clothes they wore, a rusty gun—half the barrel had been cut off—only a few charges of powder and shot, two tin-pails, one of which had a hole in it, and a few dirty deer-skins for bedding. They literally had nothing to eat. On May 19th the young man and his wife were out on some rocks on a shoal about three miles out in the Straits, gathering sea-weed, which they often eat when food is scarce; it was low water at the time, and a large block of ice which had been left high and dry by the tide fell on them. The woman was crushed to pieces and the man fearfully bruised. I heard of the accident, and with one of my men and some of the women from the neighborhood, went to the scene of the disaster; the man was moaning piteously, and lying just where he had been thrown down. The tide was rising, and now partially covered the remains of the woman. Some women and children were sitting about wondering, I presume, what ought to be done, but doing nothing. I put the invalid on a sleigh and told some of the girls to pull him to his igloo while I went home for some bandages. Off they started in one direction, I in another, old women accompanying me. When about a quarter of a mile apart I heard the girls calling, and leaving the sleigh on which the man was lying moaning in agony, they came leisurely towards us; it turned out they wanted a pinch of snuff from one of the older women, who had a good supply. This showed me how devoid these people are of all sense of feeling for the misfortunes and suffering of their neighbors.

Sixteen deaths occurred among our neighbors during the spring, and I believe that fully thirteen were caused by starvation.

By the second week in June we had fully 150 natives living within half a mile of the house; they bothered us very much; they insisted on peering in at the windows; it was very annoying having half a dozen dusky faces at each window. We had long since been short of black tobacco—the natives had none and were longing for a smoke. We could not leave the house without being assailed with cries for tobacco and questions as to when the steamer would arrive. Polulick is the Eskimo word for steamer. Not being able to obtain tobacco they would beg for the ash out of our pipes; this they used as snuff, which they consider the next best thing to tobacco for smoking.

The summer wore on. I had expected the steamer about July 10th; by 15th she might have forced a passage, but the ice did not really move until 18th. July passed and no steamer. By August 4th there was scarcely a piece of ice visible—all seemed clear. I discussed the pros and cons of the question with my assistant and the men, and we unanimously concluded that should relief not arrive by August 21st we would start for Ungava in the boat. It would have been impossible to have remained another winter. Very little provisions and no fuel was left. The winter might set in in September, and as I could not be certain that the Hudson Bay officers at Ungava could keep four men for a whole year, time had to be allowed for a boat voyage to Nain, on the Labrador Coast. We of course inferred that the steamer had come to grief and had perhaps been wrecked.

During my stay on the shore of the Straits I saw many beautiful Auroras, which in nearly all cases were accompanied by great magnetic disturbances. The mean temperature of the year was 12.5; that of January was 23° below zero, and of July 43° above; the lowest temperature registered during January was 35° below zero, and the highest 5° below. The daily range of temperature was at all times small, but more especially in the winter months. The mean temperature for February was, compared with other winter months, very mild, probably unusually mild, the mean temperature being but 3° below zero; the same month in Toronto the mean temperature was the lowest, but one, that had occurred in forty-five years. Scattered drift ice was plentiful in the Straits until the end of the first week in September, 1884; from that until the end of October we saw a few "bergs," but no field ice. On the 24th October the Straits froze over, and few days after that date navigation would have been well nigh impracticable. On the bays and inlets of the sea, ice formed to a thickness of $5\frac{1}{2}$ feet. Until after July 18 last summer we saw scarcely any signs of water in the Straits, but by August 4th the ice had almost all disappeared. We crossed the ice in the bay on July

26th, when it was all honeycombed and in a rotten condition; it went out with the ebb-tide on the morning of July 28th. The most severe storm we experienced occurred on March 21st, the temperature being 20° below zero, and the wind blewing at an average rate of 62 miles per hour, with squalls of over a hundred.

BOAT VOYAGE TO UNGAVA.

Friday, August 21st.—Left station at 4.30 a.m. No wind; rowed all day, course S. by W.; failed to make the land on other side of Bay; lay out all night; calm water.

Saturday, August 22nd.—Started to row again at 8 a.m.; occasionally light air from N. E. and E.; took many hours to recover ground lost by drifting last night; at 6.30 p.m., got into cove where I hope shall be comfortable till morning; not sheltered from E. and N.; heavy surf on rocks.

Sunday, August 23rd.—We lay quiet last night, and this morning, as the wind was unfavourable for rounding far-off point, I contented myself with bringing my boat to an inlet where she would be safe, storm as it may. We are now lying between precipitous cliffs, and within 100 yards of a waterfall of certainly 400 feet, and I think more, in height. At entrance of inlet I estimated the cliffs to be about 2000 feet. The wind keeps easterly and is fresh, threatening rain; weather cold and raw; I intend making a push to-morrow at daybreak.

Monday, August 24th.—Went out this morning but found the wind strong and dead ahead, so put back. I sprained my foot badly this afternoon; any one may imagine my present frame of mind; I am chilled through and through; weather is cold and a drizzling rain is falling; my foot tortures me; four days out and only progressed about 30 miles; quite 250 miles to go.

Tuesday, August 25th.—The easterly wind died out this morning, leaving a heavy sea; started with a light N. W. wind and a terrible jumble of a sea, which made two men sick. About 3 p.m. the wind increased to a fresh breeze, and having come some 15 miles I am now anchored for night in a little cove and under a cliff of nearly 1500 feet; by swell that is rolling in I judge that it is blowing almost a gale outside; the clouds are drifting fast from the N. W.; weather very cold.

Wednesday, August 26th, (noted some days after).—Left anchorage at daylight. When we got clear of cove and bay, found it to be blowing half a gale from N.N.W., and heavy sea running. Kept her full and by until about 7 o'clock in order to round a headland; got very wet; sheet in hand; man bailing all the time; sometimes had to luff to squalls; 7 to 8.30 wind on quarter; now thought we were clear of large bay and course would be about S.S.W. ½ W. down Ungava Bay shore, so kept her away almost dead before it. After about an hour's run it began to dawn upon me that I was running into another long bay as faintly through the mist I could see land abeam on port side, and at times thought I could discern it ahead many miles distant. Thinking it better to be on the safe side I determined to round the Point to E.N.E., and again hauled my wind, laying up for a small island off Point. What a sail that was, 8 miles, close-hauled, a very strong breeze and heavy sea; the water poured in. I had to keep a man bailing all the time; everything was soaking wet in no time. Near the Point wind and tide made a tremendous sea, so heavy, indeed, that for some time after passing the Point I was afraid of keeping away for fear of being swamped. We now had the wind almost dead aft, and until about 4 p.m., and made good way. From 4 to about 6.30 it was abeam and blowing a moderate gale; we fairly hummed along and shipped lots of water. I thanked my stars I had obtained a new mast; the old one would not have stood with half the wind. Anchored for night in a cove; landed and tried to dry some of the things. The two men slept ashore, Bennet and I on board; about 3 a.m. boat grounded, luckily no rocks; at this place managed to make a fire of moss and cooked some Johnson's fluid beef; this hot drink went well after the thorough soaking we had got.

Thursday, August 27th.—Started again when boat floated at 5 a.m.; wind moderate from N.W.; had made good about 10 miles when fell calm. 9 a.m—Passed some Eskimo tents, three men came out in kyaks and wanted to barter for powder and tobacco; they said in going by commotik to where we had come from we would have to sleep two nights. We rowed until late in afternoon and then obtained a good harbour, anchoring behind an island in a perfectly sheltered spot. Waters in these parts alive with seals and porpoises; saw one immense walrus; I had a shot at him, and hit him hard, but did not kill him.

Friday, August 28th.—We grounded last night again for about two hours; tide like a mill-stream. Started at 5 a.m.; tide coming in; foolishly did not keep near shore and got into current; took two hours going less than a mile, sail set, wind fresh and fair, three men rowing; wind moderately fresh and fair all day; made run of, I suppose, 40 miles, but by dark had failed to find harbour; had to anchor in an exposed place; saw two Eskimo; they say 8 days by commatik from this to Ungava.

Saturday, August 29th.—Under way again at daylight; scarcely any wind all day; by rowing and sailing may have made 15 or 20 miles; shore continues low. No harbour again to-night; turned in about 7 o'clock. Half an hour after one of the men called out that boat was half full of water, and so it proved; everything wet, instruments, chronometer, bags—everything. In trying to find plug-hole shoved both my arms with shirt and coat-sleeves into water. Slept in wet things as I had not a change; miserable night. How the plug came out I cannot imagine.

Sunday, August 30th.—Wind light from E.; no use trying to get on, so sought a harbour in order to dry some of the things. Found what seemed to be good one; 25 feet water at flood-tide, but a few hours after anchoring we were high and dry with no water to be seen in any direction; day raw and cold, threatening rain; very unsuccessful as to drying clothes. Tide came in again at 7 o'clock; just getting dark; saw boat safely anchored, and turned in prepared to turn out again about one o'clock in order to see that she landed on a sandy spot when the tide went out. At 2 a.m. she grounded satisfactorily, and I slept soundly until the water returned at 8 a.m. Tide here runs like a sluice; spring tides, I suspect, about 40 feet.

Monday, August 31st.—Under weigh at 8 a.m.; good N.N.E. wind all day; must have made between 40 and 50 miles. No harbour at night; anchored in two fathoms at low water, about a mile from shore; spent sleepless night, as wind freshened from N.E., and sea began to rise. At 11 p.m. thought myself in fix, but wind again fell light.

Tuesday, Sept. 1.—Started at daybreak; very light N.W. wind until about 10 o'clock; after this it freshened from N.E. with a threatening sky and occasional showers. Determined to seek a harbour early, so headed for a point which I judged could be made by 4 p.m. What a very lucky hit; this Point had a beacon on it, and proved to be at the entrance to the Ungava River. Round the Point we came to a cove on the shore of which was a log-fishing shanty, A man—a white man—the first we had seen since last September. came out to us in a boat. He proved to be an employee of the Hudson Bay Co., and was attending a salmon net. He informed us that the Hudson Bay Co's steamers *Labrador* and *Diana* were both at the post, which was 25 miles up the river. He showed us where to anchor, telling us it was useless trying to ascend against the ebb-tide. We went ashore to his shanty; he cooked us some fresh salmon and gave us some hot coffee with biscuit and butter. Never in my life had I enjoyed a meal so much before; never do I expect to enjoy one more thoroughly in the future. I turned in after this delightful supper, but did not close my eyes.

The south side of Prince of Wales' Sound is high and precipitous. In a fjord where I lay, 22nd to 24th, fair anchorage about two miles up near a waterfall of over 400 feet.

From Cape Hope to about lat. 60°; high land back in interior, but coast line low; rocky islands, reefs and shoals for many miles out.

On 30th passed inside some much larger and bolder islands, Ackpatok lying outside, and from this to Ungava River the shore seemed more open and clear of reefs. We saw a few bergs on 26th and again on 28th. I consider that the west coast of Ungava Bay is quite unfit for purposes of navigation, owing to the numberless reefs and rapid tidal currents. The spring tides are over 30 feet in northern portion and about 60 feet near the mouth of the Ungava River. We saw a few natives at different points along the coast.

I append the following list of Eskimo words, which I picked up, with their English equivalents :—

English.	*Eskimo.*	*English.*	*Eskimo.*
One	At-ousik	Coat	Koal-a-tuk
Two	Ma-cook	Skin	Kesheke
Three	Ping-ushoot	Small seal	Netchik
Four	Sheetimut	Large seal	Oog-duke
Five	Dudlimut	Seal oil	ook-chuk
Six	Pinga-she-ook-took	Island	Kik-it-tuk
Seven	do. atousicklou	White bear	Nan-ook
Eight	Sheetimaooktook	To-day	Ooblumie
Nine	do. atousiclou	Yesterday	Ik-buk-chuk
Ten	Dudlimaooktook	Me	Oovenir
No	Ow-kuk	You	Igvete
Yes	A-hi-lah	Yet	Suly
I don't know	Ah-chuke	Only	Keshani
Water	E-muk	House	Igloo

English.	*Eskimo.*	*English.*	*Eskimo.*
Ice	Nee-luck	Tent	Toopik
Deer	Took-too	Gun	Cook-e-ook
White people	Cublunac	Powder	Ogjid
Eskimo	Inhuit	There	Tomahny
Snow	Ah-poot	What	Chu-ah
Rain	Cheila-lou	Duck	Meet-uk
Fog	Duck-took	Gull	Now-yer
Broken ice	Chik-oo	Ptarmigan	Ah-hag-yer
Spring	Oopin-uk-chuk	A hill	Kuk-kuk
Summer	Oopin-ark	Land	Noon-ah
Autumn	Ook-e-ark	Sun	Chuk-in-uk
Winter	Ook-e-ook	Moon	Tukir
Good	An-an-uk	Sister	Na-yung-a
Bad	Pu-ūn-eakput	To-morrow	Cowkput
Death	To-ko	Day after to-morrow	Cowk-put-a-lou

ELEVENTH MEETING.

The Eleventh Meeting was held on 13th February, 1886, the President in the chair.

The following list of Donations and Exchanges was read :

1. Journal of the New York Microscopical Society, Vol. I., No. 8.
2. School of Mines Quarterly, Vol. VII., No. 2.
3. Science, Vol. VII., No. 157.
4. From the New Jersey Historical Society :
   (1) New Jersey Archives. First Series, Vol. I. to VIII.
   (2) Proceedings of the New Jersey Historical Society. First Series, I., III., IV., VI. to X. Second Series, I. to VII.
5. Harvard University Bulletin, No. 33.
6. Electrical Review, February 13, 1886.
7. Appleton's Literary Bulletin, No. 43.
8. The Chemical News, January 29, 1886.
9. Imperial Federation, February 1, 1886.
10. Transactions of the Manchester Geological Society, Vol. XVIII., Parts XII. and XIII.
11. Cosmos, 25 Janvier, 1886.
12. Electricité, 23 Janvier, 1886.
13. Revuede Linguistique et de Philologie comparée, Tome 19me, Fascicule 1er.
14. Bullettino della Sezione Fiorentina della Società Africana d' Italia, Vol. I., Fas. 6c.
15. Wochenschrift des oesterreichischen Ingenieur und Architekten Vereines, 22 Januar, 1886.
16. Annales des Mines, 8me Série Tome VIII, 5e Livraison de 1885.
17. Atti della R. Accademia di Belle Arti in Milano, 1884.
18. Journal für Praktische Chemie, 1886, No. 1 u. 2, Leipzig.

19. Beiblätter zu den Annalen der Physik und Chemie, 1886, No. 1.
20. Journal des Sociétés Scientifiques, 27 Jan., 1886.
21. (1) Notice sur l'École centrale des Arts et Manufactures, 1883, Paris.
    (2) Programme des Conditions pour l'Admission des Eleves.
    (3) Arrête Ministériel, 24 Mai, 1862.
22. Atti della Società Veneto-Trantina di Scienze Naturali residente in Padova. Vol. IX., Fascicolo I., II.

Total, 48.

The following were elected members: H. Piper, Adolphus Baxter, and Anthony McGill, B.A.

The President, on behalf of Mr. A. C. Lawson of Ottawa, read a paper entitled: "Some Instances of Gneissic Foliation and Schistose Cleavage in Dykes and their bearing upon the Problem of the origin of The Archæan Rocks."

The phenomenon of gneissic foliation and schistose structure in rocks is so many-sided in its character, and so far reaching in its bearing upon the elucidation of important problems in archean geology, that a comprehension of these physical characters, sufficiently adequate for the formulation of an acceptable theory explanatory of their origin and development, is one of the great desiderata of the geological science of to-day. Such a comprehension can only be arrived at after careful and intelligent sifting of evidence gathered by much patient research in many fields. That we are as yet far from having accumulated sufficient evidence upon which to base a reliable and consistent hypothesis will be conceded by all geologists who have gone, hammer and compass in hand, into the archean field and faced the problems there presented. In the whole range of geology, whether we regard it from a purely philosophic or a strictly economic point of view, there is no more important general question to be solved than that of the original character and present structure of the archean system of rocks; and for the solution of that question one of the great rëagents that is lacking, is, I believe, a good working hypothesis, or, if necessary, two distinct hypotheses that will give us the most highly probable explanation of these two phenomenal rock structures, viz.: gneissic foliation and schistose cleavage.

They are both so familiar and commonplace to all geologists that objection may be made to classing them as phenomenal, but so long as they are without a rationally consistent explanation they may fitly be so termed, since the more these rocks are studied the more is one impressed with the actual mystery that as yet veils their natural history from our view. There have been, indeed, many speculations on these problems of foliation and cleavage, and provisional theories, such as the existing state of knowledge warranted, have been accepted. But speculations devoid of a broad foundation of accumulated facts, and theories that have survived their usefulness, become in time pernicious encumbrances, instead of aids, to the advance of science, and must yield always to more and more substantial beliefs, as vigorous and intelligent investigation proceeds.

In the working out of archean geology the theory of metamorphism has been a powerful stimulant to research and has given us many valid results which entitle it to hold a place of the greatest respect in the history of the science. It has, however, fallen short of its aims in the two chief objects which it has ostensibly sought to accomplish, viz.: (1) the formulation of a consistent and acceptable account of the original character of the archean rocks; (2) the furnishing of a key that will enable us to solve their present structural complications. The great truth the theory of metamorphism has established for science is the fact, that there is *a* metamorphism to which all rocks are susceptible; but its attempt to find in this metamorphism the complete explanation of the profound problems of the old crystalline rocks, is a delusion which must sooner or later be abandoned by geologists as freely as it has been firmly and generally believed in. It is difficult to find a definite enunciation of all that the metamorphic theory of these rocks means. The general proposition, however, that it endeavours to sustain is, that the archean rocks were originally ordinary sedimentary strata which by a process of mineralogical changes or "metamorphism" have become altered into the highly crystalline rocks we know to-day. This proposition, which was once generally accepted, is now fast losing its hold upon geological belief, if we except, perhaps, that of the conservative English school. The many and fundamental objections to the theory have never been satisfactorily reasoned away, while much of the evidence in its favor is based upon assumption. I do not propose to attack the metamorphic explanation of the archean rocks in general, but simply to call attention to two assumptions which the theory both implies and finds support in, advancing such facts as I have been able to observe, which tend to prove the unreliable nature of the propositions assumed to be true. These propositions are :

(1) That gneissic foliation is a proof of bedding.

(2) That cleavage or schistose structure is peculiarly developed in sedimentary rocks.

I shall endeavour to show by an array of instances to the contrary (1) that gneissic foliation is no proof of bedding; and (2) that both gneissic foliation and schistose cleavage may be developed in true igneous rocks. The instances referred to are taken from the Lake of the Woods region, where I have had some opportunity of studying the archean rocks in their various aspects.

On an island in Sabascosing Bay, Lake of the Woods, a band of black hornblende schist runs through the gneiss. The lamination of the schist, the foliation of the gneiss and the line of contact are coincident in direction, striking 150°, and the common dip is to the north-east. The line of junction is crossed by one branch of a forked dyke half a foot wide, as represented in the accompanying diagram (Fig. 1) :—

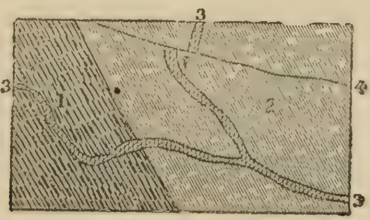

FIG. 1.

Laminated gneissoid dyke cutting gneiss and hornblende schist. Island in Sabascosing Bay, Lake of the Woods.

1. Coarse textured gray gneiss.
2. Black hornblende schist.

These two rocks are in conformable contact with a common strike of 150° and dip to north-east.

3. Dyke about ½ ft. in width, faulted at F, granitic in composition, but presenting a well-marked gneissic lamination in structure.
4. Fault cutting schists and dyke.

A small fault crosses the schist and has caused a dislocation, the extent of which is seen by the movement of the dyke along the line of fracture. The dyke is granitic in its composition, containing feldspar, quartz and mica, *and has a well-marked gneissic foliation of the crystals parallel to the containing walls of the dyke.*

On a small island in the central portion of the lake, situated about two miles north of the mouth of Astron Bay, the rock, which is here a coarse dioritic or ash-bed agglomerate schist, is traversed by a granitic dyke striking 40°, with the cleavage and longitudinal axes of the agglomerate fragments in a nearly vertical attitude. The ground plan of the dyke is given in the accompanying diagram (Fig. 2).

FIG. 2.

The dyke is of irregular width, has a ragged edge, which at places includes portions of the schist, and is, therefore, taken to be an actual intrusion. Its width varies from one to four feet, and about 21 feet of its length is shown. It is of a dark gray color, is coarsely crystalline, and has the composition of a highly feldspathic granite, but *the crystals have a well-marked foliated arrangement parallel to the strike of the dyke.*

Two and a half miles south-west of Yellow Girl Point, Lake of the Woods, lies a small island about four chains in length from east to west and about two in width. The island is composed of evenly laminated hornblende and micaceo-hornblende schists striking east and west with a northerly dip at a very high angle. At its widest part, the schists of the island, which are quite bare and well exposed, are cut by a curved north and south striking dyke about 15 feet wide, whose relation to the schists is shewn in Fig. 3.

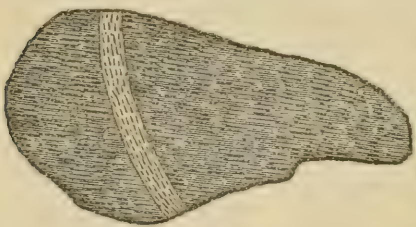

FIG. 3.

The schists abut sharply on the dyke on both sides and there is no appreciable difference in the strike of the schists on one side from that on the other. The rock of the dyke is syenitic in composition, being composed of a preponderance of a pale yellowish pink orthoclase with a black variety of hornblende and some quartz, plagioclase and mica. *The dyke presents an unmistakable gneissic structure* which is best developed along its sides, the rock being more undifferentiated and granitic in the central portions.

The island lies a little to the north of a larger island (Beacon

Island), the north shore of which is occupied by hornblende schist and finely laminated quartzose mica schists, while the southern half of it is occupied by a mass of flesh-tinted rock of the composition of a syenitic granite, but in which, in places, there is developed, in the same rock mass, a very distinct though coarse gneissic foliation, with gradations between what would be taken as a true granite and the unmistakable gneiss, which preclude the possibility of any hard line being drawn between them, both being in fact the same rock—a granite. The gneissic foliation is due to a structural differentiation, which, so far as observation would permit of judging, is more especially peculiar to that portion of the mass nearest the contact with the schists. The dyke on the small island shewn in the figure is probably an off-shoot from this granitic mass.

Along the junction of the Huronian hornblende schists with the Laurentian gneiss on the islands at the mouth of White Fish Bay, may be seen some remarkable instances of *intrusions which have all the physical aspect of a regular gneiss.* The most striking of these is figured in the annexed diagram (Fig. 4), which illustrates the condition of things seen on an island called the West Pointer at the mouth of the bay.

FIG. 4.—Scale—1 inch = 10 feet.

The northern and larger moiety of the island is occupied by the hornblende schists of the Huronian, and the southern by coarse grey gneiss. About the middle of the island the irregular intrusion of gneiss shewn in the figure breaks through the hornblende schists. The intruded rock resembles closely the regular gneiss to the south of the line of contact and its foliated character is quite as well defined. The irregular nature of the fissure through which this gneiss has been injected is such, that it cuts across the schists at some places and runs with its strike in others. The foliation of the contained gneiss is approximately parallel to the walls of the fissure. In one place this foliation and the general axis of the dyke have a coincident strike of N. 55° W., while the schists which abut sharply on the dyke have a strike of N. 80° E.

The intrusion is, I believe, identical with the gneiss of the Laurentian to the south, and is a striking proof of the plastic or viscid condition in which these rocks must have once been, either as an original state or as induced at the time of folding. The belief that this intrusion of gneiss is the same as the Laurentian gneiss of the region to the south, and that it is simply a portion of the latter that has been injected in a molten state within the rocks in which it is now found, is based not only on the similarity of the rocks, but also on the nature of the line of contact at this point, which in the conditions represented in Fig. 5 gives us another proof of the once viscid condition of the rocks.

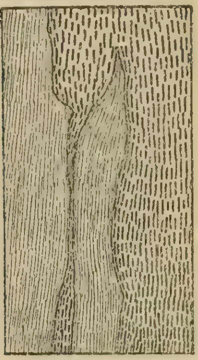
Fig. 5.

The gneiss and the schists here are the same in every way as those described in the preceding figure which occur only a few yards to the north. The wedging of the two rocks one within each other in the way represented finds its readiest explanation in ascribing a plastic or viscid condition to the rocks at the time of this folding under enormous pressure. This condition of things along the line of contact is, it may be mentioned, somewhat abnormal, the rule being that the hornblende schist presents an even line of junction with the gneiss, strictly conformable, so far, at least, as parallelism of the planes of foliation of the gneiss, cleavage and bedding (not necessarily sedimentary) of the schists, together with transitional alternations of beds of gneiss and schist may be taken as indicative of conformability.

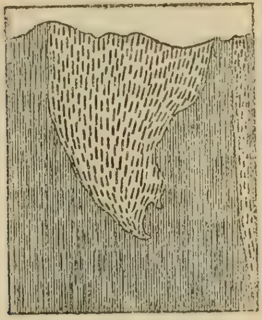
Fig. 6.

Another instance of intrusive gneiss breaking through schists is seen on the extremity of Rendezvous Pt. in Long Bay. Here, as seen in Fig. 6, an irregular wedge of distinctly foliated gneiss juts in from the shore line within the schists, presenting all the characters in its contact with the adjoining rock of an intrusive mass.

It is a coarsely crystalline gray gneiss. A little to the south is a narrow band of gneiss striking with the schists, of which it would be difficult to say whether it was a dyke or an interbedded stratum. Its origin is probably the same as that of the larger and more distinctly intrusive mass to the north of it. The aspect of the rock surface on the point in question is shewn in the annexed Fig. 6.

At the extremity of Spear Point, on the route between Rat Portage and French Portage, the mica schists, which constitute the rock of the point, are cut by an irregular dyke of a porphyritic dioritic rock, striking N. 60° E., with the schists as shown in Fig. 7.

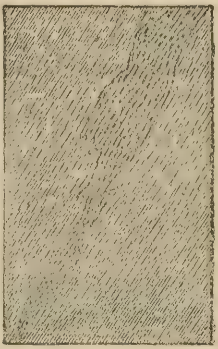

Fig. 7.

The dyke has a very ragged edge and its intrusive character is undoubted. It varies in width from two feet to a very few inches. The dyke weathers a yellowish white, and presents a surface finely pimpled with thickly disseminated crystals of feldspar, which have been more resisting than the matrix of the rock to weathering agencies. These crystals show a distinctly foliated arrangement, and give the rock the aspect, though it has not the composition, of gneiss. The foliation is parallel with the general strike of the dyke, and in addition to its gneissic structure is quite schistose.

The mica schists which occupy the north end of Hurricane Island are cut obliquely by a ragged-edged dyke of whitish yellow weathering dioritic rock, which is distinctly schistose. The mica schists have a strike of N. 60° E., while the dyke and its planes of schistose fracture strike about N. 40°E. The following Fig. 8 shows the relation of the dyke to the schists on the ground plan.

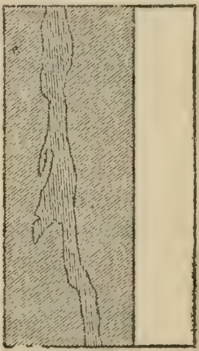

Fig. 8.

On the west shore of Sabascosing Bay the gneiss at one point is cut by a band of hornblende schist, of which neither the dyke-like character nor the schistose structure can be doubted. It is from one and one-half to two feet wide, and strikes N. 50° W. across the gneiss, the direction of whose foliation is N. 75° E. The dyke lies, as is shown in Fig. 9.

between two other dykes of fine-grained gray granite, one nine feet wide on the north-east side and one one foot wide on the south-west side. All these dykes fault the rock, as is seen by the non-correspondence of the gneiss at points directly opposite each other, and by the slight torsions of the nearly vertical planes of foliation.

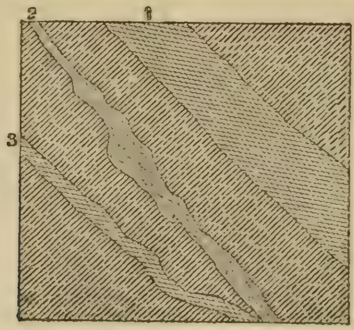

FIG. 9.

Schistose dyke, between two granitic dykes, cutting and faulting gneiss Sabascosing Bay, Lake of the Woods.

1. Granite dyke, 9 feet wide.
2. Dyke of laminated and schistose amphibolite rock—hornblende schist.
3. Granite dyke, about 1 foot wide.

On the north-west corner of Oak Island there cuts the hornblende schists a very schistose dyke of a rock, composed of hornblende, mica and feldspar, containing brecciated fragments of a highly feldspathic gray granite (Fig. 10). The dyke is from two to four feet wide, and traverses the schists across their strike. The included fragments are not numerous, but present the aspect of true brecciated inclusions.

FIG. 10.

These instances appear to prove conclusively that a gneissic foliation may be developed in a granitic rock that was at one time viscid or flowing enough to be injected within fissures of other rocks; and also that a schistose structure may be developed in igneous intrusions. Omitting for the moment all considerations as to the causes to which this foliation and schistose cleavage may be ascribed, these conclusions have an important bearing upon the possible original character of some of the archean rocks, especially if by careful research and accumulation of evidence it be found possible to extend them from the special to the general. If from admitting the development of a gneissic foliation in an undoubted igneous rock we admit the possibility of the great Laurentian system of rocks which are granites or syenites in composition but gneisses in structure, having been in a fluid state, we take a great step towards removing the necessity for a theory of metamorphism which ascribes a sedimentary origin to these rocks. It may, indeed, be urged that the metamorphic theory admits a once viscid condition for these rocks and that this state was only the extreme of metamorphic action, but the moment the theory admits this it removes at once its *raison d'être* and becomes a far-fetched and cumbersome hypothesis to explain phenomena that can be accounted for in a far simpler way. For it is absurd to admit the development of a gneissic foliation in a granitic magma whose fluid condition has been brought about by the action of heat on once solid strata, and to deny the possibility of a similar differentiation in the original granitic magma or fluid, which is generally conceded to have constituted the first surface of our globe. The development of a foliation in a magma which is such *ab origine* is as easily conceivable as that in a magma which is only such secondarily, and is far simpler as a scientific hypothesis, in the fact that it avoids the necessity of imagining an immense process of sedimentation of a most peculiar character, and leaves us as far as ever from the beginning in attempting to trace out the history of the earth's crust from the time of its molten state.

As a general rule, however, the exponents of the metamorphic explanation of the archean rocks do not carry their contentions quite so far as this. The Laurentian gneisses, they say, are sedimentary rocks, which, though in the process of metamorphism they have been reduced to a plastic condition, have never been rendered so completely homogeneous as to lose all traces of sedimentation, which traces are manifest in the parallelism of the planes of crystalline foliation; further, that many granites are but gneisses that have undergone this extreme stage of metamorphism and so had these traces of sedimentation quite obliterated. This of course puts the question on much more debatable ground; but if it can be shown that, in true igneous rocks, which, if our ordinary conceptions of intrusive phenomena are to stand, must have been in the condition of a fluid magma, a distinctly gneissic structure may be developed, as I have shown to be the case in the instances cited, then the argument that gneissic foliation is an indication of bedding is terribly shaken; and if, further, by extending observation, the foliation of gneisses generally can be shown to be due to similar forces operating on similar material, the metamorphic theory must go to the wall as a needlessly far-fetched and complicated hypothesis. I am well aware that the metamorphic theory is not altogether based on the structure of gneisses, nor do I deny that there is a metamorphism to which rocks are susceptible, but as an explanation of the origin of the Laurentian gneisses it seems to be very weak, particularly where it seeks for support in the assumption that foliation in these rocks is proof of sedimentation.

If we consider for a moment the probable causes of the differentiation of a granitic magma into a foliated gneiss, such as occurs in dykes of gneiss, we shall find that pressure was in all likelihood the most important force at work; further, that this pressure was due not to external disturbance but to internal changes; that it was, in fact, the pressure due to the expansion of the injected material during the process of solidification within confining walls practically rigid. Wadsworth has pointed out in his Lithological Studies the high probability of rock magmas following the rule found to hold in many of the economic metals. These expand rapidly during the actual process of solidification, so that when solid, but at a temperature only slightly below the point of fusion, they have a lower specific gravity than when in the fused state; though in cooling from this temperature the solid contracts so much as at the normal temperature to have a specific gravity higher than that of the molten fluid. An expansion of this kind in a dyke solidifying by crystallization can be readily imagined to have had a very potent influence upon the arrangement of the nascent crystals. The pressure would of course be equal in all directions if the magma were a perfect fluid. As crystallization proceeded, however, the pressure would act more and more in directions perpendicular to the planes of resistance, *i.e.* to the walls of the dyke, and as a consequence the crystals would be forced to assume positions in which their longest diameter would be parallel to the lines of least resistance. Such an explanation of the development of a gneissic structure in dykes may be extended with some probability of truth to the gneisses of the Laurentian, particularly those usually referred to as granitoid gneiss. The crumping and folding of the archean rocks is generally ascribed in text-books to a process of contraction, due to the cooling of the earth's crust or to the contraction of the interior molten globe, and the consequent collapse upon it of the less rapidly cooling crust. This explanation is probably the true one to account for the folding of post-archean strata, and much of the disturbance that affects the archeans themselves is doubtless due to the operation of such forces. But if it be admitted that the Laurentian gneisses ever so far resembled intrusive gneiss as to have been in the condition of a molten magma, then we have a prior and more important force to take into consideration, viz., the expansion of solidification at the time when the rock was passing from the fluid to the crystalline state. Such an expansion would be amply sufficient to throw the solidifying but yet plastic rock into the violent folds and contortions in which we to-day find the fundamental gneiss wherever it is exposed the world over. The same expansive pressure would, as in the case of the dykes, have a decided tendency to arrange the precipitated crystals in a more or less definite way with their longest diameters parallel to the line of least resistance, *i.e.* parallel to the axes, whether straight or curvilinear, of the folds. This tendency to gneissic arrangement would be aided by the pulling and flow that would necessarily be induced by the folding of such a partially crystalline still plastic mass. This seems to me to be the most plausible hypothesis to account for the origin of the granitoid gneisses of the Laurentian, and it is certainly more in harmony with the phenomena we find in the archean field than a theory which holds that they are the altered remains of once aqueous sediments. The marvellously intricate contortions and intermingling of the gneiss seen not only on natural exposures in the Lake of the Woods region, but also in some railway cuttings between Port Arthur and Winnipeg, leave room for no other conception than that the gneiss must have been in a perfectly viscid condition. It is not at all probable that the explanation advanced to account for the origin of the granitoid gneisses is true of the more finely laminated and bedded gneisses that appear to occupy a higher position in the Laurentian system. This lamination can, without serious objection, be ascribed to regularity of crystalline precipitation, a stratiform arrangement due to difference of specific gravity in different portions of the original magma, and to the variation of the fusion point of crystallizing minerals according to the proportion of other minerals present, all of which forces would have freer play near the surface, where the composition of the magma would be less constant and the superincumbent pressure be less.

The contraction which these rocks have undergone must have taken place at a period subsequent to their assumption of the solid state, and would, therefore, naturally have an immensely less chance of exerting a modifying influence upon the arrangement of their component crystals than forces at work while it was yet plastic. The results of such contraction are probably seen in the innumerable fissures that traverse Laurentian rocks, and are now filled with pegmatite granite and other intrusive material. The fact that, as a rule, there is an extremely small amount of dislocation attending these fissures favours the view that they are due to contraction of the solid rock rather than to any kind of upheaval or similar disturbance. It is, moreover, to be observed that the crumpling and folding of the original surface of the earth, due to the expansion of solidification, would, by the natural balance of physical forces, be prevented from extending to excessive depths. The pressure due to the weight of the upper portions of the globe's forming crust would at a certain depth counterbalance the pressure of expansion, and long before this point was reached the tendency to folding would be checked. The solidifying magma would expand quietly and uniformly in all directions till equilibrium was established, when, the resistance from above being equal to that in other directions, there would be no tendency to differentiation in the arrangement of the crystals. The resulting rock would be the granite, into which gneiss is often seen to graduate when denudation has exposed the lower portions.

If we now pass on to consider the question of schistose cleavage, we find that the instances cited show that such a cleavage may be developed in igneous or intrusive rocks. This schistose structure appears to be closely allied to gneissic foliation, though a rock may be distinctly gneissic, and yet not at all schistose under the hammer. Both are probably due, so far as dykes are concerned, to the same causes. It is scarcely necessary to remark that there are two kinds of cleavage, one due to a parallel arrangement of the foliated minerals in the rock, produced very probably by the operation of the same forces as those to which the foliation of gneiss is ascribed, and which may, therefore, be properly said to be allied to it; and another which crosses the strike of the lamination and seems to have been developed in the rock as a species of fine jointing after its assumption of a hard solid state. Both kinds may often be seen cleaving the same rock, but only the former will now be considered briefly, as it is that which prevails in the upper or schistose portion of the archean system. That such a schistose cleavage may be developed in igneous rocks is shown by its occurrence in intrusive dykes. It is not, however, only under the conditions in which dykes occur that this cleavage may be developed in igneous rocks, for on a larger scale I have repeatedly observed perfectly massive and homogeneously textured rocks of a diabasic or dioritic composition merge into a schistose variety of the same composition and aspect, without a break to create a doubt as to the identity of origin of both. Further, I have noticed that even granite, which is unmistakably intrusive, may exhibit a rough but quite well-marked schistose fracture. This is well seen on the northern skirts of the Echo Bay (Lake of the Woods) intrusive mass of granite, which breaks through a diabasic rock, and near its contact with the latter becomes less coarsely granular and roughly schistose.

If, then, a schistose cleavage may be developed in a truly igneous rock, the mere fact that the higher portions of the archean system are characterized by such a schistose cleavage, even though it be parallel for the most part with the stratiform arrangement or bedding of the rocks, is no reason whatever in support of the belief that these rocks were once aqueous sediments.

In answer to a question of Mr. Rouse respecting the expansion of rocks in cooling, Dr. Ellis referred to a number of substances that expand in the act of solidifying, and entered into an explanation as to the cause of the expansion in such cases.

Mr. T. Nelson Dale stated that the views of the paper agreed with those of Professor Hitchcock, the State Geologist of New Hampshire, who regarded large masses of gneiss in the White Mountains as of igneous origin, but that there were cases where gneiss was undoubtedly of metamorphic origin; thus Beudant, one of the old French geologists, cites a case of a dyke of igneous rock which, in its passage through a bed of argillite, had metamorphosed contiguous portions of it into quartz, feldspar and mica. If the rock in such a locality retained traces of its original bedding, or if the crystalline particles assumed a parallelism in the direction of least resistance, we should have metamorphic gneiss. Mr. Dale had visited, during the previous summer, a locality in Massachusetts where fine-grained gneiss was inter-bedded with mica schist, both evidently of metamorphic origin. The paper was an instructive one, and would promote just views on the subject. The upshot of the present difference of opinion on the origin of gneiss would probably be that it would be determined that gneiss might be either of igneous or of metamorphic origin.

Mr. VanderSmissen introduced Mr. C. N. Bell, of The Manitoba Historical and Scientific Society, who gave an interesting account of the Mounds of Northern Minnesota, Manitoba, and the Rainy River Valley, and of the contents of those at the opening of which he assisted. He exhibited a photograph of a copper hook found by Mr. Richardson, a C. P. Railway surveyor, at the bottom of a deep pocket in the Laurentian rocks, 30 feet below the surface, on the bank of the Pic River. In answer to a question from Mr. VanderSmissen, he gave some figures as to the cost of the exploration of these mounds.

Mr. Boyle moved a vote of thanks to Mr. Bell, which was seconded by Mr. Bain and carried.

TWELFTH MEETING.

The Twelfth Meeting was held on 20th February, 1886, the President in the chair.

The following list of Donations and Exchanges was read :

1. Le Naturaliste Canadien, Vol. XV., No. 8.
2. From Cornell University, Ithaca, N.Y. :
   (1) Annual Reports of the President for 1881, 1883, 1884, 1885. None published for 1882.

(2) Bulletin of Cornell University (Science), Nos. 1 and 2.
(3) Second and third Reports of Cornell University Experiment Stations, 1882-83, 1883-84, 1884-85.
(4) Notes on the Geological History of Cayuga and Seneca Lakes, by C. W. Foote.
(5) Ithaca and its Resources, Kurtz, 1883.
(6) Library Bulletin of Cornell University, Vol. I., Nos 1–13.

3. Science, Vol. VII., Nos. 158 and 159.
4. The Iowa Historical Record for January, 1886.
5. Bulletin of the California Academy of Science, No. 4, January, 1886.
6. The Chemical News, February 5, 1886.
7. Illustrated Journal of Patented Inventions, No. 58, February 5, 1886.
8. Scottish Geographical Magazine, Vol. II., No. 2, February, 1886.
9. Journal of the Quekett Microscopical Club, Series II., Vol. II., No. 14, February, 1886.
10. The Lancet, London, January 23rd, 1886.
11. Midland Naturalist, No. 98, February, 1886.
12. Proceedings of the Royal Geographical Society, Vol. VIII., No. 2, February, 1886.
13. Records of the Geological Survey of India, Vol. XVIII., Part 4, 1885.
14. Electricité, 30 Janvier, 1886.
15. Wochenschrift des oesterreichischen Ingenieur und Architekten Vereines, Wien, 29 Januar, 1886.
16. Gazetta Chamica Italiana, Palermo, Anno XV., 1885, Fascicoli I.–IX.
17. Bulletino della Società Geografica Italiana, Ser. II., Vol. XI., Fasc. I., Gennaio, 1886.
18. Bulletino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche. Tomo XVIII, Aprile, 1885, Roma.
19. Società Storica per la Provincia e Antica Diocese di Como, Vol. 5° Fasc, 17°.
20. Compte Rendu de la Société de Géographie, 1886, Nos. 2 et 3, Paris.
21. Mémoires de l'Académié des Sciences, Inscriptions, et Belles Lettres de Toulouse, Hintième Série, Tome VII., Premier et Deuxième Semestre, 1885.
22. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, Septemtre, 1885.
23. Journal des Sociétés Scientifiques, 3 Févirer, 1886.
24. Zeitschrift für Physiologische Chemie, X. Band, 1 u. 2 Hefte, Strassburg.

Total, 56.

The following were elected members: Rev. J. F. McCurdy, Ph. D. D. J. Gibb Wishart, B.A., M.D., Thos. J. Burgess, M.D.

Mr. David Boyle read a paper on "The Persistence of Savagery in Civilization."

The key-note to this paper was struck in the following sentence: —"As pre-natal life appears to present us in epitome with a history of the development of our race from a merely animal point of view, so does our existence, in its various stages, from the cradle to maturity, exemplify the steps in man's advancement from the condition of the untutored savage to that of a civilized being."

The writer claimed that nearly every one of our "manners and customs" betrays its lineage with some aboriginal proclivity, some instinct, or some acquired tendency which had for its main object the securing of a supply of food.

On this basis Mr. Boyle accounted for the stone-throwing proclivity on the part of boys; and with advancing years, for their indulgence in the use of pea-shooters, slings, bows and arrows, revolvers and rifles.

Cruelty to animals, cocking-mains, pugilism, and man-bull fights were traced to the same savage source. Sports and games were regarded as improved forms of old hand-to-hand encounters.

Music and dancing were rhythmical arrangements of sound and motion, but connected with the celebration of victories in war, dancing especially still showing mimic capture and recapture by contending parties.

Fondness for raw meat and for putrescent vegetable matter led the writer to the love of the human race for stimulants, and he asked whether it would not "be rash to say that the desire for intoxicants had not its origin in some instinctive and impelling longing to satisfy a want in the human organism?"

Of the jack-knife carver on every available surface, the remark was made: "He is a nineteenth century survival of Cave Man, and refrains from committing murder only because he has a wholesome regard for the terrors of the law."

Personal adornment and love of display were the results of evolution from the days of paint and feathers.

In concluding, the writer said, "The customs of modern society, the refinement, the æstheticism of the present day are but evolutionized forms of those natural expressions of instinct and of crude sentiment that are so characteristic of savage life wherever it exists. . . . That many of our proclivities bear so strong a resemblance to savagery, is not only a proof of the "Descent of Man," but goes a long way to show how exceedingly brief has been his so-called civilized condition compared with the endurance of his primeval state. . . . To acknowledge the prevalence of crime, is simply another mode of stating that civilization has not yet reached its highest attainable form."

Mr. C. N. Bell, of Winnipeg, read a paper on "The Mound Builders in Canada."

The scientific journals of the day are over-flowing with articles on the mound builders. Some writers take decided ground in claiming for the builders a remote antiquity, while others are equally positive in asserting that they were the immediate ancestors of our modern Indians. One becomes rather bewildered on finding that prominent champions of the above opposing theories rearrange themselves under different standards when the question arises as to where the Mound Builders came from. While some stoutly maintain that they were an offshoot from Central American stocks, many are confident that they came from the north. An immense number of data are produced as evidence in support of each one of these theories, but one fact seems to have been at least partially overlooked by writers. It is more than passing strange that no systematic attempts have yet been made to follow up towards the north the broad lines of mounds and other earthwork remains left by the mound builders. An immense number of mounds exist in Northern Minnesota and Dakota north of the valley of the Mississippi, and yet little has been done to survey or explore them. Two gentlemen in St. Paul lately informed me that they had surveyed some thousands of mounds in Minnesota, principally, however, south of the source of the Mississippi, but the northern districts were yet virgin soil for the archæologists. Any information therefore that is forthcoming which extends northward the known limits of the mound builders' remains will be extremely interesting and valuable. Comparatively few archæologists are aware of the fact that the Mississippi River mound system merges into one ranging up to Lake Winnipeg, if not farther. In 1867 two of the ordinary burial mounds of the truncated cone form were discovered on the right bank of the Red River in Manitoba, or, as it was then called, the Selkirk settlement. Some interesting remains were taken from them, including human and animal bones and skulls; ornaments of shell, bone and stone; implements of stone, and pottery, all of which (like too many of our Canadian archæological treasures) were exported to enrich foreign museums. Little or no interest was taken in this matter for a number of years, and it is only lately that the Historical and Scientific Society of Manitoba and private individuals have learned of the rich field for research that lies at their doors. As the country becomes settled, reports flow in of the existence of mounds in different parts of the North-West It is definitely known that earthworks of various forms are grouped on many of the streams falling into the Red and Assiniboine Rivers, and the announcement was lately made that at least one mound stands at the north end of Lake Winnipeg, or roughly speaking, in N. lat. 54°, W. long 98°. It may be well to trace one connected line of mounds from down on the Mississippi River to Lake Winnipeg. The Red River of the North takes its rise (by one branch) in Lake Traverse or, roughly speaking, N. lat. 46 degrees, W. long. 97 degrees, and following north falls into the southern end of Lake Winnipeg. There is a connected line of mounds from Lake Traverse to Lake Winnipeg. Lake Traverse is connected by a sluggish creek with Big Stone Lake, which is drained to the south by the Minnesota River, the latter emptying into the Mississippi River, near the city of St. Paul, Minnesota. Mounds are found in numbers along the Minnesota River, from the Mississippi to Big Stone Lake, and there are several groups with an earthwork fortification at the valley situated between Big Stone Lake and Traverse. Hundreds of mounds in this district have been surveyed by Mr. T. H. Lewis, of St. Paul. It will thus be seen that there is a continuous line of mound from the Mississippi, below St. Anthony's Falls, to Lake Winnipeg, following that line of water courses, from the Gulf of Mexico to Hudson's Bay, which divides the North American continent into two great halves, east and west. A brief description of a group of mounds at St. Andrew's, Manitoba, 18 miles north of the city of Winnipeg, will serve to show that in general character they are almost identical with one class of those of the Ohio and Mississippi, as reported on by Messrs. Squier and Davis and other archæologists of the United States. One mound was 8 feet high, 75 feet long, and 65 feet wide. It was covered with a clump of oak trees, ranging up to about 4 feet in circumference, and thickly matted with small underbrush and roots. Under his supervision a trench was sunk from the apex to the base on one side of the centre, and running partially around it. First was encountered a layer of decaying vegetable matter, then the general material was a rich loamy earth, evidently gathered from the immediate vicinity, though no pits or excavations were found. As the cutting was, made patches of charcoal, ashes, and burned clay appeared, mixed irregularly throughout the soil to a depth of four feet. Below this level the ashes and charcoal were more regularly disposed in streaks, and in places the earth seemed to be burned, requiring the use of a pick to loosen it. At this level, also, the remains of some oak timber were uncovered at the west side of the mound, which covered the remains of a human being, interred in a sitting position. The wood was in such a state of decay that it crumbled to dust in the hand, though often showing the lines of fibre and growth, the dust being of a bright red color. In the upper section of 4 feet, amongst the scattered patches of ashes and charcoal mixed through the loam, were found a number of skeletons, evidently "intrusives," as some of them were in a comparatively fair state of preservation, the smaller bones only having disappeared. They had all been buried with the faces upward and were unaccompanied by ornaments or other manufactured articles. It was at once evident to me that they were later interments than the original remains found at the bottom of the mound. There is recorded the fact that during an epidemic of smallpox, about the year 1780, the Indians along the Red River buried their dead in the mounds in this locality, and which were not made by themselves. Without doubt, these "intrusives" found by me were the bodies of the smallpox victims, the Indians departing from their usual mode of scaffold burial to avoid contagion. The late Senator Donald Gunn was informed of this circumstance by an old Indian who had been a resident of the district at the date mentioned. On the level of the natural surface of the ground a platform or layer of round boulder stones was found, beneath a smooth burnt clay floor, apparently dipping lightly towards the centre, which I was unable to uncover at the time, and cannot accurately describe, but it very closely answers the description of the "clay altars" of Squier and Davis. The skeleton of a man of rather above the ordinary stature was found in a sitting position surrounded by several piles or bundles of bones, each surmounted with a skull. These bundles seemed to consist of the main bones and skull of one individual to each pile, and had evidently been brought there for reburial about the central figure. These remains were very much decomposed, crumbling into fragments on exposure to the atmosphere. Some of the bones of the right foot of the sitting skeleton were found in a lump of clay, but these were the only ones, with the main bones of the legs and arms and skull, which were preserved, though much care and trouble was taken. The skull is now in possession of Dr. Daniel Wilson, of Toronto. These remains were on the level of the surrounding ground on the west side of the mound and facing the east. The following articles were found near the sitting figure. About the position of the breast a polished seashell gorget, probably cut from the *Busycon perversum.* It is four inches in diameter with a circular hole in the centre of one-half inch diameter, and two small holes in the rim for suspension purposes, which show a well worn furrow or groove worn into the shell by the friction of the cord or thong. Like the skull, the gorget is stained with a mineral paint of a red color, but no attempt has been made to engrave designs on its beautifully polished surface. Two well-finished tubes of steatite, each hollowed out and having a raised rim at one end, were taken from about the waist. The tubes show that they were finished inside by cutting, as the stripe left by the tools may be seen. A tiny earthen pot came from the side of the skeleton, but it crumbled to pieces when taken from the earth. It appears to have been filled with red ochre or some such material, as the cup was stained red, and there was a crusted deposit inside. A few shell beads were found scattered through the earth of the lower level. Those secured were very much decomposed,, and split into thin scales or crumbled into chalky lime when exposed. The shells of the common mussel, which abound in the river close by, appeared at different levels, but they were generally much decayed. These shells have been found inside pots discovered in the mounds, and were evidently at times used as spoons and ornaments. A few hundred yards from the above mound was another, which has been opened and found to contain human and animal remains, earthen pots, rough stone mauls, deer horns, and a pin or hanging ornament $5\frac{3}{4}$ inches long and $\frac{3}{4}$ of an inch thick, formed from the columella of a sea shell, probably of the *Busycon perversum.* This pin is identical with some in the collection of the Smithsonian Institution, notably with one found in a mound in Tennessee. There was also taken from this mound a gorget or breastplate, $9\frac{1}{2}$ inches long and 3 inches wide, with the ends curved. The material is very dry and brittle, and it is difficult to say exactly what it is, but in all likelihood it is a turtle shell. The marks of a scraper appear on the concave side, while the other is polished smooth and the surface indented with several lines running parallel with its length.

They are not in the form of any particular design. A peculiarity in the construction of this mound was a double layer of limestone flags, separated by a few inches of burnt earth, which was encountered about half way down from the apex, and covering the remains of the original interment at the base. In the vicinity of these mounds, which were situated on a ridge about 500 yards back from the Red River, he found an old camp site, with quantities of "Kitchen-midden," including fragments of pottery, shell and stone heads, partially worked and completely formed arrow heads and scrapers, hammering stones, two stone axes, roughly formed, beaver, buffalo and deer bones, etc. The markings on the pottery were no doubt made by indentation, though in cases the finger-nail marks are discernible. The designs consist of combinations of lines and dots or holes. On comparing the design on one rim fragment taken from the river bank with that on a complete cup taken from a mound within the limits of the city of St Paul, Minnesota, I find that they are almost alike. The materials used in making the pottery were evidently clay, with pulverised shells and decomposed granite, all of which are to be had in abundance in the immediate neighbourhood. A ridge of limestone tapped with drift gravel and boulders here crosses the Red River and supplied raw material for the manufacture of flint implements and weapons. I am unable to learn that any article of European manufacture has been found in the Manitoba mounds. What is strange also is the fact that no article of copper has come to light from these mounds, though, at a distance of 200 miles eastward, on the Rainy River, where a number of mounds have been opened, a majority of the articles found are of that metal, which was probably obtained at Lake Superior, as a direct canoe route from Rainy River leads to opposite Isle Royale where many ancient copper mines have been found. Over 20 mounds have been identified on the banks of the Rainy River, part of them being in the territory of the United States, the river here forming the boundary line between it and Canada. One mound situated at the junction of a southern feeder with the Rainy River is fully 45 feet in height and most likely the largest of the whole mound system. It has been dug into in many places and the large number of relics taken out and carried away and scattered from one end of the country to the other. One mound at the head of Rainy River contained the remains of a structure of logs, about 8 feet square, which showed the action of fire. It had evidently surrounded and covered the original interments. A number of relics were found in this tumulus. But few of the mounds in this region remain intact, and steps should be taken immediately to preserve the small number left. The builders of these mounds were doubtless of a different branch from those of the Red River, and communicated directly with the Mississippi by the streams and lakes which practically form a through canoe route. The country to the direct north of the Rainy River has not been explored, so far as I can learn for mound remains, but the broken character of this section, which is of Laurentian formation, rather inclines me to imagine that none will be found there, because the rule is to find the mounds in the most fertile agricultural districts. Lead, mica, asbestos, gold and silver are found in the rocks of the Lake of the Woods, close at hand to the Rainy River, but there is no record of any of these minerals having been unearthed from the mounds. It is true one piece of ore taken from the hand of a skeleton in the Great Mound has been identified by Dr. Bryce as arsenical iron. Many mounds are situated on the streams flowing from the west into the Red and Assiniboine Rivers, and during this week I have received a communication from a friend who has spent some time in the District of Alberta, in which he stated that "the country is rich in mounds." When it is known that numbers of mounds have been located on the Upper Missouri it is not surprising that they also appear on the streams from the Rockies to the north. Thorough exploration is required to give an exact idea of the geographical areas covered by the northern branches of the mound systems of both the Mississippi and Missouri. That the systems of the Red River and Missouri approach each other closely I proved during the past summer. Groups of the first extend to the headwaters of the Pembina and Souris rivers, which are comparatively close to the Missouri and on the old main trail between the Red River and Missouri, which was the route taken by war parties of the Crees, Assiniboines, and Ojibways from the neighbourhood of Lake Winnipeg, and in more modern times by the Red River half-breed buffalo hunters. Living about Lake Winnipeg, the Mound Builders must have known of the Nelson River, leading directly to tide water in Hudson's Bay, and of the great Saskatchewan flowing from the Rocky Mountains with its northern feeders interlocking with those of the Mackenzie. There is much food for thought and investigation in all this, and the subject is well worthy of consideration as serving to throw light on important points connected with the peopling of North America—whether the Mound Builders were Indians or a different race of men. The remains of the Mound Builders vary in character and structure in different recognized geographical areas, as, for instance, the pyramidal mounds of the Southern States, the embankments of the Ohio, the stone graves of Tennessee, and the effigies of Wisconsin. It may be taken for granted that even if one race of people with customs in the main identical, climatic influences alone would modify and alter the habits of the Builders. The presence of manufactured seashells in the mounds of Manitoba, which probably came from Southern California or the Gulf of Mexico, will give a clue to the range of the trade. Not only have specimens of the *Busycon perversum* been taken from the mounds on the Red River, but several shells of the *Natica* and *Marginella* appeared in a mound on the Rainy River, a distance of fully 1,500 miles from their native water. The Manitoba Mound Builders probably had some other medium of exchange than copper, which does not seem to have been used then (judging from its total absence so far as now known), and it is extremely probable that the fine fur of the north was sent south to regions which, though possessing a milder climate, were subject to variations of temperature that necessitated the use of warm clothing at certain seasons. In short, fur was no doubt the article exchanged for the sea shells of the south. While agriculture may have been engaged in, and the presence of mounds in the most fertile districts suggests that it was, no traces of stone spades, or "furrowed patches," such as have been discovered further south, have yet come to light in or near the mounds opened, of which record has been filed. Like the Mandous, the Builders may have used the shoulder blade of the buffalo as a spade. In a short paper of this kind it is impossible to enter into many details, and I have been compelled to omit many interesting data which have been secured by field work in the North-West.

Mr. J. H. Hunter enquired whether there was any theory in regard to the age of the mounds.

Mr. Bell did not like to offer any. It was very difficult to tell their age. Most mound-diggers have refused to give any date. Much depends on the nature of the soil adjoining them. In the case of trees, the number of rings was not a certain guide. In regard to the Manitoba mounds, there is sufficient historical evidence that at least 200 years have passed since their erection.

Mr. Browning described some graves he had seen in the North-West, and enquired whether there was any theory as to the mode of burial among the Indians.

Mr. Bell replied that all the northern tribes adopted the scaffold mode of burial. Since the arrival of the whites they have gradually adopted their mode of burial.

Mr. Hunter enquired whether there were any legends connected with them.

Mr. Bell—None whatever.

The President presented the thanks of the meeting to Mr. Bell for his valuable and interesting paper.

THIRTEENTH MEETING.

The Thirteenth Meeting was held on 27th February, 1886, the President in the chair.

The following list of Donations and Exchanges was read :

1. Monthly Weather Review, Dominion of Canada, Jan. 1886.
2. Electrical Review, Feb, 20th, '86.
3. Annals of Mathematics, University of Virginia, Vol. II., No. 1, Sept. '85.
4. Journal of the Chemical Society, New York, Vol. VII., No. 10, Dec. '85.
5. The American Naturalist, March, '86.
6. Journal of the Anthropological Institute of Great Britain and Ireland, Vol. 15, No. 3.
7. Proceedings of the Royal Society, Vol. XXXIX., No. 240.
8. The Chemical News, Feb. 12, '86.
9. Cosmos, 8 Février, '86.
10. Rendiconti del Circolo Matematico di Palermo, Marzo 1884, Marzo 1885.
11. Jahresbericht der Geographischen Gesellschaft von Bern, 1884, 1885.
12. Bulletin de la Société Impériale des Naturalistes de Moscou, Tome LXI. Nos. 1 et 2, 1885.
13. Electricité, 6 Février, '86.

14. Archivio di Letteratura Biblica ed Orientale, Anno VIII., No. 1, Gennaio 1886.
15. Mittheilungen der Anthropologischen Gesellschaft in Wien, XV. Band, II. Heft.
16. Annales de l'École Polytechnique de Delft, 3me et 4me Livraisons.
17. Mémoires de la Société Nationale des Antiquaires de France, Cinquième Serie, Tome 5*me*, Paris, 1884.
18. Wochenschrift des österreichischen Ingenieur-und Architekten, Vereines XV., No. 6. 5 Februar '86.

Total 19.

The following were elected members: Sydney B. Sykes, Robert A. Smith and Percy A. Bath.

A sale of Periodicals from the Reading Room was then held.

FIRST SERIES—Begun August, 1852; concluded December, 1855; 41 numbers, 3 vols. 4to.

SECOND SERIES—Begun January, 1856; concluded January, 1878; 92 numbers, 15 vols. 8vo.

THIRD SERIES—Begun 1879.

NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3.—Societies wishing to exchange back nnmbers of .eir Proceedings can be supplied with complete sets of the Publications of the Canadian Institute, except Vol. XV., No. 5, Second Series, and Vol. I., Part 1, Third Series.

4.—Members having either of the above, Vol. XV., No. 5, Second Series, April, 1877, or Vol. I., Parts 1, 3 & 5; Vol. II., Parts 1 & 2; Vol. III., Part I, Third Series, and being willing to part with them, will please communicate with the Assistant Secretary.

THIRD SERIES. VOL. IV. FASCICULUS No. 2.

PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

TORONTO,

BEING A CONTINUATION OF THE "CANADIAN JOURNAL" OF SCIENCE, LITERATURE AND HISTORY.

MARCH, 1887.

Whole No. Vol. XXII.] [No. 147.

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1886–'87.

FOURTEENTH MEETING.

Fourteenth Meeting, 6th March, 1886, the President in the Chair.

The following list of donations and exchanges was read :

1. The Canadian Practitioner, March, 1886.
2. The Spectator, December 5, 12, 19, 26, 1885, and January 9, 1886.
3. Electrical Review, February 27, 1886.
4. Pennsylvanian Magazine of History and Biography, Vol. IX., No. 4, January, 1886.
5. Transactions of the American Society of Civil Engineers, December, 1885.
6. Bulletins of the United States Geological Survey, Nos. 15—23.
7. American Journal of Science, March, 1886.
8. Proceedings of the Academy of Natural Sciences of Philadelphia, Part III, August to December, 1885.
8. Proceedings of the United States Naval Institute, Annapolis, Md., Vol. XII., No. 1.
10. Magazine of American History, March, 1886.
11. The Electrician and Electrical Engineer, March, 1886.
12. The Chemical News, February 19, 1886.
13. Scottish Geographical Magazine, Title Page and Contents, Vol. I., 1885.
14. Journal of the Royal Microscopical Society, Series II, Vol. V., Part 6, December, 1885 ; Series II., Vol. VI., Part 1, February, 1886.
15. Illustrated Journal of Patented Inventions, No. 59, February 19, 1886.
16. Monthly Notices of the Royal Astronomical Society, Vol. XLVII., No. 3, January, 1886.
17. Transactions of the Institution of Engineers and Shipbuilders of Scotland, 29th Session, 1885-86.
18. Correspondenz-Blatt der deutschen Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Januar und Februar, 1886.
19. Electricité, 13 Février, 1886.
20. Cosmos, 15 Février, 1886.

21. Nordisk Tidskrift for Filologie, Vol. VII., Hæfte I, II, Copenhagen.
22. Tijdschrift voor Nijverheid e Landbouw in Nederlandsch Indië, Dee XXXI, Aflevering VI, Batavia, 1885 ; Billiton Opstetten door P. H. Vander Kemp III.
23. Monatliche Mittheilungen des naturwissenschaftlichen Vereines des Regierungsbezirks Frankfurt-a-O., 3 Jahrgang, Nos. 9, 10.
24. Wochenschrift des österreichischen Ingénieur und Architekten Vereines, Wien, 12 Februar, 1886.
25. Cronica Cientifica, Barcelona, Año IX, Num. 196. Feb. 10, 1886.
26. Compte Rendu de la Société de Géographie, Paris, No. 4, pp. 113-150.
27. Journal des Sociétés Scientifiques No. 7, Title Page and Contents for 1885.
28. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XIII, No. 1.
29. Real Academia de Ciencias Morales y Politicas, Madrid, Resumen de sus Actos y Discursos 1862, 1866, 1871, 1876, 1883, 1884, 1885, Estatutos y Reglamentos de la Academia, Anuario de 1886.

Total 57.

Mr. J. B. Williams read a paper on "The Destruction of Wild Animals and the Means that should be Taken for Their Preservation," of which the following is an abridgment :

If we walk through the forest on some bright spring morning, all nature seems to rejoice around us. Squirrels are sporting, birds are singing, insects flitting in every direction.

It is difficult then to realize, or remember, what a struggle for existence all these creatures pass through at some period or other of their life. Every creature naturally increases at so high a rate, that if multitudes were not destroyed, the earth would soon be covered by the progeny of a single pair. This applies to the more slowly breeding, as well as to those that increase annually by the hundred or the thousand.

What are the means employed by nature to keep in check this too superabundant life?

To eat and *to be eaten* is the end and object for which multitudes of creatures seem to exist. Almost every creature serves as food for some other creature, and the struggle for existence causes a continual destruction of old forms by new and more highly developed races.

The causes which determine the survival and distribution of each species are very often complex and unknown to us.

Climate, the supply of food, and, in recent times, the influence of the human race, are some of the causes which have determined the existence and the range of our present species.

Just as the advent in America of a superior race of men has driven the Indians from their ancient power and position, so it has been with the races of animals; the new and more highly organized forms have supplanted, and often destroyed, preëxisting races.

The opossum is, in America, the sole surviving representative of the marsupial animals, which once probably were spread as the leading race over the whole world.

They still occupy a supreme position in Australia, because they have been protected from severe competition with higher forms by separation from the mainland within recent geological times.

Instances occur in several other islands of survival by protection, of birds and reptiles representing families, now almost extinct, but which once were the predominant races.

Thus nature has preserved some records and examples of her past work. Shall we not act wisely, if we also try to preserve for the benefit and instruction of future generations some of those creatures which will, before long, be entirely destroyed unless special means are taken for their protection?

Within recent times the extinction of the Moa in New Zealand and of the Dodo in the Mauritius has been brought about largely by human destructiveness.

The Apteryx still survives in the unsettled portions of New Zealand, but it will soon disappear unless special means are taken to protect it from advancing civilization.

In North America during the last thirty years two birds have become extinct; viz., the great Auk, whose principal breeding places were the banks of Newfoundland and Labrador; and the Pied Duck, a bird nearly related to the Eider Duck; one of the last specimens was killed in Halifax harbour in 1852.

A startling decrease in the numbers of some of our most beautiful birds has been brought about, of late years, by the unceasing war raged against them in order to supply the demands of fashion.

If we turn now to the large mammals, we find the Moose and the Buffalo, or Bison, are being gradually driven from their ancient haunts, and will probably be extinct in a few years' time.

The Buffalo is now nearly extinct in the States. Where thousands used to be met with, it is a rare thing to meet with one or two hundred. The cause has been the relentless and indiscriminate slaughter of whole herds.

The results of the destruction of the Buffalo in Canada were predicted with remarkable accuracy in 1879, when a proposal was laid before the Dominion Parliament by Dr. Schultz to prevent their destruction during the winter months. A report then presented stated that, unless the Buffalo were protected, in ten years at the very furthest, the whole number of Indians in the Northwest, who then relied on those animals for subsistence, would have to be fed and maintained, principally at the expense of the Dominion Government; and that, compelled by hunger, they would be driven to commit outrages which would result in an Indian war.

During that year—1877—about 160,000 Buffalos were killed in Canada alone, but no effective measures were taken to stay the slaughter.

The Moose once ranged as far south as Ohio, now it is almost driven out of the Eastern States, but is still common in unsettled portions of New Brunswick and Nova Scotia. Its range in Canada extends north as far as the McKenzie River, and west to the Rocky Mountains.

It would be a great pity for this magnificent creature to disappear, as it certainly must do if the forests are all destroyed. Animals as large have become extinct in Europe since the historic period. The great Wild Ox, described by Julius Cæsar in his Commentaries, no longer roams in the Hercynian Forest. The white cattle preserved by Lord Tankerville at Chillingham are the last remnants of a British wild ox.

The European Bison, or Aurochs, is now only found in the forests of Lithuania, and some parts of the Caucasus. Those in Lithuania are carefully protected by the Emperor of Russia.

The European Moose, or Elk, was at one time numerous in most parts of Sweden and Norway, but owing to increased population and other causes, it is now only met with in particular districts.

Beavers were found in England and Scotland in the 12th century, and remains of their dams still exist in some parts of Wales.

A certain amount of protection is afforded to some of our wild animals by the existing game laws, but as the country becomes settled something more will be necessary, and considerable areas of prairie and forest must be maintained in their native wildness and grandeur, if future generations are to gaze upon the Moose and Buffalo.

Such reservations could be easily created now. If left for another generation they could only be formed at very great expense.

Our neighbours across the line have set a good example in this respect. The Yellowstone National Park or Reservation in the United States was set apart by Act of Congress in 1872. It is under the control of the Secretary of the Interior, who is authorized by the Act "to provide for the preservation from injury or spoliation of all timber, mineral deposits, natural curiosities or wonders, within the said Park; and against the wanton destruction of the fish and game found within the said Park, and against their capture or destruction for the purposes of merchandise or profit."

The Park lies between Wyoming and Montana Territories. Its length north and south is sixty-one miles, and its breadth fifty-three miles, its total area being a little over 3,000 square miles. The district comprised within its boundaries is 6,000 feet above the sea level and the greater portion of the land is covered with magnificent pine forests. A report recently presented to Congress recommends that *all* shooting be prohibited within the Park, and that visitors to it shall not even be allowed to carry firearms.

It would, perhaps, be better to form in Canada several such Reservations of moderate size, rather than one very large one; for there is another object in making these reservations besides that of protecting wild animals—the rainfall of a country or district is considerably affected by the destruction of its forests.

The gradual diminution of forests in the Adirondack Mountains has seriously affected the water supply of New York State. The volume of some of the rivers has decreased from thirty to fifty per cent. within the memory of man.

The Yellowstone Park is a watershed whence several large rivers have their source, hence one reason for its selection as a permanent forest.

Look at a map of Canada and you will find several districts about fifty miles square, from each of which a number of important rivers have their source.

There is one such in the northern part of New Brunswick; one in Ontario about one hundred miles northwest of Lake Nipissing; one near the Kicking Horse Pass in the Rocky Mountains.

These would seem to be appropriate spots for forest reservations.

It may not be possible to carry out all that is suggested here, but something may be done, I trust, if the subject can be brought prominently before the public and the Government.

Mr. Marling thought a representation should be made to the Government by the Institute on the subject of providing a suitable reservation.

Mr. Bain directed attention to the tract known as the Barren Grounds as affording a suitable place for a good natural reservation.

Mr. Rouse thought that such a reservation should be easy of access.

The President was strongly in sympathy with the views expressed by Mr. Williams, and agreed on the necessity of a reservation. He was in favour of additional security being provided by law, especially in the case of birds. He did not know the exact reading of the law, but thought it should not only prohibit the killing of the animals in certain seasons, but also having them in possession or exposing them for sale. He had seen barrels of brook-trout exposed for sale by fishmongers on Yonge street during the protected time of the year. The delicate flavour of the trout was destroyed, and they were of no more value than any coarse fish. This exposure for sale could be prevented in the centres of population. Thus the law should be strictly enforced, and examples made of all offenders In the case of birds, they should not be allowed to be killed, nor exposed for sale, nor the feathers worn on the person. This would protect the birds effectually. He was in favour of the Institute bringing the matter before the Government and asking for the additional restrictions he mentioned.

Mr. Purvis suggested that the matter be referred to a Committee.

Mr. Pursey and Mr. Noble explained the views of the Natural History Society on the subject.

On motion of Mr. Livingston, seconded by Mr. Browning, it was resolved that the President be asked to appoint a Committee to co-operate with the Committee appointed by the Natural History Society in carrying out the views set forth in Mr. Williams' paper.

FIFTEENTH MEETING.

Fifteenth Meeting, 13th March, 1886, the Second Vice-President in the Chair.

The following list of donations and exchanges was read :

1. Le Naturaliste Canadien, Mars, 1886.
2. The Canadian Entomologist, Vol. XVIII, No. 1.
3. Journal of the Franklin Institute for March, 1886.
4. Electric Review, March 6, 1886.
5. Science, Vol. VII., Nos. 160 and 161.
6. West American Scientist, Vol. II., No. 1.
7. Journal of the New York Microscopical Society, Vol. I., No. 9.
8. Magazine of American History for February, 1886.
9. "Huguenots and the Edict of Nantes," from the Rhode Island Historical Society.
10. Transactions and Proceedings of the Technical Society of the Pacific Coast, Vol. II., No. 14 and Vol. III., No. 1.
11. Transactions of the American Institute Mining Engineers, Vols. I.-IX., and Vols. XI.-XIII., with Index Vol. I.-X., May, 1871 to June, 1886.
12. Imperial Federation, March 1, 1886.
13. The Chemical News, February 26th, 1886.
14. Transactions of the Cambridge Philosophical Society, Vol. III., Part I, 1886.
15. Wochenschrift des oesterreichischen Ingénieur und Architekten Vereines, 19 Februar, 1886.
16. Electricité, 20 Février, 1886.
17. Cosmos, 22 Février, 1886.
18. Boletin de la Real Academia de la Historia, Vol. VIII., No. 1, Madrid.
19. Mémoires et Comptes Rendus des Travaux de la Société des Ingénieurs Civils, Octobre, 1885.
20. Gazetta Chimica Italiana, Anno XV., Fas. 10.

Total 35.

Rev. Th. Laboureau of Penetanguishene was elected a member. Mr. J. A. Livingston read a paper on "The Desirability of giving Currency to all Convertible Securities."

SIXTEENTH MEETING.

Sixteenth Meeting, 20th March, the President in the Chair. The following list of donations and exchanges was read :

1. Canadian Entomologist, Vol. XVIII., No. 2.
2. Monthly Weather Review, Dominion of Canada, February, 1886.
3. Annual Report of the Library Commissioners and Librarian for 1885. Halifax, N.S.
4. Second Annual Address before the Oneida Historical Society of Utica, by William Tracy.
5. Science, Vol. VII., No. 162.
6. The Electrical Review, March 13th, and 20th, 1886.
7. Annals of Mathematics, University of Virginia, Vol. II., No. 2.
8. The Old Lodge, from the Georgia Historical Society.
9. Report of Proceedings of the Eighteenth Annual Convention of the American Railway Master Mechanics' Association, June 16th, 17th, 18th, 1886, presented by G. Davies Barnett, Esq.
10. Chemical News, March 5th, 1886.
11. Proceedings of the Royal Geographical Society, Vol. VII., No. 3, March, 1886.
12. The Midland Naturalist, No. 99, March 1886.
13. Trübner's American, European and Oriental Literary Record, Nos. 219, 220.
14. Quaritch's Catalogue, No. 365.
15. Proceedings of the Literary and Philosophical Society of Liverpool, Vol. XXXVIII., 1883-84.
16. Wochenschrift des österreichischen Ingenieur und Architekten-Vereines, Wien, 16 Februar.
17. Annalen des K. K. naturhistorischen Hofmuseums, Jahresbericht für 1885. Band V., No. 1.
18. Electricité, 27 Fêvrier, 1886.
19. Cosmos, 1 Mars, 1886.
20. Boletin de la Sociedad Geografica de Madrid, Tome XX., Numero 1.
21. Bullettino della Sezione Fiorentina della Societá Africana d'Italia. Volume II., Fascicolo 1.
22. Compte Rendu de la Société de Géographie. No. 5, pp. 153, 176. Paris, 1886.
23. Journal des Sociétés Scientifiques, 3 Mars, 1886.
24. Jahrbücher des Nassauischen Vereines für Naturkunde, Jahrgang 38, Wiesbaden.
25. Allgemeine Bibliographie der Staats und Rechtswissenschaften XIX. Jahrgang No. 1, 2, 1886.
26. Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche Tomo XXIII, Maggio 1885. Roma.

Total 28.

MAP OF PART OF BELGIUM TO ILLUSTRATE THE CAMPAIGN OF 1815.

COPIED FROM EDGAR QUINET'S HISTOIRE DE LA CAMPAGNE DE 1815.

Mr. R. E. Kingsford, M.A., read a paper on "The Campaign of 1815."

The Rebellion of the French nation against Louis XVI. was the protest of humanity against oppression. The French, that lively, courageous and industrious race, deserve the world's thanks for their desperate resolution to inaugurate a new system. Their thoroughness in carrying out the resolve brought upon them the enmity of almost all other nations, but those very nations profit this day by the Revolution, to punish which they invaded France. Even the insular English, then politically a century in advance of the Continent, found that they had much to learn. An impulse was given to aspirations for freedom which was communicated to each of the Continental nations in succession, and this impulse, though impeded from time to time, has never ceased in its action. But just as, in the case of individuals, men suffer in their own persons the consequences of originality, so the French nation bitterly paid for its generous self-sacrifice on the altar of Freedom. A sacred cause was defiled; enthusiasm was replaced by fanaticism; fanaticism gave way after a struggle to charlatanism; charlatanism supported itself by murder. The end was chaos. Out of chaos sprang Napoleon. A man of the sword, he smote with the sword, and he crushed the vermin who, daring to crawl on the statue of liberty, had stained it with their filth. But the statue itself he overturned, and he placed himself on the pedestal. From that eminence he was in turn struck down, but he long held the position by virtue of extraordinary genius, courage and energy. We shall see him make a supreme effort to recover himself, almost succeed, then sink, baffled and exhausted, into a Slough of Despond, from which he was destined never to emerge.

We propose to give a succinct account of the military operations of the 15th, 16th, 17th and 18th of June, 1815. A careful examination of the authorities has led us to the opinion that the popular belief of Englishmen and men of English descent with regard to this campaign requires revision, and that there are salient features which have been ignored by most English writers.

The general English idea is that "The Duke" drubbed the French well, and that he never was in serious danger.

The Prussians think, on the other hand, that the English would never have beaten the French but for their help, and that they are, equally with the English, entitled to the credit of victory, perhaps more so.

The French, again, believe that their idol would have annihilated both English and Prussians had there not been treason. They know that the Prussians were defeated and the English surprised, and why they themselves were ultimately beaten they have never understood.

Examination of the facts should inform us which of the two first opinions is correct and give us an explanation for the third. This examination we propose to make briefly, but fairly and dispassionately.

The story we have to tell may be called the "Drama of Waterloo." It consists of a Prologue and Four Acts. We propose to narrate it in that manner.

PROLOGUE.

Napoleon left Elba on the 26th February, 1815. He landed at Cannes on the 1st March. He arrived at Fontainebleau on the 20th March. That is, in three weeks he was master of France. The first prominent man who joined him was General Labedoyère. We shall meet his name again.

The army and the Marshals declared for the Emperor on the 22nd of March.

But the Bourbons had been in power since the preceding May. A few of the Marshals and a portion of the superior officers remained true to them. In the interval, also, they had broken up the old Napoleonic organization. They had replaced the Tricouleur by the White Lilies. They had changed the designations of the various regiments, studious in every thing, Mrs. Partingtons as they were, to use their feeble broom against the tide of modern feeling. But there were with the colours on the 1st April 223,972 men, 155,000 of whom were ready to take the field.

The evidence as to the condition of these men seems to establish that they were well uniformed and armed. Napoleon claimed that they were not so, but it seems that his statements were incorrect on this point.

Here is afforded the opportunity of presenting the real obstacle in the way of forming a fair judgment of the occurrences we are about to relate.

Napoleon published two versions of the campaign of 1815: the first, by General Gourgaud, in 1818; the second in 1820, as *Mémoires* *pour servir à l'histoire de France en 1815*, subsequently re-published in 1830 as Volume IX. of the Memoirs dictated at St. Helena. These volumes, according to certain French authorities, are full of mistakes, misrepresentations and inexact statements. For some years, however, they passed unquestioned. In 1840 the Duke of Elchingen, second son of Marshal Ney, with the view of restoring his father's memory, which he deemed unjustly assailed by Napoleon, gave the first shock to their authority by publishing a collection of the orders and letters of the Emperor to the Marshal, and also the result of enquiries made by himself among officers then surviving as to what actually happened. Other memoirs, such as those of Grouchy and Gérard, were also published. Between 1839 and 1842 appeared Alison's Europe. Siborne's account of the Waterloo Campaign, which, although trustworthy, contains too much fulsome eulogy of the "Great Duke," was published in 1841. The German, or Prussian, view of the matter, as given by Von Damitz and Von Clausewitz, had been published in 1837 and 1835. Thus conflicting materials accumulated. At last, in 1857, there appeared the "*Histoire de la Campagne de* 1815," by Lieut.-Colonel Charras, which, although not as commonly known to English readers as it ought to be, must ever be consulted as an elaborately minute account of the campaign. It must be read with caution, as it is very unfair to Napoleon in many points, while its author claims an eager desire to do him justice. A critical examination will lead to the conviction that the desire, if it really existed, was not carried out. M. Edgar Quinet's "*Histoire de la Campagne de 1815*" was published in 1862. He follows in Charras' footsteps. Thiers also gives a version of the events, which should be read as a corrective of Charras. If Napoleon threw the blame of the disaster upon others, a certain school of French writers, of whom Charras and Quinet are types, have not been slack in retorting on him. He is made responsible, as far as possible, for the unfortunate issue of the campaign, and in his shortcomings is found some solace to wounded French pride. In using both Charras and Quinet this fact must be borne in mind, and even-handed justice will be forced to modify their conclusions on many points in Napoleon's favour.

The divergence comes up first with reference to Napoleon's actions after he had landed in France. The anti-Napoleonic school minimize in every way what was done, but the general impression on this subject is that the Emperor displayed wonderful genius and energy.

Siborne says:—"Never, perhaps, in the whole course of the extra-"ordinary career of that extraordinary man did the powerful energies "of his comprehensive mind shine forth with greater brilliancy and "effect than in his truly wonderful and incredibly rapid development "of the national resources of France on this momentous occasion." We cannot here enumerate all that Napoleon effected between the time of his landing at Cannes in March and his taking the field in June. A discussion of his political measures during this time is foreign to our purpose.

It may be pointed out that the French complain that Napoleon did not lay before them as a nation the peril in which they stood. In May 800,000 foreign troops were on their borders. But Napoleon deceived the people by constant assurances of peace. His war measures, they urge, were not taken with the determination necessary under the circumstances. On the 25th March the Congress of Vienna had formally declared a united war of Great Britain, Russia, Prussia and Austria against Napoleon. He knew of this declaration, the country should have known of it too. But Napoleon felt his personal danger. His only line of policy in his own interest was that of not alarming the French too soon, or they would have perceived the effects of their sudden revolution in his favour and would have risen against him. He therefore declared no general levy of the National Guard. But the fact remains, that while Napoleon on the first of March was an exile, on the first of June he had a thoroughly equipped regular army of 200,000 men. He had a reserve of another 200,000. By the 15th June he would have had the conscription of 1815, producing 77,500 more, besides another hundred battalions of National Guard, or 70,000 more; in all, 555,000 soldiers. When in addition to these figures we take into consideration the immense mass of material, cannon, equipment for horse and man, provided by Napoleon during this time, the fortresses he garrisoned, besides the thinking out and preparing for the campaign with the necessary movements of troops, whatever some French writers may say, the world will not withhold from him its admiration. It should be remembered also that nothing has been said of his complete reorganization of the civil administration in all its aspects, social, financial, and political; nor of his negotiations with foreign states, alone enough to tax the greatest powers. The man who accomplished such results in so short a time now threw down the gauntlet to Europe.

ACT I.

SCENE :—CHARLEROI.

Time:—15th June, 1815.

Nothing marks more clearly the immense progress the world has made since 1815, than the advance in the means of communicating intelligence. To-day, if Russia masses her Cossacks at a point on the Indian frontier, all England knows it the same day, and explanations are demanded forthwith.

In June, 1815, Napoleon threw 130,000 men on the Flemish frontier, and neither Wellington nor Blücher knew of it until the blow struck them. Of his 200,000 men, Napoleon could at this point only avail himself of 130,000. In Alsace, Savoy, the Pyrenees, and La Vendée were 52,800 more; the remainder of the 200,000 were in garrison at Paris, Lyons, and other places. It is with the fortune of these 130,000 men that we have to deal. Napoleon, having decided to try the issue of war in Belgium, directed his efforts towards masking the movements of his troops. He had divided his army into six corps, which, on the 1st June, were at Valenciennes, Avesnes, Rocroi, Metz, and Laon. The Guard was at Compiègne. The total strength of the army was 128,088 men, with 344 guns. All this mass was quietly moved in such a manner that on the 14th of June the whole stood in front of Charleroi, ready to strike, the emperor being personally in command. Opposed, were the Anglo-allied and Prussian armies.

The Duke of Wellington had at his disposal 105,000 men and 186 guns.

Blücher had about 120,000 men and 312 guns: in other words, 130,000 French and 344 guns, against 225,000 allies and 498 guns: Napoleon against Blücher and Wellington. The Anglo-allied and Prussian armies lay side by side. The highway between Charleroi and Brussels was the dividing line. It was the English left, the Prussian right, except close to Charleroi, where the Prussians overlapped. From it Wellington's forces stretched to the sea. From it Blücher's extended to Liége, considerably over one hundred miles from the sea. Wellington had named Enghien or Nivelles as his point of concentration, as he might be attacked on his right or left centre. Blücher had chosen Sombref and Namur for the same purpose. It will be seen that, while Wellington or Blücher could each concentrate his own troops on their own respective centre within a comparatively short time, yet, if they were attacked on either flank it would take a much longer time to collect them. The readiest mode of attacking Wellington from France was on his right, that is, by way of Mons and Ath, as will be seen by looking at the map of France and Belgium. He expected to be so attacked. His secret orders of the 30th April, 1815, are a proof of this statement. Having premised that he had received intelligence that Napoleon was about to visit the northern frontier, he proceeds :—

"In this case the enemy's line of attack will be either between "the Lys and the Scheldt, or between the Sambre and Scheldt, or "by both lines."

It was neither. It was between the Sambre and the Meuse, and on his extreme left, not on his right or left centre. But Wellington's mind was pre-occupied with his own idea, and even when the attack came on his extreme left he gave orders for concentration on Nivelles, which, fortunately for his reputation, were disobeyed. Had they been followed, Napoleon's left wing would probably have been in Brussels on the 16th of June.

Napoleon struck the allies precisely where they were weak, just at the point where it took them longest to concentrate. His strategy deserved to succeed, and the impartial student, however much he may find it necessary to blame Napoleon in his career, can only come to one conclusion on this master stroke. Unquestionably Napoleon did surprise Wellington and Blücher, his plan was well laid, ably executed, and only miscarried from a series of strange accidents, which, as one reads of them, seem as if they were the result of supernatural interference.

The campaign being one of attack, it will be best understood by following the attacking force. The French army, being collected in three divisions, advanced during the night of the 14th in three columns, the left from Solre-sur-Sambre (see map) by Thuin upon Marchiennes; the centre from Beaumont by Ham-sur-Heure upon Charleroi: and the right from Philippeville (not on map) by Gerpines upon Châtelet.

Now happened the first check. General De Bourmont, a General of Division, with some of his staff, deserted. The effect was most depressing. The confidence of the soldiers in their officers, of the officers in each other, of Napoleon in his lieutenants, was shaken. It is difficult to speak calmly of such an act. The strangest part of the matter is that this same De Bourmont, being honored by the Bourbons, became Minister of War under Charles X., organized the expedition which resulted in the capture of Algiers, and was made a Marshal of France. He died in 1846, having passed his latter days in obscurity, owing to the fall of Charles X. But his reception by sturdy old Blücher must have shown him what honest men thought of him. That stout old hero turned on his heel when he was presented, and when attention was called to the white cockade De Bourmont had mounted, all he said was: *Einerlei was das Volk für ein Zeichen aufsteckt. Hundsfott bleibt Hundsfott.* "What has the "cockade to do with it? The man is a scoundrel." Quinet says of this event: "After half a century, in which we have honoured and "crowned every man who has succeeded, this desertion is perhaps "the only one which has not found apologists among us." How different was the feeling of Berthier! He refused to join Napoleon, and retired to his palace at Bamberg. But when he heard the drums of the Russian troops on their march to invade France, in an agony of shame and remorse he threw himself from one of the palace windows and was taken up dead.

But the advance continued. The first enemy met was by the left, which struck part of the Prussian division of Pirch II. (so called to distinguish him from another general of the same name, who is called Pirch I.), belonging to Ziethen's corps, one of the four of Blücher's army. News of the French advance had by this time been conveyed to Wellington and Blücher. The latter at ten o'clock on the night of the 14th, had ordered Ziethen to wait the attack and slowly retire towards Fleurus. The other three corps of the Prussian army were ordered to move. Bülow from Liége to Hannut, Pirch I. from Namur to Sombref, Thielmann from Ciney* to Namur.

As the French divisions successively came up on the left and centre they were pushed forward, driving the Prussians back, but the latter stubbornly held every position, both on the Brussels and on the Namur roads. The French had to fight their way. The Pirch II. division was gaining time for the other divisions of Ziethen's corps to concentrate at Fleurus. Charleroi was taken by one o'clock, and the French passed through, some towards Gosselies, others towards Gilly. At five o'clock, Marshal Ney came up to take command on the Brussels road. On the 11th

* Liége, Hannut and Ciney are east of the limits of the map.

he had been in Paris. He had received a message from Napoleon: "If Ney wishes to take part in the first battle, let him be on the 13th at Avesnes (not on map), which will be my head-quarters." He had started on the 13th, had arrived in Beaumont on the 14th, was detained by want of a horse, had bought a couple from Marshal Mortier on the 15th, and found Napoleon at about half-past four. Napoleon welcomed him, put him in command of the 1st and 2nd corps, D'Erlon's and Reilles' (44,300 men), and some cavalry, and concluded his instructions by ordering him to advance and *drive the enemy.*

From this point commences a division of Napoleon's army, part under Ney on the left along the Brussels road, the other part under the emperor along the Namur road. Ney ordered his men to push on. The Prussians, who were on the west of the Brussels road, had by this time all crossed it, making for Fleurus, and the way was clear to Frasne. There the advance struck the extreme left of the Anglo-allied army. It was now half-past six. The allied troops at Frasne were part of the first corps of Wellington's army, and belonged to the 2nd Dutch-Belgian division, 7,500 strong, under the command of General Perponcher. The battalion actually in position, about 4,000 strong, was under the command of Prince Bernhard of Saxe-Weimar. It held its ground firmly against the attacks of such troops as Ney brought up. The latter thought it better not to run any risk, and therefore resolved not to attempt anything more, but to hold Frasne and await orders. Frasne is between five and six miles north of Charleroi; Solre-sur-Sambre fifteen miles from Charleroi. The left had, therefore, advanced some twenty miles. They had started at three in the morning, commenced to fight at four, crossed the Sambre at ten, pushed on north to near Gosselies, and there waited for orders, which they received about three o'clock, that is, they had three or four hours rest. They then had advanced to Frasne, where, as above stated, Ney took command about five. It is not easy to understand why he was now so cautious. He had the cavalry division of Piré in hand, and Bachelus' infantry corps in support, and some artillery. If he had pressed Prince Bernhard, who had only four thousand men, he could probably have occupied Quatre Bras, instead of Frasne, that night. If he had done so, he would have commanded the line of communication between the English and Prussian armies. The road from Namur to Nivelles crosses the Brussels road at Quatre Bras. It was, therefore, of the greatest consequence to Napoleon to take it, and to the allies to hold it. A glance at the map will show that such was the case. If, then, Ney had seized Quatre Bras on the evening of the 15th, Napoleon's tactics would have been perfectly successful. His not doing so was the first failure in the campaign. Charras says Ney was right in not attempting to attack Quatre Bras. The reasons he gives are cogent, but the fact seems to be that Ney was imposed upon by the strong front shown by Prince Bernhard, and could, if he had pressed on, have carried Quatre Bras with ease.

On the centre, owing to a mistake in the transmission of orders, Vandamme's Division, instead of marching at three in the morning, did not march until seven o'clock. The Young Guard took their place in the column. But the result of the delay was that the advance guard of the centre, which appeared before Charleroi about eight o'clock, was not supported until twelve. The Young Guard then came up, and by their assistance Pajol, who led the advance, entered Charleroi, passed through and pressed the Prussians, until the latter stood firm at Fleurus. Grouchy, who subsequently came up, halted with Napoleon's approval, and the latter returned to Charleroi at eight o'clock, worn out with fatigue. The right, having started later, reached Châtelet at three o'clock, and remained in front of that place. Such were the results of the first day's operations. The Sambre was crossed, Charleroi taken, the French centre and right lay on the Namur road in front of Fleurus. Was the day successful or not? The answer to this question depends on how far the allies had made use of the time in concentrating their forces. We have seen what Ziethen did. He concentrated his corps at Fleurus, where he stood prepared to dispute the passage.

We have seen that orders were given by Blücher on the night of the 14th to his army to close up.

By midnight on the 15th, Pirch I. had his whole corps (31,758 men) at Mazy, near Sombref, while Thielmann was a mile or two in front of Namur. At ten o'clock at night of that day, Bülow was still at Liége, far off. Thus Blücher by midnight of the 15th had three corps, or nearly 80,000 men, within sixteen miles of the enemy. What had Wellington done? We have seen that news of the French advance was sent to him on the 12th. Sir Hussey Vivian, whose Brigade of Cavalry was near Tournai, reported to him on that day that the French were preparing to attack. He made no change in his dispositions. On the 15th, at nine in the morning, he received a dispatch from Ziethen, written from Charleroi, announcing that the advanced posts on the Sambre were attacked. Still no movement was made. The first order for concentration came from General Constant de Rebecque, the Chief of Staff of the Prince of Orange, at two o'clock in the afternoon. It was a partial order to the Second Dutch-Belgian division, which was the extreme left of Wellington's army, to concentrate at Nivelles and Quatre Bras. Information of these orders was sent to Wellington at Brussels, but he still ordered no general movement. Siborne says that the Prince of Orange, who was in command of the First Anglo-Allied Corps, also forwarded to Wellington a report which he had received from his outposts, stating that the French had attacked the Prussian advanced posts on the Sambre, and that this report reached Wellington at five o'clock p.m.

Between eight and nine o'clock that evening came a letter from Blücher, saying that Thuin had been attacked, and that Charleroi appeared to be menaced. Then Wellington gave his first general order for concentration. Siborne says this order was given about five o'clock in the afternoon, but Charras has proved conclusively that it was not sent until between eight o'clock and half-past nine in the evening.

There was, at the same time, a special order to the corps of the Prince of Orange. It prescribed that the Perponcher Division, part of which had been since noon disputing the Brussels road with the French at Quatre Bras, a fact of which Wellington was unaware, should go to Nivelles. At ten o'clock, further news had come in. "After orders" were issued, with the view of completing the concentration. It was this news which broke up the Duchess of Richmond's ball, so well known from Byron's lines. We cannot repeat the orders, from want of space, but they can be seen in Siborne. If they had been carried out, the Anglo-allied army would have drawn away from the Prussian. The extremity of the left wing would have been five miles west of the Brussels road, and eleven miles from Sombref, where the Prussians were collecting.

At eleven o'clock at night, more precise intelligence came in, and fresh and more urgent orders were sent out. But through all appears the idea that the French would strike at Brussels, by way of Nivelles or Braine-le-Comte, not by the Charleroi road.

The result of this delay and false movement of Wellington was favourable to Napoleon. It left him free to deal with Blücher alone. He had counted justly on Wellington's slowness and Blücher's rashness. His *coup* appeared, therefore, to have all the elements of success. The heroes of the day were, however, the brave Prussians of Ziethen's Corps, who had stopped the French at Gilly, and Prince Bernhard and his Nassauers, who had stopped them at Frasne.

ACT II.

SCENE:—LIGNY AND QUATRE BRAS.

Time:—16th June, 1815.

At nine o'clock on the evening of the 15th Napoleon had returned to Charleroi. Wearied out, he threw himself on a bed to get some rest. About ten o'clock Ney left Gosselies, and reached Charleroi about midnight. He and the emperor had supper together, and a long conversation. It was two o'clock on the morning of the 16th when they separated. Some topics, unpleasant to both, were doubtless avoided, and their old friendship seemed completely rëestablished. So far as anybody heard, the emperor had no reason to complain of the marshal. The plan of campaign must necessarily have been talked over, but no definite decision seems to have been communicated to Ney. It would have been better for France if both Napoleon and Ney had rested, instead of talking over old times.

In June the nights are short, and the day dawned shortly after Ney went to his outposts. For the bulk of the army, military operations had ceased at seven or eight o'clock of the evening before. The troops had had time to rest. They were, moreover, in good spirits, and anxious to advance. On the 15th they had started at half-past three. On the 16th the divisions in rear of the left could have been closed up to the front very early in the morning. Ney would then have had 22,254 men in hand, and D'Erlon's 20,000 close behind. If he had pressed on at any hour from four o'clock in the morning up to ten or eleven, with his 22,000 men, he would have overwhelmed all before him. Prince Bernhard and his 4,000 Nassauers held their position all night, and were not reinforced till about four in the morning, when General Perponcher marched the rest of his brigade there, making in all about 7,000 men, with sixteen guns. The Prince of Orange, who was the general in command of the first corps, to which Perponcher's Division belonged, arrived about six o'clock, but brought no reinforcements: in fact, no more came up at all, until three or half-past three o'clock in the afternoon. The Duke of Wellington was on the ground at eleven o'clock, but brought no troops. When Ney did attack, at two o'clock, he only attacked with not quite 10,000 men of all arms. By three o'clock he had 17,615 in action, but during the whole of the rest of the day, he only had 22,000 men engaged, and of these only 15,750 were infantry, one of his infantry divisions (Gérard's, 4,297 strong) having been withdrawn from him by Napoleon. He made no use of D'Erlon's corps, 20,000 strong. The delay on the left was most disastrous to the French. What was the situation elsewhere?

We have seen that at midnight of the 15th the only Prussian corps in the immediate front of the French centre and right was Ziethen's - 32,692 men, less the loss of the 15th, say 1,500—say 31,000 men with 96 guns. The nearest corps to Ziethen was that of Pirch I., three divisions of which were at Mazy, nine miles from the front. These three divisions arrived there from Namur, in obedience to Blücher's order of the evening of the 14th, at three in the afternoon of the 15th, and halted at that place. They did not advance to Sombref, face to face with the French, until about ten o'clock in the morning of the 16th, when they were joined by their fourth division, and that was the time when Ziethen received his first immediate support. Up to that hour he had been alone in front of the French, and subject to be attacked by Napoleon with the centre and right of the French army, except such part as had not crossed the Sambre. The result of such an attack could not be doubtful. The next nearest corps to Pirch I. was that of Thielmann, but he was close to Namur, twenty miles distant, during the whole night of the 15th, and only commenced to advance from Namur about seven o'clock on the morning of the 16th. He arrived at Sombref about twelve o'clock of that day.

Three cannon-shots were heard from Fleurus at half-past two in the afternoon. They were Napoleon's signal for attack. By that time he had to deal with 90,000 Germans. Three-fourths of Blücher's army were concentrated and well posted for defence.

Ney, as we have seen, had waited until two o'clock to commence his attack on the left. What caused the delay?

The French army was anxious and ready to fight. Everything depended on prompt action. Had such been the case, Ney with

40,000 men would have overthrown 7,000 troops, many of whom were doubtful, being Dutch Belgians suspected of French sympathies, and with no supports at hand. Napoleon with 83,000 would have had to attack 31,000, true, with another 31,000 to support them, but that support nine miles away. The object of the sudden attack was therefore possible of accomplishment. The question is, did Napoleon display the energy which the crisis demanded, or did he press the advantages so far in his favour? It must be remembered that fully 25,000 of the French centre and right had not crossed the Sambre on the night of the 15th. It required two or three hours at least to get these troops over, and as they were the reserve artillery and heavy cavalry, besides Lobau's infantry, 10,000 strong, it was absolutely necessary to wait for them. Again, Gérard's corps was at Châtelet, and had to be moved up to Fleurus, about seven miles, while Vandamme had five miles to cover. The Guards had nine miles to march from Charleroi to reach the front.

In view of these facts, and bearing in mind that Napoleon had to wait for the reports of his various reconnoitering parties, any charge of too great delay on his part on the morning of the 16th appears unreasonable and unfair. He rose at five o'clock. His orders to his right to concentrate were sent out before eight o'clock, those for Ney before nine o'clock. He himself reached the front about noon. The French left and centre were in position by one o'clock, and the attack on the Prussians began at two. It is not easy to see how it could have begun much earlier in the day. At the same time he was doing all he could to bring up his left without actually going over in person. He sent Ney a dispatch early in the morning, asking for exact information as to the position of his various corps. As above stated, he sent a general order of movement, and also a personal letter, giving full explanations of the plan of operations before nine o'clock. He sent another dispatch at ten o'clock in reply to a hesitating message from Ney. He sent another at two, and another at three, or a little after. All were urgent expressions of his desire that Ney should advance, and if possible manœuvre to join the right. But Ney, or rather Ney's subordinate, Count Reille, for reasons satisfactory to himself, did not think fit to obey at once the first order to advance, which reached him about half-past ten. Having asked further instructions from Ney, the order to advance was repeated, but he did not come into the field until one o'clock.

Napoleon judged correctly enough that the dispersed Anglo-allied forces could not be collected in time for serious resistance to his own forces properly handled, but Ney's want of perception of the necessity for a strenuous advance lost the emperor the advantages which should have been gained on the left.

Ney on the left and Napoleon on the right were simultaneously engaged from about two o'clock. Napoleon defeated Blücher. What then did Ney effect? All that can be said is that he prevented Wellington from joining Blücher. This was no small achievement. Wellington, after arriving at Quatre Bras at half-past eleven, rode over to Blücher and promised him that by three or so in the afternoon the English army would join the Prussians. A vain promise never kept. The Duke found Ney in his road and the way was barred. Could Ney have done more than he did? It has been shewn that he could, had he acted on his orders more promptly. But it has been shewn further that the Marshal's whole force engaged was never more than 22,000 men, and that he made no use of D'Erlon's Corps of 20,000 men.

This episode is the most inscrutable in the whole campaign. The absence of these twenty thousand men alone prevented Ney from inflicting a decisive defeat upon Wellington at Quatre Bras. Siborne, who is the Duke's most uncompromising admirer, explicitly admits this fact. How did it happen?

It seems impossible to give a satisfactory answer. But the facts seem to be as follows: When Ney got his orders from Napoleon at half-past ten o'clock in the morning to advance, D'Erlon was at Jumet. (See map.) He was ordered by Ney, as part of the general movement, to advance as far as Frasne, detaching one division to Marbais. At twelve o'clock he commenced his march. Hearing the action going on in front, he left his column and rode on in advance to Frasne. He drew rein there, and while conversing with some of the superior officers was joined by General Labedoyère, who had come from Napoleon. That general showed D'Erlon a pencil note which he was taking to Ney, and which ordered the Marshal to detach D'Erlon's Corps towards Ligny. He added that he (Labedoyère) had already given the order for the change of direction of D'Erlon's column, and pointed out to D'Erlon himself the direction in which to go to join it.

Ney, in a letter dated the 26th June, 1815, complains that Napoleon had taken away D'Erlon's Corps without notifying him (Ney), and having, therefore, to act without D'Erlon, the battle of Quatre Bras was lost. D'Erlon's account of the matter seems to contradict Ney's statement. Col. Heymes, Ney's Chief of Staff, confirms D'Erlon's account, but says that Col. Laurent, not General Labedoyère, was the aide who carried the message. As D'Erlon was put in motion by Ney about eleven o'clock, in obedience to Napoleon's letter and second despatch, and as the distance from Jumet to Frasne is a little over nine miles, and as D'Erlon galloped on in advance of his column, he must have met General Labedoyère in about an hour and a half, or two hours, after eleven o'clock—say one o'clock. Now any order sent from Napoleon to Ney by the hand of General Labedoyère, and which reached Frasne by one o'clock, must have left Charleroi very shortly after half-past ten, as Charleroi is about ten miles from Frasne—if sent from Fleurus it would be eight miles. The order which Labedoyère is said to have carried, and to have shewn to D'Erlon, was contradictory of Napoleon's third despatch, and not only of that despatch, but of the whole of the previous second despatch. What had happened so early in the day to induce Napoleon to take away the first corps from Ney? The only reason which appears at all satisfactory is, that Napoleon, as he descended from his carriage at Fleurus, at twelve o'clock, saw that there was urgent need in that part for D'Erlon just then. Instead of having only a part of the Prussian army, he found three-fourths of it in front of him. And yet this explanation is not quite satisfactory, because later on in the day, namely at two o'clock and three o'clock, Napoleon sent two more despatches to Ney. The first repeated the order to attack, and informed Ney of the arrangements for Grouchy's attack at half-past two on Ligny, and stated that there was a corps of troops (not an army) to attack. The second informed Ney that the action was at its height, and ordered him to manœuvre towards the emperor. Neither of these despatches says one word about D'Erlon, or intimates in any way that he had been withdrawn from Ney. It could not be either of these which Labedoyère shewed D'Erlon, because the first says nothing about D'Erlon's moving toward Ligny, and the second was sent too late to have reached D'Erlon at the hour he and his division were on the road to Frasne.

Again, in a despatch written by Napoleon to Ney the next day (the 17th), Napoleon complains that the marshal had not united his divisions. He says : "If the corps of D'Erlon and Reille had been "together, not an Englishman would have escaped of the corps which "attacked you." The despatch then goes on : "If Count D'Erlon "had executed the movement on St. Amand which the emperor "ordered, the Prussian army would have been totally destroyed, and "we should have taken perhaps 30,000 prisoners."

This incident of the turning aside of D'Erlon's column is one of the enigmas of history. We have stated all that we have been able to ascertain about it. We cannot accept any of the published explanations as satisfactory ; and now the actors in the drama are dead, there is no hope of any solution of the difficulty.

Where did D'Erlon go when he left his proper line of march? If the commencement of the incident was singular, its conclusion was still more so. The new line of march of D'Erlon led him towards Napoleon. The heads of his columns showed themselves in Napoleon's left rear about half-past five in the afternoon. They must either have been longer on their cross-march than the length of the march warranted, or they must have been very much later than eleven o'clock in starting from Jumet. Whatever the truth may have been, there is no doubt on one point: their arrival was unexpected. Nobody knew who they were. Napoleon sent an aide-de-camp off at full gallop to find out, and postponed a threatened attack on the Prussian centre until the messenger should return. At half-past six the aide-de camp came back with the information that it was D'Erlon's column, about two miles from St. Amand, exactly where it was needed for Napoleon's purpose. Charras says: "Let the order be given. In an hour twenty "thousand men of all arms will debouche on Wagnelée, on Bry, rolling "up in rear Blücher's right wing on his centre, while he is assailed "in front by Vandamme and Gérard, reinforced by the whole reserve. "The plan conceived by Napoleon will be realized. There will not "escape 20,000 Prussians. The order is not given, D'Erlon is not "summoned." But the fact seems to be, according to the best evidence, that Napoleon did summon D'Erlon more than once, but that Ney, at the same time, also repeatedly and urgently ordered D'Erlon to return to him, being in the very throes of his struggle at Quatre Bras, and that D'Erlon thought it best to obey the marshal under whose immediate command he had been placed, and not the emperor. It seems, at first sight, unlikely that such should be the case, and Charras disputes the fact; but, on a fair examination of the whole evidence, the conclusion just stated is the most probable.

Instead of advancing to assist Napoleon, D'Erlon having been summoned by Ney to return to him, countermarched his men and arrived at Frasne too late to help Ney, as the battle of Quatre Bras was over before he got there. Twenty thousand of Napoleon's best troops marched and countermarched on this memorable day. Their absence from one field robbed the French of what undoubtedly would have been a decisive victory. Their presence on the other field would have turned an indecisive advantage into a complete triumph. Ligny would have been a second Jena. It would have been to the Prussians what Waterloo was two days afterwards to the French. Napoleon's calculations were correct. His left wing found at first practically nothing to oppose them. His right wing and centre were sufficient to defeat the Prussians. He was not responsible for the false movement which so fatally weakened both wings without benefiting either. Had Ney swept the Brussels road clear of the Anglo-allied army, Napoleon's anticipations of being in Brussels that night would probably have been realized. That it was not so was partially Ney's fault. It was not Napoleon's.

ACT III.

SCENE:—ON THE ROADS TO WATERLOO AND WAVRE.

Time:—17th June, 1815.

The morning sun of the 17th June, 1815, rose on two ghastly fields. At Quatre Bras over nine thousand combatants had been either killed, wounded or missing, while at Ligny about twenty thousand represented the loss to both sides. Perhaps altogether 30,000 men *hors de combat.* We have set forth the actual results of the previous day. Ney had blocked Wellington, Napoleon had defeated Blücher. All had been over by ten o'clock. How had the night been passed? To appreciate what took place it will be necessary to consult the map. Blücher, being forced to retire from Ligny, had two courses open to him. He could retreat by way of Namur, but that would separate him from Wellington, or he could retire to Wavre, from which place it would be comparatively easy for him to rejoin Wellington either before or behind Brussels. With desperate tenacity he, or rather his Chief of Staff, Gneisenau, chose the latter, and the whole Prussian army, including Bülow's corps, which came up too late for Ligny, was massed upon Wavre by the next afternoon after their defeat at Ligny. Their retreat was not only not harassed by the French, but its very line was unknown to them. That it was so was a cardinal error which led directly and conclusively to Napoleon's overthrow. The more the campaign is studied, the more it appears that all other mistakes on both sides are dwarfed before this one. On Napoleon's side, Ney's inaction, D'Erlon's countermarch, were almost compensated for at the end of the 16th. On Wellington's part, his want of penetration was made up for by the intelligent disobedience of General Perponcher, and the stubborn courage of the British infantry. This error was so serious that its consequences are plainly visible in the grand catastrophe. We are quite unable to account for Napoleon's course of action. We have seen him mass his troops on the 14th, cross the Sambre on the 15th, fight Ligny, and urge on Ney at Quatre Bras on the 16th. We have seen him recognize instinctively the true situation of the Anglo-allied force, and with superior calmness quiet Ney's hesitation. We have seen him hurl at the Prussian army his old guard, a thunderbolt which laid it prostrate. Up to this point he may be said to have been quite successful enough to satisfy the demands of his proposed campaign, although not so completely successful as his plans deserved. Why did he not press his advantage? There is a mournful interest in contemplating him. We see pass before him his former glories. The Bridge at Lodi, the Pyramids, Austerlitz, Marengo. We hear the chant of the Marseillaise as they lead the van of the avenging people. We see a cruel system of despotic bondage torn away, a wakening of the fresh young life of freedom. The brave soldiers, whose bodies lie scattered in far distant fields, come before us in spirit. We see them approach their chief as he lies asleep, and with mute gesture attempt to rouse and save him from his coming fate, then pass away with dumb anguish as they perceive his lethargy. Brave children of France! Your zeal for liberty ofttimes outran discretion. You were guilty of many crimes, many follies, but you were faithful to the flag under which you fought, and to the general who led you to triumph. You came in spirit from your graves to congratulate him on his last victory and vainly to warn him of his coming defeat. There is no picture in his history so painful to our mind as the one we contemplate. The mighty emperor, surrounded by his victorious army, justly proud of themselves and him, flushed by success, confident of complete triumph; and on the next day but one, at the same hour, behold these very troops, that mighty emperor, flying in panic-struck confusion before their defeated foe, now become a pursuing fury. Although we recognize that the result was probably better for the human race, we cannot help feeling that species of gnawing regret which eats at the heart when it recurs to what might have been, but is not.

Napoleon, instead of sleeping on the field, went back to Fleurus about eleven o'clock. It is generally admitted that before he lay down, he gave orders to Grouchy to send Pajol's light cavalry and Teste's infantry after the retiring Prussians. Thiers says he also sent orders to Ney to be under arms at daybreak, to press the English again. These latter orders are stated by no other author, but are referred to in Soult's despatch of the next morning reiterating them. Even admitting the genuineness of the other orders, those for the pursuit of the Prussians appear to be utterly inadequate. With every disposition to be chary of criticising such a man as Napoleon, we must confess that the inadequacy of these orders is a mystery to us, for which we can find no satisfactory solution. Napoleon must have miscalculated the effect of the battle. Perhaps he undervalued Blücher. Some authors attribute his lethargy to his enfeebled bodily condition—it seems to us very wrongly, on a fair consideration of all Napoleon did achieve. But whatever the reason, the fact is there that the Prussians were allowed the whole night and the next morning to retire on Wavre, and no sufficient attempt was made to follow up their traces.

Napoleon was perfectly justified in turning his whole strength immediately against the English. His plan was to throw his centre where it was needed, and he was quite right to transfer it at once from his right to his left. But why he did not ascertain more exactly what his right had to do, is very difficult to explain. He seemed to have thought that the Prussians would retire towards their own base, namely, Namur, not towards Brussels by way of Wavre, as they did. His first orders were to follow them towards Namur, and there appears to be little doubt but that, in this instance, he was mistaken in the inference he drew from his success. The person to whom is due the credit of the masterly Prussian retreat, which unquestionably saved the campaign, is Gneisenau, whose name is comparatively unknown. Napoleon's mistake, for it seems to us that it can be called by no other name, undoubtedly contributed to Waterloo.

The events of the day were as follows: Napoleon rose at five, and sent off orders for Lobau's Corps to march towards the left, followed by the Guard, and then the heavy cavalry. About six o'clock, General Flahault returned from Ney, and reported the result of Quatre Bras. Napoleon immediately sent a written order through Soult to Ney, explaining the position of affairs, and urging him to advance. Charras says this order was not sent off until eight o'clock; Thiers says about seven o'clock. Napoleon left Fleurus for the front about eight o'clock. Other orders were sent out at the same time for a review of the troops who had fought at Ligny. This review began about nine o'clock, and lasted till nearly noon. Meantime Lobau, the Guard, and the heavy cavalry were moving to the left, and reports from the reconnaissances were coming in. It seems to have been Napoleon's plan that Ney should advance, on the theory that the English could not oppose him, in view of the fact that the Prussians were in retreat. Ney could not advance, because Wellington was in front of him with about forty thousand men. They were not withdrawn until about one o'clock. By noon, Napoleon sent out an order by Soult to Ney to advance, and followed it immediately himself. This fact, which is important, is fixed by the despatch from Soult to Ney, which bears the date *à midi.* Before he started Napoleon gave his famous orders to Grouchy. The latter must, then, have received them between twelve and one. These orders were verbal. Thiers gives a version of them which contradicts that of Grouchy. The historian appeals to Marshal Gérard, and other witnesses, and they appear to us exactly the orders which Napoleon would have given. The *fons et origo mali* was undoubtedly the impression which the staff had, if Napoleon himself did not share it, that the Prussians were in retreat upon Namur; and from this time to the end of the campaign we see Grouchy wasting his strength hunting for Blücher exactly where he was not, and entirely ignorant as to what line he ought to take. For the present we leave him, and follow Napoleon. The latter was delayed in the advance by the resolute front shown by the English cavalry, who were protecting Wellington's retreat. He retreated as soon as he ascertained Blücher's disaster, but only to make a better stand. The English horsemen gave the French a taste of what they might expect the next day. Between the effect of their charge at Genappes and a terrible thunder-storm, it was evening before Napoleon came face to face with Wellington at Mont St. Jean. The emperor deployed his cavalry and guns to feel whether he had a rear guard to deal with, or Wellington's whole army. When he ascertained that it was the latter, we read that he was pleased. He was destined to be more than satisfied, but the question is, was he justified in his opinion that the game was now in his own hands? We will endeavour to give a fair answer to this question, founded on the statement of the position of the various armies, as stated in the sequel.

ACT IV.

SCENE:—WATERLOO AND WAVRE.

Time:—18th June, 1815.

It is half-past eleven in the morning, Marshal Grouchy is sitting at breakfast in the garden of the notary Halbaert, at Sart-les-Walhain. With him are Gérard, Vandamme, Valazé, an engineer officer, and Baltus, in command of the artillery. Suddenly Col. Simon Lorrière enters and says: "I hear firing." The party go out to the garden, and there heavy reports are heard, so heavy that the ground seems to tremble. "It is the emperor, he is fighting the "English, let us join him," says Gérard, "We should march "towards the guns." "No," says Grouchy. "My orders are to "move to Wavre, and to Wavre I am going." The decision was fatal to France, disastrous to Napoleon, and damning for Grouchy's reputation. To correctly appreciate the situation it is necessary to retrace our steps to the position of matters after Ligny, that is on the evening of the day before the one of the incident above related.

We have seen that Napoleon sent out Pajol's cavalry in pursuit of the Prussians. Pajol took the Namur road, that is eastward towards the French right. The Prussians however were by that time in retreat towards Wavre, that is northwards, so as to join Wellington. There has never been so masterly a retreat, or so determined a strategy, as that of Gneisenau. It is impossible to give the Prussian army too much credit for their steadiness and courage during this retrograde movement. While retiring they at the same time used their cavalry in constant and vigilant patrolling, and in this respect were as active as their descendants were in 1870, while the French were equally inactive. The result of their movement was that by nightfall of the 17th the whole Prussian army of ninety thousand men were in and around Wavre.

The Duke of Wellington only received news of the disaster at Ligny the next morning. He then commenced his retreat, also ably managed, from Quatre Bras about ten o'clock, and arrived at Waterloo about five in the afternoon.

Napoleon on the 17th, after moving off Lobau's Corps and the Guards from his right to his left, about one o'clock in the day, perhaps a trifle earlier, entrusted his right wing to Grouchy, and gave him at first verbal, then at two o'clock written orders. These latter directed Grouchy to march to Gembloux. This dispatch is said to have been suppressed by Grouchy in the controversy which arose. It was first printed in 1842. Its closing sentence is: "In all cases "keep constantly your two corps of infantry united in a league of "ground, having several avenues of retreat, and post detachments of "cavalry intermediate between us, in order to communicate with "headquarters."

Owing to a combination of circumstances entirely beyond Grouchy's control, and for which he can in no way be held responsible, he with his men on the evening of the 17th was only at Gembloux. He was, moreover, quite ignorant of where the Prussians were. He had, however, been at fault in not leaving detachments of cavalry between himself and the emperor, as the latter had ordered.

Napoleon himself had moved off to the Brussels road and followed the advance of his troops, delayed by a tremendous thunderstorm, which turned the country into a sea of mud, and reached the Caillou farm, in front of Mont St. Jean, about half-past six, to find the English in position and ready to give battle. He reconnoitered their position, the reconnaissance lasting until ten o'clock, then returned to his headquarters, which were established at the farm of Caillou above referred to. We are now in a position to appreciate why Napoleon was delighted that the English were going to make a stand alone. Apparently a puzzle why it should have pleased him, it is accounted for from his point of view. He had succeeded in his plans. He had separated the two allies. He had beaten one, not quite so thoroughly as he thought, but so far as he knew sufficiently to keep him out of any fighting for some time. He had left enough of his own army with Grouchy to watch the defeated enemy, and had given him sufficiently plain instructions what to do. Now he had with himself his whole centre and left, with superb cavalry, enormous force in artillery, and the very *élite* of his infantry, and he was not personally aware, although some of his generals were, what the British soldier can do. He knew however that the Duke of Wellington's army was a very composite one, and he had good grounds for knowing that at least a third of it could not be trusted. When all these considerations are taken into account, it is not wonderful that Napoleon was glad that before him lay Wellington alone.

On his return to his head-quarters he issued the necessary orders for the battle of the next day, and, if his own statement is to be believed, he sent a special order to Grouchy. This order Grouchy, to his dying day, protested he never received. Many writers assert that Napoleon never sent it; but, on considering the orders known to have been sent, and Napoleon's plan of operations, we cannot believe but that it was sent. It was the very thing which Napoleon would be likely to do—keep touch with his right. We also believe that Grouchy did not receive it.

Napoleon, having retired to rest, rose again at two o'clock, and re-commenced his reconnoitering, which he kept up during the remainder of the night. The rain continued, but cleared up about four or five o'clock. If it had been possible, Napoleon would have attacked then, or very soon after, but the ground was wet for artillery. It was therefore necessary to wait. Moreover, Napoleon, as he alleged, expected Grouchy to close up to him, such being the substance of the order of the evening before, and a later one sent off about three in the morning. At ten in the morning, he sent an aide-de-camp to Grouchy, with a third order to the same effect. On these two considerations, he decided to postpone the attack on the British, and after sending off the aide-de-camp to Grouchy at ten o'clock, he slept for an hour. Then, waking at eleven, he gave the signal for attack, and at half-past eleven the Battle of Waterloo began by the discharge of one hundred and twenty guns. This cannonade lasted half an hour, and these were the guns heard by Grouchy, and towards which Gérard begged him to march.

We have thus ascertained the position of Napoleon, Wellington, and Grouchy. Where was Blücher at this time?

Communications passed between Wellington and Blücher on the 17th, in which the latter promised that he would assist Wellington, not only with two army corps, but with his whole army. He added that if Napoleon did not attack on the 18th, they would attack him on the 19th. Such was the spirit in which the men of that day fought for their homes. In pursuance of this promise he started his four corps early on the 18th. Bülow's was the leading division. Its advance reached St. Lambert (see map) about noon, but its main body not until three o'clock. Ziethen's Corps had to cross the line of Bülow's march, and, owing to the delay thus caused, did not reach Ohain (see map) until six o'clock. Pirch had to leave half his corps for the defence of Wavre against Grouchy, and joined Bülow with the other half about half-past seven in the evening. Thielmann was held at Wavre by Grouchy.

Thus, at half-past eleven, Bülow's was the only Prussian column near Wellington, and he was at St. Lambert, five miles from the fighting. From that time to half-past four, this corps was straggling through horrible roads in the valley of the Lasne, in order to seize a position on the French right. At that hour they entered into the operations of the field of Waterloo.

The reader will now understand (if he consults the map) what influence Grouchy could have had by advancing towards Planchenoit, instead of on to Wavre. It is, perhaps, only curious speculation, but it is worth following out, as the turning incident in the campaign. There is not much doubt upon one point, at all events: Grouchy could have considerably delayed, if he could not have prevented altogether, Blücher's junction with Wellington on the 18th. Granting that he was where he was in obedience to his orders; granting that Napoleon was as much responsible as he was for the waste of strength, and useless cavalry marches on the wrong flank; granting all this, giving him every credit for every possible effort hitherto; now, at all events, he should have seen the mistake. There was the firing, there were the Prussians plainly seen on the road towards it,—the very privates saw what was to be done, but the general was blind.

It is useless to fight the Battle of Waterloo over again. Thanks to the old stubborn valour of the British soldiery, and to the tenacity of the British commander-in-chief, who knew his men, and did not spare them, the British held their own. They had all they could do to manage it. It is easy to appreciate the influence which the

Prussians had, when we recollect that, at one o'clock, Napoleon had to detach two divisions of cavalry; then, somewhat later, two infantry divisions—in all, over ten thousand men; that he had to follow these by the Young Guard, and by part of the Old Guard; and that he was really fighting two battles at once.

The strength of the Prussian army actually engaged at Waterloo alone was over 51,000 men.* Their loss there was 6,998, while at Wavre they lost in addition 2,476, in all 9,474 men. The British loss proper was 6,936. That of the King's German Legion and other German troops under Wellington's command was 4,494. The Dutch-Belgians lost 4,147, of which 1,627 were "missing." Exclusive of the Dutch-Belgians, Wellington's total loss was 11,430. These figures shew that the Prussians must have done as severe fighting as the British, and prove they did not come on the field merely to witness an English victory. If Napoleon had had his whole army, and, what is more, his undivided attention to bestow upon Wellington, it is difficult to believe that he would not have been successful. Even as it was, with a large part of his force detached to one flank, and with his attention continually distracted to that flank, he captured one position, La Haye Sainte, he almost annihilated Wellington's cavalry and decimated his infantry. He drove the Dutch-Belgian contingent clear off the field. But he could not shake the British squares. Once more steadiness was more than a match for dash.

Had Grouchy obeyed the dictates of common sense and good judgment, he would probably have secured for Napoleon the opportunity of dealing with Wellington single-handed. He failed to do so, although it seems to us he might and ought to have done so. The result was that by eight o'clock in the evening Napoleon was overmastered, his army was in flight. The glories of the Republic, of the Consulate, of the Empire were for a time effaced by so crushing a disaster. History however will be more just than contemporary depreciation. The candid student will perceive that Napoleon was worthy of his reputation. His general plan of operations was capable of accomplishment, and its defeat is attributable primarily to the useless countermarch of D'Erlon, then to the delay in following up

* By half-past four o'clock, 15,906 men and 64 guns.
By six o'clock, 29,244 men and 64 guns.
By seven o'clock, 51,944 men and 104 guns. —*Siborne.*

the Prussians, for which as General-in-Chief he must be held more than partially accountable. But even the D'Erlon *contretemps* and the delays of the 17th were remediable on the 18th. Had Grouchy been equal to the occasion, the plan of campaign would have been successfully carried out. It was not to be. The sun of Waterloo set, "and the "land had rest forty years."

The President said that the paper that they had just listened to was one of great value. Though a long period had elapsed since the battle of Waterloo and much had been written respecting it, Mr. Kingsford had done wisely in again opening up the subject. The one-sidedness of historians was well known, and there were still several points that required to be settled. He himself had been present at an excited discussion between a number of English and Prussian officers; each party contending that it was purely a victory for their respective nationality.

SEVENTEENTH MEETING.

Seventeenth Meeting, 27th March, 1886, the President in the Chair.

The following list of donations and exchanges was read :

1. Canadian Entomologist, Vol. XVIII., No. 3.
2. Transactions of the Field Naturalists' Club, No. 6, Ottawa.
3. Science, Vol. VII., No. 163.
4. The American Antiquarian and Oriental Journal, Vol. VIII., No. 1, Chicago.
5. Johns Hopkins University Circulars, Vol. V., No. 47.
6. Thirty-Second Annual Report of the State Historical Society of Wisconsin.
7. Fifth Annual Report of the United States Geological Survey, 1883-84.
8. West American Scientist, Vol. II., Nos. 13 and 14.
9. Bulletin of the Buffalo Society of Natural Sciences. Vol. V., No. 1.
10. The American Naturalist, April, 1886.
11. The Electrical Review, March 25, 1886.
12. The Chemical News, March 12, 1886.
13. Journal of the Liverpool Astronomical Society, Vol. IV., Nos. 3, 4, 5.

14. Wochenschrift des österreichischen Ingenieur und Architekten Vereines No. 10, März 5, 1886.
15. Cosmos, March 8, 1886.
16. Electricité, March 6, 1886.
17. Bollettino della Società Geografica Italiana, Serie II., Vol. XI., Fasc. 2.
18. Boletin de la Real Academia de la Historia, Tomo VIII., No. II.
19. Boletin da Sociedad de Geografia de Lisboa, 5 Serie, No. 7.
20. Berichte über die Verhandlungen der K. Sächsischen Gesellschaft der Wissenschaften zu Leipzig, Mathematisch-Physische Classe, 1885, 37 Band, Heft III.
21. Journal des Sociétés Scientifiques, 10 Mars, 1886.
22. Bulletin de la Société Impériale des Naturalistes de Moscou, Anneé 1885, No. 2.
23. Tydschrift voor Nyverheid en Landbouw in Nederlandsch Indië, Deel XXXII., Aflevering I, Batavia.
24. Bulletin de la Sociét' Mathématique de France. Tome XIV, No.1, Paris.
25. Verhandlungen des naturhistorischen Vereines der preussischen Rheinlande und Westfalens, 41ster Jahrgang, 2te Hälfte, Bonn.

Total 28.

Messrs. Browning and Henderson were appointed Auditors.

Mr. R. R. Baldwin was elected a member.

Mr. T. B. Browning read a paper on "The Fishery Question."

Mr. Rouse thought that the limit should be increased to nine miles.

Mr. Bain referred to the scarcity of books on this subject. When the Halifax Fisheries' Commission investigated the matter they could not find any works in the English language on the natural history of the cod. They had to hunt up books in other European languages. They found one in Norwegian, these people, it seems, having paid more attention to the subject.

The President thought that the Gulf of St. Lawrence should be considered an inland water, bounded as it was by British territory. It was almost as much within British territory as Lake Winnipeg. He hoped that the care and preservation of these waters would receive that consideration from the British people that the importance of the subject demanded.

EIGHTEENTH MEETING.

Eighteenth Meeting, 3rd April, 1886, the President in the Chair.

The following list of donations and Exchanges was read :

1. From W. A. Douglas, Esq., B.A:
   (1) Ontario Loan & Savings Companies.
   (2) Harmonies and Antagonisms in the Social Forces.
   (3) John and his Master.
2. On the proposed change of time to a decimal system, by R. C. W. Goodridge.
3. Canadian Practitioner, April, 1886.
4. The Spectator, February 20th., 27th., and March 6th., 1886.
5. Science, Vol. VII., No. 164.
6. Magazine of American History, April, 1886.
7. Transactions and proceedings of the American Society of Civil Engineers, January, 1886.
8. Journal of the New York Microscopical Society, Volume I., No. 1, January, 1886.
9. American Journal of Science, April, 1886.
10. Journal of the Franklin Institute, April, 1886.
11. The Electrician and Electrical Engineer, April, 1886.
12. The Electrical Review, April 3, 1886.
13. Annual Reports of the Provost and Treasurer of the University of Pennsylvania for the year ending Oct. 1, 1885.
14. The Chemical News, March 17th., 1886.
15. Illustrated Journal of Patented Inventions, No. 61, March 18th., 1886.
16. Monthly Notices of the Royal Astronomical Society, Vol. XLVI., No. 4.
17. Proceedings of the London Mathematical Society, Nos. 253, 257.
18. Transactions of the Institution of Engineers and Shipbuilders of Scotland. 29th Session, 1885-86.
19. Transactions and Proceedings of the Botanical Society of Edinburgh, Vol. XVI., Part 2.
20. Records of the Geological Survey of India, Vol. XIX., Part 1, 1886.
21. Wochenschrift des österreichischen Ingenieur und Architekten Vereines. Wien, Nos. 11, 12, Mars, 1886.
22. Zeitschrift für Physiologische Chemie, X. Band, 3 Heft, Strassburg, 1886.
23. Electricité, 13 and 20 Mars, 1886.
24. Cosmos, 18 and 22 Mars, 1886.
25. Archivio di Letteratura Biblica ed Orientale, Anno 8, No. 2, Febbraio, 1886.
26. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XIII, No. 2.
27. Compte Rendu de la Société de Géographie, Paris, No. 6.

28. Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche, Tomo XVIII. Giugno, 1885.
29. Bericht über die Senckenbergische Naturforschende Gesellschaft, Frankfurt a. M. 1885. Reiseerinnerungen an Algerien und Tunis, von Dr. W. Kobelt, Frankfurt a. M.

Total 36.

Mr. William Haldane was elected a member.

Dr. A. M. Rosebrugh read a paper on "Telegraphing to and from Railway Trains."

He said the first public test of the new railway telegraph, or the "air telegraph," as it is now called, took place on the Staten Island railroad on Monday, February 1st., when many messages were sent to and from the train while in motion, with an ease and speed which left nothing to be desired. The second public test was made on March 19 between Chicago and Milwaukee on the Chicago, Milwaukee & St. Paul railroad, when over 300 messages were interchanged during the trip to Milwaukee and back, and the test was quite as satisfactory as that on the Staten Island railroad. (The writer here explained the arrangement of the apparatus and the philosophy of the device by two drawings, one representing the arrangement on the cars and the other the arrangement at the railway station.) On the train, one wire is connected with the metallic roof of the cars, while the other is connected with the rails by means of the axle and wheels. At the station, one wire goes to the ground, while the other divides into branches, and is connected with three or more telegraph wires. A condenser is interposed in each of these branch lines, not as a necessary part of the air telegraph, but as a protection to the telegraph wires. Both on the train and at the station an induction coil, together with a vibrating reed, is used as the electric generator and a magneto-telephone as a receiver. The signals are given with the ordinary Morse key, which is inserted in the local circuit. When the key on the train is operated, the roofs of the cars become charged with electricity ; this charges the adjacent telegraph wires by static induction, and this in turn charges the receiving telephone at the station through the branch wires and condensers. On the other hand, the generator at the station charges the telegraph wires and the telegraph wires charge the roofs of the cars, which in turn charge the telephone on the train. The several factors that contribute to make the "air telegraph" a possibility are divided into four parts, namely, (1) the electric generator ; (2) the receiver ; (3) the inductive device, and (4) the line protectors. (1.) The electric generator consists of a local battery, a rheotome or automatic vibrator, an induction coil, and a transmitting key. The wire of the induction coil is short and of comparatively low resistance. This apparatus is sometimes called "the buzzer." The key is inserted in the local circuit, and when it is closed a strong interrupted primary current charges the induction coil, which in turn charges the condensers and line by induction. (2.) The receiver is the ordinary magneto-telephone, but is made small and light, and is secured against the ear of the operator. The signals cause a buzz or humming note in the telephone—a short buzz representing a dot, and a prolonged buzz a dash of the Morse alphabet. (3.) The inductive device consists simply of the metallic roofs of the cars connected together by metallic conductors on one side, and the railroad telegraph wires on the other, the one forming practically the positive and the other the negative plate of an electrical condenser. When one plate is charged by an electrical current the other becomes charged by induction, just as when a Leyden jar or a condenser is used. The writer was aware of Mr. Edison's suggestion that the intervening air becomes alternately polarized and depolarized by the alternating induced current and that it becomes actually a conductor of said current, but, to his mind, the laws of static induction seemed to sufficiently explain the action of the so-called air telegraph.* (4.) The line protectors have a three-fold object, firstly, to prevent crossing or grounding of the telegraph wires ; secondly, to provide an unbroken circuit for the induced current during the opening and closing of the keys in the main line; and thirdly, to protect the main line instruments from being injuriously affected by the strong induced currents of the air telegraph. This is accomplished by the use of condensers. A condenser is inserted in each branch line and a condenser is used to bridge the Morse instruments at each way station. In a condenser two metallic plates, separated by some insulating material such as mica, or waxed paper, are pressed closely together, one plate forming one pole and

* Since the reading of this paper before the Canadian Institute Prof. A. E. Dolbear, of Tufft's College, Mass., claims to have invented a system of electrical communication without wires. From the descriptions of the system that have been made public I infer that it is simply a modification of the Air Telegraph. Condensers are used on the one side in lieu of the metallic roof of the car, and on the other side in lieu of the adjacent telegraph wires. The two condensers are only a few rods apart. A. M. R.

the other plate the other pole of the condenser. The condenser is a block to the passage of the primary currents from the telegraph wire, but permits the passage of secondary currents by induction. The condenser renders it possible to superimpose induced currents upon telegraph wires without interference, and the use of the condenser renders simultaneous telephony and telegraphy not only possible but practicable. Turning to the question of priority of invention, he doubted not the members of the Canadian Institute would receive the announcement with satisfaction when he stated that the so-called " air telegraph " was largely a Canadian invention. The facts are as follows :—In September, 1877, a private telephone line was constructed in this city from King street up Church street to Charles street. This was before the magneto signal bells were introduced, and as there was no battery upon the line until some time after the line was constructed, it was necessary to devise other means for signalling. This resulted in the adoption of the ordinary Faradic medical battery for the generator, and the telephone diaphragm for the receiver. This was called the " buzzer," as it gave a buzz or humming sound in the telephone. A month or two later a telegraph system was devised in Toronto on this principle, namely, using an induction coil, a vibrator, a local battery and key as a transmitter, and a magneto-telephone as a receiver. In the spring of 1878 Mr. George Black of Hamilton made the important discovery that a telephone circuit may be established through an electrical condenser. This at once opened the way for using the telephone and other telephonic apparatus as a duplex on the ordinary telegraph wire, as it was found that by means of condensers an artificial or phantom circuit could be established for the telephone instruments independent of the telegraph signalling—the condensers acting in a threefold capacity: firstly, they prevented grounding or crossing of the telegraph lines; secondly, they bridged the interval of the opening of the telegraph key, and thirdly, they suppressed induction.

This discovery forms the basis, not only of the air telegraph, but also of the Edison duplex " Phonoplex " and " Way Telegraph," as well as of the Van Rysselberghe " Telegraph *cum* Telephone " system now in extensive use in France and Belgium.

In all these cases induced electrical currents are superimposed upon the telegraphic circuit by means of condensers and both the primary currents of the telegraph system and the induced currents of the telephone system are used simultaneously and without interference. An application for a patent covering this invention was filed at Washington in June, 1878, and the patent was issued in February, 1879. Among the claims in this patent are the following:—1st. In a branch line, or a derived line of a voltaic circuit, the combination of a condenser, a telephone and apparatus for generating induced currents for signalling purposes. 2nd. The combination of two or more parallel telegraph wires with a branch line and condenser attached to each of said telegraph wires and with a common ground wire and with telephonic apparatus inserted in said ground wire. He did not wish to detract in the least from the credit due to Mr. Smith on the one hand for conceiving the idea, or from Mr. Edison and Mr. Gilleland, on the other, for developing it. His desire was simply to put the actual facts on record. With regard to the commercial value of the "air telegraph" and the possible position it is destined to take in commercial economy, he was not in a position to speak, he simply knew that it had excited much interest among railway men.*

The President said that it was gratifying to learn that in the improvements that had been made in the applications of electricity and the patents that had been obtained much was due to a Canadian. That Canadian was, though his modesty did not permit him to mention it, Dr. Rosebrugh himself.

NINETEENTH MEETING.

Nineteenth meeting, 10th April, 1886, the President in the Chair.

The following list of donations and exchanges was read:

1. Das Echo, July 25th, 1885, August 7th, 1885, December 18th and 25th, 1885, January 15th, 22nd, 28th., 1886; February 11th, 18th, and 25th, 1886; March 4th, 11th, and 18th, 1886.
2. The Spectator, March 20th, 1886.

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* A second paper by the same author, in continuation of this subject, was read before the Institute on the 8th January, 1887.

3. Science, Vol. VII., Nos., 165, 166.
4. Bulletin of the Philosophical Society of Washington, Vol. VIII.
5. Electrical Review, April 16, 1886.
6. Annual Report of the American Museum of Natural History for 1885-86.
7. The Chemical News, March 26th., 1886.
8. Transactions of the Manchester Geological Society, Vol. XVIII., Parts 14, 15, 16.
9. Proceedings of the Royal Society, Vol. XXXIX., No. 241.
10. Proceedings of the Cambridge Philosophical Society, Vol. V., Part 5.
11. Minutes of Proceedings of the Institution of Civil Engineers, Vol. LXXXIII., Series 1885-86, Part 1.
12. Wochenschrift des österreichischen Ingenieur und Architekten Vereines, No. 12, 19 März, 1886.
13. Journal de la Société Physico-chimique russe, Tome XVIII., Nos. 1, 2, St. Petersburgh, 1885.
14. Boletin de la Real Academia de la Historia, Tome VIII., Cuaderno III.
15. Journal des Sociétés Scientifiques, 17 Mars, 1886.
16. Abhandlungen des Tokio Daigaku, No. 10.
17. Revue des Langues Romanes, 3^{me} Serie, Tome 14^{me}, Juillet, Août, Septembre, Octobre, Décembre, 1885, Montpellier.

Total 37.

Messrs. Henry Holgate and Frederick B. Hodgins were elected members.

The President read the following paper :—

NOTES ON THE EARLY DEVELOPMENT OF ABORIGINAL WOMEN IN ALL LATITUDES.

BY PERCY W. P. MATHEWS, LL.D., M.R.C.S.E., ETC.,

Dominion Coroner for the N. W. Territories, and Medical Officer to the Honourable Hudson's Bay Company.

It is for the purpose of drawing attention to the early marriages of the more precocious natives of tropical climates, as well as to the marriages of mere children here, in the sub-arctic regions, that I pen these few notes, and also to become enlightened myself, by possibly giving rise to some discussion in connection with a subject that cannot be otherwise than interesting.

In the first place I will allude to the only statistics I can obtain on the subject in reference to the Tropics, and will advance those collected by Dr. Robertson, of England, and published in his Essays and Notes on the Physiology and Diseases of Women, in which he states that "the ordinary age at which women in Bengal commence to menstruate is twelve years;" and again Dr. Goodene, Professor of Midwifery at Calcutta, asserts that a large portion of Hindoo women bear children before they are fourteen years old, and the earliest age at which he has known a Hindoo woman bear a child is ten years. Dr. Curtis relates the history of a girl aged ten, who was delivered of a healthy child at the full term of pregnancy.

It will, I am sure, be thought unnecessary to adduce further instances, in support of the precocious development of children of the tropics, as it is greatly known and acknowledged; and I merely mention here that it is equally understood to be mainly owing to natural causes, insomuch as they refer to custom and to climatic influence.

It is to the early development of children of these northern climes, that I wish now particularly to draw attention, and to point to it as a full exemplification of the trite old saying, "extremes meet." Before passing on to the natives of the far north (the Eskimo), I will allude to the data that I have collected from various sources and mention, *en passant*, how trying an undertaking it is to make the "old Indian wife" disclose anything approaching trustworthy information; for assertions are made that will, on a little cross-examination, be utterly refuted; and further, their method of computing events by a species of incidental comparison necessitates their passing through a process of logical deduction before they can be settled upon. For instance, C. B. was "a wife" for the first time, "the year the Great Stone Chief (Dr. R. Bell) visited the settlement." We remember when that event took place, then refer to the register, and find the date of her birth; that is simple, but when you are informed that M. F. was a wife the year the wavies (snow-geese) were so thick on the East Coast of Hudson's Bay, as that was several years ago, and the occasion had not been particularly noted, the result is apt to be conjectural. But from my own notes of some years past, together with some intelligent help from the several Indian settlements, I have been enabled to compile a table on the subject; which leads me to infer, that if the histories of 500 women were taken, it would be found that the catamenia first appeared in these at the following ages :—

Between the	Tenth	and the	Eleventh	year in	22
"	Eleventh	"	Twelfth	"	150
"	Twelfth	"	Thirteenth	"	185
"	Thirteenth	"	Fourteenth	"	78
"	Fourteenth	"	Fifteenth	"	40
"	Fifteenth	"	Sixteenth	"	17
"	Sixteenth	"	Seventeenth	"	3
"	Seventeenth	"	Eighteenth	"	2
"	Eighteenth	"	Nineteenth	"	1
"	Nineteenth	"	Twentieth	"	1
"	Twentieth	"	Twenty-first	"	1
					500

I have myself noted only one case in which conception undoubtedly took place before the age of eleven, that of Lavinia Wastasicott, who gave birth to a fully developed child at the age of eleven years and six months, and another child within the year following. Another case that I was called upon to attend was that of C.G., aged twelve years, who was delivered of a fine child at the full period. Another, that of Ellen Wosie—about twelve years old—who gave birth to a child equally at the full period. I have noted three other cases at and before the age of thirteen, and there are several cases of between thirteen and fourteen. In short, I know of so many thoroughly well authenticated cases of conception having taken place between the ages of eleven and fourteen that I think them sufficiently interesting to note, as evidencing the precocious development of the Indian in the Sub-arctic regions of North America.

And further, as regarding precocious maternity, we observe the same to be the case when we travel northward. Indeed, among the Eskimo, early marriage, or rather co-habitation (a synonym for marriage), is more generally noted than among what may be termed Sub-arctic Indians. This fact has, I believe, been referred to by Arctic writers, but I am without authorities on the subject. It is, however, certainly borne out by facts which I myself have been able to gather. One Eskimo lad aged about sixteen, who was a constant companion of mine for upwards of two years, told me that he had been married for many years, and that such was the custom among the people of his tribe, who dwelt beyond Chesterfield Inlet, and, as may be expected, early puberty is equally met with in the male.

This is well borne out by information I have personally obtained from Churchill, a settlement on the West Coast of Hudson's Bay, which the Eskimo often visit for the purposes of trade.

The few foregoing remarks are advanced as an illustration of a fact which I would wish to explain; and in the first place, I may instance local natural causes; as playing a part in influencing this early development among the Indians of Hudson's Bay.

In olden times, before the advent of the missionary and his restraining influence, marriage was, as far as I can learn, a mere form, and ofttimes the possession of a blanket of sufficient amplitude to cover two substituted itself for any rite,—the phrase "married under a blanket" being but another rendering "of taking to wife." And again, it is a common saying throughout the Indian Territory, that a man cannot hunt well until he takes a wife, which verifies itself upon examination; for does not the wife tend the camp, fish, snare rabbits and partridges, cook, and in short almost wholly provide for 'her man,' and so enable him the more fully to occupy his time in hunting the fur-bearing animals? It may be interesting to note here, not only as an evidence of polygamy in these parts, but as an illustration of the foregoing, a remark made to me by an old Indian chief, Beardy, in reference to his poor hunt—"I have done nothing since I became a Christian." The resident missionary had made it a *sine qua non* that he should put away *five* of his wives before he could be baptized—a bitter pill indeed to poor chief Beardy, who had but lately realized the one ambition of his life, to be ahead of his late father in the matter of wives—but for conscience' sake he gave way, kept his youngest, prettiest, and most useless wife, and has since but lived to mourn her incapacity and his perversion.

When it is understood what a helpful mate the Indian woman usually is to her husband, it can be realized that the doctrine of early marriage is inculcated, and indeed considered necessary to the common weal. Touching upon this I will relate an occurrence that took place here, some few years since, inasmuch as it bears upon Indian marriage custom, based on ancient tradition: A young couple were married, and after going around and making a collection, or rather a requisition, started off to the woods for their honey-moon. Whereupon I questioned an old Indian in reference to this, and asked him, if he thought this taking of a holiday after marriage was possibly copied from the white people (though I must say I have never noted it at York Factory, where contracting parties, immediately after the ceremony is over, return all their borrowed finery, and set about their ordinary work, as if nothing unusual had happened). In answer to my question, the old man somewhat indignantly replied "No, no, it was so long ago." Now is it possible to trace some analogy between the origin of our own honey-moon and that of the Indian, and to refer it to a common source "When a man hath taken a new wife, he shall not go out to war, neither shall he be charged with any business; but he shall be free at home one year, and shall cheer up his wife which he has taken."—DEUT. xxiv. 5.

It is some 2200 years ago since Aristotle taught of the dangers of premature wedlock to the woman, and certainly the result of these precocious unions is disastrous to the child; since it is to this, together with other well recognized causes, which I treat of more fully in my "Notes on Diseases among the Indians frequenting York Factory," that I attribute the universal prevalence of scrofula (it may be here noted that Scrofula is equally prevalent in the Tropics), and early development is here indicated as a most marked symptom, for we observe in the Indian babe, among other peculiarities, the long black silky hair at birth, the very early and regular cutting of teeth, though this only holds conversely good as to Darwin's teaching, as he notes the tardy cutting and irregularity of teeth and diseased condition of hair as typical of some tribes of Indians. Again the Indian child walks very early, grows rapidly, and is very precocious generally, as a very natural consequence of this early development; the girl soon merges into the marriageable female, and very shortly the child-wife becomes the child-mother; and this baneful disease is perpetuated. But these natives, like those of tropical climes, age early, according to the laws of compensation, or as Goethe expressed it: "Nature, in order to spend on one side, economised on the other side." And when we examine into the tent life of the Indian, or even the "herding and pigging" in houses around a settlement, it is not difficult to realize, irrespective of physiological causes, why the Indian child should develop early. For they are treated by their parents even as one of themselves, and the very nature of their lives, putting aside all questions of morality, or rather the utter lack of it, again teaches and induces independence, and that independence, thus early taught by their associations and surroundings, bids them to seek a mate, and go forth in their world, "a very sorry pair of phenomena."

With the exception of the fact that the life of the Eskimo is possibly a more healthy one than that of his Indian brother, the foregoing remarks may equally and perhaps more especially apply to him, and when it is taken into consideration that for some nine months of the year he is breathing an air condensed and supercharged with oxygen, it must directly and indirectly account for his rapid and sturdy growth as a child. Under such circumstances the animal combustion must be necessarily great; still the vital waste is more than retarded by the carbon taken into the system by the draughts of warm blood from recently killed animals, and by the enormous amount of fatty and oily food which he consumes. The continued existence of the Eskimo in the Arctic regions, with a vigour exceeding that of the natives of the Tropics, proves that the human species is independent of temperature, while the equally early development of aborigines under these opposite conditions shows that we must look for its cause in something else than the climate.

We can localize the animal and vegetable kingdoms, but as Agassiz says: "Man alone is complete. His domain is the whole world." Even were this not so, any application of uniformity to man could only be maintained on the principle of double negation, for the Eskimo contrasts with his sub-arctic brother, as the Mongol contrasts with the sub-tropical Asiatic.

In briefly reviewing what I have advanced upon this subject, I cannot, in all deference, think it mere illusion to refer the solution of a phenomenon so essentially identical in nature, affecting alike peoples of diametrically opposed nationalities, temperaments, customs and associations, to other influences than the unconscious operation of local conditions and admit this remarkable fact of precocious development, physically characteristic, as it is, of people of a common descent, to be an intermediate link connecting the two extremes, and to adapt to this higher organization the accepted apophthegm in botany of "species keeping true in either one marked particular or another, although living under most opposite climes."

TWENTIETH MEETING.

Twentieth meeting, 17th April, 1886, the President in the Chair.

The following list of donations and exchanges was read :

1. Report of the Minister of Education (Ontario), 1885.
2. Literary Bulletin of Cornell University, Vol. II., No. 1.
3. Thirty-second Annual Report of the State Historical Society of Wisconsin.
4. Transactions of the American Society of Civil Engineers, February, 1886.
5. Appleton's Literary Bulletin, No. 44.
6. Journal of the Cincinnati Society of Natural History, Vol. IX., No. 1.
7. Proceedings of the American Philosophical Society, Vol. XXIII., Nos. 121. 122.
8. Twenty-third Annual Report of the State Board of Agriculture of Michigan.
9. Annual Report of the Smithsonian Institution for 1883.
10. Proceedings of the Rhode Island Historical Society, 1885-86.
11. Journal of the Trenton Natural History Society, Vol. I., No. 1.
12. Transactions of the Royal Geological Society of Cornwall, Vol. X., Part 8.
13. Transactions of the National Association for the Promotion of Social Science, 1884.
14. The Scottish Geographical Magazine, Vol. II., No. 4.
15. The Midland Naturalist, No. 100.
16. Illustrated Journal of Patented Inventions, No. 62, April 2nd, 1886.
17. Chemical News, April 21, 1886.
18. Transactions of the Royal Scottish Society of Arts, Vol. XI., Part 3. 2 copies.
19. Imperial Federation, Vol. I., No. 4.
20. Memoirs of the Manchester Literary and Philosophical Society, 3rd Series, Vol. VIII. Proceedings of the Manchester Literary and Philosophical Society, Vols. XXIII and XXIV.
21. Electrical Review, April 17th, 1886.
22. Memoirs of the Geological Survey of India, Vol. XXI., Parts 3 and 4; Palæontologia Indica, Series IV,, Vol. I., Part 5, Series XIII, Vol. I., Part 4, Fas. 5, Series XIV., Vol. I., Part 3, Fas. 5.
23. Journal of the Proceedings of the Royal Society for New South Wales for 1884, Vol. XVIII.
24. Centenary Review of the Asiatic Society of Bengal from 1784 to 1883. Calcutta.
25. Annales des Ponts et Chaussées, Mémoires et Documents. Personnel, 1886. 6e Série 1er Cahier, Janvier, 1886.
26. Boletin de la Sociedad Geográfica de Madrid, Tomo XX., Numero 2º.
27. Cosmos, 29 Mars, 1889.
28. Electricité, 27 Mars, 1886.

29. Wochenschrift des österreichischen Ingenieur und Architekten Vereines. Wien, No. 13, 29 März, 1886.
30. Tijdschrift voor Nijverheid en Landbouw in Nederlandsche Indië, Deel XXXII, Aflevering I.
31. Compte Rendu de la Société de Géographie, No. 7, 1886.
32. Bollettino della Società Geografica Italiana, Serie II., Vol. XI., Fas. 3.
33. Monatsblätter des wissenschaftlichen Club in Wien, VII Jahrgang, No. 6. Ausserordentliche Beilage zu No. 6.
34. Sitzungsberichte und Abhandlungen der Naturwissenschaftlichen Gesellschaft Isis in Dresden, 1885.
35. Compte Rendu des Séances de la Société de Physique et d'Histoire Naturelle de Genève, II, 1885.
36. Archives du Musée Teyler, Ser. II., Vol. II. 2e et 3e Parties, Catalogue de la Bibliothèque 1e et 2e Livraisons.
37. Anales del Museo Nacional de México, Tome III., Entrega 8a, 1885.
38. Bulletin de la Société Royale Belge de Géographie 9e Année, 1885, Nos. 1, 2, 3.
39. Jahrbuch der K. K. Geologischen Reichsanstalt, Jahrgang, 1885, XXVIII. Band, 2 und 3 Heft. Wien.
40. Sitzungsberichte der Naturforschenden Gesellschaft zu Leipzig, II. Jahrgang, 1884.
41. Jahresbericht der Naturhistorischen Gesellschaft zu Nürnberg, 1884.
42. XXVIII., XXIX., XXX., XXXI. Berichte des Vereines für Naturkunde zu Cassel. Catalog der Bibliothek des Vereines für Naturkunde in Cassel, 1875. Repertorium der Landeskundlichen Litteratur.
43. Tijdschrift der Nederlandsche Dierkundige Vereeniging, Deel V., V½., Supplement, Deel I., Aflevering I., II.,, 2de Serie, Deel I., Aflevering I.

Total 66

Mr. Arthur Cox was elected a Member.

On motion by Mr. Houston, seconded by Mr. Browning, it was resolved: "That a Committee composed of Messrs. Notman, Boyle, Shaw, Browning, and the mover be appointed with instructions to ascertain and report what steps have been taken by Governments, Universities, Colleges, and Learned Societies to secure the general introduction of a more simple and phonetic system of spelling English words than the one at present in force."

Mr. Houston said that he had had frequent occasions of presenting his views on this subject in other places. As a rule the scheme of spelling in a more logical and simple manner had been approved of by teachers and others familiar with the subject. The first movement in the direction of a more practical and scientific method of spelling had been made about forty years ago by Messrs. Ellis and Pitman. Since that time much progress had been made. In Spain the subject had been taken up and something done in the matter some time ago. In Germany at the present time efforts were being made to have a spelling reform. In Holland they had reformed their spelling to some extent a number of years ago. In France no steps had been taken in the matter. This reform if carried out would revolutionize the spelling of 10,000 words, or about 5,000 of those constantly used, without greatly changing their appearance.

Mr. Browning in seconding the resolution said he thought that it did not go far enough. He would prefer that the Institute should take a more active part in the matter.

Dr. Cassidy spoke against the reform. He said that he had already gone to the trouble of learning how to spell and did not want to have to learn over again. The change would partake considerably of the grotesque. In reading the works of our great writers we had become familiar with their thoughts presented in a certain style of spelling and associated with the appearance of the words. To change that style would to a great extent mar the effect of the thoughts. He would prefer to see the motion laid on the table.

Mr. Houston replied. He said that the art of acquiring our present mode of spelling was mere drudgery, and the time devoted to it could be more profitably bestowed on far more important subjects.

TWENTY-FIRST MEETING.

Twenty-first meeting, 24th April, 1886, the President in the Chair.

The following list of donations and exchanges was read:

1. From the Manitoba Historical and Scientific Society:
    (1) Annual Report for 1885-86.
    (2) Transaction 19. The Old Settlers of Red River.
    (3) Transaction 20. Notes on the Geology of some Islands in Lake Winnipeg.
    (4) Transaction 21. Change in Time Marking.
2. Monthly Weather Review, March 1886.

3. Canadian Entomologist, Vol. XVIII., No. 4.
4. Science, Vol. VII., No. 167 and No. 168.
5. Journal of the Trenton Natural History Society, Vol. I., No. 1.
6. Journal of the New York Microscopical Society, Vol. II., No. 2.
7. The Electrical Review, April 24, 1886.
8. Annual Report of the Buffalo Historical Society, January 12, 1886.
9. Proceedings of the American Association for the Advancement of Science. 33rd Meeting, Philadelphia, September, 1884, Parts I and II.
10. Proceedings of the Royal Geographical Society, Vol. VIII., No. 4.
11. The Chemical News, April 9, 1886.
12. Monthly Notices of the Royal Astronomical Society, Vol. XLVI., No. 5.
13. (1) Proceedings of the Asiatic Society of Bengal, Nos. IX. and X. November and December, 1885.
    (2) Journal of the Asiatic Society of Bengal, Vol. LIV., Part I., Nos. 3 and 4, 1885; Vol. LIV., Part 2, No. 3, 1885.
14. Geologiska Foreningens i Stockholm, Forhandlingar. Band VIII., Häfte 1, 2, 3 Januari, Februari, Mars, 1886.
15. Gazetta Chimica Italiana, Anno XVI., Fasc. I, Palermo.
16. Electricité, 3rd and 10th April, 1886.
17. Cosmos, 5th and 12th April, 1886.
18. Programme of the International Competition for Designs for a new Façade to the Cathedral of Milan, with six Illustrations.
19. Annables des Mines, Huitiéme Série Tome VIII., 6^e^ Livraison de 1885.
20. Historisches Jahrbuch der Görres-Gesellschaft, VII. Band, 2 Heft.
21. Wochenschrift des österreichischen Ingenieur and Architekten Vereines, No. 14 u 15, April 2 and 9, 1886.
22. Archivio per l'Antropologia e la Etnologia, Vol. 15, Fas. 3; Vol. 15, Vol. Fas. 1 e 2, 1885; Quadri Statistici, Serie Prusia.
23. Reale Istituto Lombardo di Scienze è Lettere, Reudiconti, Serie II.
24. Boletin de la Sociedade Antropologica de la Isla de Cuba, Tomo 1, Numero 1, 2 3, 4, 5, 6, Habana.
25. Revista da Secçao da Sociedade de Geographia de Lisboa no Brazil, 2 Serie, No. 3.
26. Società Storica per la Provincia di Como, Fas. 18.
27. Journal des Sociétés Scientifiques, 7 Avril, 1886.
28. Monatliche Mittheilungen des Naturwissenschaftlichen Vereins, Frankfurt a. Oder, 3 July, No. 11, 22, 4 Jahrgang, No. 1.
29. Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, 17 Octr., 1885; 25 Octr., 21 Nov. and 19 Dec. Chronologisches Inhaltsverzeichuis der Verhandlungen.
30. Cronica Cientifica, No. 199, 200, Barcelona.

Total 571.

Mr. Thos. B. Speight was elected a member.

Nominations for officers for the ensuing year were then made.

Mr. Roche read a paper on "The Precipitation of Iron in Saline Solutions."

ANNUAL MEETING.

The Thirty-Seventh Annual Meeting was held on Saturday, 1st May, 1886, the President in the chair.

The minutes of the last Annual Meeting were read and confirmed.

The following list of Donations and Exchanges was read :—

1. Le Naturaliste Canadien, Avril, 1886.
2. Report of the Minister of Education (Ontario) for the year 1885.
3. Canadian Record of Science, Vol. II., No. 2.
4. Historical Collections of the Essex Institute, Vol. XIII, No. 7, 8, 9, 1885.
5. Bulletin No. 1 of the American Ornithologists' Union.
6. Magazine of American History, May, 1886.
7. The American Naturalist, May, 1886.
8. Electrical Review, May, 1886.
9. American Catholic Quarterly Review, No. 42, April, 1886.
10. Science, Vol. VII., No. 169.
11. School of Mines Quarterly, Vol. VII., No. 3.
12. Journal of Speculative Philosophy, Vol. XIX., No. 4, October, 1885.
13. Journal of the Transactions of the Victoria Institute, Vol. XIX., No. 76.
14. Chemical News, April 16, 1886.
15. Illustrated Journal of Patented Inventions, No. 63, April 16, 1886.
16. Paper and Proceedings of the Royal Society of Tasmania for 1885.
17. Bulletin de la Société d'Anthropologie de Paris, Tome Huitième (III. Série) 4e Fascicule.
18. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Band XIII, No. 3.
19. Journal de la Société Physico-chimique Russe, Tome XVII
20. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils, 4e Série, 11e Cahier, November, 1885.
21. Journal des Sociétés Scientifique, 14 Avril, 1886.
22. Compte Rendu de la Société de Géographie de Paris, No. 8.

Messrs. H. B. Spotton, George S. Bean, B. A., Charles Hill Tout and William H. Huston, M.A., were elected members.

Dr. Daniel Wilson read a paper on "Ancient Celtic Art," which has since been published elsewhere.

Mr. VanderSmissen, on behalf of the author, read the following paper :

MARBLE ISLAND AND THE NORTH-WEST COAST OF HUDSON'S BAY.*

BY ROBERT BELL, B.A.Sc., M.D., LL.D.

ASSISTANT DIRECTOR OF THE GEOLOGICAL SURVEY OF CANADA.

Marble Island, in the north-western part of Hudson's Bay, is better known than any other spot in that part of the world, mainly owing to the fact that it has long been the rendezvous of the American whalers who frequent our great inland sea. But it has some very interesting historical associations as well, and its extraordinary appearance has helped to bring it into notice. Although it was first called Marble Island, the name was changed to Brook-Cobham, by Fox, the discoverer of the great Channel which constitutes the north-westward continuation of Hudson's Straits, and which bears his name. However, the original name is now generally adopted.

The island lies about sixteen miles out from the north-western shore of Hudson's Bay, in latitude 60° 40′, and between longitude 91° and 92° west. It has a length of about twenty-five miles by a breadth of five or six. The surface has an undulating outline with long, gentle slopes ; and its general elevation is a few hundred feet above the sea. The harbour used by the American whalers is situated on the south side and near the west end. It consists of an outer and an inner harbour. The outer one is formed by a small island called Deadman's Island, and from it, a narrow channel, with no great depth of water, which has been cut by nature through a ridge of rocks, leads to the inner harbour, a land-locked basin measuring fully a mile in its greatest diameter.

Perhaps the best way to give an idea of the appearance and characteristic features of Marble Island will be to describe our own impressions on first visiting it during the summer of 1884 by the S.S. *Neptune*. No one connected with the expedition had been in this quarter before. At the time when we were nearing this side of the bay, we had lost our reckoning owing to thick weather, and although

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* The illustration accompanying this paper is inserted by the kind permission of Dr. Alfred R. C. Selwyn, C.M.G., F.R.S., Director of the Geological and Natural History Survey of Canada, as is also the illustration accompanying Mr. Stupart's paper in this volume on "The Eskimo of Stupart's Bay.

British American Bank Note Co. Montreal

we happened to be going straight towards the island, none of us at first recognized it on account of the very singular appearance which it presented. All the other shores we had been visiting looked nearly black, but we had also become accustomed to plenty of whiteness in the form of snow, ice and fog-banks. On approaching it in the early morning, at first sight we naturally supposed, from its extent and whiteness, that what we saw before us must be one of these objects; but still, on closer observation, it did not correspond with any of them in shape or other characters. It was too large for an ice-berg (even if there were any in Hudson's Bay, which is not the case), too stationary in position and outline for a fog-bank, and too high for field-ice. Then the extraordinary dark lines and patches which we saw here and there, puzzled us very much. As we drew nearer to it, however, we concluded it must be the far-famed Marble Island, but we had not anticipated seeing such a gigantic mass of marble; and its clean, smooth, white appearance was as wonderful as its extent, for the weathered surface of marble is seldom smooth and white. When within a short distance of the shore, the morning sun shone out and the gorgeous appearance of the steep slopes of pure white rock, washed by the bright sea, with screaming gulls sailing about in the air, was beautiful in the extreme. On entering the harbour behind Deadman's Island, the evidences of the work of civilized man which met the eye, were in singular contrast to the monotony of nature in these desolate regions of the north. A bank of shingle, rising a few feet above the spring tides, forms the highest part of the island. Along this ridge is a row of recently erected white monuments, which stand out in bold relief. Some of them are high columns, but the majority resemble ordinary headstones. They looked like white marble, and where this material was so abundant, it was natural to suppose that they had been formed from it. But appearances, as well as names, are sometimes very deceptive. On going ashore, we found the marble monuments and headstones only painted wood and the marble hills solid white quartzite, as hard as flint. But in spite of the fact that this rock proved to be something very different from white marble, yet even on close inspection, every detail in its appearance was still that of marble. All the most beautiful varieties were there—the pure white, dove-colored, veined, mottled and streaked, lovely lilac and pink, and delicate tints of green and rose color and many other shades, which would charm the most æsthetic eye.

Around both harbours we noticed various discarded articles which had been used in the whale-fishery, and in two or three places on the steep walls of rock overlooking the inner basin were painted lists of the names of many men whose bones are buried among the gravel near by. These, as well as the poor fellows who lie under the wooden monuments of Deadman's Island outside, were seamen and whalers who had died of scurvy, consumption, and other diseases, or from accidents and shipwreck in prosecuting the whale-fishery. The short notes accompanying some of their names suggest many a pathetic history of brave and adventurous men who had gone to these northern waters to earn, by honest toil, the means of bettering their condition. No doubt they must have endured great sufferings from sickness, cold, hunger and pain, during the dark days of the long dreary winter before they died a miserable death, unseen by any, save their equally miserable companions.

In carrying on the whale-fishery around Marble Island the American captains call to their assistance the Eskimos of that region, who are willing and industrious workers, already trained to the business; but it is said they receive very little remuneration for their services. The black whale is stated to be the commonest species taken, but other kinds are met with. In addition to killing the larger whales, our neighbours are reported to collect from the natives considerable quantities of the oil or blubber of the small white whale, the walrus, the narwhal, the polar bear and various kinds of seals. As Hudson's "Bay" is really an inland sea of the Dominion, it is questionable if this business may not be a violation of our treaty rights. The Russian government is understood to exact a very heavy license fee from vessels whaling in the White Sea, which is by no means so land-locked as the Canadian Mediterranean. In this matter we may be allowing a source of revenue to go unimproved.

The Whalers' Harbour in Marble Island is an excellent place for ballasting ships. The beach is steep, so that boats can lie against it at all stages of the tide, and it is almost everywhere covered with small boulders or coarse shingle derived from the white quartzite. While the *Neptune* was lying here the captain availed himself of these advantages and took in a large quantity of ballast to compensate for the weight of fuel we had burnt. When the voyage was over, the vessel went to Sydney for coal, and here these beautifully white rounded stones from Hudson's Bay, which were now put ashore, attracted considerable attention and were much admired.

Marble Island and the mainland opposite are entirely destitute of timber, which, near the coast, does not extend further north than Seal River, 280 statute miles to the south. From Seal River, the northern limit of the forest, which at the verge consists of only small spruce and tamarac, runs in a north-westerly course almost directly to the mouth of the Mackenzie River, thus leaving two or three hundred miles of the Barren Grounds between this line and the coast opposite to Marble Island.

Although no trees grow on the island, there is an abundance of sub-arctic vegetation. The large ponds or small lakes among the hills in the interior are encircled with green, and they have become the breeding places of swans, arctic and red-throated divers, and other water-fowl. Many species of smaller birds were noticed, and owing to the open nature of the country they probably fall an easy prey to the peregrine falcon which also breeds on the island. The reindeer, or barren-ground carriboo, and the musk-ox, are found on the mainland opposite, which is the southern limit, on the coast, of the latter animal, but it ranges further south in the interior.

The American whalers and others constantly speak of Marble Island as if it were really composed of marble. Although I had not an opportunity of personally examining it before 1884, I had long been aware that the white rock of this island was quartzite, having received specimens of it through friends in the Hudson's Bay Company's service. It appears to be identical with the quartzites of the Huronian series, so largely developed on the north shore of Lake Huron between Killarney and the Spanish River. The Marble Island quartzite must have a very great thickness, and it is unlikely that this is the only locality in the region where similar rocks occur. Indeed we have statements from both Hudson's Bay Company's officers and Indians that similar white rocks are found in abundance on the mainland opposite, and at various places for a long way into the interior in a south-western direction. I have obtained a specimen of quartzite of a light or delicate pink color, said to have been broken from the rock *in situ* on the south side of Nevil Bay, about 150 miles south-westward of Marble Island. Continuing the same course inland, white rocks are reported as occurring around White Rabbit Lake, between Nevil Bay and Hatchet or Wollaston

Lake, and boulders of white quartzite are very numerous at the Methy or Long Portage, still further to the south-west.

Our visit to Marble Island was so short that I had only time to examine the western part, the whole of which consisted of different varieties of light-colored quartzites. The rocks being free from lichens or staining, both the shores and the hills in the interior have a uniform white appearance, which might be taken for that of snow, but for the strong contrast due to the dark brown of the peaty depressions. The stratification is usually very massive. Ripple-marks, varying from coarse and wide to fine and narrow, were observed on the surfaces of many of the beds, especially the thinner ones.

Near the south-western point of the island the quartzite presents beautiful lilac colors of various shades. Here the direction of the dip is N. 5° E., *true* (the magnetic variation being 5° W.), and the inclination 80° from the horizontal plane. At the north-western point the direction of the dip is N. 80° W., *true*, and the inclination 45°. This is also the prevailing direction and angle in the interior of the west end of the island. But on the north shore, opposite the harbour on the south side, the direction is N. 65° W., *true.*, and the inclination 40°. It will thus be seen that the strike of the bedding varies considerably in different places. It was further observed that although the general course of the rocks might be tolerably straight locally, the lines of stratification undulated a good deal, the minor sinuosities appearing on smooth sections as mere corrugations of the lamination.

On Deadman's Island, the white quartzites pass into grey, and these rocks are associated with a dark glossy micaceous schist, all striking N. 80° W., *true*, or dipping N. 10° E., at an angle of 90°.

In the course of my examination of Marble Island, I observed the debris of a variety of Huronian rocks, including the brown-weathering dolomite of that series, strewn upon the surface, from which it was inferred that these rocks would be found *in situ* at no great distance in the direction from which the drift had come. Since my visit to the island I have received from a friend a most interesting collection of lithological specimens, representing the fixed rocks of the coast from Chesterfield Inlet south-westward to Eskimo Point (where the rocky shore terminates), embracing a distance of about 180 statute miles in a straight line. They include a considerable variety of species, and from them it is manifest that the Huronian series is well developed and occupies a large area on the north-west side of Hudson's Bay. This would be a highly important fact, even if the collection referred to contained no direct evidence of the existence there of economic minerals, because we already know, from an extensive examination of these rocks in other parts of the Dominion, that they constitute the repositories of numerous metallic ores and other useful minerals, while the primitive Laurentian rocks are almost destitute of them. But in this collection there are eleven specimens of granular iron pyrites, from different parts of this coast, all of which apparently contain small quartz grains. Most of the specimens are angular, and their aggregate weight is about fifty pounds. Mr. Hoffmann, chemist to the Geological Survey, has made an assay of one of these specimens from a bay south of Cape Jones, which forms the southern horn of Rankin Inlet, and found it to contain traces of both gold and silver. A good sized angular piece of similar pyrites, which I obtained from the Eskimos in 1879, and which they brought from a place called Iñari, described as being about two-thirds of the distance from Churchill Harbour to Marble Island, had a small quantity of light bluish grey magnesian limestone adhering to it. Some of the other specimens of this pyrites have small pieces of soft dark-greenish schist attached to them.

The specimens from the above-mentioned 180 miles of the north-west shore of Hudson's Bay embrace the following rocks: Chloritic schist, dark cherty schist, hard dark argillaceous slate, finely ribboned hornblende and quartz schist, imperfect gneiss, dark silicious breccia with calcspar, dark-green crystalline pyroxene rock, dark chocolate-coloured silicious argillite with conchoidal fracture, calcspar veinstones, semi-translucent white quartz, red aplite of medium texture, rather fine-grained grey granite, grey diorite, consisting of light-coloured felspar and dark hornblende in small distinct crystals, giving it an even and finely speckled appearance, fine-grained hornblende schists, greenstones, quartz and epidote rock, light grey coarse grained sandstone altered to quartzite and holding fragments of indurated red shale, compact banded white quartz-rock with crystals of iron pyrites in some of the layers, light quartzite like that of Marble Island, grey felsites, crystalline hornblende-rock, diorite, consisting of compact white felspar with long crystals of dark hornblende, banded grey hornblende and quartz-rock with some layers approaching chert, mica schists of different kinds, mixed hornblende and mica-schist, chocolate-coloured porphyry with flesh-coloured crystals of felspar and grains of clear quartz, granulite, red jasper with dull fracture, hard brownish-red sandstone, grey felsitic quartzite with lenticular patches of dark mica-schist, chloritic schist, the granular iron pyrites associated with dark-greenish schist above referred to, several hundreds of cubes of iron pyrites, mostly small, taken from a dark glossy schist, quartz veinstone with large scales of light-coloured mica together with garnets, calcspar veinstone with embedded crystals of quartz and having grey steatitic rock adhering to it, also a veinstone of quartz containing silky radiating aggregates of hornblende and a few specks of calcspar and iron pyrites; some greenish schist is attached to this specimen. A loose piece of brown-weathering dolomite with reticulating strings of white quartz was found on Marble Island.

The granular quartziferous iron pyrites of this collection bears a strong resemblance to that of the mines at Capelton, in the Township of Ascot, Province of Quebec, and to that of the more cupriferous pyrites of the Tilt Cove Mine in Newfoundland, as also to the equally rich copper-bearing pyrites more recently discovered among the Huronian rocks at Sudbury, in the Province of Ontario. The specimen of pyrites from Iñari did not show the presence of copper, but elsewhere in working pyrites veins it has been observed that although this metal may be present only in small quantities at the surface, the proportion increases rapidly in going downward.

The resemblance between the pyrites of the three localities above mentioned is interesting, not only from an economical, but also from a geological point of view, especially in connection with the question of equivalency in age, or otherwise, of the different sets of rocks in which they are found.

At the south-west point of Marble Island, large green stains of carbonate of copper occur on the surface of the quartzite, some of them being three or four feet in diameter. They are probably due to the decomposition of sulphide of copper in the rock.

In 1850, James Tennant, Esq., Professor of Mineralogy, in King's College, London, examined seven rock-specimens which had been brought from the north point of Rankin Inlet, directly opposite to and in sight of the west end of Marble Island, and among them he mentions "quartz, enclosing chlorite and copper-pyrites; carbonate and silicate of copper, with copper-pyrites on argillaceous slate; ditto, with a thin coating of green carbonate of copper."

Judging from what Professor Tennant says as to a few rock-specimens which were submitted to him from Repulse Bay and vicinity, 300 miles northeastward of Marble Island, the Huronian rocks would appear to occur there also. One specimen from this bay, he describes as "quartz coloured by oxide of iron and containing minute particles of gold." The existence of visible gold in quartz at Repulse Bay is an important fact. It has been already mentioned that gold and silver were found by assay in a specimen of iron pyrites from a bay south of Cape Jones, not far south-west of Marble Island. Both gold and silver have been discovered by assay in specimens of quartz or pyrites which I have brought from various parts of Hudson's Bay and Straits. In 1877, Dr. Harrington, who was then chemist to the Geological Survey, detected both gold and silver in iron pyrites which I had collected from a small vein cutting gneiss on a point about one mile south of the mouth of Great Whale River, and also in pyrites from veins in the dolomite which forms Dog Island, close to the main shore, a few miles north of the Cape Jones of the East-main coast. The galena of the old mine, about three miles north-east of Little Whale River trading post, was found to contain 5·104 ounces of silver to the ton of 2,000 lbs., and that from the south side of the inlet of Richmond Gulf, 12·03 ounces to the same quantity of ore. More recently, Mr. Hoffmann, now chemist to the Survey, has found small quantities of gold and silver in quartz which I obtained from a thin vein on one of the Ottawa Islands, in the north-eastern part of Hudson's Bay. He has also proved the occurrence of the precious metals in quartz veinstones, which I brought from Cape Prince of Wales, about the middle of the south side of Hudson's Straits; Cape Chudleigh, on the south side of the eastern entrance to the Straits; and Nachvak Inlet, on the Labrador coast, about 140 miles south of the last mentioned cape.

From the data I have gathered at Marble Island and that afforded by the valuable series of specimens which I have referred to, as well as from the fact that Laurentian types of rocks are absent from the collections, it is to be inferred, as already stated, that we have a great development of the Huronian series along the 180 miles of coast from Chesterfield Inlet to Eskimo Point, both in regard to the variety of the rocks themselves and their geographical extent. The information afforded by the materials of the drift and that derived from the other sources I have alluded to, all indicate that these rocks likewise occupy a very large area of country extending inland from this part of the coast. This unexplored region would, no doubt, prove a highly interesting field for research both to the geologist and the miner.

In my various reports on Hudson's Bay and Straits, I have had occasion to refer to the indications everywhere to be met with, of the great changes which have taken place in the relative levels of the sea and land in comparatively recent geological times. Similar phenomena have been observed in Baffin Land and on the northern shores of the American continent, as well as on all the islands north of the mainland, by the officers of the numerous Franklin search expeditions, and other explorers. This change in the relative levels of the land and water has not, therefore, been limited to "an area of upheaval," but has been general in all these northern regions of the earth.

The evidence of the rapid rise of the land, or perhaps more correctly speaking, of the recession of the sea, is strikingly manifested on Marble Isiand. The smooth pebbles and rounded stones of the ancient beaches, being snowy white, the horizontal lines of the latter are rendered conspicuous in the naked landscapes by their contrast with the yellowish-grey or brown color of the vegetable matter which occupies the intervals between them. They occur at numerous different levels, up to 200 or 300 feet, and some at still greater elevations.

The solid rocks of Marble Island are pretty thoroughly glaciated and the striæ are very distinct. At the north-west point of the island their course is S. 25° E. *true*, and on Deadman's Island it is S. 15° E. *true*. It may be mentioned in connection with this subject that at Fort Churchill the course of the glacial striæ is S.S.W., and at the first solid rock seen in ascending the Hayes River it is S.S.E., with an older set at the same place, running nearly east and west. To the west and south of James' Bay the general course is south-westward; along the southern part of the East-main coast, westward, and toward the northern part of this coast, northward; while in Hudson's Straits it is eastward. From these facts it might be inferred that during the glacial period, the ice which formed in the basin of Hudson's Bay, or flowed into it from the high lands to the north-west and those of the Labrador peninsula to the east, found outlets towards the south and south-west, and also to the north-eastward into Hudson's Straits. The glacial debris, found all around the Bay and in the Straits, has been transported in directions corresponding with this view of the general conditions during the drift period.

At the east end of Marble Island there is a bay or harbour, with which a very sad history is associated; and as the events connected with it form an interesting chapter in the progress of discovery in these parts, I may be here allowed to devote a little space to the subject. When the Hudson's Bay Company first established a trading post at the Churchill River, in 1715, the Indians who ranged over the Barren Grounds to the westward of Marble Island frequently brought samples of native copper to the settlement, and stated that they were found near a large river, which afterwards proved to be the Coppermine, flowing into the Arctic Sea. At that time, however, the Company's people believed the river referred to emptied into Hudson's Bay, as they did not suppose these savages could wander or trade as far as a great river discharging into another sea. In addition to this pure copper, it was supposed that "gold and other valuable commodities" were to be found "to the northward." To prove this and to discover the North-west Passage, the Company, in 1719, sent out two vessels, the *Albany* frigate, George Barlow, master, and the sloop *Discovery*, David Vaughan, master, under the command of Mr. James Knight, "who had been many years governor at the different factories in the Bay, and who had made the first settlement at Churchill River."

Mr. Knight was then nearly eighty years of age, but nevertheless he appears to have been full of enthusiasm; and Hearne says "he was so prepossessed of his success and of the great advantage that would arise from his discoveries, that he procured and took with him some large iron-bound chests to hold gold-dust and other valuables which he fondly flattered himself were to be found in these parts."

Neither of the vessels having returned to England, and the Company feeling alarm for their welfare, in 1722 a sloop called the *Whalebone*, John Scroggs, master, was sent from Churchill in search of them, but he returned the same season without having ascertained anything definite as to the whereabouts of the vessels.

The story of the unhappy termination of this expedition is graphically told by Samuel Hearne in the account of his "Journey from

Fort Prince of Wales to the Northern Ocean, in 1769 to 1772," and as it is not long, I shall quote what he says:—

"The strong opinion which then prevailed in Europe respecting the probability of a North-west passage by the way of Hudson's Bay, made many conjecture that Messrs. Knight and Barlow had found a passage and had gone through it into the South Sea by the way of California. Many years elapsed without any other convincing proof to the contrary, except that Middleton, Ellis, Bean, Christopher and Johnson had not been able to find any such passage. And notwithstanding a sloop was annually sent to the northward on discovery and to trade with the Eskimos, it was the summer of 1767 (forty-eight years) before we had positive proofs that poor Mr. Knight and Captain Barlow had been lost in Hudson's Bay.

"The Company were now carrying on a black-whale fishery and Marble Island was made the place of rendezvous, not only on account of the commodiousness of the harbour, but because it had been observed that the whales were more plentiful about that island than on any other part of the coast. This being the case, the boats, when on the lookout for fish, had frequent occasion to row close to the land, by which means they discovered a new harbour near the east end of it, at the head of which they found guns, anchors, cables, bricks, a smith's anvil and many other articles, which the hand of time had not defaced, and which, being of no use to the natives, or too heavy to be removed by them, had not been taken from the place in which they were originally laid. The remains of the house, though pulled to pieces by the Eskimos for the wood and iron, are yet very plain to be seen, as also the hulls, or more properly speaking, the bottoms of the ship and sloop, which lie sunk in about five fathoms of water, toward head of the harbour. The figure-head of the ship, and also the guns, &c., were sent home to the Company, and are certain proofs that Messrs. Knight and Barlow had been lost on that inhospitable island, where neither stick nor stump was to be seen, and which lies sixteen miles from the mainland. Indeed, the main is little better, being a jumble of barren hills and rocks, destitute of every kind of herbage except moss and grass, and at that part, the woods are several hundreds of miles from the sea-side.

"In the summer of 1769, while we were prosecuting the fishery, we saw several Eskimos at this new harbour, and perceiving that one or two of them were greatly advanced in years, our curiosity was excited to ask them some questions concerning the above ship and sloop, which we were the better enabled to do by the assistance of an Eskimo, who was then in the Company's service as a linguist, and annually sailed in one of their vessels in that character. The account which we received from them was full, clear and unreserved, and the sum of it was to the following purport:

"When the vessels arrived at this place (Marble Island), it was very late in the fall, and in getting them into the harbour, the largest received much damage; but on being fairly in, the English began to build the house, their number at that time seeming to be about fifty. As soon as the ice permitted in the following summer (1720), the Eskimos paid them another visit, by which time the number of the English was greatly reduced, and those that were living, seemed very unhealthy. According to the account given by the Eskimos, they were then very busily employed, but about what, they could not easily describe, probably in lengthening the long-boat, for at a little distance from the house there is now lying a great quantity of oak chips, which have been most assuredly made by carpenters.

"Sickness and famine occasioned such havoc among the English that by the setting in of the second winter their number was reduced to twenty. That winter (1720) some of the Eskimos took up their abode on the opposite side of the harbour to that on which the English had built their houses, and frequently supplied them with such provisions as they had, which chiefly consisted of whales' blubber and seals' flesh and train oil. (I, Hearne, have seen the remains of those houses several times; they are on the west side of the harbour and in all probability will be discernable for many years to come). When the spring advanced, the Eskimos went to the continent, and on their visiting Marble Island again in the summer of 1721, they found five of the English alive, and those were in such distress for provisions that they eagerly ate the seals' flesh and whales' blubber quite raw, as they purchased it from the natives. This disordered them so much that three of them died in a few days, and the other two, though very weak, made a shift to bury them. Those two survived many days after the rest and frequently went to the top of an adjacent rock and looked earnestly to the south and east, as if in expectation of some vessel coming to their relief. After continuing there a considerable time together, and nothing appearing in sight, they sat down close together and wept bitterly. At length one of the two died and the other's strength was so far exhausted, that he fell down and died also in attempting to dig a grave for his companion. The skulls and other large bones of those two men are now lying above ground, close to the house. The longest liver was, according to the Eskimo account, always employed in working of iron into implements for them ; probably he was the armourer or smith."

The Annual Report was read and adopted as follows :

ANNUAL REPORT.

SESSION 1885-86.

The Council of the Canadian Institute have the honour to lay before the members their 37th Annual Report.

The most noteworthy event in the history of the Institute during the past year has been the formation of a Biological Section and the incorporation into the Institute of the Natural History Society of Toronto. The alterations in the regulations rendered necessary by the change come into force for the first time at this meeting. It is to be hoped that the Union now consummated will prove of benefit to all those interested in it.

An earnest effort has been made during the year to awaken public interest in the subject of local archæology—the study of the records, now so quickly being obliterated, of the aboriginal races of this country. It is much to be desired that the Provincial Government will see their way to assist in some manner this important object.

We have lost during the past year by withdrawals and deaths 37 members, among whom is our lamented former President, Mr. J. M. Buchan, whose untimely death last summer fell on us with startling suddenness. During the year 26 new members have been elected ; so that we now number on our roll 233 members, 11 less than last year. In this connection it seems proper to call attention to the large number of gentlemen who, after permitting themselves to be nominated and elected members of the Institute, have apparently performed no other function in connection with our body. On examining the statistics of the past three or four years, it appears that nearly one-third of these gentlemen elected as members never really became such.

With regard to the list of exchanges it will be seen that the number has been doubled during the past year, and is now five times what it was four years ago.

All of which is respectfully submitted.

(Signed) W. H. ELLIS, *President.*

JAMES BAIN, Jr., *Secretary.*

APPENDIX I.

MEMBERSHIP.

Number of Members, April 1st, 1885	244
Withdrawals and Deaths during the year	37
	207
Elected during the Session, 1885-86	26
Total Members	233
Composed of :	
Honorary Members	5
Life Members	15
Ordinary Members	213
Total	233

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE—SESSION OF 1885-6.

To Summary :	
" Balance on hand	$ 23 63
" Annual Subscriptions	584 00
" Rents	285 00
" Journals sold	2 51
" Books and Periodicals sold	41 65
" Interest on Deposits	1 30
" Government Grant	750 00
	$1,688 09

By Summary :

" Salaries		$344 00
" Periodicals		69 90
" Interest on Mortgage		238 78
" Printing		593 84
" Fuel		94 00
" Gas		43 57
" Water		24 00
" Postage, Post Cards and Delivering Proceedings		117 01
" Express charges		19 04
" Stationery		12 07
" Caretaker		10 00
" Taxes		11 07
" Discount on Cheque		25
" D. Boyle for Specimens		15 00
" Refreshments (opening night)		13 00
" Repairs		19 51
" Balance on hand, cash	24 74	
" in bank	38 31	63 05
		$1,688 09

Examined and found correct.
Signed

W. HENDERSON,
T. B. BROWNING, } *Auditors.*

ASSETS.

Building	$11,000 00
Warehouse	720 00
Ground	2,500 00
Library	6,100 00
Specimens	1,300 00
Personal Property	500 00
	$22,120 00

LIABILITIES.

Mortgage	$ 3,411 00
Balance in favor o Institute	18,709 00
	$22,120 00

APPENDIX III.

DONATIONS AND EXCHANGES—BOOKS AND PAMPHLETS RECEIVED FROM APRIL 1ST, 1885, TO APRIL 1ST, 1886, AS COMPARED WITH THE THREE PRECEDING YEARS.

	1882-83	1883-84	1884-85	1885-86
Canada	30	90	110	129
United States	60	300	200	510
Great Britain and Ireland	100	200	160	344
India and Australasia	20	40	80	30
Foreign	70	170	180	489
Total	280	800	730	1502

APPENDIX IV.

The number of Societies and Publications with which the Institute now exchanges is 328, shewing an increase of 168 during the year. They may be classified as follows :—

From	Exchanges
Canada	20
United States	97
Mexico	
Island of Cuba	1
South America	4
England	36
Scotland	11
Ireland	6
Austria-Hungary	15
Belgium	4
Denmark	4
France	26
Algeria	1
Germany	32
Iceland	1
Italy	19
Netherlands	8
Norway	5
Portugal	1
Russia	4
Spain	4
Sweden	8

Switzerland	5
Turkey	1
Japan	3
Java	2
India	3
Australia	4
New Zealand	1
Tasmania	1
Total	328

APPENDIX V.

The number of Volumes bound during the year, including a set of the JOURNAL sent to the Colonial Exhibition, 124.

APPENDIX VI.

The number of Books and Periodicals issued to members, 1885-86. 1,129.

APPENDIX VII.

The Periodicals subscribed for are the same as last year.

APPENDIX VIII.

REPORT OF CURATOR FOR 1885-86.

In the additions made to the Institute during my term of office, specimens illustrative of aboriginal and pioneer life occupy the first place.

In April, 1885, with the consent of the Council, I prepared a circular, of which about one thousand copies were addressed to representative men of all classes throughout the Province, asking for information relative to localities connected with prehistoric and early historic events, and requesting persons in possession of relics to forward them to the Institute for the purpose of enabling us to form an archaeological exhibit worthy of the Province of Ontario.

In reply to that circular a large quantity of exceedingly valuable information has been collected relating to ancient village sites, battle grounds, portages, etc., and to persons in whose hands there are private collections of more or less value.

In company with other members of the Institute, as well as alone, I visited a few of the places within easy reach of the city, and was enabled to add several hundred excellent specimens to our collection.

A number of gentlemen also who had small collections kindly presented them to the Institute, and, by an arrangement made with the York Pioneers, our Society became custodian of a large number of Indian and other specimens which are now in our cases.

Owing to the rapid expansion of our knowledge as to a number of places that are worthy of examination and survey, as well as because of the many objects we have discovered in the hands of collectors, it is to be deplored that our lack of funds precludes us from proceeding in a systematic and scientific manner in the formation of an archæological museum that would ultimately prove valuable to the Canadian student, and it is to be regretted that the Provincial Legislature failed to respond to our application for assistance in the prosecution of this national work.

The following is a list of the specimens that have been secured during the year, and which are now in cases supplied by the Institute at a cost of $100. The cases have an area of 100 square feet and contain :—

104 Pipe Heads and Stems.
92 Fragments of Pottery.
3 Clay Cups.
4 War Clubs.
18 Strings of Beads.
200 Loose Stone, Bone and Shell Beads.
8 Small Stone Disks—Perforated.
13 Perforated Stone Tablets.
19 Pieces of Shell.
1 Piece Carved Bone.
1 Small Animal—Stone Carving.
2 Horn Gouges.
1 Piece of perforated Horn.
1 Complete Turtle Shell.
1 Perforated "
1 Piece of Human Skull, perforated.
5 Skulls, almost perfect.
1 String of Bone Beads.
44 Bone Needles.
460 Arrow Heads—(flint).
7 " mounted (iron).

121 Stone Axes, Gouges and Chisels.
9 Pieces of Sheet Copper.
1 Whole Copper Kettle.
12 Iron Knives—rusted and worn.
9 Indian Ornaments (various.)
3 " Medals (silver.)
6 Brass and Copper Rings.
14 Iron Tomahawks.

Besides these there are several articles of a miscellaneous kind—the whole numbering fully one thousand.

The principal contributors were :—

Rev. T. T. Johnston, of Ancaster.
Mr. A. F. Hunter, Flos.
Mr. Loughead, Sunnidale.
Mr. B. Jackes, Toronto.
Mr. A. Elvins, "
Mr. A. McKnight, Kirkwall.
Mr. James Rae, "
Mr. James Dwyer, Beverley.
Mr. George E. Laidlaw, The Fort.
Mr. J. Long, Eglinton.
Mr. J. Welbone, Myrtle, and
The Curator.

There are many fine geological specimens that ought to be attended to immediately, but with which it is impossible to do anything for the want of case room.

Before the close of another year it may be reasonably hoped that the whole collection in possession of the Institute will be put in proper shape for study.

All of which is respectfully submitted.

DAVID BOYLE, Ph.B., *Curator.*

On motion of Mr. Keys, seconded by Mr. Kerr, the report was adopted.

The following gentlemen were elected officers for the ensuing year :—

President—W. H. VanderSmissen, M.A.
Vice-President—E. A. Meredith, LL.D.

Secretary—Alan Macdougall, M. Inst. C.E., F.R.S.E.
Treasurer—James Bain, jun., Esq.
Editor—George Kennedy, M.A., LL.D.
Librarian—G. E. Shaw, B.A.
Curator—David Boyle, Ph. B.

Members of Council—
R. Ramsay Wright, M.A., B.Sc., F.R.S.C.
James Loudon, M.A.
W. H. Ellis, M.A., M.B.
D. Wilson, LL.D., F.R.S.E., F.R.S.C.
P. H. Bryce, M.D.
Alex. Marling, LL.B.

THE FOOD PLANTS OF PLATYSAMIA CECROPIA.

BY WM. BRODIE.

(Read before the Natural History Society of Toronto.)

In December, 1880, I read a paper before the Natural History Society on the food plants of *Platysamia cecropia*. The paper was a synopsis of observations extending over 17 years, made in the County of York and contained a list of 49 species. This list was afterwards published in the February number of "Papilio" for 1882.

To this list I have made several rather important additions which are included in the following revised list:—

MAGNOLIACEÆ.

Liriodendron tedipifera, L.

LILIACEÆ.

Lilia Americana, L.
" Europæa, L.

SAPINDACEÆ.

Staphylia trifolia, L. in W. Lean's orchard.
Aesculus hippocastanum, L.
Acer Pennsylvanicum, L., Muskoka.
" spicatum, Lam.
" saccharinum, Wang.
" dasycarpum, Ehr.
" rubrum, L.
Negundo aceroides, Moench.

ROSACEÆ.

Persica vulgaris, D.C.
Prunus Americana, Mar.
Prunus domestica, L.
" pumila L., Harbor Island, Georgian Bay.
" Pennslyvanica, L.
" Serotina, Ehr.
" Virginiana, L.
Cerasus vulgaris, L.
Spiræa opulifolia, L.
" salicifolia, L.
" tomentosa, L.
Cratægus coccinea, L.
" tomentosa, L.
" cruxgalli, L.
Pyrus malus, L.
" communis, L.
" coronaria, L.
" arbutifolia, L.
" Americana, s.c.
" acuparia, Gaer.
Amalanchier Canadensis, Torr, Gray.

SAXIFRAGACEÆ.

Ribes lacustre, Poir. Tobermorey.
" floridum, L.
" floridum officinale, L.
" rubrum officinale, L.
" Aureum, Pursh.

CAPRIFOLIACEÆ.

Symphoricarpus vulgaris, Mich.
Diervilla trifida, Moench.
Sambucus Canadensis, L.
" pubens, Michx.

COMPOSITÆ.

Lappa officinalis, Alli.

OLEACEÆ.

Fraxinus Americana, L.

URTICACEÆ.

Ulmus fulva, Michx.
" Americana, L.
" racemosa, Thorn.

JUGLANDACEÆ.

Carya tomentosa, Nutt.
" porcina, Nutt.
" alba, Nutt.

CUPULIFERÆ.

Quercus alba, L.
" macrocarpa, Michx.
Quercus obtusiloba, Michx.
Castanea vesca, L.
Fagus ferruginea, Ait.
Corylus Americana, Walt.
" rostrata, Ait.
Ostrya virginica, Willd.
Carpinus Americana, Michx.

BETULACEÆ.

Betula excelsa, L.
" lenta, L.
" lutea, Michx.
" alba, Spach.
" papyracea, Ait.
" glandulosa, Michx., Tobermorey
Alnus viridis, D.C., Manitoulin.
" incana, Willd.
" serrulata, Ait.

SALICACEÆ.

Salix humilis, Mar.
" sericea, Mar.
" viminalis, L.
" lucida, Mühl.
" alba, L.
Populus tremuloides, Michx.
" granditenta, Michx.
" balsamifera, L.

On the morning of June 5th, 1885, I found eight Cecropia larvæ, just out of the egg, in one of my breeding boxes. I immediately placed them on a plant of burdock which was growing in the garden. About two weeks afterwards I was somewhat surprised to find four larvæ feeding on the leaves, and from a rather peculiar shade of color I at first took them to be *C. promethea.* From this time I watched them closely; when about half-grown, one left the plant and was lost, the remaining three reached a fair average size, and two when mature left the plant to spin up elsewhere, and were lost. But I succeeded in securing one cocoon. Very possibly we may yet find that Cecropia larvæ will feed and mature on the leaves of many herbaceous plants.

During the summer of 1883 I had over 50 Cecropia larvæ feeding on a plum tree in my garden. At a short distance grew a peach, the upper branches of which nearly touched those of the plum. On the leaves of this peach I had often placed young cecropia larvæ, invariably they refused to eat and starved to death. Twice I put larvæ about half grown, with the same result.

When the larvæ on the plum were about half grown, a gale of wind blew the branches of the trees together. A few days afterwards I noticed the upper shoots of the peach denuded of leaves. On close inspection I found four cecropia larvæ—having evidently worked over from the plum—feeding greedily and thriving well. These all matured and spun upon the peach.

The horse-chestnut is entered from finding eight cocoons so situated that the larvæ could not have fed on any other tree.

The *Symphoricarpus vulgaris* is entered from one convincing example—the shrub was isolated a long distance from any other shrub or tree—the cocoon was found soon after completion, and several shoots denuded of leaves gave evidence of the presence of the larvæ.

Some doubts have been expressed as to the elm being a food plant. The repeated finding of cocoons, often 30 ft. or more from the ground, seems quite conclusive, but for several seasons I have reared a large number of larvæ on an elm tree in my garden and the only noticeable difference was the generally small size of the cocoons. Cocoons are sometimes found on the common privet, but, although it is most probably a food plant, in absence of sufficient evidence it is omitted from this list.

I have no doubt it will be found that the larvæ feed indiscriminately on all our species of willow and poplar.

In all our northern lumbering sections, a few years after the sweep of a bush fire, you find a dense growth of sambucus birch and willow. Thus, with abundance of food and absence of parasites, this would be the Cecropia's paradise, were it not for the woodpeckers which perforate the cocoons and feed on the pupæ during the winter.

I am indebted to Mr. R. Morey and Mr. W. Squires for valuable assistance in the collection of material for this list.

TANNIN IN CLOVES.

BY W. HODGSON ELLIS, M.A., M.B.

(Read before the Canadian Institute, Nov. 27, 1886.)

Some time ago, while examining cloves adulterated with farinaceous matter, I was struck by the fact, that in testing for starch with solution of iodine, it was necessary to add a considerable quantity of iodine before a blue colour appeared. The quantity of iodine required could even be used as an approximate measure of the quantity of pure cloves in the sample. Some preliminary experiments led me to attribute this action to tannin, and I made, with the assistance of Mr. F. T. Shutt, a number of determinations of tannin in pure cloves by means of Löwenthal's process.

Our manner of working was as follows:—2 grms. cloves were exhausted by boiling under an inverted condenser, filtered, and the filtrate made up to 500 c.c.; 50 c.c. of the filtrate was then titrated with a solution of permanganate (1 grm. to the litre). In 100 c.c. of the filtrate the tannin was precipitated by gelatine and acid salt solution, made up to 250 c.c. filtered, and 50 c.c. titrated with permanganate. Indigo carmine was used as an indicator. The titration was carried out in a porcelain basin. The liquid operated on was diluted to about 750 c.c., and the permanganate was allowed to run into the basin at about the rate of one drop in a second, with constant stirring. The method was essentially that described by Proctor (Chem. News, xxxvi., 58).

We then made determinations of tannin in clove stems and in allspice. I have subsequently, with the assistance of Mr. F. W. Babington, made a number of similar determinations in commercial cloves and allspice, both pure and adulterated. The following table gives our results, stated in c.c. decinormal permanganate, required to oxidize one gram of cloves before and after the precipitation of the tannin. In calculating these results to tannin, I have used Neubauer's factor, viz., 6.3 grm. oxalic acid will require for oxidation as much permanganate as will oxidize 4.157 grm. gallotannic acid. The solution of permanganate used was titrated against oxalic acid and checked by pure tannic acid. In using this factor I do not, of course, intend to assert that the tannin of cloves is identical with gallotannic acid. The factor is only used provisionally to afford a means of comparison.

	C.C. Decinormal Permanganate required to Oxidize one Gram.			Percentage of tannin calculated as gallotannic acid.
	Before the precipitation of the tannin.	After the precipitation of the tannin.	Required for tannin.	
Cloves I	69.54	42.66	26.88	11.17
" II	74.76	49.33	25.43	10.55
" III	74.59	45.35	29.24	12.16
" IV	75.22	46.50	28.72	11.91
Clove stems	37.65	18.86	18.79	7.01
Allspice	24.83	11.33	13.50	5.61
Commercial ground cloves	63.26	39.26	24.00	9.98
Ground cloves adulterated with peas	23.51	15.83	7.68	3.19
Ground cloves adulterated with flour	19.36	12.58	6.78	2.82

It appears from these experiments that cloves contain about 10 or 12 per cent. of tannin calculated as gallotannic acid, that clove stems contain about 8 per cent., and that allspice contains 5 or 6 per cent. of tannin so calculated. It is also evident that the quantity of tannin is a valuable criterion of the quantity of cloves contained in an adulterated sample.

The large quantity of permanganate required by the oxidizable matters other than tannin is remarkable in the case of cloves. It is in every case much larger than that required to oxidize the tannin. I hope to be able to make a further investigation on the nature of these substances at a future time.

The Canadian Institute exchanges with the following Societies and Periodicals:

I.—AMERICA.

(1.)—CANADA.

Canadian Practitioner, Toronto.
Meteorological Reports, Toronto.
Public Library, Toronto.
Education Department, Toronto.
Provincial Board of Health, Toronto.
Publications of the Provincial Government.
Geological and Natural History Survey of Canada, Ottawa.
Parliamentary Library, Ottawa.
Royal Society of Canada, Ottawa.
Ottawa Field Naturalists' Club, Ottawa.
Entomological Society of Ontario, London.
Hamilton Association, Hamilton.
Natural History Society of Montreal.
Literary and Historical Society of Quebec, Quebec.
Le Naturaliste Canadien, Cap Rouge, Que.
Natural History Society of New Brunswick, St. John, N. B.
Nova Scotia Historical Society, Halifax, N. S.
Nova Scotia Institute of Natural Sciences, Halifax, N. S.
Manitoba Historical and Scientific Society, Winnipeg, Man.—19.

(2.)—UNITED STATES.

Bureau of Steam Engineering, Navy Department, Washington, D. C.
Smithsonian Institution, Washington, D. C.
Bureau of Ethnology, Washington, D. C.
United States Geological Survey, Washington, D. C.
Philosophical Society of Washington, Washington, D. C.
United States Coast and Geodetic Survey, Washington, D. C.
United States National Museum, Washington, D. C.
Department of Agriculture (Division of Chemistry), Washington, D. C.
California Academy of Science, San Francisco, Cal.
Technical Society of the Pacific Coast, San Francisco, Cal.
Western Scientist, San Diego, Cal.
Colorado Scientific Society, Denver.
Bridgeport Scientific Society, Bridgeport, Conn.
American Journal of Science, New Haven, Conn.
Connecticut Academy of Arts and Science, New Haven, Conn.
Yale College Observatory, New Haven, Conn.
Georgia Historical Society, Savannah, Ga.
Chicago Historical Society, Chicago.
Illinois State Laboratory of Natural History, Champaign, Ill.

American Antiquarian and Oriental Journal, Chicago, Ill.
Brookville Society of Natural History, Brookville, Ind.
Academy of Natural Sciences, Davenport, Iowa.
State Historical Society of Iowa, Iowa City.
Kansas Historical Society, Topeka.
Kansas Academy of Science, Topeka.
Academy of Natural Sciences, New Orleans, La.
Peabody Institute, Baltimore, Md.
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Academy of Sciences, St. Louis, Mo.
Missouri Historical Society, St. Louis, Mo.
Sedalia Natural History Society, Sedalia, Mo.
New Jersey Historical Society, Newark, N. J.
E. M. Museum of Geology and Archaeology, Princeton College, Princeton. N.J.
New York Academy of Sciences, New York.
American Museum of Natural History, Central Park, New York.
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New York State Museum of Natural History, Albany, N. Y.
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(3.)—MEXICO.

Museo Nacional de México.—1.

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ENGLAND.

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Revue de Linguistique et de Philologie Comparée, Paris.
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Société Mathématique de France, Paris.
Bulletin d'Histoire Ecclésiastique et d'Archéologie Religieuse des Diocèses de Valence, Digne, Gap, Grenoble, et Viviers.—22.

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Zeitschrift für Physiologische Chemie, Strassburg.
Nassauischer Verein für Naturkunde, Wiesbaden.—32.

(7.)—ICELAND.

Islenzka Fornleifafélags, Reykjavik.—1.

(8.)—ITALY.

Ateneo di Brescia, Brescia.
Società Storica per la Provincia e Antica Diocesi di Como.
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Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche, Roma.
"Cosmos" di Guido Cora, Torino.
Notarisia Commentarium Phycologicum, Venezia.—22.

(9.)—NETHERLANDS.

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(11.)—PORTUGAL.

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(12.)—RUSSIA.

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Société Impériale des Naturalistes de Moscou.
Société Physico-Chimique Russe à l'Université de St. Petersbourg.
Comité Géologique, St. Petersbourg.—5.

(13.)—SPAIN.

"Crónica Cientifica," Barcelona.
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Sociedad Geográfica de Madrid.—4.

(14.)—SWEDEN.

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Kongliga Svenska Vetenskaps Akademien, Stockholm.
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Geologiska Föreningens i Stockholm, Stockholm.
Acta Mathematica, Stockholm.
Kongliga Universitetet, Upsala.—9.

(15.)—SWITZERLAND.

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Geographische Gesellschaft von Bern.
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(16.)—TURKEY.

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Geological Survey of India, Calcutta.
Survey of India Department, Calcutta.

The Indian Antiquary, Bombay.
The Orientalist, Kandy, Ceylon.—5.

(2.)—JAPAN.

University of Tokio.
Asiatic Society of Japan, Tokio.
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(3.)—JAVA.

Bataviaasche Genootschap van Kunsten en Wetenschappen, Batavia.
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(2.)—NEW ZEALAND.

New Zealand Institute, Wellington.—1.

(3.)—TASMANIA.

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

TORONTO,

BEING A CONTINUATION OF THE "CANADIAN JOURNAL" OF SCIENCE, LITERATURE AND HISTORY.

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TORONTO:

THE COPP, CLARK COMPANY, LIMITED,

1887.

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OF THE

CANADIAN INSTITUTE

1886–1887.

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☞ THE CANADIAN INSTITUTE is not responsible for the views expressed in the papers or abstracts of Papers published in its Proceedings.

PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1886–'87.

FIRST MEETING.

First Meeting, Saturday, 6th November, 1886, the President in the Chair.

The following donations were announced to Nov. 6th, 1886:

1. Dominion Church of England Temperance Journal, Vol. I, Nos. 1–7.
2. Report of the Second Hudson's Bay Expedition, Lieut. A. R. Gordon, R.N., with Charts.
3. Report on Canadian Archives for 1885, by Douglas Brymner, Archivist.
4. Annual Report of the Superintendent, Toronto Water Works, for 1885.
5. Report of the Entomologist, Canada, 1885, James Fletcher, F.R.S.C.
6. Phenomena of Suggestion in Hypnotic Sleep, &c., by Giuseppe Seppilli, translated by Dr. Workman.
7. The Origin of Languages, by Horatio Hale.
8. Algonkin Forest and Park, by A. Kirkwood, Esq.
9. The Educational System of Ontario, 1886.
10. Quaritch's Catalogues, Nos. 367, 368, 369.
11. Edinburgh Astronomical Observations, Vol. XV., 1877-86, Star Catalogue.
12. Bergens Museums Aarsberetning, for 1885.
13. Ward's Natural Science Bulletin, May 1, 1886.
14. Appleton's Literary Bulletin, Nos. 45, 46, 48.
15. Report of Third International Geographical Congress, Venice, 1881, from G. M. Wheeler, Capt. Engineers, U. S. Army (2 copies).
16. Bibliotheca Americana, for 1886, from R. Clarke & Co., Cincinnati.
17. Powdered Anthracite and Gas Fuel, from the Lackawanna Institute.
18. Indiana Historical Society, Pamphlet No. 2.

The following summary of Exchanges since the last Annual Meeting, 1st May, 1886, was presented:—

Exchanges—America		251
"	Europe	601
"	Asia and Australasia	50
"	Africa	16
		918
Same period last year		617
	Increase	301

On motion by Mr. James Bain, seconded by Mr. J. Herbert Mason, it was resolved: "That this General Meeting authorize and empower the Council to mortgage the land and premises of the Canadian Institute, situate at the corner of Richmond and Berti Streets, Toronto, for a sum not exceeding $1,000, upon such terms and conditions as to time or times of payment and rate of interest as to the Council shall seem expedient, the sum so raised to be expended by the Council in fitting up the upper story as a Museum, and in necessary additions for the use of the Institute."

On motion by Mr. J. H. Pearce, seconded by Mr. J. C. Dunlop, it was resolved: "That the President, Hon. G. W. Allan, Dr. Ellis, Prof. Wilson, Prof. R. Ramsay Wright, J. Herbert Mason, the Secretary, the Treasurer, and the mover, be a Committee for the purpose of devising ways and means for raising funds to complete the building, to report at a future meeting."

ANNUAL CONVERSAZIONE.

A Conversazione was held in the Library on the evening of Friday, 12th November, 1886, when the President, W. H. VanderSmissen, M.A., read his Inaugural Address.

After returning thanks for his election, and referring to some of his distinguished predecessors, such as Sir Wm. Logan, Gen. Sir Henry Lefroy, Rev. Dr. McCaul, and Dr. Daniel Wilson, the Address continued as follows:—

THE PRESIDENT'S ADDRESS.

The aims and object of the Canadian Institute are succinctly defined in our Constitution as "The Promotion of Pure and Applied

Science." Let us then enquire, first, why science should be promoted at all, and secondly, whether and how this Institute has been and is promoting it, and how its activity in this matter may and ought to be extended in the future. It should not be necessary, at this advanced date, and in this city, which is fond of boasting of its enlightenment and intellectuality, to defend the claims of science to public sympathy and support, but unfortunately the history of the Institute and its struggles abundantly shows this necessity. Yet nothing is more plain than that science is the greatest promoter of the material well-being, at least, of the human race. Without it no bridges can be built, no public works carried on, no increased facilities for traffic or intercommunication are possible. The musical instrument maker cannot dispense with the labours of the adept in the science of sound, which is itself founded on pure mathematical laws; the public health is directly dependent on the aid of chemistry and biology.

The application of science to practical results is, of course, impossible without pure science. Pure science is the foundation of applied science; and if the former be not properly fostered the latter will infallibly languish.

But pure science, if we except the mathematics, which rest on self-evident truths, is built upon experiment and investigation. Wherever science is cultivated, she has an army of indefatigable investigators in every portion of her wide domain, engaged in laborious and minute researches into the various manifestations and phenomena of nature in her various forms.

Investigation, however, is not in itself sufficient. Laborious Wagners may go on forever adding to the heap of our knowledge, and may catalogue them and lay them out, as Goethe said of the scientific men of his youth, in different lots and parcels, giving to each a name; the world is but little richer for such knowledge as this. This is but *knowledge*; to make it *science*, the dead bones of the heap must be clothed with living flesh and breathed upon by a life-giving spirit. The investigator, indispensable though his labours be, must be followed by the philosopher. The highest type of the scientific man must have the qualities of the poet, the maker, the creator—the very noblest powers of the intellect. What Shakespeare, Dante, Goethe are in literature, he must be in science.

Of him we may say what Goethe says of the poet, that

> When nature winds her endless threads along
> The spindles, heedless how they cross or tangle,
> When all created things, a jarring throng,
> In chaos intermingling, clash and jangle,
> He parts them till each living fibre takes
> Its ordered place, and moves in rhythmic time,
> And in the general consecration makes
> Each unit swell the symphony sublime.

He reveals to us the macrocosm, and shows us :

> How all things live and work, and, ever blending,
> Weave one vast whole from Being's ample range,
> How powers celestial, rising and descending,
> Their golden pitchers ceaseless interchange,
> Their flight on rapture-breathing pinions winging,
> From heaven to earth their genial influence bringing,
> Through the wide sphere their chimes melodious ringing.

Like the archangels, he

> On the floating forms of earth and sky
> Stamps the fair type of thought that cannot die.

* * * * * *

Assuming then that the promotion of science, both pure and applied, is a desirable object, I shall now endeavour to show that this Institute has faithfully pursued this object in the past, and is still pursuing it in the present. With a view to investigating the question of our past activity, I have taken the trouble of examining the published "Proceedings of the Institute," from their inception in 1852, and I find that in both branches of science, in the field of the patient investigation and accumulation of facts, as well as in that of philosophical deduction and induction, the Institute, in its Journal, has a high record. Here are to be found investigations, more especially into the geology of our own country, in the labours of Sir Wm. Logan and Professor Chapman, into its archæology and philology by Prof. Wilson, Sir J. H. Lefroy, Rev. Charles Dade and others, including two native Indians, Francis Assiginack, who described the language and customs of the Ottawas, and Oronhyatekha, who treated of his own Mohawk language; in mathematical and physical science we have the brilliant papers of Professors Young and Loudon, which have attracted considerable attention ; in the domain of classical archæology, Dr, McCaul contributed those remarkable interpretations of Britanno-Roman inscriptions which, even before their publication as a separate work, gained for him the position of the first English scholar in classical epigraphy.

* * * * * *

The chief use of the Journal has been to disseminate the views and investigations of our members by means of exchange among the members of the various learned societies of the world. The societies with which we are thus connected extend over the whole civilized world, including not only every country in Europe, but India, Japan, Australasia, and South and Central as well as North America. Publication in our "Proceedings" ensures a hearing for the author of a paper wherever scientific men are gathered together; and the Institute may therefore claim that it has in the past fulfilled honourably, with small means at its command, its pretensions to be an institution for "the promotion of pure and applied science," as far, at least, as dissemination of knowledge is concerned. Nor has the Canadian Institute ever been narrowly local, or shown any jealousy of kindred institutions in other parts of the country. It has, on the contrary, more than once extended a helping hand to its weaker or younger sisters, and has encouraged individual workers in all parts of Canada to come forward with the results of their investigations. Thus, in the columns of the *Canadian Journal*, there were published in 1855 the proceedings of the Quebec Literary and Historical Society and of the Montreal Natural History Society, though both were older societies than our own, the former established in 1834, the latter as early as 1827, or more than twenty years before the first inception of the Institute. Again, in the volumes of the Journal throughout will be found papers contributed from all parts of Ontario, as well as from the neighbouring province. So far as the promotion of pure science, then, is concerned, it may safely be asserted that the Institute has done its fair share. How stands the matter with regard to applied science, the handmaid through whom pure science confers her most immediate benefits on mankind?

A further enquiry into the past history of the Institute will show, as to this point, that the members, individually and collectively, have constantly been alive to all questions of public moment, whether affecting this country as a whole, or only the city in which the Institute is situated; and this most effectually in two ways, viz., (1) by the reading, discussion and subsequent publication of various memoirs or papers, and (2) by memorials presented to the Government of the province, or provinces, in support of various public institutions of a scientific character.

I.—PAPERS.

In the very first volume of the *Canadian Journal* will be found a series of able articles, copiously illustrated, on that most practical of subjects, the harbour of Toronto, by Mr. Sandford Fleming, Mr. Kivas Tully, and others. In the same volume is a paper on Toronto's water supply, a subject which has constantly engaged the attention of the Institute, and still continues to do so. Certainly no subject is of more direct importance to our fellow-citizens than this, and I am persuaded that the publication in the daily press of papers read before this Institute from time to time on this subject has been of great advantage to the civic authorities in deciding upon this vexed question, as well as on that of the disposal of our sewage. I believe that even more can and will be done in this direction, to the great benefit of the public. Continuing the examination of our past work, I find in Vol. I. again Mr. Kivas Tully suggesting plans for the improvement of our Esplanade, and Prof. Cherriman advocating, as early as 1853, the adoption of the decimal currency; in Vol. II. there appears the first geological map of Upper Canada, by Mr. (afterwards Sir) Wm. Logan, our first president; and Dr. Cottle gives an account of Canadian silk-producing moths—a subject to which the present chairman of our Biological Section, Dr. Brodie, has devoted further unwearied and valuable investigation.

In the third volume, 1855, I again find a practical paper by Dr. Bovell on the best modes of dealing with the terrible scourge of cholera, the first of a series of communications on public health which have been presented to the Institute from time to time, concluding, for the present, with the contributions of Drs. Oldright, Bryce, and Ellis. In the year 1870 a member of this Institute, Mr. Andrew Elvins, anticipated by at least two years the labours of other astronomers and meteorologists in investigating the connection of sunspots with rainfalls, as well as with other meteorological elements, and the result of his investigations seemed to hold forth some prospect of establishing such a connection between these natural phenomena as should ultimately enable the meteorologist to predict for some time beforehand extraordinarily wet or dry years with some approach to certainty. The great practical benefit of such a prediction to a country so much interested in agriculture as our own will be plain to everybody; and I call attention here to the fact of Mr. Elvins's right of priority, because it has not been properly acknowledged in all quarters. In one quarter only has such acknowledgment been made, viz.: in Prof. S. F. Baird's "Annual Record of Science and Industry" for 1871. That Miss Clerke, in her lately published "History of Astronomy," should have overlooked this matter is, perhaps, not altogether surprising; but that Prof. Norman Lockyer, whom Mr. Elvins kept constantly informed as to his investigations, should have entirely ignored his claims to priority, and have given all the honours to Mr. Meldrum, of Mauritius, is, to say the least, unpleasantly remarkable. The fact that, for some reason unknown to myself, Mr. Elvins's results were never published in the *Canadian Journal*, has no doubt been the principal cause of this want of acknowledgment. Ill-health has for many years suspended Mr. Elvins's labours, but I am glad to say that, this cause being for the present happily removed, we may look for further valuable results from their resumption.

II.—MEMORIALS.

The selections I have just presented from the subjects of Papers read before this Institute abundantly prove that the members have always been in the habit of doing a good deal of pretty hard thinking on subjects of the most practical kind, and so contributing to the solution of problems of the greatest interest to the public; and a consideration of the number and nature of Memorials presented to the Canadian and Provincial Governments by the Institute from time to time will show that they were men of action as well as of thought, who were wide enough awake to give effect to their ideas, since we find that, in every instance but one, the memorials were successful. In the decade from 1853 to 1863 alone I find no less than five of these successful memorials recorded in our "Proceedings," as follows:

1. Up to the year 1853 the magnetic observing station at Toronto had been carried on at the expense of the Imperial Government, and under the direction of officers of the Royal Artillery. In this year, however, the observatory was about to be discontinued. Capt. (now

Gen. Sir Henry) Lefroy, at the time president of the Institute, was recalled, and the removal of the instruments had, I believe, already been begun, when the Council of the Canadian Institute came forward and represented to the Canadian Government the great loss which the country would sustain by the discontinuance of this long established observing station, urging its retention as a provincial institution, the purchase of such instruments as had not already been removed and of additional apparatus, and the extension of the station for meteorological purposes. All this was acceded to by the Government of the day, and the outgrowth of it is our present efficient Observatory in the Queen's Park.

2. In 1856, when the discontinuance of the Geological survey was contemplated, the Institute again memorialized the Government for its continuance as a permanent organization, and again its advice was not only listened to with respect, but followed in full.

3. In the following year, 1857, Professor Kingston presented before the Institute a scheme for utilizing the telegraph system of the country for the foretelling of storms, which was the foreshadowing of the present signal service. The Institute gave instant adhesion and support to his scheme by urging its adoption upon the Government, and it was adopted. With its present working and value every reader of the morning papers is familiar.

4. In the same year the Institute, with the same success, urged upon the Government the establishment of the Astronomical Observatory at Quebec, thus showing that it was truly Canadian, and watchful of the interests of science in every part of the country.

5. Early in the year 1862, the Institute urged upon the Government a proper representation of Canada at the Great Exhibition of that year, and again with success.

6. The recent memoirs of Mr. Sandford Fleming on the adoption of a system of uniform time were not merely allowed to repose in the receptacle of the Journal, but the Institute took immediate steps to bring this matter, through the medium of our then Governor-General, the Marquis of Lorne, and the Canadian and Imperial authorities, before the notice of the various Governments of Europe and America, and the principal learned societies in those countries. The practical value and importance of Mr. Fleming's suggestions were at once recognized in many quarters. Thus, in Spain, the officer who had

been delegated by the Government to devise some system of uniform time for the purposes of navigation presented a translation of this memoir as a complete solution of the difficulty. On this continent the adoption by American railway systems of the standard time belts, with the practical convenience of which every traveller is familiar, is largely the result of these papers, and I feel that we may with confidence look forward to the ultimate adoption ere long of the greater scheme of uniform time for the world.

7. In the course of last year a deputation, appointed by our Council, waited upon the Government of Ontario, and urged upon them the desirability of protecting such monuments of prehistoric times as are still to be found within the provincial boundaries, as, for instance, the mounds on Rainy River and others, and of encouraging and assisting in the collection and preservation of the fast vanishing relics of the Red Man. I cannot say of this application, as I did of the others, that it has as yet borne fruit; but let us hope that the next President may be able to record its complete success.

I trust that the foregoing sketch of the past history of the Institute will have sufficiently established its claim to have done good work for the promotion of pure and applied science, as well as the direct and indirect benefits conferred on the public by this work. I come next to the question of our present condition, and in the first place let me say that there is great reason for congratulation. The attendance at the meetings and the interest taken in the various subjects under discussion show a considerable and steady progress. The number and character of the papers read during the last session are highly satisfactory, and the prospects for the ensuing session very encouraging. Even at this early date the number of papers promised will more than fill every evening, and it may be confidently affirmed that our published "Proceedings" will be more varied in range of subjects, and perhaps more thorough in character, than ever before. The accession of new blood by the incorporation of the Natural History Society has already produced greater activity and enthusiasm in our institution. The creation of the new class of associates, consisting of young men, for the most part earning their daily bread in mechanical and commercial pursuits, is another pleasing feature which cannot fail to be of benefit to the youth of this city. The membership, though not largely increased, at least yields a larger income in proportion to its apparent extent than was the case in former years. The balance sheet has at the first glance a pleasant look, since income and expenditure are duly equalized, and our assets are greatly in excess of our liabilities. But let us enquire more closely into the last item. Has our expenditure been what it ought to have been, so as to promote to the limit of our obligations the interests of pure and applied science? It is true that our financial condition is better than it was five or six years ago; but is it as good as it can and ought to be made? In order to answer this question, let us recur again to the means by which a scientific institution ought to promote the cause of science, and inquire whether in any department we have been cramped so as to impair our efficiency. These means of aiding science may be arranged under four heads, viz.:—1. The Published "Proceedings;" 2. The Library; 3. The Museum; 4. Public Lectures. Let us consider each of these items by itself:

I.—THE PROCEEDINGS.

The expenditure on this item forms a very large proportion of our total outlay, but it will have to be much larger in the future, if our deliberations are to be of any value, either to the world at large or to the investigators who contribute papers. I have dwelt above on a case in which priority of investigation on the part of one of our members has been ignored through failure of publication in the Journal, and it will be plain to everyone that no observer will care to contribute to a society which allows a year or more to elapse before the results of his investigations are sent forth to the world. Publication, however, is a costly thing, especially prompt publication; the cost will increase with the number and importance of our communications, and the Government grant to the institution for this purpose is even now no longer equal to what ought to be our expenditure.

II.—THE LIBRARY.

The Council has long since wisely abandoned the attempt to create a scientific library by the purchase of works as they are issued from the press, and our present efforts are confined to the incorporation in the library of the transactions of scientific societies which we receive in exchange for our "Proceedings." These, regularly bound, form a consulting library in every branch of science of inestimable value to the student; but the large increase in the number of our exchanges, to which I have called attention above, renders the cost of binding much heavier than before, and is a new and heavy drain upon our limited resources.

III.—THE MUSEUM.

The educational value of public museums is so evident that I need not enlarge upon it. In the past history of the Institute many valuable and interesting specimens have been presented to its museum, both biological and archæological, but a great portion has disappeared, simply because we have been too poor to house them. At the present juncture there are awaiting us renewed gifts of very great value, which may be lost to the Institute and public for the same reason, unless vigorous measures are at once adopted. Some provision we have already made in this direction, and some further provision can be made without seriously increasing the load of our obligations. But if our museum is to be one worth visiting, it should have an income independent of that derived from members' fees. The mere collection of specimens, I may add, does not fulfil all the needs of a good biological museum. It should be supplemented by the purchase of a microscope of the best pattern and highest powers. Such an instrument, available to public use, is not to be found in the city of Toronto; yet it is indispensable for the purposes of applied biology and chemistry, for the proper examination of organic bodies, and for the study of disease germs. The cost of such a microscope is about $500. I am happy to be able to state that, through the efforts of Mr. J. H. Pearce, one of our most active members, the sum of $60 for this object has already been collected.

IV.—PUBLIC LECTURES.

The inestimable value of free courses of public lectures, particularly to young men engaged in winning their bread by laborious toil, hardly needs a word of comment. Why should we not have such courses in Toronto as the Somerville lectures, for instance, at Montreal, held in connection with the Montreal Natural History Society? The Canadian Institute would be only too glad to provide this kind of public instruction. But again the answer is: "No funds!" Omitting the cost of publication, which we may fairly expect to defray from our present resources, our needs may be summed up as follows:—

1. The finishing of the library, and increased income for necessary expenses of binding, &c., connected therewith.

2. The fitting up of a museum, and a sufficient annual income to allow of the continuous purchase of specimens. The former we can accomplish, for present needs only, by fitting up the third storey at a cost of about $1,000 ; but it is highly desirable that we should be able to build an addition in the rear, where the museum would be less cramped and more accessible. For its proper maintenance we require an additional income of at least $500 per annum.

3. The endowment of courses of public lectures, and the building of a large lecture-room, fitted up with the proper apparatus. The sum required for this will be large : the proposed lecture hall would cost from $4,000 to $5,000, and a considerable annual expenditure would be necessary.

I think it will be evident from what I have just said that we are still, in spite of the improvement in our financial condition, much cramped in our promotion of science from want of adequate means.

The remainder of the address was taken up with suggestions, (1) as to possible sources of increased revenue in the future, (2) as to the extension of the influence of the Canadian Institute by the formation of branch societies in other parts of the province, and the affiliation of the various scientific associations among the students of University College.

SECOND MEETING.

Second Meeting, Saturday, 13th November, 1886, the President in the Chair.

Exchanges since last meeting, 42.

The following donations of Eskimo implements, dresses, and other objects of interest from Prince of Wales' Sound, by F. F. Payne, Esq., were announced :

1 Cannon found on the shore of Prince of Wales' Sound.
2 Model Kayaks.
1 Stone Lamp.
1 Stone Kettle.
1 Woman's Dress.
2 Men's Coats.

1 Boy's Coat.
1 Pair of Trunk-hose.
1 Arctic Fox Skin.
1 Coil of Rope.
2 Pairs of Boots.
1 Duck Spear.
2 Whalebone Duck Traps.
1 Snow Shovel.
1 Pair of Snow Goggles.
1 Pair of Deerskin Mitts.
1 Eskimo Snow Knife, used in building houses.
1 Snow Duster, a stick carried by women to knock the snow off men's dresses.
1 Ivory Set of Eskimo Dominos.
1 Powder Measure, 1 Harpseal Skin, 2 Thimbles, and some small ornaments.

By Lieut. A. R. Gordon, R. N.:

A Sleeping Bag from Hudson's Bay.

By H. S. Howell, Galt:

A large Photograph of the keys of the Bastille, Paris.

By Prof. R. Ramsay Wright:

A Lamp.

By the President:

A Reading Desk.

Moved by Mr. Shutt, seconded by Mr. Elvins, and carried: That the thanks of the Institute be tendered to Messrs. Payne, Gordon, and the other donors for their valuable gifts to the Institute.

The following were elected members:—C. F. Durand, B.A., I. E. Martin, B. A., F. F. Payne, E. J. Kendall, G. B. Abrey, C. E., Benjamin Bayliss, jun., J. Robinson, M. D., Rev. Prof. Ferguson, William Burns, B.A., C. Fessenden, B.A., Horatio Hale, H. S. Howell, Prof. J. Hoyes Panton, Rev. John McLean, B.A., John Seath, B.A., Hugh Neilson, J. T. B. Ives, F. G. S.

Moved by Dr. Kennedy, seconded by Mr. Alan Macdougall, and carried: That a vote of thanks be tendered to the President for his interesting and instructive inaugural address delivered last night at the Conversazione, and that that part of the address containing suggestions for new sources of income be referred to the Committee on Ways and Means appointed at the last meeting, and that the other suggestions of said address be referred to the Council.

Mr. W. F. W. Creelman, B.A., read a paper on "The Relations between Physiology and Psychology," of which the following is an abstract :--

The object of this paper is not the inculcation of any new theory, or of any definite theory, with regard to the relation that might be supposed to exist between what are ordinarily called Mind and Body, but rather a brief explanation of the course Philosophy has taken of late in the investigation of that relation, or of the general question as to whether any such relation in reality exists.

The question, from the point of view from which it is here considered, may be said to have recently arisen. Its importance was indeed recognized by the astute and polymathic Aristotle; but his investigations were crude, and neither they nor those of the thinkers and investigators of many succeeding centuries throw any light upon the problem as it is now understood in England, Scotland, France, Germany and America.

The advance in the study of the relation between Mind and Body has been one from abstract to concrete; from a study of the two sets of faculties (if we may so speak), commonly called mental and physical, as if those two sets of faculties were entirely independent, and should be treated as independent, to a study of them as exhibiting dependent, connected construction, and as throwing light upon one another mutually.

The four various theories which have been held with regard to the relation between the sciences which deal with the phenomena of Mind and Body respectively are set out in a work on "Mind and Body," by Prof. Alex. Bain, whose whole philosophy may be said to be the elaboration of a fifth position, that "a knowledge of the bodily workings has already improved our knowledge of the mental workings, and as the researches are further continued, will do so more and more."

That there is some mutual co-operation between the two natures—mental and physical—can now be assumed without argument. How intimate is the mutuality found to be ?

It must be remembered that the brain is not the only substance having connection with mental functions. The entire bodily system shows such connection, though "in varying degrees."

The proof derived from the facts showing the completeness of the connection between the two natures is overwhelming. Bodily changes affect mental states; the condition of the stomach, the brain, or the nervous system shows its effects in the mental tone or condition, and affects not only the sensational part of man, but also the emotional, the moral and the æsthetic. And mental changes in their turn react upon the whole bodily organism; sorrow and fear show their effect no less upon the nervous system than upon digestion.

How readily do our emotions express themselves! And how close is the connection between them and their expression! Darwin tells us that they are so closely connected with their expression, that they hardly exist if the body remain passive.

And does not the capacity for thought, the rapidity or sluggishness of thought, depend upon both the quantity and the quality of the blood supplied to the brain? And does there not here display itself the dependence of our higher life upon the healthy tone of the stomach, and of the purifying and other organs connected with it?

Lengthened reference cannot now be made to the light thrown upon this question by investigations into disease and lunacy. Physicians now deal with Mind and Body as a practical unity. They are, avowedly or not, materialists.

The Mind is ordinarily dealt with as having a three-fold aspect—Feeling, Will and Thought—the mental trinity in unity. A separate consideration of these shows clearly their dependence upon bodily conditions and organisms.

The direct dependence of Feeling, and of feeling in its variations, upon bodily conditions and changes, need not be considered; only through the bodily medium can it be conceived as possible.

With regard to the Will, whatever may be our accepted theory with regard to the growth of volition, it is incontestable that the development, and manifestation, and direction of will, are all dependent upon bodily stimulus, acting through the nerves and nerve centres, and thence outwardly upon the organs which the will may be said to use as its instruments.

Coming to the Intellect, we find it manifesting itself in various modes, called memory, imagination, reason, etc. Might it not appear that here at least we have risen above the physical encumbrances which surround the lower manifestations? Let us briefly examine two of what the Scottish philosophers would call "faculties," and see how far memory and imagination are independent of bodily conditions and changes. The philosophers referred to treated these mental states as God-given faculties, independent altogether of bodily influence. This was the only consistent position open to them. But their theory is now but seldom heard of, except through the still small voice of Dr. McCosh, of Princeton?

What we are concerned with here is not an analysis of Memory in the abstract, but the pointing out what may be said to be an incontrovertible fact, that the commencement of acquisition, the rules of acquisition, and the use of acquisition and recollection, are all directly, if not entirely, dependent on bodily states and organisms. The content of memory is but those impressions and feelings whose existence is dependent upon nervous action, and but represents the great mass of our nervous growths and nervous combinations. When a feeling or impression is renewed, what is its seat? Beyond a doubt, the renewed feeling occupies the very same parts, and in the very same manner, as the original feeling, and no other parts, and in no other manner, that can be assigned. The seat of the memory of an impression is the seat of that impression in its origin. Thus the persistent memory of a bright color fatigues the nerves of sight. There is no one seat of memory; but each memory has its own seat, appropriate to its character. Indeed, as has been said, there is no such thing as memory, but only memories. "Every tract of nerve tissue is its own autobiographer." Memory is not, as the vague phrase of common speech has it, "in the soul"; it is fixed in its birthplace, in the nervous system. Ribot may, after all, be right in saying that a well-stored memory is but a collection of impressions and of an assemblage of "dynamic associations," very stable and very readily called forth.

The pathology of memory is interesting here, mainly as shewing how subject is memory to the fundamental conditions of life, and to the varying condition of the bodily organism. Reference may be made to the many examples given by Ribot; one of the most curious of which, in this connection, is that of a Frenchman, living in

England, who spoke English fluently, but who, receiving a blow on the head, during his illness was able to answer questions only in French.

So with Imagination. We find that imagination differs from sensation in little but the recalling of past impressions, either in the same order, or in a different order, from that in which they appeared when actually present to the senses; so that with regard to the imagination it is not necessary to recapitulate the reasons indicated for the conviction that the pictures recalled depend as much upon action of the nerves and other bodily functions, as do the contents of the faculty, so called, of memory.

The moral sphere cannot be here considered at length. But this statement may be advisedly made, that the constituents of our moral being depend almost entirely upon our bodily organism. One instance only will be given of the influence of bodily changes upon the moral character and conduct of an individual. It is that of an officer in the United States army, who during the late war was noted for his dash and bravery in many battles, but who, being once knocked down by the concussion produced by a cannon ball, became from that hour as noted for cowardice as he had formerly been for bravery, and could never again be induced to go into a battle, or to resume his military career.

The question under consideration has assumed increased importance in connection with the comparatively-new, but firmly-established doctrine of Heredity. This doctrine assumes the fact of the transmission from generation to generation of both mental and physical tendencies, and of these in conjunction with, and dependent upon, one another, handed down through a progressive development of the nervous system. To understand the possibility of improvement from age to age, we must understand, in its "subtle materialism," this principle which makes transmission possible, this principle which plays upon the nerves of men, and makes them its instrument for the storing-up of power for future use, accumulation and development. It is this which makes possible the growth of civilization from age to age, which explains that element of good or evil in man, which no surroundings, no education, can entirely eradicate or overcome. It is thus that the sins of the fathers are visited upon the children unto the third and fourth, and many generations, and thus that the doctrine of "original sin" acquires an intelligible interpretation.

A brief reference may be made to the phenomena of dreams, which have presented so puzzling a problem to thinkers of former times. Of all the absurd hypotheses framed for the explanation of subtle mental processes, none were more absurd than those framed to explain the phenomena of dreams. More light has been thrown upon them by the principle of the universal connection of the bodily organs with mental workings than by all previous theories together. In fact, without it dreams are unintelligible. Every person is familiar, in his own experience, with the stirring-up of imaginary pictures during sleep, connected with various parts of the body, and caused by disease, irritation or injury in the part interested. If the material of memory and imagination is given by bodily movement and modification, why not also that of dreams, which differs only in arrangement? If, during sleep, the falling of a poker, the rolling out of bed, the flicker of a candle before the eyelids, the sound of a voice, the smell of sulphur, or the taste of acid in the mouth, can call up, as they undoubtedly do, all sorts of clear or obscure images and scenes, why may not the whole of those images and scenes be connected with bodily organism? If sensation and nervous affection, irritation and combination, can cause so much of the content of dreams, why not all? Why seek a supernatural cause to explain what is capable of explanation by natural laws?

A few words may be allowed upon the practical importance which this question, rightly understood, assumes.

We have seen the importance of a due consideration of the relation now dealt with, in the study of medicine, and particularly in the study of lunacy. In these, rapid advance has resulted from a reversal of method, and the study of body and mind hand in hand. Hence, too, the light which has been thrown upon the question as to what has been called "moral insanity," and the wider question as to Responsibility for Crime.

We see, too, the influence of a correct theory, in this direction, upon Education. As the possibility of all education is based upon the existence of the power which the nervous system possesses of organizing conscious actions into more or less unconscious reflex operations, we see, in view of what has been said as to the influence upon the ability to acquisition, of the healthy state of the nervous system, of blood circulation, and of nutrition, how important is equal attention, in education, to health and strength of body and mind.

And we can appreciate more and more, from the position of a correct understanding of this relation, the influence upon health, that is, upon mental and bodily strength, of scientific sanitation, and, what may not be so manifest, its influence upon morality. The London Commissioners pointed out, a few years ago, that the tendency in the lower parts of London to gin-drinking was owing mainly to the depression of the physical system caused by impure atmosphere. The teaching and practice of temperance philanthropy are not yet sufficiently scientific.

Nothing could be of greater importance to the practical purposes of life than a just apprehension of the influence which the body exercises over the conceptions of the mind. *Orandum est ut it mens sana in corpore sano.* Happiness is the chief good of man. And the highest happiness has as its most necessary condition such a state of physical and mental health as will allow a free field for the exercise of the highest powers which we possess.

* * * * * * *

No theory is here given as to the exact relation that exists between Mind and Body. What it has been attempted to urge and illustrate is, that the mind and body can only be thoroughly understood when studied together, as correlatives or complements, and that Psychology and Physiology can only surely advance when they advance hand in hand.

There is not room here to trace the history of the growth of the recognition of some connection between mind and body, however variously dealt with and explained, from its first crude acknowledgment down to the later developments, which have been in the direction of materialism, though a modified materialism, somewhat short of the position which one writer says is the prevailing one, that mind and matter, the two sets of properties, are but one substance with two sides—a double-faced unity.

Materialism came as a reaction wherever it appeared. And reactions run to extremes. Locke's doubt as to the materiality of the soul, while it woke Kant from his "dogmatic slumber," and thus produced the most profound system of philosophy yet elaborated, on the other hand drove Hume to speak of "that little purturbation of the brain which we call thought." In France, as a reaction, came, among many, La Mettrie, with his clever and vivacious work on "Man a Machine," in which an attempt was made to explain the workings of the human mind on principles similar to those involved in the mechanism of clock-work. And in Germany, where transcendentalism soared to its loftiest heights, materialism fell the lowest, so that Hartmann can calmly say that "Man is what he eats."

But these positions have been extremes. Between them there have been the many who recognize that materialism cannot be ignored, and that the mind and body must be studied together that either may be perfectly known. And where formerly the teaching of philosophy began with the abstract consideration of the mental "faculties," or powers, the basis is now laid in a knowledge of those physiological conditions which render all knowledge possible, and which furnish the material of all we know.

Some writer has well characterized the later tendencies in this direction in the statement, that while the problems which presented themselves to Hartley and Priestly, to Berkeley and Hume, are the same which present themselves to Bain and Calderwood, to Darwin and Spencer, yet they present themselves to the latter in the light of an advanced physiology.

The President, on behalf of Rev. John McLean, B.A., Fort McLeod, Alberta, N.W.T., read the following paper on

THE MORTUARY CUSTOMS OF THE BLACKFEET INDIANS.

The Blackfoot Confederacy comprises three tribes, Bloods, Piegans and Blackfeet proper. Though now separated by means of different reservations, their customs and language are the same, the latter having a few dialectic differences. By studying the mortuary customs of one tribe, we learn those belonging to the confederacy, but in order to secure uniformity, our studies must have reference to the time preceding the overpowering influences of the civilization of the white man.

Three modes of burial have been practised by these Indians: platform or tree burial, lodge or house mode, and underground.

In the tree mode of burial a large tree of suitable proportions and location is selected, and the body is placed in one of its crotches, safely lodged from the depredations of wild animals, the covering of the corpse protecting it from the ravages of carnivorous birds.

On the plains the platform method is adopted through scarcity of timber, and even when in the vicinity of the timber patches that line the rivers, many prefer platforms to trees, this preference arising, no doubt, from long usage.

The platform method consists of four posts firmly placed in the ground, at a sufficient distance from each other to make a suitable platform upon the top as a receptacle for the corpse. The posts are from eight to twelve feet high. The body being properly prepared for burial is laid on this platform, and beside it the prized treasures of the deceased, together with the gifts of friends.

When a chief or notable warrior dies, a lodge is placed on an eminence or secluded spot, and the influential leader of his people is honoured with this conspicuous style of burial. As the buffalo-skin lodges are no longer in existence, many of the people are erecting small log buildings over the remains of their relatives, and these are used indiscriminately for young and old, male and female. Since the advent of religious teachers, the underground mode of burial is being resorted to, and although this detracts from the fascinations of Indian life for the students of American antiquities, it is preferable for the advancement of the red race. Button Chief, a famous Blood Indian chief, although adhering strongly to the principles of Christianity, said to his friends before his death: "Bury me not in the ground like a white man, I am an Indian. Lay me down as an Indian warrior, and there let me rest."

As soon as a person dies, the females in attendance upon the relatives begin to wail bitterly, and such is the grief of the female portion of friends and relatives that it is very difficult to obtain the body for burial. One or two blankets spread on the ground form the Indian's bed, and just as the deceased lies there, is he prepared for burial. Having been properly arranged, two or three blankets are used as a covering, which, being strongly tied or sewn together, constitute the Indian's coffin. Within the past few years, wooden coffins are being used, although the majority of the people adhere to the Indian mode of arranging the body in death. Well do I remember when nothing but buffalo robes were used for this purpose, and buffalo-skin lodges were extensively employed for Indian burial. When all the arrangements are completed, the corpse is placed on a *travaille*, the mourners proceed to the grave without any order of procession, the men, women, and children groaning deeply on account of their sorrow. The near relatives cry aloud plaintively, the burden of their funeral wail being the calling upon the deceased by name to return to his home and friends.

In former years horses were killed at the graves of warriors, that their spirits might follow their masters to the hunting grounds beyond; now the religious conservative spirit must yield to poverty and other influences, and the mourners are contented with cutting a part of the hair from the forelock, mane and tail of the favourite horses, and depositing it in the grave. The female relations cut their hair short, lacerate their legs and cut off a finger. The female attendants take the bereaved females, place the hand on a block of wood, lay a knife upon the finger, and with one blow from a deer's horn scraper or other instrument sever it by the first joint. The front parts of both legs from the foot to the knee are then cut with a knife until the blood trickles down and covers the front parts of the legs. No bandages are put on these, nature evidently aiding when art is discarded. A small piece of wood is placed in the palm of the hand having the severed finger, and this serves to keep it in position, after which ashes are sprinkled upon it. Sometimes the relations will visit the homes of their friends, and amid their wailing will go around the lodge kissing the females who weep with them. For several weeks after the funeral, the women go out to the grave at sunset, and again at sunrise, and continue their wailing. Should any persons die while the Indians are travelling and be buried a long distance from home, in after years when passing the grave the female relations will spend some time mourning their loss. The Indians move their camp when anyone dies. After erecting log buildings they kept up this custom and tore down their houses, rebuilding them in some other part of the reserve. Living as they have done for some time in lodges, they still move their lodges when their friends die. This arises from their dread of spirits. This custom has decided physical benefits, as it secures pure air, mental relaxation and exercise. These mourning customs exhibit many pleasant traits of character, and though not at all inviting to persons of refinement, they are none the less interesting and worthy of study, if we would understand the social customs and native religion of these people. We learn something concerning the *native religious belief* of the Blackfeet from a proper study of their mortuary customs.

Their home of the spirits is the sand hills. A dying Indian will say: "*Nitakitupo sputsikwi*—I am going to die," literally "I am going to the sand hills;" and the bereaved will tell their friends: "*sputsikwi etupo*—He is gone to the sand hills." They believe in the communion of spirits with each other. Their *animistic* ideas are very crude. Spirits dwell in trees, rapids, peculiar stones, and many other strange things in nature. Dreams in which friends appear are the visits of the souls of the departed. These ideas are also transferred to the gifts of friends to the dead. In the grave are placed pieces of bread, meat, newspapers, relics of the deceased, furs, blankets, &c.

Several visits have I made to *dead lodges*, which revealed to me these ideas of object-souls. Entering a lodge that had been opened, I found the corpse lying as in life, wrapped in a buffalo robe. Beside the bed were placed a tin cup, pipe and tobacco, and some pieces of buffalo meat. There were also in the lodge a trunk for travelling with, bow and arrows, an old gun, and numerous Indian trinkets. Introducing this subject among the Indians, I asked why they placed those things for the dead. "For their use," they replied. "Yes, but I have gone months and years after they were placed there, and they still remained." "My friend, you do not understand the Indian's way of thinking. These are spirits, and they live on the souls of these things; we are material, and we live on the matter of these things. When one of our friends dies, we place our gifts beside his body; the spirit of our friend returns, and he brings with him his friends from the spirit-world, and there they feast together. They take with them the souls of these things for their use." The friends of the dead take their own clothes, finger rings, and ornaments and present them as gifts to the dead. In one grave I found buried a saddle, some excellent furs, and many trinkets. In others I have seen placed utensils of all descriptions, and the hair of prized animals. Remonstrating with them at different times for placing these things there and suffering in consequence themselves, they have replied to my question as to why they did not keep them: "What shall we do with them?" "Take them home." "We dare not, they are not ours, they are *his*, and we cannot steal from him."

They are very superstitious and are afraid of the dead. In crossing dangerous streams in a boat or vehicle of which they know little, they will sing or pray. Passing the graves of their friends they will do the same. Several times have the Indians entreated me not to go home in the darkness, lest the spirits should follow me. Generally the people are restrained by fear and reverence from molesting the treasures of the dead. The pious heathen touches not these things, being sacred to the spirits, and those who are sceptical and immoral are afraid of the consequences of such a daring deed. Seldom do we hear of graves being robbed by the Indians themselves. Many adhere rigidly to their native customs, and follow the traditions of their native religion, yet gradually, and almost imperceptibly, we can notice the change that is taking place. Already when studying American antiquities have we to refer to the past few years to obtain facts to illustrate any Indian subject we may wish to discuss. It is well that this is so, if we hope for the development of the red race. Yet it is our duty to study these things with enthusiasm, for the years are not far distant when the transformation of life will be such as to hinder the lovers of science from obtaining facts illustrative of native customs among the Indians.

THIRD MEETING.

Third Meeting, 20th November, 1886, the President in the Chair.

The Committee on Ways and Means reported, recommending that a canvass be made of the leading merchants and other citizens in this city for subscriptions at an early day, with the view of raising a sum of not less than $10,000, to defray the cost of the necessary additions to the present building, and for increasing the general efficiency and usefulness of the Institute, which report was, on motion by Mr. Pearce, seconded by Mr. Macdougall, received and adopted.

On motion by Mr. Pearce, seconded by Mr. Bain, it was resolved: That the Committee appointed on the 6th November be further empowered to devise ways and means for increasing the efficiency of the Institute, and have power to add to their number.

Donations since last meeting:

From Messrs. Maisonneuve Frères, Paris:

"Traditions Indiennes du Canada Nord-Ouest, par E. Petitot."

From H. S. Howell, Galt:

"Kennett's Antiquities of Rome."

Exchanges since last meeting, 22.

The following were elected members:—J. H. McKinnon, Charles A. Walton, W. T. Jennings, C.E.

W. Houston, M.A., read a paper on "The Scientific and Pedagogic claims of Sociology," of which the following is an abstract:

After defining the terms "Science" and "Scientific," he went on to describe the scope of the term "Sociology," including under it all that relates to the association of living beings together for mutual aid. The general principle of Sociology in this sense is coöperation, as that of Biology is the struggle for existence, and that of Cosmology is conservation of energy. This definition of Sociology would include coöperative associations of the lower animals, but it is convenient to limit the term to human society, and so limited it may be divided into (1) the Science of Civilization, (2) the Science of Government, (3) the Science of Law, (4) the Science of International Comity, (5) the Science of Material Prosperity, and (6) the Science of Language, or, in other words, into History, Politics, Jurisprudence, International Law, Political Economy and Philology. The claim of Sociology to scientific recognition rests partly on the nature of its subject-matter, its phenomena being amenable to scientific treatment; partly on the nature of the method to be employed—the inductive one; partly on the fact that its leading principles, like those of Cosmology and Biology, have been already ascertained and formulated; and partly on the further fact that it is progressive, new discoveries being made as rapidly in this as in any other field of knowledge. The researches in one branch alone, that of comparative politics, by such men as Maine, Morgan, Maclennan, Hearn and others have almost revolutionized, within the past quarter of a century, our views as to the origin and development of political institutions. The claim of Sociology to a prominent place in the curriculums of teaching institutions rests, in the first place, on its educative value as a means of culture. It brings the student into contact with some of the greatest minds of all ages; it furnishes as good a field as can be had in either Cosmology or Biology for the exercise of the observing and reasoning faculties; it gives breadth of view in matters relating to social life, and teaches toleration; and, lastly, it corrects the tendency alike to exaggerated optimism and to exaggerated pessimism. The pedagogic claim of Sociology rests, in the second place, on the practical character of the various subjects it comprises. Civilization is the result of sociological progress. Portions of its subject matter are such sociological conceptions as those connoted by the terms "family," "property," "juridical institutions," "religious institutions," "civic institutions," "international relations," "socialism," "individualism," "anarchism," "tribalism," "communism," &c. In view of the deep practical interest which the community has in these and other sociological topics, they should be dealt with pedagogically in every part of the State educational curriculum from the primary school to the university.

In answer to a question from Mr. Squair, Mr. Houston replied that the science of Sociology embraced the whole science of Law, as well as Philology and Archæology.

Mr. Kirkland asked if any general principle ran through the whole of the science.

Mr. Houston said the principle was that of coöperation for a common end, which he illustrated by examples taken from the division of labour in the production of manufactured articles.

The President remarked on the many advantages that Canada presented for the study of Sociology, as in the case of Indian languages and archæology. Many of these advantages were passing away. He advocated the necessity of a publication society, as well as other measures for the promotion of archæological research.

C. Fessenden, B.A., exhibited a new Planimeter, the joint invention of himself and Mr. Butler, C.E., and read the following paper :—

A NEW PLANIMETER.

Mechanical integrators are constructed on the assumption that if a wheel is moved over a smooth surface in the direction of its axis it will slide without revolving; if moved at right angles to its axis it will revolve without sliding, and if moved in any other direction it will both slide and revolve. For example, if it is moved a distance l in a direction making an angle O with its axis it will revolve through a distance $l \sin O$ and slide through a distance $l \cos O$.

If the wheel is perfectly turned and truly mounted this assumption is absolutely accurate; and, from experiments that have been made, it has been shown that it is possible to turn a wheel so perfectly and mount it so truly that this assumption shall be verified to within less than one-tenth of one per cent. However, even slight imperfections in the turning and mounting will lead to results far from accurate, and it is therefore of the utmost importance in the construction of instruments for mechanical integration to make the wheel as perfect as possible.

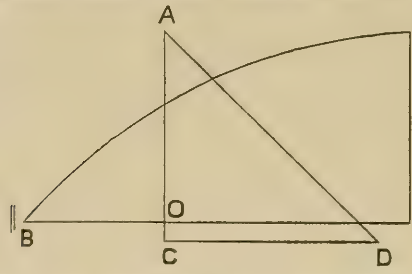
To make an instrument for integrating any quantity it is necessary and sufficient to so arrange its parts that while a tracing pointer is describing a diagram involving the independent dimensions of the quantity the wheel shall revolve through a distance which varies as this quantity.

In the case of areas and other quantities of two dimensions this has been accomplished in several ways, some exceedingly ingenious, notably so that of Prof. Amsler, whose planimeter is widely known

Lately a planimeter has been made from designs furnished by Mr. Butler, C.E., and the writer, on a plan, so far as I know, not hitherto adopted in any mechanical integrator. Moreover the same idea may be applied in constructing instruments for integrating quantities of more than two dimensions, such as volumes of embankments, moments of inertia, total pressure of water on irregular submerged surface not horizontal, and many others.

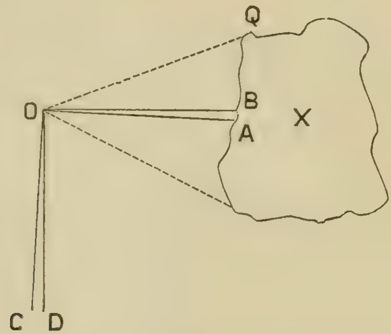
This planimeter is constructed as follows:—

A semi-parabola is arranged to slide on a right angled triangle, so that the axis of the parabola shall be always parallel to CD, one side of the triangle. A wheel is placed at B, the vertex of the parabola, with its axis in a line with that of the parabola. A tracing pointer is placed on CA, the other side of the triangle, on a slide so arranged that it shall always rest in contact with the curve. At O,



the intersection of CA with the axis of the parabola, is fixed an anchor pivot by which the triangle is anchored to the paper on which the area to be measured is plotted. The instrument is, when anchored, capable of revolving freely about O, while at the same time the parabola may be made to slide upon the triangle. By revolving the instrument and sliding the parabola the tracing pointer may be made to follow the boundary of any figure.

If the wheel is perfectly turned and mounted the sliding of the parabola will cause the wheel to slide without revolving, and the turning of the instrument about O will cause the wheel to revolve without sliding.



Let X be an area to be measured and let A and B be two positions of the tracing pointer very near together, and let C and D be the corresponding positions of the wheel. Let a be the circular measure of the angle BOA. We may suppose that the pointer is moved from A to B by revolving the instrument about O without sliding the parabola. Now while the pointer is moving from A to B the wheel revolves through the arc CD.

$$\text{Measure of sector BOA} = \tfrac{1}{2}\text{OA}^2 a.$$
$$\text{" \quad " arc CD} = \text{OD}a.$$

But from the properties of a parabola

$$\text{OB}^2 = b\text{OD}.$$

Therefore

$$\text{Measure of sector BOA} = \tfrac{1}{2}b\text{OD}a,$$

while

$$\text{Measure of arc CD} = \text{OD}a.$$

Hence the distance through which the wheel revolves while the pointer is tracing the arc AB varies as the area of the sector BOA, and by suitably graduating the wheel the area of the sector BOA is registered on the wheel.

The boundary of the figure X may be considered as made up of an infinite number of infinitely small arcs having the centre O and different radii. As each arc is traced the wheel registers the area of the corresponding sector, while a change of radius causes the wheel to slide without revolving. Hence, while the tracing pointer is describing the boundary of the figure from P to Q in the direction of the hands of a watch, the wheel registers the area of the figure contained by OP, OQ, and the part of the boundary of X passed over by the tracing pointer. As the tracing pointer goes on from Q to P, the wheel revolves in the opposite direction, registering the area of the figure contained by OP, OQ, and the part of the boundary of X meanwhile traced. It is therefore easy to see that when the tracing pointer has described the whole boundary of X just once, the wheel will indicate the area of X.

Mr. G. B. Abrey exhiibted one of Amsler's Planimeters and said that the introduction of the curve of the parabola was new so far as he was aware. Other curves could be introduced, and the principle extended indefinitely. He hoped to have an instrument made that would be a practical success. He explained the theory of another form of the instrument, simpler in practice, though more complex in theory.

Mr. Macdougall called attention to a Planimeter invented by Mr. John Say, of Kirkaldy, the leading feature of which was the employment of a cone, acting on an index-wheel from which is read off the area of any figure whose outline has been followed by the tracer of the instrument. When the cone was employed as a multiplier it was easy to fix upon the proper proportions, so that the number of revolutions of the index-wheel in relation to those of the moving wheels and of the cone, being always directly in proportion to its distance from the apex of the cone, the area of the figure would be indicated. No Planimeter, however, had been invented in which the errors arising in using the instrument had been entirely got rid of, such as the retardation of the index-wheel by the compound sliding and revolving motion in the back-action.

FOURTH MEETING.

Fourth Meeting, 27th November, 1886, the President in the Chair.

Exchanges since last meeting, 45.

F. Chamberlain, B.A., and George Andrew McKinnon, were elected members.

F. T. Shutt, M.A., F.C.S., read the following paper on

CANADIAN APATITE.

Amongst the economic minerals that enrich the Dominion of Canada, Apatite (commonly known as "Phosphate") holds a prominent position.

The vast deposits of this valuable mineral, which occur in various parts of Canada, are now, and have been during the last fifteen years, extensively worked, until now phosphate mining is recognized as standing in the front rank of our mining industries. The annual "out-put" steadily increases, for while in 1875 only 3,701 tons were exported, in 1884 nearly 25,000 tons were mined. These figures go to show that this industry is fast becoming one of great commercial importance, and, considering the value of "Superphosphate" as a fertilizer, one which demands the highest scientific treatment.

The name "Apatite," derived from the Greek verb *ἀπατάω*, I deceive, was first given from the great similarity which this mineral bears to many others, *e.g.*, pyroxene, beryl, etc., it having often been mistaken for these by mineralogists and miners.

Essentially, it is a tricalcic phosphate, its chemical composition being represented by the formula $3Ca_3(PO_4)_2CaF_2$. This formula shows the presence of calcium fluoride, which in our Canadian species amounts to about 7%. In many European species this is replaced by a somewhat larger percentage of calcium chloride. This fact makes our apatite the richer in phosphoric acid of the two, as the following figures will show :—

Canadian fluor-apatite....... $3Ca_3(PO_4)_2CaF_2 \left\{ \begin{array}{ll} Ca_3(PO_4)_2 \ldots\ldots & 92.26\ \% \\ CaF_2 \qquad \ldots\ldots & 7.74 \end{array} \right.$

European chlor-apatite.... $3Ca_3(PO_4)CaCl_2 \left\{ \begin{array}{ll} Ca_3(PO_4)_2 \ldots\ldots & 89.32 \\ CaCl_2 \qquad \ldots\ldots & 10.68 \end{array} \right.$

These percentages have been calculated from the molecular formulæ.

We find, however, that a small amount of the calcium fluoride is as a rule replaced by calcium chloride, and that the percentage of tricalcic phosphate is lowered by the presence of calcium carbonate to an extent of from .05 to 5%, apparently present in thin laminæ in the cleavage planes.

The analysis of a specimen from the Templeton district, of a fair average quality, shows it to have the following composition :—

Tricalcic phosphate..................................	89.85
Calcic fluoride.....	7.90
Calcic chloride.........................	.37
Calcic carbonate.....	.49
Insoluble residue..................................	.05

Note.—The difference, 1.34%, may be partly accounted for by the presence of moisture, and partly by the presence of small quantities of alumina and magnesia not estimated in this case.

The rocks in which this mineral occurs belong to the Laurentian period. They cover a vast area both in Ontario and Quebec, overlying a district in the northern portions of these Provinces from Labrador to the Arctic Ocean, and stretching down to the St. Lawrence between Kingston and Brockville. For the most part this district is exceedingly wild and rugged, often densely wooded, though in many places overlaid by rocks of the Palæozoic Age and by glacial and post-glacial deposits, where agriculture to a greater or less extent may be pursued. The origin of these rocks (the Laurentian) is still veiled in mystery, though it is generally conceded to have been a metamorphic one. Deposited in prepalæozoic seas, in similar manner to the later stratified rocks, they are supposed to have been subjected to the agencies of subterranean heat and vapour at high pressure, and of eruptive overflows. By such treatment they have become so metamorphosed that their stratification and chemical composition alone point to their sedimentary origin and character. They are highly crystalline and often much folded and contorted, and consist of quartzite, gneiss, pyroxene and other related silicious rocks. Traversing these, however, are to be found strata or bands of crystalline limestone and dolomite—the limestone often highly coloured—together with beds of many economic minerals. These latter consist principally of iron ores, graphite and apatite. It is always in connection with these bands of limestone that the phosphate is found, and therefore they have acquired the name of the "Phosphate-bearing Rocks."

These are especially rich in the townships of Templeton, Hull, Buckingham and Wakefield (Ottawa Co.), Quebec, and North Burgess, Elmsley and adjoining townships in Ontario. These two districts are most probably, geologically speaking, one—the characteristics presented by one being recognizable in the other for the greater part. In the former district the rivers Gatineau, La Blanche and Aux Lièvres run, and in their valleys the largest deposits lie. By a reference to a map of Ottawa County it will be seen that the La Blanche at a distance of some ten miles from the Ottawa River widens into Lake McGregor, and proceeding northward we find a succession of narrowings and widenings—so typical of many of our rivers—forming a chain of connected lakes till we reach the northern boundary of Wakefield. This district is especially rich in phosphate, as is the district between the La Blanche and Aux Lièvres, where the Dominion Mining Co. and the Montreal Mining Co. have made extensive operations.

The origin of apatite is as debatable ground as that of the rocks in which it occurs. Many are fond of ascribing to phosphate an organic source and seem to see a necessary connection between phosphorus in its compounds and animal life. Prof. G. M. Dawson suggests its formation from coprolitic layers, becoming crystalline by metamorphic action (before described). A discussion of this subject is of little practical benefit, but I would merely point out, in this connection, that *this* cannot be its primary origin. Coprolites, as we know, are the fossil excrement of animals. Now animals not being able to *create* any element, but only to assimilate and form new compounds, it is obvious that they obtained the phosphorus, which they possess as calcic phosphate, from the vegetable kingdom ; the vegetable kingdom in like manner draws upon the mineral kingdom for its raw material. Hence in some form or other the phosphate existed before this Laurentian period, even granting that animal life was so abundant as to produce such a large deposit—a theory very untenable from the general geology and palæontology of the period. It should be remembered that many other mineral phosphates occur in nature besides apatite. In a large number of cases the apatite is closely associated with pyroxene, and there is evidence to show that it has been derived, to a large extent, from this source. In small but appreciable quantities, phosphate of calcium has been shown to be a constituent of many metamorphic and igneous rocks.

Apatite occurs both crystalline and massive ; the latter variety, however, may be said to be more or less crystalline in structure.

The crystals are usually found in a matrix of red limestone, and though presenting a very beautiful appearance are of little or no value, owing to the great difficulty in separating them from the limestone. Occasionally, however, large cavities of loose crystals are discovered, the matrix having become disintegrated and decomposed by atmospheric and other agencies.

The crystals consist of six-sided prisms with complete pyramidal terminations, though often possessing one pyramidal termination and one basal plane. In size, they vary greatly, viz., from those of less than half of an inch in length and corresponding thickness, weighing only a fraction of an ounce, to those of many hundredweights. A section of a good-sized crystal from this district is at the School of Science, Toronto.

The usual colour of crystals is green. Some, however, approach white, while others are of a pink, yellow, or violet tint, and others nearly black. Apatite in the massive condition shows the same variability, and in a more marked degree, with respect to colour. The colour appears to be purely accidental, and is due to various impurities mechanically mixed with the minerals. Thus the red and brown varieties contain minute crystals of hematite; the blue and green, scales of chlorite; and the yellow and violet owe their tints to organic substances. Some few years ago crystals were a rarity, as much as $5 being paid for one with good edges and terminations, though of small size; now they are so plentiful as to be practically valueless as specimens.

It would be well to mention here the so-called nodules, which appear to have been crystals, subsequently subjected to partial fusion, so that all exterior resemblance, except in size and rough outline, has been lost. It is possible that rounding of the edges is due to the solvent action of steam at high temperatures and pressure.

It is in the massive condition, as obtained from veins and "stocks" or "pockets," that it is extensively mined.

For some years it was supposed that apatite did not occur in true veins, but a study of the Templeton district has proved that such is the case. At Mud Bay, Lake McGregor, this is clearly shown by the phosphate deposit cutting the *strike* of the containing rocks; and again, in the same neighbourhood, there is a vein that has a true banded structure, the gangue consisting of alternating layers of calcite and mica and pyroxene. Examples are not wanting of veins consisting of alternate layers of pyroxene and apatite.

The veins are of various dimensions. Traversing the dead rock—limestone, pyroxene, &c.—they narrow and widen with great suddenness, and are characterized by an uncertainty of yield,—it being impossible to predict, by any formula, the "out-put" obtainable from any vein. The surface appearance may promise an abundant harvest, but at a few feet below the vein may become entirely "pinched" out. It is only right to add that the reverse of this has proved true—the vein increasing in width at the depth of a few feet. It is not uncommon to notice the phosphate in a vein, with an average width of say three feet for a depth of six or eight feet or more, suddenly narrowing to a thin streak only an inch or two in breadth. This may continue without much alteration for a further depth, and suddenly enlarging to a size equal to that of the upper deposit.

In some instances, large amounts have been obtained from veins—one in this district yielded eight hundred tons. It was situated on the side of a hill—an eminence apparently being favourable for the outcrop of both veins and pockets. As an off-set against the uncertainty in quantity, the quality is usually better than that of the "stocks," the phosphate being less intermixed with gangue. Cavities in veins often contain large crystals of apatite.

The greater quantity is obtained, however, from lenticular masses or "pockets," which would appear to be segregations from the enclosing rock matter, and more closely related to veins than to beds, which latter they are supposed to be by some geologists. They are from two to forty feet deep, and usually expand to a depth of a few feet. Sometimes the phosphate is entirely surrounded by dead rock, and a sharp line of demarcation may be drawn between them. When such a pocket or stock is exhausted, the hole has often a basin shape, in the bottom of which may sometimes be seen a thin streak of phosphate, perhaps only a few inches in width. In others, it would be hard to say where the phosphate ended and the dead rock began, so intermingled is the gangue. In a few instances borings, in deserted pits, have revealed the presence of phosphate at depths of from ten to sixty feet. It is probable, therefore, that in many cases further large deposits exist at lower levels. Almost all the apatite hitherto mined has been obtained from surface deposits, and until these are exhausted, little will be done toward developing these subterranean beds, owing to the great expense in removing the superincumbent rock matter.

"Stocks" very often occur close together, say ten to twenty in an area of five acres, with large intervening, perfectly barren tracts.

The mineral, both of the veins and pockets, presents itself in many varieties, both as regards colour and texture. The more common are the following: (1) Very fine granular, white, known as "sugar." (2) Granular white, spotted with red, known as leopardite. (3) Coarse and fine crystalline varieties of green, often tabular in cleavage. (4) Crystalline red varieties. (5) Violet, lustrous, semi-translucent. (6) Pink, much harder variety, of feldspathic aspect.

The operation of mining is extremely simple; it should rather be called a species of quarrying, except in a few cases where, quite recently, shafts have been sunk and underground workings employed for the extraction of apatite. Surface deposits being worked for the most part, complicated apparatus is not required. A derrick for lifting the mineral and *débris*, and a pump to carry off the accumulated water, seem to constitute, in most places, the entire plant.

The process consists in drilling holes of various lengths—one man holding the drill, which may be of inch and a-quarter steel, and another, or two, hammering. In places where there is not sufficient room for the striker, a long drill is often attached to a spring-pole. The method of working in this case is obvious. The holes are charged with gunpowder or dynamite, and well tamped with sand and broken rock matter, and the adjacent area is loaded with heavy logs to prevent too much scattering of the phosphate. The fuse being left of sufficient length to allow the men to retire in safety, the charge is fired. After the explosion the lumps of pure phosphate are placed by themselves, and those containing intermixed rock matter are removed to the dressers' tables, where, with small hammers specially made for the purpose, the gangue is separated as far as possible; but the phosphate being much softer than the intermixed matter, this can only be approximately done. Hitherto a phosphate containing 70% $Ca_3(PO_4)_2$ or over has been required, but probably in the future much of the stuff now in the "dump" will be used.

The gangue consists chiefly of quartz, feldspar, phlogopite (magnesian mica), pyroxene and calcite, and these, therefore, constitute the principal impurities in the commercial article. The predominance of calcite not only lowers the percentage of calcic phosphate, but decomposes much of the acid when the mineral is being converted into "superphosphate." The other impurities are insoluble in sulphuric acid, and consequently only lower the percentage of apatite present.

In this district (Templeton), if the mines are near navigable waters, the mineral is brought down in scows as far as possible, from whence it is teamed to the Ottawa River, where it is re-loaded on barges, or on the cars of the Canadian Pacific Railway for Montreal. It is shipped here as ballast principally, and exported to England, where it is treated with sulphuric acid, converting it into an acid phosphate of calcium, or "superphosphate," containing more or less sulphate of calcium, and sold either *per se*, or mixed with blood and other refuse for agricultural purposes. The action of sulphuric acid at a moderate temperature upon apatite may be thus depicted:

$$Ca_3(PO_4)_2 + 2H_2SO_4 = CaH_4(PO_4)_2 + 2CaSO_4.$$

Strange to say, although much United States capital is involved in our mines, little or none of the raw material is shipped there direct, but after treatment in England, a considerable quantity is sent there. The reason for this appears difficult to find, as materials for sulphuric acid manufacture are cheap, both here and in the United States.

It is of the greatest importance to the prosperity of the country that our farmers should early become aware of the great value of superphosphate as a fertilizer. Now, not only is phosphorus exported in this condition, but large quantities of wheat containing much phosphoric acid are sent out of the country; and thus the land is impoverished without the concomitant addition of this valuable element in the form of a soluble phosphate. A proper balance between the phosphoric acid removed by vegetation and that returned in the form of a fertilizer must be maintained, if we are to expect such bountiful harvests in the future as we have enjoyed in the past. With the realization of the worth of superphosphate by agriculturists, the manufacturing industry of sulphuric acid will receive a healthy impetus, and then we shall be more fully able to estimate the great value of our Canadian apatite deposits.

This paper is the result of information gained and observations made while staying with the late John G. Miller, on his extensive phosphate mines in Templeton Township, a few years ago; and in reading this paper before the Canadian Institute, a society one of whose duties and privileges it is to place on record the work of Canada's benefactors, I think it not inappropriate to conclude with a word of tribute to the memory of a gentleman who contributed not a little to Canadian Geology and Mineralogy, and who occupied a position in the foremost rank of the pioneers of phosphate mining. Mr. Miller was an enthusiastic and skilful worker, and, possessing an untiring energy, he placed Canada under a lasting debt of gratitude by the assistance he rendered the authorities of the Geological Survey, by the able articles which he contributed through the Ottawa press, by the enterprise which he displayed in opening up and developing Canada's mineral resources, and lastly by the large and valuable collection of minerals which he made, and which is now known in the Museum of McGill College as "The Miller Collection."

Dr. Ellis in referring to the opinion that many entertained as to the animal origin of Apatite, said one reason of it was the curious fact that fluorine was also associated with phosphate of lime in the bones of animals. He showed by a formula on the blackboard how fluorine played a necessary part in the composition of the mineral.

Mr. T. Nelson Dale inquired what was the chemical difference between the Norwegian Apatite and the Canadian.

Mr. Shutt stated that in one of the publications of the Canadian Geological Survey the difference between the Canadian and European Apatite was given.

Mr Dale alluded to the Apatite locality of Kragerö, on the southern coast of Norway, which he had visited many years before. The Apatite was pinkish in colour and opaque, resembling some of the Feldspars. The associated minerals were Ilmenite, Hornblende, Praseolite, Rutile, Epidote, &c. This Apatite had also been exported to England for fertilizing purposes. Another well known locality in Norway was that of Snarum, further inland. The crystals at these places generally had the basal plane with the pyramid. At Arendal, near Kragerö, the bluish-green translucent variety of Apatite occurred in small crystals, and here the crystals, especially those of Colophonite, had the peculiar rounding of the edges alluded to by Mr. Shutt as characterising some of the minerals of the Canadian Apatite region, and due probably likewise to metamorphism, subsequent to crystallization.

Mr. Shutt remarked that as many as 30 species of minerals occurred associated with the Apatite of Canada. The opaque pink variety, closely resembling feldspar, mentioned by Mr. Dale as occurring in Norway, was also found in Canada.

The following paper by Mr. A. McGill, B.A., B.Sc., was then read by Dr. Ellis :

NOTES ON REICHERT'S DISTILLATION PROCESS FOR THE IDENTIFICATION OF BUTTER-FAT.

An abstract of Reichert's original paper appears in the Chemical Society's Journal, Vol. 36, 1879, p. 406. The facts (1) that butter-fat is distinguished from other animal and vegetable fats likely to be used in the sophistication of butter, by containing about 6 to 7 per cent. of butyric acid (as butyrin), and (2) that this acid is sufficiently volatile to make it possible to distil it over in a current of air, are made the basis of this process, which was originally carried out by Reichert as follows :—

2.5 grammes of the dry, filtered fat were weighed in the liquid state into a 150 c.c. flask, and saponified by the addition of 1 gram solid potassic hydrate dissolved in 20 c.c. of 80 per cent. alcohol ; 50 c.c. water were then added, and then 20 c.c. dilute sulphuric acid (1 to 10 by volume). The mixture was then distilled, a slow stream of air being aspirated through. After 15 c.c's distillate was collected, this was returned to the distillation-flask, and the distillation continued till 50 c.c. was collected. This was titrated with deci-normal soda, litmus being the indicator. Reichert found that an average of 14 c.c. deci-normal soda was required to neutralize the acid in this distillate, with a variation of $\pm$ 0.45 c.c.

Medicus and Scherer (*Zeitschrift für Analyt. Chemie*, 1880, p. 159,) have examined this method, and highly recommend it. Various changes in it have been suggested, as by Meissl, who uses 5 grammes butter-fat, and a weaker alcohol for dissolving the alkali requisite for saponification in order to avoid the loss of volatile acid by etherization during saponification. Meissl collects 110 c.c. distillate, and finds a minimum of 26 c.c. deci-normal soda requisite for neutralization.

C. E. Schmitt uses phosphoric acid instead of sulphuric for decomposing the soap.

A. H. Allen *Analyst*, Vol. X., p. 103,) has examined the process, and reports favourably upon it. He saponifies 2.5 grams fat with 25 c.c. semi-normal potash in a closed flask, and after evaporating off the alcohol on a steam bath, dissolves the soap in water, adds excess of dilute sulphuric acid, and makes up to 75 c.c., distilling over 50 c.c. He finds a minimum of 12.5 c.c's deci-normal alkali required to neutralize this distillate.

A paper read by R. W. Moore, A.B., M.S., before the American Chemical Society in September of last year, and published in the "Analyst" for December, shews the very great superiority of Reichert's process for the identification of cocoa-nut oil used as an adulterant of butter-fat, and was the immediate cause of my undertaking the work described in the following pages. My friend, the late lamented H. Sugden Evans, F.C.S., Chief Analyst for the Dominion, requested me to examine the process with a view to ascertaining the limits of accuracy obtainable by it under fixed conditions.

I prepared from a genuine butter, pure, dry fat, by allowing the salt and water to separate by subsidence in a tall beaker on the water bath at about 80° to 90° C., pouring off the supernatant fat, and freeing from suspended caseine, etc., by filtration (using a steam jacket). The fat so obtained had a specific gravity of 0.914 at 100° Fah. (water at 100° Fah. = 1).

The liquid fat was weighed by difference from a light glass tube, having a lip, directly into the flasks used in saponification.

The difficulty of weighing exactly 2.5 grams of fat suggested the use of an approximation to that quantity, and the subsequent calculation into *volatile acidity* per gramme of fat used.

I employed an approximately normal solution of alcoholic potash for saponification, the alcohol having a specific gravity of 0.823 (equivalent to 90 per cent. anhydrous alcohol). The saponification was effected in stoppered flasks of strong glass (the stoppers being tied down), on the water bath at 100° C.; and 10 c.c. alcoholic potash was used for each gram of fat taken. One hour was allowed for the completion of this process.

The melted soap was decanted into a flask of about 250 c.c. capacity, about 2-3 c.c. of dilute alcohol used to rinse, and 20 c.c. of approximately normal sulphuric acid (accurately 0.98 N.) added for each gram of fat used. During the subsequent distillation the flask was placed on a sand bath, and a pretty strong heat supplied by a Berzelius's alcohol lamp.

A tube leading to the bottom of the flask permitted a current of air to be aspirated through the whole apparatus. A 24-inch Liebig was used and kept well cooled. The distillate was collected in a graduate which was connected with a Richard's filter pump, by means of which a current of air was drawn through at the rate of about 4 to 6 bubbles per second.

The distillate, before titration, was thoroughly cooled (to about 55° Fah.) and filtered through wet paper. Phenol-phthalein was used as the indicator.

SERIES I.

These experiments were intended to illustrate the effect of using air *not* freed from carbon dioxide. The tube of the condenser did not dip into liquid in the receiver.

Number of Experiment.	Fat used.	Potash used.	Sulphuric Acid.	Distillate collected.	Total Acidity in c.c. on Soda.	Acidity per gram fat.
1	5.167	51.7 c.c.	103.3 c.c.	103.3 c.c.	21.0 c.c.	4.06 c.c.
2	2.975	29.7 "	59.5 "	59.5 "	10.2 "	3.43 "
3	3.809	38.1 "	76.0 "	76.0 "	17.1 "	4.50 "

The acidity found bears no constant relation to the quantity of fat used; nor is any average increase shewn for increasing quantities of fat used.

The arbitrary volume of distillate collected (equal to the quantity of sulphuric acid used, or to *two-thirds* of the total quantity of the liquid in the distillation-flask) is more than that collected in Series II., and less than that collected in Series III.

SERIES II.

In this series of experiments the air drawn through the apparatus was freed from carbon-dioxide by being washed through strong solution of caustic potash.

Number of Experiment.	Fat used.	Potash used.	Sulphuric Acid.	Distillate collected.	Total Acidity.	Acidity per gram fat.
4	3.669	36.7 c.c.	73.4	55 c.c.	9.6 c.c.	2.6 c.c.
5	3.089	30.1 "	60.2	46.3 "	8.7 "	2.8 "
6	3.376	33.8 "	67.4	50.5 "	9.3 "	2.75 "
7	1.638	16.4 "	32.8	24.8 "	4.7 "	2.86 "

From this series it appears that, while there is a fair approach to constancy in the quantity of volatile acid distilled over, there is a relative increase for lessening amounts of fat used. To find whether this was still observable with a larger (proportional) distillate, the next series of experiments was undertaken. In these the distillate collected was three-fourths as great as the total quantity of liquid in the distillation-flask.

SERIES III.

Number of Experiment.	Fat used.	Potash.	Acid.	Distillate.	Total Acidity.	Acidity per gram fat.
8	3.777	37.8 c.c.	75.6 c.c.	85.0 c.c.	15.6 c.c.	4.1 c.c.
9	2.967	29.7 "	59.4 "	67.0 "	12.2 "	4,1 "
? 10	2.487	24.9 "	49.8 "	56.0 "	11.9 "	4.8 "
11	2.054	20 5 "	41.0 "	46.1 "	8.45 "	4.1 "

A remarkable constancy in the acidity of the distillate, calculated on the fat used, is observable in this series, and seems to indicate that under the given conditions, the percentage of acid distilled over is constant. Experiment 10 is not to be counted, except as an illustration of the amount of error that may occur through not properly cooling the distillate before filtering. This filtrate became distinctly turbid on cooling (a circumstance noted at the time), although the results were allowed to stand.

In all the preceding experiments the delivery tube of the condenser merely entered the receiving graduate, not reaching to the bottom of it. In the following experiments the tube reached to the bottom of the graduate, and dipped into 20 c.c. of distilled water at the beginning of the experiments, and the aspirated air bubbled through the distillate during the whole of the operation.

SERIES IV.

Number of Experiment.	Fat used.	Potash.	Acid.	Distillate.	Total Acidity.	Acidity per gram fat.
12	3.188	31.9 c.c.	63.8 c.c.	71.8 + 20	13.9 c.c.	4.36 c.c.
13	3.475	34.7 "	69.4 "	78.1 + 20	15.85 "	4.56 "
14	1.563	15.6 "	31.2 "	35.1 + 20	7.4 "	4.74 "
15	3.847	38.5 "	77.0 "	86.6 + 20	16.6 "	4.31 "
16	2.693	26.9 "	53.8 "	60.5 + 20	11.6 "	4.31 "
17	2.257	22.6 "	45.2 "	50.8 + 20	9.6 "	4.24 "

Experiment No. 14 taken in connection with No. 7 would seem to indicate that with very small amounts of fat—say less than 2 grams—the volatile acidity found is higher than the average. The whole series shews that, as might be expected, a slightly higher volatile acidity is obtained when the first portions of the distillate are received into water already placed in the receiver than with the arrangement used in Series I., II. and III.

In the following table my average results, expressed in cubic centimetres of deci-normal alkali required to neutralize the acidity of the distillate found, for each gramme of fat taken, are compared with the results—similarly expressed—obtained by various chemists who have examined the process. The numbers have been calculated by me from a table of results given by Allen in the *Analyst* for June, 1885 (Vol. X., p. 105).

CHEMIST.	ACIDITY PER GRAM FAT.	
Reichert	5.6 c.c. d.n.	
Ambuhl	5.9 c.c. "	
Caldwell	5.9 c.c. "	
Schmitt	5.4 c.c. "	
Moore	5.3 c.c. "	
Allen	5.4 c.c "	
McGill	4.4+c.c. "	From Series IV.
McGill	4.1 c.c. "	From Series III.

It will be seen that the average acidity obtained by me is much lower than by the other chemists named. This may be due either to the different conditions under which the work was done, or to the different character of the butter fat submitted to examination. I can vouch for the absolutely accurate strength of the standard alkali employed in titration of the distillate; and I also took care to ascertain that no traces of sulphuric acid were present in the distillate. The process is, of course, not intended to estimate the *total volatile* acid in a butter fat, but only that which is volatile under *exactly* defined conditions; and the examination which I have made justifies me in saying that with the same fat, under constant conditions, the quantity of volatile acid distilling over is constant within 3 to 4 tenths of 1 c.c. deci-normal for each gram of fat used, provided that not less than 2 or more than 4 grams be taken.

I may add that the work described was done in January of this year (1886); since which time I have had an opportunity of examining several commercial butters by the process, carried out as in Series IV.; and I have found no sample examined to give more than 4.5 c.c. deci-normal per gram.

Dr. Ellis read a paper on "Determination of Tannin in Spices, particularly Cloves and Allspice." For this paper see page 214, vol. IV., *ante*.

FIFTH MEETING.

Fifth Meeting, 4th December, 1886, the President in the Chair.

Exchanges since last meeting, 33.

D. A O'Sullivan, D.C.L., read the following paper on "The Jurisprudence of Insanity."

To the law of the land is entrusted the protection of the lives and property of all entitled to seek that protection. It professes to be no respecter of persons, but it is obliged, nevertheless, to take notice of certain states and conditions which may be regarded as exceptions to the general rule. The first and second childishness, the reason impaired by abuse or defective from natural causes, and the various forms of mental unsoundness, exact a share of the law's protection under the exceptional class of cases referred to. When we consider that one person in every three or four hundred is unfit to take care of himself or his property, it becomes evident that the law frequently finds itself confronted by a very large class of cases requiring a display of the nicest discrimination, while each case unfortunately is almost always useless as a guide for the next instance that may present itself. When in every day life, as we are assured, very many doctors, lawyers, clergymen, merchants, as well as ordinary day labourers, go on each with his proper work while yet a victim of delusional insanity, it is evident that at any moment, and from any quarter, a specimen case may present itself for the consideration of the Courts.

The class of cases which I propose to discuss in this paper is comprised very generally under the head of the ordinary term "insanity," though the legal term is "unsoundness of mind," and the questions which Jurisprudence has in view are :—

1. When is any given person to be considered as insane.

2. What degree of responsibility or capacity is he fixed or gifted with.

The law sets out with the assumption that all men are sane, but nevertheless it recognizes the fact that some are insane ; just as the law recognizes the existence of crime, although acting ordinarily on the presumption that every person accused is innocent. The law assumes the more noble, more perfect state of humanity.

The gradation from sanity to insanity, as from health to disease, or light to darkness, may be slow or instantaneous, as those versed in such matters may speculate. The law when called upon has to say which of the two states exists. The twilight stage — part sane and part insane, weak-minded, balancing between capacity and incapacity—is a condition that calls for the greatest vigilance at its hands, especially as regards property and contracts generally.

"Sanity," says a great English lawyer, "exists when the brain and the nervous system are in such condition that the mental functions of feeling and knowing, emotion and willing, can be performed in their regular and usual manner."

"Insanity," says the same authority, "means that state in which one or more of the above-mentioned mental functions is performed in an abnormal manner, or not performed at all, by reason of some disease of the brain or nervous system."

The result of this is stated by the same author to be knowledge that an act is wrong and the power to abstain from doing it. This is the test in criminal matters. A similar rule applies in civil cases.

How is it to be determined that any given person has knowledge of right and wrong, and a will to do the one and shun the other?

It is difficult for medical men to listen to lawyers discoursing on diseases of the brain and of the nervous system; and on the other hand the lawyers and judges thought and think that they know as much of the functions of feeling and knowing of emotion and willing as is permitted to the medical gentlemen.

The jurisprudence of insanity is in consequence a subject claimed by doctors and by lawyers. It is one of those debatable territories on the border lands of two sciences that needs the assistance of the best minds in both; but it so happens that these are not always in harmony, indeed sometimes in apparent or real contradiction. Each one claims to be the real judge or the sole judge, and each disputes the right of the other to decide what may be common issues.

The medical men assert that common sense and science are with them, and it may be so; but the fact is that the legal luminaries have not only the law, but what is more important the verdict on their side. The conflict continues apace. The Courts and the lawyers have retained for a long time their view of the matter, and are unmoved by any advancements in the medical world. The medical writers adhere to their own views, and are not sparing in their ridicule of unskilled persons meddling with things of which they know nothing.

"The ground which medical men should firmly and consistently take in regard to insanity," says Henry Maudsley, "is that it is a physical disease; that they alone are competent to decide upon its presence or absence; and that it is quite as absurd for lawyers or the general public to give their opinion in a doubtful case, as it would be for them to do so in a case of fever."

Mr. Balfour Brown replies to this as follows:—"No lawyer wants, so far as we know, to give his opinion either as to insanity or as to fever. He does not profess to be able to do so, but he does assert that he and the public are in a position to judge of conduct, that the proof of the existence of such insanity as incapacitates for civil acts or renders an individual irresponsible in case of the commission of a criminal outrage lies in conduct, and that the fact that in the case of the insane the act is the result of certain changes which medical men have chosen to call disease, and that in the other it is due to certain changes which medical men have with as much arbitrariness chosen to call health, has nothing whatever to do with the subject."

To obtain the result of a perfectly legal and otherwise irreproachable lunatic or person of unsound mind, the assistance of two sciences is requisite; so law and medicine combine for that purpose, then after each particular sentence is pronounced relapse into their accustomed and time honoured antagonism. The offspring is begotten of this wrangling parentage, though the peace of the family be endangered thereat and thereafter.

It is natural and proper that each scientific person considering any subject in his particular line, as it is said, should view it with reference to his own special training and profession. The metaphysician and the physiologist meet on the one ground and each claims it as his own, one surveying it from a mental the other from a material point of view. In the same way a medical man and a lawyer brought face to face with a madman in the dock or in the witness-box come to regard his capacity or responsibility as subjects for detection in their own particular way. Theoretically medical skill must pronounce as upon any disease looking out for symptoms and making a diagnosis. Practically it keeps its eyes and ears open and observes what are less ordinarily the *indicia* of disease—of the absence of health. Legal skill, on the other hand, is thrown entirely, or almost entirely, on observations upon the conduct of the person in question, on astuteness under examination, propriety of an action under certain conditions, and on the thousand and one circumstances that separate common from extraordinary conduct. The judges and the Courts say—the law in fact lays it down—that what justice or equity demands is, not whether the particular individual is diseased mentally, but whether his conduct is the result of a sound mental guidance. If it is, then he is to be treated as other persons, and the law cares no more for the disease than the jury cares for the name of it. This disregard of medical science and of complicated classification is not relished by doctors, but they console themselves by the reflection that they instructed the Court, and possibly confounded all others by the intensely scientific character of their answers.

The law then is primarily concerned with the condition of the mind, the disease is of secondary importance. Medical skill aims to detect the disease, and if possible to remedy it; for this the law cares nothing ordinarily, its object is to discover capacity and responsibility. On this subject, as on all others within the province of evidence, the purpose of the law is to obtain information just as it would endeavour to discover foreign law, or ecclesiastical law, or facts concerning engineering, mechanics, or any of the arts and sciences. What medical experts and writers complain of is that judges and lawyers can and do know nothing of disease of insanity, while the legal gentlemen say it is too much and intolerable that the witness should usurp the functions of judge and jury, and claim the right of deciding the whole question.

The common ground upon which these conflicting scientists fight this battle is evidently the mind—an unsound mind law says, a diseased mind medicine says. The chief difficulty is, therefore, not which science should claim the exclusive right of appropriating the mind, but what the mind in itself is. When the mind is diseased, one party says every act is that of a diseased mind, and is, therefore, to be regarded as an insane act. The mind is a totality says Lord Brougham; and this has been quoted approvingly by Dr. Willard Parker, by Dr. Gilman, and others of eminence.

The Courts of law, however, have not acted upon this doctrine, and they repeatedly and every day act upon the assumption that a man may be sane upon one subject and insane upon all others, or that being insane upon one, or a monomaniac, he may be sane upon all others. He may be subject to delusions, but otherwise sensible. And so a man who is unquestionably insane upon one or on a variety of subjects, may yet have his will upheld, or his contract enforced against him. If he understands fully what is necessary to dispose of property by will or by agreement, he may be so far as the law cares hopelessly and incurably insane upon all others. Does he understand the nature and value of his property, his relations and their claims upon him? Then his will stands, though it were drawn (as wills have been drawn) in the rooms of an asylum. If he understands the value of property and conducts himself so that the other party had no suspicion of his insanity, then his contract can be enforced against him, though his object were to use that property to erect another tower of Babel.

These conclusions of the Court leave no doubt as to its view on the totality of the mind and on the effect of a diseased mind, though it is not disputed that many able lawyers side with the medical view. It is evident if unsoundness as here been stated is due to diseased organisms, the doctors ought to be the proper, and indeed the sole judges; but if there be such a thing as mental unsoundness with physical integrity, then the lawyers have good foundation for their reasoning.

There is a form, perhaps many forms of physical disease, which result inevitably in mental weakness, and so given certain symptoms the result is predicated to a certainty almost mathematical.

There is a disease which I take as an example, because it is probably as good for a popular example of medico-legal strife as any other: a disease called *Locomotor Ataxia.* The name primarily suggests a want of order in physical movements; as for example when the patient in attempting to drink would bring the glass to his ear, or would walk to the window in the endeavour to go out the door.

To be exact I append the examination of Dr. Seguin, Specialist Professor of Diseases of the Mind and Nervous System in the University of the City of New York, in reply to questions I put to him in a contested Will case a few years ago. The doctor, after referring to the different stages of the disease, replied as follows:—

Q. Please define briefly the first and second stages of this disease, [Locomotor Ataxia.]—A. The first stage is characterized by the recurrence of peculiar neuralgic pains in the legs, by absence of relex movements at the knee, and by double vision in some cases. The second stage consists in the above symptoms, with the addition of a staggering, jerky, or ataxic walk, and in some cases ataxic movements.

Q. Are the symptoms of this disease solely physical, or are they both physical and psychical?—A. Purely physical.

Q. Has Locomotor Ataxia any effect upon the mind?—A. Not except through the occurence of a rare complication.

Q. Will you state shortly what complications in this disease give rise to mental impairements?—A. In a few cases, from one to two in a hundred, in my experience, the symptoms of the disease known as General Paresis, or Dementia Paralytica, make their appearance after the development of the Ataxia.

Q. Will you state briefly the physical symptoms of a person affected with Dementia Paralytica?—A. These are: first, a condition of tremor of the muscles of the face, tongue, and hands, clearly visible to the eye, and sensible to the touch; second, a vibratory tremulous articulation—words are often clipped or shortened; third, a tremulous, jerky handwriting; fourth, unnatural smallness of and inequality of the pupils.

Q. Will you state briefly the psychical symptoms of a person affected with Dementia Paralytica?—A. They are: first, progressive impairment of memory and judgment; in other words, dementia. Second, variable mental state; which may be hypochondriacal, or melancholic, or maniacal. Usually, the patient is active and exacted; entertains delusions of great strength, of vast wealth. He has extravagant plans and boasts. These exalted notions are very numerous, and constantly changing in a given case. They are not fixed ideas.

Q. What is the chance of recovery in the case of a person afflicted with Dementia Paralytica?—A. There is no chance of recovery.

Q. To which of the two classes of symptoms, physical or psychical, do you attach the most importance in Paresis?—A. The physical symptons are more constant, and appear earlier, in my opinion. In some cases of Dementia Paralytica, the physical symptoms, together with failure of memory, are the only symptoms to the end of life.

Q. What is the mode of attack in Dementia Paralytica?—A. Usually by the gradual development of the physical symptoms I have named and diminution of memory, and by faults in judgment.

Q. In your experience, have you known a case of sudden attack in Demen- Paralytica?—A. I have not.

Q. Are the exalted notions to which you have referred confined to Dementia Paralytica, or are they found in other forms of insanity?—A. When varied and numerous, exalted delusions are highly characteristic of Dementia Paralytica, but not pathognomonic. When the exalted notions are few and fixed, they are indications of a condition of mania subacute or chronic.

Q. Can there be said to be anything hereditary in the disease, Dementia Paralytica?—A. The hereditary tendency in this disease is not strong, and is usually indirect.

Q. Generally speaking, have persons afflicted with Dementia Paralytica testamentary capacity; and, if so, what?—A. In some cases with uninterrupted progressive development of the disease, there is usually no such capacity; in other cases characterized by alternations of excitement or mania and remarkable remissions, the patient may, in my opinion, be capable during such remissions of correctly expressing his testamentary wishes.

Q. Generally speaking, is testamentary capacity affected in Locomotor Ataxia?—A. Not at all, in my opinion.

Q. Is there any defined limit to the advancement of the disease, Locomotor Ataxia?—A. There is none. It may terminate fatally in a few months, or there may be no advance in the symptoms for many years.

Q. Is there any defined limit to General Paresis of the insane?—A. There is no defined limit, but I have stated it as my opinion that no case has extended over six years which has not terminated by death. I have known no case which has recovered, and it is my opinion that it is always fatal.

On this point also I had the opportunity of examining Dr. Wm. A. Hammond, one of the best known scientific experts in America, or perhaps now living. In this examination, of course, I pursued only the facts of the particular case. I incline to the view (though

I don't know) that such cases are comparatively rare; when they do occur, it is manifest that if that be the weight of medical evidence no judge would feel disposed to set it aside in favour of a finding of mental unsoundness by reason of rational conduct in the person so affected. Conduct is deceptive and can be simulated when the *indicia* of disease cannot be concealed. The important part of Dr. Hammond's evidence is the following :—

Q. What has been your experience in cases of this character ending in mental disorder?—A. I have known several cases where that has occurred, one especially, that of a distinguished actor, under my charge for several years with Locomotor Ataxia, and not shewing any mental aberration until towards the last of his life, when there was decided mental disorder.

Q. Does the mental aberration you refer to point toward any particular form of mental disorder?—A. I should say distinctly, no, it does not, but there is a disease of the brain that occasionally resembles in its ataxic symptoms Locomotor Ataxia. There is a cerebral form of Locomotor Ataxia, which is not common, and a spinal form of general paralysis of the insane. In the one case, the mental symptoms are superadded to the spinal; in the other, the spinal are superadded to the mental.

Q. Is it the exception or the rule that in disease of Locomotor Ataxia the brain becomes affected through the medulla oblongata?—A. The brain may be affected in two days in Locomotor Ataxia, either by extension through the medulla oblongata or indirectly through the sympathetic nerve.

Q. In case the brain is affected by the former, what symptoms are present?—A. Irregular action of the heart; nausea and vomiting; difficulty of swallowing, and irregular respiration. Locomotor Ataxia sometimes ends life suddenly, before the morbid symptoms reaches the brain.

Q. Does any implication of the medulla oblongata necessarily suppose mental disease?—A. It does not.

Q. What percentage of cases of Locomotor Ataxia coming under your observation resulted in mental disease?—A. I should say not one per cent. In the sixth edition of my book on nervous diseases, I did not call attention to insanity as a symptom of the disease, Locomotor Ataxia. This may be because my attention was not specially directed to it, and since such sixth edition, I have seen seven or eight cases. My sixth edition was written four years ago, and my new book, soon to appear, will express my views upon this point. The recognition that there are sometimes symptoms of insanity accompanying Locomotor Ataxia, is a fact comparatively recent.

Q. What would you regard as the best indication that a patient affected with Locomotor Ataxia was progressing towards insanity?—A. The recurrence of delusions.

Q. Are there any other psychical symptoms?—A. A change in the emotional characteristics of the patient. He laughs and cries without sufficient cause, and becomes suspicious of those about him. These are the most prominent.

Q. Will you state the physical symptoms?—A. Probably the first would be some disturbance of the vision, and motion of the eyeball. Speech may be affected, and convulsions may occur. The hearing may be impaired. The patient may die in convulsions; but all these symptoms of brain lesion may exist without insanity, and such is generally the case. There is a distinction between the cerebral symptoms accompanying Locomotor Ataxia and the mental symptoms of insanity.

Q. How do these symptoms make their appearance—slowly or suddenly?—A. Either they may be developed slowly or suddenly, according to the means by which they are produced. The sudden appearance of the disease is by the sympathetic nerve, whereas the gradual development is through the medulla elongata.

Q. What value do you place upon the test of handwriting?—A. The handwriting would not be affected unless the disease had advanced high enough to affect the arms; and when it did so rise, the arms would not be co-ordinate, the same symptoms would appear in the arms as in the legs.

Q. What conclusion would you draw from the fact that the patient wrote a firm hand?—A. I should say that the disease had not reached the upper portions of the spinal cord.

Q. In Locomotor Ataxia, does the disease necessarily affect the mental power?—A. No.

Q. In General Paresis of the insane, would you say that the person had testamentary capacity?—A. There are stages. When the disease is well established, I should say the patient was entirely deficient in such capacity. There are remissions in the disease in which the patient is apparently lucid, but he is not to be depended upon even in these conditions.

Q. What is the duration of this disease, usually?—A. On the average, three to five years.

The law having with the combined assistance of the technical evidence of medical experts and the common sense of a jury, became apprised of the fact that the person under consideration is insane, the judge or Court is left to its self to decide what follows. If in a civil case under a contract or a will, the Court must say whether or not there was sufficient capacity to perform the act in question; if in a criminal matter to decide how far the accused is responsible and so punishable.

The law of England and of this country, so far as I can make out, is that the same rule in effect is applicable to both class of cases. As may have been expected few cases are to be found on what is for the most part a question of speculative law; but Chief Justice Tyndal and Sir James Hannen have both expressed themselves to the effect that the same formula holds good in both cases. The learned Chief Justice in dealing with a case of irresponsibility by reason of a "defect of reason from diseases of the mind as not to know the nature and quality of the act he was doing, or if he did not know it. that he did not know he was doing what was wrong," goes on to say that this illustrates a civil case of a will fully under the same principle. In a case of murder, for example, you have, say a knife in the hand of the accused. Does the latter know the consequences of putting the knife in the heart of the living man, and does he know it is wrong? In the other case of a disputed will, put his possessions, his money before the testator. Does he know the effect of signing with a pen in his hand a sheet of paper that will operate as his will? Does he know his property, his relatives, and their claims on him, and so on?

One American case has not followed these views of the English jurists, and of the general conclusion of American judges, but held that a less degree of imbecility is necessary to invalidate a will than would be found for acquittal from a criminal charge. As Mr. Balfour Brown has expressed it, "The question in connection with crime is: Does the accused know what he is about, and can he refrain; has he capacity to choose one course rather than another? That in connection with testamentary dispositions is: Did the testator know what he was about, and had he power to will this disposition?" And so if he knows that death ensues to a living man by means of wound with a knife, and that he knows he is raising his arm and has the strength necessary, there is knowledge sufficient to criminate; otherwise the knife was, as Mr. Brown puts it, a mere instrument in the hands of disease. The knowledge in the civil case is of a like character; a man must know whether he had $100 or $10,000 worth of property; he must know that a will is an instrument by which his wishes are given effect to after his death; he must know whether or not he has relatives, who are his relatives, and what claims they have on him and his bounty. If he knows nothing of these things, he knows not what he is doing. In the same way the law holds that if he knows these and is insane upon every other point, his will is valid as if he were sane in every particular. This may be taken as an exact enough summing on this prolific source of litigation; and the civil side may be disposed of with the remark that as to contracts generally it requires much more capacity than to make a will, though even this is now questioned.

On the criminal side the law is not easily stated, nor is it so satisfactory. The foundation of irresponsibility is the inability to distinguish right from wrong; but if a man has this power of distinguishing, and is yet impelled by mental disease to raise his hand and slay some one, he may not be punished. An act is not a crime, unless the person committing it knows not only that it is wrong, but knows the nature and quality of act, and is free to do it or leave it alone. These elements combine a number of things about which people are not always agreed; people who are perfectly sane, and who can give a good account of their belief. What is highly reprehensible to one, may be less so to another, or to a third more so; and so in an ascending or descending scale from the average mind. Yet this part of the verdict is the least difficult, because the results are as evident as if the element of insanity did not exist. A man killed or injured by a lunatic is as palpable a result as if killed by a sane man. But to discern whether or not the accused was impelled irresistibly to kill him, or if the doing of it was believed by the accused to be a wrong forbidden by law, are things generally much more difficult to determine.

If a man has an insane delusion that by shooting his neighbour he will benefit the whole community, he may work himself up to the degree of committing the deed. He knows that death will ensue; he expects it, his delusion would not be satisfied without it; he knows too that it is forbidden by law, but he is impelled by his delusion to go on consistently in his insane project. For such an act, under the law as it stands, this man would hang, unless he was insane in other respects. But this rule of the judges, and a hard rule it is, really applies only to one class of the insane—to monomaniacs. To one man who wants to steal everything, and to another who desires to set fire to his neighbours houses, or to kill people, the plea of insanity is unavailing until the mind is shown to be gone in other respects.

The fourth answer given by the English judges to the House of Lords raises a cognate question to this. If a man labouring under an insane delusion believes that his neighbour is attempting to take his life, and if he kills him in self defence he is free, though his neighbour may have only the kindest feelings towards him. But if he killed him because he fancied his neighbour did him a wrong, he would hang for it, because revenge and not self defence would be at the foundation of his act.

The only other point in which the judges make answer was that already referred to. In their view of the law to establish a defence of insanity it must be clearly proved that at the time of committing the act the accused was labouring under such a defect of reason from disease of the mind as not to know the nature and quality of the act he was doing, or if he did know it, that he did not know he was doing what was wrong.

It would be impossible towards the end of this paper to refer to the criticism that has been bestowed by medical writers on these extra-judicial opinions of the judges of England. To hang or imprison as a felon an insane man seems a shocking proceeding. Not that insane people are to be let at large, or that sane people are not to be protected. A man nurses delusion until it masters him, is controls his acts, it forces him to do extraordinary things. The kings and queens in our asylums would consistently put to death the subjects unreasonable enough not to pay court to them, and outside the asylum they would possibly hang for such an act. If the mind has its separate compartments for an individual craze leaving the others as in sane people, there may be reason for the law, but it is hard to suppose a case where there is deeply seated delusion so clearly cut from all other notions as not to influence them in some degree. I think that Mr. Stephen, following the idea in Lord Brougham's totality of the mind, was well justified in recommending a verdict of guilty, but his power of control was weakened by insanity. To punish for the same offence an insane man in the same way as you punish a man in his full senses appears an unequal dispensing of justice, and so far as the ends of punishment are concerned must fail to a great degree in the case of the insane man.

Dr. Cassidy referred to the difference between the legal and medical views of insanity. The lawyer naturally directed his attention to the conduct of the individual, and endeavoured to form an estimate of it. The physician, who studied the nature of the disease, its origin, symptoms and character, would be better qualified than the ordinary observer to pronounce on the insanity of an individual. In many cases where there was a degree of unsoundness of mind, it was difficult to decide whether it amounted to insanity. In these doubtful cases the experience and scientific skill of the physician would render him better qualified to give an opinion than the lawyer.

Dr. Oldright, referring to the instances of abnormal conditions of uncertainty mentioned by Dr. Cassidy, said that such questions had occurred to himself, though he did not let them go to the stage of worrying himself as many had done. He knew cases where persons had injured themselves in morbid conditions of uncertainty. He agreed with the last speaker that a medical man was better qualified to judge of cases of insanity than a lawyer. He sees more cases, and sees them at an earlier stage. The lawyer seldom sees the early stages of the symptoms.

Dr. Ellis, in referring to *Locomotor Ataxia*, said that in many cases the mind was not diseased.

Dr. O'Sullivan said that in working up a case, he made enquiries in New York of eminent authorities whether *Locomotor Ataxia* necessarily resulted in insanity. The answers were not very decided either way. The opinion seemed to be that in the milder stages it did not.

Mr. H. R. Wood, B.A., read a paper, entitled "Contributions to Blowpipe Analysis."

SIXTH MEETING.

Sixth Meeting, 11th December, 1886, the President in the Chair.

Certain amendments to the Constitution and Regulations were adopted.

Exchanges since last meeting, 216.

F. N. Kennin, B.A., Ernest C. Mackenzie and John H. Horsey, were elected members.

Mr. A. F. Chamberlain, B.A , read the following paper on "The Relationship of the American Languages."

I shall devote this paper to an inquiry into the arguments which have been advanced in favour of the north-eastern Asiatic or Peninsular origin of the American Indians, and an endeavour to assign to them an origin in other directions. That the question of American Origins is still an open one is apparent. Thus, Prof. Flowers, an eminent ethnologist, says: "It is quite as likely that the people of Asia may have been derived from America, as the reverse," (Pop. Science Monthly, Jan., 1886); and, speaking for a sister-department of the science of man, Horatio Hale, the distinguished American philologist, declares that "Philologists are well aware that there is nothing in the language of the American Indians to favour the conjecture (for it is nothing else) which derives the race from Eastern Asia," (Indian Migrations as Evidenced by Language, 1883, p. 25).

The Eskimo, the most northern of our American aborigines, have in particular been claimed as being certainly northern Asiatic in their origin. They seem, however, to possess in the most marked degree, the characteristics of a very primitive people. With regard to their origin, their scanty mythology and their legendary lore furnish us with no clue; their religion is silent; and no evidence of recent Asiatic origin can be gleaned from an inquiry into their language. I insert here a short comparative vocabulary of those Eskimo dialects which it seems certain have sprung from a common stock. Though in many instances the affinities may not be striking, they are still sufficient to bear out the idea of a common origin.

COMPARATIVE ESKIMO VOCABULARY.

English.	Kotz. Sound.	Tchuktchi.	Kadiac.	Unalaska.	Aleutan.	Greenland.	Hudson's Bay.
bear	tsunak	kainga		tanhak	tanguak		nennook
black	kangnoak			kahchehzeek	kaktshikluli		kerniuk
blood	aook	auku	auk	amak	aameyek		aoonak
canoe	kaiyak	kajak	palayak				keiyak
daughter		pannica				panik	panneeya
day		aghynak	aganok	anneliak	anghalik	ullit	
dog	kenma	kymyk		aykok	nikuk		keimeg
ear	tscheeutik	tschintak	tshijun	tootoosuk	totusak	suit	heeutinga
earth		nunna	nuna	chekeke	tshekak	nuna	noona
eye	eerruka	iik	inalak	thak	thaek	irsik	eieega
father		atta	adaga	attak	attan	attalak	attata
feet	idiguy	iguk	igugu	keetok	kita	isiket	ittikeik
fingers	tamaridreh			athoonen	atchon	tirkerit	tikkiek
fire	ignuck	annak	knok	keyhnak	kignak	ingnek	ikkooma
fish	khalloo	ssaljuk					ekkalloo
great		kaaguk			taangoellik		angerooke
hair	nuchet	niyak	nujet	imleen	emley	nyak	nuyakka
hand	arge-gei		eshet		tsha	arkseit	addeeyutka
head	neakoa	naskok	naskok			niakuk	neakoke
house			oolak			iglo	igloo
I	wonga	wanga			keen	wanga	ooanga
man	tuak	juk	shuk	tayaho	toioch	innuk	innueet
moon	tadkuk	tankuk	toogehda	tooheedak	toogithak	anningat	anninga
mother			anaha	annak	anaan	annanak	amama
mouth	kainneeak		kanok	aheelrek	aghilga	kannek	kanneera
night		unjak	anak	angik			oonooak
nose	kingar	chinga	kinaga	ankozin	anghosin	kingak	kingara
rain				chehtak	tshiotakat		
red		kakluk	kawychly	oolluthak	aluthak		aoopalook
river	koouk	kiuk	kuik	chehanok			koo
sky	keilyak	kuilak	keliok	innyak	inkak	killak	keiluk
snow		annu	anuju	kanneeh	kaneek		kanneuk-poke (it snows)
son		rinaka				ernek	eerninga
star	obloaret			stan	sthak		oobloorak
stone	angmak	aigach	yanak	koovvanak		ujarak	ooyarra
sun	neiya	shekenak	agadak	ahhapak	akathak	ajut	neiya
tongue		kandak	agonok	ahnak	aghnak	okok	okhara
tooth	kootay	gutyk	chudyt	keahoozen	aghalun	kiutit	keuteetka
water	eemik	mok	mooe	tanak	taangak	imek	immek
white	kowlook	katulge	katogalee	oommeleek	komakuk		kowdlook
woman	oolea	aganach	aganak	onhahenak		arnak	arnqua
one	adaitsuk	atamek	attauden	atoken	attakon	attamek	attowseak
two	eepak	malgok	aslcha	arlok	alluk	arlaek	ardlek
three	pingeyook	pinajut	pingaswak	kankoo	kankoon	pingajuak	pingahuke
four	tsetumet	istamat	stanik	seecheen	shitshin	sissamat	sittamat
five	taleema	tatlimat	talinik	chaan	tshaug	tellimat	tedleema
six	aghwinnak	atashimagligin	aghoiljujun	atoon	attoon	arbouek	argwenrak
seven	aghwinnighipagha	nalguk	malchonghin	oolloon	olung	arlekh	argwenraktowa
eight	penniyooik	pingaju	entjujun	kancheen	kamtshing	arbouek pingasut	kittukleemoot
nine	seetuma	aghinlik	kuluglmen	seecheen	sitching	kolliniloet	mikkeelukkamoot
ten	tadleema	kulle	kulen	atek	hasuk	kollit	eerkitkoka

From this we see that the Greenland *attatak* (father) becomes in Kadiac *adaga*, in Tchuktchi *atta*, and in Aleutan *attan*, in Unalaska *attak; annanak* (mother) becomes in Unalaska *annak*, in Kadiac *anaha*, in Aleutan *anœan; arkseit* (hand) becomes in Kadiac *eshet*, in Aleutan *tsha; ingnek* (fire) becomes in Kadiac *knok*, in Tchuktchi *annak; immek* (water) becomes in Tchuktchi *mok*, in Kadiac *mooe; ujarak* (stone) becomes in Tchuktchi *aigach; oonooak* (night) becomes in Tchuktchi *unjak; keuteetka* (tooth) becomes in Tchuktchi *gutyk*, in Kadiac *chudyt; attowseak* (one) becomes in Kadiac *attauden*, in Unalaskan *atoken*, in Aleutan *attakon; ardlek* (two) becomes in Aleutan *alluk*, in Unalaskan *arlok; pingahuke* (three) becomes in Tchuktchi *pinajut; sittamat* (four) becomes in Tchuktchi *istamat*, in Kadiac *stamik; kollit* (ten) becomes in Kadiac *kulen*, in Tchuktchi *kulle; ekkaloo* (fish) becomes in Tchuktchi *ssaljuk*. From this examination of the Greenland and Hudson's Bay Eskimo, the Eskimo of Kotzebue's Sound, the Tchuktchi, Kadiac, Unalaskan and Aleutan, we see that they have all sprung from one common stock; that the language of Greenland and Hudson's Bay approaches the nearest to what must have been the common tongue of the primitive stem from which they have all separated. And moreover I believe that the separation of these tongues from the parent stock took place in America, not in Asia. A comparison with the Tungusian, the Koriak, and other languages of north-eastern Asia, reveals many affinities which tend to show that these also are derivative languages, but have suffered much more change than the other members of this primitive family. The Kamtschatka tongue bears upon its face the evidence of great corruption and loss of words, and replenishing from other and less cognate dialects, but there is still proof enough to connect it with the great northern American family.

I believe also that the Lapps, Samoiedes, and the whole so-called "Mongolian" peoples are related to the peoples of northern America; that their languages have had a common origin, and that the seat of the primitive stock was in America. The long period which must have elapsed since their separation must necessarily have worked great changes among the numerous languages of this family, but there yet exist many distinct evidences of their common linguistic origin.

In proposing the origin of the Mongolian Peninsular Asiatic and languages of Asia from America, I believe I am offering a fair explanation of the fact noted by Dr. Latham, "that the Peninsular languages agree in the general fact of being more closely akin to those of America than any other." Before passing on to consider another family of speech, I will cite the opinions of two eminent writers, Dr. Robt. Brown (Races of Mankind, Vol. I.) and Dr. Rink, who have held that the Eskimo are not recent immigrants from Asia, but are an "Hyperborean American race" forced by circumstances and the inroads of other peoples into the position they now occupy. Dr. Rink says, "The Eskimo people evidently representing the north-polar coast people of America, the first question which arises seems to be, whether their development can be conjectured with any probability to have taken place in that part of the world. Other geographical conditions appear greatly to favour such a proposition" (Eskimo Tales and Traditions, 1874, p. 70), and again: "There is very little probability that a people can have moved from interior Asia to settle on the polar sea-shore, at the same time turning Eskimo, and afterwards almost wholly migrating to America" (*Ib.*, p. 73). Dr. Rink also concludes that in the religion and mythology of the Eskimo there is nothing that can prove the recent Asiatic origin of that people. The great Athapascan stock of languages shows some traces of affinity with the Eskimo family; but the great diversity and corruption of the vocabulary show that a considerable period has elapsed since they separated from the parent stock. Members of this family are found as far south as New Mexico; and Prof. Buschmann (Ueber die Spuren der aztekischen Sprache im nördlichen Mexico und höheren amerikni-schen Norden, Berlin, 1854, p. 648) has shown that the languages of the Comanche, Wihinast, Utah, &c., have numerous marked affinities with the Aztec.

We now come to the great Algonkin group, which in particular has been claimed as of recent Asiatic origin. Whatever linguistic affinities can be shown to exist between this or any other group and the Peninsular languages of northern Asia, do not, as I have shown, prove satisfactorily an Asiatic origin. A great deal of argument has been based upon the idea that the legends, traditions, and mythology of the Indians prove for them an origin from north-eastern Asia; and those of the Algonkin tribes have been most frequently cited to that effect.

Horatio Hale (Indian Migrations as evidenced by Language) discusses this question with regard to the Dakotan, Wyandot, Iroquois and Choctaw-Muskogee families, and comes to the conclusion that, instead of pointing towards Asia, the traditions of these peoples point to the north-east as the land of their forefathers and their earliest abode. He says: "The striking fact has become evident that the course of migration of the Huron-Cherokee family has been from the *north-east* to the *south-west*, *i.e.* from eastern Canada on the lower St. Lawrence to the mountains of northern Alabama" (p. 11). Mr. Hale and others have shown the connection which exists between the Algonkin stock and the Cherokee and cognate tongues, and in investigating the Tutelo language, he discovered that it was the oldest form of speech in the Dakotan family. As the original habitat of the Tuteloes was in Carolina, it follows that the whole Dakotan stock came from the *east* of the Mississippi. This opinion has lately been strikingly confirmed by the investigations of the Rev. I. Owen Dorsey amongst the tribes of the Siouan family. He observes: "Some authors speak of a series of migrations of these Siouan tribes from the west towards the east, but the author has been unable to learn upon what authority such statements have been made, nor has he ever found any tradition of such eastern migration among the tribes which he has visited." . . . . Ages ago the ancestors of the Omahas, Ponkas, Osages, Kansas, Kwapas, Winnebagoes, Pawnee-Loups, and Rees, dwelt *east* of the Mississippi. They were not all in one region, but they were all allies, and *their general course was westward*" (Migrations of Siouan Tribes, Amer. Naturalist, March, 1886). Thus from the Mississippi to the Atlantic, and from Labrador to Florida, careful study has shown a general affiliation of speech to exist (the relation in many cases it not easy to discern, but enough has been shown to prove that it does exist). It is probable that a like application in other regions will produce a like result. Neither from the languages nor from the traditions of the Indians of this vast region does the theory of Peninsular Asiatic origin gain support, and the same may be said of their mythology.

In dealing with questions of mythology, some writers have gone to the extreme of deriving all known phenomena of this kind from one source. But too much attention cannot, I think, be paid to those phenomena which are manifestly the product of the "working of like minds in a like state of culture." The disregard of this has led to many curious, and sometimes most absurd, views as to the origin of some of the peculiar features of the customs and mythology of our American Indians. Here let me cite a case in point. Among certain tribes of northern Asia the "hare" appears frequently in their mythology and folk-lore. In the great Algonkin family we find the myth of the "*Great White Hare.*" In this apparent coincidence the advocates of an eastern Asiatic origin would find a striking proof of the truth of their theory. But when we examine into the matter we find that it is a "myth of the dawn," as Max Müller would term it; and from this as a basis the myth of the "Great White Hare" has grown in the following manner:—The words for "hare" and "white" in the Algonkin dialects are in many cases evidently the same at bottom, *e.g.*:—

Chippewa—*wabos*, hare; *wawbishkaw*, white.

Menomonee—*wawpos*, hare; *waubish keewah*, white.

Miami—*wapawsuoh*, hare; *wapekinggek*, white.

The words for "*white*" in old Algonkin, Micmac, Penobscot, Etchemin, Abenaki, Bethuk, Cree, Massachusetts, Mohican, Nanticoke, Narragansett, Montaug, Pampticoe, Saukie, Sheshatapoosh, Squallymish, &c., are all from this same root. Thus, instead of an imported myth from Asia, we have a "language myth" grown up amid the Algonkin family. The transition from the *white of the dawn* to the *white hare* is easily understood, and the result is the myth of the "Great White Hare," Michabo. And I have no doubt but that in our study of American mythology we shall meet with many of these language-myths for which no other satisfactory explanation can be given.

Mr. Horatio Hale suggests that the foreign element of the Cherokee language may have been derived from the speech of the ancient "Mound-builders." He bases this view upon the fact that the Choctaw and Cherokee, "though differing in the more common words of vocabulary, agree in quite a number of terms which seem likely to have been borrowed." Dr. Brinton suggested that "the Mound-builders were in part the progenitors of the Chahta tribes." Robertson, the historian, considered the Otomis to be their present representatives. Frost (North-Americans of Antiquity, 1882,) sums up the evidence in favour of their identity with the Nahuas; others have connected them with the Natchez. The best authorities regard their civilization as essentially American.

Prof. Campbell, in several papers read before the Institute in favour of the Peninsular Asiatic origin of American peoples, claims that the "Mound-builders" were "*Hittites*." The weight of his arguments rests upon the facility with which (he says) the "mounds" can be traced from the "Tels" of Syria *via* Behring's Straits to the works of those ancient settlers in the Ohio valley; upon the alphabet derived from certain inscribed stones alleged to be genuine relics of the Mound-builders of America; and upon certain topographical and linguistic arguments to which I shall refer later. In a communication to the writer a few weeks ago, Dr. D. G. Brinton says:—"I would suggest that the 'Mound-builders' were probably not one but many nations, and may have belonged to quite different stocks. The time has past when they should be looked upon as a single tribe or nation. As to the origin of any one of the 'Mound-building' nations, I think it is premature to express any opinion; we have not sufficient data." Respecting the inscribed tablets Dr. Brinton says:—"With regard to the inscribed stones you mention (the Grave Creek, Brush Creek, and Davenport stones), I personally consider them all frauds and utterly unworthy of consideration. I have not been hasty in this conclusion, but have reached it after conscientious examination." Coming from one whose thorough research and calm and unprejudiced spirit of investigation have placed him in the foremost rank of Americanists, this effectually disposes of the first two branches of Prof. Campbell's argument. The last, as will be seen, rests upon evidence still less trustworthy. I prefer, then, to see in this ancient people a nation (or nations), with a culture essentially American, and not a horde of quasi-civilized intruders from Syria. Too much, I am convinced, is being made at present of these "Hittites;" and when we are in possession of all the facts in the case, I think it may possibly turn out that the Hittites were not the wonderful and ubiquitous people that some writers would have us believe they were. The question whether the "Mound-builders" came into the Mississippi from the north or the south has not yet been satisfactorily settled. There are evidences which point in both directions; and may they not both be right in the light Dr. Brinton has suggested? The existence of mounds in the far North-West has been held to be an evidence of migration from that direction. The fact that there are mounds in Brazil bearing a remarkable likeness to those of the Ohio valley has lately been pointed out by M. Netto (Archivo do Museo nacional do Rio de Janeiro, Vol. VI., 1885), and certain objects held to be of southern origin, or as indicating such origin for those whose handiwork they were, have often been found in the mounds of the Mississippi valley. But such objects may have been obtained by commercial interchange, and the South American mounds may be of independent origin, or perhaps the work of refugees who fled from the north after the defeat of the "Mound-builders" and their dispersion. Perhaps the best view of the matter is that the "Mound-builders" were a vast confederacy, similar perhaps to the great league of the Iroquois, or to the combination which existed between the kings of Mexico, Tezcuco, and Tlacopan, in the time of Montezuma. This league may have consisted of many tribes, and the art of mound-building may have been a foreign graft from more southern peoples; but this is doubtful.

Many writers have professed to see in the Pueblos Indians of New Mexico the modern representatives of the old Mound-builders. If this be true, the Mound-builders must have spoken a dialect akin to some of the numerous Athapascan languages, or these survivors of that ancient people must have adopted such a language instead of their former tongue. For a comparison of the Pueblos dialects (Tesuques, Jemez, Zuni, &c.) with the Navaho, Xecorilla, Apache, and other languages, with Athapascan affinities leads to this conclusion. It may, as Mr. Hale suggests, be philology which will finally settle the much vexed question of the origin of the peoples known as Mound-builders.

Our present knowledge is not sufficient to entitle us to speak with certainty regarding the origin of the numerous tribes who occupied the Pacific coast from California to Alaska; it is very probable that a great mixing has taken place here, and only long and careful study of these languages can aid us in solving the question of their origin.

We now turn to the populations of Mexico and Central America. Since the day when Father Duran in 1585 expressed the opinion that they were the Lost Ten Tribes of Israel, human ingenuity has been almost exhausted in suggesting possible origins for these interesting peoples. It is needless, perhaps, to observe that all theories which make their civilizations a late importation from the Old World are gradually being abandoned and cast aside. Prof. Campbell, however, comes to the conclusion that the Aztecs were Hittites, and brought their hieroglyphs from Syria. Let us consider the Mexicans first, as the Maya-Quiches are evidently a people of much greater antiquity. A recent writer says:—"The movement by which in a remote antiquity, the peoples of Central America ascended towards the north, carrying with them their relative civilization to Mexico and beyond, was reversed at the epoch of our middle-ages by a migration in the opposite direction, and it is probably to invasions of this description that we must ascribe the fall of the Maya civilization of the isthmic region" (Dr. A. Réville, Native Religions of Mexico and Peru, p. 20). The traditions of the Aztecs have been held by many to betoken an Asiatic origin; but they are much corrupted and bear in many cases evidences of Spanish influence. The prevailing view is that the Nahua nations came from the north-west, the Huehue Tlapalan being held to be the region round the Rio Colorado. Buschmann, it is true, has pointed out traces of the Aztec in the languages of the Pacific coast, and it seems to me that there are similar traces in the language of Kamtschatka; but all these are best explained (they are but faint) by migrations from the primitive Aztec seat in America, rather than by making the Aztecs a colony from Asia. Some recent writers have held with some show of reason that the Nahua tribes came from the east; in fact some of their oldest traditions point to the north-east as the point of origin. With regard to the Aztecs I am inclined to connect them with the northern tribes of America, with whom their language shows them to have been related; and it is rather curious that some of their legends represent their forefathers as coming from a land of sandy wastes strewn with bowlders, which seems to point to a northern region; besides, Aztlan (the white land) may find its explanation here, as may also Huehue Tlapalan (the old red land), though it seem at first contradictory of the former. A linguistic chain of evidence seems to connect the Aztecs with the Athapascan tribes, but their later development seems to have taken place in the valley of the Gila and Colorado.

Much has been written on the relations of the civilizations of Mexico and Central America; the prevailing veiw being that though the Mayas preceded the Mexicans, the civilization of the latter shows an independent origin in many respects. The traditions of the Mayas point to the east as the region whence their forefathers came to America; and their antiquity precludes all possibility of a recent origin from Asia. But it is in the philology of Mexico and Central America that we find the strongest evidence against such an origin. The pictorial (or as Zelia Nuttall would have it, the phonetic) writing of the Aztecs, and the phonetic, perhaps even alphabetical, system of the Mayas, bear upon them the proofs of their essentially American origin. Speaking of the phonetic aspect of some of the Mexican writings Tylor says "There is no sufficient reason to doubt that this purely phonetic writing was of native Mexican origin" (Early History of Mankind p. 96). And the ablest writers upon the subject agree that the Maya system of writing is of independent growth, and not an importation from the Old World. The length of time requisite for the development of the sixteen languages of the Maya-Quiche family must take us back to a vast antiquity; add to this the period necessary to allow the development through its various stages of the Maya phonetic system, and we reach an age in the primeval past that may vie with the most ancient civilizations of the other hemisphere. When we read that from five cities alone on one occasion the Spanish governor obtained no less than 16,000 volumes or scrolls, it is but reasonable to suppose that America had a literature as well as an alphabet; and we impatiently wait for the appearance of the American Champollion who shall unlock for us the stone records of Palenque and Copan, and read for us the few volumes of ancient American history that priestly intolerance has permitted to escape the flames. That late migrations from Asia have had any appreciable effect (if they ever took place at all) upon American civilizations, I do not for one moment believe.

Dr. E. F. Hamy lately (Nov. 9th, 1886) read a paper before the Anthropological Institute "On an Interpretation of one of the Copan Monuments," in which he claims to have found upon one of the stone figures at Copan, the Chinese sign Tai-Ki; from this he obtains "fresh proofs of the influence of Asiatic upon American civilization." Referring to such views in terms of disapprobation, W. H. Dall says (in Science Nov. 5th 1886): "We believe that the very wide hypothesis thus broached (*i. e.* of early Chinese voyages to America) and which in one form or other has had a certain currency for more than a centuary, rests upon a totally insufficient basis. . . . . Mr. Wolcott Brooks informed me that he had patiently searched into the matter, and that he had conclusive evidence that the voyage which actually took place was one to the well known and still existing province of Fusang in Corea (see Griffis' work) and had no connection whatever with America." Some have professed to see philological evidence of the Asiatic origin of the Otomi, an alleged monosyllabic language, which Senor Najera (Disertacion sobre la lengua Otimi 1835 p. 87) has compared with the Chinese. But Dr. Brinton has pointed out many evidences in this language of the prevailing American polysynthesis; and there is nothing improbable in the fact that a close resemblance to a monosyllabic language should develop itself upon the continent of America, as we find similar approaches to such a state amongst certain languages of Western Africa, where purely monosyllabic tongues are unknown.

With regard to the relations of the multitude of languages in South America, we have not the same light to guide us as in North American philology. Most writers, however, have seen fit to discern at least four different stocks, viz.: the Muysca, Quichua-Aymara, Carib-Tupi, and Araucanian. The two former of these seem to have developed considerable civilization; the Quichuas having attained a degree of culture which in point of antiquity can only be compared to the Maya of Yucatan. Bochica, the culture hero of the Muyscas, is represented as having come from the east; as did also Tupi and Gurani the twin progenitors of the Carib-Guarani tribes. The legends of Peru are said to bring the Incas from over the Pacific; but the best authorities regard their civilization as but a further development of primitive Aymara culture, and not a foreign graft. That these people must have reached Peru at a very early period is evident from the fact that no clear proofs of connection between the civilization of Peru and Central America have ever been made out; a portion of the primitive American stock early reached the Andean region, and there developed their peculiar civilization, without the advent of Zinghis Khan's grandson, or of Buddhist priests from China, or shipwrecked sailors from Japan.

With regard to the Quichua-Aymara language speculation has been rife. Dr. Lopez, of Monte Video, has claimed for it an Aryan origin (Les Races ariennes du Pérou par Vicente Fidel Lopez, 1871); and the Rev. Prof. Campbell (Proc. Canad. Instit., 1881, Vol. I., Pt. 2, p. 189), styles it the "pre-Aryan Celtic," whatever that may mean. Dr. Ellis would derive it "in common with the other American tongues from Central Asia" (Peruvia Scythica, 1875). The last two writers note its resemblance to the Basque.

What the relations of the Araucanian family are has not yet been satisfactorily settled. Prof. Campbell claims the Fuegians (a branch of the Araucanian stock) as members of his "Khitan" family and immigrants into America from Asia. Mr. Hyde Clarke claims to have discovered a relation between the Fuegian and certain languages of South Africa. He says:—"It is sufficient to state that these gelations enter into a definite group, No. VIII. of Dr. Koelle's Poly-Metta Africana, and bear a notable resemblance to the Ngoten and Ekamtufulu languages. How such relations can exist between Tierra del Fuego and South and West Africa, others may explain. My own conclusions have often been made public" (Journ. Anthrop. Inst. of Gt. Brit. and Ire., Nov., 1885). The existence of a primitive Negroid people at the southern extremity of South America is not very improbable. If Mr. Hyde Clarke's views be correct, the relation of the Araucanian proper and the Pampean families to the Fuegian will be of great help in solving the problems of South American ethnology.

But it is in Brazil and Guiana that the philologist and the ethnologist alike are puzzled. The multitude of languages in these regions bewilders the investigator, but it is quite likely that proper study and application will prove (as has indeed been tacitly assumed by most writers) that they have all (or nearly all) sprung from the primitive Carib-Guarani stock. Lang (Polynesian Origins and Migrations), comparing certain languages of Polynesia and Guiana, would bring the Polynesians to America, and the contrary theory has been held by not a few.

A recent writer, M. Peixoto (Archivo do Museo nacional do Rio de Janeiro, Vol. VI., 1885), arrives at the conclusion that "no type yet examined in Brazil presents the essential characteristics of a race; a great mixing has been long going on among South American peoples; the plastic forms of the primordial factors in the mixture have long ago disappeared in the general fusion." The resemblance in manners, customs and mythology of the Botocudos, Suyas, Yaruras and other Brazilian tribes to those of certain African peoples has often been noticed. It is possible that the ancestors of the Mosquito Indians of Central America, of the Caribs of the West Indies and the coasts of Venezuela and Guiana, and of some of the Brazilian tribes, may have crossed over from Africa at a time when the African Islands in the Atlantic were connected with that continent, and when the West India Islands projected much farther to the eastward than is the case at present. Mr. Horatio Hale suggests that it would have been easy for a people using the immense canoes, from time to time dug up in Britain and Ireland, to cross the Atlantic with favouring winds; and is inclined to find in this the origin of the Iroquois and other North American peoples, as well as the Caribs of the West Indies.

Up to the present no one has been able to show any marked connection between the languages of North and those of South America; and as the time of their separation from a common stock is so remote, we can hardly hope that very many marked resemblances will ever be found, for among the "Turanian" languages the divergence or vocabulary is remarkable when compared with that among the Semitic or the Aryan tongues. Still I believe that careful study will in time reveal those few and important connecting links which one cannot but think exist between many languages of North and South America.

Having thus briefly reviewed our present stock of knowledge, I now return to the general question of the origin of the American peoples and languages, with a view to assigning them a trans-Atlantic origin. Prof. Whitney has said:—"The Basque forms a stepping-stone from which to enter the peculiar linguistic domain of the New World, since there is no other dialect of the Old which so much resembles in structure the American languages" (Life and Growth of Lang., p. 258). And some relation between the two is admitted by most writers on philology.

With regard to archæology, I quote Prof. Boyd Dawkins:—"We have therefore proof that an Iberian or Basque population spread over the whole of Britain and Ireland in the Neolithic age, inhabiting caves, and burying their dead in caves and chambered tombs, just as in the Iberian Peninsula, also in the Neolithic age" (Cave Hunting, p. 24). Now, notwithstanding the wide currency of the Finnic hypothesis as promulgated by Rask, I am inclined to believe that the Basques or the brown race, rather than the Finns or Lapps of the yellow or Mongol race, represent to-day the pre-historic Europeans. Carl Vogt is of opinion that the Basques cannot have come from Central Asia; and Dallas proposes Europe as the scene of the origin of the Mongolian tribes, whence, he says, they may have reached Asia by way of America (Dallas on Distrib. of Races, Journ. Anthrop. Inst., Vol. XV., No. 3). There are, however, many objections to Europe having been the primitive home of the so-called Mongol peoples. The Basques are not truly a Mongolian or Turanian people in the accepted sense of these terms. It is in the brown race that created the civilization of the Nile, and whose extraordinary culture meets us on the banks of the Euphrates, that the Basque finds his nearest congeners; the Finns and Lapps are later and ruder developments from the same stock on another continent, the continent of America.

In the dim past of antiquity, a branch of that same primitive stock, from which the Basques, Egyptians, and earliest settlers of Accad are descended, crossed over from Europe to America, at a time when land connection between north-eastern America and Western Europe *via* Greenland, Iceland, and the Faroes, still existed. Other migrations may have taken place across the ocean, or by the sunken Isle of Atlantis, from Western Europe and Northern Africa.

It is from the race that produced the civilizations of Egypt and Accad, rather than from the wandering Mongols of the Siberian steppes, that I would seek to derive that race whose culture we see in the valley of the Ohio, on the shores of lake Tezcuco, at Palenque, Uxmal and Copan, and on the slopes of the Andes in Peru. The "Mongol" race so termed I regard as a subsequent development, starting from American soil, of the same primitive stock; spreading by Behring's Straits into Asia, and thence into Northern Europe; having since their departure from America separated into numerous petty tribes and undergone many and extensive changes in their languages.

The following comparative list will I think bear out the reasonableness of the views I have advanced; as has been often remarked, however, we cannot look for very striking evidences of community of origin amongst the members of a stock which has been so widely dispersed, and that, too, in the remote past. But subsequent study will, I hope, reveal the true state of the case to be much as I have stated it to be.

COMPARATIVE ESKIMO-TURANIAN VOCABULARY.

ENGLISH.	ASIATIC (NORTH ASIATIC).	AMERICAN (ESKIMO).
axe	galgate (*Koriak*)	algatta, kalkalima (*Tchuktchi*)
belly	ksuch (*Kamtschatka*)	aksheka (*Tchuktchi*)
black	kad, katte (*Samoied*)	kakshikluli (*Aleutan*)
	kacth (*Lapp*)	kahchehzeek (*Unalaskan*)
boy	oongua (*Loo Choo*)	einyook (*Kotzebue Sound*)
brother	aki (*Tungus*)	agituda (*Aleutan*)
cold	iyich (*Ostiak*)	ikkee (*Hudson's Bay*)
	kai (*Samoied*)	keja (*Greenland*)
day	hallug (*Kamtschatka*)	ullıt (*Greenland*)
	halui, halo (*Koriak*)	
	tjeld, tell, telga, jalle (*Samoied*)	
	yeld, dialle (*Tawgy*)	
	jalakas (*Lapp*) [light], chald (*Ostiak*) [sun]	
dog	kanak (*Samoied*)	keimeg (*Hudson's Bay*)
		kenma (*Kotzebue's Sound*)
		kymyk (*Tchuktchi*)
duck	galle (*Koriak*)	galgagalachi (*Tchuktchi*)
ear	schen (*Tungus*)	schijun (*Kadiak*)
	kus, ku, chau (*Samoied*)	heeutinga (*Hudson's Bay*)
		suit (*Greenland*)
		tschintak (*Tchuktchi*)
earth	na (*Tungus*)	nuna (*Greenland, Hudson's Bay, Kadiak*)
		nunna (*Tchuktchi*)
egg	muni (*Samoied*)	mannig (*Hudson's Bay*)
	muna (*Finn*)	manik (*Mackenzie River*)
	munna (*Esthonian*)	mannik (*Kotzebue's Sound*)
	muno (*Tcheremiss*)	
	monn, muni (*Wogul*)	
eye	eha, esha, ihseh (*Tungus*)	eieega (*Hudson's Bay*)
	hai (*Samoied*)	iik (*Tchuktchi*), iyik (*Mackenzie River*)
		irsik (*Greenland*)
father	atja (*Samoied*)	atta (*Tchuktchi*)
	etcea (*Yukagir*)	attak (*Unalaskan*)
	achai (*Sojot*)	athan (*Aleutan*)
finger	gyhgek (*Kamtschatka*)	tikkiek (*Hudson'ss Bay*)
	tarka (*Samoiod*)	tegheya (*Kotzebue's Sound*)
	tarka (*Finn*)	tirkerit (*Greenland*)
fish	kalla, kual (*Samoied*)	ekkaloo (*Hudson's Bay*)
	kala (*Finn*), kole (*Tawgy*)	khalloo (*Kotzebue's Sourd*)
	kal (*Hungarian*)	ssaljuk (*Tchuktchi*)
	kalmach (*Suanic*)	
	guolle (*Lapp*)	
	olla (*Tungus*)	
	olloga (*Yukagir*)	
	xul (*Ostiak*)	
	enneu (*Kamtschatka*)	annegui (*Tchuktchi*)
fire	ku (*Yeneseian*), agoime (*Yakut*)	ikkooma (*Hudson's Bay*)
great	agga (*Samoied*)	kaaguk (*Tchuktchi*)
hair	nyurrit, nurikteh (*Tungus*)	nyakka (*Hudson's Bay*)
	tenge (*Yeneseian*)	niyet (*Kadiak*)
		nujak (*Tchuktchi*)
		nuyak (*Greenland*)
		nuchet (*Kotzebue Sound*)
		tinge (*Greenland*)
hand	chkatsch, syttu (*Kamtschatka*)	tsax, tsha (*Aleutan*)
	kit (*Tcheremiss*)	eshet (*Kadiak*)
	giette (*Lapp*)	arkseit (*Greenland*)
	ket (*Ostiak*), kett (*Mordwin*)	tathchka ((*Tchuktcht*)
ice	cign (*Koriak*)	tschikuta (*Tchuktchi*), ticku (*Mack. R.*)
	djuko, dschuche (*Tungus*)	sikkoo (*Hudson's Bay*)
	ser, sok (*Samoied*)	sermek (*Greenland*)
	seren (*Sojot*) [cold]	
lake	tuse (*Samoied*)	tessek (*Greenland*)
	teu (*Ostiak*)	tatcirk (*Mackenzie River*)
		touga (*Tchuktchi*)
live, life	inni (*Tungus*)	innuowoke (*Hudson's Bay*) [he lives], innuk (*Mackenzie River*)
mountain	naju (*Koriak*)	naigak (*Tchuktchi*)
man	chu (*Loo Choo*)	juk (*Tchuktchi*)
	chujakutsch (*Koriak*)	shuk (*Kadiak*)

English.	Asiatic (North Asiatic).	American (Eskimo).
man	khuyukutsch (*Koriak*)	chojatschin (*Tchuktchi*)
	ennete (*Samoied*)	innuk (*Greenland*)
	innimene (*Esthonian*)	innueet (*Hudson's Bay*)
moon	jailgat, gailygen (*Koriak*)	yaalock (*Kadiak*)
mother	anguan, aingga (*Kamtschatka*)	anaan (*Aleutan*)
	angnan (*Koriak*)	anaha (*Kadiak*)
	amma (*Samoied*)	amama (*Greenland and Mackenzie River*)
	ama (*Yeneseian*)	annak (*Unalaska*))
	anga (*Ostiak*)	anana (*Mackenzie River*)
	enie, ani (*Tungus*)	
mouth	zehylda (*Kamischatka*)	aghilga (*Aleutan*)
	khan (*Yeneseian*)	aheelrek (*Unalaska*)
	angya (*Yukagir*)	kannek (*Greenland*), kanok (*Kadiak*)
nails (finger)	chada (*Samoied*)	shetooe (*Kotzebue Sound*)
	kad (*Ostiak*)	setunka (*Tchuktchi*)
	kacth (*Lapp*)	kukek (*Mackenz e River*)
night	nygynok (*Koriak*)	unnuk (*Mackenzie River*)
	kyunnuk (*Kamtschatka*)	unjak (*Kadiak*), unjuk (*Tchuktchi*)
		oonooak (*Hadson's Bay*)
nose	kaankang (*Kamtschatka*)	kinaga (*Kadiak*), kingak (*Greenland*)
	hang (*Yeneseian*)	kingara (*Huds. Bay*), kingar (*Kotz. Sd.*)
	joonul (*Yukagir*)	chinga (*Tchuktchi*), krenyark (*Mack. R.*)
	enku (*Koriak*)	ankozin (*Unalaska*), anghosin (*Aleutan*)
rain	tshukutshi (*Kamtschatka*)	tshutakat (*Aleutan*)
		chehtak (*Unalaskan*)
red	cholachin (*Tungus*)	kawychly (*Kadiah*), kakluk (*Tchuktchi*)
river	gozem (*Koriak*)	koo (*Hudson's Bay*), koouk (*Kotz. Sd.*)
	gychi (*Kamtschatka*	kuik (*Greenland*), kuuk (*Mackenzie R.*)
	kiha (*Kamtschatka*)	kuik (*Kadiak*)
sky	kochall (*Kamtschatka*)	kulak (*Tchuktchi*)
snow	char (*Sojot*), char (*Yakut*), qar (*Turk*)	sermek (*Greenland*) [ice]
	anighu (*Koriak*)	annu (*Tchuktchi*), annju (*Kadiak*)
		kanneuk (*Hudson's Bay*), anniyo (*Mackenzie River*), kanneek (*Aleutan*)
stone	wrhaugon (*Koriak*)	ujarak (*Greenland and Mackenzie River*)
	guwwen, gugun (*Koriak*)	ooyarra (*Hudson's Bay*)
	hyma (*Tungus*)	yamak (*Kadiac*)
	kiwwi (*Finn*), kaw (*Mordwin*)	kooooanak (*Unalaska*)
	kow (*Wogul*), koch, kug (*Ostiak*)	
sun	schigun (*Tungus*)	sukkenuk *Hudson's Bay*)
	ziguni (*Tungus*)	shekenak (*Tchuktchi*)
	hajur, chaja (*Samoied*)	ajut (*Greenland*), agadak (*Radiac*)
	xat (*Ostiak*)	tchikreynerk (*Mackenzie River*)
	tykete (*Koriak*)	tekkinek (*Labrador*)
	tirgani *Tungus*) [day]	tirkiti (*Tchuktchi*)
tongue	onnior (*Yukagir*)	ahnak (*Unalaska*), aghnak (*Aleutan*)
	njuoktem (*Lapp*)	agonok (*Kadiak*), ukrark (*Mackenzie R.*)
tooth	kuppet (*Kamtschatka*)	kiutit (*Greenland*), keuteet (*Huds. Bay*)
	tody (*Jukagir*)	kootay (*Kotzebue's Sound*)
	tjiw (*Jurak*), tji (*Jeneseian*)	gutyk (*Tchuktchi* , chudyt (*Kadiak*)
	ikta (*Tungus*)	kigut (*Mackenzie River*)
water	mu (*Tungus*)	mooe (*Kadiak*)
woman	heghe (*Tungus*)	aganak (*Kadiak*), aganach (*Tchuktchi*)
	innago (*Loo Choo*)	anhahenak (*Unalas.*), anrenak (*Mack. R.*)
one	dyshak (*Kamtschadale*)	attausek (*Greenland*)
	dizi (*Loo Choo*)	adaitsuk (*Kotzebue Sound*)
	akte (*Lapp*), yksi (*Finn*)	atoken (*Unalaska*)
	otik (*Syrjani*), ikta (*Tcherem.*)	attakon (*Aleutan*)
three	ilan (*Mandzu and Tungus*)	illaak (*Mackenzie River*)
four	tjiet (*Jukag. and Ostiak*) [(*Kamaas*)	tcita-mat (*Mackenzie River*)
	tjata (*Tawgy*), teto (*Jenes.*), thede	tsetumet (*Kolzebue Sound*)

As regards the grammar of many of the Turanian languages, many resemblances in structure to the Northern American languages have been pointed out, and it is not necessary at present to elaborate this feature of the case.

I do not, however, propose to derive the American languages from the Basque, believing that they are but sister branches of the same parent stock. To the Basque are intimately related the brown races of Africa (the Berbers, Foulah, Houssa), the old Egyptians and the pre-semitic Accadians. The migrations of these primitive Eur-African races into America must have taken place at a very remote period; it may be however that several distinct migrations have in course of time taken place. The routes by which they reached America were by land from Western Europe to Labrador and across the Atlantic (or over the isle of Atlantis) to Florida, the West Indies and South America. The earliest to migrate were probably the ancient Peruvians, (who may have reached South America while land connection between it and North America by the isthmus of Panama did not yet exist) the Maya-Quiches, and the ancestors of the Eskimos. Certain South American tribes probably migrated from Africa at a time much more recent.

At a very early period migrations to Asia must have taken place, the result being to develop the various Mongol tribes of Northern Asia and the Finns, Lapps and Esthonians of Europe. It may seem strange to attempt to derive the Japanese and Chinese from America. The philological relations of the Basque and Japanese, and the relations which the Japanese seems to bear to the Dakota and Cherokee-Muskhogee families can best be explained in this way. And a few coincidences can be noted between the Eskimo and the languages mentioned. A recent writer (Our Arctic Province Alaska, H. W. Elliott) would see in the Aleuts a connecting link between the Eskimo and the Japanese, and, though favoring an Asiatic orign for the Eskimo, he refers the migration to a very remote period. An American origin for the Japanese is just as reasonable. The Chinese have ever been a puzzle to the ethnologist; all we know of them is that they seem to have appeared first in the north; and to derive them also from America is as satisfactory as the solutions of the problem which have hitherto been proposed. It may be objected, that to derive the American aborigines from Africa or Europe would not give sufficient time for their early spread into Asia and the development of their civilizations in America and Asia. But the existence of an Iberian race in Europe in the Neolithic age is conceded; and the brown race [one of whose representatives, the Foulahs, are described by Mollien (Voyage en Afrique 1818 vol. 1 p. 275) as "redskins and nomads" (hommes de couleur rouge et des nomades)] have dwelt in Northern Africa from time immemorial.

Barth says that the relations of the Peulhs (Foulahs) carry us back to an antiquity prodigiously anterior to the domination of the Pharaohs (see Crozal Les Peulhs, p. 268), and the date of the disturbance of the primitive negro people of Africa by the ancestors of the Peulhs etc., is fixed by F. Mueller at about 6000 B. C. It is to a people boasting an antiquity like this that I would seek to attach the ancestors of the aborigines of America. Prof. Anders Retzius, from a comparative study of crania of the ancient Caribs of the West Indies and of the Guanches of the Canaries, unhesitatingly came to conclusion that these two peoples were closely related; and the Guanches belong to the great brown race of Northern Africa and it is probable that many South American tribes cause the same way as the Caribs did from Africa to the northern coast of that continent.

It has been attempted to derive some of the American peoples from Asia by reason of an apparent similarity in tribal names and names of rivers, mountains etc. This is a very dangerous ground to tread upon; and random comparison is worse than useless. For example "Koriak" and "Cherokee" have been thus co-related. But "Koriak" is from a word "Kora" (cp. Tchuktschi "Korang") meaning "rein-deer," and can have no possible connection with "Tshelaki" the name of the Indians here mentioned. The names "Yuma" and Yemez have been connected with "Yamato," "Himalaya," "Haemus" and "Hamath." "Yum-a" according to H. L. Pinart (Zeitschrift für Ethnol, 1886, Heft III.) is a borrowed word, being applied to the Yuma Indians by the Pima tribe, and its signification is probably the same as we find in other cases of tribal nomenclature where the name is of foreign origin. "Himalaya," according to the best authorities, means "abode of snow" in Sanscrit, and the related word "Haemus" (and "Himalaya" as well) is clearly explained by Pliny, (Imaus incolarum in lingua nivosum significante). In tracing the alleged migrations of the Hittites or Khitai into America much use has been made of topographical resemblances. The river-name *Songala* has been connected with *Saghalien* (island) and *Sangar* (sts). Now the meaning of *Saghalien* is easily seen; the native name is "*Saghalin anga hada*" "isle of the black mouth" *i. e.*, the island at the mouth of the "black river," the Amur, the native name of which is "*saghalinula*" (black river). The same word is seen in the Tungus "sachalin," black. Now it is altogether unlikely that *Songala* means the "black river" or *San-*

gar the 'black strait.' The primitive meaning of *Hamath* is probably the very opposite of *Haemus* and *Himalaya* (snowy, white,) being most likely the same as *Ham, Khem,* "the dark one, the black one" (see I Chron. ii., 55).

Bunbury (Hist. Anc. Georg., 1879, Vol. I., p. 505, note) states that the resemblance of the name of the "*Cathaei*" of the Punjaub to the name "*Cathay*" is purely fortuitous. With regard to the "*Kitai*," Dr. Gustav Oppert says:—"The home of the Kitai is to be found in those mountainous regions in the north of Corea, whence all the rulers of China descended to the plains, as in later times did the Niutche and the Mandju" ("The Kitai and Kara-Kitai," Journ. Anthrop. Inst., 1869–70, Vol. II.). So if the *Khitai* and the *Hittites* are one and the same people, they, along with the rest of the Mongols, may have come over from America. Prof. Campbell, in his papers on "Asiatic Tribes in America," has endeavoured to connect the Ainos and certain American tribes in respect to their languages, and the inference to be drawn from his remarks is that the Ainos are Mongols. But Scheube (Die Ainos, p. 3) says:—"I cannot discover the Mongol type in the Ainos;" and D. P. Penhallow (Canad. Record of Science, 1886, Vol. III., No. 2, p. 128,) concludes an article upon these interesting people with the remark that "the prevailing view is that they are distinctly Aryan." Dallas (Journ. Anthrop. Inst., Nov., 1885,) says:—"There seems to be now no doubt that the language of the Ainos has not the slightest affinity with the languages of the neighbouring Mongolian races." It may be that they are an Aryan tribe that has adopted a non-Aryan language; their connection with the American Indian has not, I think, been proved.

The topographical evidence by which Prof. Campbell would connect the Hittites with America does not, after careful examination, bear the construction which he puts upon it, and the philological evidence which he adduces seems to be singularly unfortunate. In his paper "On Some Phonetic Laws in the Khitan Languages," he claims to have discovered a sort of Grimm's law amongst the so-called "Khitan" tongues. It cannot be admitted that he has proved the existence of such a law. *A more complete knowledge of the various American languages in themselves is necessary before such extensive phonological rules can be laid down.* The Basque *hilargia* (moon) is compared with the Iroquois *kilanquaw* (sun, moon). Now the derivation of *hilargia* is *il-argi* (light of the dead), not a strange appellation for the earth's silent and lifeless satellite [cp. the Algonkin *nipa* (moon), *nip* (I die), *nipua* (dead)]; but *kilanquaw*, being applied to both sun and moon, can never have meant "light of the dead." The Basque *biloac* (Lat. *pilus*), *ezurra* (Latin *os* with a Basque termination), and *kharrika*, are of Latin or Romance origin, and cannot possibly be related to any American words. *Curcira* (thunder) is probably onomatopoeic, as we find in Basque another word *ortzanz* (cloud-noise). Comparisons based upon these words must therefore fall to the ground. The Aino *kunezu* (moon) is in no way related to the Basque *hilargia*, being probably a corruption of *kane-nozu* (night-star). The case for the eastern Asiatic origin of the American peoples rests too much upon apparent phonetic resemblances, such as those I have just pointed out. Before any law like that of Grimm can be discovered and demonstrated between the American and related linguistic families, a thorough understanding of the relations which exist between the individual members of each branch of the American stock is requisite and of paramount importance.

The President read the following paper by Rev. Dr. McNish, of Cornwall, on "The Language and Literature of Brittany."

These remarks regarding Brittany occur in the last edition of the Encyclopædia Britannica: "Brittany, Britanny, or Britany, in French Bretagne, an ancient province and duchy of France, consists of the great north-western peninsula of the country, and corresponds very nearly to the present departments of Finisterre, Cotes-du-Nord, Morbihan, Ile et Vilaine, and Lower Loire. It is popularly divided into Upper or Western and Lower or Eastern Brittany. . . . . The Celtic language is still generally spoken, especially in Lower Brittany, and a considerable body of traditional story and song is current among the people." It is obvious that Britanny is identical with Britain, and that the etymology of the two words must be the same. The Bretons or inhabitants of Britanny give to their own country the designation *Breiz*—a word which corresponds with *brat*. Professor Rhys, of Oxford, in a somewhat elaborate discussion maintains that we are to discover in *Brit*—the first syllable in Britannia—*breth* or *brath*, and that in Irish *bratt* or *brat* means a cloth, a cloak, or a sail,and *brattan* a little cloak. "It would then appear that the word Brython and its congeners meant a clothed or cloth-clad people." "Who then," he asks, "were the people whom the Brythons did not consider cloth-clad, or properly clad? They could hardly have been Celts of any kind, as the art of making cloth of some sort was known even to the earliest of them that ever landed here. They were probably some of the aboriginal tribes whose country they, *i.e.* the Brythons, invaded on the continent."* The Bretons give to themselves the appellation *Breiziaded*, and to their language the appellation *Brézonek*. England has among them the name *Bro-Zaos*, *the Saxon land;* and France bears the name *Bro-Chals*, *the land of Gaul.* The word *bro* which is thus employed is the Gaelic *bree*, and is to be found in *bruthaich*, a hill. *Breiz veur* is the name which the Bretons apply to Great Britain. Their own province bears the name *Breiz vihan.* Upper Brittany is known among them by the designation *Breiz uchel*, or *Gorre vreiz;* and Lower Brittany by the designation *Breiz isel*, *Gmelled vreiz.*

The Welsh, the Cornish and the Breton form the Cymric family of the Celtic languages. *Armorica*, which is another name for Brittany, reveals its etymology at a glance, signifying as it does *a country that borders on the sea*, and exhibiting an unmistakable resemblance to the Gaelic words *air muir*, or *air a' mhuir*, *on the sea.* In Welsh, Brittany bears the name *Llydaw;* the people of Brittany are known as *Llydawiad*, and the language of Brittany is known by the designation *Llydawaeg*.

The Bretons and their language date from a very remote antiquity. Niebuhr thus writes:—"The Venetians were a Belgic tribe, and so, without doubt, were all the inhabitants of Lower Brittany, whose Cimbric character seemed so evident in the time of the Romans, when all the country round about was peopled by Gaels, that a late immigration from Britain was invented to explain it. The Celts occupied the extent of country from Lusitania in Spain to the country about the Tanais in the East. . . . . At an earlier period the Cymri inhabited a much greater part of Gaul. In Lower Brittany alone they maintained themselves against the invading Celts, while Normandy and the other countries were conquered by the Gael."†

* Celtic Britain, pp. 207–210.

† History of Rome, Vol. 2, p. 522. Ethnography and Geography, Vol. 2, p. 304.

In his preface to his Dictionnaire de la Langue Bretonne, Le Pelletier, who expended twenty-five years on the study of that language, remarks "that it is perhaps the most ancient language among those that are spoken to day in the world." With the patriotic enthusiasm for which he was remarkable, Le Gonidec, who may appropriately be designated the Eugene O'Curry of Breton Literature, avers "that the greatest proof of the antiquity of the Breton language is that up to the present time no learned man has been able to make us reascend to its origin, and to show us its first steps and progressive march. It appears incontestable that the Breton language has had Asia for its cradle, and that from Asia it spread into Europe with the nations which have peopled this part of the world." It is stated on the authority of Heraclides that the person who carried intelligence to Athens of the destruction of Rome by the Gauls, related that Rome had been taken by a great host of Hyperboreans—a people who came over the icy mountains from the unknown regions of the north. Whether the Bretons belonged to those Hyperboreans or not, there can be no question that they and their language have the hoar and the honour of a remote antiquity on their side.

The physical configuration and the comparative remoteness of Brittany from the thoroughfare of human connections and migrations lead us to expect that the Celts of Brittany have been allowed to occupy their homes without much molestation. As it is *prima facie* probable, if not altogether likely, that the first Celtic occupants of Great Britain must have crossed at the Straits of Dover, and as there is abundant evidence that Celts at one time possessed the whole of France as well as the south-west of Europe, there is nothing unreasonable in the conjecture that the Bretons of to-day are the descendants of the earliest Celts that had their home in the western part of Europe.

In his tour through Brittany the famous Welsh scholar, *Carnhuanaux* the Rev. Thomas Price, thus writes: "If I were asked what language I was chieflly reminded of, by hearing the Breton spoken by the natives in conversation, I should say certainly not so much the Welsh as the Gaelic; and this from the frequent occurrence in the Breton, of a certain nasal pronunciation very much resembling that so frequently heard in the Highlands of Scotland."

Mr. Price remarks that Druidical remains can be found in greater profusion in Brittany, than perhaps in any other country whatever.

There is still existing in Morbihan a greater variety of those curious remains, than in all the British islands put together. This corner of Europe was the favourite resort of the Druids. Then this attaches to Brittany an unusual interest, owing to the numerous evidences which it presents of the manners and industry and peculiarities of the Druids; and it is also conceded that Brittany was the cradle of chivalry and romance, and that there some of the most essential materials of romantic fiction had their home. Owing to the political upheavals which obtained over several centuries in Great Britain, it might be expected that frequent interchanges took place between the Celts of England and their brethren in Brittany, and that communications of an intimate character must often have passed between them. Stephens, than whom there can be no more reliable authority, thus writes in his Literature of the Kymry (p. 402): "We must therefore seek the first traces of the Arthur of romance among Kymry of Armorica, and the people of Armorica, and of ancient Gaul generally, are supposed to have been the same people as the colonists of Britain, and this would seem to be the reason why, during times of distress, the Britons fled there for refuge, and the oppressions of the Picts led many more to leave the island; and after the Anglo-Saxons had entered A. D. 513, fresh bodies flew to Armorica, and settled in the Country of Vannes and Quimper, then called Lectavia, Littan and Llydew, and the conclusion is both legitimate and irresistible that the romantic Arthur is a creation of the Armorican Kymry." "The primitive people of the British isles," writes Le Gonidec, "who did not wish to submit to the yoke of the Saxons, fled into the mountains of the country of the Gauls . . . Another party of the insular Britons went to find an asylum in Armorica, because they knew well that they would find a friendly people and one that spoke the same language. Saint Mayloire followed the emigrants to the Armoricans; how could the Saint have been able to make the Armoricans understand him, if he had not spoken the same language that was in use in Armorica?"

The Celts of Brittany have accordingly many features of interest and of historical importance. The inhabitants of that portion of France exceeded two millions and a half in 1876. Le Gonidec stated in 1838 that no less than two million Bretons spoke the Celtic language of their native province. It must afford immense satisfaction to Celts, whose sympathies are either directly or indirectly connected with Great Britain and Ireland, that a dialect of their common language is spoken by a very large population on the continent of Europe. It is much much to be regretted that the literature of a people so ancient and so remarkable is not very extensive, and that but few fragments have come down to our times from a date that can be regarded as in any sense early or remote. In the article on Celtic literature in the last edition of the Encyclopædia Britannica, it is stated that Armoric like Welsh is a living language, but that no monument of the old form of the language exists. The relics of middle-Breton literature consist of two miracle plays, a prayer-book or "Hours," a dictionary and the chartularies of two monasteries. Of this small list only one of the plays and the dictionary are known to exist in early manuscript originals or copies. One of the plays bears the title *Buhez Santez Nonn*, or the life of St. Nonna. The other play is entitled *Bursud braz Jezus*, or the great mystery or miracle of Jesus, and consists of two parts, the "Passover and the Resurrection."

In his famous "Archæologia Britannica," which was published in 1707, Lhuyd inserted an Armorican Grammar and Vocabulary. In the preface to his laborious work Lhuyd states "that the Armorican Grammar and Vocabulary which have been mentioned, were written in French by Julian Manoir, Jesuit, about the middle of the seventeenth century, and published by order of the Bishop of Quimper. The author was one of the masters at the Jesuits' school in that town, and afterwards a famous missionary in *Bass Britany.* His vocabulary, though not very considerable, was yet, so far as I could learn, the most copious extant; and so scarce that 'twas my fortune to meet but with only two copies, and those in convents." There was published at Paris in 1752, an excellent dictionary of the Breton language by Dom Louis Le Pelletier, a Benedictine Monk. It is said that he expended fifty years in the preparation of his dictionary. Great ability and industry are perceptible in the work which cost so much indefatigable pains, and which must continue to be of very great service to the student of Armorican. Other works of more or less value in connection with the literature and language of Brittany might be enumerated.

Le Gonidec may fitly be regarded as the Eugene O'Curry of Armorican literature. In a notice of the enthusiastic Breton scholar, which is prefixed to a second edition of his Celto-Breton Grammar by Brizeux, the latter mentions that Jean-François-Marie-Maurice-Agathe Le Gonidec was born at Cinquet, a small harbour situated at the western extremity of Brittany, on the fourth September, 1775. He was not a stranger to the troubles which convulsed France towards the end of the last century. He rose to a position of eminence as chief of the foresters on the Rhine under Napoleon I. The overthrow of that Emperor's army at Moscow led to the loss of the lucrative situation which Le Gonidec held. He was compelled in his declining years to toil assiduously for his support. It has to be said to his credit that he continued faithful in his devotion to the language and literature of his native province. Brizeux justly observes that Le Gonidec can be called the restorer of the language and literature of the Celto-Bretons: Grammar, dictionaries and texts of language—his work embraces all, and his books, if dear to his country, are not the less recommended by their pure criticism to the learned of all Europe. Eleven years of wakeful hours, that were obtained after the daily and necessary labours for the support of his family were over, were given to the dictionaries, two years were devoted to the grammar, and ten to his admirable version of the Holy Scriptures. Three Armorican grammars were in existence before his Celto-Breton Grammar appeared in 1807. The grammars in question were La Grammaire Bretonne-Galloise, by Jean Daires, which appeared in 1621, the Grammaire Bretonne of P. Mannoir, which appeared about the same time, and the Grammar of P. Grégoire de Rostrenen, which was published towards the end of the seventeenth century. Le Gonidec's Breton-French Dictionary appeared in 1821. His French-Breton Dictionary must have been published about 1838. His translation of the New Testament, which Brezeux pronounces to be the most beautiful book of their language, appeared in 1827. Among minor translations which Le Gonidec made into Breton, is to be mentioned Thomas A. Kempis' Imitation of Christ.

So far as the value of the argument which can be drawn from the topography of any country is concerned, as to what language was spoken by its earliest inhabitants of any strength or permanence, there is much in the topography of Brittany to sustain the theory that Gaels who spoke the same language which is now spoken in the Highlands of Scotland, gave the names that the rivers and headlands and islands of Brittany still bear.

In the topography of Bretagne, accordingly, Gaelic roots are unmistakably present. The names of the rivers of Brittany disclose their Gaelic origin very readily, *e. g.* :

Loire, luath, fast, and *shruth, sruth*, a stream.

Loire corresponds with *Lora*, a name which frequently occurs in the poems of Ossian.

Sevre appears to be compounded of *seamh*, gentle, and *shruth, sruth*, a stream.

Vilaine seems to be the Gaelic *aluinn, excellent.*

Oust is the Gaelic *useje*, water.

Don is domhainn, deep, a *dubh black*, and *amhainn*, a river : *the black river.* The word *Don* occurs in the topography of the Highlands of Scotland.

Seiche appears to be related te *seacach*, fading.

Blauet, Blath, the Gaelic word for *warm*, forms the first syllable of *Blauet. Et* is *aite*, a place.

Daorelas is compounded of *dubh*, black, and *glas*, grey ; *Douglas*, a name which occurs in the topography of Scotland and of the Isle of Man.

Aff is *abh*, water.

The names of the rivers in Brittany which have been cited are Gaelic, and, therefore, are closely allied to the names of rivers in Scotland and elsewhere, where the Gael has had his home from a remote past.

Ros, a cape or *promontory*, is of common occurrence in the topography of Scotland and Ireland. It is to be found also in the topography of Brittany, *e. g.* : *Rosporder, ros* and *portair*, the ferryman's promontory.

Rostrenen, ros trian, a third part.

Roscoff, ros and *cobh*, a victory.

Rohan seems to be derived from *sruthan*, a streamlet.

Quimper is the Gaelic *cuimir*, elegant.

Penmarch is compounded of *pen ceann*, a head, and *mara, muir, mara*, the sea.

Quintin is closely allied to the Gaelic *cinntinn*, growing.

Arree Mount. In Arree *airidh*, a shealing seems to be present.

Auray is allied to *ora*, golden.

Antram is the Antrim of Ireland, *an druim*, the ridge.

Baird is the Gaelic *ban*, white.

Concarneau is a compound of *cu coin dag* or *cuan*, *ocean*, and *carn*, a heap.

Craon is the Gaelic *craobhan*, trees.

Douarnenez comes from *dubh*, black, *airne*, a sloe, and *eas*, a cataract.

Dol is akin to *dail*, the Gaelic word for meadow.

Dinan is the Gaelic *dunan*, a hillock.

Frehel, Gaelic *fritheil*,

Faon, Gaelic *faobh*, spoil.

Glenan, *gleannan*, a little glen.

Gourin may be *guerean*, a pimple, or *gobhan*, a goat, as in Gourock.

Guer is the Gaelic *gaoir*, a noise.

Lanmon. *Lan full* is the first syllable of this word.

In *Liosneven*, *lios*, a garden or fort is present. *Lios* enters largely into the topography of Ireland and Scotland.

Landernean seems to be a compound of *lan*, and *tighearna*, a lord.

Locmine is compounded of *loch*, a small lake, and *min*, soft or calm.

Londeac appears to be *lointean*, marshes, from *lon*, a marsh.

Mur signifies a wall or fortified place.

Muzillac is *muisealach*, *muiseal*, a muzzle.

Morlaix may be either *morluach* or *murlach*.

Angouleme is a compound of *ancon*. *Armorican* for dead, and *leum*, Gaelic, leap.

Ploermel is resolvable into *plorie* (arm), Gaelic *blar*, and *mel*, Gaelic *maol*, *bare*.

Redon is from *reidh*, smooth, and *dun*, a hillock.

In *Rennes*, the well-known Gaelic word *raon* is present.

Vannes is akin to *ban bhan*, white.

Ushant seems to pertain to the same root as *fhoiseneach*, *fois*, quiet, rest.

Morbihan is not unlike *Morbheinn*, the Mower of the poems of Ossian.

Morbihan may also be a compound of *mur*, a wall, and *beag*, small.

Cerfili is *cathair*, a seat, and *filidh*, a poet.

The topographical names which have been adduced are sufficient to indicate that Gaelic is the substratum of the topography of

Brittany, and that, accordingly, Celts, whose language was Gaelic, were the earliest occupants of any permanence in that portion of Europe.

In the extensive region of the Alps, in the South of France, and in Spain and Portugal, there survives in the names of streams, and headlands, and mountains, and passes, imperishable evidence that in the far off past, Celts who spoke Gaelic occupied that portion of Europe in sufficient strength and over a sufficiently long period to enable them to give those topographical names, which defy the change and commotions of nations and centuries. The argument which can be drawn from the topography of Brittany tends to corroborate the theory that so far, at least, as the Celts are concerned, Gaels or Celts who spoke Gaelic preceded the other members of the Celtic family in their occupation of Europe and Great Britain and Ireland.

SEVENTH MEETING.

Seventh Meeting, 18th December, 1886, the President in the Chair.

Exchanges since last meeting, 26.

A. Hamilton, M.D., and Rev. G. M. Wrong, M.A., were elected members.

Rev. Prof. Ferguson, of Queen's College, Kingston, read a paper on

THE ETRUSCAN QUESTION.

In January last, Professor Campbell, of the Presbyterian College, Montreal, read a paper before this Institute, in which he seeks to prove the affinity of the Etruscan with the Basque, and claims to have found the clue by which he is enabled to read the Etruscan inscriptions. It is an accepted principle that our only hope of deciphering and translating the inscriptions on the monuments of a nation that has passed away is by means of a bilingual inscription. It was in this way that the hieroglyphics of Egypt, and the cuneiform inscriptions have been read. Any other way than this must be hypothetical, and therefore unreliable, for, however ingeniously the researches may be conducted, we cannot accept the results with any confidence. Proceeding on this hypothetical principle it is quite possible, by a mere resemblance in the words, to show with great plausibility the affinity of a language, and consequently of a nation, with any other language or nation. We have not hitherto attached any importance to Professor Campbell's researches. Any attention we may have given to comparative philology has been because of its historical importance, and, if Professor Campbell derived any satisfaction from his Hittite or Aztec researches, we were not disposed to detract from that pleasure, for neither the Hittites nor the Aztecs have contributed much to the general development of civilization, and historically considered are unimportant nations. The Hittites had relations with Egypt during the Hyksos period, and during the reign of Rameses II., but they did not affect to any extent the progress of civilization. But Professor Campbell was treading very different ground when he entered the field of Etruscan research. The Etruscans were a very important people. They at one time occupied the greater part of the Italian peninsula, and largely influenced Roman civilization. They had extensive commercial relations with the inland countries of Europe, and with the Baltic. They have been regarded as foreigners on Italian soil, and there has been a very strong desire to read their numerous inscriptions, and to trace their affinity with other nations. It is more than half a century since Niebuhr said that he would willingly give half of what he possessed, if he could possibly obtain a clue to the deciphering of the Etruscan language, but he had come to look on this as utterly hopeless. Undoubtedly since Niebuhr's day some advance has been made in our knowledge of the Etruscan language. In 1828 appeared the first edition of Ottfried Müller's "Die Etrusker," and in the second volume of this very learned work the author established the value and power of both the Etruscan and the Umbrian letters. Five years after, in 1833, appeared Lepsius' work, "De Tabulis Eugubinis," in which he substantiated the results arrived at by Müller. The subsequent researches of Aufrecht and Kirchhoff, of Grotefend and Lassen, of Mommsen and Deecke, of Corssen and Pauli, of Curtius and Bugge, with those of English, French, Italian, and Swedish scholars, have all tended to support the results arrived at by Müller and Lepsius, till in the last edition of Müller's work, edited by Deecke, we have a very valuable supplement, in which there is very clearly and satisfactorily represented, not only the value of the Etruscan letters, but the changes of which they are susceptible, their possible combinations, the laws of syncope, of inlaut and auslaut, of anlaut and ablaut, in fact a thorough treatise on the subject.

Prof. Campbell ignores the results arrived at by these scholars, whose names are a sufficient guarantee of the conscientiousness of their labours, of their industry and judgment, their extensive learning, and their sincere love of the truth. Lepsius was perhaps better versed than any other in Egyptian writing, and his researches are marked by striking calmness and judgment. Grotefend and Lassen devoted themselves with equal success to the study of the cuneiform inscriptions. Kirchoff and Aufrecht have thrown a flood of light on the old Italian dialects. Mommsen is our greatest authority on Roman history and Roman epigraphy. Why has Prof. Campbell ignored the works of all these eminent scholars? He once quotes from Deecke, but it is from that rather meagre article which Deecke contributed to the Encyclopedia Brittannica—an article scarcely in keeping with Deecke's erudition. These earnest students were obliged to confess their inability to translate the Etruscan inscriptions, or to establish the affinity of the Etruscan language. But where these men, who spent their lives in such studies, failed, Prof. Campbell claims a complete victory. He enters the field, and waves his magic wand, and all is done; the old Etruscan starts again into life, and gives up its long impenetrable secrets. "Etruria capta est," and he declares: "I have the honour to report to this Institute, as one of the most important results of my studies in Hittite Palæography, the solution of the Etruscan problem." Perhaps we are unfitted for criticising this last wonderful achievement, as we had attached no importance to the results which Prof. Campbell imagined he had reached in regard to other languages, but we were long at a loss to understand, even from his own point of view, what possible connection there could be between Hittite Palæography and this Etruscan problem. But this present contribution is only a part of a great "Etruria Capta." He promises a fuller work in which he will offer a translation of the Eugubine Tables. We quote his words: "Of these Tables, seven only and a part of the eighth are in the Etruscan character, the rest are written in the Roman alphabet, and are in Umbrian. These Umbrian Tables are being translated and will be shortly presented to the world as the oldest Celtic documents." Umbrian Celtic! As well tell us that English is Japanese or Choctaw.

But in this promised translation of the Eugubine Tables, will Prof. Campbell kindly begin with the eighth. We have to inform him that there are not more than seven of these Eugubine Tables, and they are all in Umbrian, though five are in the Etruscan characters, and two in the Latin. The Etruscan Tables are much older than the Latin, and they prove the early extended influence of the Etruscans, and the prevalence of their alphabet. But when in 307 the Umbrians became subject to the Romans, they adopted the Roman customs and the Roman alphabet, and so the acts and the ritual of the College of Priests, which had been previously in the Etruscan alphabet, were transliterated into Latin.

Prof. Campbell has imagined that Etruscan may be Basque, and he resolves to prove it Basque. He is not the first who has imagined this. Some fifty years ago, Sir Wm. Bethran wrote some articles in "Les Annales de Philosophie Chrétienne," having for their object to prove the identity of the Basque and Etruscan. Scholars did not even condescend to review his absurd hypothesis. The only notice we believe the work ever received was in this form, "Cette assertion gratuite ne mérite pas de réfutation." Mr. Ellis, in one of his posthumous works, proposes the same.

Prof. Campbell, however, approaches the subject from a different point of view—from the supposed syllabic character of the Etruscan. But he never attempts to prove this syllabic character, he merely supposes it to be syllabic, and proceeds to prove its affinity with the Basque. Now there is a very great number of Etruscan inscriptions found, from Capua in the South up in to the Alps in the North. They are for the most part monumental inscriptions, and are therefore short. Many of them are bilingual—Latin and Etruscan, and it is reasonable to suppose, judging from other bilinguals, that the one will be a literal translation or reproduction of the other. Unfortunately these monumental inscriptions consist largely of proper names, and can aid us little in gaining a knowledge of the language; but there is this advantage which proper names present, and that is, that they will enable us to determine the character and value of the letters, and some of the grammatical forms, and it is just this advantage which has enabled Lepsius and Deecke to determine so exactly the value and power of the letters and to study the laws, which apparently govern their relations, without however gaining any fuller knowledge of the language. But besides these bilingual inscriptions there are in the writings of Greek and Roman authors some forty or fifty Etruscan words, transliterated into Latin characters. So far as these words go, they are important, and yet they do not throw much light on the construction of the language, and they form a very meagre vocabulary; but this one thing they do, they confirm the bilingual inscriptions in establishing the character of the letters. As this is the point which Prof. Campbell pooh-poohs, it will be necessary to consider it for a little, and we shall take one or two examples of bilingual inscriptions:

V · LECNE V · PAPIRINAL

VEL · LICINIUS VEL · PAPIRI NATUS.

Now are we wrong in supposing that V of the first line corresponds with V of the second line, and the L of the first with the L of the second, and the whole of the word Papiri of the first with the word Papiri of the second? But before *n* in Etruscan the preceding vowel is always syncopated—the Latin Capena is the Etruscan Capna, the Latin Marcanius the Etruscan Marcna, and so Menelaus = Menle, Herakles = Herkle, and here the Latin Licinius is the Etruscan Lecne; the *i* and *e* being often interchanged. The suffix AL is a masculine genitive termination, and is of constant occurrence in the monumental inscriptions, as Arnthal of Arnth, Larthal of Larth, or son of Larth; just as in Latin we say Marcus Tullii, Marcus the son of Tullius, and the Papirinal of the above inscription is rende ed in Latin Papiri natus, and the whole inscription reads, Velleius Licinius, the son of Velleius Papirus. While *al* is the masculine suffix, the corresponding feminine suffix is -alisa, and we have this inscription, where both the father's and mother's names are given:

LARIS FRAUCNE VELUSA LATINIALISA.

LARIS FRAUCNE the son of VELUSE and LATINIA.

Similar inscriptions are very common, and a number may be found in Prof. Campbell's Etruria Capta. But the Eugubine Tables, being principally in the form of rituals, present several formulæ which occur in the Tables of the Etruscan, and also of the Latin or Umbrian character. Compare the following formulæ as they occur in the Etruscan characters of the first Table, and in the Latin characters of the sixth Table:

ETR.—Vukukum : iuviu : pune : uvef : furfath : tref : vitluf : turuf : marte : hurce :

Lat.—Vocucum · ioviu · ponne · ovi · furfant · vitlu · toru · trif · fetu · marte · horse ·
fetu : pupluper : tutas : iiuvinas : tutaper : ikuvina : vatuva : ferine : fetu :
fetu · popluper · totar · iiovinar · totaper · iiovina · vatua · ferine · fetu ·
puni : fetu : arvia :
puni · fetu · arvia ·

And again a little below in the same Tables:

Etr.—Vukukum : kureties : tref : vitlup : turup : hunte : feitu : pupluper : tutas :
Lat.—Vocucom · coredier · vitlu · toru · trif · fetu · honde · fetu · popluper · totar ·
iiuvinas : tutaper : iiuvina : vatuva : ferine : fetu : arvia :
iiovinar · totaper · iiovinar · vatve · ferine · fetu · arvio ·

It would seem impossible to doubt that in these instances we have a simple transliteration, and that the formulæ written in the Etruscan characters are literally reproduced in the Latin characters; and if so, then they establish the value of the Etruscan letters. This would seem almost self-evident, and no one has for one moment doubted it, till Prof. Campbell propounds his hypotheses. Believing that he has solved all other linguistic problems, of the Horites and Hittites, of the Japanese and Aztecs, of the Cypriotes and Choctaws, he believes it his duty also to untie the Etruscan knot. He ridicules all these bilingual similarities, and marks out a certainly original mode of dealing with the subject. He has resolved that Etruscan is Basque, and Basque he intends to prove it, and all difficulties must give way before this hypothesis. But in choosing the Basques with which he is to prove the affinity of the Etruscans, we think Prof. Campbell has been very unfortunate. The Basques are a small body of people living on the Spanish and French slopes of the Pyrenees. They number about 700,000, and are the descendants of the old Vascons. They have never played an important part in history, and have contributed nothing to the general development of civilization. They show some affinity with some of the native tribes of North Africa, but perhaps more with the inhabitants of the American continent. We know that at one time Africa was joined to Europe at the Straits of Gibraltar, and there is every probability that in the Miocene period Europe was connected with America, and the people of America may have crossed over by a great Atlantic bridge, having left however a small remnant in Spain. But, whatever the affinity of the Basques, they have, from a very early period, been largely affected by foreign influences. No part of Europe has so changed masters as Spain. Phœnicians, Celts, Greeks, Carthaginians, Romans, Visigoths, Alans, Moors, and the Romance nations have at one time or other held Spain, and have influenced the Basques, and these at the present day present physiological characteristics so diversified as to baffle all attempts at ethnological classification; and the Basque language is perhaps the most corrupt of all languages. The writer of the article on the Basques, in the Encyclopædia Brittannica, a work Prof. Campbell is fond of consulting, says: "Foreign words are easily assimilated, but with modifications to suit the Basque ear." If Prof. Campbell was resolved on proving the affinity of the Etruscans with the Basques, he ought to have positively assured himself, that in using individual words, it was really in each case a Basque word of which he had got hold; for to prove the affinity of the Basque and Etruscan by means of Greek or Latin, Gothic or Romance words, however perfectly incorporated into the Basque, would be an absurdity; and we shall presently show that this is one of the absurdities in which Prof. Campbell has rather freely indulged.

But there is another difficulty. The Etruscan inscriptions are perhaps none of them later than the second century B.C., but the earliest examples of Basque literature are of the fifteenth century, except a short charter granted to the commune of Daviles in 1150, 3 Tomes chant des Cantabra. Now under any circumstances there must be great difficulty in proving the affinity of languages whose literatures are separated by not less than seventeen centuries, but the difficulty becomes insuperable when it is remembered that one of the languages has been subjected to very great foreign influences. We quote from M. Blabé, the greatest authority on the Basque:—"L'idiome Basque s'est tellement modifié depuis le XV ième siècle, qu'il est toujours très dificile, quand il n'est pas ab olument impossible, d'expliquer les premières textes connus qui remontent à cette époque." If the changes have been so great within three centuries, during which time the language has acquired, we should suppose, some degree of fixity through a printed literature, and when it has been comparatively free from foreign influence, what changes must have taken place in the sevent en centuries when the country was constantly changing masters, and there was no literature to fix the language. M. Blabé points out that it is impossible, just on account of the mixed character of the language and of the people, to determine the affinity of the Basques or of their language. After a lengthened review of all the sources of information, he says:—"La toponymie ancienne de l'Espagne, la numismatique dite ibérienne, le droit coûtumier, et les prétendus chants héroiques, ne jettent donc, jusqu' au présent, aucune lumière sur l'origine des Basques. Les moyens d'information sont limités à l'histoire positive, à l'anthropologie, et à la philogogie comparée. Ces trois sciences constatent unanimement que les Basques sont un peuple fort mélangé." M. Blabé plainly points out the great difficulty in determining the affinity of the Basques themselves. The undecided relations of the Basques and of their language has hitherto deterred Etruscologists, and would naturally deter any ordinary scholar; but Prof. Campbell's ingenuity can adapt itself to the most adverse circumstances, or perhaps we should be more correct in saying that he is quite unconscious of these difficulties. But he has not only determined that Etruscan is Basque, but also that it is syllabic, and therefore he has found it necessary to reject all the bilinguals. "The bilingual inscriptions," he says, "present many difficulties. In some cases I doubt their being bilinguals at all, as the Etruscans used characters hardly differing from the Latin." Prof. Campbell is evidently ignorant of the relation between the Etruscan and Latin alphabets. We shall presently tell him something about this relation, but in the meantime does he not see that the existence of even only one bilingual inscription is sufficient to give us the characters of the letters! How many Rosetta stones, or how many Behistun inscriptions, would Prof. Campbell wish! The very scant inscription on the boss of Tarkondemos, consisting of only seven words, in the bilingual of Hittite and Persian cuneiform, has afforded Prof. Sayce a key by which he has been able not only to determine the value of the letters, but even to read some of the Hittite inscriptions. Prof. Campbell, if consistent, must reject all the bilingual inscriptions. But these Etruscan bilinguals present many difficulties to Prof. Campbell, simply because they will not fall in with his hypothesis. He believes that Basque is Turanian, and as he has determined that Etruscan is Basque, it must therefore be Turanian also. But he imagines also that the Turanian languages are syllabic, and he concludes that as Etruscan is Turanian, it must also be syllabic, and now we begin to catch some idea of his meaning when he says:—"I have the honour to report to this Institute, as one of the most important results of my studies in Hittite Palæography, the solution of the Etruscan problem." The Hittite is Turanian and syllabic; the Etruscan he has determined is also Turanian, and therefore syllabic. There can then be no doubt as to the light which his studies in Hittite Palæography throw on the Etruscan problem. Let us satisfy ourselves of Prof. Campbell's reasoning: Etruscan is Basque, Basque is Turanian, Turanian languages are syllabic, therefore Etruscan is syllabic also. We are not responsible for Prof. Campbell's logic, we have only tried to reduce it to the simplest terms; but to himself nothing can be clearer, and all that is necessary is to illustrate it by examples, and applying this key, he imagines that he can unlock all the treasures of the Etruscan language. All those bilingual inscriptions are of no value, nay they are deceptive, no doubt intentionally so, possibly to perplex such men as Müller and Lepsius, Mommsen and Deecke. If we are not to accept these bilingual inscriptions as virtually duplicates, then we cannot divine their meaning. In every other case bilingual inscriptions have been of the utmost value, have been indispensable, and we cannot understand why they should be worthless here. Prof. Campbell has however decided that they are worthless, and that the door will only open to his key. Now the whole value of Prof. Campbell's researches rests on the syllabic character of the Etruscan language; but we beg to differ from him, and we maintain that Etruscan is not syllabic. But admitting with Prof. Campbell that these bilinguals are worthless, yet apart from these, apart also from the fact that we know the history of the Etruscan alphabet better perhaps than we know the history of any other alphabet, we maintain that every circumstance is against the possibility of the Etruscan being syllabic. Prof. Campbell seems ignorant of the life and growth of languages, or at least of linguistic symbols. Languages pass through separate and distinct stages in regard to the character and value of the signs or symbols of thought. The first of these stages is the Ideographic, or, as it is generally called, the Hieroglyphic. A man in his barbarous state wishes to express his idea of a horse, and he draws the picture of a horse; of a man, and he draws the picture of a man. This is the earliest form in which man has expressed his ideas, whether for the purpose of communicating those ideas to others, or of preserving them, and assisting his own memory. This figurative writing is presented in the inscriptions of Egypt and of Mexico.

But this is an exceedingly cumbersome mode of expressing ideas. An almost unlimited number of separate signs would be required. This would be most burdensome to the memory, and be unable to express grammatical relations. With the growth of ideas one sign came to express several ideas by means of determinates, or small distinguishing marks added to the sign itself somewhat similar to the vowel signs in Hebrew; but there was a tendency in these original types of figurative writing to become conventional, as in the case of Chinese and the language of the cuneiform inscriptions. Here the signs do not at once suggest what they are intended to represent. They have undoubtedly grown out of iconographic prototypes, but they have lost their resemblance. They are called semeiographs, or better ideograms. Now these ideograms mark a progress from purely figurative writing to phonetics. Thought and feeling naturally express themselves in voice, and a phonetic value came to be attached to the ideogram, and the sign suggested at once an object and a phonetic value. But the representative value of these signs became less and less prominent, and in time they were used only to express a sound or combinations of sounds. The name of the object represented a certain sound, at first no doubt the whole name, and then only a part of the name. And in this way arose syllabic writing, which was generally acrological, that is, the initial letter or letters came to express the sound which was itself expressive of an idea. In the case of the Chinese the ideogram has continued to express only one sound, and not a combination of sounds, and so the language has remained monosyllabic. The sacred books of the Chinese were however accepted by the Japanese, who adopted the characters in which the sacred books were written, but they ascribed to these characters a different phonetic value, while they combined them according to the exigencies of their own national idiom, and to permit of certain flexions. But this change, as exemplified in the Japanese or similar instances, marks a change from the ideogrammatic to the syllabic form. But the combination of signs permitted by the syllable allowed a great diminution in the number of the signs. In place of the innumerable signs of the Chinese, the Japanese expressed their vocalization by forty-seven characters wholly borrowed from the Chinese, but having different determinate values. This change of the value of the Chinese characters to the Japanese took place probably in the third century, but some five hundred years after the connection of Japan with India led to the formation of a new syllabary, based on the other, but presenting a more cursive form, and reducing the number of syllabic signs. This syllabic state of a language marks a distinct stage in the growth of language, or rather of linguistic symbols. But there is still another stage in which individual signs are used to represent individual sounds, as they are uttered by the organs of speech; and now there is possible a classification of sounds, and consequently of letters into vowels and consonants, or into dentals, labials, gutturals, and nasals, and an alphabet is formed. Now this throughout is a gradual development. The figurative writing of the Egyptians was developed into the alphabet of the Phœnicians. The conventional figurative writing of the Chinese was developed into the syllabic of the Japanese, and from that into the alphabet of the Coreans. The writing of the Accadians was developed into the cuneiform character of the Assyrians and the Babylonians, and from this passed, on the one hand into the syllabic cuneiform of the Persians, and of the Cypriots on the other. What we wish especially to point out is, that these changes mark distinct stages in linguistic development, and consequently in the development of civilization, for the two are inseparably connected. But Prof. Campbell imagines that the syllabic form is peculiar to the Turanian languages. That we may not misrepresent him we shall quote his own words. He says:—"The problem therefore is to find the powers of the Turanian alphabet or *syllabary*, Besides the Cypriote, the Corean of far Eastern Asia has furnished me with phonetic values of forms belonging to the Etruscan and other old *Turanian syllabaries*." Again:—"As the syllabic values of the Aztec characters are well known, I gained in them the actual key to the old Turanian *syllabaries*." With only a passing allusion to the absurdity of connecting the Aztec characters with the Cypriote, we wish to lay especial stress on Prof. Campbell's association of syllabism with the Turanian languages. On the other hand we would express our entire divergence from him, and we maintain that syllabism is a stage of linguistic development common to the Semitic and the Aryan with the Turanian languages. Take Persian as a type of the Aryan; Egyptian, or Assyrian, or Babylonian of the Semitic, as well as Japanese of the Turanian. It is quite true that very many of the Turanian languages at the present day are syllabic. The Japanese have only now reached that stage of development in which they find the syllabary inadequate to their growing requirements, and are adopting the alphabet of the European nations. But we repeat that syllabism is not peculiar to any one class of languages; it marks a stage in linguistic development. However, Prof. Campbell has determined that Etruscan is Turanian, and therefore syllabic. This is the result of his researches in Hittite Palæography, and cannot be doubted, and he sets about forming an Etruscan syllabary. But here a new difficulty meets him in the small number of the Etruscan signs. Simple letters may enter into an almost unlimited number of combinations, but syllables are not so flexible, will not so easily combine, and we require a very much larger number of syllabic signs. Thus the Amharic has thirty-three consonantal signs, each of which may combine with seven vowel signs, and a separate sign is used to denote each of these combinations, so that in the full Amharic syllabarium there are two hundred and thirty-one different signs. The Persian, though approaching very closely the alphabetic form, has thirty-six distinct characters. But Etruscan has only twenty signs. Here too Prof. Campbell's ingenuity does not fail him, and he makes his syllabic signs mean anything, thus:—

I = ha he hi ho hu au ou eu oi o u hau.

π = ta te ti da de di at et it ad ed id.

K = os ots oz otz u o uts ots uz utz hotz hetz hy hots hits.

L = so sa za zo zu us oz, sometimes es ez, also it may denote cho chu cha, and ja jo ju.

In other words, the Etruscan syllabic signs represent in each case nearly all the vowel sounds in combination with a large number of consonants, so that we may make anything we please of these syllabic signs. Prof. Campbell acknowledges this, for he says:—"The poverty of the Etruscan syllabary multiplies the equivocal to such an extent that the context, or even a knowledge of the nature of the document in which the words occur, must decide their value."

The signs of this syllabary may mean anything we may choose to make them mean, only we must know beforehand what we expect them to say before we can make them say it. This is certainly very accommodating, but has it not struck Prof. Campbell that it is an insuperable difficulty in the way of receiving his hypothesis? But his syllabary of such a low order is inconsistent, not only with the evident laws of linguistic growth, but with the known facts of

Etruscan civilization. The Etruscans had reached a high degree of civilization. At an early period, long before the date of the earliest of these inscriptions, the Etruscans were in close relations, commercial and otherwise, with two of the most civilized nations of the ancient world, the Greeks and the Carthaginians, and among whom the Alphabet had reached the fullest development. It is inconceivable,—it is wholly inconsistent with what we know of linguistic development, that the Etruscans should, alone of these nations, have remained in the syllabic stage, that while in every other respect they should have been noted for their civilization,—a civilization to which every museum in Europe bears evidence, that yet in their language they should have belonged to a past epoch. In a work of William Humboldt, "Über die Verschiedenheit des Menschlichen Sprachbaues, und ihren Einfluss auf die geistige Entwickelung des Menschengeschlechtes," there are such expressions as this: "There is a mutual action of language on the mind and intelligence of a people, and of the mind and intelligence on the language. This is a capital fact. The mind of a nation, and the character of its language are so intimately bound up together, that, if the one is given, the other may be exactly deduced from it." We hold it impo-sible that a nation which was in a degree of equality with the Greeks,—a nation from which the Romans borrowed some of the most prominent features of their civilization, should have made no advance in their language beyond the syllabic state. But suppose we admit Prof. Campbell's assertion, let us see what he makes of it. We have already stated that there are some forty or fifty words occurring in Greek and Latin authors. and written in Greek and Latin characters. These words, however, he treats as literal or alphabetic; but it happens that some of these words oocur in the inscriptions, and here he treats them as syllabic. But so elastic in his mode of procedure that both alike are made to serve his purpose. He says: "Of the Etruscan words furnished by classical authors, many at once reveal their Basque origin. Lar or Lars, as Lars Porsena is the Basque *larri*—Great." This titular prenomen appears to have been one of the most common among the Etruscans, as: Lars Porsena, Lars Tolumnius, Lars Herminius Now when it is found in Greek or Latin writers it is allowed to retain its literal form, but when it occurs in the incriptions it is syllabic, and is read Saratuka, and means "engraved." It occurs in an abbreviated form at page 34 of "Etruria Capta," and again at page 29, in the feminine. But is difficult to imagine how the same word can be at one time alphabetic and at another syllabic. This Lars as it occurs as a titular prenomen means *great*, no doubt in the sense of famous; just as we say Charles the Great, or Peter the Great, or Frederick the Great. Unfortunately we can find no such meaning given to *larri* in our Basque Dictionary. Here it is defined as "un peu gros,"—somewhat gross, or rather perhaps fat. Not as if it were Charles the Great but Charles the Fat, Charles le Gros,—whom the Germans called "Karl der Dicke." It is great in the Falstaffian sense. We doubt whether Prof. Campbell will be willing to accept this rendering. But in our Dictionary *larri* stands in a very suspicious connection, and has a very Romance look. It occurs as follows:—Largo, élargir; Laranzo, largesse; Largo, large; Larri, un peu gros. It is evidently a Romance word accepted by the Basque, and therefore cannot be used in tracing the affinity of the Etruscan with the Basque. Let us take another example of Prof. Campbell's translations:

Etr.—F. LEONE, F. OA/ꟷIPNAL.

Lat.—C. Licinii. C. F. Nigri.

Translit.—*Age* Sanesikane *age* morabautukarasa.

Basque, —Age Zunt-gikin age Maira Baitu sortze.

We shall not occupy time with minor criticisms, but "*age*" does not mean "to behold"; the proper word for behold is "icust." But Prof. Campbell says, "The Latin Licinii is a derivative from licium, a leash, a tag, a thread. It corresponds exactly with the Basque *zunft*, a needleful. The final *kane* represents *egin*, to do; Zuntzegin may be an old name for tailor or weaver. The other proper name translated Nigri is Maira, a Moor or person of dark complexion. The Etruscan adds Baitu, the spotted, from *bai*, a spot, as the mother of Maira. In Latin her name would probably be read as Varia." This is a very partial instance of the playfulness of Prof. Campbell's fancy. What possible connection can there be between Licium and Licinii? Licinius was one of the most common of the Roman Gentile cognomens. It especially occurs in the Gens of the Fabii, who had other connections with Etruria than the disaster at Veii. But the Licinian Gens, though of plebeian origin, was very influential. It is generally regarded as having come from Etruria, and when C. Licinius Calvus was consul in 364, mindful of his Etruscan origin, he secured the admission of Etruscan youths to the Roman games. The name occurs very often in Etruria, but also in Latium; at Tusculum we have the Porcii Licinii, and at Lanuvium the Murenae Licinii. The form Lecne, and also the feminine Lecnesa, are very often met with on the Etruscan monuments. Licinius is simply the latinizing of Lecne, and has nothing whatever to do with *licium*, and still less with the Basque Zunft. But in this inscription occurs the word, or rather terminal, *nal*. No form occurs so frequently in these inscriptions as this. In the bilinguala it is invariably rendered by the Latin *natus* or *filius*. Now, the uniformity of this rendering evidently occasioned some difficulty to Prof. Campbell, and his object is to work in some word which will preserve this signification; according to his syllabarum, "*nal*" reads "karasa," and he says this represents the Basque "sortze". Now, as Prof. Campbell evidently attributes much importance to these words, and seems to regard "karasa" and "sortze" as test words, going far to show the connection between Etruscan and Basque, and as his reasoning here presents a very good example of his reasoning in general, at the risk of being a little tedious, we shall examine it, and shall give his own words. He says, "The Rev. Isaac Taylor and other Etruscologists, while failing to translate these inscriptions, have made some good guesses. Such are their suppositions that the characters they have read *isa* denote a wife, those read *sec* a daughter, those read *al* a child. The first is read *nare* or *anre*, a wife; the second, *nechi* or *nesca*; and the third, *karasa*; in modern Basque, *sortze*, *natus*." Surely Prof. Campbell must be aware that modern Basque can have no bearing on the present question; he might as well try to prove the affinity of the Japanese with the old Gauls by means of the present French. However, he proceeds at some length to justify the relation of these two words *karasa* and *sortze*. He says, "It has been objected that *karasa* and *sortze* are difficult to reconcile; that *nal karasa* means natus, several bilinguals attest." Prof. Campbell's consistency is very wonderful. "The Basque 'natus' is *sortze*. The only difficulty in the words is the replacement of *ka* by *so*, after an interval of over one thousand years in the history of the language." We must plead inability to understand Prof. Campbell, but so far as we can make out, he means that one thousand years ago the *so* of *sortze* was *ka*; and that within the last thousand years it has undergone a change, and *kartze* has become *sortze*. What proof can Prof. Campbell adduce of this? How does he know that a thousand years ago *sortze* was *kartze*, when he has no document with which to compare it older than four hundred years ago? He refers to Van Eys's "Tableau des permutations des consonnes dans les mots Basques des différents dialectes." We fail to see what this reference has to do with the question. Van Eye is alluding to the large number of the Basque dialects, and he tabulates these dialects as they at present exist, but this has nothing to do with the historical changes which have taken place in the language, or with its analogies with other languages any more than a comparison of the dialect of Yorkshire with that of Lancashire, or with the London cockney has to do with the old Celtic of the earlier Britons. But Prof. Campbell regards the words *karasa* and *sortze* as so important that he illustrates their relation to one another by their supposed common affinity to the Japanese. He says the Japanese equivalent of the Basque *sortze* is *harama*. This is very learned, and we feel our inability to follow Prof. Campbell; fortunately, it is not necessary. We suppose he will not require to be told that the nearest neighbours of the Basques on the north are the Provençal, a people speaking a Romance dialect. But if Prof. Campbell will turn to a Romance Dictionary he will find this word *sortze* not even changed, as the writer in the Encyclopædia says, "to suit the Basque ear"; or, better still, if he will turn to Diez's Dictionary of the Romance languages, he will find there *sortze* with all its Romance affinities; it is a derivative from the Latin *surgere*. This word is not Basque; it is a Romance word so lately introduced into the Basque, that it is as yet unchanged, and the very learned disquisition about its being *kartze* a thousand years ago, and about its affinity with the Japanese *harama* is all thrown away upon us, and we still doubt the Etruscan being syllabic or that it has any connection with the Basque.

But further, on page 27 of "Etruria Capta" occur these words *Rakora* translated "offering," and in each of the next three inscriptions occurs the word *Rako;* so that on the same page *Rakora* occurs once, and *Rako* three times, and on all these occasions it is a noun and means an offering. These words occur very frequently in "Etruria Capta." So also do *Ra* and *Rano*, and at page 69 occurs *Rapi*, a verb, "to receive," and at page 98 we read "*Rako atso Rakone*," translated "towards age acknowledging,"—and regarding *Rakone* Prof. Campbell says: "The final ne seems to change the post-position *rako* into a verb,"—rather a unique grammatical change, we think unparalleled in the history of language, and surely he forgets that he has all along translated *Rako* as a noun and not as a post-position. He continues: "Here *Rakone* seems to signify "acknowledging," "paying respect to." We very much wonder, that with Prof. Campbell's profound knowledge of Basque, he has not discovered that in Basque no word begins with R. When we began to read "Etruria Capta" we were rather surprised at frequently meeting with words beginning with R, and to find even allusions to them in the notes without any apparent consciousness of their irregularity; we turned over page after page of Basque to find a word beginning with R, but without success. We again consulted our Dictionary, and under the heading R we found the following: "Cette lettre R n'est en usage, au commencement des mots Basques, que pour les noms propres tels que Rome, Rambouillet, et encore dans le langage familier, les Basques diront Erroma, et non Roma. Il est à croire que le suppression de la consonne R comme initiale des mots a pour cause certaines difficultés que son articulation semble offrir d' abord." Humboldt says: "No word in Basque commences with R. The Basques always place an *e* before foreign words of this category, and then double the R. And in certain cases, as in the words *edastea* and *erastea*, there is a dialectic change of *d* and *r*. But they always say *erregue*—roi" M. Blabé, the most competent authority, says: "Je conviens que le Basque n' a point en propre de mots commençants par *r* et que lorsqu' il donne l'hospitalité dans son glossaire a des mots ou *r* est en tête, il a soin de les faire précéder d'une voyelle. Sur le versant Nord des Pyrénées occidentales cette voyelle est un *a*—*arraya* la race," *arrichina* resine. De l' autre côté des Pyrénées les Basques disent aussi *arrocher*—rocher. Cependant ils préfixent plus volontiers l' *e*—*errisina*, resine, *errabia*, rage. Peutêtre en bien cherchant trouvera-t-on quelques mots où ces préfixes *a* et *e* seraient remplacés par *i*. Aussi selon les pays, viz.: se dit *arrosa* ou *irrisa*." We do not see how we can reconcile Prof. Campbell's constant use of the *R* with the plain testimony of these eminent Basque scholars.

From the first page to the last of "Etruria Capta" any affinity between languages is based on mere similarity of sound. Prof. Campbell never once points to any similarity in grammatical forms; yet it is on this alone that any such affinity can be proved. Nay, he even makes a virtue of his rejection of grammatical forms, and he says: "I have set forth the fact that, various as are the grammatical forms of Basque, Caucasian, Yeniseian, Japanese, Corean, Iroquois, Chocktaw, and Aztec, they are one in vocabulary, and constitute with many other members a linguistic family of no small importance. The parent speech belongs to Syria. West of Syria, in Asia Minor, Italy, Spain, and Britain, the inscriptions yield Basque." We think we have shown how far Prof. Campbell is competent to speak of this. He continues: "East of Syria, in India, Siberia and on this continent, the Japanese at first, and afterwards the Aztec, are the languages set forth." And again: "The threefold Tyrseni, Tuscer, Naharcer, Japuscer, carry us back to Mesopotamia, the land of Nairi or Nahirina, and to the region of Khupuscai, as well as forward to Navarre and Guipuscoa. The former even takes us to this continent, where the Aztecs or Citin also called themselves Nahuatl or Navetl. Who the Tuscer were it is harder to say, for the final *er* is a termination; otherwise the great Basque name *Euskara* would at once suggest itself in such a form as the Dioscurias of Colchis, now Iskurieh, near which Chapsoukes or modern Khupuscians and eastern Guipuscoans dwelt." It is hard to characterize this. It is simply philology run mad. Euskara and Dioscurias connected! Prof. Campbell knows Greek, and should know that the cities which bore the name of Dioscurias, and of which there were several, received that name because they honoured as their tutelar Deities, the twin sons of Leda, Castor and Pollux, the Dioskouroi.

Perhaps the leading error into which Prof. Campbell falls is the constant application of the laws which govern the Aryan languages to the Turanian also. Grimm's laws, of the variations of consonants in the Aryan languages, do not hold good in the Turanian. But even in Aryan languages, it is always dangerous to conclude that words which assimilate in sound, or that have the same class of consonants, are connected, and much less may such assimilation be trusted in the Turanian languages. Rask, Schott, Cap'trén, Rémusat, and Boetlingk,—in fact all who have written on the Turanian languages, are very particular in guarding us against depending on the similarity in sound. But they also tell us that it is absurd to expect the existence of the same words running through the Turanian languages as they do in the Aryan. The Turanian languages have not been thoroughly classified, and the difficulty lies not only in the variation of grammatical forms, but quite as much in the vocabulary. Speaking generally, the Turanian nations have had no literature to fix words, and the consequence is that they differ from one another to a degree of which the Aryan scholar has no idea, and which makes it impossible to compare them in the very loose way Prof. Campbell has attempted. The basis of the classification of the Turanian languages has hitherto been according to the employment of pronominal affixes, but this is an unsatisfactory and very meagre mode of arriving at a classification. Max Müller says: "To maintain a word and not to allow it to be replaced by a new expression was possible in the Aryan, that is in a social state of the language, not among nomad tribes, who, living only for the present, were little concerned about the past or future, without history, without ambition; and thus we find that the number of common words is very small." Schott says: "We ought not to despair about the affinity of these languages, the Turanian, although the words for the most necessary ideas in them are so essentially different. To Prof. Campbell, however, the Turanian languages present no difficulty whatever, and he proves their affinity with one another by long lists of words, which he says are identical in Basque and Etruscan, in Japanese and Circassian, in Hittite and Chocktaw, in Iroquois and Aztec. We trust Prof. Campbell will pardon us if we prefer the judgment of Müller and Schott, and of a score of other Turanian scholars to his judgment, and if we express a very strong doubt as to the value of his researches and his very remarkable conclusions.

And now a few words regarding the Etruscan alphabet, its origin, some of its peculiarities, and the extent of country over which it prevailed, and a short statement of what is generally received concerning the origin of the Etruscans. The town of Chalcis in Eubœa was one of the oldest of the Phoenician colonies, and received from Phoenicia the alphabet, which it adopted with very little change. When Chalcis became an Ionic possession it still retained its alphabet, which is more closely connected with the old Phoenician than any other of the Greek alphabets. Shortly after Chalcis became Ionic it entered into rivalry with Miletus for commercial and colonial supremacy. Miletus acquired a supremacy in Eastern Europe, in the Ægean, and the Euxine; while Chalcis turned to Italy and the West. Cumae was founded by a colony from Chalcis, and became a centre from which Greek learning, Greek culture, and the Greek Chalcidian alphabet were communicated to the rest of Italy. Etruria early received its alphabet from this source and an examination of the Etruscan letters will at once show their similarity with that earliest Greek alphabet. The Etruscan, the Umbrian and the Oscan of the Italian dialects approach most nearly in their alphabets to the Chalcidian, and the Latin is the farthest removed. The Etruscan rejects the soft mutes B, G, D, and retains the aspirates *th*, *ph*, *ch*. The Latin on the other hand retains the soft mutes and rejects the aspirates. The Etruscan and the Umbrian alike retain the Sam and the Sigma, the Zain and Samekh of the Phoenicians. At that early period we perhaps cannot expect exact fixity in the alphabet, and while all the Etruscan inscriptions are of the same type, there are yet some minor differences, as we may see by comparing the pure Etruscan alphabet with the Etruscan alphabet of Campania. This last lying close to the Oscan, seems to have been affected by it. The influence of the Etruscans was very great in the South, but especially so in the north of Italy, and even in the districts still further north. They carried on commerce with central Europe, and apparently with the countries around the Baltic. Northern wares are frequently found in the tombs, and were also exported from Tarquinii, a seaport which rivalled Massilia in the amount of its exports. The result was that the Etruscan alphabet extended far into Europe, and from the *Romana Provincia* on the west to the Tyrol and Carinthia on the east. Throughout this extended district the Etruscan alphabet prevailed. But in the north-eastern corner of Italy another element was introduced and another Greek alphabet. That movement which drove the Dorians out of Thessaly to the south seems to have compelled the migration of another tribe into north Italy, and this tribe settled about the mouths of the Po and the Adige. Whether these were Veneti or the Euganei, we are not prepared to say. The inscriptions in this alphabet are found principally at Este. With which of the Greek alphabets we are to connect it is still uncertain. Berndorf believes it to be Ionic; Kirchhoff regards it as Locrian; while the Bronze of Tegea would seem to connect it with the Arcadian or the Elean.

And now, before we close, a few words regarding the origin of the Etruscans. Herodotus tells us that the Lydian nation having, from internal difficulties, become divided, one portion emigrated from Lydia under Tyrrhenus, or, as he is some times called, Tarchon, and that after a time these emigrants settled in Umbria, and by Umbria Herodotus means North Italy. Whatever importance we may attach to this story it must be admitted that there are some facts which seem to lend it plausibility. The sea which washes the west coast of Etruria has, from an early period, been called the Tyrrhenian Sea, and the city of Tarquinii is regarded as having derived its name from Tarchon. That a band of pirates called Tyrrhenians did long infest the Ægean Sea is well attested, and it seems equally certain that a portion of them settled in Italy. Thucydides speaks of Tyrrhenian-Pelasgians who had originally dwelt in the peninsula of Athos, but were driven from there to Athens or Attica, and finally took refuge in Lemnos. Herodotus adds that these Tyrrhenians drove out the Minyae and held the island for some time but were overpowered by Otanes, a general of Darius Hystaspes. After the close of the Persian wars, the Athenians took possession of the island. Both ancient and modern writers identify these Tyrrhenians with the Tyrrhenian invaders of Italy. Niebuhr was the first to point out that the Etruscan was a mixed language, and Lapsius believes that with a strong Pelasgic element there is combined an Umbrian and possibly a Greek. Without entering into any discussion of these opinions we notice that the identification of the Tyrrhenians of Lemnos with the Tyrrhenians or Etruscans of Italy has been confirmed by the recent discovery on the island of Lemnos of two inscriptions in unmistakable Etruscan. These inscriptions, which seem of different dates, are engraved on two sides of a large block of stone, which evidently formed part of an altar. As read, the altar is called the Altar of the Hephaestii, and is dedicated to Zerona, worshipped in Myrina. Hephæstias and Myrina were the two principal towns on the Island. This deity, Zerona of the Tyrrhenians of Lemnos, suggests a connection with the Zirne of the Etruscans, and the Macedonian Zeirene, and, perhaps, with the Thracian Zarunthos, -thos being a masculine termination. These similarities would seem to identify the Tyrrhenian-Pelasgians of Etruria with the Pelasgians of Greece. But there is satisfactory evidence connecting this stone with the place where it was found. It bears the names of the two towns of the island, and is dedicated to the tutelar Deity of one of these towns, and it must be remembered that the dedication is in the Etruscan language. This new discovery certainly corroborates the information given by Herodotus, by Thucydides, Hellanicus, Plutarch and Strabe. But perhaps this new discovery does not determine very much, for the question will be asked: Who were these Tyrrhenian-Pelasgians? But this discovery will have the effect of pointing out more definitely in what direction researches ought to be pushed, while it renders more probable the finding of some bilingual which may furnish the key to unlock the Etruscan mystery. It does not as yet permit any new solution of the Etruscan problem, it only gives hope of some further light on the subject.

The President said that it was hardly fair to consider that Prof. Campbell had overlooked the fact that a syllabic language was a stage of development from picture-writing. He considered that Prof. Ferguson had taken quite as much liberty with the principles of philology as Prof. Campbell. In regard, however, to inscriptions that he had shown Prof. Campbell, the latter acknowledged that if a satisfactory explanation could not be given, his whole theory must fall to the ground.

The President read a paper on "Eskimo Numerals."

EIGHTH MEETING.

Eighth Meeting, 8th January, 1887, the President in the Chair.

Exchanges since last meeting, 136.

The following were elected members :—Thomas M. Scott, G. S. C. Bethune, A. Gaunt, S. Jardine, John L. Kerr, W. E. H. Massey, R. Pitman, C. F. Wagner, Henry Winnett, H. S. Alexander, F. D. Manchee.

Mr. Arthur Görgenyi, on invitation of the President, read a paper on "The Corea."

On motion by Dr. Meredith, seconded by Mr. J. C. Dunlop, the thanks of the Institute were tendered to Mr. Görgenyi for his interesting and valuable paper.

On motion by Dr. Kennedy, seconded by Mr. Boyle, the privileges of membership of the Institute were tendered to Mr. Görgenyi during his stay in Toronto.

Dr. Rosebrugh read the following paper on "Duplex Telephony."

In this paper I desire to call the attention of the members of the Institute to some recent advances that have been made in the direction of duplexing telephone lines. It is now ten years since the telephone was introduced but it is only quite recently that attention has been directed to duplex telephony. Duplex telephony seems to be adapted to long distance telephony only. In long distance telephony the best results are obtained when two wires are used, one wire being used as a return wire;—the two wires forming what is called a metallic circuit. The wires used for this purpose require to be first-class conductors. They are now made of copper. This necessarily very much increases the cost of long distance telephone lines, firstly because copper wire is expensive and secondly because two wires instead of one are used.

Hence any means or device that will increase the working capacity of telephone-trunk-lines will proportionately decrease the cost of long distance communication by telephone.

When I took up this question a little over two years ago my object was to use the metallic circuit or double wire trunk line system connecting two telephone exchanges so that either two telephone subscribers or a telephone subscriber and a central office operator at each end of the metallic circuit could communicate simultaneously without interference. In order to accomplish this I found that there were two problems to solve, firstly, how to render the central office receiving telephones neutral to the subscribers' transmitters, and secondly, how to render the subscribers' receivers neutral or irresponsive to the central office transmitters.

The solution of the first problem was not attended with any great difficulty. The plan adopted was as follows, namely : —At each central office and at each end of the metallic circuit a subscriber's line was attached. Instead of using the ordinary telephone receiver with a single coil, a telephone with a double coil was used and instead of inserting said coil in a single branch of the metallic circuit, one coil was inserted in one branch and the other coil in the other branch of the metallic circuit and the connections were made so that electrical currents traversing one coil, would be neutralised by the electrical currents traversing the other coil. Speaking technically, the coils were connected differentially. The electrical currents generated by the subscribers' transmitters passed through the two coils in opposite directions and consequently neutralized each other. Hence while two subscribers, one at each end of the metallic circuit, were using the line, nothing would be heard in the central office telephones.

The first problem having been solved, I was encouraged to attempt the solution of the second, namely, how to render the subscribers' telephones neutral to the central office transmitters. This was found to be a difficult problem. It was obvious that if the transmitters were placed in either branch of the metallic circuit, the electrical currents generated by said transmitters would divide at the junction of the subscribers' lines and a portion of said currents would escape to ground through the subscribers' telephones. Without stopping to enumerate the different expedients resorted to, I finally saw that the only solution to the problem was to arrange the central office transmitters so that both branches of the metallic circuit would be charged equally, simultaneously, and in opposite directions. By charging one wire positively and the other negatively at the same time, I saw that the electrical equilibrium between the two wires could be disturbed without affecting the equilibrium of the subscribers' lines. Fortunately after many and various experiments the means for accomplishing this were discovered and the problem was finally solved.

I also discovered that this can be accomplished in several ways. I will call your attention to but two of these. The first of these methods is to use a transmitter with two induction coils, the primary coils being connected either in series or in multiple arc, and the

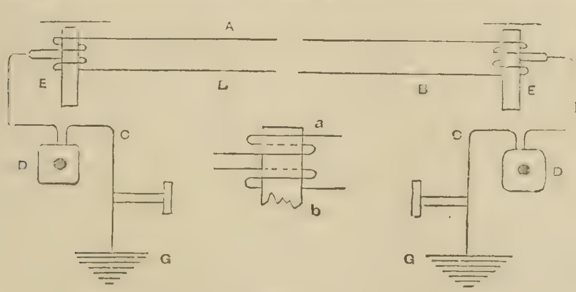


FIG. 1.

In Fig. 1 *A.A.* and *B.B.* are two branches of a metallic circuit, and *C.C'.* are two subscribers' lines attached thereto. *D.* and *D'*, subscribers' transmitters, and *E.E.* are receiving telephones at two central offices at each end of the metallic circuit respectively. The telephones *E.E.* have two coils, *a* and *b*, the former connected with wire *A.* and the latter with wire *B.* These coils are connected differentially, and the telephones are neutral to the subscribers' transmitters.

secondary coils being connected in circuit, the one in one branch of the metallic circuit and the other in the other branch of the metallic circuit. In the second method, repeating coils are used with one coil in each branch of the metallic circuit, said coils being connected with each other and also with an independent telephone circuit.

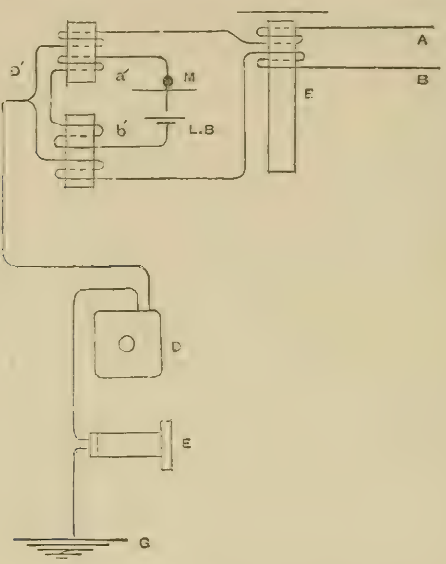


FIG. 2.

In Fig. 2 *A.* and *B.* are the two branches of a metallic circuit at one end of a telephone trunk line. *C.* is a subscriber's line, and *E.* a receiving telephone in said subscriber's line. *D′.* is a transmitter with two induction coils at the central office. The secondary coil of coil *a′* is in circuit with wire *A*, and the secondary coil of coil *b′* is in circuit with wire *B.* *M.* is a microphone, and *L.B.* the local battery connected with the primary coils of *a′* and *b′*. *E.* is the differentially wound receiving telephone at the central office.

In the first method the operation is as follows : The voice impulse vibrates the diaphragm of the transmitter, this varies the strength of the local battery circuit traversing the primary coils of the two induction coils. this generates secondary currents in the two secondary coils and this in turn generates electrical currents in the two branches of the metallic circuit, and if the two coils are properly balanced, electrical impulses are generated in each branch of the metallic circuit equally and simultaneously, and if the connections are properly made, these electrical impulses traverse the metallic circuit in opposite directions, the currents generated in one coil being reinforced by the currents generated in the other coil.* I might mention here in passing that the converse is also true, namely, if the connection of one of the coils be reversed, the currents generated by one coil will be opposed by those of the other and no current will traverse the metallic circuit, the currents will meet, however, at the subscribers' lines, and, being re-inforced, will proceed to "ground" through the subscribers' telephones. Advantage may be taken of this fact and two sets of transmitters may be used at the central office or at any point in the metallic circuit, and they may be connected in such a manner that the subscribers' telephones will be responsive to one and neutral to the other.

Preferably, however, I would give the subscriber both a return wire and a ground wire, and, preferably, two installations of telephonic apparatus ; one a single installation for ordinary use, and the other an installation of duplex apparatus for long-distance telephoning on the metallic circuit.

When repeating coils are used for charging the two branches of the metallic circuit, said branches are charged indirectly through said repeaters. I am aware that there is nothing new in using repeating coils in telephone circuits, but, so far as I am aware, they have never been used as here described nor with the same object in view, namely, to actuate and to be actuated by both branches of a metallic circuit simultaneously. The advantage of using repeaters, as here indicated, is to enable two subscribers at each end of the metallic circuit to communicate simultaneously without interference, one subscriber using a line connecting directly with the metallic circuit and the other subscriber using a line connecting indirectly by means of the two repeating coils. Hence by a combination of these two methods it will be seen that either two subscribers or one subscriber and a central office operator at each end of a metallic circuit may communicate simultaneously without interference.

One important advantage resulting from this arrangement remains to be named, namely, the subscribers have the advantage of two conductors instead of one. This reduces the resistance of the line one-half, and must necessarily very much improve the working of long-distance telephone lines. This idea may be extended as follows : Two metallic circuits may be connected at each end so as to form a

* Adjustable cores are used in connection with the two induction coils for the purpose of balancing, in case the two branches of the metallic circuit are not perfectly balanced.

third metallic circuit. This third metallic circuit may contain duplex central office telephonic apparatus and form a connection with a subscriber's line as well. This would give the subscriber the benefit of four conductors. The four trunk lines would be formed into three metallic circuits, and three repeating circuits could be used. In other words, the four wires would admit of four subscribers at each end of the line using the same wires simultaneously.

In August, 1885, I communicated my duplex telephone system to Prof. S. P. Thompson, of the Finsbury Technical Institute, London, England, and, through his advice and kind offices, a patent was taken out in Great Britain. An application was also filed at Washington. I submitted my system to the American Bell Telephone Company in May last, but I have not learned whether it has as yet been put in practical operation. In the meantime two claimants have made their appearance, namely, one J. J. Curry and one J. A. Barrett, the former an employee of the New England Telephone Company, and the latter an employee of the New York Telegraph and Telephone Company, both under the control of the Bell Company. One claims the arrangement of the differentially wound apparatus, and the other the arrangement of the repeating coils.

I will conclude this paper by giving two extracts from the New York *Electrical World* bearing upon the subject. The first appeared July 31st, or about two months after my system was submitted to the Bell Telephone Company. It says:—

"The great expense attending the construction of copper lines for long-distance telephony has naturally led those engaged in solving the long-distance problems to seek means for increasing the capacity of the wires. The steps to be taken are analogous to those adopted in the case of the telegraph, where the duplex and quadruplex have greatly increased the value of the lines. It is not hard to believe the report, therefore, that the American Telephone and Telegraph Company, a description of whose lines between New York and Philadelphia we gave lately, is now undertaking experiments with the object of duplexing its wires, and thus practically doubling their capacity and utility. Several methods of duplexing telephone lines have already been proposed and have been the subject of discussion and trial among telephonists, but they have not come into use, in this country at least. The delay has been due probably to a lack of necessary incentive, such as the long-distance service now furnishes. While the difficulties to be overcome in the duplexing of telephone lines are greater than with the telegraph, it is safe to say that satisfactory results will in time be attained. We understand that the work in the present instance is in highly competent hands, and even now gives excellent promise of developments scarcely hoped for."

The second notice appeared October 23rd last, and reads as follows:—

"The telephone lines connecting New York and Philadelphia, recently erected by the American Telephone and Telegraph Company, of this city, have already been described in our columns. It was evident to all interested that lines running parallel for over one hundred miles would suffer from induction if the ordinary "grounds" were employed: hence complete metallic circuits of hard-drawn copper wire were erected, through which the articulation obtained, as we have ourselves tested, leaves nothing to be desired. It becomes manifest, however, that the erection of a double circuit is accompanied by a considerable increase in the cost of construction. Hence it is but natural for the company to seek in some way to increase the capacity of its lines, but still to retain the advantages of the metallic circuit.

"The duplexing of these telephonic circuits was, therefore, undertaken by Mr. John A. Barrett, of Brooklyn, who has succeeded in devising a system which, broadly stated, *consists in bringing the metallic or double-wire instruments at the terminal stations into inductive relation, by means of converting or repeating coils, with both sides of the circuit.*"

The question of priority of invention will be decided by the United States Patent Office, and I doubt not due justice will be done in the premises.

Mr. R. F. Stupart read a paper on "Barometric Pressures."

The President congratulated the Institute on the three valuable and important papers that had been read that evening, and contrasted the present with the time when it was difficult to procure even one paper, which was read to an audience of from six to a dozen persons.

NINTH MEETING.

Ninth Meeting, 15th January, 1887, the President in the Chair.

Exchanges since last meeting, 19.

The following were elected members:—J. J. Kelso, William George Mutton, Alfred Henry Mason, F.C.S., M.R.M.S.

Mr. F. F. Payne read the following paper on "The Mammals and Birds of Prince of Wales Sound, Hudson's Strait."

During a stay of thirteen months at Prince of Wales Sound, Hudsons Strait, with the primary object of taking meteorological observations, and having some leisure time I devoted as much of this time as was possible to the study of natural history of this region, making collections of the mammals, birds, fishes, insects, and plants; also making numerous notes from my own observations and from such information as I could gather from the Eskimo, who are most keen observers of nature.

So much has been written descriptive of the habits of the mammals and birds found in these regions, by those who accompanied the expeditions of Drs. Hayes and Kane, and by other able writers, that it would be almost useless to go over the same ground again. I shall now therefore only dwell briefly on such other items of interest as came under my personal observation and knowledge, giving the dates of migrations, etc., of each species in the order in which they stand.

MAMMALIA.

Polar Bear *(Ursus Maritimus, Linn), (Nannook, Eskimo).*

The Polar Bear, though numerous two hundred miles to the westward, is scarce in Prince of Wales Sound, and although a sharp lookout was kept for them only four were seen, one of which was shot.

The Eskimo informed me it was useless to look for them during the winter, as they were never seen until June, when the ice is breaking up. They are then occasionally taken on the ice-floes as they drift to the eastward with a regular current that sets this way, which is of great assistance to the bear in its migrations.

At this season, the seals, on which the bear mainly subsists are very numerous and are captured while they sleep, the bear creeping to within a short distance and then running at full speed upon them.

Though almost a marine animal, the bear occassionally visits the land where it regales itself on the young grasses, the eggs of the gull and duck, and has been seen capturing salmon and trout by driving them into a corner in shallow streams.

On the whole I do not think it is as fierce as it is generally supposed to be, for although many enquiries were made of the Eskimo as to this, they could not recall a single instance of its having attacked any of their people, nevertheless it is feared by the women who were careful not be alone at the time several were seen and all of them expressed fear of it.

Wolf *(Canis Lupus Occidentalis), (Armarho, Eskimo).*

Little can be said of this animal as none were seen during my stay here, and I was informed by the Eskimo they were now seldom taken though at one time were very numerous.

They are very troublesome to the Eskimo, often tearing their sealskin boats or kyaks in pieces and devouring the skin, which they relish very much.

Their food is very varied and their appetite so great there are few animals they will not attack and devour, even the Eskimo dog is occasionally carried off.

Their fur is very much valued by the Eskimo for clothing, but as a rule goes to the trader for powder, lead and tobacco.

WOLVERINE *(Gulo Luscus), (Kubvic, Eskimo).*

This is the Eskimo's greatest enemy, and should one appear at any time near their camps they will not rest until it has been killed, and when one is brought in there is great rejoicing. It is the most ingenious thief of all the animals in this region, and is so strong that no Caché, however well built, is safe where it exists. It will turn heavy stones over and once in the Caché it does not stop to untie the well made skin bag but soon tears a hole and, Eskimo fashion, lives on oil and blubber until the bag is emptied, when it turns its attention to the next Caché.

The thieving propensities of this animal are so like that of a dishonest human being that an Eskimo who is known to be a thief is called a "Kubvic" by his people.

Fortunately this animal is not numerous in the Sound, though they are often trapped a few miles to the westward where they, like the wolf, are seen throughout the year.

ARCTIC FOX *(Vulpes lagopus L.), (Ter-i-in-i-ak, Eskimo).*

There are two varieties of this animal, common in these regions, the blue and the white, the habits of which, with a few exceptions, appear to be so like that of the red, black and silver-grey foxes, all of which were seen, that it will only be necessary to speak of them as a single species.

About the beginning of September the white fox began to appear in large numbers upon the coast, and shortly after those of other colour, which are much rarer, were reported as having been seen.

At this time the fur of all the foxes is very short, and that of the Arctic Fox is, for the most part, of slatish colour, though in some instances, almost white, with a few scattered black tipped hairs.

Spring traps were kept set throughout the winter, and a number of red and white foxes were taken, by which means we were enabled to note the changes in the colour of the fur.

Late in November the fur was still very grey, especially near the roots of the hair, and showed little change a month later. During

January the fur appeared to grow very fast and by the middle of that month was perfectly white, with the exception of small tufts of the old hair, which in a great many instances remained entangled in the new throughout the winter. It was also generally noted that the largest and best conditioned foxes had the best fur.

During the winter the fox depends almost entirely on the Lemming (Myodes torquatus) for subsistence, but during the seal breeding season may often be seen roaming over the ice in search of the young seal, and when very hungry will attack the older ones.

On visiting the traps one day it was found that a fox had been caught, but had by some means gone off with the trap. As it was supposed it could not go far it was tracked in the snow, but after walking five miles the attempt to come up with it was given up. Three weeks later this fox was sighted a few hundred yards from the observatory and was given chase by an Eskimo who soon captured it, when it was found the trap was very rusty and deeply imbedded in the leg.

Unlike the red fox the white species when caught will howl most piteously as it is approached by the trapper, and upon going up to it it immediately stands on the defensive and will fight most fiercely for its life.

After February 1st foxes became very scarce and few were taken, the last being seen on May 10th. A few remain on the coast throughout the year, but nearly all migrate to the interior, where they can enjoy the luxuries of young ptarmigan and other birds, besides the pleasure of scratching their backs upon small bushes when undergoing the difficult process of change of clothing.

ESKIMO DOG *(Canis Familiaris, Linn), (Kingmik, Eskimo).*

The Eskimo dog so nearlyr esembles the wolf (Canis Lupus occidentalis) it is difficult to describe it as other than that animal, excepting when in harness and under the lash of its master's whip.

When at liberty it may often be seen roaming over the country in search of the Lemming or other food, and appears only to care for its master for the food it may get from him.

There is only one redeeming quality in its habits, and that is its simple appetite; it will live a great length of time without food and is not at all particular what it eats, as the following list of articles which I have seen it devour will show:—An old cloth hat, a boot, part of a flannel shirt, part of a pair of trousers without the buttons, and a lot of greasy felt gun wads, which were seen the next day carefully placed beside a stone undigested. It may be added, *en passant*, these gun wads were subsequently used by an Eskimo for his gun. As might be supposed the dogs do not grow very fat, nevertheless they are often slaughtered for food during hard times, and their skins are made into clothing.

In harness the Eskimo dog appears as a different animal, it is then fed occasionally upon the skin of the walrus and other refuse, but woe betide the dog that refuses to pay for this food by pulling too lightly upon the load that is given it. Thrashing is then often far too good for it, it must pay with a part of its body, and carelessly going up to it the quiet, though enraged, Eskimo will take his knife and cut a small piece off its tail or ear and will as coolly return to the sleigh with the call "whoots," which means "get on."

Having a large Newfoundland dog with me, which was brought up on the ship from the Labrador coast, it was very interesting to watch its treatment of and by its Eskimo neighbours. From first to last the males were deadly enemies, my Newfoundlander disdaining to have anything to do with them, but with the females he was a particular favourite, thereby causing some most terrible rows in the camp.

REINDEER *(Rangifer Tarandus (Limn, Baird), (Took-too, Eskimo).*

The reindeer is only a summer visitor to the coast, arriving in the early part of April and leaving again for the interior in November.

The horns of those taken about April 10th were soft and a great many were covered with velvet. At this time of the year a great stir is noticed among the Eskimo, and in a few days all leave for the hunting-grounds a few miles inland where the deer are most plentiful, returning to the shore again about six weeks later.

The reindeer is undoubtedly the most useful animal to the Eskimo that is found in these regions; its hide is used for clothing and bedding, its horns for spear and arrow heads, and the lining of its belly for sewing thread, while the fat, which is usually melted down, is one of the greatest luxuries the Eskimo possesses.

In June the young are dropped, and during this month and July the deer is not molested as the Eskimo is then too busily engaged in seal hunting. In August the hunt again commences, and at this time the Eskimo secures all the skins he can for winter use; unfortunately, however, owing no doubt to the large number that are killed annually for their tongues which are shipped to the London market, they are not so numerous as formerly and many a poor Eskimo has to make shift with a few thin seal skins for his bed and the same for his clothing throughout the winter.

While exploring one day, a natural deer trap was found in the shape of a wide crevice in the side of a hill that had doubtless been formed by the action of frost. The sides of it were perpendicular and about twelve feet high, and in it were the skeletons of several deer, and one that had recently fallen in.

POLAR HARE *(Lepus Glacialis, Leach) Oak-a-luk, Eskimo.*

Like other varieties of the same species, the Polar Hare is a most timid animal, and is so watchful of its enemies that it can seldom be seen to any advantage, and is only shot as it passes, like a ball of snow, in its swift retreat; nevertheless, a few fine specimens were taken and added to my collection.

Although it undoubtedly remains here throughout the year, none were seen until the month of December, and from that time until the end of May in the following year, its well-known tracks could be seen in the snow in every direction. Its food consists of a number of small plants, especially the knotty roots of certain grasses, which it obtains by burrowing in the snow and moss.

HUDSONS BAY LEMMING *(Myodes torquatus Pallas: = Mus Hudsonius, Forster) Avingnuk, Esk.* :

This is the smallest of the quadrupeds found in these regions, and, apparently, only inhabits the coast where it is so numerous that by turning over a few stones, one or more are sure to be found. On a still winter's night, when everything appears hushed in sleep, this interesting little animal may be heard in every direction boring through the snow, and then stopping as if to take breath, and again returning to its labours. Then is the time its enemy, the fox, stands and listens a minute, and pouncing upon the spot where the boring is heard, cuts off its retreat and with little trouble secures its prey.

The fur of the Lemming is of a greyish colour in the summer time, gradually turning white as the winter approaches, but never becoming perfectly so. In some cases the skin was found perfectly hairless in parts that had been affected by a parasite which infests this animal.

WALRUS *(Trichechus Rosmarus, Linn) Iviuk, Esk.:*

The Walrus is not numerous at any time in the Sound, and disappears altogether in July, not returning again until about the middle of November; it is then eagerly looked for by the Eskimo, who may be seen exploring the ice from a neighbouring hill with their telescopes, and occasionally walking out to the open water when one is sighted.

During my stay here very few of these animals were seen, and of those taken, only one was an adult specimen, the others all being very young.

The tusks of the walrus are of great value to the Eskimo for spear heads, and for many other purposes, the ivory often being sawn into lengths and used in shoeing their sleighs.

GREAT SEAL *(Phoca Barbata, O. Fab) Oog-jook Esk.:*

This is the largest of all the seals found in these waters, and next to the deer it is perhaps the most useful animal to the Eskimo.

It arrives in the Sound soon after the ice has broken up, about the end of June, and although never very numerous they are taken from that time until the Strait again fills with ice towards the end of October.

In common with other seals they are shot or harpooned either while they sleep on the ice or while swimming in the open water. The Eskimo say the Great Seal has never been known to breed here, and all those taken during my stay must have been over five months old.

The skin of this seal is used in making kyaks or boats, and harpoon lines of great length are made from it by cutting the skin in a narrow strip round the body, as you would peel an apple. It is also used for the soles of boots, the hair being first scraped off and the skin then dried in the sun, and afterwards going through a process of chewing by the female Eskimo.

HARP SEAL *(Phoca Grœnlandica), (Kyro-lik, Eskimo).*

The Harp Seal, so named from a distinct mark of the harp of Erin upon its back, arrives in the Sound a little later than the Great Seal and is much more numerous, leaving again as soon as the ice approaches in October. It does not often take to the ice, but may be seen swimming a short distance from land and is seldom alone, there almost invariably being several together.

With the exception of one or two, all those taken were adult seals, the youngest being about four months old.

The skin of this seal, which is very large, is used in making wigwams and for the upper part of Eskimo boots.

ROUGH SEAL *(Phoca Fœtida Fab), (Natchuk, Eskimo).*

This is the most numerous of all the seals found in these waters, and constitutes the principal part of the Eskimo food.

It remains here throughout the year, but is scarce during the months of February, March and April.

The first young seal taken was on March 5th, and about this time several more were found. They are born on the ice where the snow is deep, the parent seal making a most comfortable house under the snow. These houses are not easily found and are only detected by a small mound slightly above the level of the snow.

It is often wondered how the seal may be seen to appear on the ice where only a short time before not a hole could be seen, and some writers on the subject have declared the seal makes a hole from the underside of the ice, by keeping its warm nose pressed against it. This appears so absurd that during my stay here a careful examination was made of all the seal holes that were seen, and in every instance they were found along the line of wide cracks that are constantly being formed by the ever changing tides. As will be readily understood the water between these cracks soon freezes and becomes covered with snow, and the seal keeps a hole open by constantly diving and returning again to breathe.

Many are the arts the Eskimo resorts to to capture this seal, and perhaps the best is by two hunters, one of whom lies down at the edge of the ice near some open water, while his companion remains about ninety yards further from the edge. Here he scrapes upon the ice with his spear and whistles in a low note, while the charmed seal, if there is one anywhere near, slowly swims towards the object at the edge of the ice, and when near enough is surprised with a charge of shot, à bullet or a spear.

RIGHT WHALE *(Balæna Mysticetus Linn).*

Only two of these whales were seen, and as the Eskimo seldom meddle with them little could be learned of their habits.

They apparently only pass here on their way to or from Hudson's Bsy, and will not attempt to make the passage while there is ice in the Strait.

Portions of what undoubtedly were the skeletons of three of these animals were found on the shore, and the Eskimo informed me that at one time, when there were more of their people living here, they would not hesitate to surround one of these huge monsters in their kyaks, and with harpoon and floats would sometimes succeed in killing one.

NARWHAL *(Monodon Monoceros, Linn), (Uglung-war Esk).*

Commonly known as the Unicorn, the Narwhal is often met with in the Strait, and is much valued for its large ivory tusk which often measures five feet in length. Only one of these animals was seen late in the summer, and the remains of another were found on the shore, the tusk of which measured four and a half feet.

WHITE WHALE *(Beluga Catodon [L.] Gray), (Kelleluak, Esk).*

The white whale, though indigenous to the Strait, does not come near the coast until the ice begins to open, the first seen being on April 26th, when there was some open water about five miles from the shore. From this time they were often seen throughout the summer, sometimes singly, but oftener in small schools following the line of the coast. Then the Eskimo may be seen standing motionless at some prominent point, with gun ready waiting patiently for a shot. To one accustomed to extremely quick shooting, a white whale might seem an easy mark to hit, but with the inexperienced, to make the best of it, the bullet never seems to strike anything else than the place where the whales head was.

During the summer this animal forms a large part of the Eskimo's food, and is eagerly hunted by them.

BIRDS.

STONE CHAT *(Saxicola œnanthe L.).*

This is perhaps the most valuable zoological specimen taken during my stay in the Strait. It was the only one seen, and is described by Mr. Whiteaves, Palæontogist of the Geological and Natural History Survey of Canada, who identified all the birds in my collection, as being an adult male of a European species not previously recorded as occurring in Canada, though found in Greenland.

This active little bird was shot after a long chase on May 19th.

SHORE LARK (*Eremophila Alpestris, Forster*).

Arrived May 17th, mating June 1st, young fledged July 15th, was last seen on August 10th. This bird was very numerous during the summer.

Water Thrush (*Siurus nœvius, Bodd*).

Arrived May 20th, mating June 1st, young fledged July 25th, last seen on October 1st. A great number of these birds were seen.

Lapland Longspur: Lapland Bunting (*Plectrophanes Laponicus L.*).

Arrived May 14th. This was the only specimen seen and taken.

Snow Bunting (*Plectrophanes nivalis, L.*), (*Capenoir, Eskimo*).

The first Snow Bunting seen was on April 1st, and shortly afterwards they were very numerous. They were mating about May 25th, young were fledged about July 16th, and about August 23rd the adult birds appeared to leave, returning again a month later, and by October 21st all had disappeared.

Raven (*Corous Corax L.*), (*Tooloouk, Eskimo*).

The Raven is indigenous to the country, and although most of them appear to migrate southwards a few were seen throughout the winter. They were mating about May 25th, and the young were fledged July 15th,

This bird is the Eskimo's companion, following him everywhere in his hunts, and when a seal is shot will perch only a few yards from him and "caw" most vociferously.

They do not seem to understand the mechanism of a fox trap and are often caught in the act of taking the bait.

Gyr Falcon (*Falco sacer, Forster*).

Arrived September 6th. They were not often seen until about September 15th, when a number were seen apparently flying south. The last seen was on September 20th.

Rough-legged Buzzard (*Archibutes lagapus, Brunnick*).

Arrived on May 15th. Were rather numerous throughout the summer. Fledglings seen on August 20th. Last seen on September 30th.

Snowy Owl (*Myctea Scandiaca*), (*Ook-pi, Eskimo*).

Only two of these birds were seen in September, neither of which was taken.

Rock Ptarmigan (*Lagopus rupestris Gmelin*).

Arrived May 11th, mating June 30th, when they were very numerous, young fledged August 18th, and last seen on October 30th.

RING-NECKED PLOVER *(Oegialites semipalmatus, Bon. :)*

First seen on June 1st. Mating, June 10th. Young fledged, July 12th. Last seen, September 25th.

These birds were very numerous throughout the summer. One was seen to pick up its young and fly some distance with it.

RED PHALAROPE *(Phalaropus fulicarius, L.)*

First seen on May 31st. Several of these birds were brought to me during the month of June; but after July 1st, none were to be seen.

PURPLE SANDPIPER *(Tringa Maritima, Brunn.)*

Only one of these birds was seen and shot on May 27th.

WHITE-RUMPED SANDPIPER : BONAPARTE'S SANDPIPER *(Tringa Bonapartii, Schlegel.)*

None of these birds were found breeding, but a few were seen after July 1st; and about August 10th, very large flocks arrived, remaining until September 20th, when the last of them were seen.

BRANT GOOSE *(Bernicla brenta, Stephens.)*

The Brant Goose does not breed here. A few were seen in company with Hutchins Goose in their flight southward, on September 6th, and one was brought to me by an Eskimo on December 1st.

HUTCHINS GOOSE *(Bernicla Hutchinsi, Richardson.)*

This bird, in company with the Brant and Snowy Goose, arrived in great numbers on September 6th, and remained here five days, all disappearing when the wind shifted to the southward.

SNOWY GOOSE *(Chen hyperboreus.)*

Thousands of these birds, in company with those just named, arrived here during a gale on September 6th, and were so tame that seventy were shot in a few hours with very little trouble. They remained here five days, when a steady breeze springing up from the southward, they all disappeared in a few hours and none were seen after September 12th.

LONG-TAILED DUCK *(Harelda Glacialis, L.)*

The first of these birds seen was on June 1st, and the first fledglings found was on August 31st.

This is one of the most numerous and certainly the most noisy duck that visits these regions; its long-drawn note of ar-ar-ow-oo may be heard in every direction.

Its eggs were found on the margin of ponds, from which small streams ran to the sea, and through these the parent bird was seen to conduct her brood when about ten days old. The last of these birds seen was on November 10th.

HARLEQUIN DUCK *(Histrionicus torquatus, L.*

The Harlequin Duck was most numerous during the month of June, but after the end of that month, none were to be seen. Apparently this bird does not breed here.

KING EIDER *(Somateria spectabilis, Leach.)*

Large flocks of these birds arrived about May 5th, almost darkening a small piece of water about five miles from the shore. About June 1st, pairs were seen to visit small lakes inland, where, as soon as the ice had melted round their shores, the eggs of this bird were found in nests of down on small, mossy islands.

The King Eider lays from four to six eggs, and in some instances continued to lay in the same nests after they had been robbed of the first two or three eggs.

Two nests with eggs of this bird were found several hundred yards from the water upon a high ledge of rock from which it would be impossible for a young bird to descend without assistance.

The first young seen was on August 25th, and like the Long-tailed Duck the parent bird in a few days conducts her brood to the sea.

The last of these birds seen was on November 30th.

HERRING GULL *(Larus Argentatus, Brunnich), (Nowia Esk).*

First seen on April 20th. Was mating June 1st. Young were fledged on August 12th. Last was seen on November 15th.

This bird is very numerous throughout the summer and its nests and eggs were found beside those of the King Eider on small, mossy islands.

COMMON TERN *(Sterna hirundo, L.), Emo-cootatia Esk).*

Eggs and specimens of these birds were brought to me by Eskimo on July 20th, from a small island about six miles from the coast. These were the only ones seen during my stay here.

GREAT NORTHERN DIVER: LOON *(Colymbus torquatus, Brunnich).*

The first of these birds seen was on June 1st, and the last seen August 20th. None of the young of this bird were found, and I think that very few breed here.

RED-THROATED DIVER *(Colymbus Septentrionalis, L) Coxzow Esk.* ;

This bird arrived about June 20th and was often seen during the summer.

One nest only of this bird was seen a little above high-tide mark, and the Eskimo informed me they could seldom be found.

On August 7th, some fledglings were seen, and all had disappeared by September 28th.

BLACK GUILLEMOT *(Uria grylle, L.)*

This interesting little bird is seen here throughout the year, being most numerous during the summer.

During the coldest weather it was often taken on small pieces of water, where the ice had been broken by the ever-changing tides.

Quantities of eggs of this bird were brought to me by Eskimo from an island about four miles from the coast, and fledglings were seen on August 10th.

LITTLE AUK *(Mergulus alle, L.)*

A small number of these birds were seen some distance from the shore during the summer, but nothing could be learned of them. One specimen was taken.

In conclusion it may be well to add that with the exception of the Snowy Owl, specimens were taken of all the birds noted herein, and I regret very much that more time could not be devoted to the study of these interesting branches of the Natural History of Prince of Wales Sound.

Prof. Wright enquired whether Mr. Payne had seen any of those extraordinary migrations which had been observed as in the case of the Lemming.

Mr. Payne had not noticed any such changes in their movements. So far as he was aware none had been observed in North America.

Dr. Ellis read a paper on "The Chemistry of the Natural Waters of Ontario."

TENTH MEETING.

Tenth Meeting, 22nd January, 1887, the President in the Chair.

Exchanges since last meeting, 28.

The following were elected members :—R. Dawson, Henry Steele, John Horwood, C. D. Lennox, T. Simpson, B.A., M.B.

Dr. Daniel Wilson read a paper on "Some Stone Implements from Lake St. John, Que."

After referring to the system of barter indicated by the dispersion of the flint implements, he said that from the Gulf of Mexico to the farthest north there was not the slightest evidence of fire having been applied. At no period in the history of this continent were there any indications of the slightest knowledge of the metallurgic art. So that man has not existed on this continent, except in a low state of savage life.

Prof. Wright asked Mr. Macallum, who was present and had just returned from Mexico, whether he met with any stone implements in Mexico.

Mr. Macallum had met with them in considerable abundance, such as stone axes, arrow heads. The colour was a dark-brown, darker than that of those exhibited.

Mr. A. B. Macallum, B.A., read a paper on "Theories of Heredity."

ELEVENTH MEETING.

Eleventh Meeting, 29th January, 1887, the President in the Chair.

Exchanges since last meeting, 30.

Messrs. James Bain, jun., and John Notman, were appointed Representatives of the Institute on the Board of the Industrial Exhibition Association for the present year.

The Council announced the election of the following as Associates :—A. F. Wickson, Ernest Wilby, D. A. Hewitt, W. C. Tilley, W. L. Symons, J. P. Hynes, Harry Sproatt, Henry Simpson, J. F. Brown, F. H. Herbert, F. Otter, Charles Langley, G. T. Goldstone, F. F. Mallany, W. A. Smith.

The following were elected members :—T. M. Logie, B.A., W. B. Ewing, James G. Ramsay, J. B. Millar, Edward Thomas Carter, Gerald Fitzgerald, W. W. Fox, E. R. Parkhurst, Dr. John Hall, Charles B. Petry.

Mr. James T. B. Ives, F.G.S., read a paper on "Geology in the Public Schools," of which the following is an abstract :—

The author produced evidence that Ontario possesses vast mineral resources ; and that those resources are not receiving the attention which they demand ; that the dissemination of geological knowledge would promote their development ; and further, that the Public School system of the province is adapted to secure such dissemination. At the close he exhibited an appliance, designed to assist the Public School teacher in conveying to the minds of his scholars the first principles of structural geology :—

"It is designated the Strata Map and consists of several layers, or *strata*, of variously coloured cardboard or other suitable material, hinged in the form of a book or otherwise put together. The SUPERPOSITION of the STRATA of the earth's crust is represented by that of the layers of the map ; and it is thus seen that the order of succession of the *formations* cannot be reversed although either may be absent.

"Portions of all the *strata*, excepting the lowest, are removed according to a definite plan ; a larger proportion being removed the higher the *stratum* occurs in the series. By this means a pattern is produced corresponding with the geological map of the area represented. It being pointed out that the exposure of the several geological formations is due to an analogous cause operating in nature ; a correct and comprehensive conception is obtained, of the nature and operation, of the phenomenon known to geologists as DENUDATION.

"Where, in descending order, the successive *strata* make their appearance projecting beyond those by which they are overlaid, OUTCROP is illustrated. The steps formed by the thickness of the card *stratum* at the same time illustrate another phenomenon and its verbal sign, these being miniature ESCARPMENTS.

"The term DIP, and that which it expresses, may be illustrated by tilting the map; as a whole, when all the *strata* will *dip* towards the lower end; or by placing a small object beneath some of the *strata* and pressing them down on either side of it, when those *strata* will *dip* from it in each direction. In the latter case the upraised portion will represent what is known in nature as an ANTICLINAL ridge. If a second object be placed at a short distance from the first and the strata be depressed between them a SYNCLINAL trough will be formed.

"Whilst illustrating DIP, another term usually very perplexing to learners, may, by means of the Strata Map, be most readily explained, viz.: STRIKE.

"By removing portions of overlying *strata* geological INLIERS are clearly exhibited; and OUTLIERS are shown by means of a portion of the *stratum* to which they belong cut to the shape of the *outlier* to be represented and attached to the underlying *stratum* in the proper position.

"The *strata* of the map being all *superimposed*, horizontally, one upon the other, that condition of things known to the geologist as CONFORMABLE stratification is exhibited, and UNCONFORMABILITY is easily explained.

"Where IGNEOUS rocks occur within the area represented, the space so occupied is marked by a distinctive colour indicating such intrusion. But as it is usually impossible to say whether underlying *stratified* rocks are pierced thereby, their presence is not indicated on underlying *strata*. In any case where, by the operations of the miner or otherwise, such rocks are found to exist, the fact may be indicated on any stratum affected.

"The Strata Map may be made of any size, and may consist of a small number of layers representing groups of formations or of a large number representing the several formations or their subdivisions.

"Upon the various *strata*, FOSSILS, characteristic of the formation represented, may be figured and named.

"The LITHOLOGY of the various formations may be described thereon, whether limestones, sandstones or clays, &c., and whether used, or capable of being used, in the arts and manufactures.

"The localities where economic MINERALS occur may be indicated by numbers corresponding to a key in the margin of the map in which those occurring in the area are enumerated.

"The THICKNESS of the beds represented may be expressed in feet where known. Where, by well boring or otherwise, it has been ascertained that certain subterranean strata are absent in a particular locality, corresponding portions of the stratum affected may be cut away or a note to the effect placed thereon.

"By cutting away portions of the *strata* at the margin a LEDGER INDEX is formed similar to that of an alphabetically indexed account book showing the colours of all the strata in succession. On these spaces the names of the several formations represented are written, and their approximate maximum thickness within the *area* represented is stated."

Besides the survey map of the Dominion, geologically coloured, he illustrated his subject by means of an outline map of the province, on which he had indicated by distinctive colours the various minerals at present worked or known to exist, in localities ranging from the County of Carleton in the east to the Lake of the Woods in the west. In evidence of the variety and wide distribution of the minerals of Ontario, he quoted the reports of the Geological Survey, the Bureau of industries, Ontario, and a valuable synopsis, compiled by Mr. H. B. Small, of Ottawa. The same authorities were cited in proof that this Industry is not receiving due attention, and the sketch map on which he had indicated the known localities was appealed to, as showing how much of the province still remains untouched by the miner. He showed how the dissemination of a knowledge of stratification and its attendant phenomena would check useless and wasteful operations, and at the same time promote judicious prospecting and mining. He looked to the diffusion of such knowledge as a wholesome bar to the spirit of mere speculation at present so rife here, as well as in the States. The author advocated the introduction of geology into the Public Schools, not as a separate subject, but as an expansion of geography, in its physical branch, contending that the latter cannot be taught intelligently or intelligibly without explaining the causes which have operated to produce the present contour of the earth's surface. He gave a brief resumè of the work done at the colleges of the province where geology is taught; at the High Schools, where physical science is greatly at a discount, as evidenced by extracts from the High School Inspectors' reports, and at the Normal Schools. Chemistry, zoology and botany being taught in the latter, he contended that the teachers in training would not find it difficult to acquire so much knowledge of geology as would enable them to impart it, in an elementary manner, to the pupils of the Public Schools. The curriculum of the Public Schools was briefly considered. Statistics were given from the report of the Minister of Education, showing the relative attention given to the various subjects. Geography being taught to more than two hundred and eighty thousand pupils, out of the total number of four hundred and sixty-six thousand on the register, the author inferred that the systematic inculcation, in connection with that subject of elementary structural geology, would be of incalculable value to the Province in the proximate future, and of great immediate service. He combated the view that the subject is too abtruse for Public Schools, outlined the scope of such teaching and its method, and made a suggestion as to the course to be adopted in initiating the introduction of geology into the Public Schools.

Mr. Boyle thought that the map would be very useful in teaching geology. As an old teacher, however, he did not think that it would be advisable to place the subject of geology in the curriculum for Public Schools. The subjects were already too numerous, and he did not see how geology could be introduced with advantage. In accordance with the representations of a deputation of the Natural History Section, the study of natural history had been put on the Normal School programme, but practically no attention was given to it. The very slight acquaintance that it was possible to impart, under the circumstances, was of little value. In order to have it taught with efficiency, the teacher should be saturated with the subject.

Mr. J. L. Hughes, Public School Inspector for Toronto, agreed with Mr. Boyle as to the value of Mr. Ives's map for purposes of illustration. The subjects on the Public School curriculum were already too numerous. It was impossible to teach them all thoroughly. Nearly all the subjects specially intended to develope the observing faculties of pupils had been suffered to drop out. It was true that geology was of great utility, but a study should not be put on the programme merely on account of its utility. He thought that the branches taught in the school should vary according to the wants of the locality. Steps should be taken to allow the local authorities an optional power in regard to certain subjects, so that those may be taught that were best suited to the circumstances of the place.

Dr. Hamilton thought that the subject of geology should be made a prolongation of physical geography. As to the introduction of the snbject into the classes of Mechanics' Institutes, it would be of very little benefit, owing to the inefficient management of classes by those institutions.

Mr. Macallum had come to the conclusion from his own experience that geology was a subject that should not be taught in the Public Schools. He was not in favour of local options, but thought that a strict rule as to the subjects to be taught should be made uniform through the province. It may be taught in the High Schools, and made optional with them. Chemistry, however, should have the precedence. He agreed with Mr. Boyle that to teach efficiently a teacher should be saturated with the subject.

The President communicated a paper from Prof. Campbell, of Montreal, "Etruria Capta," Part II., "The Eugubine Tables."

The President stated that he presented many points to Prof. Campbell that he had not been able to solve to his (Mr. VanderSmissen's) satisfaction. Should these not be solved, he considered that Prof. Campbell's theory must fall to the ground.

Mr. Boyle presented a very remarkable Indian pipe of curious workmanship, found on a farm in the western part of the Province. He stated that it was one of the most interesting specimens of the kind he had ever seen.

A letter was read relative to an offer of the remains of the Mammoth lately found at Eglinton. A tooth was at present in the Museum of the Academy of Science at Buffalo, but the owner offered to give it to whoever would find the rest of the body.

TWELFTH MEETING.

Twelfth Meeting, 5th February, 1887, the President in the Chair.

Donations were announced from Dr. Rosebrugh of "The Electrical World for 1886," and from Lieut. A. R. Gordon, R.N., of Seventeen Skins of Arctic Birds, collected on the shore of Hudson's Strait, for which thanks were tendered.

Exchanges since last meeting, 27.

The following were elected members:—G. S. Ryerson, M.D., Wallace Nesbitt, A. Percival Will.

Prof. Dunlop read a paper on "The Quichua Language."

The Quichua language, spoken by the Incas, or ancient native rulers of Peru, previous to the conquest of that country by the Spaniards, under Francisco Pizarro. The paper was strictly philological and dealt altogether with the grammar of the language, going as fully into a detailed account of its structure as the time would allow. The Quichua belongs to the agglutinate order of languages, and differs greatly from those of the Aryan and Semitic type, as may be supposed. It had its cradle in the districts around the ancient city of Cuzco in Peru, and it was the policy of the Incas to introduce it into every country which they conquered. Thus its use was gradually extended over the vast region from Quito in Ecuador on the north, to the boundaries of Araucania on the south, and from the Pacific to the Atlantic, exclusive of Brazil, an area of some 3,600,000 square miles. The conquered tribes nearly all spoke dialects of Quichua, which occupied, to the literary dialect of the capital, much the same position that the Prâkrits, or dialects of modern India, do to the literary and sacred Sanskrit. Thus the people of Quito spoke a dialect which differed scarcely at all from that at the capital; no greater difference subsisting between them than subsists between the Queen's English and the dialect of Yorkshire, if indeed there was so much. In the northern and central parts of the sierra of Peru the Chinchay-Suyu was spoken. The Yunca was the language of the Peruvian coast, the Lama of the tribes near the great River Huallaga and the Cauqui of the people of Tauyos in Central Peru. Round the shores of Lake Titticcaca the Aymara language is still spoken, from the city of Puno to the south of Bolivia. Aymara is certainly very different from Quichua in pronunciation, but not more than Lowland Scotch from English south of Tweed, the vocabulary being on the whole the same, and the grammatical construction is identical with that of Quichua. Further south, in Tucuman, in the Argentine Republic, the Calchaqui, a variety of Aymara, is spoken. With the exception of the Lama, which is a branch of the great Tupi family of languages, all these dialects, and a large number more, are from one common stock, and Quichua is to be considered the elder sister and representative of the group, even if we do not regard it as the parent of them all. During the period of Inca ascendancy, Quichua superseded all the other dialects as the language of the governing race; it was the language of a people far advanced in civilization; it was assiduously cultivated by learned men for several centuries; and it may therefore be selected as the most perfect of the extensive American group of languages. Hence its importance to the philologist. Through the rapid diminution of the aboriginal population, and the constantly increasing corruption of their ancient tongue, through the substitution of Spanish for Quichua words, the introduction of Spanish idioms and the loss of all purity of style, this language, once so flourishing, which was used by a polished—and we might even say splendid court—and a well-established Government, which was once spoken throughout a vast empire, is fast disappearing. Ere long, perhaps, it will entirely fade away from the memory of living generations. With it will disappear the richest form of the great American group of languages—no small loss to the student of philology. With it will be lost all the traditions which yet remain of the old glory of the Incas—all the poems, elegies and love songs which stamp the character of a once happy people. The paper closed with a brief account of Quichua literature, a couple of short fragmentary specimens of which were translated, an analysis of the most important Quichia drama "Ollautay," and a translation of its most interesting scenes being promised on some future occasion.

T. B. Browning, M.A., read a paper on "The Alaskan Boundary."

He entered into the history of the dispute between the United States and Great Britain, and described the position which Russia occupied in the question. He said there was no mention of dominion over sea in the treaty. The rights conceded were expressed to be over the firm land and islands adjoining. Authorities were cited to show that it was the custom of nations when seas were conveyed or presumed to be conveyed to specify them in the grant, and therefore the seizure of a British vessel for trespassing on the waters off Alaska could scarcely be defended. Under the convention of 1825 Britain had rights in the North Pacific of commerce, of navigation, of fishing, which both in the Atlantic and Pacific includes seal hunting, of landing on unoccupied coasts—a fifth right respects refuge in stress of weather. The Pacific Ocean was then to Britain not a *mare clausum*, but a *mare liberum*. The paper also contained a description of the eastern limit of the territory, and showed the difficulties of accurately defining it.

THIRTEENTH MEETING.

Thirteenth Meeting, 12th February, 1887, the President in the Chair.

Exchanges since last meeting, 25.

The Council announced the election of the following as Associates:—Frank Douglas, A. H. Gregg, George W. King

Dr. Scadding read a paper entitled "Canada in Sculpture," and exhibited a photograph of a marble statue of George II. in the Senate house of the University of Cambridge in England, which represents the King as a Roman general or imperator, crowned with laurel, and encircling with his right arm a globe, inscribed with the word Canada, in rather large characters, the whole being commemorative of the conquest of Canada in the reign of this king. This photograph was taken expressly for the lecturer, the statue in the Senate house having been never before copied in this way. The smallness of the scale, however, does not allow the word Canada to be visible to the ordinary eye. Dr. Scadding also exhibited a photograph of the graceful idealization of Canada in the grand group entitled America, by the sculptor, John Bell, at the north-west angle of the lower platform of the Prince Consort memorial in London. This fine figure of Canada, who is seen "pressing the Rose of England to her breast," was expressly prepared for the illustration of this paper by Mr. Lemaitre, 324 Yonge street, who skilfully detached it from a photograph of the general group and enlarged it.

In addition to the photographs mentioned in the paper, Dr. Scadding exhibited an engraving of the interior of the Senate House of the University of Cambridge, showing the four statues; a large medallion with heads of George II. and Queen Caroline facing each other on the obverse, and on the reverse their seven sons and daughters; an engraved portrait of Queen Caroline; a two pound gold piece (1739) of George II. inserted in a contemporary silver cup, and having, in addition to the usual titles of the king, the following:—*Brunsvicensis e Luneburgensis Dux: Sacri Imperii Romani Archi Thesaurius et Elector*, abbreviated thus: B : ET : L : D : S : R : I : A : T : ET : E. Also an engraving of the seated bronze figure of the Prince Consort in the Memorial.

C. Gordon Richardson read a paper on "Dextrine Maltose in Beer-Worts," of which the following is an abstract:—

When malt is acted upon by the peculiar ferment of malt called diastase it breaks up into dextrine and maltose. The proportion which these two bodies when found will bear to each other depends upon three things: The heat at which the mash is made, the length of time it is permitted to stand, and the diastatic capacity of the malt itself. Dextrine is the first product of diastase—it is, so to speak, the half-way house between starch and sugar. To the brewer it possesses many valuable qualities. It ferments but slowly, lends palate-flavor and body to the beer, and also those keeping qualities so essential to the production of sound stock ales. To the maltose on the other hand, the brewer is indebted for the source of the alcohol which finished beer always contains, in more or less quantity. On the due proportion, therefore, between these two bodies, maltose and dextrine, the future history of the beer largely, if not wholly, depends.

All authorities agree in assigning 145° F. as the temperature of the malt infusion or mash most favorable to diastatic action, and consequently to the production of maltose. But, unfortunately, a great difference of opinion exists amongst the standard authorities as to the temperature most favorable to the increased relative proportion of dextrine to maltose. The English authorities declare in favor of low heats, viz., below 150° F., and the American chemists in favor of high, viz., above 150° F. Now since all diastatic action ceases at a heat of 172° F.—diastase itself being destroyed at that heat, it might reasonably be inferred that as we approached this maximum limit we should find the diastatic action decrease, and if such were the case, only the half-way stage in the conversion of starch, viz. dextrine, would be attained, and the practical test of experience bears this reasoning out. The English chemists base their reason for advocating low heats for the formation of dextrine upon similar chemical considerations; that, as at very low temperatures diastase is inactive, so by a lowering of the mashing temperature we limit the action of diastase to the production of dextrine. But this is not borne out by experiment, and the fallacy lies in confounding the checking of too vigorous quantitative action of diastase by the influence of low temperature with the qualitative and destructive influence of high heats upon the nature of diastase itself. Although 145° F. is the temperature most favorable to diastatic action, yet at that heat the relative proportion of dextrine and maltose vary very considerably with different malts, and according to the results obtained from a large number of test brews and analyses, made by the writer, seemingly in direct proportion to the diastatic capacity of the malt used. The ordinary standard of diastatic capacity of malt is the absolute amount of starch converted into maltose, at a given temperature, and in a given unit of time, each analyst having to make his own standard, but the relative proportions of dextrine-maltrose obtainable at given temperatures is of far more consequence, ordinarily, to the brewer than is the absolute convertible capacity of the diastase contained in a given sample.

In view of the fact that under the present system of estimating the diastatic capacity of malt, no comparison can be made between the results obtained by different observers, each analyst having to make his own standard, and the doubtful utility of such returns to the prudent brewer, the writer is led to propose the following method of analysis and stating results. In brief, to take a fixed quantity of malt, infuse at a given temperature, preferably 150° F. ; keep at that temperature half an hour, then boil. Estimate the dextrine and maltose formed and return as such. And the diastatic capacity to be judged by the relative proportions of these two bodies, as referred to a certain fixed ratio. This latter the writer trusts shortly to be able to suggest, or at least to produce some data for fixing the same, from the results obtainable from a series of experiments he is now conducting.

In answer to an enquiry of Dr. Bryce, Mr. Richardson said that the result was much affected by the difference in the quality of the grain. The English barley was heavy in albuminoids, which was counteracted by the infusion of more hops. The Canadian barley through manuring also contained more albuminoids, which affected the diastatic action. The effect of free oxygen was so small as not to be noticed in practical work in England.

FOURTEENTH MEETING.

Fourteenth Meeting, 19th February, 1887, the President in the Chair.

The Curator announced a donation from Mr. Finlay McCallum, of Milton, of a valuable carved Stone Pipe, for which thanks were tendered.

Exchanges since last meeting, 79.

Mr. R. H. Bethune was elected a member.

The following paper was read by W. A. Douglas, B.A., on "The Antagonism of Social Forces."

When Adam Smith pointed out what a vast advantage accrues to mankind from the division of labour, he first gave a clear indication of the grand harmonies existing in society. Other writers have followed in the same direction, and with much beauty and eloquence have pointed out what an inestimable blessing society is to itself. This department of economics has received very ample treatment. Indeed, so much has the attention of writers been fixed on these harmonies that a very large majority teach either explicitly or by implication that harmony prevails throughout all our social organization, for they make no mention of antagonisms.

Some writers, indeed, go so far as to deny that there are antagonisms, and the few who have noticed and pointed out their existence have done so in a manner much more brief and meagre than their importance deserves.

In his celebrated illustration of the pin-makers, Smith showed that by the sub-division of labour the product was increased between two and three hundred-fold. In the same way the nail-makers' product is also increased. When, therefore, the pin-maker exchanges with the nail-maker each gives more and each receives more, each enriches and each is enriched—the benefit is mutual. This is harmonious trade—toil for toil, burden for burden, service for service, reward for reward, enrichment for enrichment.

I shall endeavour to show (first) that there exists another kind of trade, not harmonious—mutually enriching, but antagonistic—enriching one by the impoverishment of another; and (second) that this antagonistic trade is one of the most important factors in determining the condition of the bulk of humanity.

To prove the existence of such antagonism I ask attention to the following question:

In what length of time could society, by the utmost exertion of industry and frugality, accumulate sufficient supplies to maintain all succeeding generations free from toil? Obviously never. Each season brings its share of toil, and each year we consume the bulk of the product. Wonderful as have been the applications of steam and electricity, we have no indication that humanity will ever be exempted from toil. The physical law is inexorable: "By the sweat of thy brow shalt thou eat bread." But a portion of the race now enjoy incomes which exempt them from toil, and with every guarantee, so far as our laws and customs can guarantee anything, that such exemption shall continue to the end of time

What are the inevitable conclusions from these two considerations?

First.—Since no man or number of men can produce sufficient supplies to maintain them for all time without further toil, therefore, that part of society which enjoys everlasting incomes that require no toil from their recipients for their maintenance, possesses the power of appropriating an amount of wealth that could not by any possibility be the result of its own productive effort.

Second.—All society cannot possibly live for all time without toil; some now possess that power. Therefore some enjoy a privilege from which others by inexorable physical law must be for ever excluded.

Whence comes it that we see this extraodinary division in society? One part empowered to live without toil, another part doomed to everlasting toil. This I shall now try to make plain.

Let us first try to ascertain what is the law of distribution of the products of labour. Two men settle on the prairie, each taking a section. One section continues to be a farm, the other becomes a town site. After thirty years the farmer has a property worth, say, three or four thousand dollars, while the land-owner's property is worth, say, three or four hundred thousand dollars. The toil of the farmer has exceeded that of the land-holder a thousand fold; the reward of the land-owner has exceeded that of the farmer a thousand fold. Reward is inversely as service. The distribution is not according to production, but it depends mainly on the *increase of value.* To understand, therefore, the laws of distribution we must examine the nature of value.

Why has a fresh egg value and an unseasonable egg none? Because the former possesses that quality called "utility;" the latter does not.

Why has air, which has much utility, no value, while a diamond, with little utility, has very great value? The air is super-abundant and immediately accessible, while diamonds are scarce.

Value, therefore, may arise in two ways. First, it may come by the production of utilities that are scarce, or, second, it may arise from the scarcity of certain utilities.

Machinery is scarce. Toil takes the ore and converts it into a machine. This is one way of acquiring value by the path of utility.

Let a drought come until water sells, as it has sold sometimes in Australia, for three shillings a bucketful; this is another way of acquiring value; it arises from the increased scarcity.

In the first case an increase of value caused by the increase of a utility, as in the production of machinery, is an increase of wealth. In the second when the value is the result of scarcity, as in the increased value of water from drought, the increased value is an indication of increased poverty.

To distinguish these two kinds of value, let us call the former "toil-produced value," and the latter "scarcity value." The commodities included in the former are our food, clothing, buildings, machinery, etc., while the scarcity values include minerals, forests, water-power, land, etc.

As distribution takes place according to the "production or growth of values," and as values arise in two different ways, there are two different ways in which a person may acquire wealth:

1. By producing utilities, as houses, clothing, etc.

2. By holding some natural commodity that acquires value by becoming scarce, such as lands, mines, etc.

The first method requires toil. We can convert the crude ore into a machine, the raw cotton into a garment, only by toil. But the increased value of mines, or at least a large portion of these values, is due in no way to the labour of the holders of these lots or mines.

Our present method of distribution, therefore, has the following most momentous results:

First,—One part of society obtains a share of the products of labour only after it has produced utilities, after producing wealth; the other portion obtains wealth by the growth of scarcity values that requires no toil. Hence we see the division of society into toilers and idlers, or, what is the same thing, the imposition of the whole toil of maintaining society on one part of the population, allowing the rest to enjoy a share of the product, to the production of which they have contributed no effort.

Labour-produced values are transient. The food of this season will be consumed by the next, the clothing will soon be worn out, buildings will crumble and decay, our dwellings and clothing will quickly become soiled, machines will rapidly wear out. To replace the worn out or consumed, to repair the broken or decayed, requires toil, and we have no evidence that we can ever be free from the necessity for toil.

But some of the scarcity values do not possess this transitory character. The value of a city lot continues as long as the population clusters round that spot. It requires no effort to maintain its value, for it is not subject to decay or consumption, like other utilities. To allow such values to be appropriated by individuals, therefore, allows them not merely to become rich without effort, but allows their wealth to continue undiminished for ages. The division of society into toilers and idlers is thus perpetuated.

Let a drought come till water becomes a salable commodity, then the populace become poorer in water. If a few individuals possess some unfailing springs, then the increased value of water would render these persons richer. Let population increase till land becomes relatively more scarce, the people are poorer in land ; but values advance and the holders become richer. Here we notice a movement in society not mutually enriching, but enrichment of one part accompanied by, and as the consequence of, the impoverishment of the rest of society. This is a movement not harmonious, but antagonistic, enriching one by impoverishing another.

Scarcity itself is a calamity. To be cooped up in tenements is not the kind of life that is resorted to of free choice ; a breathing space would be no small fortune to many in our most congested centres of population. But by our present system this calamity is not simple, but compounded and intensified.

Let population become dense, and we must not only crowd each other to the degree of discomfort and inconvenience, but we must furnish the owner of the land with wealth, in some cases to an enormous amount ; we must board, lodge, and furnish him and his family, it may be in princely style. Two calamities—first, crowding ; second, tribute to idleness. First, impoverishment in space ; second, impoverishment in surrender of product to a non-producer. The calamity is compounded.

But this is not all. The division in society is still further intensified by another characteristic of the law of values. With increased population there is diminished competition for the sale of lands, forests, mines, and water privileges. But increased population facilitates production of some commodities in two ways —first, by permitting better organization, and second, by permitting the more extended use of machinery. Hence, in the sale of labor-produced commodities there is intensified competition. While we witness the values of town lots advance from almost nothing per acre to sums ranging amongst the millions, we at the same time see the price of steel rails decline from two hundred and fifty dollars per ton to one-tenth that figure. The holders of scarcity values therefore become richer in a compounded degree—first, by the advanced price of their own possessions, and second, by the diminished price of the commodities with which they are paid. As the brokers say, the market is "bulled" when they sell and "beared" when they buy. Thus is still further widened the breach between the toiler and the non-toiler.

One of the most intense passions of man is for wealth. For the gratification of this passion we see him on the one hand using every device to increase production, and thus enrich, at the same time by allowing the appropriation of the scarcity values by individuals we see a disposition to push the scarcity values to their utmost limit, thus tending to impoverish the producer for the benefit of the non-producer.

If I have correctly interpreted these phenomena I have shown why it is that our social development presents such remarkable contrasts—toil degraded and impoverished, while many enjoy lives of luxurious idleness, why every city on this continent presents the same features —ostentatious wealth at one end and penury at the other; and I have shown further that our social mechanism is not arranged according to the principle of mutual assistance and mutual elevation; but that we make the advantage of one part of society dependent on the degradation and impoverishment of another part. The scarcity values of our mines, our town sites and other natural opportunittes have risen to emormous figures. These values are increasing and persistent. What is the relation of these values? What is the meaning of a ground rental of ten thousand dollars yearly? It means, on the one side, an everlasting surrender by the toilers of the products of their labour to the value of ten thousand dollars yearly, and on the other side, the appropriation of these products without the obligation to render any service in return.

Alas! how little knowledge of these simple but far-reaching principles has been manifested by those in whose hands have been intrusted the destinies of nations. In the settlement of the new territories of this continent one of the grandest opportunities ever offered to mankind to lay the foundation in such a way that society would develop harmoniously has slipped by. But what do we witness everywhere? The obligation of the toiler to yield up his product to a number of his fellow men, who are thus relieved more or less from the necessity to toil. As population increases, this obligation increases; the mortgage on labour becomes greater and greater. Is it not true that labour is now mortgaged to the finger-ends? And is it not also true that no amount of industry, frugality, improved education or better organization can remove this obligation? The only means of escape is by the resumption of the scarcity values by the public and thus cutting off the possibility of any able-bodied man escaping his fair share of toil. To remedy our method of distribution we must abolish the law of "distribution by values" and substitute the true law, "to each according to his work."

Mr. Browning objected to Mr. Douglas's division of individuals into classes, toilers and idlers, as invidious. He did not know of any class that were either all toilers or all idlers. The ordinary meaning of the word toiler was a mechanic, or any one that lived by manual labour; if the professional class was included, the class of idlers would be reduced to a very small number, as there were very few that lived entirely without some kind of labour, so that to include all under these two classes would be virtually to include all in the one class and none in the other. He objected also to the division into utility and scarcity as components of value.

Mr. Douglas said that every person that produces something for his fellow men is a toiler, but there were individuals who produced no more for the benefit of society than if they were chloroformed on the first of January and remained so to the last of December. In his remarks he did not propose any levelling of incomes, but to point out the existence of antagonisms.

Mr. Elvins expressed the pleasure he felt in having the question put before them in so clear a light. He had spent much time in endeavouring to solve the question. The only difficulty with him was how to find a remedy. He hoped that thoughtful men would give the subject due consideration, and find a remedy for the evil before it was too late, and thus obviate a great and impending danger.

Dr. Hamilton agreed with the reader of the paper as to the existence of the antagonisms, which had indeed long agitated the world. He referred to the agrarian contests in the Roman State, the troubles connected with the Gracchi, and the Servile wars, so that the question was really a very old one. He thought that the gentleman who had read the paper had clearly made out his case, though he had not shown the remedy.

Mr. Ives thought that the subject was one of great practical utility. He gave from his own experience, when a tenant of the Duke of Portland, an instance confirming the views of the reader of the paper.

Mr. J. J. Kelso read a paper on "The Necessity of a Society for the Prevention of Cruelty in Toronto."

He pointed out that there was no society of the kind at present in existence in Toronto, and he proposed the establishment of one as a general humane association, having before it the following among other objects:

To stop cruelty to children: to rescue them from vicious influences and remedy their condition. The beating of animals; overloading street cars; overloading waggons; working old horses; driving galled and disabled animals. To introduce drinking fountains; better laws; better methods of horseshoeing; humane literature into schools and homes. To induce children to be humane; everybody to practise and teach kindness to animals and others. As a humanizing, educating and refining influence, he believed there was no better society in existence than this would prove. Its foundation would rest upon a religious but undenominational basis. It would include in its membership young and old, rich and poor, Catholics and Protestants.

and all could unite in the unselfish and ennobling work of alleviating and removing human and animal suffering. The object of the society would be to prevent rather than to punish. As instances of what might be accomplished, he gave the following examples from the record of the Illinois Humane Association :—"Arrested a man, who was fined $10 and costs and put under bonds of $200 to keep the peace, for extreme and repeated cruelty to a girl in his family, 16 years old. Took the child away from him and placed her in charge of this society." . . . "Arrested a little girl, 14 years old, for obtaining money under false pretences ; had the prosecution dismissed and sent her to the Industrial school for girls at Evanston." . . . "Rescued four little children from a worthless, drunken father and a disreputable mother, and placed them in the St. Joseph orphan asylum." . . . "Took a little girl, who was badly abused, kicked and knocked down and overworked by a cruel, heartless woman, child working like a slave in the kitchen, dirty and ragged, and placed her in the Industrial school for girls." . . . "Arrested a man who was fined $75 and costs for drunkenness and extreme cruelty to his little boy, eight years of age, whom he compelled to sleep out of doors. This society placed the child in the Home for the Friendless." . . . "Arrested a man, who was fined $50 and costs, for stabbing a horse with a knife." . . . "The officers of this society, after a prolonged search, found a little girl of 16 years of age who had been abducted from her home and led astray for immoral purposes, and restored her to her parents. There were three persons connected with the abduction who were arrested by the officers of the society and held to the criminal court and indicted by the grand jury. Still pending."

On motion of Mr. Houston, seconded by Dr. Bryce, it was resolved, "That in the opinion of the Institute the formation in this city of a society for the prevention of cruelty would be conducive to the interests of public morality, and this meeting desires to express its sympathy with the object contemplated."

A communicating respecting "The Elizabeth Thompson Science Fund," was referred to a committee composed of the President, Dr. Ellis, and Prof. R. Ramsay Wright.

FIFTEENTH MEETING.

Fifteenth Meeting, 26th February, 1887, the President in the Chair.

Exchanges since last meeting, 30.

G. M. Rae and T. G. Mason were elected members.

Mr. A. F. Chamberlain, B.A., read a paper on "Pre-historic Ethnology."

He said man probably originated in a continent occupying in former times the ocean south of Africa and Australia. He approximated in physical features to the negro. At a very early date the primitive stock divided into two branches, one with lighter skin and hair less woolly than the other. From the latter of these the surviving negro races have descended; from the former the brown races of Africa, from the parent stem of which have descended the Aryan and Semitic nations, who passed into Europe and Asia respectively from Africa. The Semites are probably less Caucasian in type than the Aryans. The primitive seat of the Aryans before their dispersion was in Europe; The Swiss lake dwellers and the old Pelasgians, who survive in the Albanians of to-day, were descended from the primitive Aryan stock. The Eskimo reached America from Europe, and from their parent stock have descended the Mongol tribes of Asia, with the Japanese and the Chinese. Two points which are of great importance in prehistoric ethnology are the antiquity of man in America and the extensive range of the old Caucasian type in early times. It is well to note that the evidence gained from the study of the languages does not bear out the theory that language originated in monosyllabic roots. The rest of the paper was taken up with the discussion of surviving primitive races, *e. g.*, the Basques, Fulahs, Australians, Ainos and Eskimos, and their bearing on prehistoric ethnology; and with the proofs that archæology and comparative mythology and folk-lore afford of the attainments and culture of primitive man.

Mr. Rouse thought that too high an antiquity had been assumed for the lake dwellings of Europe. He had visited the museums of the lake dwellings at Zurich, and had noticed that a number of the specimens of cereals showed the action of fire. May not this have occurred at the time of the inv sion of Julius Cæsar? as we read in his commentaries that the Helvetians then burned their possessions and abandoned their dwellings.

Mr. Chamberlain replied that lake dwellings were found all over central Europe. No one would imagine that the Helvetii had burned all the lake dwellings in Europe.

Mr. VanderSmissen said that much that related to prehistoric antiquity was purely conjectural. Great care should be exercised in forming opinions on those matters. The same results in different parts of the globe did not prove a similarity of race, or original relationship, but a similarity arising from general principles of human nature.

Mr. H. R. Wood, B.A., read a paper by Prof. T. Nelson Dale, on "The Geology of Mount Greylock," of which the following is an abstract:—

The paper gave a brief review of several months geological field work in Berkshire County, Mass, in the service of the U. S. Geological Survey (Archean Division, in charge of Prof. Raphael Pumpelly, of Newport, R.I.). After a few remarks on the general aim of the U. S. Geological Survey, the topographical basis of its work in Massachusetts, and an explanation of the method pursued in the summer's work on Greylock, the general lithological and structural character of the mountain was outlined, and some of the difficulties which beset the geologist in a highly metamorphic region were dwelt upon in detail. The paper closed with a brief allusion to the various industries, occupations and characteristics of the inhabitants of the region described.

SIXTEENTH MEETING.

Sixteenth Meeting, 5th March, 1887, the President in the Chair.

Exchanges since last meeting, 29.

Mr. John Phillips read a paper on "The Centrifugal Forces of the Planets."

Mr. J. A. Livingston read a paper entitled "Notes on Astronomy."

SEVENTEENTH MEETING.

Seventeenth Meeting, 12th March, 1887, Dr. George Kennedy in the Chair.

Exchanges since last meeting, 35.

The Council announced the formation of a Philological Section, which was approved on motion by Mr. Marling, seconded by Mr. Williams.

The Council announced the election of the following as associates: U. T. Phillips, Thomas Stevenson, J. C. Maybee, G. F. Timms.

Wm. Campbell and W. R. Strickland were elected members.

Mr. A. B. McCallum, B.A., read a paper on "Some Pathological Growths in Lower Animals."

Mr. Macallum exhibited a number of cat-fish affected with cancer in various stages.

In answer to questions from Mr. Livingston and Mr. Rouse, as to whether there was any danger in eating the fish so affected,

Mr. Macallum replied that he did not think there would be any danger at all.

Mr. Macdougall called attention to the salmon disease, or *Saprolegnia*, which affects not only salmon but perch and eels. He had noticed the perch with large holes cut out of the body, jump out of the water as if in pain. The internal organs and the flesh were perfectly sound, and people ate of them without injury The disease seemed to be the same as the cancer in the fish exhibited by Mr. Macallum.

Mr. Macallum said that the disease attacked all fish that were not in a normal condition. To prevent it a normal amount of food and aerated water were necessary. The sewage in water in the old country caused it.

Dr. Kennedy referred to the number of dead fish sometimes seen floating in the bay, and asked the cause of it.

Mr. Macallum said it was the inability to procure suitable food. They stood the first season very well, but conld not procure food the second. There were no parasites in them, they were in a perfectly normal condition.

Mr. Brodie asked the difference between pathological and normal growths.

Mr. Macallum could not, he said, tell which was pathological and which was normal, until all the conditions were understood.

FIRST SERIES—Begun August, 1852; concluded December, 1855; 41 numbers, 3 vols. 4to.

SECOND SERIES—Begun January, 1856; concluded January, 1878; 92 numbers, 15 vols. 8vo

THIRD SERIES—Begun 1879.

NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal," 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3.—Societies wishing to exchange back numbers of their Proceedings can be supplied with complete sets of the Publications of the Canadian Institute, except Vol. XV., No. 5, Second Series, and Vol. I., Part 1, Third Series.

4.—Members having either of the above, Vol. XV., No. 5, Second Series, April, 1877, or Vol. I., Parts 1, 3 & 5; Vol. II., Parts 1 & 2; Vol. III., Part 1, Third Series, and being willing to part with them, will please communicate with the Assistant Secretary.

THIRD SERIES. VOL. V. FASCICULUS No. 2.

PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

TORONTO,

BEING A CONTINUATION OF THE "CANADIAN JOURNAL" OF SCIENCE, LITERATURE AND HISTORY.

APRIL, 1888.

Whole No. Vol. XXIII.] [No. 149

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1888.

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OF THE

CANADIAN INSTITUTE

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PROCEEDINGS

OF

THE CANADIAN INSTITUTE,

SESSION 1886–87.

EIGHTEENTH MEETING.

Eighteenth Meeting, 19th March, 1887, the President in the chair.

Exchanges since last meeting, 33.

The following were appointed auditors for the year :—D. B. Dick by the President, and T. B. Browning by the members.

The following were elected members :—Frank Rolph, Jos. Kilgour, R. T. Blatchford.

Rev. Father Laboureau, of Penetanguishene, read a paper entitled "Reminiscences of the Huron Missions." He also presented to the Institute a photograph of a letter by Father Chaumonot, Missionary to the Hurons, written on birch bark, and dated "Ste Marie des Hurons, 1645," the original being in the possession of a gentleman of Dijon, France ; a brass ring found near the supposed site of the Huron town of Ossossane ; and a tomahawk taken from the ruins of the French Fort of Ste. Marie; for which a vote of thanks was passed.

Dr. P. H. Bryce read a paper on "Diphtheria and Scarlatina in their various aspects."

After some discussion,

On motion by Mr. Marling, seconded by Mr. Creelman, it was resolved, "That the Council of the Institute be requested to make such representations to the City Council on the subject under discussion as they may think fit."

NINETEENTH MEETING.

Nineteenth Meeting, 26th March, 1887, the President in the chair.

Exchanges since last meeting, 38.

Charles Potter and M. O'Connor were elected members.

Prof. J. Hoyes Panton, M.A., read a paper on "Places of Geological Interest near Medicine Hat," illustrated by diagrams and Geological specimens.

Mr. President and Gentlemen:—To-night, I purpose taking you with me in imagination, to the banks of the majestic Saskatchewan, that wooer of many a stream in the North-west; there we shall examine some places of geological interest, and glean something from the fragmentary records, as we find them at that place and in some ravines of more than passing interest not far from that locality.

Before directing your attention to the places under consideration, allow me, in a few words, to outline the striking geological characters of that vast stretch of country extending from the Western Boundary of Ontario to the Rocky Mountains.

The geology of the great North-west, like its vast plains and immense rivers, is on a magnificent scale. To the eye of the geologist, a grand vision appears, as he contemplates the marvellous panorama, that rolls before him, portraying the geological features of the country lying between the Laurentian rocks to the east, and the lofty mountains of the west; the former, representatives of the first rocks to triumph over the universal waters of primeval days, the latter belonging to a period comparatively near the summit of the geological series. Between these great natural boundaries we see stretching before us, the three vast prairie steppes of the North-west, rising in succession above each other and distinguished by characteristic physical features.

FIRST PRAIRIE STEPPE.

This fertile region well known as the Red River Valley, is about fifty miles wide at the boundary line which separates Canada from the United States, but widens to the north. It has an elevation of 800 feet above sea level and embraces an area of 6,900 square miles. Being the last of that country to emerge from water, it has received the drainage of the North-west for countless years and has thus become enriched by an alluvial deposit of almost inexhaustible fertility.

Some sixty feet beneath the surface solid rock is reached, but in some places, Selkirk, Stony Mountain and Lake Winnipeg, the rock reaches the surface and is usually a magnesian limestone, rich in fossils belonging to the Silurian period.

SECOND PRAIRIE STEPPE.

This is well marked off from the preceding by the Pembina, Riding and Duck Mountains, along its eastern side; it has an elevation of 1,600 feet above the sea, is about 260 miles wide at its southern limit and narrows slightly towards the north. Within this large area, are 10,500 square miles of land more rolling in character than that of the former district, but also containing extensive stretches of prairie land.

The underlying deposits here differ from those of the Red River Valley, both in character and age. In this area you find Cretaceous clays, some bearing very interesting fossils, while in the preceding, Silurian limestones characterize the deposits.

THIRD PRAIRIE STEPPE.

The so called Dirt Hills indicate the eastern limit of a vast region, some 465 miles wide on the forty-ninth parallel, with an elevation of 3,000 feet above sea level and embracing some 134,000 square miles. In this immense area are located the vast coal fields of the North-west; here too, we find the localities, that are to occupy our attention to-night. The underlying deposits of this region are also Cretaceous. the surface is more rolling than in the other steppes referred to, and in many places lakes and ponds occur with waters strongly alkaline, As this great scene sweeps before us showing in succession these marked natural steps, each full of interest, we can readily perceive what an attractive country the North-west is to a student of geology.

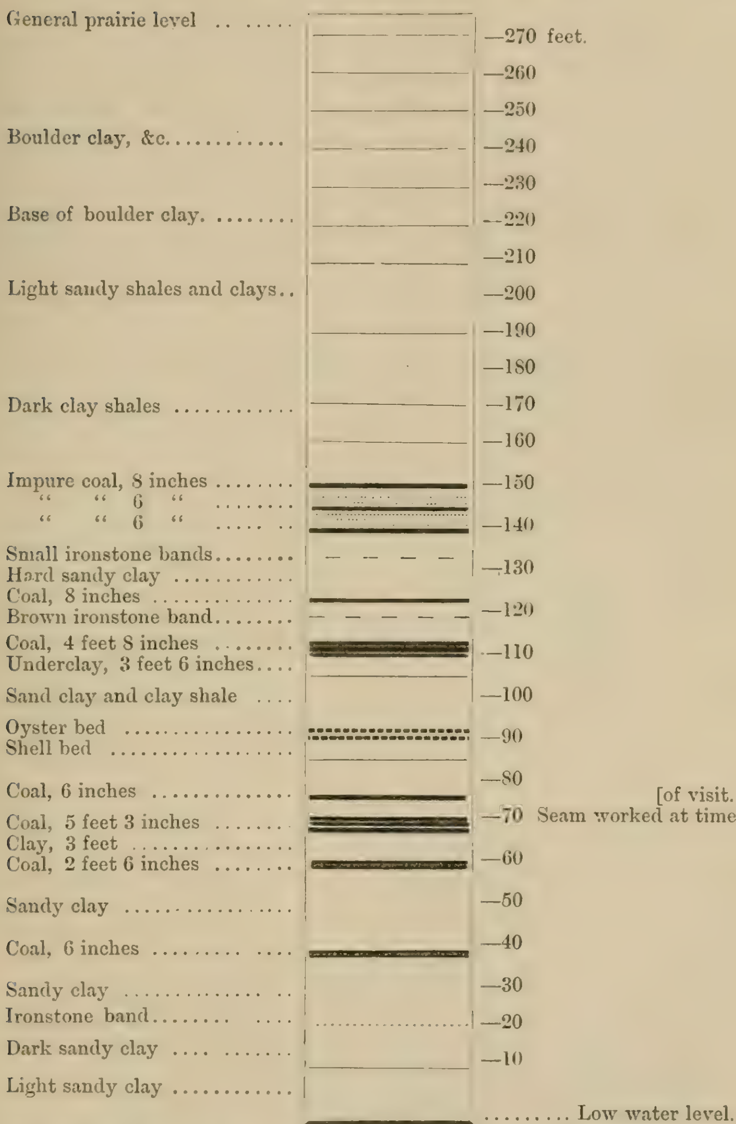
The rich ores of the Laurentian rocks to the east, the level lands of almost exhaustless fertility in the Red River Valley, the rolling districts of the second plateau, with a drier and warmer soil and the third region more vast than the preceding, bearing an inexhaustible store of fuel, all offer attractions to those, who are interested in the development of our great Dominion.

MEDICINE HAT.

This somewhat progressive town is situated 660 miles west of Winnipeg on the banks of the Saskatchewan River over which the Canadian Pacific Railway passes at this place. This is about half-way across the third prairie steppe. Proceeding westward by rail, after a short run of seven miles the station Stair is reached, about one and a half miles from the Coal Mines of that district. As you walk from the station across the prairie, in the direction of the mines, you see no indications of the great ravine, through which the river passes, and from which you are but a short distance. It is only when you come directly upon it, that you see the work nature can perform through the agency of water. As you stand upon the bank of that majestic river, 290 feet above the level of the water and observe, not only the channel worn out by the river, but also the immense lateral excavations made by streams no longer seen, and spring freshets of modern times, you are astounded at the impressive examples of denudation before you.

There being but little solid rock in this region, running water very soon wears immense cuttings through the clays. The coal mine in this vicinity is not located directly on the banks of the river, but on the sides of one of these great ravines leading to it.

The following section of the deposits at this place was prepared by J. P. Lawson, Esq., Manager of the Company mining coal in that district. On the occasion of my two visits to this place I had the pleasure of meeting Mr. Lawson who was very ready to give any information sought.



Section of deposits near Medicine Hat, showing the seam of coal worked by the Saskatchewan Coal Mining Co.

A mine could scarcely be more favorably situated for access than this; the coal comes to the edge of the ravine and has a slight dip to the southeast.

It can either be rolled down to the river's edge, and transported by boat to Medicine Hat, or drawn up an incline to the prairie level and taken by train to points east and west; the latter plan has been followed. During the past year active work in the mines at Lethbridge has affected operations at this place. It is not likely after this that Medicine Hat coal will be used much beyond that locality; for it is found that coal from localities nearer the mountains is superior to that obtained farther east.

Before the opening up of other mines the coal from Medicine Hat was used in considerable quantities in Winnipeg. It is easily kindled, burns with an intense heat and leaves no clinkers. Consumers considered that $1\frac{3}{4}$ tons were equivalent to 1 ton of anthracite.

The following analysis taken from the report of the Geological Survey gives the composition of this coal.

	Slow coking	Fast coking
Hygroscopic water	16.82	16.82
Volatile combustible matter	29.54	31.90
Fixed carbon	46.34	43.98
Ash	7.30	7.30
	100.00	100.00
Coke per cent	53.64	51.28

Ultimate analysis

Oxygen and nitrogen	17.52
Carbon	54.35
Hydrogen	3.34
Sulphur	.67
Ash	7.30
Hygroscopic water	16.82
	100.00

Calorific power—determined by experiment.

Indicated power of fuel in * calorics 51.44

Indicated evaporative power of water (at 100°c) per pound of fuel. 9.57 pounds

* A caloric—one grain of water raised through 1°C of temperature.

Specific gravity—1.3972. the weight of a solid cubic foot being 87.32 pounds

The composition of this coal indicates that it is a lignite, showing a considerable proportion of water and ash and a tendency to disintegrate when exposed to the air. A comparison of this coal with that derived from seams nearer, and in the Rocky Mountains, shows the latter to be freer from water, gives less ash and a much higher percentage of carbon, in other words the quality of the coal improves as you approach the mountains. In the iron-stone band near the river several interesting fossil plants were found in the fragments of stone. These are well defined and in many respects can be readily observed to be closely related to the genus Brosenia and the species has been given the name Brosenia antiqua by Sir William Dawson to whom some specimens were shown. These before you were obtained near the river's edge. On account of the gradual slope from the prairie level down the ravine to the river's edge, it is an easy matter to examine the different layers of deposits indicated in the section already referred to. The fossils from the bed almost two hundred feet below the level of the prairie can be readily identified as allied to the oyster family. They are not imbedded in solid rock, but form a layer of loose shells lying between beds of clay; they are exceedingly fragile, usually small and require to be handled very carefully, or they crumble to pieces on examination.

From many gathered, the specimens before you are the only ones, which have remained at all complete.

The presence of oyster shells so far below the prairie level, in a region now removed 2,000 miles from the sea is very suggestive of the wonderful changes which that country has undergone in the ages long receded into the past. At several places along the banks of the river, the remains of petrified trees are very common; some of these belong to types entirely different from those which now grow on the banks of the Saskatchewan.

The clay band 110 feet above the river in some places presents a very attractive appearance, being almost as red as vermilion; a condition which has likely resulted from the burning of coal in the seam below.

This clay seems to have little or no lime or magnesia in it, possesses a fine compact texture and may yet be of economic value as a supply for the manufacture of pottery.

Leaving the mine and passing down the river, the banks do not present the appearance of an escarpment, but immense piles of gravel; these great heaps or hills are covered with grass and the deposits seem to have assumed this condition, long after those seen in the vicinity of the mine. These large mounds of gravel are no doubt comparatively recent in their origin, glacial or post-glacial, while those of the mine are decidedly Cretaceous, belonging to the Belly River series of that system.

IRVINE RAVINE.

Proceeding by rail eastward from Medicine Hat for a distance of 20 miles you reach Irvine station, on the Canadian Pacific Railway. There is very little at this point calculated to prove of interest to a geologist, but on looking to the south, about two miles, in the distance a comparatively high hill appears, with a pecular flat-like summit. This indicates the entrance to a ravine or "Coulee" of more than ordinary attraction. At almost any point it teems with interest to a student of palaeontology; if he desires, and time permits, it can be followed up until the Cypress Hills are reached; a place where during the past few years members of the Geological Survey have made some startling discoveries regarding the extinct fauna of the North-west.

In the Spring of '83, Mr. Lawson, Manager of the Medicine Hat Coal Mine, while prospecting for coal in the region of Irvine, discovered the remains of what appeared to be an animal allied to reptiles

On his return to Winnipeg, he was interviewed by a reporter, and a short notice in the daily papers appeared, describing the pecular remains, found among those lonely hills. In July of the same year, Sir William Dawson, while visiting the North-west heard of this discovery, and set out to find the remains after having obtained directions as to their location from Mr. Lawson; but his efforts were in vain. On his return to Winnipeg, having learned that the writer was preparing to search the same locality in August, he kindly gave the sketch of the locality that he had used, and advised, if possible, to see Mr. Lawson, for he (Sir William Dawson) was under the impression that there was a mistake in the directions given him.

On reaching the Coal Mine in August, I at once communicated to Mr. Lawson the results of Sir William Dawson and asked him to examine carefully the sketch and make any corrections he saw necessary.

Some changes were made and in a few days in company with a gentleman from Medicine Hat, I started with considerable enthusiasm to seek this fossil, around which so much of interest was gathering. It was a very bleak day, when we reached Irvine station and began to wend our way across the flats to the entrance of the ravine. We followed the directions and gradually ascended the hill on the trail, which leads to the Cypress Hills. As soon as the summit was reached, and we beheld the complicated nature of the place, an immense central ravine, and innumerable lateral ones, we began to feel that we had undertaken an almost forlorn hope, in setting out to find a particular spot among such hills. The sketch was frequently consulted, but all was obscure in this wild spot. Among the rugged ravines, we climbed hour after hour, seeking in vain the reptile, that had lain so long among these peculiar hills. Though apparently unsuccessful at first, still much was seen that was exceedingly interesting and instructive. The effect of "weathering" upon the rocks of this place is astonishing. So striking is the result, that my companion frequently observed, "It looks as if some of these hills had been pounded to pieces." Among the debris, we observed numerous crystals of Selenite, which appeared to have been in the upper layers of the clay. Some of these were very perfect and of all sizes and in some parts very numerous indeed. From their occurrence in these argillaceous strata, this mineral seems to have resulted from the decomposition of some iron compound and its reaction on the carbonate of lime in the clays.

Sulphide of iron may have been present and oxidized into the sulphate of the protoxide of iron, which becoming decomposed by the bicarbonate of lime, would give rise to sulphate of lime and carbonate of iron, the former separating out in the form of the crystals already referred to, and the latter remaining as ironstone.

We also found many fragments of large shells resembling the genus Corbula but they all seemed exceedingly fragile and no complete forms were observed. In several parts of the ravine, layers of ironstone intercalcated among the strata of grey sandstone, are of common occurrence and at some points exposures of coal appear, but the seams are comparatively thin, and experience has shown that they are of too irregular a nature to pay to work.

When the hope of finding reptilian remains was beginning to lessen, and my companion becoming disheartened ; (for he had come expressly to see the interesting relics of past life,) our energies were revived by finding four fragments of thoroughly petrified bones : these lay on the side of the hill, and appeared as if they had fallen from layers higher up the exposure. Our fallen hopes much revived by this discove y, with renewed vigor we climbed the hill-side, where we expected to find more remains in their original position. Though this seemed on consulting our sketch, to be near the spot we sought, still, we were forced to abandon further search for the reptile, cross over to another part of the ravine and confine our attention to the lofty sides of the escarpment there.

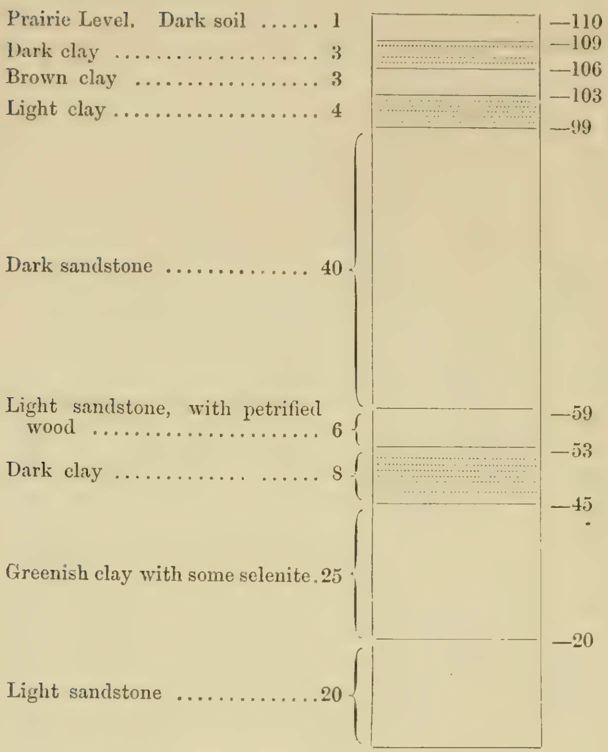
Here a magnificent exposure appeared, largely made up of beautiful sandstone comparatively soft interspersed with bands of stone more or less ferruginous and in some places seams of inferior coal.

The effect of the weather upon this soft sandstone was very marked much of it appeared to have crumbled away leaving shelves of the ironstone, along which we could walk.

In some places the crumbling sand had fallen down the sides and covered over cave-like spaces, into which we sometimes fell, as we walked along the sides of the ravine, the sandy covering, which appeared to bridge over these holes, proving too thin to sustain our weight.

Along the face of this escarpment, and usually near the layers of coal, we saw several bones protruding from the rock, but as often as we attempted to dig them out, all crumbled away except the portion we saw, and which seemed to have hardened by weathering. A visit to the same place the next year and many attempts made to secure fossils from this sandstone, have convinced me that we can obtain only fragmentary fossils at best from this rock ; its porous nature allows the water to percolate readily through, and thus affect any bones imbedded in the sandstone. This is a striking contrast to the condition of fossils found in some of the Cretaceous clays of the North-west, where they possess all the lustre and beauty, which characterize some shells of modern seas. On some of the elevated shelves, excellent fragments were found, which the weather, through long periods had prepared. Almost anywhere in this vicinity upon the ironstone bands, fragments of bone could be secured. There was no longer doubt in our minds, that the remains of extinct animals would be found among the deposits of this wild and dreary place, that the bones belonged to creatures of immense size and that they thronged the Cretaceous seas in which these deposits had been formed. We felt amply repaid for all our exertions in this wild, rough and lonely spot, although we found no skull bones or teeth. Some of the bones were very large, apparently portions of thigh bones and vertebrae; all of which were presented to the Historical and Scientific Society of Winnipeg, with the exception of the specimens placed before you, for examination at the close of the evening's proceedings.

At one place, in particular, where the escarpment was very marked, large quantities of petrified wood lay about at the base and bore a marked resemblance to a pile of ordinary wood, so much so that at first sight, an ordinary observer would naturally consider it such; portions of the trees from which these had been derived could be seen in the sandstone. As this place the strata were so well defined, that a sketch was taken, a vertical section of which may be represented as follows; but it must be remembered, that this is not a uniform condition in the ravine, for the strata vary much in different parts: while a general arrangement may be observed, such as sandstone, ironstone, clay and seams of coal, yet a wonderful difference occurs, when you compare one series of deposits with those in other parts.



On the occasion of a second visit to this place the following year '84, better results followed my investigations. Many fragments of fossil bone were secured but all of little use in identifying the animals to which these remains belonged. However I had the good fortune to discover some teeth. These with some fragments of peculiar bones were forwarded to Prof. Cope, of Philadelphia, who identified the teeth as belonging to a large deinosaur of the genus Lælaps allied to the Megalosaurus, and the peculiar bones as fragments of the carapace of a Cretaceous land turtle of the genus Trionyx.

Portions of other teeth were obtained; but not complete enough for identification; in addition to these, a vertebra was found which in all probability belonged to a fish.

The specimens, some of which are on the table for your examination, would seem to indicate that these deposits among the "weathered" hills of this locality are of absording interest to a student of Science. The district is extensive and days could be spent in examining it. Further south beautiful ammonites are readily found, while in the Cypress Hills deposits of a most interesting character occur.

Regarding the geological horizon of the deposits in Irvine Ravine, the subject has received considerable attention by some members of the Geological Survey, who place them in the Cretaceous of which the Belly River series and Pierre Shales are represented in the escarpment near Irvine Station, the Pierre Shales being uppermost and represented by clay banks of a more or less dark color, below follows the Belly River series composed of sandy clays and layers of ironstone nodules among them. The beds are readily acted upon by the weather producing the striking appearance already referred to. Seams of coal appear in these deposits at some places; that mined at Medicine Hat being at the base of the upper division of this series of deposits, while the seam at Irvine Ravine lies at the base of the Pierre Shales. Irvine Ravine thus becomes of more interest than Medicine Hat, the former affording an excellent section in which the Pierre Shales and Belly River series are well illustrated, the latter being largely made up of the Belly River deposits; both groups belong to the Cretaceous system in the geological system.

Having thus directed your attentiou to these attractive geological hunting grounds in the vicinity of Medicine Hat, I shall close this paper with the following diagram which will enable the reader to compare the Cretaceous deposits of the North-west with those of the same system in some parts of the United States and England.

ENGLAND.	MISSOURI.	NORTH-WEST.
Eocene or latest Cretaceous	Fort Union.	Laramie.
Maestricht	Fox Hill.	Fox Hill.
White Chalk	Pierre.	Pierre.
Chalk Marl	Niobrara.	Belly River.
Upper Greensand..	Benton.	Benton.
Gault...........	Dakota.	Dakota.

TWENTIETH MEETING.

Twentieth Meeting, April 2nd, 1887, the President in the chair.

Exchanges since last meeting, 82.

The Council announced the admission of Ernest M'Craken as an Associate.

A communication was received from the Council recommending the formation of a House Committee, a Museum Committee, and an Archaeological Committee.

The following were elected members :—W. J. Cooper, Geo.

Graham, Robert F. Scott, P. K. Stern, Thomas Pinkney and Thomas McCraken.

Dr. W. B. Nesbitt read a paper on "The Volumetric System in Materia Medica."

In bringing the following paper before you I am conscious of its many imperfections. and that it is not as yet a perfect system, yet I hope you will bear with me, and that in the discussion which I hope it will be its merit to engender, I may receive such hints and criticisms as will enable me to place my system on a still more practicable basis.

The first thing that the student of Materia Medica is struck with, is the almost illimitable number of drugs and preparations, whose number is only comparable with the likewise illimitable and varied doses. It is this heterogenous system of dosage that I would try to place on a more satisfactory basis. We will just glance at a few of the preparations and their doses. We will commence with the inorganic salts. This is what we find :—

Potassic Carbonate	10—30	grs.	Potassic Bromide	5—30	grs.
" Bicarbonate	10—40	"	" Citras	20—60	"
Liquor Potassæ	15—60	"	" Acetas	10—60	"
Potassic Permanganate	1—2	"	" Chloras	10—30	"
" Iodide	2—10	"	" Sulphurate	3—8	"
" Tartras acid	20—60	"	" Nitras	10—30	"
			" Sulphas	15—60	"

I have chosen the salts of Potash simply because they come first in the book most used by students, *i. e.* Mitchell Brown's Materia Medica. All these preparations when prescribed by the Physician, are first triturated in the mortar for such as are in the form of xtals, and then dissolved in water, water being almost invariably the medium for holding the different drugs in solution, sometimes as in the case of Quinine, a little sulphuric acid is added to assist the dissolving.

Now if these drugs were kept in solution by physicians and pharmacies, and the strength of *each* so graduated that the dose of *all* would be the same, you have the principle of the system. For instance, we will take two or three of the above mentioned salts,

Potassic Carbonas	10—30	grs.
" Permang	1— 2	"
" Iodide	2—10	"

We will keep these on our shelves already dissolved, and we will have the dose for all 1 drm. In order to do this we will make up say one quart, 40 ozs, of each solution. In 40 ozs. there are 320 drms. therefore to have the maximum dose of

Potassic Carbonas	in one drm. we must have	320×30 or	9600 grs.
" Permang.	" " " " "	320×2 "	640 "
" Iodide	" " " " "	320×10 "	3200 "

Now we see by the above, that in 320 drms. of the Pot. Carb. solution we have 9600 grs., or in 1 drm. of solution we have $\frac{9600}{320} = 30$ grs.: in the Pot. Permang., in 320 ozs. we have 640 grs. *i.e.* in 1 drm. we have $\frac{640}{320}$ or 2 grs. which is the requisite dose.

Leaving the inorganic we next come to the organic portion of Materia Medica, this like organic chemistry, has a little more system in it, for we find here the majority of the tinctures have a dose of from 1—2 drms. Still we have such discrepancies as

Tinct. opii 5—40 m.	Tincture opia ammoniata $\frac{1}{2}$—1 drm. m.
" Camp. Co. 15—60 m.	Liquor morphine Hydrochloratis 10—60 m.
Fluid Ext Pilocarpine 10—60 m.	Tinct. Pilocarpine 5—20 m.
Tinct Tolutana 15—30 m.	Tinct. Lobelia 10—30 m.

Also there are the various infusions, decoctions, wines, elixirs and every manner of fluid preparation, with doses varied for each class and the doses for any class varying among themselves.

What possessed the originators of our Pharmacopeia to have the doses so varied, when they might just as well and as easily have had them the same, is to me incomprehensible. The same system and principle will serve here as in the previous instance, by adjusting the amount of the principles taken it would be very easy to have the dose for all $\frac{1}{2}$—1 drm.

In this plan there would also be much less liability to poisoning. The *Modus operandi* of poison cases is as follows: A druggist receives a prescription which calls for Quina Sulph. xxx grs.; now Sulphate of Quinine, as well as the salts of many other alkaloids, have a great resemblance to each other in external appearance, so much so, that the Druggist just looking at the contents, can easily mistake Morphine for Quinine. He gives xxx grs. of Morphine by mistake for Quinine, the man dies; the stomach is sent to Dr. Ellis, and the Druggist appears at the next assizes to answer to the charge of manslaughter. Now, had these been in volumetric solution, with dose for each 1 dr., the Physician would have written Quinine Sulph. 6 drs. and then, as the dose for morphine would been exactly the same, a poisonous quantity would not have been administered.

The above are the principal features of the system, but what would I think still further improve it, would be the introduction of the metric system of measures. The dose for all being the same, there would not be the danger of misplacing decimal points as in the metric system as now applied. Taking for the standard dose 1 to 2 cubic centimetres and having our bottles in sizes of 100 and 200 C. C.'s, there would be much greater facility of reckoning than at present.

By having a uniform dosage system, not only would much unnecessary work for the student be abolished and enable him to devote more of his time to the much more essential study of therapeutics, but for therapeutic purposes we would have a most complete scientific system, as the standard dose $\frac{1}{4}$—1 dr. or 1—2 C.C.'s as the case may be the therapeutic unit, as 1 dr. of tinct. aconite would produce maximum therapeutic effect of the drug, and so likewise the 1 dr. of tinct. opii. the 1 dr. of tinct. digitalis, etc., *ad infinitum*.

Mr. Charles Hill Tout, read a paper on "The Study of Language."

In the May Volume of the Popular Science Monthly of last year, is an article from the pen of Mons. Havelocque in which he puts forth the astounding statement that language is an organism. Now, as this touches upon an extremely important point in linguistics, and is propounded, presumably, in support of the views held by the school Mons. Havelocque represents, it will be well worth while to consider the grounds on which he makes this assertion.

He begins his paper by telling us that the faculty of language stands in close relation with a certain one of the frontal convolutions of the brain which the inferior monkeys do not possess, and which is found in a rudimentary state in the anthropoids, but the full acquisition and most complete development of which has made man what he is—the master of articulate speech—and from this physiological fact alone, he claims a place for that purely conventional medium of thought—language, among the Natural Sciences.

But seemingly conscious of the weakness of this argument, he brings in another by way of strengthening it, viz., in the fact, to use his own words, that no man or group of men is competent arbitrarily to change the structure of its language. The morphological evolution of language defies all convention, all encroachment; it goes on by virtue of its own force, more or less slowly or speedily, but without the fancy or the pleasure of men having any power to divert it from its course. On these two facts, the former at best true only of the *faculty* or *power* of speech, and the latter less than half true, he sweepingly puts aside all objections to his theory and declares that the study of language must be classed among the Natural Sciences. Having got so far he now finds no difficulty in *asserting language* to be an organism. What (he asks in effect) are the characteristics of an organism Formation, growth, development, decay, these are just the characteristics of language; ergo language is an organism. Frivolous as this kind of reasoning may appear it is just what Mons. Havelocque used. Languages, he says arise, are developed, pass on to decadence and perish like other organised beings, and there can be no doubt that language behaves in reality like an organism, and that it is in a constant state of evolution, that is to say, because language has a *birth*, *growth*, *development*, *decadence* and because these are the identical terms used in speaking of the evolution of an organism, terms borrowed indeed from the nomenclature of Physiology, language forsooth must be an organism.

This I contend is the only fair deduction that one can make from his statement. Following on this, he goes on to show the successive evolutions of this new organism, running somewhat superficially through the principal phases of linguistic development. Basing his remarks on the theory proposed by Wm. Schlegel in 1818, viz., that all languages first pass through a monosyllabic period, which the result of later research and study has confirmed and strengthened and which although we are not acquainted with any language in its embryonic or even strictly speaking monosyllabic stage, notwithstanding is undoubtedly the first phase of linguistic life, he tells us that existing monosyllabic languages have greatly improved upon their primitive processes, all of which is incontestably true. The only remark we would offer here is that the term *monosyllabic* when applied as above to *existing* languages should be qualified in some way ; as we have *no* example on record of a purely monosyllabic language and that to bring forward the Chinese, as he does, as an example of this class is to talk about a matter we are ignorant of and to put ourselves in conflict with the authority of those whose scholarship in that tongue is beyond dispute. I refer here, in particular, to such men as Prof. Douglas, of British Museum, and Professor of Chinese, at King's College, London, the author of an exceedingly interesting History of the Chinese people, who in this connection states that the Chinese language like most others has suffered loss through phonetic decay. Even at the present day it is as I have shown, he says, less purely a monosyllabic language than has generally been supposed, but in bygone ages there are evidences that it was *poly-syllabic.* We find for instance many words with aspirates in them which point to the loss of a syllable, for example, such a word as K'an leads us to the conclusion that in all probability it was originally Kahan. But there are other combinations of characters which are unmistakably representations of polysyllabic words, and a close examination of any of the dialects shows that these words bear no inconsiderable proportion to the entire number of words. In Pekingese these pc ysyllabic words are very numerous, partly owing no doubt to the introduction of Manchu and Mongolian words into the vocabulary. But there are also quite enough native polysyllabic words to redeem the spoken language at least from the charge of monosyllabism. A study of a few pages also of Sir Thos. Wade's Tzu Erh Chi is instructive reading on this head. But to return. From this point Mons. Havelocque goes on to show how the agglutinative stage is evolved out of the monosyllabic, but confesses to a difficulty in the evolution of the agglutinative into the flexional or synthetic, and as this has long been felt to b a difficulty we would beg to call attention here to the numerous tongues of the American group or family of languages as offering and affording the very evidence we need to show how the monosyllabic or agglutinative or incorporative may pass into the flexional or synthetic.

Humboldt who first called attention to this family believed that we could clearly discover in them the origin of the tense and mood signs, that is to say, the *process* by which the higher phase is evolved or developed out of the lower; and he cites several good examples in successive stages of transition, for instance, he says that the actual process of transition from the incorporated, the distinguishing feature of the American family, to the inflexional is presented to us in the Mbaya tongue where we find such verbal forms as "*dalali*" which means, thou wilt throw; "*nilabuite*" which means, he has spun, where the *d* is the sign of the *future* and *n* of the *perfect*. At first sight they look like *true* infl xions, but on closer examination we find that *d* is in fact simply a relic of the word "*quide*" meaning, hereafter or later, and *n* stands in the same relation to the word "*quine*" which means, "*and also*" and both have their independent signification at the present time. But it is quite conceivably and highly probable that at no distant date, the independent signification of these abbreviated words will gradually slip, as has actually been the case in the Mexican aud Tamanaca tongues, from the mind of the speaker and be lost and the letters will then become purely formal elements denoting the tense of the verb and nothing more. Indeed some of the American tongues may be said to have already reached the inflexional stage, their primary tenses ending in different letters, for example in the Mexican language there are the terminals "*ya*" or "*a*" in the imperfect and the augment "*o*" in the preterite and others in the future. In the Tamanaca also the present ends in *a*, the preterite in *e*, the future in *c*, and in speaking of these Humboldt says "there is nothing in either of these tongues to show that these tense signs have independent meanings as they once undoubtly had; and there is no reason why they should not be classed with those of the Greek and Sanskrit as true inflexional elements." It is clear then from this that a study of the American tongues is absolutely necessary in order to a right understanding of the process by which the inflexional is developed from a preceding stage and if there were any doubt about this the labors of Dr. Brinton in this field would soon remove it. But as it was not the intention of my paper to demonstrate the processes by which the several phases cf language pass into one another although the subject is a most enticing and attractive one, we will return to the point from which this digression on the sythetic process has led us. What most astonishes us then in reading through Mons. Havelocque's paper is the extraordinary confusion of terms he is guilty of in trying to put the study of language upon the foremost pedestal in the Temple of the Natural Sciences. He distinctly in the earlier part of his paper draws attention to the common habit which confuses the *art* of speech with that of the *faculty* and yet in the same breath uses the two terms interchangeably. We are altogether at a loss to see, unless this is so, why one who speaks at one moment of speech as an *art*—a thing to be acquired—can at the next cull it an *organism*, and this is even more striking when we remember that Mons. Havelocque claims to be treating language exclusively from the scientific point of view. That the *faculty* of speech is in close relation with a certain convolution of the brain no one will dispute I suppose; nay we will go farther and say with him that this same faculty is hereditarily transmitted and goes down with the structure, nature and qualities of the brain, but by what process of reasoning I am to arrive at the conclusion that the *art* of speech, a man made thing, is an organism I am at a loss to conceive. One might as well say that the conventional signs of our methods of recording knowledge, or that the art of painting or sculpture are organisms, all are equally the products of human effort, preseverance and labor. Language is to put it briefly and clearly, simply and purely an instrument for the conveyance of thought, the use of which depends entirely on the skill of him who handles it, in exactly the same manner as the pencil, brush and chisel depend upon the skill of their several users. This seems to me to be so demonstrably obvious and the error and confusion of terms Mons. Havelocque has fallen in to be so plain that it is not worth while to spend more time over it, but go on at once and examine his second argument which because it contains a partial truth may seem for the moment slightly more convincing. Here he says that his *reason* for including the study of language among the Natural Sciences lies in the fact that no man or group of men is competent arbitrarily to change its structure, etc. Here we perceive in a brief glance that the fallacy of his second argument lies in the peculiar and unscientific notion, which he in common with his school holds, concerning the *origin* of language. Though he does not say so in so m ny words it is abundantly clear from his argument that he pre-supposes man to have started on his career fully equipped with a ready-made and to a certain extent perfect medium for the communication of his wants and thoughts, whereas a study of the phenomena of language on sound inductive principles proves beyond doubt, to use Prof. Whitney's language, that there was a time when man was as destitute of language—*i.e.*, articulate speech as a medium for the communication of his wants and thoughts—as the dog, that is to say, that man, as man, had to acquire by patient and labored effort, a medium of expression in precisely the same way as every child has since, with this important difference, that primitive man had to do it wholly unaided while the child receives the assistance of those around it. The closer one examines the phenomena of speech the more irresistibly is one drawn to this conclusion, a conclusion I may add now held by the majority of the most eminent of modern philologists, and hence in accordance with this supposition Mons. Havelocque most unhesitatingly asserts that language is altogether beyond the control of man or groups of men, whereas experience even within the historical period goes to show that this statement is only partially true, and if we can show the reason why the growth and development of language is, in a measure, outside of the control of man on a more scientific basis than Mons. Havelocque has attempted to do, we shall have taken away the only argument he uses that carries any force with it and this with the light modern research has thrown upon the subject we shall have no difficulty in doing.

In examining the phenomena of language then, one of the most obvious features always confronting us is the different families or groups as we term them into which language is divided, a method of division rapidly growing less fixed and clear, and assuredly pointing to a time when the science shall be a little older and our knowledge of the subject a little more extensive, when we shall be able to trace with comparative clearness all the various existing families or groups to one primitive source. The whole tendency of modern research leading in that direction ; and this being so it will then become a comparatively easy task to put one's finger upon the law or force which differentiates the offspring one from another and all from the common parent, and if we turn to the older science of physiology we shall there discover a law or tendency at work which if we borrow and set in motion within the province of language will clearly demonstrate the processes that developed all existing groups of language from one primitive and common source. In citing an example of this law or tendency, to be seen in its operations in physiology it will suffice for us to take the human face. Now it is an incontestable fact that the facial features are greatly influenced by a force at work upon them from the moment of their embryonic existence down to their full development and decay, known as the Law of Conformity to Type. To take the nose for an example we know that in certain families and even peoples this is invariably the most marked and striking feature of the face, and which has been known to persistently run in that family or people for many generations, and when we ask the reason of this phenomenon we are told and we have proved the force of this tendency in many of our domestic animals, of which the pug-dog is a noted instance, that some remote ancestor of this particular family or people possessed a remarkably developed nasal organ, which by the unique force and strength of his character, he conferred in perpetuity so to speak on his favored descendants.

And as it is with the nasal feature so is it with all the others. Now in precisely the same way in primitive times when men were splitting up into families and clans and struggling hard with the difficulties that naturally then in the early stages of language, beset the expression of their wants and thoughts, certain of them stood out like Nimrods above their fellows in mental capacity and power, and so left the impress of their individuality upon their language, giving it just that tendency, setting it just on those lines within that certain groove that would start it on the plane of its development and characterise it through all the phases of its existence.

In the operation of this law of Conformity of Type we maintain that we can discover why we have found it is necessary in the first place to group languages into families; and secondly, and here is our point of divergence from the notion held by Mons Havelocque and his school, that this and this alone, is the reason why language is in a limited sense beyond the direct control or power of man, not because it is an organism given to him in the same way as his nose or his eyes, but rather acquired in the way in which he gets his teeth, if the figure is allowable, by much vexation of spirit, multiplying and developing as do his teeth in corresponding ratio with his needs. Every growth, change and development in speech is due and indeed must be in the first place to an initiatory action of some one individual sanctioned and accepted by his community. Man has absolute power and control over the changes and developments of language, so long as he lets it run on its own peculiar lines. He is powerless only when he would seek to turn the course of its growth and development into some channel other than that it started from and which is invariably laid down and marked out, more often unconsciously than not, while its speakers are uncultivated and in a primitive condition of being. And when it is asked why one language is is superior to another, why one is much better adapted to the uses to which we desire to put if we ask a counter question. Why is the nose of the Jew for instance in general a more striking feature in him than in most other people? And the answer to this question carries by inference the answer to the other, viz., because of some remote ancestor of this people whose individuality and personality of character was so remarkably strong as to leave one of its chief features on all his descendants. Language may be said to resemble organisms in other ways than mere similarity of formation, growth, development, etc. As it is dominated by the law of its type so it is also in much the same way by the law of the Survival of the Fittest. That language which had the good fortune to be sent rolling down the vistas of future ages by a superior master-hand. will by its intrinsic merit and force be best able to adapt itself to all the varying changes of its environment, and will undoubtedly live and flourish while others less favored either remain stunted and deformed, or else drop out of existence altogether.

But while language is dominated by laws identical with some of those running through the Organic Kingdom, and we are obliged for lack of better to fall back upon the nomenclature of physiology to mark its various changes and developments, it is only a warped. prejudiced and unscientific mind that can possibly mistake a mere superficial resemblance for a deep-rooted living reality.

Mr. CHAMBERLAIN referred to the different theories that had been advanced to account for the origin of language. Noiré (whose theory has been partially endorsed by Max Müller) ascribed the origin of roots to the sounds simultaneously used in social acts, as when people work together in digging, threshing, spinning, rowing, &c. These sounds become signs of repeated acts, continuing in the memory as signs of such acts, and so became roots embodying a concept, and being uttered by persons engaged in a common work are understood by all. He (Mr. C.) was of the opinion that language was originally polysyllabic, and was developed according to man's wants. The Chinese was referred to in opposition to this opinion, but this was not a fair example to cite, besides there were indications in Chinese of a polysyllabic structure.

Mr. TOUT thought the mistake was in supposing any one theory contained the whole truth. There was no one individual way in which language was formed. He imagined that language was first formed partly dissyllabic and partly syllabic.

TWENTY-FIRST MEETING.

Twenty-First Meeting, April 9th, 1887, the President in the chair.

Dr. Ellis was appointed representative of the Institute at the next meeting in Ottawa of the Royal Society of Canada.

A donation was announced of 83 species of plants, from Mr. G. Montague White.

Exchanges since last meeting, 44.

Mr. Goodwin Gibson was elected a member.

Mr. H. R. Moore, on behalf of Mr. A. C. Lawson, M.A., Geologist to the Geological Survey of Canada, read a paper on

THE DIABASE DYKES OF RAINY LAKE.

The most recent of the crystalline rocks of the Rainy Lake region are comprised in a series of strong dykes of comparatively fresh diabase which are observed to cut, at different localities, the various members of the Archæan complex of formations. These dykes are not infrequent throughout the country lying between the eastern confines of the first prairie steppe, which forms the basin of the Red River of the north, and the western border of the area of Animikie and later formations of the Lake Superior basin. Their occurrence and some of their characters are briefly referred to in my report on the Lake of the Woods region.* As there observed, the occurrence of these dykes cutting the older folded rocks, which in their eastward geographical continuation, pass under the flat-lying Animikie and Keweenawan formations, is suggestive of their

* Geological and Natural History Survey of Canada, Annual Report, 1885, p. 41 CC., p. 47 CC.

possible connection with the bedded traps that form so large a part of the two latter geological series. With the question of the possible identity of character and age of these dykes with the traps of the Animikie or Keweenawan, or of both, is associated the equally interesting one of the extent of the earth's surface, over which, in early geological times, were in simultaneous operation, those particular volcanic forces which appear to have had their focus in the Lake Superior basin.

The more notable field characters of these dykes are : their common strike throughout the region from N.W. and S.E. to N.N.W and S.S.E. ; the sharp, well defined nature of the gash or fissure which they fill, no matter what may be the character of the country rock ; the absence of inclusions of the country rock, or of apophyses of the dyke running into it, except in very occasional instances ; their generally uniform width under different conditions of occurrence in different localities, the limits being as a rule 60 and 150 feet ; their continuity for one or several miles where exposures permit them to be traced ; their passage from a very compact, aphanitic, black rock at the immediate contact with the dyke walls, by insensible gradations to a very coarse-grained, mottled, dark gray rock in the middle of the dyke ; an occasionally observed peculiar pitting of the weathered surface, arranged in straight, more or less uniformly spaced lines transverse to the strike of the dyke ; their prominent, steeply rounded, or domed, glaciated surfaces in contrast to the more gently inclined *roches moutonnées* of the schists and gneisses ; their assumption of brownish tints on surfaces aerially weathered ; (surfaces beneath high water mark of the lakes are generally quite fresh and black).

These dykes have as yet only received a preliminary study, and it will require a much more extended examination of the country in which they occur and a much more elaborate investigation of their petrographical characters before a comprehensive statement of their geological relations can be formulated. A few notes regarding the microscopic features of these dykes, taken together with what has been said of their field occurrence, may however, be of interest, and will serve as a report of progress of what is being done in this line of investigation in the field west of Lake Superior.*

* These rocks were studied microscopically in the laboratory of the Johns Hopkins University, Baltimore, under the guidance of Prof. G. H. Williams, for whose kind advice and assistance the writer desires to express his grateful acknowledgments.

One of the most characteristic of these dykes is one that traverses the coarse granitoid gneiss of the west arm of Jackfish Lake, which lies to the north-west of Rainy Lake. Its width is 135 feet and its contact with the country rock is well exposed as a sharp line. From a macroscopic examination the gneiss does not appear to have been altered perceptibly towards the contact. Specimens for microscopic examination were taken from different parts of the dyke, viz., at 60 feet. 20 feet, and 6 feet from the contact, and at the contact. At 60 feet from the contact, the rock is a coarse-grained mottled gray rock in which dirty white feldspar and black pyroxene are the prominent constituents. Under the microscope it presents the characters of a coarse-grained, comparatively fresh diabase. Augite of a pale mauve tinted gray colour is abundant and often occurs in masses that fill the field of the microscope when low powers are used. Sometimes these plates of augite are individual crystals. For the most part however, they are not single individuals. When examined between crossed nicols the plate of augite is seen at once to be resolved into an intimately interlocking mosaic of irregularly shaped grains of diverse optical orientation. In ordinary light the boundaries between the different members of these "polysomatic"* masses of augite are traceable only with difficulty and uncertainty. There is no interstitial matter whatever, the different grains being as intimately associated as in the case of interpenetration twins of feldspar. That they are not twins is shown by the fact that there are often as many as half-a-dozen grains all of different orientation thus combined in the same mass. The cleavage, by its lack of continuity over the field of course indicates a difference of orientation in different parts of it, but the cleavage traces are not strongly marked, and attention is only directed to the discordance of the cleavage after the polysomatic character of the mass has been rendered prominent by the analyser of the microscope. This polysomatic structure of augite does not appear to be common. Rosenbusch does not mention it in his last comprehensive summary of the present state of petrographical knowledge.† The nearest approach to this structure that is at all well known is the polysomatic character of some chondri of olivine in certain

* Adapted from Tschermak's use of this word as applied to a similar structure in the olivine of certain meteorites.—V. Die Mikr. Beschaff. der meteor. Stuttgart, 1885.

† Mikr. Phys. der Mineralien und Gesteine Stuttgart, 1886

meteorites such as are figured by Tschermak‡ and Wadsworth.§ Olivine in a similar condition in terrestrial rocks has recently been described and figured by Renard in specimens from Kerguelen Island in the Indian Ocean.|| The polysomatic structure in augite is not so well known. Renard notes that the augites of the feldspathic basalt of Heard Island, Indian Ocean, are grouped together at certain points,** and again in the same rocks in Marion Island that the augite is characterized by a tendency to form groups of individuals having their vertical axes parallel.†† Teall mentions "Granular Aggregates" of augite in the Hett and the High Green dykes in the north of England.‡‡ Some of these appear from the figures given to be aggregates of grains of augite not in close juxtaposition with an interstitial base, although that figured in Plate XII, Fig. 5, would seem to be a polysomatic augite, and if so is the only strictly parallel instance that I can find of this structure so common in this dyke and in others of the region.

The augite is generally altered to hornblende at its periphery and occasionally the latter mineral entirely replaces the former. The process of alteration does not appear to proceed along the almost or quite imperceptible lines of demarkation between the different individuals of the polysomatic augite, but extends from the periphery of the mass as a whole in towards its centre.

The plagioclase appears in two general forms, a rather stout or tabular form which is the larger and usually the more cloudy with decomposition products, and a small long lath shaped feldspar which appears quite fresh and in which the polysynthetic lamellae are much more distinct than in the former.

Magnetite occurs in irregularly bounded masses or is disseminated, often quite thickly, through the augite as inclusions of dusty or finely granular aspect. Pyrite also occurs and is discernable macroscopically. Apatite is seen in occasionally colorless hexagonal sections and in slender prisms with rounded terminations. Water-clear quartz, with inclusions of apatite microlites and liquid inclusions

‡ Die Mikr. Beschaff. der Meteor. Stuttgart, 1885, Taf. xv. Fig. 1 and 2.

§ Lithological Studies, Mem. Mus. Comp. Zöol. Harvard, Vol. x., pl. 1.

|| Notice sur la geologie de l' ile de Kerguelen, Bul. Mus. Roy. Hist. Nat. Belgique, Tome IV. No. 4., p. 233, fig. 1, pl. v.

** Notice sur les roches de l' île Heard. Bull. Mus. Roy. Hist. Nat. Belgique, 1886, 8 p. 260.

†† Notice sur les roches de l' île Marion. Ibid. p. 250.

‡‡ Petrographical Notes on some north of England Dykes, Q. J. G. S., 1884, 158. p. 229 and 242

with dancing bubbles, forms a considerable proportion of the mineral constituents of the rock and is characterised by having a common orientation for isolated sections over a wide area of the microscopic field, as in the micropegmatite structure. A few colorless garnets are also present. The rock, such being its characters, may be classed as a uralitic quartz diabase.

At 20 feet from the contact the rock is very similar to that at 60 feet but is much less coarse in texture. It differs from the latter in mineralogical composition in the fact that there is present an abundance of white or colorless garnets, all perfectly isotropic. They have a well defined border indicative of a high index of refraction and a perceptibly rough surface. Their shape is for the most part rounded, or, when rectilinear outlines are observable, they are hexagonal sections of the rhombic dodecahedron. The larger grains have a curved parting which may be demarkation lines between different individuals. The treatment of the slide with hydrochloric acid cold or hot, leaves them unaffected. The occurrence of garnets in basic dykes is by no means unique. They are however regarded as a product of contact metamorphism within the dyke. Speaking of the "Iron District of Lake Superior," Wadsworth says, "Most of the "diorites" (uralitic diabases) here (at Republic Mt.) contain garnets, this mineral being found principally along the edge of the intrusion while the centre was nearly if not entirely free from it. The schist in like manner near the "diorite" frequently contains garnets both rocks appearing to have mutually reacted upon each other."* The garnets in the Jack Fish Lake dyke do not appear to be a product of contact metamorphism since they are found in the middle of the dyke and very much more abundantly at 20 feet from the contact than at 6 feet from it, or immediately at the contact, where their presence has not been detected. Beyond the abundance of garnets, the dyke at 20 feet has the same characters as at 60 feet. The polysomatic structure of the augite is pronounced.

At 6 feet from the contact the rock is fine grained and the ophitic structure of typical diabase is much more characteristically developed than in the coarser grained parts of the dyke. In this part of the

* Notes on the Geol. of the Iron and Copper Districts of Lake Superior. Bull. Mus. Comp. Zöol. Harvard, 1880, pp. 45, 46, 47.

dyke there is first observed a differentiation of the rock into constituents of different periods of crystalization, the order being first plagioclase in more or less idiomorphic* lath-shaped individuals lying in all positions, then augite generally allotriomorphic,* sometimes hypidiomorphic* and finally a base or matrix of both these minerals in a very much more finely crystalline state together with magnetite. The structure of the base is rather obscure, the chloritic substance usually present in diabase rocks being more prominent here than in the coarser grained part of the dyke when it is almost or perhaps entirely wanting. Quartz is present but in smaller quantities than in the coarser grained portions of the dyke. The augite occurs both in simple individuals and in polysomatic masses. The uralitization of the augite, which is generally observable, is much more pronounced in the irregularly bounded polysomatic masses than in the simple allotriomorphic development of the same mineral. A few garnets are present as inclusions in the feldspar but were not identified with certainty. In this respect this portion of the dyke differs markedly from the more central portions examined. The most interesting constituent of this portion of the dyke remains, however, to be mentioned. It is the non-pleochroic colorless rhombic pyroxene, enstatite; it occurs in idiomorphic development showing the characteristic obtuse domes in some of the sections. It shows regular cleavage parallel to ∞ P (110), upon which the angle of extinction is zero, and characteristic cross parting along which partial alteration of the mineral to bastite or serpentine is apparent. This enstatite is not abundant and plays the role of an accessory mineral. Its occurrence in a rock of well marked diabase structure is interesting. Rosenbusch remarks that it is present in only a few diabases which have a gabbro-like structure,† and Teall has recorded the occurrence of the allied rhombic pyroxene bronzite in the Whin-Sill of the north of England as an accessory.‡ Enstatite also occurs in a variety of the allied rock diabase porphyrite from Schaumberge, which has been described by Laspeyres and Streng under the name Palatinite. This enstatite was not observed in the coarser parts of the dyke but occurs, as will be noted, in the still finer grained diabase at the contact.

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* Terms introduced by Rosenbusch. Cf. op. cit. p. 11.

† Mik. Phys. der Massigen Gestine, 2nd Ed., 1886, p. 188.

‡ Q. J. G. S., 1884, p. 652.

At the immediate contact the dyke assumes microscopically the characters of a very compact grayish black aphanitic rock in which can be occasionally detected minute glistening facets of porphyritic crystals. With low powers of the microscope the matrix is not resolvable but appears as an uniformly yellowish to greenish gray ground thickly dotted with grains of magnetite. Under the higher powers this is seen to be made up, in addition to magnetite, of a fine felt-work of minute lath-shaped crystals of plagioclase imbedded in hazy, somewhat yellowish green flocculent chlorite substance derived presumably from the alteration of the augite, since that mineral cannot with certainty be identified in the base. The porphyritic character of this part of the dyke is well marked, though the imbedded crystals are small. These are augite in small irregular polysomatic masses, with a hazy margin or fringe of greenish decomposition product, and long lath-shaped plagioclase and occasionally stouter broken fragments. Besides these there are porphyritic crystals of enstatite much more altered and less plentiful than at 6 feet from the contact. Neither quartz nor garnets are observable in the contact rock.

Considering then the dyke with reference to its variation in structure and mineral composition the points of interest to be noted are: The passage of the coarse grained central portions of the dyke to the compact aphanitic rock at the contact; the absence of porphyritic structure in the middle of the dyke as contrasted with the well marked development of the same as the rock becomes finer grained towards the dyke walls; the absence of the characteristic chloritic substance of diabase in the centre of the dyke and its abundance towards the contact; the presence of quartz in greater quantity in the coarse grained middle portions than at the sides; the presence of garnets in the coarsest parts of the dyke, their abundance in the medium grained parts and their rarity or total absence in the neighborhood of the contact; the presence of the rhombic pyroxene enstatite in typical idiomorphic porphyritic crystals in the fine grained parts near the contact and its absence in the coarser central parts; the diminution in size of the porphyritic crystals near the contact in co-extension with the increasing fineness of the ground mass; and finally the "polysomatic" structure common to the augite throughout the dyke.

Three quarters of a mile from the exposure where the specimens whose characters have just been given were collected, there occurs, on the opposite side of the bay in the line of the strike of the dyke, another exposure of the same dyke. On the islands of the bay which lie intermediate between these two localities the outcrop of the dyke is observable, so that there is no doubt of their both being exposures of the same dyke. The rock here was not studied in so great detail as at the last exposure. The specimens taken were of the same grade of coarseness as those taken at 20 feet from the contact on the north side of the bay. The feldspars are more decomposed and the twinning lamellae often obscure, and the small quantity of quartz which is associated with them appears to be of secondary origin; whereas the origin of the quartz noted in the same dyke on the north side of the bay seemed much more problematic. In the latter case the common micropegmatitic character of the quartz and the occurrence in it of needles of apatite, which in no way differ from those in the feldspar, together with the not infrequent occurrence of one individual of apatite partially included in quartz and partially in an adjacent feldspar, would argue for the primary character of the quartz. The augite in the dyke on the south side of the bay resembles that already described occurring both in simple individuals and in polysomatic masses. It is largely altered to uralite. Titanic iron with its alteration product leucoxene shows characteristic barred structure of the cleavage traces parallel to the planes of the rhombohedron. The leucoxene is frequently accompanied by a margin more or less extensive, of secondary brown mica. Apatite is present in comparative abundance. Chlorite occurs in vaguely defined masses and the garnets which, as before, are present, are associated with it.

On the south-east shore of Pipestone Lake about a mile west of Stone-dam Portage occurs another of these dykes cutting transversely schists which have a strike of N.E. to E.N.E. The specimen taken from the middle of the dyke has the characters of an uralitic quartz diabase. The feldspar as a rule is remarkably fresh and occurs in the usual lath-shaped twinned crystals of plagioclase. The crystals are commonly observed to be cracked transversely and the cracks filled with a brownish yellow material which shows aggregate polarization. The augite occurs more commonly in polysomatic masses than in simple individuals. The magnetite is often surrounded by rims of secondary brown mica. The quartz is apparently original and has numerous inclusions of an opaque granular character together with fluid inclusions with dancing bubbles, gas pores with black borders and glass inclusions oval and circular.

Fig. 1.

Section of diabase, from Pipestone Lake dyke, showing large polysomatic grain of augite in three granules of diverse orientation *a b c*; *d* uralitic hornblende; *e* magnetite. X 28.

On the south shore of the North-west Bay of Rainy Lake, a similar dyke cuts both the biotite gneiss of the region and the red granite which is intrusive through it. It is an uralitic quartz diabase. The feldspar is in rather stout crystals in the coarser grained part of the dyke, though usually lath-shaped. It is much decomposed and is partially replaced by quartz and chlorite. The polysomatic character of the augite is not prominent but this may be due to the fact that it is about half altered to hornblende and to chlorite. The augite individuals are often twinned and the cleavage traces are unusually well defined. The magnetite shows a tendency to peripheral arrangement around the altered augite indicative of its secondary origin. Quartz is present which is probably original besides that which is clearly secondary. Apatite in long slender needles and leucoxene in irregular masses, are the accessory constituents.

In the same dyke, nearer the contact where the texture is fine grained, the rock is much more uralitized, traces of augite being observable only in cores of the compact green hornblende, which has almost entirely replaced it. Apatite appears more abundant, as do also the secondary quartz and chlorite. Garnet of a pale yellowish color occurs sparingly.

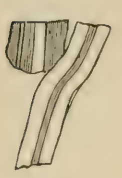

Fig. 2.
Plagioclase fr'm diabase dyke, Northwest Bay, Rainy Lake, sh'wing effect of pressure of one crystal against another.

At the contact the dyke rock is a compact aphanitic base in which can be detected minute porphyritic crystals. Under the microscope the base is seen to be made up of minute lath-shaped crystals of fresh plagioclase augite grains, magnetite and chloritic substance. The porphyritic crystals are lath-shaped feldspars occasionally broken and showing the lamellae in some instance bent, as the result of pressure of one individual against an angular part of another, and augite generally surrounded with an irregular border of secondary hornblende, which, in turn, has an outer girdle or wreath of granules of magnetite that have separated out in the process of uralitization as in fig. 3.

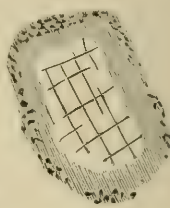

Fig 3.
Augite from diabase dyke, Northwest Bay, Rainy Lake, showing marginal alteration to green compact hornblende with an encircling wreath of secondary magnetite.

In the south part of the Rainy Lake and on the Rainy River a number of these dykes have been observed. One cuts the coarse granitoid gneiss of the river between Couchiching and Fort Frances on the south side of the river, and another crosses the river at the Manitou rapids. Neither of these have yet been examined microscopically. On the lake near the extremity of Gash Point one of these dykes cuts the schists with a strike of N. W. and S. E. across the whole breadth of the point and traverses the islands on both sides of it. Here it is traceable on the point and on the islands for a distance of a mile. Three miles to the south east in the line of the strike of the dyke, a dyke occurs cutting the schists on the islands off the south shore of the lake which is probably a continuation of that of Gash Point. From this point it is traceable for two miles across the islands to the main shore on the south side of Grassy Narrows. Thus, this dyke has a length of at least six miles and has an extension to the north-west and south-east of the points observed, for a distance that is probably very much greater. A specimen from the central part of this dyke, proved on examination to have the characters of a uralitic quartz diabase. The plagioclase occurs in long, rather stout, lath-shaped crystals, which are generally so cloudy as to obliterate the twinning in most cases. The augite occurs both in simple individuals and in polysomatic masses. It exhibits the usual marginal alteration to hornblende and there is besides a certain amount of chlorite. Original magnetite is frequently surrounded by a margin of secondary biotite. Micropegmatitic quartz is abundant. It is often intimately intergrown with the feldspar, and as the latter is much decomposed, would seem to replace it as a partial pseudomorph, but apatite needles of the same aspect as those which occur as inclusions in feldspar, augite, and quartz, are often seen to be inclosed partly in a feldspar and partly in quartz grain. The primary origin of the quartz in spite of its micropegmatitic character, is however, not beyond doubt. It is to be noted that were the quartz original we would hardly expect to find it in such close association with the feldspar. The plagioclase of these rocks affords unmistakable evidence in its idiomorphic character of its having first crystallized from the magma. The augite crystallized next, enclosing the lath-shaped plagioclase; and the quartz, which would be the last to crystallise, we would expect to find separate from the plagioclase by the augite, *i.e.*, to fill in the interstices between the augite. Again although single apatites are often found extending from a quartz grain to a feldspar grain, a condition of things favoring the notion of a common primary origin of both the latter minerals, yet such a phenomenon is not incompatable with a secondary origin for the quartz, since the replacement of feldspar by quartz must necessarily be a slow operation and proceed particle by particle. Further, if the quartz were original we should hardly expect to find in it inclusions of crystals of the first generation like apatite, which would be liable to be enclosed for the most part in the earlier secretions like feldspar and augite, rather than in the residual silica of the magma. The non-existence, however, of quartz in some diabases which are very much decomposed and its presence in fresh ones, militates against the theory of the secondary origin of the quartz in these rocks, so that the question of how much of the quartz is primary and how much secondary in an old diabase is a

Fig. 4.
Polysomatic grain of augite—Grassy Narrows dyke Rainy Lake, *a* and *b* are twins —the other granules are of diverse optical orientation. X 28.

question that as yet does not appear susceptible of definite settlement.

About a mile to the west of this dyke where it crosses Grassy Narrows Island is another nearly parallel dyke converging on the former at a small angle towards the south. The rock is an uralitic quartz diabase and in its coarser portions, near the middle, the texture is more granular than that of typical diabase. The plagioclase is cloudy with decomposition products and quartz is abundant. The augite is entirely replaced by compact green hornblende the only indication of the augite that remains being the light colored character of the central portion of the hornblende and the abundance of magnetite granules that have separated out in the process of alteration. Apatite occurs in slender hexagonal needles mostly in the quartz, but also in the feldspar and hornblende; and a number were observed which were common to both feldspar and quartz. A few zircons showing parallel extinction, deep black border and brilliant polarization colors also occur. A few colorless, rounded, isotropic grains probably garnets were observed. Nearer the contact where the rock is much finer grained the typical diabase structure is much better developed, the feldspar having its usual lath-shaped character with augite in allotriomorphic structure around it, although the character of the latter is obscured by its extensive alteration into hornblende. The augite so far as it is revealed in the cores of the hornblende occurs both in simple individuals and in polysomatic masses and it is interesting to note that the hornblende derived from a polysomatic aggregate of augite is of uniform orientation throughout. Magnetite or titanic iron with associated leucoxene is generally distributed. The quartz is in small grains proportioned to the finer grained texture of the rock. In the central part of the dyke the quartz is in large grains commensurate with the increased size of the feldspar and augite. In neither case does it occur in the mosaics which are so characteristic of the secondary or vein quartz. In addition to the minerals enumerated in this part of the dyke, there is in prominent porphyritic development an altered rhombic pyroxene. The alteration has proceeded very far and the mineral is now represented only by a mass of yellowish green serpentine with perhaps some of the intermediate alteration product bastite. The cleavage is, however, well defined and the extinction in the several cases noted is sharply parallel to it. These characters together with the traces of the obtuse dome so characteristic of sections of enstatite are sufficient to identify it as that mineral in an altered state. The occurrence of the enstatite in this dyke in its finer grained parts towards the contact is analogous to, and an interesting confirmation of the similar occurrence of the mineral noted in the Jack Fish Lake dyke also in the vicinity of its contact.

To summarise, the main points of interest are, briefly: 1. Post Archæan age of dykes. 2. Their problematic relationship to traps of Animikie and Keeweenawan. 3. Their uniform strike and width. 4. Sharp contact. 5. Passage from coarse texture at centre to aphanitic at sides. 6. Granular character towards centre, porphyritic at sides. 7. Prevalence of quartz and garnets towards centre and absence near contact. 8. Presence of enstatite at sides, absence towards centre. 9. "Chloritic substance" abundant at sides, absent towards centre. 10. Polysomatic character of augite throughout. 11. Uralitization of augite. 12. Very marked contrast of texture of two different parts of a rock mass which solidified under practically the *same pressure* but at *different rates of cooling*.

Mr. James T. B. Ives, F.G.S., read a paper on "Iron and the other Ores of Ontario."

The Secretary of the Bureau of Industries, Ontario, Mr. Archibald Blue, in applying himself to the task of compiling a report of the mines for the year 1884, wrote: "the only records we have for the whole province are those of the censuses taken by the Federal Government, for the first time in 1871 and again in 1881." "These," he adds, "are very meagre, for the only information they give, relates to the quantity of raw mineral products for the year preceding the one in which the enumeration is made." The opening words of that report are: "A country so rich in mineral resources as Ontario should be able to exhibit a good record of operations from year to year." However, Mr. Blue succeeded in compiling a report in which fourteen iron mines are noticed; and the following year, 1885, some others were reported upon by the same official writer. Those notices include statements as to the depth and underground extension of the workings the quantity of ore obtained, the number of men employed and in several cases analyses of the ore. Moreover, it is stated in nearly every case whether the ore is Hematite or Magnetite. These reports of the Ontario Bureau of Industries are the fullest account we have of the mines of the Province.

Next to these ranks the report issued in 1882 by the Department of Agriculture, Ottawa, on the mineral resources of the Dominion, in which each province is treated separately in reference to its own minerals. In that report about twenty localities in Ontario are mentioned, where iron was then being, or had previously been worked.

I only find five mines of iron ore mentioned in the Geological Survey Reports. A catalogue was, however, compiled last year of the minerals exhibited at the Colonial Exhibition, and the iron ores included in that list represent about a dozen different mines.

In Professor Chapman's Outline of the Geology of Canada, describing the Laurentian formation, he states that it contains "beds of magnetic and specular iron ore." In reference to the Gananoque and Northern Townships District he says: "Although not favourably adapted, as a rule for agricultural occupation, the district contains valuable economic minerals. The principal of these comprise: The iron ores of McNabb, Bedford, Crosby, Sherbrook, Madoc, Marmora, Belmont, Limerick, Minden, Snowdon." Again, describing the Huronian strata in the region of the Upper Lakes, enumerating their more important economic minerals, the same author mentions "the iron ores of Echo Lake, Michipicoten River, Pic River, etc."

Of course the notices of one writer often refer to the same mines as those of another. I have, however, jotted down the localities on the map now exhibited and find that the total number of mines recorded is thirty, as follows:—In the County of Haliburton, Lutterworth, Minden, Glamorgan and Snowdon; in Peterborough, Galway, Silver Lake, Balsam Lake, Blairton, Marmora; in Victoria, Digby; in Hastings, Wollaston, Madoc, Tudor; in Renfrew, Bagot, McNab; in Lanark, Darling, Lavant, Sherbrooke, Bathurst, Perth; in Frontenac, Palmerston, Bedford; in Northumberland, Seymour; in Algoma, Bruce Mines; also bog iron at Sarnia and Normandale. The map I have colored to represent the various formations of the Cambro-Silurian, Silurian, and Devonian systems, which overlie the Archean rocks of this area. My object in doing so is this: I wish to show that all these iron deposits appear to occur in the Archean rocks, with the exception of two localities, where bog iron occurs, which is not a deposit in the same sense. In a paper on the economic minerals of Canada, which Mr. W. Hamilton Merritt, M.E., F.G.S., read before the British Association at their Montreal meeting in 1884, he enumerated the localities in which the various ores occurred, and the Geological formations in which they were found. In reference to the iron of Ontario, he stated that in the Lake Superior District it occurred in one instance in the Devonian, and that in the Lake Ontario and St. Lawrence District it occurred in four cases in the Silurian. These particulars he subsequently stated he had obtained from a mineral map of the Dominion displayed at the Paris Exhibition of 1878. That map is not published and in the absence of it I find no evidence of the existence of Devonian strata on the Canadian side of Lake Superior, and the apparent occurrence of iron in the Silurian rocks of the eastern part of the province may perhaps be explained away. I think it will be found that the iron deposits proper are all pre-Silurian.

The Geology of my map is based on the very small map published by Sir William Logan in 1866, to illustrate the Geology of Canada, and revised by the present director, Dr. Selwyn for the Dominion Atlas in 1876.

According to that map it appears that the mines at Blairton and Seymour, and also that at Gros Cap on Lake Superior occur in, or are overlaid by Silurian strata. Unless, indeed, and it is a perfectly legitimate alternative, there be at the points where those mines occur *inliers* of the Archean rocks. This is, of course, a matter of observation in the field. In the case of Blairton and Seymour it is the more probable as those localities appear by the map to lie within the valley of the River Trent, whilst the Gros Cap Mine occurs so near the outcrop of the Archean rocks that it is probable the ore is obtained therefrom.*

How meagre do these references seem when one thinks of the beautiful and voluminous census returns and monographs devoted to the Geology of the same formations on the opposite shores of our own lakes! Or, without soaring to the Monographs of the United

*Although engaged during the whole of the summer months in exploring geologically the Huronian and Laurentian regions lying between those extremes the author did not visit either Blairton or Gros Cap and cannot therefore speak from personal observation, but is satisfied from analogy that his conclusion is correct.

States Survey, if we compare the fragmentary information we possess in reference to the economic resources of this Province with such complete and practical publications as the annual report of the Mineral Statistics of the State of Michigan, a convenient, portable volume full of information and profusely illustrated with actual sections of the mines, we cannot but sigh for the *good time coming.* As a new comer desirous of informing myself as to the geology of the Province in which I reside I look, anomalous as it may seem, to the publications of our neighbors having reference to the formations of the adjacent states for instruction, for on this side it is not to be found. British soil may be separated politically from that of the United States, but the Archean and Silurian rocks are older than the Declaration of Independence, and the laws by which they are governed do not recognize the boundary.

In view of the undeveloped mineral wealth of the country and the necessity for securing information and preventing the loss of that which is often obtained at great cost to individuals or communities. how important it is that records should be preserved! On this point abundant testimony was afforded by men of science and experts of the highest standing in their evidence before a select committee of the House of Commons at Ottawa in 1884.

Dr. George M. Dawson, D.S., A.R.S.M., F.G.S., one of the Assistant Directors said: "The difficulty in the way is, that the mines of the various provinces are under the control of the provinces themselves, and, consequently, in some provinces there are departments of mines, Nova Scotia and British Columbia, I think, are the only two, and those departments collect for their own provinces all the mineral statistics, probably as fully as necessary, and they have the authority to do so. In the other provinces, there is no authority to collect statistics, and if they are collected by the Geological Survey, they must be collected as a matter of favor from the owners of mines, and that takes a good deal of trouble, and in some cases actual personal visits, as it is not possible to accept a report without some supervision."

Dr. Robert Bell, C.E., M.D., LL.D., one of the Assistant Directors, stated that an attempt was made in 1870 to collect statistics by means of a circular addressed to mine owners or managers, accompanied by a blank schedule to be filled up. When the survey abandoned the attempt, he continued it privately, a conclusive way of proving how important he thought it. He found that the only way to secure the information was to interview the parties personally.

Dr. T. Sterry Hunt, F.R.S., etc., etc., formerly President of the Institute of Mining Engineers of the United States and of the Chemical Society of the United States, speaking of the position of things eighteen years ago, stated: "The work of the Survey was, in the first place, to determine the geological relations of coal, iron and copper deposits, and around them the stratigraphical geology of the country grew up. There were special memoirs prepared on the questions relating to the metallurgy of iron and steel, and these were published in the reports of the Survey; these were of value to Canada in utilizing the iron of the country."

He explained that in Great Britain the collection of mineral statistics is under the control of the Home Office, having until recent years been in the hands of a keeper of Mining Records, Mr. Robert Hunt, F.R.S., who undertook to get mining statistics as volunteer contributions. In France, he stated all these economic questions came in the front rank, there being a regular corps of mining engineers, part of the civil service, to inspect mining districts and keep the public informed. They visit and report upon the mineral resources of other countries, and have published valuable memoirs respecting Canada. But the State surveys of Ohio, Alabama, Kentucky, Pennsylvania, and New Jersey were those which Dr. Hunt thought should afford models to the Dominion. He stated that Pennsylvania had of late years been expending "about $50,000 annually, in a careful survey of all the points relating to the distribution of its rocks, and the geological relation of its iron deposits, of its salt and petroleum, and of the bituminous and anthracite coal, the results of which have been published in small volumes at the cost of paper and printing. Each mineral is dealt with in a separate volume."

Mr. R. W. Henneker, D.C.L., Commissioner of the British American Land Company and President of the Eastern Townships Bank, urged the desirability of securing careful and trustworthy statistics, which "would do an enormous amount of good to the country, as it is hard to find out from private sources any information of this kind."

Mr. William McIntosh said, "That it would be of the greatest advantage to practical miners like himself, to get a report of what had been done in each of the mines, and that it would be just the thing to induce capitalists to invest their money."

Professor Chapman said: "People even come to me from the States and say, Where can I find a Geological report and map of such a district? I am obliged to say that it cannot be found, except in detached portions." He considered that small maps should be published, accompanied by plain reports explanatory of the map and giving lists of economic minerals, with their analyses, current values, etc., accompanied if possible by a few plates, showing commonly occurring distinctive fossils.

Mr. Raphael Pumpelly, Director of the Northern Trans-Continental Survey, Newport, R. I., recommended the collection of such statistics, and considered that the "work should begin with a thorough canvas, similar to the one carried on for the tenth census of the United States, that is, every known locality containing mineral of economic value, whether worked or not, should be visited, and commercial samples taken of its products and these samples should then be subjected to the processes of testing or analysis, according to the requirements of the case. At the same time the statistics of production where workings exist, should be a part of the work."

Professor Dana, the author of the well-known Manuals of Geology and Mineralogy, wrote that he believed "it to be very desirable that mineral statistics should be collected and preserved under government direction."

"This work," said he, "does not necessarily come within the duties of a State Geologist. But it could be connected with a survey, provided it be entrusted to a separate agent, who should make it his special business. Such information is often collected with difficulty on account of the unwillingness of owners to make known the state of their affairs, and it is in danger of being largely erroneous, as a consequence of interested misrepresentations, the fluctuations in the conditions of mines, and the uncertainties of ordinary methods of obtaining values, or estimates of values, by samples. The work, therefore, requires special qualifications, very different from those needed in a geological survey."

I trust I shall be excused for using so largely the words of others, but these testimonies are scattered throughout a long and tedious report, which few are likely ever to read and they appear to me so important that I venture to submit them to your consideration.

Mr. Hamilton Merritt said if he understood Mr. Ives aright, he stated that all the iron deposits were archean and none of them Silurian. There was no question, however, that there were large deposits of iron ore in the silurian in the other Provinces. Mr. Merritt then alluded to the difficulty of obtaining information in regard to mines and minerals. It was necessary to travel round the country, and obtain the required information from personal inspection. The importance of collecting this information was recognized by every civilized country, as it was of the greatest value to the projectors, the investor, and the man of science. In England this information was collected under a statute. In the United States it was chiefly collected by the Central Government, though in many of the States there were mining bureaus. It was a matter of great regret that there should be such a great disparity in the amount of capital invested in mines in Canada and the United States. The excess in favor of the latter country was enormous. It was not correct to say as Dr. Selwyn had concluded, that we had not the minerals, as was abundantly proved by the different exhibitions. No country showed a more creditable display of large masses of ore than Canada had done at the late exhibition. Government supervision in the matter was greatly needed. Not merely mining statistics, but every kind of information should be collected that would be useful to persons working in the locality. This valuable information that other countries had seen the necessity of collecting, would give us the same advantages that they enjoy.

Mr. A. Blue was sure that the views just presented by Mr. Merritt, would commend themselves to the attention of all. Few were aware of the extent and value of the mineral deposits of this Province. He called attention, especially to the petroleum deposits, and the copper mines. He was strongly in favor of steps being taken to collect statistics, and to present the information to the public from year to year.

Mr. Shutt knew from his own experience that Mr. Miller had collected very much valuable information respecting the phosphates, some of which had been preserved, but much was lost beyond recovery.

Mr. Boyle asked how the information had been hitherto collected. He did not think that persons owning mines would give the required information, and he did not see how the Government could compel them to give it. He could not see how a law could compel a man to divulge knowledge that would benefit others and injure himself. He thought that other means could be employed to obtain the information required.

Mr. Notman in reference to the discrepancy between the favorable show that Canada had made at the different exhibitions in mineral products, and the little that had been done in developing them, said that it should be recollected that Canada was a young country, and though there was much mineral wealth. there were not the same facilities in working it as in older countries.

Dr. HAMILTON thought that the Government should make explorations. It would be more useful than collecting mere statistics.

The PRESIDENT referred to the number of geological papers read this session, as showing the necessity for the formation of a geological section.

On motion of Mr. W. Hamilton Merritt, seconded by Mr. Charles Armstrong, it was resolved, "That a Committee consisting of the President, Messrs. Notman, Blue, Ives, Wood and the mover, with power to add to their number, be formed, to report at the next meeting of the Institute on the advisability of forming a Geological and Mining Section, that this Committee in view of the facts laid before this meeting, shall take what measures they deem advisable to call the attention of the Dominion Government, or the Government of Ontario, or both of these Governments to the necessity of some improved method of collecting correct returns of mineral statistics, and information regarding mines and mining locations."

Mr. A. B. Macallum presented a paper on "The Origin of Haemoglobin."

TWENTY-SECOND MEETING.

Twenty-Second Meeting, April 16th, 1887, the President in the chair.

Exchanges since last meeting, 41.

The Committee appointed at last meeting presented a report recommending the presentation to the Dominion Government of a memorial regarding the collection and publication of mineral statistics, which was adopted.

The following were elected members :—William Burns, J. Blackstock, B.A.

Dr. A. M. Rosebrugh read a paper on "Photographing the

Living Fundus Oculi," illustrated with diagrams and photographs.

Dr. HAMILTON referred to accounts of murderers having been taken, and convicted by means of their picture remaining some time in the retina of the murdered man. He had seen this denied. Could Dr. Rosebrugh give any information on the subject?

Dr. ROSEBRUGH.—As to the popular opinion that the image of the last object the person looked at remained in the retina; if an examination were made five or ten minutes after death no image would be seen.

Mr. Boyle read a paper, prepared by Sheriff McKellar, on "A Bragh or Stone Flour Mill," presented to the Institute by the Sheriff.

Mr. Clougher spoke in favor of the establishment of a mining journal.

TWENTY-THIRD MEETING.

Twenty-Third Meeting, April 23rd, 1887, the President in the chair.

Exchanges since last meeting, 26.

The following were elected members :—Thos. R. Clougher, Charles M. Dobson, James Mason, David Spence.

On motion of Mr. Ives, seconded by Mr. Merritt, it was resolved, "That in view of the remarks of Mr. Clougher at the last meeting of the Institute, in reference to the publication of a mining and scientific journal, the Institute do refer the matter to the Geological and Mining Section, with authority to enquire into, and report on a project for the establishment and maintenance of such a journal."

Mr. J. B. Williams read a paper on "Canadian Woodpeckers," illustrated by specimens.

Mr. Dion C. Sullivan, LL.B., read a paper on "Fortuitous Events."

On motion of Mr. Shaw, seconded by the President (Dr. Workman having taken the chair,) it was resolved, "That the Canadian Institute cannot allow this first meeting, since the death of the Rev. John McCaul to pass, without expressing its sorrow at the loss, though in the fullness of years and honours of that eminent scholar and teacher, to whose great abilities and force of character, not only our Provincial University and this Institute, of which he was so bright an ornament, but also the City of Toronto owe so much."

TWENTY-FOURTH MEETING.

Twenty-Fourth Meeting, April 30th, 1887, the President in the chair.

Exchanges since last meeting, 23.

The Council announced the admission of the following as associates:—J. H. Lowe, Wm. Murdoch, S. Beckett.

The following were elected members:—J. C. Forbes, R. Moodie, Alexander Macnabb, Thomas Shortiss, S. Macklem.

Nominations for officers and members of Council for the ensuing year were then made.

Mr. Alfred Baker, M.A., read a paper on "Some Experiments in Connection with the Doctrine of Probabilities."

I. The problems that had been treated experimentally were three in number. The first may be stated thus: A number of equidistant parallel lines are drawn on a plane, and a rod whose length is equal to the distance between two consecutive lines is thrown at random on the plane, to determine the chance of its falling on one of the lines. This chance is readily shewn by the theory to be $\frac{2}{\pi} =$ ·6366 . . . . . ; *i. e.*, in 10 throws it should cross a line 6 times, in 100 throws 63 times, or in 1,000 throws 636 times, etc. In the experiment a large drawing board had formed the plane, and a fine glass rod had been used. In all, 3,800 throws had been made. Taking any 10 consecutive throws, the widest possible divergences from the 6·366 of theory were observed, the incidents on the ruled lines varying from 3 to 10. The following are numbers selected from ten consecutive decades:

	3,	4,	8,	8,	8,	7,	10,	5,	4,	6,
And again,	6,	7,	4,	7,	7,	9,	5,	4,	4,	6,

When any 100 consecutive throws were considered, a much closer relative agreement between experiment and the 63·66 of theory was observed, in the first 1,000 throws the incidences on the ruled lines varying from 59 to 74; in the second 1,000 from 59 to 71; in the third 1,000 from 55 to 75.

Taking 1,000 consecutive throws, a wonderfully close agreement between experiment and the 636·6 of theory was observed. Thus in the first 1,000 there were 633 incidences on the lines.

And finally for the entire number of throws (3,800) while theory gave 2,419 incidences on the lines, experiment gave 2,423.

II. The second problem was: Two points being taken at random in any triangle: to determine the chance that the line joining them shall cut two particular sides of the triangle. This chance is by the theory shewn to be $\frac{1}{3} = \cdot 333 \ldots\ldots$; *i.e.*, in 10 locations of the points, the line should cross the sides 3 times; in 100 locations 33 times; in 1,000 locations 333 times, etc. For the experiment, a perfectly level triangular board with elevated rim about it had been used. For points, five small shots were placed on the board, so that after each agitation of them (which was effected by means of a whisk) by joining them two at a time, 10 lines were obtained. In all, 1,000 events were produced.

Taking any 10 consecutive events the widest possible divergences from the 3·33.... of theory were observed, the number of times the joining line crossed the sides varying from 0 to 8. The following are numbers selected from 10 consecutive decades:

	3,	2,	7,	5,	4,	1,	5,	4,	0,	4.
And again,	4,	3,	8,	4,	2,	5,	2,	2,	2,	4.

Considering 100 consecutive events, a much closer relative agreement between experiment and the 33·33.. of theory was observed, in the 1,000 the intersections varying from 26 to 37.

Taking 1,000 consecutive events, a remarkably close agreement between experiment and the 333.33.... of theory was observed, there being by experiment 332 intersections.

III. The third problem was: Two points are taken at random on a given line of length, a: to determine the chance that the distance between them shall exced a given length c. This chance is by the theory readily shewn to be $\left(\frac{a-c}{a}\right)^2$, *i. e.*, if $a = 00$, we have, according as $c = 25$, 50 or 75,—probability required $= \frac{56\frac{1}{4}}{100}$, $\frac{25}{100}$, or $\frac{6\frac{1}{4}}{100}$. So that

(1) In	10	trials	distance	bet.	points	shd.	exceed	25,	5·625	times,
"	100	"	"	"	"	"	"	"	56·25	"
"	1000	"	"	"	"	"	"	"	562·5	"
(2) In	10	"	"	"	"	"	"	50,	2·5	"
"	100	"	"	"	"	"	"	"	25	"
"	1000	"	"	"	"	"	"	"	250	"
(3) In	10	"	"	"	"	"	"	75,	·625	times.
"	100	"	"	"	"	"	"	"	6·25	"
"	1000	"	"	"	"	"	"	"	62·5	"

For the experiment a perfectly level rectangular board with an elevated rim about it had been used. Paper divided into 100 equal spaces by lines drawn parallel to two sides of the board, was pasted down on it. Five small shots were placed on the board, so that after each agitation (effected as before) there were furnished 10 sets of two points each, located on a line, which was any line running the length of the board. The ruled lines running across the board assisted in immediately locating the points on such (any) line extending along the board. In all 1000 events were produced.

Taking any 10 consecutive events, the widest possible divergences from the 5·625, 2·5 and ·625 of theory were observed; the number of times the distance between the points exceeded 25, 50 and 75, varying from 0 to 8, 0 to 6 and 0 to 6 respectively. The following are numbers selected from ten consecutive decades:

$c = 25$...... 6, 7, 6, 6, 6, 8, 6, 8, 3, 0.
$c = 50$...... 5, 0, 1, 6, 0, 2, 6, 0, 1, 1.
$c = 75$...... 0, 0, 0, 0, 3, 2, 0, 0, 1, 2.

Considering 100 consecutive events a much closer agreement between experiment and the 56·25, 25 and 6·25 of theory was observed, in the 1000 the number of times the distance exceeded 25, 50 and 75, varying from 55 to 63, from 16 to 33 and from 2 to 10 respectively.

Taking 1000 consecutive events a singularly close agreement between experiment and the 562.5, 250 and 62.5 of theory was observed; there being by experiment 577, 253 and 66 occasions on which the distance between the points exceeded 25, 50 and 75 respectively.

The conclusion so far as these problems were concerned was that the hypothesis on which the theoretical solutions were based was correct; and this hypothesis was that the rod and the points located themselves by chance, that all positions were equally likely, and that in a great number of throws the rod and the points would be equably distributed in various positions. Of course the objects had not located themselves by chance; their every movement was guided and controlled by fixed and definite laws—gravity, resistance of air, friction, elasticity, etc., but no one cause operated to constrain them into constancy of position. We might be disposed to think that where uniform determining cause was absent—where, as we might express it, chance reigned; there would be, when a large number of events occurred, an utter unevenness of distribution, accumulating in heaps at one place and leaving another quite blank. Such, however, had not occurred in these experiments; and with respect to them the assertion could be made that, where complex forces are acting so that determining cause is absent, what might be termed a law of equable distribution held.

Mr. John Notman, Queen's Printer for Ontario, read a paper on "The Manufacture of Paper."

Men have in all ages been proud of their own achievements, while labor, a certain amount of self-conceit and a desire to seek acquaintance with primitive and past events, form the basis of progress and promote civilization.

Men who have recorded their own thoughts and actions, or those of others, are the ones who have exerted the greatest influence for good, or for evil, in all ages.

The hieroglyphic form of description is said to have been used in Egypt as early as the third dynasty, the date of which is placed about 4,000 years B.C. by some chronologists; but the markings and engravings upon rocks have been mostly rubbed out by the hand of time and we have to come down to the times when they wrote or modelled in soft clay and baked it with fire. In that grand storehouse, the British Museum, many such indestructible terra-cotta specimens may be seen from the ruins of Nineveh and Babylon and whose decipherment reveal much concerning Chaldea, Babylonia and Assyria.

There is something about those tablets of clay that forbids any desire on our part to discredit them. They seem to appeal to our practical understanding and the tendency to doubt them is not so strong as with some modern written histories. The word paper is derived from the Greek word "Papyrus" and it was derived from the Egyptian word "Papu" which name was given to a very useful plant belonging to the family of the sedges. It grew, and still grows on the marshy banks of rivers in tropical climes.

The plant has large and abundant rootstocks which spread in the mud and throw up numerous stems from five to ten feet high. The stem is triangular and smooth.

The right of growing and selling the plant was a government monopoly in Egypt. It was used for a great variety of purposes besides paper.

Its graceful plumes, or drooping flower-tufts, crowned the statues of the Gods and decorated their temples; its pith was eaten as food; wicker-work boats, boxes, and baskets were woven of its stalks; while sails, cordage, cloth, mats and sandals for the priests were made of its bark. It was applied as medicine to the cure of ulcers and swellings; it furnished material for torches and candles, while its roots were used for fuel and manufactured into furniture and household utensils.

In making paper the inner cuticle of the stalk was cut into very thin slices. The finest slices were those next to the pith and decreased in quality as they approached the outer integument.

The slices were laid side by side on a smooth flat surface and covered with a second layer placed at right angles to them, after which they were pressed so as to cause the different laminae to adhere to each other and form a single sheet, which was then dried in the sun. The glutinous sticky sap of the material was sufficient to bind and hold the slices together in a firm and compact sheet. In the Roman times, a thin sizing was brushed over the sheets, when they were beaten smooth with a mallet and polished with a piece of ivory or a shell.

Various qualities were manufactured and used as occasion required, from the finest writing to wrapping paper.

In the reign of Claudius, fineness, strength and color were imparted by putting a new layer of the best slices over a sheet of coarser quality. Paper found on mummies recovered from the Pyramids, Egyptian tombs, Catacombs and overwhelmed cities indicate an antiquity of 2,000 years before Christ, and through decipherment of the writings thereon much information has been obtained as to the history, manners, customs and literature of the Egyptians.

Papu, or papyrus, was usually made into rolls fifteen inches in width by one hundred and fifty feet in length, and cut off as required.

In the seventh century the conquest of Egypt by the Saracens put an end to the export of Papyrus, and Western Europe was obliged to supply its place with Parchment and Vellum, until the introduction of paper.

Parchment was in use about 500 years B.C. and about a century B.C. it was the chief material for writing upon, when its use spread all over Europe. Parchments were made of the skins of sheep and goats while Vellum was made of the skins of young calves, kids and lambs.

Animal parchment has been superseded by vegetable parchment, or parchment paper, first known in 1854, which resembles animal parchment so closely that it is not easy to distinguish the difference. It is made by immersing unsized paper in a bath of oil of vitriol, or sulphuric acid. The exactness of the bath and the time of immersion are of the greatest importance to the success of the result and several apparently trifling points must be carefully attended to, or the operation will not succeed. The alteration which takes place in the paper is very remarkable. No chemical change is effected, nor is the weight increased, but a decided molecular change takes place. Insects do not like it, and it is valuable for Land Patents, Deeds, Diplomas and valuable documents deserving preservation.

The Chinese were the first to make paper from vegetable fibres about the beginning of the Christian era.

The Hindoos and Arabs carried the art thence to Spain and from there it found its way to all parts of Europe. Paper made from cotton, dates in Europe, from the tenth century, and from linen, from the thirteenth century, when it took the lead and maintained it to the end of the eighteenth century.

In the establishing of a papermill it is necessary to select a site where water of good quality and in great quantity can be had.

It may also be necessary to construct filter-ponds so as to have plenty of clean water when freshets and heavy rainfalls soil the rivers. Then a solid stone foundation should be built, for the machinery is ponderous and hardworking and the foundation on which the paper machine is to be mounted must be solid and firmly united, so that not the least vibration or change in position of any of its parts can take place.

Timbers that will best withstand the influence of water, such as white oak, or hard yellow pine should be used.

Rubber belting is always preferable to leather as it withstands the influence of water and moisture so certain to be in every papermill.

875 different materials of a vegetable, fibrous and cellulose nature have been worked into paper pulp, but only a few are worthy of special consideration.

Esparto-grass is a spontaneous product of sandy soils, is abundant in Eastern Spain and Northern Africa, makes a beautiful paper and yields 48°/₀ of pulp

Manilla grass is a product of Eastern Asia, is extensively made into ropes and bagging and reaches in due time, like rags, the papermill. It is considered the strongest of all known fibres, and furnishes the well known tan colored wrapping paper. Competition, large demand and skillful manipulation, have produced manilla paper, however, with much straw, old paper, some jute and very little manilla grass in it.

Jute is another East Indian fibre very similar to manilla, is much cheaper and makes a good substitute in appearance, though not nearly so strong.

Cane:—In the Dismal Swamp and along the rivers of North and South Carolina, as well as in the low lands of the Mississippi the country is covered for many miles with the spontaneous growth of a reed or cane. This cane is a hollow tube about twelve feet high, nearly white and apparently composed of tough, strong fibre.

The territory covered with it is so vast and unfit for any other useful growth that the supply of cane seems to be nearly inexhaustible, especially if it is considered that a new crop can be cut every three years. The dried fibres have a strong resemblance to oakum and make a strong spongy paper.

The woods give a good per centage of pulp and are most easily obtained in large quantity.

The per centage of fibre obtained from the woods runs from 26 to 38, the least being from walnut and the greatest from horse-chestnut.

All the grasses are reduced to a very small proportion of their original bulk by the time they leave the pulpmill and nothing but the clean fibres are contained.

Out of 100lb of flax or hemp, as it comes from the soil, only about two and a half pounds of good white linen can be obtained. Paper-makers unanimously agree that "Rags are King" over everything for making the best qualities of paper.

The everchanging prices and demands of the markets, and the difference of raw materials, together with keen competition, tempt the makers to their utmost skill to use inferior stuff for good papers.

The great bulk of the news and cheap bookpapers is now made of woodpulp, and after the dissipation of many supposed and imaginary obstacles as to the propriety of using such paper, it has come to be preferred. Printers' ink is an oily, little fluent substance which does not spread beyond the limits given by the type on any common paper, so that a better impression is made by a fast running printing press on woodpulp paper.

Whatever products are used, the art of paper making consists in the reduction of all into their primitive fibres and forming them into felted sheets, and the less the fibres are cut or broken the stronger and better will the paper be.

There are some 1,500 trade definitions and commercial classifications relating to papers, such as sizes, qualities, materials, clays, chemicals, coloring stuffs, etc., too numerous to be retained in the memory, so that quite a reference pamphlet has to be consulted.

The essayist then gave a minute and detailed description of papermaking by hand; still continued, but mostly due to the conservatism of the people, though good for Bank Notes. He described the production of water marks and showed some beautiful specimens. He explained the disinfecting of rags by a machine which takes in a bale, bores it throughout and disseminates sulphurous acid to a sufficient extent. The rag trade and its tricky dealers. The mill operations in cleaning, sorting, cutting, boiling and bleaching. Before the discovery of chlorine for its powerful bleaching, the color of the rags determined the color of the paper. Rags to be kept dry and in moderate heaps, for fear of spontaneous combustion. Wood is received at the mill as cordwood, is freed from bark and dead-knots and piled up to dry. It is then fed on to a machine which grinds it to dust; or better, which cuts it into small chips; the best is to cut it into blocks, as the fibres are but little broken. The wood is then boiled at a high temperature and with strong chemical agents to soften the wood, toughen the fibres and lessen their adhesion, after which they are soon ground to pulp. The object of boiling all papermaking substances is, to decompose the fatty, glutinous and coloring substances and remove everything but pure fibre.

The alkaline substances used are fresh burned quick-lime or the milk of lime, carbonate of soda and caustic soda.

The boiling is continued for about twelve hours, but ropes and bagging require twice that time.

The materials must then be washed from all impurity, most surely from all traces of chlorine.

They are next put into the Beating-engine and macerated into fibre by knives and friction. Everything to be added to the fibre must be put in here, such as china-clay, sizing or coloring.

Animal sizing is obtained from skins, ligaments, cartilages, tendons, hoofs and ears of animals, steamed and strained until only 5% of matter is left; alum is added to prevent fermentation or decomposition of the gelatine. Paper run through this is known as tubsized paper.

Vegetable sizing is composed of resin, carbonate of soda and alum, this mixture is added to the pulp in the Beating-engine and such paper is known as engine-sized.

There are two degrees, viz. soft-sized and hard-sized and are mostly applied to printing and book papers.

Writing papers are commonly coated with animal size. Papers put through vegetable sizing and then through animal sizing are known as "Double-sized" also as "Hard-sized" which paper has superior hardness, lustre, enamel and smoothness of surface.

The reader detailed the calendering of papers and enumerated quite a variety of papers made for special purposes.

He referred to the great Chicago fire in 1871 when ten thousand houses 16 × 20 feet were built in one day, of paper boards both waterproof and fireproof, and served speedy shelter for thousands of homeless people.

He referred to the different movements of the paper machine and the various improvements made until such perfection has been attained that paper can be made in one continuous web of any length, and before leaving the machine can be made, sized, dried, calendered, hot-pressed and cut into sheets, and at the rate of 125 feet long by 100 inches wide per minute.

At present there are 3,500 papermills in Europe.

The Dominion of Canada occupies but an insignificant position among the paper making countries, while the United States occupies a very high one. Great Britain occupies the highest position and the total production of all the mills there, is not less than 3,500 miles of paper daily.

THIRTY-EIGHTH ANNUAL MEETING.

Thirty-Eighth Annual Meeting, May 7th, 1887, the President in the chair.

Exchanges since last meeting, 33.

The following were elected members :—T. G. Williamson, W. Williamson, W. Canniff, M.D., C. Egerton Ryerson, B.A. George Cox, A. W. Murdoch.

The following reports of sections were read :

1. Philological Section.

1. The first meeting of the Section was held on March 15th, 1887, when the following officers were elected :—Chairman, Rev. J. F. McCurdy, Ph. D.;

Vice-Chairman, D. R. Keys, B.A. ; Secretary, George E. Shaw, B.A. Committee :—J. Squair, B.A. ; M. L. Rouse, J. H. Cameron, B.A. ; J. Cunningham Dunlop, Ph.D. ; W. H. VanderSmissen, M.A. ; Wm. Houston, M.A.

2. The first two meetings were held on Saturday afternoon, March 5th and March 12th, at 16 o'clock, all the subsequent ones on alternate Mondays, beginning March 28th, 1887.

3. The Section has 18 members.

4. The following papers have been read before the Section :

1. "How we Speak," by A. Hamilton, M.D.

2. "The Science of Language in Popular Education," by Rev. J. F. McCurdy, Ph.D.

3. "Umbrian Inscriptions," by Rev. Neil McNish, B.D., LL.D.

All which is respectfully submitted.

GEO. E. SHAW,
Secretary of Philological Section.

2. Architectural Section.

This section consisting of five regular and nineteen associate members of the Canadian Institute, has held eleven meetings since its formation, of which the following is a list :

Monday, January 10th, 1887, Discussion on "What Style of Architecture is Best Adopted to this Country."

Monday, January 17th, 1887, Discussion on "The Use and Abuse of the Romanesque Style of Architecture."

Monday, January 24th, 1887, Paper on "Foundations," by Henry Steele.

Monday, January 31st, 1887, Lecture on "Wood Floors," by S. G. Curry.

Monday, February 7th. 1887, Paper on "Style," by J. C. Horwood

Monday, February 14th, Lecture on "Columns," by Alan Macdougall.

Monday, February 28th, 1887, Paper on "Hints to Young Architects," by Henry Langley.

Monday, March 7th, 1887, Lecture on "Arches," by W. L. Symons.

Monday, March 14th, 1887, Paper on "The Doric Temple in its Religious and Artistic Aspects," by J. W. Gray.

Monday, March 21st, 1887, Receiving the judge's report on, and describing the competitive drawings.

Monday, March 28th, 1887, Paper on "Masonry," by A. F. Wickson.

J. D. HYNES,
Secretary.

3. Photographic Section.

The first meeting of the Section for the purpose of organization, election of officers, &c., took place on the evening of February 23rd, when the following were elected:—Chairman, H. Neilson; Vice-Chairman, R. Ewing; Secretary-Treasurer, A. Gaunt. Executive Committee—E. R. Parkhurst, W. W. Fox, F. D. Manchee, C. F. Wagner, W. A. Forbes. The number of members now on the roll is 28; associates, 5. Total, 33.

Meetings for the transaction of business, &c., have taken place on the first Tuesday in each month, but so far no papers have been read. The first exhibition of the Section took place in the Library of the Institute, on April 12th and 13th, and was very successful, considering the short time given for the preparation of pictures.

ARTHUR GAUNT, Secretary.

4. Biological Section.

FROM JUNE 1886 TO APRIL 1887.

During this period eighteen meetings of the Section have been held, with an average attendance of $18\frac{3}{4}$ (say 19) members. The Section has 36 ordinary members and 12 associates. Twelve papers have been read at the meetings, and nine short communications received. Two of the meetings were set apart for microscopical exhibition and discussion under the able conduct and superintendence of Professor Ramsay Wright.

In June a branch of the Audubon Society was organised in connection with this Section, and Mr. Hollingworth was appointed Local Secretary. There are now 106 members in the Toronto Branch.

In October a special vote of thanks was passed to W. H. Doel, J.P. (one of our members,) for his earnest efforts made during the summer, for the protection of insectivorous birds, by fining all violators of the law that were brought before him.

During the same month an offer of the Section to provide the interest for two years on a loan of $1,000, led the Council of the Institute to decide on at once, fitting up the attic of the building as a museum, instead of leasing a part of it to the Art School, and since the completion of the new rooms, the members of the Section have assisted in moving the objects and cases from the various places in which they lay, to the top of the building.

J. B. WILLIAMS,
Secretary of the Biological Section.

5. Geological and Mining Section.

SIR,—I have the honor to report that, proceeding under authority conferred by the Canadian Institute, a meeting of members was held on the 20th of April, ult., when a Geological and Mining Section was duly organised, and that at an adjourned meeting, on 30th April, regulations and by-laws were adopted, which have since been approved by the Council of the Institute, and that the following officers have been elected for the incoming year. W.

Hamilton Merritt, Chairman ; Alexander Macnabb, Vice-Chairman ; Archibald Blue, Secretary ; George T. B. Ives, Assistant Curator. Messrs. Boyle, Dobson, Notman, Phipps and Dr. Bryce, Executive Committee.

The first regular monthly meeting of the Section was held on Thursday evening, 5th inst., at which the Chairman gave his inaugural address. The Section is composed of 15 members.

Your obedient servant,

A. Blue, Secretary.

Alan Macdougall, Esq.,
Secretary Canadian Institute.

The President read the 38th Annual Report.

ANNUAL REPORT OF THE COUNCIL OF THE CANADIAN INSTITUTE.

SESSION 1886-87.

The Council of the Canadian Institute have the honor to lay before the members their thirty-eighth Annual Report.

During the past session twenty-six meetings, including the annual conversazione, have been held, at which forty-nine papers have been read, in addition to twenty-three read at section meetings. This number is largely in excess of that of any previous year in the history of the Institute. The character of these communications is fully equal to the standard of previous years, and the range of subjects (as shown in the appendix) is unprecedently large. The average attendance at the regular weekly meetings also shows a considerable and steady increase.

The distinguishing feature of the year has been the successful establishment of no less than four new sections, in addition to the Biological section, incorporated at the end of last session, viz.: (1) A Photographic section; (2) an Architectural section ; (3) a Philological section and (4) a Geological and Mining section. The creation of these sections has extended the benefits of the Institute to new classes of the citizens, and has been the chief cause of the large increase of membership. Their annual reports, which are appended, show a gratifying spirit of activity in every branch of the Institute.

A further evidence of this increased activity is seen in the number of memorials presented to the Provincial Government, with successfull results in many cases, as follows: In February last the Committee of Ways and Means waited on the Minister of Education and urged him to increase the annual grant to the Institute from $750 to $1,500, for general purposes, and to enable us to give courses of public lectures on scientific subjects, especially in connection with industrial pursuits. While gratefully acknowledging the increase of the grant to $1,000 for general purposes, the Council regrets that the Government did not see fit to comply with the latter part of the application.

In the same month the Archæological Committee urged the Minister to make a yearly grant of $1,500 for Archæological research in Ontario, and the passing of an Act for the protection of Archæological remains founded upon Sir John Lubbock's "Ancient Monuments Act of 1882." The Council again thankfully acknowledge the liberal grant of $1,000 for this purpose, but regret that the heavy work falling upon the Minister this session in connection with educational matters should have made it impossible for him to bring in an Ancient Monuments bill, which would have greatly enhanced the value of the grant. It is hoped, however, that such an Act may become law in the next session of the Legislature.

In March a deputation waited on the Commissioner of Crown Lands to urge the establishment of a large park reserve in the district of Nipissing, for the protection of wild animals and of timber, and were assured of the Minister's sympathy. An Act for this purpose will, it is hoped, be the result of this application in the near future.

In April a Committee urged upon the same Minister the propriety of some improved means of collecting information on matters connected with the mining interests of the Province, and received assurances of co-operation.

Another pleasing feature of this year's work is the partial completion of the Museum of Natural History and Archæology in the third story of our building, which will, it is confidently expected, enable us, for some time at least, to properly accommodate our collections and donations. In this direction the Council desires to acknowledge the liberality of the Biological section in guaranteeing the interest for two years on the $1,000 borrowed for this purpose.

The Library has been increased by the addition of 124 volumes of bound exchanges; but further shelf accommodation is urgently needed.

While congratulating the Institute on the increase in membership, in income and in activity, the Council feel that it is necessary to impress upon the members the fact that the current expenses are greatly increased, especially in printing and gas, while there is a falling off in the rentals; and also that, in order properly to fulfil the objects for which it exists, the further extension of the Museum and Library and the completion of the building by the erection of a commodious lecture hall is highly desirable. They therefore urge upon the members the necessity of supporting the present efforts of the Committee of Ways and Means by every means in their power, by contributions, by presenting the claims of the Institute to the public in every possible way, and by endeavouring to obtain new members.

During the past year the Institute has lost by death one of its most distinguished honorary members, the Rev. John McCaul, LL.D., late President of University College, and President of the Institute from 1862 to 1864. The deceased was for nearly half a century one of the leading figures in social and educational affairs in this city, and his articles on Roman Inscriptions in the *Canadian Journal*, which formed the basis of his great work on that subject, had much to do, not only with the establishment of his own claims to be called the first English scholar in Latin epigraphy, but with the high standing attained in those early years by our journal.

[Signed.] W. H. VanderSmissen, *President.*

Alan Macdougall, *Secretary.*

APPENDIX I.

MEMBERSHIP.

Number of Members April 1st, 1886	233
Withdrawals and deaths during the year	14
	219
Elected during the year	71
Total members April 1st, 1887	290
Composed of :—	
Honorary Members	5
Life Members	13
Ordinary Members	272
Total	290
Associates	30

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE FOR THE YEAR ENDING MARCH 31st, 1887.

To Summary—	
" Balance on hand	$ 63 05
" Annual subscriptions	919 00
" Rents	218 00
" Government Grant	750 00
" Proceeds Wallace Lectures	107 42
" Journals sold	29 29
" Periodicals sold	32 61
" Mr. Sanford Fleming's proportion of printing	62 41
" Interest	2 65
" Natural History Society, balance of funds	8 73
" Subscriptions to bust of Dr. Wilson	25 00
" Proceeds of note discounted	300 00
" Proceeds of Mortgage due 1892	3,000 00
	$5,518 16

By Summary—	
" Salaries	$ 373 50
" Printing Journal	338 76
" " Miscellaneous	7 50
" Binding	124 60
" Stationery	32 89
" Postage	201 95
" Freight and express charges	20 91
" Repairs, stoves	4 30
" Gas	43 12
" Water	24 00
" Show cases for specimens	100 00
" Advertising	3 00
" Periodicals, 1886	120 36
" " 1885	60 55
" Discount on cheque	25
" Consul's certificate and Custom's expenses	3 50
" Sweeping chimneys	2 00
" Fuel	109 90
" Painting	104 13
" Interest	194 39
" Mortgage due August, 1886	3,411 00
Carried forward	$5,280 61

	Brought forward		$5,280 61
"	Taxes		10 21
"	Bust of Dr. Wilson		25 00
"	Legal expenses		25 00
"	City Directory, 1887		3 00
"	Repairs to building		60 47
"	Matting for reading room		26 80
"	Housekeeper's expenses		10 00
"	Journals purchased		50
"	D. Boyle, disbursements and expenses		20 17
"	Balance, Imperial Bank	$50 00	
"	" Cash on hand	6 40	
			56 40
			$5,518 16

Examined and found correct.

(Signed) T. B. BROWNING, } Auditors.
April 22nd, 1887. D. B. DICK, }

BUILDING ACCOUNT.

1886.		
Dec. 1,	To Donation Natural History section	$ 50 00
1887.		
Jan. 8,	" Mortgage due 1892	1,000 00
	" Interest	48
		$1,050 48

1887.		
Feb. 9,	By Law expenses	$ 12 65
	" Carpenters' contract, Certificate No. 1	300 00
Mar. 11,	" " " " No. 2	75 00
	" Balance Imperial Bank	662 83
		$ 1,050 48

Examined and found correct.

(Signed) T. B. BROWNING, } Auditors.
22nd April, 1887. D. B. DICK, }

ASSETS.

Building	$11,500 00
Warehouse	720 00
Ground	3,000 00
Library	5,500 00
Specimens	1,300 00
Personal property	600 00
	$22,620 00

LIABILITIES.

Mortgage, No. 1, due 1892	$ 3,000 00
" No. 2, "	1,000 00
Note discounted	300 00
Balance in favour of the Institute	18,320 00
	$22,620 00

Appendix III.

Donations and Exchanges.—Books and pamphlets received from April 1st, 1886, to April 1st, 1887:—From Canada, 190; United States, 398; Great Britain and Ireland, 310; India and Australia, 82; all other countries, 1,250; total, 2,230.

Total number received in 1882-3, 280; ditto. 1883-4, 800; ditto 1884-5, 730; ditto 1885-6, 1,502; ditto 1886-7, 2,230.

Appendix IV.

The number of societies and publications with which the Institute exchanges is 341.

Appendix V.

To the periodicals subscribed for last year the following have been added:— *English Historical Review*, *Scottish Review*, *Hardwicke's Science—Gossip*, *Science*. There have been discontinued:—*British Quarterly Review*, *Brain*, *Times* (Weekly), *English Medicine*, *American Journal of the Medical Sciences*.

APPENDIX VI.

Classification of papers read by subjects:—General, 3 ; Psychology, 1; Archæology, 5; Sociology, 2; Mathematics, 2; Chemistry, 5; Mineralogy and Geology, 7; Jurisprudence, 1; Philology, 8 ; Meteorology, 1; Geographical Science, 2 ; Electricity, 1 ; Biology, 5 ; Astronomy, 2 ; Medicine, 2 ; Photography, 1 ; Industrial Science, 1; total, 49.

Read at section meetings, 23 ; total, 72, as follows : Biological section, 12 ; Architectural section, 8 ; Philological section, 3.

The election of officers for the ensuing year resulted as follows :

President—W. H. VanderSmissen, M.A.

Vice-President—E. A. Meredith, LL.D.

Treasurer—James Bain, jun.

Secretary—Alan Macdougall, M. Inst., C.E.

Editor—George Kennedy, M.A., LL.D.

Curator—David Boyle, Ph.B.

Librarian—G. E. Shaw, B.A.

Members of Council—W. H. Ellis, M.A., M.B.; Alexander Marling, LL.B. with the Chairman of Sections and Secretary of Biological Section.

On motion of Mr. Boyle, seconded by Mr. Browning, it was resolved, "That in the opinion of this meeting it is advisable to form a Historical and Archæological Section in connection with the Institute, and the President and Secretary are hereby empowered to make all preliminary arrangements for the purpose of forming a Section forthwith."

On motion of Mr. Shaw, seconded by Rev. Dr. McCurdy, it was resolved, "That the thanks of the Canadian Institute be tendered to the city daily papers and especially the *Mail* for their kindness in publishing reports of the proceedings of the Institute."

On motion of Dr. McCurdy, seconded by Mr. Keys, a vote of thanks was tendered to the retiring councillors.

A paper was presented by A. McGill, B.A., on "Tartaric Acid in Admixtures."

LIST OF COLEOPTERA COLLECTED BY MR. BRUCE BAILEY, IN KICKING HORSE PASS, ROCKY MOUNTAINS, C. P. R., 1884.

From a paper read before the Biological section by Mr. Brodie.

Mr. Bruce Bailey a member of this section, while on the Engineering staff of the mountain section of the C. P. R., made a large collection of Natural H story objects, consisting of Mammals, Birds, Reptiles, Fish, Insects and plants. Several species of the Diptera and Hemiptera, have not yet been satisfactorily identified, and it is believed there are a few new to science. The following is a nearly complete list of the Coleoptera.

I am indebted to the eminent coleopterologist Mr. H. Ulke, of Washington, for the identifications, with a few exceptions. The species marked * are new to the Canadian list.

Carabidæ :—Cicindela longilabris, *Say.*
" 12-guttata, *Dej.*
Nebria trifaria, *Lec.**
" Mœsta, *Lec.*
Platynus bembidioides, *Kirb.*
" quadripunctatus, *Dej.*
Agonoderus lineola, *Fabr.*
Bembidium Grapii, *Gyll.**
" nigripes, *Kirb.*

Dytiscidæ:—Colmybites sculptilis, *Harr.*

Dermestidæ :—Anthrenus scrophulariæ, *Lec.**
Orphilus glabratus, *Fabr.**

Cucujidæ—Cucujus clavipes, *Fab.*

Trogositidæ :—Tenebrioides sinuata, *Lec.*
Calitys scabra, *Thun.*

Coccinellidæ :—Coccinella trifasciata, *Linn.*
Hippodamia 13-punctata, *Linn.*
Adalia frigida, *Schn.*
Anisocalvia 12-maculate, *Gebl.*
Scymnus lacustris, *Lec.*

Byrrhidæ :—Bryrrhus cyclophorus, *Kirb.*

Lucanidæ :—Platycerus depressus, *Lec.*

Scarabaeidæ :—Dichelonycha subvittata, *Lec.*
" Sulcata, *Lec.**
Serica frontalis, *Lec.**

Diplotaxis trevicollis, *Lec.*
Lachnosterna errans, *Lec.**
Trichius affiinis, *Gory.*

Buprestidæ:—Dicerca tenebrosa, *Kirby.*
Buprestis Langii, *Marin.**
" radians, *Lec.**
Melanophila Drummondi, *Kirb.*
Anthaxia inornata, *Rand.*

Elateridæ:—Adelocera profusa, *Cand.*
Dolopius lateralis, *Esch.*
Corymbites furcifer, *Lec.**
" pulcher, *Lec.*
" insidiosus, *Lec.*
" morulus, *Lec.*
" æripennis, *Kirb.*
" umibripennis, *Lec.**
" fallax, *Say.**

Lampyridæ:—Eros mundus, *Say.*
Photinus lacustris. *Lec.*

Telephoridæ:—Podabrus puncticollis, *Kirb.*
" Sp.——undetermined.*
Telephorus, Sp.——undetermined*
" Sp.——undetermined.
Silis difficilis, *Lec.**

Malachidæ:—Melyris, Sp.——known not described.*

Cleridæ:—Trichodes ornatus, *Say.**
Clerus undulatus, *Say.*

Spondylidæ:—Spondylis upiformis, *Mann.*

Cerambycidæ:—Asemum mœstum, *Hald.*
Hylotrupe ligneus, *Fab.*
Callidium janthinum, *Lec.*
Clytus 3-vittatus, *Meb.**
Xylotrechus undulatus, *Say.*
Neoclytus, Sp.——probably new.*
Rhagium lineatus, *Oliv.*
Acmæops pratensis, *Laich.*
" longicornis, *Kirb.**
Leptura sex-maculata, *Linn.*
" sanguinea, *Lec.*
" chrysocoma, *Kirb.**
" canadensis, *Fab.*
Monohammus maculosus, *Hald.**
" scutellatus, *Say.*

Chrysomelidæ:—Orsodachna atra, *Ahr.*

Syneta ferruginea, *Germ.*
Pachybrachys femoratus, *Oliv.**
Adoxus vitis, *Linn.*

Tenebrionidæ:—Iphthinus serratus, *Mann.*
Phellopsis obcordata, *Lec.*

Melandryidæ:—Allopoda lutea, *Hald.**
Phryganophilus collaris, *Lec.*

Mordellidæ:—Anaspis atra, *Lec.**
Mordella scutellaris, *Fab.*

Œdemeridæ:—Ditylus cœruleus, *Rand.*

Pythidæ:—Pytho niger, *Kirb.*

Otiorhynchidæ:—Evotus naso, *Lec.*
Scythropus elegans, *Coup.*

Rhynchitidæ:—Rhynchites bicolor, *Fabr.*

Curculionidæ:—Anthonomous musculus, *Say.*

Scolytidæ:—Dendroctonus terebrans, *Oliv.*

INDIAN LANGUAGES AND LITERATURE IN MANITOBA, NORTH-WEST TERRITORIES AND BRITISH COLUMBIA.

Dr. Rae in a lecture delivered at the London Institution stated that in the Northern part of Canada there were five hundred different Indian languages, divisible into seventy-five ethnical groups.

I am unable from my reading and observation to corroborate this statement, but give the results of my studies and experience in the following notes.

I. *List of Languages in Manitoba, Keewatin and North-West Territories.*

1. The Sioux Language—A small band of these Indians is located near Portage la Prairie

2. The Stony Language—This is a dialect of the Assiniboine or Dakotah Indians. They are located at Morley, on the C.P.R. forty miles west of Calgary and on a reserve near Edmonton.

3. Ojibway Language—Some of these Indians may be found around Lake Superior.

4. The Saulteaux Language—This is a dialect of the Ojibway. These Indians are to be found in the vicinity of Hudson's Bay and near Norway House.

5. Sarcee Language—This is the same language as the Castor or Beaver. These Indians are located on a reserve about eight miles south of Calgary. There is not a white man in the country conversant with the language, and all interpreting is done in Blackfoot or Cree which these Indians understand.

6. The Beaver Language--These Indians are found in Athabaska.

7. Cree Language—Divided into Plain Cree, Wood Cree and Swampy Cree. These Indians are numerous and are located on the plains and in the forests, all over the North-west and Keewatin.

8. Blackfoot Language—Spoken by the Bloods, Piegans and Blackfeet.

9. Nez Percé Language—A few of these Indians occasionally reside at Pincher Creek, thirty miles west of Macleod. They are United States Indians.

10. Slave Language.

11. Dog Rib Language.

12. Chippewayan Language.

13. Dinje or Loucheux Language.

14. Hare Language—These all belong to the Tinné family and are found in Athabaska and Alaska.

15. Eskimo Language.

16. Tukudh Language.

II. *Languages in British Columbia.*

1. Bella Bella.
2. Bella Coola.
3. Tsimpshean.
4. Nimpkish.
5. Hydah.
6. Chinook Jargon.
7. Cowichan.

III. *The Languages of which Vocabularies and Grammars have been published, the Authors and place of publication.*

1. Sioux—A Grammar and Dictionary of the Dakotah Language. Edited by Rev. S. Rigg, D.D., Washington, 1852, $10. A new edition is now in course of preparation.

2. Ojibway—A Grammar and Dictionary of the Otchipwe Language By R. R. Bishop Baraga, new edition, 1879, $3. Beauchemin and Valois, Publishers, 256. 258. St. Paul Street,

Montreal. There are several grammars and dictionaries prepared for the Ojibway of Ontario, etc.

3. Cree Language—(1) A Grammar and Dictionary of the Cree Language in French by Rev. Pere Albert Lacomb, O.M.I. $3. Beauchemin and Valois, Montreal. (2) A Cree Dictionary by Rev. E A. Watkins, published by the Society for Promoting Christian Knowledge, London, England. (3) A Grammar of the Cree Language by Right Rev. Bishop Horden, published by the Society for Promoting Christian Knowledge, London, England. (4) Grammar of the Cree Language by Henry Howse, London, England, 1815, now out of print. This is said to be the best Cree Grammar published. (5) A Lecture on the Grammatical Construction of the Cree Language by the Ven. Archdeacon Hunter, M.A., 1875, by the Society for Promoting Christian Knowledge, London, England. This contains Paradigms of the Cree Verb with its various conjugations, moods, tenses, inflections, etc.

4. The Blackfoot Language—A small phrase book was published as a money speculation by C. Lanning, but it is full of mistakes and of very little use. Nearly all the missionaries have MSS. vocabularies for their own use. I can only speak positively of my own work on Grammar and Dictionary which I have been working at for years, and will take three years at least to finish.

5. Eskimo—Paradigm of the Verb, by Dr. A. Pfizmaier, Vienna. "The Eskimo Dialects as serving to determine the relationship between the Eskimo Tribes," published in the journal of the Anthropological Institute, by Dr. Rink. Both of these are on the Greenlandic Dialect.

6. Addendum re Cree Language—Rev. Archdeacon John McKay, Prince Albert College, N. W. T., has a MSS. grammar in Cree which he is preparing to publish.

7. Addenda re Languages in British Columbia.

Kwakiute.
Bilhoola.
Clallam.
Lummi.
Snohomish or Nisqually.
Chehalis.
Twana.

These last five are found on Puget Sound, W. T., and in British Columbia. There are very many dialects of these.

8. Bella Coola or Viloula—Dr. Frank Boaz is making a special study of these Indians at present. See Mittheilungen aus der Ethnologischen Abtheilung der Museum zu Berlin.

9. Chinook Jargon—(1) "Dictionary of the Chinook Jargon or Indian Trade Language of the North Pacific Coast," 1883, 35 pages. T. N. Hibben & Co., Victoria, B.C. (2) Dr. George Gibbs, Report on Chinook, etc., published by Smithsonian Institute, 1863, Vol I. Contributions to North American Ethnology.

10. Bilhoola—A brief grammatical sketch of this dialect is found in "Science," of New York, March 5th, 1886, by Dr. Frank Boaz.

11. Nisqually—A Vocabulary was prepared by Dr. George Gibbs and published in Vol I. Contributions to North American Ethnology.

12. Clallam and Lummi—A Dictionary prepared by Dr. George Gibbs and published in Shea's Library of American Linguistics.

13. Snohomish and Chehalis—Comparative Vocabularies of the Tribes of British Columbia by Tolmie and Dawson, 1884, published in Montreal.

Further study and observation may be productive of more information on this subject.

JOHN McLEAN, M.A.

Blood Reserve.
Macleod, Alberta.

SYNOPSIS OF A PAPER READ BEFORE THE BIOLOGICAL SECTION BY DR. GARNIER ON A NEW SPECIES OF MENOBRANCHUS.

Dr. Garnier presented an account of a species of Menobranchus which he believes to be new, and dedicates to Mons. F. Lataste as *M. Latastei.* Prof. Cope, to whom a sample was submitted, regards it as a well-marked variety of the ordinary northern Menobranch *Necturus lateralis*, Baird, which would accordingly bear the name *N. lateralis var. Latastei.* Garnier.

The following are the points which Dr. Garnier thinks entitle the

Menobranchus under consideration to rank as a separate species. (1) Smaller size. (2) Colouration, the body being entirely black except the gular fold which is white, the abdomen which is sooty and the toes and an occasional present band at the base of the tail which are olive brown. (3) Proportionately greater size of the head. (4) The smaller number of teeth, especially on the vomers, superior maxillaries and mandibles, and (5) habitat, the form under consideration being always found in swift streams, not in sluggish waters.

Dr. Garnier gives some particulars as to his observations of the habits of the Menobranchus he has studied. He finds they do not survive more than two or three hours out of water; they swim rapidly, compressing the limbs against the trunk; and shelter themselves in crevices and under stones; they eat small living fish and cray-fish by preference, and do not readily take meat in captivity; they spawn towards the beginning of May, laying eggs which measure in the ordinary species quarter of an inch in diameter but in the *var. latastei* three-sixteenths; during the spawning time the cloaca becomes swollen and the tail stiffer as in Proteus. The ordinary lake Menobranchus are often taken by fishermen in the winter in lake St. Clair, and like the dog-fish (Amia) and like sheepshead are regarded as unwelcome additions to the catches in seines.

The variety *Latastei* has been found by Dr. Garnier in the Maitland river, the ordinary Menobranchus with which he has compared it having been obtained from the Don and lake St. Clair, where they are common.

UMBRIA CAPTA.

Read before the Philological Section by Rev. N. MacNish, B.D. LL.D. April 25th, 1887.

I have the honour to present to the Canadian Institute a new interpretation of the Umbrian portion of the Eugubine Tables. I have to remark at the outset, that I have derived very great assistance, as well in the interpretation of the Tables as in the preparation of the geographical and ethnological notes which are appended, from the Rev. Professor Campbell, of Montreal, whose learning and researches in this particular field of investigation have been conspicuously exhibited in his *Etruria Capta*. It will be possible, I believe, to adduce satisfactory evidence to show that Gaelic is the language of the Umbrian Tables; and that, accordingly, they present to us altogether the oldest specimen that has hitherto been discovered, of Irish and Scottish Gaelic. As even the learned and laborious Celtic Grammarian Zeuss was not led to turn his attention to the Gaelic characters of those Tables, no material assistance is furnished by his elaborate Grammar in determining the grammatical forms of what has to be regarded now as the oldest Gaelic composition in the world. Mr. Whitley Stokes who has given extensive and scholarly attention to old and early middle Irish Glosses, enables us to perceive, *e.g.*, in his *Goidelica*—that the Turin Glosses, etc., and the Irish Hymns in the *Liber Hymnorum*, forming as those do some of the oldest Irish compositions of which we have had hitherto any knowledge—present fully as large combinations of words and peculiarities of grammatical construction as are to be found in the Umbrian Tables. The same remark may be made regarding the very old specimen of Scottish Gaelic which is contained in the Book of Deir; and also regarding the first book which was printed in Scottish Gaelic; viz., the Gaelic translation of John Knox's Liturgy, by Bishop Carswell of Argyll. It was published in 1567.

In his History of Rome (Vol. I. p. 160), Mommsen states that "our information regarding the migration of Umbrian stocks comes to us like the sound of bells from a town that has been sunk in the sea." Niebuhr in his History of Rome (Vol. I. p. 143) thus writes; "It is certain that the Umbrians were a great nation before the time of the Etrurians in the age of the Sicilians, and that they have the right to the name of a most ancient and genuine people of Italy." The same learned writer remarks in his Ethnography and Geography (Vol. II. p. 209) "that people have been extremely anxious to discover the Etrurian language, and who should not be so? I would readily give a considerable part of my property as a prize to any one who should discover it. An entirely new light would thereby be thrown upon the character of the nations of Italy."

The *Tabulae Eugubinae* were discovered in 1444 among the ruins of a Theatre in the neighbourhood of Gubbio in Umbria. Gubbio is the modern name of Iguvium. It has been maintained that those Tablets which were made, as Concioli asserts, *ex aere purissimo*, were originally nine in number. Two of the Tablets which were conveyed to Venice in 1540, have, it is to be feared, been irrecoverably lost. The seven that remain are preserved in the Palazzo Municipale of Gubbio. Tablets I., II., V. and VI. are engraved on both sides. A blank space is left on one side of Tablet II. and V. A few lines merely are engraved on one side of Tablet VII. The Inscriptions on Tablets VI. and VII. and nearly all the Inscriptions on one side of Tablet V. are in Roman letters.

According to the computation of Aufrecht and Kirchoff:

Table VI., *a*, has 59 lines.
Table VI., *b*, has 65 lines.
Table VII., *a*, has 54 lines.
Table VII., *b*, has 4 lines.
Table V., *b*, has 11 lines.

There are thus 193 lines in the Umbrian portion of the Eugubine Tables.

In his preface to his *Les Tables Eugubines*, Professor Bréal gives an interesting account of the various efforts which have been made to interpret those Tables. It is noteworthy, from a Celtic point of view, that there appeared in 1772 a work by Stanislas Bardetti, in which he endeavoured to explain the Umbrian Inscriptions principally by the aid of Anglo-Saxon, old High German and Celtic. In an article on the Eugubine Tables which occurs in the Encyclopaedia Britannica, it is stated among other things that "Aufrecht and Kirchhoff, summing up the labours of their predecessors and working according to strict scientific method, brought the interpretation of the Tables to a degree of perfection that could hardly have been hoped for, though there still remained in matters of detail sufficient scope for such investigators as Bréal, Ebel, Corssen, etc." Professor Bréal's *Les Tables Eugubines* was published in 1875. As, in addition to his own unambiguous asseverations, he has come to be regarded as having at last succeeded in giving an intelligible and satisfactory solution of the Umbrian Inscriptions, it is advisable to insert here the conclusions at which he has arrived. "The Eugubine Tables are the acts of a Corporation of priests who had their seats at Iguvium, and whose authority appears to have extended over a somewhat large extent of the adjacent country. They call themselves the Attidian Brethren, and the name of the Confraternity is given to the College. They are twelve in number. Different names of magistracy such as questor and fratrecks are mentioned. The person who plays the principal part has the title of *adfertur*. . . . It does not appear that the Attidian Confraternity was specially devoted to the service of a single divinity. We perceive that it offered sacrifices to an entire series of gods and goddesses. Thanks to that circumstance, the Eugubine Tables furnish us with precious indications of the Pantheon of an Italian people. Certain names coincide exactly with Roman names. Such are Jupiter, Sancus and Mars. Other names present a resemblance more or less remote as Fiscus, Grabovius, Cerfius. Other names, again, were entirely unknown, as Vofonius, Tefer, Trebus, etc. We have here, then, the monuments of an indigenous worship which the Roman religion had not yet effaced."

I have taken from the Umbrian Inscriptions certain words which any one who has even a moderate knowledge of Irish or Scottish Gaelic, can have no difficulty in admitting to be Gaelic. The combinations which are formed between prepositions and personal pronouns in Gaelic, present a striking peculiarity of the Gaelic languages. Pictet in his *De l' affinité des Langues Celtiques avec le Sanscrit* (pp. 170. 171.) virtually maintains that the points of difference between the Celtic languages and the other members of the Indo-European family of languages are confined, " to the permutation of initial consonants, and to the composition of personal pronouns with prepositions." " Quant aux composês pronominaux. . . . s'ils sont étrangers aux autres branches de la famille ils offrent une analogie tres curieuse avec les langues finnoises." In his *Grammatica Celtica* (p. 324.) Zeuss writes " Pronominum in utraque lingua, tam Hibernica quam Britannica ea proprietas est, ut non semper ut in aliis linguis Indeuropaeis per se posita plenam formam servent, sed etiam. . . . si sunt personalia post praepositiones suffigantur." It thus appears that Scholars like Pictet and Zeuss regard the composition of personal pronouns with prepositions as a peculiar feature in the Celtic languages.

I have chosen to consider the prepositional pronouns which I am about to cite and which occur repeatedly in the Inscriptions, *in* and *by* themselves, and apart from the particular meaning which they may bear in the place which they occupy in the Tables; in order that thus their purely Gaelic character may appear in its simplest manner.

Esto, *as iad*, *asta*, out of them.

Este, *aiste*, out of her.

Eesteso, *aiste so*, out of this one, *an deigh so*, after this.

Est, *asad*, out of thee, *asda*, out of them.

Eso, *às so*, out of this.

Dersva, *dar iad*, *thar iad* and *tharta*, over them.

Dersas, *dar thar iadsan*, *thartasan*, over them.

Dersaus, *thar iadsan*, *thartasan*, over them or over these very persons.

Nersa, *air ais*, back and backwards.

Erus, *air ais*, back and backwards.

Eno, *ann e*, *ann*, in him.

Eam, *annam*, in me, and again with me *aig mi*.

Erer, *air ear*, *air an ear*, on the east.

Erar, *air iar*, *air an iar*, on the west.

Enom, *ann mi*, *annam*, in me.

Ero, *air e*, *air*, in him, *air thu*, *ort*, in thee.

Erom, *air mi*, *orm*, on me.

Esome, *asmi*, *asam*, out of me.

Aso, *as thu*, *asad*, out of thee.

Ouse, *o* or *bho thusa uait uaitse*, from thee.

Ose, *o bho se e uaithe*, from him.

Etru, *eatorra*, between them, *eadar thu*, between thee.

Deitu, *do thusa*, *duit*, *duitsa*, to thee.

Difne, *do sibh*, *duibh*, *duibhse*, to you.

Fri, (Irish) with by.

Frif, *fri sibh*, with and by you.

Frite, *fri iad*, *iadsan*, by and with them.

Treif, *tre sibh tromhaibh*, through you.

Vovse, *bho sibhse*, *bhuaibhse*, *uaibhse*, from you.

Pusi, *bho si i*, from her.

Puse, *bho se e*, from him.

Reste, *ri* or *ris ise iadsan*, to her, to them.

Riutha, *riuthasan*, to them, themselves.

I shall now cite several words which reveal their Gaelic lineage at a glance, and which along with the prepositional compounds that have been enumerated, go far to establish the Gaelic character of the Umbrian Inscriptions.

Enetu, an aite, in place of.

Nesimei, a m' ionnsuidh, to or towards me, *ionnsaighim,* I attack.

Ficla, fo cheile, asunder.

Hondra, aon trath, one time, *an trath,* the time, when.

Screihtor, sgriosadair, a destroyer.

Verisco, fearachas, manhood.

Esona, easaon, without one, disagreeing.

Socair, quiet.

Ferine, fearran, ainn, land.

Arvio, arbhar, corn.

Heri, or oir, gold.

Vini, fainne, ring.

Poni, bonn buinn, coin coins.

Scalseto, sgaoil, scatter.

Tases, pl., *Tasetor, toiseach,* a leader, the *Intosh* in MacIntosh. the *Toiseach* of Mediaeval times in Scotland.

Suront, saor, free, *aonta,* consent.

Serse, srac, tear.

Seritu, saruich. harass.

Esisco, sasuich, satisfy.

Paca, bac, restrain.

Osatu, osadh, osaim, I desist.

Fetu, faighteadh, faigh, get.

Covertor, cobhartach, booty.

Prestotu, brisdeadh, brisd, break.

Portatu, furtaich, help.

Eine, feadhainn, people, *fine,* a tribe.

Cuirnase, cuir, put.

Mehe, maoidh, threaten.

Ote, eadhon, even.

Mucatu, mothuich, perceive.

Arsir, aithris, tell.

Porsi, purr, push.

Trebeit, tearb, separate.

Ehcleir, ath-ghlac, capture again.

Sent, sannt, desire.

Tote, tath, tathaim, (Ir.), unite.
Tuer, taobh, side with.
Naratu, an iarruidh, iarr, ask.
Strusla, sruthail, streachlaim, I tear.
Farsio, bris, break.
Tenitu, thig, thainig, come.
Persontu, brosnuich, incite.
Efrar, tabhair bheir, give.
Aitu, aidich, confess.
Turse, tuirse, tuir, lament.
Eiscrent, Eascaraid, enemy.
Fratrus, brath, betray.
Ocrer, acarach, kind, gentle,
Peracri, furachair, watchful.
Pihafi, bho bhuaidh, buadhmhor, victorious.
Tertiu, deireadh, last.
Sir, sir, ask.
Sorsalem, surdail, surdamhail, active.
Mescapla, mishiobhalta, uncivil.

Another strong argument in favour of the contention that Gaelic is the language of the Umbrian Tables can be extracted from the numerous words or verbs that terminate in *mu, me, am, om, e. g.*

Arsmo, arsa mi, said I.
Carsome, greasaim, I hurry.
Hondome, aontuighim, I assent.
Spahmei, spochaim, I rob.
Persnimu, brosnuighim, I incite.
Purome, tabhaiream, tabhraim, I give.
Pertome, bhruthaim, I bruise.
Tettome, dithighim, I crush.
Todcome, tudhchaidhim, I come.
Vocucom, boghaighim, I beseech.

Those verbs readily disclose their Gaelic character. The terminations *mei, me, mo, am, mu,* are merely the first personal pronoun which is appended to Gaelic verbs. I have given the Irish equivalent of the verbs which have just been cited. A *present* tense is recognized by Irish Grammarians, while in Scottish Gaelic the tenses are, the *past* and the *future* merely; the other tenses, the present among the rest, being compounded of the substantive verb and of portions of the verb that is under consideration. It is the *present* tense of the Irish verb that I have given as the equivalent of the verbs which I have taken from the Inscriptions. Several, indeed all, of the verbs in question could easily assume a Gaelic form and preserve the distinctive termination of Gaelic verbs, e. g.

Hondome, dh-aontaich mi, I assented.
Carsome, ghreas mi, I hurried.
Persnimu, bhrosnuich mi, I incited.
Pertome, bhruth mi, I bruised.
Purome, bheir mi, I will give.
Tettome, dhithich mi, I destroyed.
Todcome, thainig mi, I came.
Spahmei, spoch mi, I robbed, etc.

It is thus the past tense of the Gaelic verb that represents the present tense of the Irish verb. It may be well to observe that the aspiration of words in Irish Gaelic is effected by placing a dot over them, and that in Scottish Gaelic aspiration is effected by inserting the letter *h*. It may be remarked here, that the evidence which the verbs under consideration furnish, is in favour of the contention of Irish Grammarians respecting the antiquity of the *present tense*, and against the opinion of Gaelic Grammarians, that Scottish Gaelic is more ancient than Irish Gaelic, because it has a past and future tense merely, and because it is thus on the same level with the Semitic languages so far as the number of tenses is concerned.

Stahmei, stad mi, shuidhich mi, I settled.
Asame, asam, I make.
Smuirsime, smuais mi, I break to pieces.
Tertiamne, tairthighim, I save.
Randeme, raonaim, I defeat.
Totam, tathaim, I unite.
Proman, pronnaim, I give.
Pesnimu, beascnaighim, I grant.
Eturstahmu, dh- eadar shuidhich mi, I interposed.
Termnome, thearmunnaich mi, I protected.

Here are additional verbs which occur in the Inscriptions, and which corroborate the argument that I have sought to extract from the termination *mu*, *me*, *am*, *om*, representing as those monosyllables do the first personal pronoun in Gaelic.

The preterite tense, Indicative, Active, of modern Irish verbs is thus declined, *e. g.*, *mol-aim*, I praise

Singular.	Plural.
1. *Mhol-as.*	1. *Mhol-amar.*
2. *Mhol-ais.*	2. *Mhol-abhar.*
3. *Mhol-se.*	3. *Mhol-adar.*

There are to be found in the Umbrian Tables several words with terminations similar to those of the plural which has now been given *e. g.*

Fisier, *bhiomar*, we were, or *bhiobhar*, you were.

Arsmor, *arsa mar*, we said.

Totaper, *Totar*, *tath-abhar*, you joined.

Surur, *shaor-abhar*, you freed.

Tuer, *thaobh-abhar*, you sided.

Serfiar, *shearbh-abhar*, yon embittered.

Motar, *mhoid-abhar*, you vowed.

Nomneper, *dh-aom-abhar*, you inclined.

Nomneper is a verb that occurs frequently in the Inscriptions. It is doubtless the second person plural, past indicative, active of *aom*, I incline, *aomaim*. Zeuss contends that *nu* or *no* prefixed to a verb is the mark of a completed action. In this manner, the presence of *n* in *nomneper*, standing as it does for *nu* or *no*, can be satisfactorily explained. Pictet in his well-known book to which reference has been made already, remarks (p. 152.) "that the second person plural of Irish verbs has two suffixes which are commonly used, *thaoi* and *bhar*." The second Irish form *bhar* which has, I believe, no analogy in any other European language is employed in the *present*, the *past* and the *future*, *e. g.*, *Mealabhar*, you deceive; *Mealfabhar*, you will deceive; *thangabhar*, you came." According to the high authority of Pictet, therefore, *bhar* as the termination of the second person plural of verbs is confined to the Celtic languages. The words which have been already adduced along with other words in the Inscriptions that may fairly be construed and expanded in a similar manner, clearly lead to the conclusion, that *bhar* as the termination of the second person plural of verbs is to be found frequently in the Umbrian Tables, and that additional evidence is thereby furnished in favour of their purely Gaelic character.

Fisi, fisim, fisiem, fisie, fisier, fisio, futu, pifi, bue, sei; here are words which occur very often in the Umbrian Tables. They are doubtless parts of the Celtic substantive verb, and present to us, therefore, very old forms of that verb. The very sound of those words will convince any one who has even a slight acquaintance with Gaelic as it is spoken, that their Gaelic character is unmistakable; for they call up several forms of the substantive verb as it is known in Gaelic, *e. g.*

Fisi; bha e or *i bha esan* or *ise*, he or she was.
bhidhis, thou wast, *bhi se*, he was, *bhidheas*, I was.
bhidheadh e or *bhiodh e*, he would be.
bi thusa or *bisa*, be thou.
bitheadh e or *i*, let him or her be.
bithidh e or *i*, he or she will be.

Fisim; } *bitheam*, let me be, *bha mi*, I was.
Fisiem; } *bithidh mi*, I shall be.
bidhim, I am accustomed to be.
bhidhinn, I used to be.
bhithinn, I would be.

Fisie; bithidh e he will be, *bitheadh e*, let him be.
bhitheadh e, he would be, *bhiodh i*.
bhidheas, I was, *bhi se*, he was.
bia or *biaidh se*, he will be.
bidhir, bir, thou usually art.

Fisier; bhiomar, we were, *bhiobhar*, you were.
bhiodar, they were, *biair*, thou shalt be.
bheithi, you could be, *beidhir*, thou shalt be.
bhatar, bhathar, was; *bitear bithear*, will be.
bhitheadh iad, they would be; *bha iad*, they were.

Fisiv; bithibh, be ye, *bha sibh*, you were, *bithidh sibh*, you will be, *bhitheadh sibh, bhiodh sibh*, you would be.
bithi, you are; *bhidhis*, thou art; *bidhidh*, be ye; *bhithi*, you were.

Futu; bha thu, thou wast, *bu thu*, it was thou.
bhitheadh thu or *bhiodh tu*, thou wouldst be.
bhidhthea, thou wast wont to be, *bhithi*, you were wont to be.
biathaoi, you will be, *bheidhthea*, you would be.

Pifi ; bu mhi, it was I, *bithibh*, be ye.
bithi, you are, *bhithi*, you used to be.
Bue ; *bu e*, it was he, *b' e*.
Budh ; *ba h-e*, it was he, *ba*, it was, *budh*, it was.
fa, it was, *bhus*, *budh*, *bidh*, *pu*, it will be.
Sei ; is e or *is i*, it is he or she, *s e*, *'s i*.
is he or *it e*, it is he.
is si, it is she.

It is thus abundantly evident that there is a close correspondence between *fisi*, *fisim*, *fisiem*, *fisier*, *etc.*, and numerous portions of the Irish and Gaelic Substantive verbs. There is likewise a close correspondence between some of the words in question and certain parts of the substantive verb in Armorican, *e. g.*

Imperative Mood.	*Bez*, be thou.
	Bezet, let him or her be.
	Bezomp, let us be.
	Bezit, be ye.
	Bezent, let them be.
Future Indicative.	*Bezinn*, I shall be.
	Bezi, thou shall be.
	Bezo, he shall be.
	Bezimp, we shall be.
	Bezot or *biot*, you shall be.
	Bezint, they shall be.

In consideration of the conclusive evidence that has been adduced that *fisio*, *fisi*, *fisim*, *etc.*, belong to the Substantive verb in Gaelic ; is it not a little surprising that *fisi* has been magnified into a Divinity *Fisus* by Bréal and others, and that *ocre Fisi* has been metamorphosed into *Colli Fisio*, the Fisian Hill ? Can elaborate ingenuity go to a more untenable extreme, or expend itself in more unlikely and indefensible conjectures ?

As Umbrian Gaelic is so very much older than any Gaelic writings of which there has hitherto in modern times been any knowledge, it is from the Inscriptions themselves that all grammatical rules and forms must be derived. A few Grammatical references will not here be inappropriate, as bearing on the Gaelic character of the Tables, There are various terminations of the nominative singular of nouns *e. g.*, *ei*, *ne*, *a*, *tor*, *as*, *re*, *te*, *us*, *u*. Forms of the genitive singular are *is, no, a, o.* Forms of the dative singular are *a, ef, o, etc.* The nominative plural of proper names generally terminates in *er, ir, ar, e.g.*

Pelmner, the Flamonenses.	*Aseriater*, the Asseriates.
Perscler, the Perscli.	*Peihaner*, the Vicumniae.
Rufrer, the Orbii.	*Nonair*, the Nannes.
Salier, the Salassi.	*Hoier*, the Euganei.
Atiersir, the Taurisci.	*Paveller*, the Medulli.
Popler, the Populonii.	*Serser*, the Isarci.
Treblanir, the Triumpiliui.	*Tesonocir*, the Ticinates, etc.

The common termination in modern Irish and Scottish Gaelic for patronymics and national and tribal names is *ach e. g. Albannach*, a Scotchman; *Eirionnach*, an Irishman; *Sasunnach*, an Englishman; *Frangach*, a Frenchman; *Caimbeulach*, a Campbell; *Camaronach*, a Cameron. There is thus a marked difference between the Umbrian and the modern method among Gaels of expressing patronymics and tribal names. In his minute examination and collation of the Celtic languages, Pictet was led to conclude, " En Irlandais, *ara, aire, ar, air, oir*, et en gallots *awr* forment principalement des appellatives et des noms d' agents." I believe that the endings *er, ir, ar* of the plural nouns which I have cited, represent *feara, fir*, the Gaelic words for men. Very common in Gaelic is the combination of *fear* with other nouns to indicate a trade or calling, *e. g.*

Clachair, a mason.	*Seoladair*, a sailor.
Saighdear, a soldier.	*Sgoilear*, a scholar.

Figheadair, a weaver, etc

The plural of such nouns as those ends in *an* or *ean*.

Fear, a man, is thus declined :

Singular.	Plural.
N. *Fear*,	*Fir*, *Feara*,
G. *Fir*,	*Fhear*,
D. *Fear*,	*Fearaibh*,
S. *Fear*,	*Fear*,
V. *Fhir*,	*Fheara*,

In the numerous proper names which occur in the Inscriptions with the endings *er, ir, ar*, in the nominative plural : the Gaelic *fir, feara* is present ; so that the words will signify, *Perscler*, the men of the Perscli, *Popler*, the men of Populonia, etc. Those terminations are eminently Gaelic ; and though the collocation or composition of the proper names in question has no exact counterpart in modern Irish or Scottish Gaelic, resemblances there are of such strength and clearness as to establish the Gaelic character of those Umbrian syllables or endings.

In Irish and Scottish Gaelic, in Manx and Welsh though not in Armorican, adjectives are declined, and, therefore, undergo inflection as nouns do. The same peculiarity attaches to adjectives in the Umbrian Inscriptions, *e. g.*

Avvei mersta,	*Aveif merstaf,*	*Mersta ancla,*
Ocrer peihaner,	*Ocre fisie,*	*Ocriper fisiv,*
Ocrem fisiem,	*Ocre fisim,*	*Totar ijovina,*
Totar ijovinar,	*Tote jovine,*	*Totam ijovinam,*
Toteme jovinem,	*Tote tarsinate,*	*Totar tarsinater,*
Totam tarsinatem,	*Trifo tarsinatem,*	*Trifor tarsinater,*
Trifo tarsinate,	*Tote ijovine erer nomne,*	
Nomner Naharcer Tapuscer, Tuscom Naharcom Tapuscom nome.		
Purdito fust	*Capif purdita,*	*Purditom fust,*
Peracrei,	*Peracrio tursituto,*	*Acre tlatie,*
Acre casilos,	*Casilis Herti,*	*Casilate diram Herti.*

Mersta, ocre, tote or *tota, trifor, nomne, purdita, peracrei, casiler* : Here are adjectives, whether verbal or otherwise which indicate conclusively in the connection where they are found, that they fulfil the condition of Celtic adjectives, and undergo inflections in the same manner as the nouns that they qualify do. I am disposed to regard *ocriper* and *ocreper* as a comparative form of *ocre (i. e. acarach).* Zeuss indeed calls attention to a rare termination *thir* of the comparative degree of adjectives. There is a resemblance between the *per* of *ocriper* and the *thir* which is mentioned by Zeuss.

The Infinitive of verbs in Irish and Scottish Gaelic generally ends in *adh.* In the Umbrian Inscriptions *tu* is the common ending of the Infinitive, corresponding thus very closely to *te* and *ta,* the ending of the past participle of Gaelic verbs. It is evident that the form of the verb which indicated the Infinitive in the Umbrian language, now appears in the past participle of Gaelic verbs. The correspondence between the Infinitive forms of the Inscriptions and the past participles of modern Gaelic verbs, is so apparent as not only to be readily recognized in the case of several verbs but also to furnish another argument in favour of the Gaelic character of the Umbrian Tables, *e. g.*

	Past Participle.
Merstu, to err, *mearaighim*,	*mearaighthe.* (Irish)
Ehveltu, to revenge, *aichbheilich*,	*aichbheilichte.*
Serse, to tear, *srac*,	*sracta*, *srachdta.*
Seritu, to harass, *saraich*,	*saraichte.*
Esisco, to satisfy, *sasaich*,	*sasaichte.*
Carsitu, to hurry, *greas*,	*greasta.*
Habitu, to desist, *ob*,	*obta, air obadh.*
Paca, to hinder, *bac*,	*bacta, air bacadh.*
Pihatu, to conquer, *buadhaich*,	*buadhaichte.*
Naratu, to ask, *iarr*,	*iarrta.*
Fetu, to get, *faigh*,	*faighte*, *faighteadh.*
Trebeit, to separate, *tearb*,	*tearbta.*
Ditu, to press, *dith*,	*dite.*
Osatu, to desist, *osaim*,	*osta, air osadh.*
Tenitu, to come, *thig*,	*air tighinn.*
Stiplo, to go, *siubhail*,	*siubhailte.*
Stiplatu, to cast out, *stápla.* (Armorican)	
Covertu, to assist, *cabhair*,	*cabhairte.*
Amboltu, to hinder, *amail*,	*amailte.*
Portatu, to help, *furtaich*,	*furtaichte.*
Stahito, to arrange, *suidhich*,	*suidhichte.*
Prestotu, to break, *brisd*,	*briste.*
Etuto, to refuse, *eitich*,	*eitichte.*
Vesticatu, to hire, *fasdaidh*,	*fasdaidhte.*
Aitu, to confess, *aidich*,	*aidichte.*
Combifiatu, to vow together, *comhbhoidich*,	*comhbhoidichte.*
Tefruto, to give, *tabhair*,	*tabhairt*, *toirt.*
Furo, to bend, *fiar*,	*fiarta.*
Tesedi, to cut, *teasgaim*,	*teasgta.*

It is vain at this distance of time, and in the absence of any trustworthy guide whatsoever, to entertain the hope, that it will be possible to reproduce with accuracy the peculiar method which the Umbrians followed in pronouncing their language, or to ascertain the exact value which they attached to any given letters or syllables.

An internal argument which admits of great elaboration can be drawn from the Inscriptions themselves in support of their Celtic character, inasmuch as several interpretations of given phrases present themselves with instant readiness;—interpretations that are purely Celtic and that have to do with Celtic roots and words, and with those alone. A few illustrations will suffice:

Table VI. *a.*

Line 1. *Curnase, chuirinn se,* I would place him.
Chuir iade, They place him.
Chuir iad esan, They placed him, i. e., that very person.

2. *Eesteso, An deigh so,* after this.
aiste so, out of this one.

5. *Stahmei, stahmeitei.*
Eisidhim—amaoid I decide, we decide.
Stad mi, I stopped.
Shuidhich mi, I settled.
Esmei, aicme, tribe.
Is mi, it is I.
'Us mi, and I.

6. *Stu. sosda,* a city.
aisde, out of her.
stigh, inside.
stuth, substance.

7. *Sue. suaip,* exchange.
so e, this is he.
shuidh e, he sat.

8. *Verfale. buair fala,* tempt in vain.
fir a' bhaile, townsmen.

9. *Nesimei. a m' ionnsuidh,* towards me.
ionnsaighim, I attack.
thionndaidh mi, I turned.
Somo. seasaim, I stand.
sheas mi, I stood.
so mi, here I am.
suidhidh mi, I will set.

11. *Eine. fine* a tribe.
feadhainn, people.

12. *Foserclome. fiosrachailim,* I knowing.
Bha sireadh leam, there was seeking by me.
Bha aircill leam, there was lying in wait by me.

13. *Smursime. smuais mi,* I broke to pieces.
smur chum, to the dust.

19. *Vasor verisco. bhasmhor fearachas,* deadly manhood.
fasmhor fearachas, thriving manhood.

20. *Paca ostensendi eso iso ostendu.*
bac ioc dean cain a siad ioc dean.
To withdraw the tribute which they paid.
bacadh an staonachaidh a bha iad a' staonachadh.
checking the inclination to which they were tending.

21. *Teio-subocav suboco,*
Tiom-suighim suibhich, To gather together, a gathering.
Tha sibh subhachas subhach,
You are cheerful in your happiness.

22. *Fos sei pacer sei,*
Fos ise feochair ise, Still let your valour appear.
Fos sibh bhacar sibh, also you, you were hindered.

24. *Tio-esu, Daimheach,* a relative.
Bha esan, he was.
Tha esan, he is.

27. *Virseto avirseto fas est,*
farsuing anfharsuing fas aisde,
From near and from far pour out.
Fearachas so am fearachas so fas aisde.
This manhood growing out of that manhood.

55. *Sevom surur purdovitu,*
Suaip saorsa furtaich-baidh.
In exchange for independence, helpful alliance.
'Se bhuam shaorar furtaichte.
It is from me the assisted men saved.

Mefa spefa,
Meas easba, little respect, disregarding.
fo mi, fo sibh, under me, under you.
By means of me, by means of you.

Table VI. *b.*

Line 5. *Ape sopo postro peperscust.*
a bho sabh bho eadar bibhsaigh siad.

By which they were deprived of mutual help.
fein sheap bho stri a dh-fhabradh cuis, etc.:
He himself went stealthily from the strife to favour the cause, etc.

35. *Sehemo atropusatu.*
Cenomani aithre barc.
The Cenomani repenting desertion.
Cenomani bhatar a putadh,
The Cenomani they were pushing.

47. *Crinca trohatu, gairm gu trei treig*, to summon to withdraw.
crion cath ro bhadar, they were (men) of small fight.

48. *Efrar. Tabhair,*
A bheirear that will be given.

52. *Ehesu—nosne ier ehesu*
ach—an suaip foir ach.
But (the Populonans) who refuse to exchange help.
ach a so nuas bha iad ach a so.
But hereupon down they were, but hereupon.

63. *Simo. Team*, to warn.
Is iomadh. There are many.

Table VII. (*a*)

Line 2. *Atrof, aoibh er ibh*, ye tribes.
abraibh, say ye.

3. *Tiom-plener. daimh-fhlann*, blood relations.
D'am bheilear, to whom there is.
De'm bheilear, of whom there is.

Evidence is furnished by their Tables that the Umbrians were for a long time in possession of their alphabet, whether it was borrowed by them from the Romans or not. The process of phonetic decay from which the Gaelic language has suffered so severely that the orthography is no safe guide to the pronunciation of Gaelic words, had already manifested itself. Thus Anderse, Marte, and Martier represent Ancherse, Marche, Marchier. Had the alphabet been a recent acquisition, it would have been employed phonetically. Happily for the philologist, the Umbrian orthography like that of all the Celtic languages, with the exception of Manx, is historical.

Fortunately the name of the author of the Umbrian inscriptions is given in Tables V. b. and VII. b. He is Herti, King of Umbria, and Suzerain over all the Celtic as well as over many Ligurian tribes from the Rhaetian Alps to the northern border of Umbria, and from the confines of Gaul to Istria. His name contains the root of the well-known word *Arthur*, and corresponds with Art, the name of more than one king in Irish legendary history. There are even some curious coincidences between the story of his Tables and the history of Art Aonfhir, who is said to have reigned in Ireland in the middle of the second century A. D. (Keating, p. 248.)

Table VII. b. ends with the words *sins a ccc.*, which may be interpreted "the 300th year of the age or era." The question at once suggests itself, "Who can tell when the Umbrian era began?" The other Tables mention Marcius Philippus, Valerius Flaccus, L. Porcius Licinus and Hasdrubal, but not as contemporaries: so that our only safe inference must be that the events recorded must have been later than 186 B. C., when Marcus Philippus made his unfortunate campaign in Liguria. (Livy xxxix, 22.)

The Umbrian Tables are rhetorical in the extreme, and abound in repetitions that are apparently unnecessary and indeed useless. Some valuable fragments of history are to be found in the Tables. The enumeration of tribes and peoples is of great importance to the Ethnologist, *e. g.* the three divisions of the Tyrrhenians, the five divisions of the disloyal Perscli, the fourteen tribes of Ijovine, and the five tribes of the Insubres.

Liguria, Cisalpine Gaul and Venetia are the three regions with which the Tables deal. There is much difficulty in identifying the names of the places that are mentioned, as well because the information which can be gathered regarding such places from classical historians and geographers is very meagre, as because the Romans either translated the native Celtic name, or so adapted it that it became significant and euphonious to Latin ears.

Concordia, Patavium, and Verona in Venetia were Celtic settlements, which in the Umbrian Tables were called Andersa, Hebetafeben and Purdin. The well-known cities Cremona and Placentia were in Umbrian, Crabove and Fiso-Sansie. Though, with the changeful circumstances of those old Celtic tribes, the names of places must have disappeared, the Italian topographer may find some of the ancient names still lingering in obscure portions of the region with which the Tables deal.

Summary of the Umbrian Narrative.

The Persceli, a generic title, embracing most of the tribes of Western Venetia and Transpadana, who did not belong to the Cenomani or to the Insubres, formed the Umbrian army of occupation in those regions. The tribes composing the Persceli appointed the general of the whole army by rotation. When the turn of the Asseriates of Venetia to elect a general came round, they nominated one of themselves who bore the name Parfa. The other tribes were not pleased at the election of Parfa, because they wished to retain their former general, whose name was Appei. The army revolted under Appei, and was favoured in so doing by the city Concordia, which though Celtic in origin, was under the joint jurisdiction of Pisa and Luna. Appei and his insurgents, joined by the Taurisci, Flamonienses, Isarci, Cenomani, and other tribes eager to be free from paying tribute to Herti, sacked Tarvisum in Venetia, which stood in friendly relations to Parfa, as a matter of revenge; and then passing into Transpadana took possession of Tetellus where they established themselves. Encouraged by this revolt, the Insubres who had joined Appei and had doubtless been incited by him, marched southward to the Padus, pursuing the fugitives from Tetellus. Herti, gathering an army in Umbria, marched northward and defeated the ravagers at Brixellum. Nevertheless, the subsequent history shows that a large body of the Insubres still remained in Cispadana, north of the country of the Apuans.

The time was one of general upheaval. The Populonians of Etruria took advantage of it to extend their colonial system, attempting to gain the Apuans and Vicumnians of Liguria and succeeding in detaching from Umbria the Adrians and Fiscaglians of Venetia, and in taking possession of Edro; at the same time inciting the mischievous Concordians to make trouble in the north. One of the tribes most hurtful to Umbrian interests was that of the Triumpilini who dwelt north of Brixia. They endeavoured to withdraw from their allegiance, but with very partial success the Vicumnians, Ticinates, and Boii. However, they succeeded, in withdrawing Brixia and its colony Verona.

The Crabovian tribes, in whose country the Roman colony of Cremona was situated, thought the time favourable for reconquering their ancient seat, and besieging Cremona, called for the aid of the

Triumpilini. The whole of the revolted Perscli, from Eporedia, Brixia, Ateste, and Vicetia, with the Vocontii, who dwelt about Vercellae, responded. Herti summoned the faithful tribes of Ijovine or the race of Feinne, to the relief of Cremona, and apparently succeeded in raising the siege, though in his rhetoric he forgets to state the fact.

Taking advantage of Gallic dissentions, the Genoese of Liguria either took Placentia, or taking possession of the surrounding country, besieged it. Herti, alluding to this result of disunion, summoned the Ticinates and the faithful Fenians to aid him in delivering this city from its invaders. He next turned his attention to Bergomum which was similarly besieged by the rebellious Perscli. Through the loyal Boii, he succeeded in winning back Verona. The people of this city and Vannia endeavoured to get Arnipo,—the Nahepara of the Etruscan Tables, who had been sent from Umbranum in the country of the Boii to quell rebellion in Venetia, but who had himself rebelled—to join them in loyalty. He refused to do so, and going westward tried to incite the people of Comum to deeds of violence. The example of Verona, however, was contagious and many disloyal tribes even among the Perscli and the Cenomani, returned to their allegiance. The original inhabitants of Bononia and the Claternians gave assistance.

Appei made his way towards the Apuan border, and Anovi-himu, the Annovi-gabe of the Etruscan Tables, whom Herti ordered to repel the invasion of Appei, was won over by the rebel general. Thus the Albans were added to Umbria's enemies. Yet Bobium, the Apuans, and the lord of Compiano remained faithful. Herti protected the Ligurian border by the Etruscan forces, and by the Trian tribe about Clastidium. He placed the Anamani in Umbranum to guard the Umbrian border proper, and sent the Umbranians to guard the Venetian border at Patavium. As a reward for their loyalty, he granted independent union to the Anamani, Ædui and Umbranici. In the Table he enumerates fourteen loyal tribes, half of whom seem to have dwelt in Liguria, and the other half in Venetia and Transpadana.

After this, he turned his attention to Venetia where the Populonians were carrying on war with the aid of the Adrians and Fiscaglians; while the Salluvii, Marici, and Albans in Western Transpadana and Liguria were acting in concert with them. He called Ravenna on the north and the Epanterii of Liguria on the west, to aid him, and commissioned two Vetulonian generals Marte Ijorsi and Honde Serfie, to exterminate the Saluvii and the Marici who were special objects of his hatred. Again, we find him at Sesterno on the borders of Liguria, engaged in expelling the Insubres with the aid of the peoples of Comum and Cameliomagus. The Taurini in Dertona were wavering, but the Inscription ends before the result of his appeal to them can be stated.

The two short Tables VII. b. and V. b. contain, the one an injunction to have no dealings with Appei, with the Taurisci, Populonia and the lord of Concordia; the other, a statement of the tribute, which the Taurisci, Cenomani, Tigurini, Flamonienses and Isarci refused to pay, and of the larger tribute imposed upon them by the new masters.

The Umbrian Tables, therefore, form an historical document, dealing as they do with a very important period and with very important circumstances in the history of that portion of Italy which is embraced by them. From the ethnological and geographical notes which are appended, it can readily be seen, that powerful evidence of a corroborative kind in favour of the interpretation of the Tables which is now advanced, can be gathered from Greek and Latin historians and geographers. An interpretation, then, which presents an important and continuous narrative and which furnishes an intelligible and sufficient reason for the preparation of such Tables at all, is *a priori* to be regarded as more sensible, and as possessed of a much larger measure of verisimilitude than the interpretation which Bréal and others have offered. To contend that words denoting lapwings, and magpies, and ravens, and crows, etc., occur in the Umbrian Tables; to be told that such words as smurrim, tettum, rantim, pertum, etc., are Latin words, while it is clear that if they are Latin words they have the very questionable merit of being original and altogether unintelligible to the ordinary Latin scholar; to be told by Bréal that such interpretations as these are to be put on some of the phrases that occur in the Tables (though no one has elsewhere ever heard of a Fisian Hill, and of deities bearing the designation Die Grabovie, Trebo, Jovio, Marti Grabovie, Fiso Sancio) Die Grabovie piato collen Fisium, sues altiles tres facito Trebo Iovio pro colle Fisio; tres boves facito Marti Grabovie pro colle Fisio, sues lactentes tres facito Fiso sancio pio colle Fisio:—such considerations are of themselves *a priori* not very acceptable, and do not deserve to be regarded as offering a satisfactory explanation of a serious document. The honest contention must be strengthened as it can be, and is, by any amount of cumulative evidence, that such an interpretation as Bréal has advanced, intangible and chimerical in many of its forms and explanations, must be regarded as altogether inferior to the historical interpretation of which a somewhat full summary has been given.

NOTE:—It has not been found possible to print *in extenso* the decipherment of the Umbrian Inscriptions, together with the Geographical and Ethnological notes, that are appended, all of which are in readiness.

GEOLOGICAL AND MINING SECTION.

A Committee of the Geological and Mining Section, consisting of Wm. Hamilton Merritt, F.G.S., Chairman; Archibald Blue, Secretary; Dr. P. H. Bryce, Mr. John Notman and Mr. R. W. Phipps, have made a Report on the Mining Industries of Canada, which states:

1. That as shown by successive annual reports of the Geological Survey, extending over a period of more than forty years, the known mineral resources of our country are a vast and valuable possession. In precious metals there is reason to believe that we have rich occurrences of gold and silver; while in the economic minerals the country is pre-eminently rich in iron, copper, gypsum, apatite and coal. We have also manganese, barytes, antimony, plumbago, asbestus, salt, petroleum, slates, building stone, marbles, limes, cements, mineral pigments and minerals applicable to the fine arts in proved abundance.

The recent discoveries of copper and gold in the vicinity of Sudbury, of new silver lodes in the district of Port Arthur, of anthracite and bituminous coals on the eastern slope of the Rocky Mountains, as well as various new discoveries of gold, silver, lead and coal in the heart of British Columbia, now accessible by means of the Canadian Pacific Railway, encourage the hope that a systematic survey of the country will reveal stores of vast extent and richness, the existence or locality of which is not now suspected.

2. Your Committee have obtained information relating to the mineral and metallurgical products of the United Kingdom of Great Britain and Ireland from the annual reports prepared by Her Majesty's Inspectors of Mines, and to the same in the United States from returns compiled by the "Division of Mining Statistics" of the United States Geological Survey.

From one of the first-mentioned reports a good deal of information has been obtained concerning the trade between the United Kingdom and her colonies, and also the production of the principal colonies.

The data for the tables illustrating the trade between the Dominion and the United Kingdom has been obtained from our Trade and Navigation Returns, and the trade with the United States from the same source, and also from the Commerce and Navigation Returns of the United States.

While these latter tables have been made up to the year 1886, though it is feared more or less imperfectly owing to varying and incorrect returns, much of the trade of Great Britain, both with her colonies and the rest of the world, is from the returns of the year 1883, which was the only report available to your Committee until quite recently, when the returns for 1884 and 1885 were received; but it is found that in the aggregate the variation between the returns for the years 1883 and 1885 is so small, and the work of sifting out the special returns for the colonies (which are not kept separate) so laborious, that it was thought the returns above mentioned would serve every requisite on this occasion. For example, the general summary of the mineral product of the United Kingdom for 1883, was about fifty-six million pounds sterling, for 1884 about sixty-one million pounds sterling, and for 1885 about fifty-eight million pounds sterling.

3. The tables accompanying this report reveal to us at the first glance the small mineral production of Canada, not only in contrast to the United Kingdom, and to our neighbor the United States, but as compared with the other leading colonies.

Taking the figures collected by Her Majesty's Inspectors of Mines for 1884 we have for—

African Colonies	$15,905,181
Asiatic (including India)	5,532,089
Australasia	47,885,069
British North America	6,108,995

The following table makes a brief comparison between ourselves and our neighbors showing the total number of miners employed in both countries and the production of copper, iron and salt in the last census years respectively :—

	Canada. 1880.	United States. 1879.	Ontario. 1880.	Michigan. 1879.
No. of miners...........	6,541	234,228	493	6,978
Copper ore, tons..........	8,177	1,007,490	170	938,960
Iron ore, tons	223,057	7,974,806	91,887	1,837,712
Salt, bbls...............	472,000	3,521,221	472,000	2,485,177

In 1886, according to the Report on Minerals in Canada by the Geological Survey, the total value of mineral production vas $10,-529,361 (or $11,529,361, errors corrected) while the total value of mineral production in the United States in the same year, according to the Report on Mineral Resources by the Geological Survey of that country, was $459,327,888—being a proportion of about 1 to 40.

Your Committee are emphatically of opinion that this great disproportion does not exist in the mineral resources of the two countries.

4. From Table "A," accompanying this report, it will be seen that for the year 1886, the imports into Canada of mining and crude metallurgical products from the United Kingdom were $6,880,103 and from the United States $9,448,776, while the exports from Canada in the same year to the United Kingdom were $591,632 and to the United States $3,187,163.

The above figures are from the Trade and Navigation Returns of the Dominion. We give a separate table "Aa," compiled from the United States Trade Returns in order to show the remarkable difference there is in the returns of the same article given by the two countries.

In each case there was a balance against us of about six millions of dollars, but it will be borne in mind that the tariff of the United States is in many productions practically prohibitory.

Again, taking Canada's exports of produce of the mine to Great Britain, the United States and all other countries for the ten fiscal years 1877-1886, we have the following figures :

Year.	Great Britain.	United States.	Other Countries.
	$	$	$
1877	1,061,201	2,413,525	169,314
1878	142,374	2,472,979	200,994
1879	265,305	2,636,334	181,261
1880	216,867	2,495,624	164,860
1881	253,652	2,346,529	167,648
1882	311,456	2,418,021	284,096
1883	443,831	2,198,014	329,041
1884	519,672	2,505,501	221,919
1885	485,408	2,898,518	255.611
1886	589,832	3,115,696	245,619
	4,289,598	25,500,741	2,220,363

5 Believing it would be of interest to ascertain the trade of the United Kingdom and of the United States as well as that of Canada with the world at large in minerals and metallurgical products, your Committee have prepared two sets of tables with this in view.

The first set " B " take the exports and imports for the years 1881 to 1884 inclusive. They shew that on the average the values of exports were, from

Great Britain	$228,908,727
The United States	72,500.654
Canada	3,338,231

and that the values of imports were, to

Great Britain	98,801,964
The United States	72,887,652
Canada	24,349,898

The second table " C " treats more fully with the detail and takes into consideration only the crude metallurgical products.

From this we get values of exports of

	United Kingdom.	United States.
Ores	$ 54,149,094	$13,770,477
Metallurgical Product	176,560,594	65,262,079
Total	$230,709,688	$79,032,556

While the values of imports were:

	United Kingdom.	United States.
Ores	$33,512,356	$ 9,033,986
Metallurgical Product	33,433,902	54,775,490
Total	$66,946,258	$63,809,476

The first table shows us that the United Kingdom exports three times as much of minerals and their products as the United States, while she imports one-third more than the United States.

From the second table we gather that the United Kingdom imports about four times as much ore matter as the United States and a little more than one-half the crude metallurgical product.

The imports of ores to the United Kingdom are chiefly copper ores and regulus, silver ore, iron ore, iron pyrites and phosphates, with lesser quantities of ores of lead, manganese and gold; while the United States imports her largest quantities in coal, silver and iron ores and salt, with smaller quantities of clays, copper ores, phosphates and asbestus, and a small quantity of most other economic minerals.

In crude metallurgical productions the United Kingdom imports very large amounts of copper, lead, tin and zinc, while the importation of the United States is chiefly made up of iron and steel, with tin, earthen and China-ware next in importance, and lesser amounts of fertilizers, lead, zinc and marbles.

6. A Table "D" has also been prepared shewing the trade carried on by the United Kingdom with Canada, with her other colonies and also with the rest of the world in mining and crude metallurgical product.

This shews that the colonies do as yet but a small proportion of business compared with that carried on by the United Kingdom with foreign countries, the imports to the United Kingdom in 1883 being:

From Canada	$ 512,471
From Colonies (other than Canada)	8,137,274
From other Countries	58,281,835

While exports from the United Kingdom were:

To Canada	$ 7,765,344
To Colonies (other than Canada)	51,616,930
To other Countries	170,975,358

A.

From Dominion Trade and Navigation Returns.

EXPORTS, 1886.

	Value in Dollars.	
	To United Kingdom.	To United States.
	$	$
Coal, bituminous	76,304	1,127,677
Gold	450	1,210,864
Gypsum		112,271
Mineral oil		27,742
Antimony ore	35,320	3,000
Copper ore		291,397
Iron ore		23,039
Manganese ore	29,853	13,001
Silver ore		25,134
Phosphates	407,314	6,817
Plumbago	1,481	
Salt		26,714
Sand and gravel		23,195
Slate		4,256
Stone and marble (unwrought)		59,888
Other articles	40,588	159,670
Gypsum (ground)		18,485
Lime		18,552
Stone and marble (wrought)	328	15,461
	$591,638	$3,187,163

IMPORTS, 1886.

	Value in Dollars.	
	From United Kingdom.	From United States.
	$	$
Salt—Bags fine, coarse ; bags coarse and bulk........	206,262	14,348
Brass—Tubing, bars, strips, wire clots, scrap, sheet and wire....................................	88,625	298,960
Cement—Hydraulic, bulk and bags, and Portland....	104,592	15,441
Coal—Anthracite..................................		4,095,966
" Bituminous..................................	199,661	2,527,807
Coke..	6,037	37,798
Copper—Bars, rods, scrap, pig, sheet and wire........	92,600	132,611
Earthenware.......................................	413,223	32,367
China and porcelain................................	76,859	9,372
Iron and steel—Dutiable and free, including scrap and wire..	4,625,841	1,091,986
Lead..	149,107	5,439
Marble..	3,138	78,575
Britannia metal, type and babbit metal, pewter......	12,295	75,226
Asbestos (manufactured)............................	548	6,283
Mineral substances and ores (not otherwise specified)..	5,995	23,882
Plumbago—Raw and manufactured.....................	118	5,663
Mineral oil..		421,730
Products of shale, petroleum, etc....................	1	59,374
Gypsum (manufactured).............................	2,469	6,034
Diamonds and precious stones—Unset................	60,634	15,970
Paint—Fireproof...................................		2,143
Slates..	1,060	25,651
Building stone, granite, flagstone and grindstone.....	16,312	85,513
Tinware and block tin..............................	154,649	190,529
Zincware and block zinc............................	53,434	16,584
China—Fire, pipe and other clays and chalk........	18,690	16,558
Brimstone...		2,809
Tin plates...	619,971	124,849
Litharge, lime and whiting..........................	35,106	15,446
Nickel and bismuths................................	70	289
German silver and silver sheets......................	2	9,981
Sand and gravel....................................		22,692
	$6,880,103	$9,448,776

Aa.

From Commerce and Navigation Returns of the United States.

Exports (to Canada), 1886.

Ore or Metal.	Value in Dollars.
	$
Coal Anthracite	2,564,340
" Bituminous	751,895
Copper—Ingots, bars, old, sheets and other manufactures	27,080
Copper ore	4,680
Earthen and stoneware	68,310
Chinaware	8,145
Iron—Pig, bar, carwheels, castings, plates and sheets, railroad bars or rails, iron and steel; wire, iron and steel	374,182
Iron ore	1,122
Lime and cement	25,047
Marble and stone, unmanufactured; roofing slate and other manufactures	228,639
Mineral oil—Naphthas, illuminating and lubricating	479,576
Quicksilver	3,666
Salt	4,873
Tin, manufactures of	38,893
Zinc—Pigs, bars, and manufactures of	11,439
	$4,591,887

Imports (from Canada), 1886.

Ore or Metal.	Value in Dollars.
	$
Coal Bituminous	1,014,116
Copper ore	332,240
Gold bars and bullion	687,705
Silver bullion	1,827
Unspecified mineral substances	3,646
Iron ore	25,731
Stone, slates, etc	92,756
Mineral oil	15,204
Salt	53,317
Phosphates	6,740
Gypsum, unground	115,003
Plumbago	2,405
Precious stones and imitations	65,637
	$2,416,327

IMPORTS OF THE UNITED STATES.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Brass and mnfrs. of...	494,249	668,136	570,666	470,435
Coal and coke.. ...	2,008,967	2,192,689	2,084,151	2,589,958
Copper and mnfrs. of.	564,923	317,172	191,285	291,603
Iron and steel & mfrs. of (including ore)...	51,454,574	53,898,267	40,837,376	42,917,747
Lead and mnfrs. of...	163,742	211,935	170,198	92,861
Marble and stone and manufactures of....	749,763	798,542	819,567	950,217
Metals and mnfrs. of, not elsewh'r specif'd	1,162,913	1,429,918	1,489,445	2,248,814
Mineral oils and other mineral substances..	112,152	187,248	141,532	89,154
Platinum............	294,635	334,183	391,766	373,110
Salt	1,900,610	1,561,132	1,476,946	1,527,455
Slate and mnfrs. of...	46,864	45,928	49,919	
Tin and mnfrs. of....	18,685,903	21,838,261	22,903,572	5,482,909
Zinc and mnfrs. of...	262,218	949,041	802,933	251,476
Totals..........	$77,901,513	$84,432,452	$71,929,356	$57,285,739

B.

EXPORTS OF CANADA.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Coal................	1,123,091	1,078,704	1,087,411	1,201,172
Gold................	767,318	930,951	911,383	952,131
Gypsum, ground and unground.........	132,787	138,180	160,794	172,928
Lime	....	....	....	....
Mineral oils..........	631	136	368	7,546
Antimony ore........	3,921	4,733	11,842	4,855
Copper ore..........	150,412	139,245	150,479	214,044
Iron ore and products of iron and steel....	445,707	571,700	556,100	354,667
Manganese..........	38,738	37,485	29,417	15.851
Silver	34,494	15,110	14,200	12,920
Phosphates..........	239,493	327,667	302,716	453,322
Salt.................	39,566	36,418	17,511	17,408
Sand and gravel......	12,511	13,789	17,755	14,152
Stone, marble & slate, wrought & unwrou't	95,726	115,167	94,880	82,392
Total.............	$3,084,395	$3,409,285	$3,354,856	$3,504,388

IMPORTS OF CANADA.

ARTICLES.	1881.	1882.	1883.	1884.
	$	$	$	$
Brass and mnfrs of.. .	276,958	362,581	383,106	393,544
Coal	4,094,294	4,696,007	6,389,804	7,503,871
Copper and mnfrs of..	160,329	222,219	243,222	235,510
Gold and silver and mnfrs. of.	233,806	333,820	345,515	230,614
Iron and steel and mnfrs. of *.	12,224,180	16,378,344	18,253,179	13,464,742
Lead and mnfrs. of. . .	150,292	181,354	203,100	166,804
Marble, slate and stone and mnfrs. of. . . .	220,323	236,440	265,491	265,594
Metal, composition and other.	368,967	462,286	649,236	611,909
Oils, mineral.	280,638	453,250	460,728	427,641
Salt	494,633	323,807	422,367	360,192
Zinc and mnfrs. of.. .	126,469	99,736	22,599	99,742
Tin and mnfrs. of. . . .	413,924	946,522	1,258,136	1,001,769
Total.	$19,044,813	$24,696,366	$28,896,483	$24,761,932

* Not including sewing machines and agricultural implements.

C.

Ores.	Exports.		Imports.	
	From United Kingdom, 1883.	From United States, 1886.	To United Kingdom, 1883.	To United States, 1886.
	$	$	$	$
Clays, except ordinary	935,404	9,978	....	225,323
Coal, anthracite......	....	2,707,590	....	20,140
" bituminous.....	51,739,166	1,480,940	....	2,551,954
Coke....	....	18,327	....	....
Cobalt and nickel ore and matter........	....	11,687	....	....
Copper ore & regulus.	....	3,068,879	2,387,926	417,449
Gold ore...........	....	34,160	21,384	1,397
Silver ore...........	....	....	5,008,434	1,263,257
Iron ore	....	144,652	13,369,228	1,306,033
Iron pyrites, chiefly cuprous....... ..	....	....	6,590,563	....
Lead ore.....	16,524	....	983,129	....
Manganese ore......	....	....	496,217	....
Phosphates..........	....	....	3,955,189	426,243
Quicksilver...	....	219,259	....	....
Salt	1,458,000	29,827	....	1,499,182
Tin ore......... ...	....	....	3,474	....
Zinc ore...........	....	24,951	696,812	....
Mineral oil, crude....	....	5,859,577	....	15,581
Marble and stone, unmanufactured	....	159,553	....	....
Platinum...........	....	....	....	356,041
Plumbago..........	....	....	....	164,111
Aluminum	....	....	....	5,298
Bismuth	....	....	....	117,768
Gypsum	....	....	....	116,202
Buhr stones, unmnfd.	....	....	....	40,772
Lithographic stone ...	....	....	....	73,884
Mica...	....	897	....	43,107
Charcoal...........	....	....	....	35,544
Emery.............	....	....	....	83,214
Pumice.............	....	....	....	30,128
Talc	....	....	....	25,394
Mineral subs, not elsewhere specified....	....	....	....	123,864
Asbestos, crude......	....	....	....	91,089
Total ores.... ..	$54,149,094	$13,770,477	$33,512,356	$9,033,986

C.

Metals.	Exports. From United Kingdom, 1883.	Exports. From United States, 1886.	Imports. To United Kingdom, 1883.	Imports. To United States, 1886.
	$	$	$	$
Brass and mnfrs. of	....	150,807	....	404,678
Bronze and mnfrs. of	....	....	....	714,473
Cement	....	123,103	....	722,576
Asbestos, mnfd	....	29,303	....	....
Copper, unwrought, partly wrought, pigs, bars and sheets	23,660,224	2,498,898	8,679,717	57,651
Copper, mnfrs. of	45,527	108,975	362,293	122,985
Earthen, stone and chinaware	....	163,908	....	4,947,621
Fertilizers	....	1,107.657	....	1,680,473
Iron { Pig	....	....	....	4,041,366
Iron { Mfrs. of iron and steel	138,948,439	15,745,569	....	33,278,088
Lead, pig, mnfrs. of	2,765,937	114,098	7,423,354	865,820
Lime	....	....	....	41,107
Mineral oil { Refined / residuum	....	44,340,267	....	....
Slates	1,216,098	605,261	....	....
Terra alba, etc	....	....	....	25,878
Tin plates	....	....	....	....
Plaster Paris, ground and calcined	....	....	....	38,852
Tin, bars, blocks or pig / Tin, mnfrs. of	9,042,163	....	11,872,790	5,873,752
Tin, mnfrs. of		157,724	....	....
Marble and stone and mnfrs. of	....	....	....	872,036
Zinc, blocks and pig	882,206	64,410	5,095,748	119,425
Zinc, mnfrs of	....	12,749		49,406
Nickel, mnfrs. of	....	35,302	....	....
Platinum, mnfrs. of	....	4,048	....	....
Other metals, metal compts & mnfrs, not elsewhere specified	....	....	....	1,920,103
Total metals	$176,560,594	$65,262,079	$33,433,902	$54,775,490
Total ores (carried forward)	54,149,094	13,770,477	33,512,356	9,033,986
	$230,709,688	$79,032,556	$66,946,258	$63,809,476

D.

From Report H. M. Inspectors of Mines, 1883.

Articles.	Exports from United Kingdom.			Imports to United Kingdom.		
	To Canada.	To Colonies, (other than Canada.)	To Other Countries	From Canada.	From Colonies, (other than Canada).	From Other Countries
Clays (except ordinary)			$ 935,404			
Coal	$397,445	$7,490,270	43,851,449			
Copper, unwrought, wrought, yellow metal and manufactures	266,814	8,241,082	15,152,347		2,316,276	6,725,734
Copper ore				and Newfld. 166,909	354,425	1,851,834
Iron ore			38,014			13,369,228
Iron—Pig, bar, angle, bolt, rod, railroad, Tin plates and sheets, hoops, sheets and boiler plate, wire (except telegraph), cast and wrought, steel, unwrought, iron and steel combined	6,735,474	33,705,135	98,507,840			
Lead—Pig, rolled sheet, piping and tubing.	145,493	1,093,014	1,527,629			7,423,354
Lead ore			16,524		96,665	886,464
Salt	120,712	400,566	930,131			
Slates		104,762	1,111,336			
Tin	98,726	31,794	8,573,465		5,022,285	6,850,505
Tin ore					3,474	
Zinc	680	550,307	331,219			5,095,748
Zinc ore					208	696,604
Gold ore						21,384
Iron pyrites						6,590,563
Manganese ore (1882)				21,252	24,951	450,014
Phosphates				324,230	278,473	3,352,486
Silver ore					40,517	4,967,917
Total	$7,765,344	$51,616,930	$170,975,358	$512,471	$8,137,274	$58,281,835

SNAKE POISONS.

Abstract of paper read before the Canadian Institute by Dr. J. H. Garnier, November 5th, 1887.

Snake poisons have riveted the attention of mankind from the earliest ages, and the Hindoos likely used snakestones even before the first historical mention of men. Snake charming is a profession in all the Indo Malay countries as well as Hindostan proper, and the secrets of their profession are carefully handed down from father to son. All things go by caste in that country and the secrets of a profession never are allowed to pass out of the family and its proper descendants. In North America there are three well marked varieties of poisoning; first, by the Colubrine snake, "elaps fulvias" and the local varieties of it that exist in various regions of the Southern States; second, by the Copper head and Cotton mouth, Ancistrodon Contortrix and Ancistrodon Piscivorus. thirdly, by the true rattlers. In Canada there may be two or three species, but they are now becoming very scarce. The only variety in Ontario is the little prairie rattle snake or Massissauga, the Caudisoma Tergemina of Baird and Girard. The symptoms of the bite of rattlesnakes, are extreme pain in the bite, yet with a dead or numb-feeling; swelling of the adjacent regions; rapidity of pulse; laborious breathing; congestion of the lungs; spitting blood or rusty sputa; then gradual syncope and failing pulse; extreme drowsines; faintings and death. The poison is absorbed from the bite, and disseminated through the entire body, blood, nerves, veins, arteries and every tissue is affected.

We need a remedy that will follow this death dealing poison into every cranny and corner of the system, and neutralize it the moment they meet, there and then. Such a remedy I propose to lay before you to-night, and from the extreme ease of giving it and as, both portions of it being easily procured, it is at everybody's command, I hope sincerely it may be given a fair and honest trial. The ingredients are first Iodide of Potash say one dram to be taken in two ounces or more of cold water, tea, coffee or any similar fluid. Then let it have about ten minutes to get absorbed into the blood and circulation. It is very rapidly passed through the coats of the stomach into the circulation and system. This had best be repeated twice to make sure and have the entire system impregnated. Then use an incompatible or another substance that at once resolves the iodide into its elements, and sets the iodine free. Sweet spirits of Nitre does so. Give an ounce in water or mucilage or syrup of any sort. It is far best to give a large dose and make sure. The Nitric Ether is even more rapidly absorbed than the iodide of potash and the instant they meet in solution the iodine is freed and at once attacks and neutralizes the venom.

I had received a large jar from India, with many poisonous snakes, and the jar was broken on its route, the snakes consequently on arrival were withered and dried. These were placed with the heads down in a large vase and a quart of water and a pint of proof spirit poured over the heads to soften them. In the vase were two gnans Hamadryas Elaps, (Cantor). These are the most deadly of the cobra family, and the largest. The first was 9 feet 1 inch, the smaller 7 feet 8 inches. This herculean cobra fears nothing and flies from nothing. Mr. Theobald mentions a case of an adult young male elephant that was struck between the eyes by a large gnan, and died in three hours and of a snake charmer who was bit in the wrist and died in a few minutes. The reason of dwelling on this species will be seen on reviewing my own personal case, and I do not wish to endure such extreme agony again.

There were two adult cobras, one sixty and the other fifty-six inches long.

One Trimesurus Carinatus half-grown eighteen inches long.

Two Echis Carinata, one adult sixteen inches, the other twelve and half inches very deadly from Bushere, in Persia.

Two Bungarus Fasciatus, one five feet four a grand specimen, and a smaller twenty-nine inches but large enough to kill anybody.

Three Bungarus Cœruleus—the Krait, adults forty-four, forty-three and thirty-six inches respectively.

Two Daboia Russellii, the famous Tic Polonga killed in the Botanic gardens of Calcutta, thirty-seven and thirty-four inches long, about half-grown.

It is a well established fact, that snake poisons lose nothing of their virulence by the addition of water or spirit though a rather larger quantity is required to be injected to kill.

What came from all these heads was comparatively small of necessity, but even a small portion of it produced the symptoms of this terrific poison as I found to my cost. In February, 1883, I read a paper before the Institute, "On the poisonous snakes of North America," pointing out in theory the use of iodine as a remedy and little deemed I should be personally the first on whom it was to be tested.

After the above mentioned snakes heads had been duly softened I very cautiously manipulated them, opening their mouths and examining the fangs with a powerful hand glass. Previously, that morning in lifting a stove-stick I received a small abrasion and some slight scratches on the ring finger of my right hand. I worked away among this fluid for about three hours, the abrasions being constantly immersed, and at first smarted a little, but this soon subsided, and I continued my investigations and my notes. I then drove into the country for a couple of hours and was unconscious of any pains or annoyance whatever from the poison. About six in the evening there was a dead numbness and great pain in the ring finger and all up my arm, but I took little notice of it. At no time did it extend above the shoulder. Then I became dizzy and squeamish, but these symptoms were transient, but the pain and numbness were continual and persistent and I asked myself what had produced it. I was asked if I had got my arm hurt? No, I had not.

Were you working with strychnine or other poisons? No, I was not. What were you doing with the snakes' venomous heads? Has that caused it? No. Yes! Yes perhaps. I felt very heavy. I belittled the matter but felt truly alarmed. I then mixed a dram of iodide of potash in two ounces of cinnamon water and swallowed it. In ten minutes I did so again. Then in a few minutes more I took an ounce of spirit of nitre in water and mucilage and a glass of whisky. The relief was very rapid and I cannot have been mistaken in attributing the quick relief to the remedy I took. It was no fancy. It was a fact. I took some more whisky and a little after nine o'clock I took a glass of strong brandy punch and went to bed. The pain decreased but my arm felt as if recovering from a heavy blow. I began to perspire and soon fell asleep. Next morning I was nearly all better, and in a few days I was quite well.

In snake bites a deal depends as to deadliness, on the size and species of snake, the season of the year, autumn and extremely hot weather being worst, and the part bitten. A bite in the throat, an artery or vein being worst, then the extremities and glandular portions etc. Dr. Jefferies, of Cain City, near Elsworth, Kansas, was requested by me to try my plan and gave me three cases in which he was most successful. He says, "The first was the case of a young farmer, aged nineteen, Mr. Sweicher, who was bitten on the left foot by a large rattesnake on September 23d, 1884. I saw him two hours and a half after as he had to drive fifteen miles. The foot was much swelled with intense pain up the leg. I gave him a glass of whisky. Then one dram iodide of potash in rose water. In ten minutes I gave him an ounce spirit ether nitre. I repeated these doses three times, and gave him several doses of whisky. He was at once wonderfully relieved, and feeling greatly better soon went away. On leaving I gave him a mixture of iodide of potash three drams to an eight ounce mixture, and directed a desert-spoonful thrice a day. He went to Southern Kentucky for a time and thoroughly recovered and used no other remedy, nor had he the recurrent symptoms.

The second was the case of Mr. Labrodaire, aged thirty-five. On May 9th, 1887, was bitten by a rattlesnake, just above the ankle. I saw him about an hour after the accident. He was weak, pulse 112, face anxious and livid, ankle swelled, and great pain extending into the leg and up the thigh. I at once gave him a drachm and a half of iodide in solution, and in ten minutes half an ounce of sweet spirit of nitre. I also gave about three ounces of brandy. I repeated this treatment for an hour and a half, but I greatly reduced the doses every twenty-five minutes, and gave a little more brandy. He was at once relieved, indeed astonishing so, and on his going I prescribed for him, Iodide Potash, 4 drams; Fluid Extract of Sarsaparilla, 2 ounces; Carbolic Acid, 20 drops; Rose water to 8 ounces, mix and direct a tea-spoonful three or four times a day. He quickly recovered and never experienced any recurrent troubles to any amount.

But the most notable case was of a valuable collie dog which was the property of a Mr. Burt, who lived two miles from my office. He was ploughing and saw a large rattlesnake strike his dog in the leg. He at once unhitched, put his horses to his waggon and brought his dog to me in it. He was most anxious about his dog. I gave the animal two drams of iodide in solution and had some difficulty in getting it down his throat. In ten minutes I gave him an ounce of sweet spirit of nitre. We then went into the office intending to repeat the dose diminished, in half a hour or so, and left the dog in the waggon. I had little faith in any remedy in this case, as the creature was greatly paralyzed and exhibited great suffering. His life was ebbing fast and he seemed to be dying, with no hope of recovery. Mr. Burt was very sorry and did not wish to see his faithful dog die, in agony, in the waggon. In half a hour we intended to repeat the dose and then went out to do so. But you may guess at our astonishment when we found that our canine patient had disappeared, where we could not tell, and we searched and whistled for him in vain. Mr. Burt and myself were puzzled, and he was anxious and started for home. On arriving he was more astonished still to find that the dog had arrived first, and was quietly awaiting his master's return. He came to my office next day, and informed me, the dog was alive and doing well, and was tied up for a few days that he might have a perfect recovery and rest. When I reflect on the prostrated condition he was in on arrival, and knew for a fact, that he had received a full dose of poison from the fangs of a large rattlesnake, I cannot but express the greatest amazement, at the almost miraculous rapidity, with which this seemingly simple remedy acted. "Dr." said Mr. Burt to me, "that dog is worth hundreds of dollars to me, as he does two or three men's work, in herding my cattle."

This animal throughly recovered and seemingly had none of the paralysis and pain, so often left as a souvenir of rattlesnakes' bites, both to man and beast.

I have had other minor cases but these are the most noteworthy, and in all cases the iodide of potash given first and then followed in ten minutes by the spirit aether nitre has been eminently successful. Judging then, by my own experience, I believe if your method of treatment is carried out, in cases similar to these that a failure is impossible and that a speedy restoration will always follow.

(Signed) B. Grant Jefferies, M.D."

I am not the first to point out iodine as a cure for snake bites, as twenty-five years ago Mr. Viaud Marais did so, but he used metallic iodine and failed.

Snake bites cannot well be tested in Canada except foreign poisonous snakes be procured for this purpose. But trivial dependence can be placed on experiments on dogs and other animals. We need positive trials on the human subject and nobody will voluntarily undergo such a test.

But it would be an easy matter for the executive authorities to sanction such an ordeal, and have it carried to completion on the human body without annoying the feelings of the most sympathetic. Are there not very many persons yearly condemned to death, all over the world? What good is obtained for society by hanging or guillotining these miscreants? They have forfeited the sympathies of mankind, and are, so to speak, beyond the human pale. Why not utilize such desperadoes in the causes of science? In testing the efficacy of this, so far, seeming cure, in a legitimate manner on the carcase of a murderer, it should outrage nobody's feelings and humanity heeds little the distorted sympathy of a foolish crank. If all mankind be benefited and a remedy for snake poisons proved effectual by this means, even though a miscreant be sacrificed in the trial, such a life already condemned to be extinguished, is little to be regarded. I most unhesitatingly assert that if the bodies of parties who had forfeited their lives, were employed for scientific research, it would be a grand step in the march of civilization, a step in moral improvement, and must tend to the elucidation of our knowledge in the treatment of very many obscure diseases. Is it not fit that a few cast-aways should suffer to save the living masses of society?

Other assistants to the treatment here presented are snakestones and ligatures.

Snakestones are applied at once to the puncture made by the fang of the snake and adhere and draw out the poison, and as soon as they become filled drop off and hold the venom so extracted; they are then thrown into milk or water and the venom swims on the top. Milk is the better to use, as the poison turns green and is easily seen. I recommend a cut to be made over the puncture and several folds of blotting paper to be introduced, so as to suck up the serum and poison at once. Absorbing cotton or any similar article is always readily obtained.

Ligatures delay circulation and absorption and give more time for action, and thus help. Nevertheless ligatures alone, no matter how tightly applied, do not prevent the poison getting into the circulation and causing death. But in case of a finger or toe being bitten, amputate at once. It is the King of all cures. In case it is practicable cut out the part bitten at once and delay no time.

Next to the knife I certainly think the iodide of potash and followed in a few minutes by sweet spirit of nitre, is the best remedy we have. In all cases whisky and spirits are a very great help. If a person is truly under the influence of snake poison, it is scarcely possible to make him drunk.

A most careful series of researches have yet to be made on the action of snake venom on the blood, on the nerves, on the muscular coats of the arteries, and veins, and the tissues, and glands. This must be done in the near future, and every part be brought upon the field of the microscope.

If Iodine be a remedy in general for snake bites and their venom which I am strongly led to believe, then I think I have pointed out a scientific mode of distinguishing it, when bona fide in circulation. It will be admitted that my own case, and the cases stated by Dr. Jefferies bear a powerful evidence in its favor that none can lightly cast aside. Be it the iodine, be it the nitrate of potash or the the spirits, mixing in the blood, and reacting on this venom and poison in the serum, fibres or blood-corpuscles, there seems little doubt that the action and destructive energy of this venom on human or animal life is quickly stayed and the subsequent recurrent and most distressing symptoms are greatly alleviated. I claim no specific for snake bites in this my treatment, as I know full well that such a claim is futile "*just now*," but I do claim that it is well worthy of a fair and honest trial, and if it prove a success in treating such deplorable and terrible accidents, I shall feel heartily glad to know that I have been of some use to my fellow men.

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Internationales Permanentes Ornithologisches Comité	"	—17.

(3.)—BELGIUM.

Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique	Bruxelles.	
Société Royale de Botanique de Belgique	"	
Société Royale Belge de Géographie	"	
Musée Royale d'Histoire Naturelle de Belgique	"	
Société Liégeoise de Littérature Wallonne	Liège.	—5.

(4.)—DENMARK.

Kongelige Bibliotheket	Copenhagen.	
Kongelige Danske Videnskabernes Selskab	"	
Kongelige Nordiske Oldskrift Selskab	"	
Nordisk Tidskrift for Filologi	"	—4.

(5.)—FRANCE.

Académie Nationale des Sciences, Arts et Belles-Lettres .... Caen.
Société Nationale des Sciences de Cherbourg .... Cherbourg.
Académie des Sciences, Arts et Belles-Lettres de Dijon ...... Dijon.
Union Géographique du Nord de la France................ Douai.
Société Géologique de Normandie .... Le Havre.
Société Géologique du Nord.............................. Lille.
Société de Géographie de Lille .... "
Société pour l'Étude des Langues Romanes................ Montpellier.
Académie des Sciences, Inscriptions et Belles-Lettres...... Toulouse.
Annales des Mines....................................... Paris.
Annales des Ponts et Chausées .... "
Société des Ingénieurs Civils .... "
Société Nationale des Antiquaires de France .... "
Société Géologique de France .... "
Société Académique Indo-Chinoise de France.............. "
Société d'Ethnographie.................................. "
Société Américaine de France............................ "
Société d'Anthropologie de Paris .... "
Bibliothèque Nationale .... "
Société de Géographie .... "
"Cosmos" .... "
"L'Électricité"... "
Association Française pour l'Avancement des Sciences...... "
Journal des Sociétés Scientifiques......................... "
Revue Scientifique.. "
Revue de Linguistique et de Philologie Comparée.......... "
Société Zoologique de France .... "
Société Mathématique de France .... "
Bulletin d'Histoire Ecclésiastique et d'Archéologie Religeuse
des Diocèses de Valence, Digne, Gap, Grenoble et Viviers. Romans. —29.

ALGERIA.

Société de Géographie et d'Archéologie de la Province d'Oran.
Académie d'Hippone.—2.

(6.)—GERMANY.

Naturforschende Gesellschaft zu Freiburg .... Baden.
Königliche Preussische Akademie der Wissenschaften..... Berlin.
Gesellschaft Naturforschender Freunde .... "
Gesellschaft für Erdkunde................................ "
Berliner Gesellschaft für Anthropologie, Ethnologie und
Urgeschichte .... "
Bibliographie der Staats-und Rechtswissenschaften .... "
Archiv der Mathematik und Physik .... "
R. Friedländer und Sohn .... "

Naturhistorischer Verein für die Preussischen Rheinlande und Westphalen .... Bonn.
Verein für Naturwissenschaft zu Braunschweig .... Braunschweig.
Naturwissenschaftlicher Verein .... Bremen.
Naturwissenschaftlicher Verein "Isis" .... Dresden.
Senckenbergische Naturforschende Gesellschaft .... Frankfurt-am-Main.
Naturwissenschaftlicher Verein .... Frankfurt-an-der-Oder.
Dr. Ernst Huth .... "
Oberhessische Gesellschaft für Natur-und Heilkunde .... Giessen.
Königliche Gesellschaft der Wissenschaften .... Göttingen.
Naturwissenschaftlicher Verein .... Hamburg.
Verein für Naturwissenschaftliche Unterhaltung .... "
Naturhistorisches Museum zu Hamburg .... "
Geographische Gesellschaft .... Hannover.
Naturhistorischer Verein für Niedersachsen .... "
Historischer Verein für Niedersachsen .... "
Naturhistorisch-Medicinischer Verein .... Heidelberg.
Verein für Naturkunde .... Kassel.
Ostpreussische Physikalisch-Oekonomische Gesellschaft .... Königsberg.
Naturforschende Gesellschaft zu Leipzig .... Leipzig.
Königlich Sächsische Gesellschaft der Wissenschaften .... "
Verein für Erdkunde zu Leipzig .... "
Verein für Vaterländische Naturkunde in Würtemberg .... Stuttgart.
Naturhistorische Gesellschaft zu Nürnberg .... Nürnberg.
Königlich Baierische Akademie der Wissenschaften .... München.
Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte .... "
Görres Gesellschaft (Historisches Jahrbuch) .... "
Verein für Naturkunde .... Offenbach-am-Main.
Zeitschrift für Physiologische Chemie .... Strassburg.
Nassauischer Verein für Naturkunde .... Wiesbaden.—37.

(7.)—ICELAND.

Islenzka Fornleifafélags .... Reykjavik.—1.

(8.)—ITALY.

R. Accademia Petrarca di Scienze, Lettere ed Arti .... Arezzo.
Ateneo di Brescia .... Brescia.
Società Storica per la Provincia e Antica Diocesi di Como .... Como.
R. Istituto di Studi Superiori in Firenze .... Firenze.
Società Italiana di Antropologia, Etnologia, e Psicologia Comparata .... "
Sezione Fiorentina della Società Africana d'Italia .... "
Società Entomologica Italiana .... "
Società di Lettura e Convrsazione Scientifiche .... Genova.

R. Accademia di Belle Arti	Milano.	
R. Istituto Lombardo di Scienze e Lettere	"	
Società Veneto-Trentina di Scienze Naturali	Padova.	
Società Toscana di Scienze Naturali	Pisa.	
Gazetta Chimica Italiana	Palermo.	
Circolo Matematico di Palermo	"	
Società Siciliana per la Storia Patria	"	
R. Accademia di Scienze, Lettere, e Belle Arti di Palermo	"	
Direzzione del Giornale del Genio Civile	Roma.	
Società Geografica Italiana	"	
R. Comitato Geologico d'Italia	"	
R. Accademia dei Lincei	"	
Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche	"	
"Cosmos" di Guido Cora	Torino.	
Archivio di Letteratura Biblica ed Orientale	"	
Notarisia Commentarium Phycologicum	Venezia.	—24.

(9.)—NETHERLANDS.

Koninklijke Akademie van Wetenschappen	Amsterdam.	
Koninklijke Zoologisch Genootschap "Natura Artis Magistra"	"	
Nederlandsch Aardrijkskundig Genootschap	"	
École Polytechnique de Delft	Delft.	
Société Hollandaise des Sciences à Harlem	Harlem.	
Fondation de P. Teyler van der Hulst	"	
Nederlandsche Botanische Vereeniging	Leiden.	
Nederlandsche Dierkundige Vereeniging	"	
Recueil des Travaux Chimiques des Pays-Bas	"	
Koninklijk Nederlandsch Meteorologisch Instituut	Utrecht.	—10.

(10.)—NORWAY.

Musée de Bergen	Bergen.	
Polytekniske Forening	Kristiania.	
Forening til Norske Fortidsmindesmerkers Bevaring	"	
Videnskabs Selskabet	"	
Kongelige Norske Frederiks Universitetet	"	
Nyt Magazin for Naturvidenskaberne	"	
Norwegische Commission der Europæischen Gradmessung	"	—7.

(11.)—PORTUGAL.

Sociedade de Geographia de Lisboa	Lisboa.	
Académie Royale des Sciences de Lisbonne	"	—2.

(12.)—RUSSIA.

Kharkow Mathematical Society	Kharkow.	
Société des Naturalistes à l'Université Impériale de Kharkow	"	

Société des Naturalistes à l'Université de St. Wladimer ...... Kiew.
Societas Scientiarum Fennica Helsingfors .... Helsingfors.
Tifliser Observatorium .... Tiflis.
Société Impériale des Naturalistes de Moscou .... Moscow.
Société Physico-Chimique Russe à l'Université de .... St. Petersbourg.
Comité Géologique .... St. Petersbourg.
—8.

(13.)—SPAIN.

"Crónica Cientifica" .... Barcelona.
Real Academia de Ciencias Morales y Politicas .... Madrid.
Real Academia de la Historia .... "
Sociedad Geográfica de Madrid .... " —4.

(14.)—SWEDEN.

Kongliga Universitetet .... Lund.
Kongliga Fysiografiska Sällskapet .... "
Kongliga Svenska Vetenskaps Akademien .... Stockholm.
Kongliga Biblioteket .... "
Kongliga Universitetet .... "
Svenska Sällskapet för Antropologi och Geografi .... "
Geologiska Föreningens i Stockholm .... "
Acta Mathematica .... "
Kongliga Universitetet .... Upsala —9.

(15.)—SWITZERLAND.

Geographische Gesellschaft von Bern .... Bern.
Naturforschende Gesellschaft in Bern .... "
Société de Physique et d'Histoire Naturelle .... Genève.
Société de Géographie de Genève .... "
Société Neuchateloise de Géographie .... Neuchatel.
Naturforschende Gesellschaft in Zurich .... Zurich.—6.

(16.)—TURKEY.

Syllogue Littéraire Grec de Constantinople .... Constantinople.
Institut Météorologique de Roumanie .... Bucarest.—2.

III.—ASIA.

(1.)—INDIA.

Asiatic Society of Bengal .... Calcutta.
Geological Survey of India .... "
Survey of India Department .... "
"Indian Antiquary" .... Bombay.
"Orientalist" .... Kandy, Ceylon.
—5

(2.)—JAPAN.

University of Tokio	Tokio.	
Asiatic Society of Japan	"	
Deutsche Gesellschaft für Natur-und Völkerkunde Ostasiens..	"	
Literature College of Imperial University of Japan	"	—4.

(3.)—JAVA.

Bataviaasch Genootschap van Kunsten en Wetenschappen...	Batavia	
Nederlandsch-Indische Maatschappij van Nijverheid en Landbouw	"	—2.

(4.)—CHINA.

China Branch of the Royal Asiatic Society	Shanghai.—1.

IV.—AUSTRALASIA.

(1.)—AUSTRALIA.

Royal Society of New South Wales	Sydney.	
Department of Mines, New South Wales	"	
Linnean Society of New South Wales	"	
Board of Technical Education	"	
Royal Society of Queensland	Brisbane.	
Royal Society of Victoria........................	Melbourne	
Public Library of Victoria	"	—7.

(2.)—NEW ZEALAND.

New Zealand Institute	Wellington —1.

(3).—TASMANIA.

Royal Society of Tasmania	Hobarton.	—1.

Total, 394

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THIRD SERIES—Begun 1879.

NOTES.

1.—The First Series has for title, "The Canadian Journal: a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." The Second Series has for title, "The Canadian Journal of Science, Literature, and History." The title of the Third Series is, "Proceedings of the Canadian Institute." Parts 1 & 2, Third Series, are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

2.—By inadvertence, No. 85 (November, 1873) of the "Canadian Journal,' 2nd Series (Vol. XIV.) immediately follows No. 79. There is, however, no *lacuna* between these two numbers, as is shown by the fact that the paging is consecutive.

3.—Societies wishing to exchange back numbers of their Proceedings can be supplied with complete sets of the Publications of the Canadian Institute, except Vol. XV., No. 5, Second Series, and Vol. I., Part 1, Third Series.

4.—Members having either of the above, Vol. XV., No. 5, Second Series, April, 1877, or Vol. I., Parts 1, 3 & 5; Vol. II., Parts 1 & 2; Vol. III., Part 1, Third Series, and being willing to part with them, will please communicate with the Assistant Secretary.