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JOURNAL AND PROCEEDINGS

OF THE

Hamilton Association

FOR SESSION 1889-90.

PART VI.

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PRINTED FOR THE HAMILTON ASSOCIATION BY THE SPECTATOR PRINTING COMPANY.

1890.

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton Association

FOR SESSION 1889-90.

PART VI.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE SPECTATOR PRINTING COMPANY.

1890.

OFFICERS FOR 1889-90.

President.

B. E. CHARLTON, Esq.

Vice-Presidents.

T. J. W. BURGESS, M. B., F. R. S. C. J. ALSTON MOFFAT.

Secretaries.

H. B. WITTON, B. A. A. ALEXANDER, F. S. Sc., Lon., Eng.

Treasurer.

RICHARD BULL.

Curator and Librarian.

ALEXANDER GAVILLER.

Council.

COLONEL GRANT. T. W. REYNOLDS, M. D. S. J. IRELAND.
WILLIAM TURNBULL. A. W. HANHAM.

Museum and Library.

NEW PUBLIC FREE LIBRARY BUILDING,
Main Street West, near James.

NOTICE.

THE HAMILTON ASSOCIATION was instituted on 2nd November, 1857, and continued its regular meetings to the close of the year 1860. During the period between 1861 and 1871, the meetings were held at irregular intervals, the office bearers of 1860 holding office in the meantime. During the years 1871, 2, 3, 4, and 5, the association was more active in its work, regular meetings being held. An interregnum of four years ensued from 1875 to 1880, during which time the Council met at stated intervals. From 1880 to the present time the Association has been in active operation, the Annual Meeting held in May, 1890, being the one hundred and sixty-fourth meeting of the Association.

The Association was incorporated in 1883.

OFFICE-BEARERS.

	President.	1st Vice-Pres.	2nd Vice-Pres.	Cor. Sec.	Rec. Sec.	Treas.	Libr. and Cur.
1857	Rev. W. Ormiston, D. D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1858	John Rae, M. D., F. R. G. S.	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Chas. Robb.....	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith	Rev. W. Ormiston, D. D.	Dr. Craigie ...	Wm. Craigie ..	W. H. Park...	Chas. Robb.
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Rev. W. Inglis, D.D.	Dr. Craigie...	Wm. Craigie ..	W. H. Park...	T. McIlwraith.
1871	W. Proudfoot	Judge Logie.....	R. Bull.....	J. M. Buchan, M. A.	I. B. McQuesten M. A.	W. G. Crawford	T. McIlwraith.
1872	Judge Logie.....	H. B. Witton, M.P.	R. Bull.....	J. M. Buchan, M. A.	I. B. McQuesten M. A.	W. G. Carwford	T. McIlwraith.
1873	H. B. Witton, M.P.	J. M. Buchan, M.A.	A. T. Freed	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.....	T. McIlwraith.
1874	H. B. Witton, M.P.	J. M. Buchan, M.A.	A. T. Freed	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.....	T. McIlwraith.
1875	H. B. Witton,.....	J. M. Buchan, M.A.	W. H. Mills.....	Geo. Dickson, M. A.	Geo. Dickson, M. A.	A. Macallum, M. A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull.....	A. T. Freed.
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D.	B. E. Charlton....	Geo. Dickson, M. A.	A. Robinson, M. D.	R. Bull.....	W. H. Ballard, M. A.
1882	J. D. Macdonald, M. D.	B. E. Charlton....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.....	W. H. Ballard, M. A.
1883	J. D. Macdonald,	B. E. Charlton	H. B. Witton	Geo. Dickson,	Wm. Kennedy,	R. Bull.....	W. H. Ballard,

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1883	J. D. Macdonald, M. D.	B. E. Charlton	H. B. Witton	Geo. Dickson, M. A.	Wm. Kennedy,	R. Bull	W. H. Ballard, M. A.
1884	J. D. Macdonald, M. D.	H. B. Witton	Rev. C. H. Mockridge, M.A., D.D.	Geo. Dickson, M. A.	A. Alexander	R. Bull	Wm. Turnbull.
1885	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle	W. Kennedy	Geo. Dickson, M. A.	A. Alexander	R. Bull	A. Gaviller.
1886	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle	Matthew Leggat	Geo. Dickson, M. A.	A. Alexander, F. S. Sc.	R. Bull	A. Gaviller.
1887	Rev. S. Lyle, B. D.	B. E. Charlton	W. A. Child, M.A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull	A. Gaviller.
1888	Rev. S. Lyle, B. D.	T. J. W. Burgess, M.B., F.R.S.C.	W. A. Child, M.A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull	A. Gaviller.
1889	B. E. Charlton	T. J. W. Burgess, M.B., F.R.S.C.	J. Alston Moffat	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull	A. Gaviller.
1890	B. E. Charlton	J. Alston Moffat	A. T. Neill	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull	A. Gaviller.

LIST OF

Corresponding, Honorary and Life Members

—OF THE—

HAMILTON ASSOCIATION.

ELECTED.

CORRESPONDING MEMBERS.

1881 Clark, Chas. K, M. D., Rockwood Asylum, Kingston, Ont.
1881 Van Wagner, P. S., J. P., Stoney Creek, Ont.
1884 Bull, Rev. George A., M. A., Niagara Falls, S., Ont.
1882 Lawson, A. C., M. A., Geological Survey of Canada, Ottawa, Ont.
1881 Spencer, J. W., Ba. Sc., Ph. D., F. G. S., Columbia, Mo., U. S.
1870 Wright, Prof. W. P., M. A., Los Angelos, California.
1871 Seath, John, M. A., High School Inspector, St. Catharines, Ont.
1885 Frood, T., Sunbury, Ont.
1889 Yates, William, Hatchley, Ont.
1890 Wilkins, D. F. H., B. A., Beamsville.
1890 William Kennedy, Little Rock, Ark.

HONORARY MEMBERS.

Grant, Lt Col., Bay St. South, Hamilton, Ont.
Macoun, John, M. A., Government Botanist and Naturalist, Geological Survey of Canada, Ottawa, Ont.
Dawson, Sir J. William, F. R. S., F. G. S., F. R. S. C., Principal McGill College, Montreal, Que.
Fleming, Sanford, C. E., C. M. G., Ottawa, Ont.
Wilson, Sir D., L L. D., Principal University of Toronto, Ont.
Farmer, William, C. E., New York, U. S.
Ormiston, Rev. Wm., D. D., New York, U. S.
Rae, John, M.D., F.R.G.S., L.R.C.S., L.L. D., London, Eng.
Hurlburt, J. B., M. A., L.L. D., Ottawa, Ont.
Small, H. B., Ottawa, Ont.
Charlton, Mrs. B. E., Hamilton, Ont.
Keefer, Thomas C., C, E., Ottawa, Ont.
Symons, S. Hamilton, Ont.

LIFE MEMBERS.

Proudfoot, Hon. Wm., Q. C., Vice-Chancellor, Toronto, Ont.

MEMBERS OF COUNCIL.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. W. Inglis, D. D.; Adam Brown; C. Robb.

1859—Rev. D. Inglis, D. D.; Adam Brown; Judge Logie; C. Freeland; R. Bull.

1860—J. B. Hurlburt, M.A., L.L.D.; C. Freeland; Judge Logie; R. Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C. E.; Rev. W. P. Wright, M. A; A. Macallum, M. A.; A. Strange, M. D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M. A.; John Seath, M. A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1875—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1880—M Leggatt; I. B. McQuesten, M. A.; A. Alexander; Rev. A. Burns, M. A., L L. D., D. D.

1881—T. McIlwraith; H. B. Witton; A T. Freed; Rev. W. P. Wright, M. A.; A. F. Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M. A., D. D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe.

1884—A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M. D; C. S. Chittenden.

1887—J. Alston Moffat; James Leslie, M. D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

1888—J. Alston Moffat; B. E. Charlton, T. W. Reynolds, M.D.; S. J. Ireland; Wm. Kennedy.

1889—T. W. Reynolds, M. D.; S J. Ireland; William Turnbull; A. W. Hanham; Lt.-Col. Grant.

1890—Col. Grant; A. W. Hanham; W. A. Robinson; A. E. Walker; Thomas Morris.

ABSTRACT OF MINUTES

OF PROCEEDINGS OF THE

HAMILTON ASSOCIATION

FOR SESSION 1889-90.

THURSDAY, NOVEMBER 14, 1889.

The opening meeting of the session was held this evening. The retiring President, Rev. Samuel Lyle, B. D., in the chair.

The Curator and Librarian announced that several important additions had been made to the Library and Museum during the recess.

The Secretary reported what the Council had done during the same period, and Dr. Reynolds told of the work done in the Biological Section.

Attention was directed to the improved appearance of the room by the elegant and valuable donation of new stands for the cases made by Mr. S. Symons.

An offer of two extra rooms, without increase of rental, was made by Dr. McQuesten of New York, through Mr. Chisholm, his agent, on condition the Association renewed the lease. It was left in the hands of the President and Secretary.

Messrs. Harry Lee, manager of the Glass Works, and D. J. Campbell, inspector of the Canada Life Assurance Co., were proposed for membership.

At the close of the routine business, the retiring President introduced the new President, B. E. Charlton, Esq., who delivered his introductory address, at the close of which several members expressed their high opinion of its excellence. It will be found among the published papers of this session.

It was announced that the next meeting would be held on the 2nd Thursday of December, when a paper would be read by Mr. Moffat, and also one by Colonel Grant.

The meeting then adjourned.

THURSDAY, DECEMBER 12, 1889.

The President, B. E. Charlton, in the chair.

The minutes of the previous meeting were read and approved.

A hearty vote of thanks was passed to Mr. Symons for his handsome contribution of new stands for the show-cases and other articles of value.

Messrs. Harry Lee and D. J. Campbell were elected members of the Association, and Mr. William Kennedy, of the Geological Survey of the State of Arkansas, U. S. A., was elected a corresponding member of the Association.

Mr. Chas. E. Torrance was proposed for election.

Mr. John A. Barr presented a series of photographic views of Stratford-on-Avon and of Shakespearian views, for which he received the thanks of the Association.

Contributions to the Museum of Indian relics, and some geological specimens were reported from D. J. Campbell.

J. Alston Moffat then read his paper on "The Question of the Variation of Species." A strong desire was expressed that the paper be published.

Colonel Grant also read a paper entitled "Notes Geological and Antiquarian."

At this meeting Mr. Moffat exhibited his large collection of insects, which added much to the instruction and pleasure of the audience.

The meeting then adjourned.

SPECIAL MEETING, DECEMBER 23, 1889.

This meeting was called for the purpose of considering the offer of the Art School Board to give the Association room for its museum and meetings in the new Public Free Library building.

Mr. Charlton presided, and called on the secretary to read the letter received from the directors of the Art School. The Board

offered the Association about 1,200 square feet of floor space for five years, at a yearly rental of $130, exclusive of caretaker, said lease to be concurrent with the Art School lease, and to be renewed for other five years upon the same terms, provided the Art School obtains a like renewal; but no right to sublet except to the "Wentworth Pioneer Association."

The Council having had this proposition before them, recommended the acceptance of the offer of the Art School Board, and that the President and Secretary be authorized to execute a lease upon the terms mentioned, and also that the owner of the premises now occupied be notified that the Association will vacate the same on the 1st of July next.

On motion, these recommendations of the Council were adopted and the meeting adjourned.

THURSDAY, JANUARY 9, 1890.

In the absence of the President, Mr. J. Alston Moffat presided.

The minutes of the previous meeting and of the special meeting were read and confirmed.

Additions to the Museum and Library were reported by the Curator.

Mr. Charles E. Torrance was elected a member of the Association.

A letter from the President was read, suggesting the handing over of the library of the Association to the Trustees of the Hamilton Public Free Library. The matter was discussed by several members, all of whom expressed disapproval of the proposition. It was eventually left in the hands of the Council to decide.

Mr. H. B. Witton then read an excellent paper on "Indian Fable Literature."

After many members expressed their high appreciation of the paper, the meeting adjourned.

THURSDAY, FEBRUARY 13, 1890.

The President in the chair.

The minutes of previous meeting read and approved.

Mr. S. J. Ireland, Principal of the Art School, read a valuable paper on "Color, Chromatics and the Permanency of Pigments."

The subject was very beautifully illustrated by a costly collection of diagrams, very carefully colored, showing the various tints of the colors supplied by Messrs. Rowney, of London, England, to whom a hearty vote of thanks was accorded.

The meeting then adjourned.

THURSDAY, MARCH 13, 1890.

The President in the chair.

The minutes of the February meeting confirmed.

H. B. Small, Esq., of Ottawa, was appointed to represent the Association at the annual meeting of the Royal Society to be held there in May.

A volume of the Slavonic Bible was presented, through Mr. Witton, from Mr. Charles Robinson, who found it in Sebastopol at the close of the Crimean War.

It was reported that the Council suggested that a portion of the Library be *loaned* to the Free Library, and that Messrs. Moffat and Gaviller had been appointed to make a selection of the books to be so used.

Mrs. J. Rose Holden was elected a member of the Association.

Dr. Burgess then read a paper "Notes on the History of Botany."

The paper was full of interesting information regarding the science and indicated a vast amount of research and an intimate knowledge of the subject.

The meeting then adjourned.

THURSDAY, APRIL 10, 1890.

The President in the chair.

The minutes of the previous meeting confirmed.

A letter was read from Professor Wright, of Los Angelos, California, a corresponding member of the Association, conveying to the Association several beautiful specimens of the lower forms of life on the Pacific coast mounted on cardboard. Those sent being forms of the Polyzoa.

A paper on "Coinage and Money," by H. B. Small, of Ottawa, was read by Mr. Witton.

The paper was peculiarly interesting and brimful of information. Hearty thanks were voted to Mr. Small for his paper.

The meeting then adjourned.

THURSDAY, MAY 8, 1890.

The President in the chair.

Minutes of the last meeting confirmed.

It was announced that the Council had considered the question of lending the Association books to the Public Free Library and propose the following:

1. That all the Government Blue Books and Reports—British, Canadian and American—be handed over to the Public Free Library Board as their absolute property.

2. That all the books suitable for the Circulating portion of the Library be handed over for use in that Department, each book to have the Association label attached and to remain the property of the Association.

3. That all the valuable Reports and Transactions of Learned Societies be loaned to the Trustees of the Public Library to be used in the Reference Department of the same, on condition that they be bound at the expense of the Board and have the Association label attached.

4. In case of the Association having at any time to leave the Library building it is to be understood that the books be given up.

A paper on the "River Valleys of the Niagara Escarpment," by D. F. H. Wilkins, B. A., of Beamsville, was read by A. T. Neil, Secretary of the Geological Section. The paper was well received, and a desire expressed that Mr. Wilkins be requested to attend a meeting of the Association next session, so that the subject of his paper might be thoroughly discussed.

The meeting then resolved itself into the Annual Meeting. The President in the chair.

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

The Secretary read his Annual Report.

Mr. A. T. Neill read the Report of the Geological Section, while that of the Biological Section was read by Mr. Hanham. The Curator, Mr. Gaviller, reported the additions made to the

Museum and Library, and Mr. Bull, Treasurer, gave his Financial Statement. All these Reports were adopted and will be found in full at the end of this volume of the Transactions.

The Election of Officers was then proceeded with, resulting as follows:

B. E. Charlton, - - - - - - President.
J. Alston Moffat, - - - - First Vice-President.
A. T. Neill, - - - - - Second Vice-President.
H. B. Witton, B. A., - - - - - Cor. Secretary.
A. Alexander, F. S. Sc., - - - - Rec. Secretary.
Richard Bull, - - - - - - Treasurer.
Alexander Gaviller, - - - Curator and Librarian.

COUNCIL—A. W. Hanham, Colonel Grant, W. A. Robinson, A. E. Walker and Thomas Morris.

The meeting then adjourned to meet in the new premises on the 2nd Thursday of November.

B. E. CHARLTON,
President.

A. ALEXANDER,
Secretary.

HAMILTON ASSOCIATION

SESSION 1889-90.

THE BENEFITS OF SCIENTIFIC STUDIES, BEING THE OPENING ADDRESS.

BY B. E. CHARLTON, ESQ. (PRESIDENT.)

Ladies and Gentlemen,— 14th November, 1889.

I am sensible of your kindness and courtesy in electing me to the honorable place of first officer of the Hamilton Association, and sensible also of my own indifferent abilities for efficiently discharging the duties thereof.

It is pleasant to be selected for preferment and honor by those with whom one has been long associated in agreeable intercourse, and I would wish to express my acknowledgements and thanks to those around me by whose choice I am placed in this position.

At this the opening meeting of another season of activity, it occurs to me that what I have to say to you to-night might take the line of invitation and solicitation to membership to many worthy friends resident in this city, especially those of literary or scientific tastes, who I am sure would appreciate and enjoy our meetings, and appropriate the benefits to be derived therefrom; and also the line of stimulating and encouraging present members to be active and industrious in promoting the interest and success of our association during the coming winter by preparing, more than usual, papers and lectures upon various subjects, in order that others may enjoy the rich stores of information which they possess.

Anticipating therefore that you will grant me a great deal of latitude and indulgence in this brief address, let me say to the work-

ers in counting house, office or study, whose exhausted brains need healthy relaxation and change of mental food; and to the tired of muscle from busy workshop and the unceasing noise of wheels, and you young people of abundant leisure, surfeited maybe with works of fiction, whose appetites even for the wildest flights of fancy of a Rider Haggard have become dull,—come to our meetings, and we will show you delightful lanes and avenues of mental thought down which you may pleasantly wander and lose all your weariness and satiety in the pursuit of information upon interesting subjects which become appetizing, stimulating, elevating and refreshing, as you proceed.

Let me show you something of the men, and ladies too, who will be your associates and will gladly welcome you to their pursuits, hobbies and summer outings.

Come, and I will introduce you first to members of our geological section, who know the solid framework of our globe, and the history of every rock and pebble, and who will be pleased when the weather is fine, to permit you to go with them to yonder mountain face, and with small hammers open up the great geologic book, on the rocky leaves of which they will show you the indellible records that tell of the earth's days of infancy, and progress from a fiery, molten mass, when ages upon ages ago, the crust was being deposited in hardening strata, disrupted by titanic forces, and re-deposited. Records that tell of the first appearance of life upon the earth, and of the great ice age when the northern half of this continent was enveloped in its glacier cap.

And next, to other members, whose deep researches in ancient literature have made them conversant with the venerable Sanscrit of India, a language unused and forgotten before Greek and Latin were invented, and who can translate therefrom, beautiful thoughts, clothed in glowing words, as the following, being a hymn:

TO THE DAWN. RIG-VEDA, VII, 77.

Bright as a bride, shines forth the virgin day-break,
Arousing all that lives to daily action.
Only freed by man's toil can Agni shine forth,
The dawn brings light by striking down the darkness.

Upwards she rose, and spread, still nearer coming,
With glistening garments clad, she grew in brightness,

Of golden splendor, and of face most comely,
Parent of morning clouds, leader of day-light.

Oh! happy she, blest dawn, the God's eye, bringing
Whitest of steeds, and proudest, sleekest, leading.
In radiance draped, the ruddy morn is coming,
In treasures rich, she tracks the path for mortals.

Or, here are our botanists, old friends and acquaintances of each fair floweret, who can tell you that all the brilliant glory, far exceeding that of Solomon, all the delicate perfume and the tiny pot of honey, were given to each queen of the meadow, not alone to regale your senses, but to invite and reward yonder bustling bee, whose woolly, dusty back, performs such a service in enabling it to perpetuate its posterity. They can tell you of every plant that can possibly be met with in your rambles, and of all their qualities and uses, edible, medicinal, or destructive; even of that marvel of construction and destruction, the pitcher plant, whose treacherous lips entice to death the unwary insect seeking to explore its cool recesses for treasure, but once within those shining portals he can nevermore return,—the slippery sides and downward pointing spears leave him no resource but exhaustion, death, and finally absorption.

Then here are our friends the conchologists, in from wandering in leisure hours along streamlet, creek and lakeside, with collections of hundreds of varieties of shells from the tiny foraminifera to the great yawning clam, all beautiful in finish and wonderful in construction.

Over there is our veteran ornithologist with his ambitious pupils, who know every feather that cleaves the sky, and can tell you great things even of the pugnacious sparrow.

And there are the entomologists, chief among them yonder thoughtful man, serious of demeanor, but delightful to know, who spends much of his life among butterflies, moths and beetles; a perfect arsenal of information in his particular hobby. He can tell you of the fascinations of the studies of insect life, and has wondrous things to say of bees and ants; of the ant lion who makes his pitfall in the sand and pounces on his stumbling victims, or of a crawling grub, which, arriving at maturity, feels within itself a great change coming, and admonished of a long night of helpless sleep to end in a new life of gaudy splendor. He will tell you that to prepare for this marvellous transformation it ascends a lofty tree, aware

that if it made its bed upon the ground its life would end in the wet and ice of winter; aware also, by an intuition startling and amazing, that the green leaflet which it proposes to use as a blanket will become withered by the first blast of frost and quickly fall to the ground, it spins a silken cord with which it securely fastens the green leaf to the firm wood of the limb, then wraps itself up for its long sleep. The frost comes and the wind detaches the leaf with its precious burden, but the silken cord holds fast, and the erstwhile crawling grub of astonishing forethought, swings securely in his leafy cradle all through the bleak winter, and when the warm rays of approaching summer stir the life currents of his body he comes forth a glorious butterfly, the beautiful Promethia. Spontaneously there arises in the thoughtful mind the question: Who taught it that the leaf would fall and not the branch?

But here are our historians, who know all about the local history of our country and neighborhood, written and unwritten; all about the discovery of Macassa water, and the battle of Stony Creek.

And astronomers who, in useful telescope, can show you the face of the moon, and name its mountains, volcanoes and vast depressions, with the same familiarity as a schoolboy explains the map of Europe.

Surely in this galaxy of talent you devotees of business or labor may find something attractive or amusing for your leisure hours. Your natural bent or inclination may tempt you to follow one or other of the delightful avenues which I have indicated, or still others, for they are numerous. The microscope and the telescope will lead you beneath and above the limits of vision into the two infinities, between which lies the world which is revealed to our senses, far down among the infinitesimals, or above into the far reaching illimitable fields of splendor, till the brain becomes dizzy amid the whirling worlds.

The limit of natural vision for small objects is about the one-hundredth of an inch. With the microscope the limit of resolving power is somewhere near the one-hundred-thousandth of an inch. One of the most interesting illustrations of the highest power of the microscope is by Dr. Dollinger. He has followed the life history of one of the infusoria down through all its phases, comprised within ten or twelve hours. A full grown individual divides itself lengthwise into two perfect beings in about five minutes. In another five

minutes each of these go through the same operation again, and so on for hours. After from three to seven hours of this kind of multiplication the older ones die off, while some of the younger and more vigorous attach themselves to each other in pairs. One entirely absorbs the body of the other into its own and settles down into the quiet, cysted state. Then after a certain time there commences to ooze out of this body perfect little clouds of the minutest spores, until nothing is left of the parent organism but the shrivelled skin. These spores, at first too small to be resolved by the highest powers of the microscope, soon grow to be visible as distinct points, then to push out their little threads of locomotion, and at length to become full-grown monads, ready to commence the other kind of generation—that of self-division. It is estimated by Dr. Dollinge that fifty millions of these monads could easily disport themselves in a single drop of water. And there is the easy possibility, and even probability, of other realms of living kingdoms still far below the reach of the microscope.

Turning in the opposite direction, the sharpest eyes can see only about five thousand stars in all the sweep of the heavens. With the highest powers of the telescope it is estimated that twenty millions of stars are visible. Yet all these are only the brightest or the nearest of the suns which compose the great cluster of the Galaxy, or Milky Way, to which system our sun belongs. And this immense aggregation of worlds is only one of thousands of star clusters that are within the range of telescopic observation. Over three thousand star systems, probably in every way similar to the one which lights our night skies, have already been located in the outlying regions of space. And what is there beyond?

Or suppose you try photography and find yourself rambling, with camera in hand, to paint with pencils of sunbeams, pictures, with an accuracy almost divine.

Any, or all of these pursuits, tend to make their votaries, observant, thoughtful, to "see sermons in stones, and good in everything."

Observation, after all, is the great instructor. When a boy, a worthy teacher once said to me, "Be observant. Learn something every day of your life. Do not be like the sailor who has sailed round the world, and when he has returned has no other information to impart than the prices of tobacco and rum in the various ports at which he has touched."

Again, too close application to one pursuit or study is apt to lead one into a narrow groove of intelligence and thought. A book-worm is not a desirable character to imitate.

To you my colleagues, officers and members of this venerable association, who by means of your pursuits, hobbies or fads, have now concealed about your persons such hoards of wisdom, let me urge upon you to be zealous in doing, each your part, in making our meetings interesting during the coming winter, and you will find that the law of compensation will give you a large share in the pleasure which your associates will enjoy.

To one and all I would say, let us make the coming season one of great enjoyment and brilliant achievements in the fields of literature and science. Let us seek to be worthy imitators of our predecessors, the Craigies, Hamiltons, Ormistons, Hurlburts, Raes, or others of the long list of useful men who, all along down the years of the past history of the Hamilton Association have shed lustre on its records.

What more appropriate than the words of the wise man uttered nearly three thousand years ago: "Happy is the man that findeth wisdom and the man that getteth understanding. She is more precious than rubies, and all the things thou canst desire are not to be compared unto her. Length of days are in her right hand, and in her left hand are riches and honor. Her ways are ways of pleasantness and all her paths are peace. Get wisdom, get understanding. Wisdom is the principal thing, therefore get wisdom, and with all thy getting get understanding. Exalt her and she shall promote thee. She shall give to thine head an ornament of grace, and a crown of glory shall she deliver to thee."

ON THE QUESTION OF THE ORIGIN OF VARIATION IN SPECIES.

Read before the Hamilton Association, December, 1889.

BY J. ALSTON MOFFAT.

Neither nature nor science has given us any certain information about the origin of species.

Geologists have found satisfactory evidence that man is one of the very latest species introduced into this scene of life; therefore, he is not in a position to know anything personally about the introduction of the others.

The geological record affords us abundant illustrations of variation, but its species as made by its authorities are artificial to the last degree, therefore quite uncertain.

Variation in existing species is even now going on, and by close observation we may see its progress in nature, whilst man can take hold of some species and vary them almost at his will. No doubt man has by his intelligent control produced varieties that probably never has, and probably never will appear in nature; but the possibility must have been there or he could never have brought them out.

Spontaneous variation is as contrary to the laws of nature as spontaneous generation. Every effect in nature must have its originating cause. A variety appearing ever so suddenly is not a proof of spontaneity, but of a favorable opportunity for it to manifest itself; the possibility had been there, and it may have been gathering force for a hundred generations, and just then got sufficient power to assert its right to be seen; or it may have been lying dormant awaiting a combination of favorable circumstances to call it into action.

Man originates nothing; what he does is to seize on a point when it appears—concentrate, consolidate and exaggerate it. Now if we could discover how these possibilities and liabilities to vary

got into the constitution of the organism, we would be in a position to answer one of the most urgent questions of the day in biology, and it might enable us to trace a connection with their remotest manifestations.

So, as an assistance in my effort "to see clear and think straight" on this subject, I have put my ideas in the following order:

Scientific investigation has extended our knowledge greatly on the origin of the individual, if not on the species; the authorities are now very full and clear on this point in the higher orders, and which is more or less applicable to all. They inform us that every new being originates from an egg or cell—animal and vegetable; egg, cell and seed, being interchangeable terms.

The order of nature, as a rule, is bisexual. That at the conjunction of the sexes there are a dozen possibilities or more on each side; that by a union of any two of these possibilities the life of an entirely new individual is originated, and generally the rest perish. That that individual, in its physical form, and its mental constitution, is but the latest manifestation of countless preceding generations. That it is likely to be most influenced by its immediate parent, but peculiarities of remote ancestors are liable to crop out in the most unexpected manner; that a change in the constitution of the parent produces a change in the egg. The eggs of a pure bred animal, when examined under a microscope, are found to be all alike, in type, form and vitality; in one cross-bred they are not all alike, and in the egg-mass of such, some can be found corresponding with those of a pure bred. That in-and-in-breeding of a particular type for generations results in such a fixity of that type that it becomes difficult to eradicate it; that by careful selection, elimination and rejection for generations, a type can be brought to such a degree of oneness in all its parts that the character of the offspring can be predicted with absolute certainty. In cross-breeding this is impossible, and the more violent the cross the greater the uncertainty, and yet from such crosses some of the very finest types of their kind have been secured; by some fortunate combination they have reached a higher standard of excellence in some particular point than any of their ancestors ever attained to

These are now well attested facts brought to light by the study

of animals in domestication, and will act as safe and useful guides to us in the study of nature as well.

All life does not exist under the same conditions in nature. The habitable surface of the globe is immensely diversified; these diversities affect the life of the locality in some cases to such an extent that an expert can indicate the locality by its products. How it is accomplished has not yet been determined, but that it is accomplished requires no proof, as no one denies it. Geographical distribution asserts its right to consideration from every student of nature, but differences of opinion exist as to the amount of importance that should be attached to it as a cause of variation in nature, some regarding it as of little or no consequence, others as of the very highest importance. Of recent writers on the subject, one says, "no one can study organic life without being impressed with the great power of environment." Another speaks of the organic kingdom "lying plastic and passive in the hands of environment." Others insist on the influences of physical conditions as the cause of the origin of species. Some claim the influence of climate and temperature as the producing cause of specific change, whilst one asserts that "differences of specific value can only originate through the direct action of external conditions;" and yet another concludes, "that no power which acts only as a selective, and not as a transforming influence, can ever be put forth as an efficient cause of these changes."

Now, whilst accepting to the fullest extent all that can be claimed for the power of external conditions to produce change in organic life, I reject utterly this artificial, unscientific, and bewildering use of the term 'species.' A species is a set of forms that will commingle and produce fertile progeny, no matter how diverse they may be in appearance, all such different forms being varieties of that species. Hybrids, being uniformly infertile, such uniform infertility being proof that the parents were of different species, therefor these external influences are not making species, they are but rectifying existing ones. So I shall review the subject from this position.

All species had their origin in the past, just how far in the past it may not be possible to determine, further than to say—before man appeared. All species did not appear at the same time. Geology has made that plain to us. All naturalists are agreed that organic life in nature is in complete harmony with its environment, that is,

that the organism and the conditions in which it exists in nature are perfectly adapted, the one to the other. Now we are credibly informed that the conditions of the earth's surface were quite different in some of the periods of the world's history to what they are now; so the life of these periods would therefore have been quite unsuited to the present conditions, just as the life of the present is wholly unfit for the past conditions. So then we infer that life appeared on this globe at such times as the conditions were ready to receive it, and in such forms as were suited to these conditions. Every form of life in the past being as perfectly adapted to its requirements, and as thoroughly in harmony with its environment as that of the present. Now the present diverse conditions of the globe's surface are as nothing compared with what the past conditions were, with what they are at the present; therefore the disclosures of geology, that the forms of the life of the past were so different from those of the present, is the natural and necessary result of the vastly different conditions in which they lived.

The idea entertained by many, that at every change of the earth's conditions the previous forms were wholly swept away, and an entirely new set introduced, is contrary to the evidence and opposed to the requirements of the case. That new forms appeared on the scene long after others had been introduced, is quite evident, that they appeared conspicuously, and even suddenly, seems to be indicated, but that they also appeared whilst some at least of the previously existing forms were still there, seems to be satisfactorily demonstrated. The geological record clearly indicates that there has been no break in the stream of life from its first introduction to the present, but a steady, progressive continuity. Geologists inform us that they recognize some of the very earliest forms of life to be found in the rocks, as still living at the present day. Is it at all unlikely that there may be many more of the descendants of early forms still living that they do not recognize? We know that some of the species of the present can change their location and accommodate themselves to altered conditions, and are modified thereby. May not many of the forms of life of the past periods in the world's changing conditions have succeeded in accommodating themselves to these changes, and been themselves so changed by them, bringing them into harmony with their surroundings, as to make it impossible now to recognize them? The probability is, there is not a

solitary form on the face of the globe to-day identical in every particular with that in which it originated—not even man himself—all having been more or less subjected to the modifying influences of external conditions. This being the case, we have no means of knowing with certainty what any species may have been like when first originated; nor can we tell what kind of change would take place in an organism by a given change in its surroundings, that, as yet, is only known by observation, for we do not know what is the geologic and climatic chemical compound that constitutes the influence of any locality of the present, and far less of the past. So that if we would trace any species from its origin to the present, we must deal with the principles that are at work, and leave the form to the imagination. For a time, then, let us go back in thought to the first appearance of a pair of some species, on a continent with diverse geographical conditions. That pair would, no doubt, be in perfect harmony with its environment, in size, form, color and constitution; they would propagate and multiply, and in due time the progeny would fill the locality, then overflow into other localities, there in turn to repeat the process, and pass on until the continent was completely stocked with that species; but in their migrations they have come in contact with geographical conditions quite different from those they had left, which would act upon them and change their appearance more ro less, to bring them into harmony with their new conditions, so that we would have not only the land filled with the species, but we would have a number of local varieties of that species, each adapted to its own locality. Now as it is a migratory species we are considering, some of those varieties would in time return and get into localities already occupied by a different one, then cross-breeding would begin, with such consequences as we have already seen, when we would be likely to get several forms of the same species in the one locality, and some of these might be quite different from any of those that had hitherto appeared. I would just note here the principle of reversion, and the likelihood of permanent residence bringing a migrant into conformity with the native, more or less exact. Now suppose that this species had the power, or opportunity of getting to another continent, and continue its progress until it had encircled the globe, it would meet with more diversity of conditions to be yet more changed thereby. Then suppose some violent commotion took place, separating some portions

of the land from the rest, forming impassable barriers, and isolating some portions of the species from the others; this isolation would act exactly as in-and-in-breeding does in domestication, giving the influences of the locality time to work their utmost on the organism, giving a power and permanence to its peculiarity that would affect it for all time to come, and make it difficult to obliterate it, and stamping it with an individuality all its own. Now this isolation could have the effect of producing quite opposite results in the constitution of different organisms, for instance, if these barriers were, after a lengthened period of time removed, this form may have become so localized that it would be difficult or impossible for it to survive in greatly altered conditions, so that if it ventured beyond its own locality it would have a struggle to exist, or might perish altogether; or it may have been so enfeebled that it would be easily absorbed when it commingled with the forms of other localities; or it may be so strengthened that it would leave its impress on any other form of the species that it commingled with, or absorb them altogether; or its pecularities might have become so consolidated and fixed in its constitution that it could pass into any other locality and be but little, if at all, affected thereby. Now this is not merely an imaginary sketch, but a brief outline of processes that are actually going on, in part at least, at the present time; and there is good reason for believing that it has been gone through with fully by the ancestors of many forms of the present, and it may be even a hundred times in the life history of some of them. When once a species was introduced into the world, what seems necessary to make it a permanent resident for all time after, is a sufficient degree of elasticity in its constitution to enable it to accommodate itself to the altered conditions as they came upon it.

The forms of the past, as made known to us by the geological record, seem in great measure, to have perished by catastrophe: indeed I do not understand how in any other way than by a sudden removal of their remains from the disintegrating power of atmospheric influences, their forms could have been preserved to us at all. No doubt myriads of them perished in the ordinary course of events, that have not left the shadow of a shade to indicate to us that they have ever existed. Now, as no one catastrophe would be world wide then, any more than at present, so whilst numbers perished suddenly in one locality, numbers would be left alone

in another to continue the species; and as it is now held by the more advanced geologists that strata of the same kind were not formed all at the same time, but that when they were completed in one portion of the globe they might be only beginning to be formed in another portion, so that, although the effect produced by an overwhelming catastrophe in one portion of the globe might be felt to some extent over all its surface, its influence would be slight at first in the remoter regions, giving plenty of time for the life of these localities to accommodate themselves to whatever change in their conditions might result from it, if it was in them so to do. Take as an illustration of the idea which I wish to convey, the case of the Saurians. It is generally accepted that the Saurians of the present are the lineal descendants of some of those of the far past; although none of their forms which have been found are identical with any of those of the present. The geological record clearly indicates that there was a period in the world's history when the Saurians were the ruling power on earth. The conditions were no doubt particularly favorable for them: these are supposed to have been shallow seas of tepid water, an abundance of food, animal and vegetable, and an atmosphere surcharged with carbonic acid gas. They seemed to have fairly revelled in the luxuriance of their surroundings and increased in numbers, size and diversity of kinds amazingly. But a catastrophe overtook some of them, these were hermetically sealed and placed on the shelves of nature's museum, from whence we take and examine them at our leisure. Others escaped and went on their way for a time, but the conditions were beginning to change; slowly but steadily they were becoming less and less favorable for them and they could no longer continue their revelling. A real and genuine "struggle for existence" had for them set in with all its natural and necessary accompaniments, and many of the forms finding it too severe for them, gave up the struggle and disappeared from the scene. Some continued it for a longer period, but they too had to succumb to the inevitable and dropped out of view. Others, less particular and with more elasticity in their constitution, accommodated themselves to the evils of their lot, held on their course and made the best they could of it, whilst matters were still going on from bad to worse with them, until, in the present most unfavorable circumstances, all that is left of the royal race of Saurians of the past are a few ridiculous mendicants that existed by a confirmed habit of skulking and a

perverse tenacity of life, an unquestionable "survival of the most fit" for the condition, but a discredit to their ancestors and a disgust to the present rulers of the earth. They are getting scarcer every day, and when man has asserted his rightful dominion over every portion of the globe's surface, they too will have become extinct.*

Now, this I think, is applicable in some measure to the life of the past, in every era of the world's history. Away back in the primitive condition of the globe primitive forms emerged, suited to the then existing condition, these being in every way favorable, they prospered to the utmost. A change takes place that produces conditions less favorable to them. Another set of forms appear: better adapted for these conditions they succeed for a time, and the first has to occupy second place. Another change, and another set of forms comes to the front, whilst the second retires to take its place with the first; and yet another, and so on through the whole series, until man appears on the scene, whose duty and prerogative it is to change the whole face of nature and thereby assert his dominion over it. Each set of forms attaining their maximum when the conditions were most favarable and their minimum when they are least so, giving us an explanation of what appears like an anomaly in the life of the past: that the great forms should have preceeded the lesser of their kind and assuring us of the utter impossibility of their ever attaining like proportions again.

The causes producing these geologic and climatic differences which have appeared during the progressive history of this globe, would be a subject of intense interest and open up a field of investigation, limited only by the capacity of the individual investigating, but one that hardly comes within the scope of my subject, yet, if we could get a correct clue to it would lead us to a better understanding of the other.

The original elements composing this globe and all within the circle of gravitating force may be stated as earth, air, fire and water. These may be sub-divided indefinitely and their chemical constituents given in figures and letters. Now whatever changes took place in these during the protracted periods of time occupied in bringing this globe to its present condition, we may rest assured were not

* I am aware that some object to such a statement of the case; but it seems extremely probable that many creatures living at present may be in very much the same position of some men we read about who have outlived their usefulness.

brought about by any arbitrary enactment, but by the natural process of cause and effect, nor by any change in the laws of nature, nor by any addition made to the kind of materials through which these laws operated, but simply by a different combination of these that would produce quite different results.

I think we get an instructive view of one of the natural methods employed in making one stage of progress prepare the way for another in what is called the carboniferous era. This was characterized by a remarkable profusion of vegetation of a particular kind. For the production of this certain conditions were necessary, amongst others heat and an unlimited supply of carbonic acid gas, such as would be fatal to the animal life of the present. Now, whilst this vegetation was growing in rank luxuriance, the result of favorable conditions, it was also engaged in absorbing the carbonic acid gas from the atmosphere in vast quantities and retaining it. This was by some put under the surface of the ground, thereby making a permanent change in the condition of the atmosphere. This would deprive the descendants of that vegetation of the materials for growth in sufficient quantity, or in the required combination to produce like luxuriance, making a change in the character of the vegetation inevitable, and preparing the way for entirely different forms. This change in the vegetation of the period would have a powerful effect on the animal life of the same: some of the forms not being able to accommodate themselves to the change would perish, giving place to others that were better suited to the new conditions.

Now take into consideration the vast periods of time through which all this has been progressing—ages on ages roll; no hurry, but no delay. Change follows change—the destiny and doom of all matter—and the stream of life running parallel with it standing persistently, progressively, generation after generation come and go, living forms appear, perpetuate their kind, but to die and be resolved into their original elements, these to reappear in yet other forms, and go through the same routine—the true and real transmigration of nature. Then add to this the fact that during each and every one of these periods of time the geographical conditions were various, moulding and modifying the life of each, and that these living forms were given more or less to migrating, and consequently to a commingling of these and thereby multiplying their diversities, and making it possible for them to be yet greater and more numerous

and then consider if we have not got in all this a cause abundantly sufficient to account for all the puzzling and perplexing variations and modifications that we find in the species of the present day. It appears to me that the wonder ceases to be that they are so many, and the surprise comes in rather that their should be any stability left in any organism whatever, and I quite believe there would be none, but for the yet more marvellous power of hereditary transmission that holds every living form true to the species from which it came and from which it has not the power nor possibility of escape, and which alone makes classification possible.

Man produces his artificial varieties through his intelligent control of the natural laws of generation and propagation. Nature originates its varieties through the external influences of diverse geographical and geological conditions, and multiplies them by a commingling of these. Natural selection, as distinguished from artificial, begets promiscuous commingling of a species, and the power of environment produces the comparative uniformity in nature that we see. Natural selection, combined with external local influences, produces the local flora and fauna, which we can arrange, classify and systematize, and it is to a commingling of these diverse forms, producing a multitude of transmittable possibilities in the organization, that we may have to attribute many of those occasional and oft surprising differences that we find it so difficult to classify.

When contemplating any of the living forms of the present, and considering as to how it came to be as it is, we have to take into account not only its present existence and existing conditions, but also when and where it may have originated, the locality from which it may have come, and the direction in which it may have travelled. We have to think of the time that has elapsed since it was first originated, of the hundreds and thousands of generations which have come and gone since then, of the thousands of diverse influences that have encompassed and pressed in on every side in its onward course, moulding and modifying it in so many imperceptible and unsuspected ways. How it may have been held for thousands of years under one set of influences, and thousands of years under another, and as many more under a third, whilst during all these thousands of years it was mingling its diverse forms and producing yet more diversity, and this specimen which we are naming may be one of the last that has appeared in this seemingly interminable line

and may bear in its constitution and impress from each and all of these that may yet distinctly manifest itself in some of its offspring.

I regard this as a particularly profitable subject of investigation in many respects, but chiefly because it touches man at so many points. We get from it at a glance the origin of national characteristics. How differences and peculiarities at first sight were increased and intensified by environments, seclusion and non-intercourse, and how these are in the present day being softened and moderated, and are likely to get more so. It also gives us an insight into the origin of personal peculiarities—to that pronounced individualism that characterizes every free community—and how this is likely to increase and become yet more marked and observable. In it also we find an explanation of what appears a puzzle to many, the complete uncertainty as to what may be the development from any given union, and the sometimes startling differences seen between the parents and their children and the oft expressed surprise that these do not always come up to the standard of the parents.

The question is often asked, "Cannot man be improved as well as his domestic animals?" I reply most assuredly he can, if the same methods were followed to secure the same result, and these are all summed up in three words: selection, elimination and rejection.

Wallace has said that "So far natural selection has done nothing for man." Well, I suspect that is just about as much as it has done for anything else. Let anyone observe nature and its methods and they will soon be convinced that this is not the direction to look for progressive improvement. Its whole tendency is toward uniformity, and uniformity is not favorable to progress. Human history is a runniug commentary on this great truth. Progressive improvement for man has come so far, principally through the external influences of education, cultivation and refinement; but these seem to work very slowly and with great uncertainty. An Italian once sarcastically remarked: "Who knows but one of these days a powerful microscope may detect globules of nobility in the blood." We have seen that the microscope has been more scientifically used, and with what results. Edmond About, when commenting on that quotation, said: "I am too French not to enjoy a joke, but I confess 'globules of nobility' does not offend my reason." We know that dogs are slow or fast, keen scented or keen sighted,

according to their breed, and we buy a two-year colt on the strength of its pedigree.

Can we consistently admit nobility among horses and dogs and deny it among men? I reply, if the same methods are not adopted to secure it we have no right to look for it. True, individual specimens of humanity will occasionally appear, with an innate nobility in mind, mien and form, that compels acknowledgment from all who come in contact with them, where no design was used to secure it; but it is not permanent in their line, as is the case where selection has been carefully attended to. This is the kind of occurrence that is unscientifically called 'accidental,' but would be termed among breeders of stock, if appearing there, as 'a fortunate hit,' from a want of a knowledge of the combination of causes that were at work in producing it.

One irreverent scribe has gone so far as to say, "there is no other such mongrel breed on the face of the earth as man, and that a large portion of the present scrub race should never have been born, and have no right to be allowed to transmit their deficiencies." This is going to the root of the trouble with a vengeance. Will the time come when a free people, in their zeal for the improvement of the race, shall demand the appointment of a governmental inspector of marriage-matches, upon whom shall devolve the responsibility of selecting, eliminating and rejecting? Then we would be warranted in effecting a steady improvement of the race, in appearance at least; but this would in the course of time lead to uniformity. Now there can be no doubt that a genius is the result of some fortunate combination of diverse elements, and as one genius is of more importance to the world's advancement than a thousand common-place individuals, can we afford to run the risk of loosing our geniuses for the sake of a general uniform rise in the standard of the race? But more, we know that man can improve his stock out of existence; when he has got any one of his organisms up to about the point of perfection, he finds that its constitution has become so enfeebled that it is necessary for him to fall back on cross-fertilization to secure its continuance. So in this, as in many other things, we may find it better to endure the ills we have than fly to those we know not of.

ANTIQUARIAN AND GEOLOGICAL NOTES, No. 1.

Read before the Hamilton Association, December 12th, 1889,

BY COLONEL GRANT.

In 1862, when quartered with the 2nd battalion of H. M. 16th Foot, at the Curragh of Kildare, Ireland, I obtained from a gravel pit in rear of "The Lines" a fine, well-preserved specimen of a round flat, rather sharp-edged, stone Disk—deeply grooved on one face, while a similar groove presented itself on the opposite, running at right angles. It was taken from apparently undisturbed gravel, a few feet below the clay overlying the bank; that it was fashioned by the hand of man seemed plain enough. How did it come there was the only difficulty to solve, and I came to the conclusion that a Palæolithic Warrior had been interred there. Human or other bones for that matter are invariably ill-preserved in "gravel" or "sandy soil," and when the body underwent the process of decomposition, the water-rounded pebbles and sands above would naturally fall and fill the vacancy beneath, (perhaps a close search might have revealed flint arrow points and stone celts also.)

The specimen I obtained could scarcely have been "the Leiagh-lama-liagh," (champion hand-stone) described by the Irish scholar and antiquarian, Eugene Curry. Massive, it certainly was not, but propelled from a sling perhaps it would have been as efficient a weapon as in after time, "When the Slingers of Laney forced the Norman De Bourghos to flee."

Grooved oval disks, it is said, have also been found on this continent.

The gravel pits at the Curragh contain many fossiliferous pebbles of the carboniferous (mountain limestone mixed with granites) Porphyries, etc., derived probably from "The Wicklow mountains" adjacent. I have not seen the report on the surface geology of the district, and therefore may erroneously suppose the gravel beds to be a glacial or inter-glacial deposit.

If the alleged discovery of Mr. Skertchley, an officer of the English Geological Survey, can be clearly demonstrated, viz: finding flint implements in beds formed before the close of the glacial period at Brandon, Suffolk, it may be doubted whether my stone implement may not be of far greater antiquity than was at first supposed.

Referring to Mr. Skertchley's find, a correspondent of the *London Times* states, "One implement was picked out of the beds in a pit at Culford, Suffolk, two others were dug out of like beds at Botany Bay, on the Norfolk side of Brandon. It was not until Mr. Skertchley himself found another implement at Culford, and saw the boulder clay above the beds from which he extracted it, that the importance of the discovery dawned on him.

Alongside "the Culford implement" he found a deposit of broken and scraped Mammalion bones and "fresh water" shells; these bones were all in a circumscribed area. Underneath the bones the clay was found to be burned. Mr. Skertchley's explanation is that we have here preserved the solitary instance in the whole world of a camping ground of Palæolithic men, and the camping ground occurred below the boulder clay which belonged to the earliest part of the *glacial period.*

In the coal shale of Wezicon, Switzerland, it is said a series of pointed fir poles, covered with wicker-work, have been found; they are supposed to be the most ancient evidence of the existence of man, and belonging to the period intervening between the two glacial epochs.

I am aware that a still greater antiquity is claimed for man on this continent. Professor Whitney supposes the now famous Calaveros Skull (found in auriferous gravels in the West) to be of the Pliocene age; but a recent writer, Professor H. Haynes, well remarks, "In the Pliocene age we cannot expect to find traces of man upon the earth, as the living placental mammals had only then begun to appear." Has not this still greater force when applied to the Miocene, a yet older age. The recent origin of man has been well urged, says Sir William Dawson, by Le Coute: "Some Mesazric protozoa still survive, so do many tertrary mollasks, but the mammals are of much less duration. No living species goes back further than the 'Pliocene,' few extend further than the 'Glacial' age."

It is asserted that many of the flint implements discovered in New Jersey and other places in the "States" were obtained from superficial gravels, (not true glacial drift). I noticed some years ago, part of the rib of a Mastedon (probably) in a "Slab-town" gravel pit; but as yet I failed to procure any flint or other implements either there or at Burlington Heights. It was in making the excavation for the Desjardin's Canal that the bones of a mammoth jaw of a Beaver, and horns of the "Wapiti" were found. Although the Canadian Geological Survey, in Sir William Logan's time, noted that the Erie clays *underlie* the gravels, Burlington Heights, at the Desjardin's Canal, I can find no record of their *overlying* our local glaciated chert on the Niagara escarpment here. This circumstance probably escaped observation. I think it has an important bearing on the ill understood superficial geology of this district.

The clay containing rounded transported Laurentian pebbles, fills up the grooves made by glacial action, and can be easily distinguished from the mere surface soil above it. I have placed in one of the side cases of the Museum a specimen for examination.

NOTES ON THE HISTORY OF BOTANY.

Read before the Hamilton Association, March 13, 1890.

BY T. J. W. BURGESS, M. B, F. R. S. C., ETC.

My contribution for your consideration this evening, entitled "Notes on the History of Botany," is indeed but a few brief notes on the subject. To prepare anything like a complete history of this charming science, is a task far beyond my ability, and, even were I able to execute it, so extensive is the subject that the listening to it would occupy, not an hour or two, but night after night of your valuable time.

In every age, in every clime, flowers have ever been regarded as among the most beautiful of the varied works of creation. Scarce a poet but has sung of their beauties—not an artist but has attempted to depict their gorgeous colorings. The sculptor and the architect have sought to render them imperishable in stone, and novelists have woven some of their tenderest fancies about them. Who has not read that sweetest of stories, "Picciola?" How the leaves of the little flowret, stretching themselves between the harsh prison stones, carried a message of truth and beauty, spoke of mercy and grace, to a despairing soul. Flowers are entwined about our lives, and from the earliest times they have been represented in the social and religious ceremonies of most countries. Children greet them with shouts of joy; to the bride they are a fitting emblem of a happy future; and at the tomb kind friends deposit them on the bodies of departed loved ones. Numberless are the lessons to be learned from these beautifiers of the earth, which smile alike upon the peasant and the peer, which bloom equally for the abode of poverty and the home of unlimited luxury. Every herb, ever shrub, every tree is full of interest; not a plant but has some peculiar beauty or some exquisite adaptation.

"Your voiceless lips, O Flowers! are living preachers,
Each cup a pulpit, every leaf a book,
Supplying to my fancy numerous teachers
From lonliest nook."

So sang the poet Horace Smith, and not less sweetly or truthfully did the Scotish minstrel, Allan Cunningham, write:

"There is a lesson in each flower,
A story in each stream and bower;
In every herb on which we tread
Are written words which, rightly read,
Will lead you from earth's fragrant sod
To hope, and holiness, and God."

Viewed even by the critical eye of science, Botany presents many attractions unknown to the other branches of Natural History, and well deserves the appellation of our French cousins, "la belle science." To the history of this most charming of studies I would now call your attention.

Botany, derived from a Greek word meaning a plant, is the natural history of the vegetable kingdom. In its widest sense it embraces everything respecting plants—their nature, their kind, the laws which govern them, and the uses to which they may be applied in medicine, chemistry, or the arts in general. As, however, their medical virtues fall most properly under the province of the physician, their chemical properties under that of the chemist, and their various other qualities, beneficent or otherwise, under different departments of the scientific world, it is commonly restricted to a knowledge of the plants themselves, their mode of growth, their anatomical and physiological phenomena, and those characteristic marks by which the various species may be distinguished from one another. It is only within comparatively recent years that, in this sense, the science of botany has been developed, its great misfortune having been that, from its very inception, it was looked upon merely as an adjunct to medicine. This was the reason why our ancestors sought only for healing virtues in plants, whilst a knowledge of the plants themselves was totally neglected. Botany, as a study, was nothing, and those among the ancients, who prided themselves most on their acquaintance with plants, had no idea of their structure or the relation borne by one class to another. They knew, perhaps, by sight a few of the plants of their own neighborhood, to which they gave names at random, and to which they attributed wonderful virtues from some fancied good resulting from their use in various ways. These same plants had different names in every state and country then known, and those who adopted them in their paniceas,

at most gave them only the name by which they were known in their own immediate vicinity. A dozen names were often given to the same plant, and the same name to a dozen plants. The confusion resulting from this arbitrary bestowal of names can be imagined. When a recipe travelled into a new locality it was no longer known what plants composed it. Everybody substituted in the mixture or ointment, as the case might be, another plant after his own fancy, but, to keep up the sale of it, gave it the same name, so that in a short time all trace of the original plant was lost. A relic of this barbarism remains even to this day in the numerous cases we have of the same common name applied to plants the most diverse, a notable instance of which exists in the term Mayflower, affixed to at least half a dozen different plants in as many different orders. For example, the Trailing Arbutus *(Epigæa repens)*, the Spring-Beauty *(Claytonia Virginica)*, and the June-Berry *(Amelanchier Canadensis)*, are all known by this title in different localities, a fact which has led to no little disputation in the effort to establish what plant was originally so called by the New England Loyalists. Probably, at this period, some good observations, which deserved not to have been forgotten, were made, but, amid such a chaos of nomenclature, those who made them had no possible means of communicating or recording them in a recognizable style. The result was that there followed endless disputes upon words and names, every useful enquiry and description being lost for want of the disputants being able to decide what plant each observer had really referred to.

Not content with such a mixing of names and terms, these earliest botanists, or more properly herbalists, drew largely on their imagination for properties in plants, or greatly exaggerated any slight virtue they actually possessed. Their object in this was, most likely, the filling of their pockets at the expense of their dupes, for quacks existed in those days as well as in our own. However, be their reason what it might, the fact remains that, through such deceptions, many marvellous beliefs about plants arose and were handed down. Most of these, viewed in the light of modern philosophy, are truly laughable. Thus, Xanthius, the historian, tells us that a man killed by a dragon can be restored to life by a herb, which he calls *balin*, and Democritus gravely asserts that there is a plant, the juice of which applied to a wedge will cause it to

spring out of the tree into which it has been driven. Again, Vitruvius, speaking of the virtues of Spleenwort *(Ceterach Officinarum)* as regards its reputed action on the spleen, says that in the island of Crete, on the side toward Cortyna, the flocks and herds were found without spleens because they browsed on this herb, while on the other side, toward Gnosus, they had spleens because it did not grow there. Such superstitions continued through the days of the Roman Empire, were very prevalent during the middle ages, and remnants of them still exist, especially in country districts. How fixed was the belief in the magical properties of certain plants, may be judged from the following lines by Virgil, written, not in a strain of poetic, fervid imagination, but of sober earnest:

> "These poisonous plants, for magic use designed,
> (The noblest and the best of all the baneful kind)
> Old Mæris brought me from the Pontic strand,
> And culled the mischief of a bounteous land.
> Smeared with their powerful juices, on the plain
> He howls, a wolf among the hungry train:
> And oft the mighty necromancer boasts
> With them, to call from tombs the stalking ghosts."

Later, we find Culpeper, in his herbal published in 1653, saying of Moonwort *(Botrychium Lunaria)*: "Moonwort is an herb which will open locks, and unshoe such horses as tread upon it, and country people that I know call it 'Unshoe the Horse.' Besides I have heard commanders say, that on White Down in Devonshire, near Tiverton, there was found thirty horse-shoes pulled off from the feet of the Earl of Essex his horses being there drawn up in a body, many of them being but newly shod, and no reason known." Numberless further examples of the superstitious belief in the magic power of plants might be cited, but I must pass on to the history of botany proper. This, for convenience of description, I shall divide into four great epochs, calling them the Ancient, the Arabian, the Artificial, and the Natural Epochs.

The Ancient Epoch embraces the period between the creation of the world and the destruction of the Western Empire by the Goths and Vandals, which races, cradled in war and rapine, hated science, believing it caused effeminacy in its devotees, and would not allow their children to cultivate it. The earliest known mention of plants is in the Book of Genesis, where it is recorded by Moses that, on the

third day God said: "Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth; and it was so." It is also recorded that Adam gave names to all the beasts of the fields and fowls of the air, and the "Blind Bard" Milton, in his "Paradise Lost," has beautifully and poetically ascribed a similar task to Eve regarding the flowers, making her exclaim, in her lamentation on quitting the Garden of Eden:

"Oh flowers,

* * * * * * * * * * *

* * * which I bred up with tender hand
From the first opening bud, and gave ye names."

Throughout the Bible we find numerous allusions to trees and herbs, and Solomon, it is probable, wrote a treatise upon the subject, for in the Book of Kings it is said of him: "He spake proverbs and songs; he also spake of trees, from the cedar-tree that is in Lebanon, even unto the hyssop, that springeth out of the wall." Anything he may have done in this way, however, is totally lost. Anaxagoras, Pythagoras, and other ancient Grecian philosophers also wrote upon plants, but their works have shared the same fate, and the poems of Homer, in secular literature, afford us the only vestiges of the botanical knowledge of the earliest ages.

Aristotle included the vegetable kingdom among his numerous subjects of study, and considered plants as intermediate between unorganized matter and animals. Although we know that a treatise on botany was issued among his other writings on Natural History, about 384 B. C., all trace of it having disappeared, we may say that the proper historical era of the science begins with his friend and disciple Theophrastus, who, about 300 B. C., published a History of Plants in ten books, only one of which, however, is now extant. In this he treats of the origin, propogation, and anatomy of plants, describing about five hundred species, which are divided into classes with respect to their generation; their place of growth; their size, as trees or shrubs; their use as culinary herbs and esculent grains; and their juices.

Nearly three hundred years after the time of Theophrastus, or about the beginning of the Christian era, another Greek, Dioscorides, travelled over Asia Minor and Italy, studying plants, of which he gives the names and properties of about six hundred, arranged in four classes, according to their uses; viz., aromatic, nutritious,

vinous, and medicinal plants. Nearly contemporary with Dioscorides were Cato, Varro, and Virgil, who wrote on agriculture and rural economy.

Following these worthies came the elder Pliny, who, in his fifty-sixth year, became the victim of his curiosity for enquiry, while attempting to witness an eruption of Vesuvius. He devoted sixteen of the thirty-seven books comprising his "History of the World" to plants. Besides enumerating the discoveries of Theophrastus and Dioscorides he described many new species, bringing the number up to above a thousand. Like the other ancient botanists though, Pliny admits, with little or no distinction, truth and error, useful knowledge and absurd fable, which fact, together with the want of a proper systematic arrangement, renders it impossible to determine which are the plants he described.

With Pliny closes what I have called the Ancient Epoch of Botany, for after his time, its study rapidly declined, and ages of darkness and lethargy succeeded.

The second, or Arabian, Epoch of Botany began during the eighth century, with the reappearance of the elements of ancient plant lore among the Saracens. This barbarous but noble race, who had formerly shown their contempt for science by the wanton destruction of the magnificent library of Alexandria, at this time became imbued with a love of it, chiefly by contact with the many enlightened men, who, banished by the Emperor Theodosius, had found refuge amongst them. A succession of Caliphs, most notable of whom was the famous Haroun Alraschid, by their fostering care of learning and learned men, made Bagdad the most enlightened city in the world. Serapion, well known in medicine, stands first on the Arabian catalogue of botanists, and was followed by Rhazis, Avicenna, Averhoes and Actuarius, while Plato Apuleius, of whose herbarium very old manuscript copies are still preserved, is supposed to have lived about this period. These men discovered many plants of Persia, India and China, which were unknown to their predecessors, but unluckily they thought less of observing nature and chronicling their own observations, than of translating and commenting on the old Grecian writers. In consequence, their descriptions of plants are imperfect, and, for want of a systematic arrangement and comprehensive nomenclature, generally unrecognizable. If, however,

they did little to advance the science, they at least kept alive the love of it, and vigilantly watched over the intellectual treasures of antiquity, translating the works of the ancients and introducing them into their schools.

Early in the eighth century, the Moors, who had made themselves masters of northern Africa, induced by the representations of the traitorous and apostate Count Julian, crossed the straits under the command of Taric ben Zeyad, or, as he was known to the Spaniards, Taric el Tuerto, or Taric, the one-eyed. Seizing the rock of Calpe, this doughty chieftain fortified it as a stronghold, changing its name to Gibel Taric, or the Mountain of Tarib, since corrupted into Gibraltar; and by his defeat of Don Roderick, last of the Goths, on the banks of the Guadalete, ended the Gothic power, which had remained unshaken in Spain for two and a half centuries. The subjugation of the whole peninsula was speedily completed, and the elements of botanical science, as known to the Arabs, soon spread to France, Italy, Germany, and England. Abenguist, a famous Saracenic physician and botanist, flourished about the end of the twelfth century, and superiority in the sciences was preserved by the Arabians until toward the close of the fifteenth. But when, in 1492, this wonderful people, gradually divested of their European conquests, lost their last foothold in Spain by the fall of Granada, they seemed at once, with the departure to Africa of the the last of the Moorish kings, Boabdil el Chico, to replunge into that savage ignorance from which they had so brilliantly emerged.

Arrived now at the beginning of the sixteenth century, we enter upon the third great botanical epoch, which I have called the Artificial, being the period during which the artificial arrangement of plants flourished, a period adorned by such names as Cæsalpinus, Morison, Ray, Tournefort, and, greatest of all, the immortal Linnæus.

An artificial classification differs from a natural one, in that the former singles out one or more points of resemblance or difference, and arranges by them without reference to other considerations, convenience and facility being the controlling principles. On the other hand a natural system aims to arrange all known plants into groups according to their resemblances and their degrees of resemblance, so that each species, genus and order shall stand next to that which it most resembles *in all respects*, or rather in the whole plan of structure.

In other words, an artificial system arranges plants on a certain part, or parts, of them, while a natural one takes all the parts into consideration.

The initial point of this epoch was the arising of greater independence of thought concerning ancient writers. Men began to say—we have been looking everywhere for the plants of Theophrastus, Dioscorides, and Pliny, whereas they did not know a tithe of those covering the earth. What foolishness to endeavor to apply to the plants of one's own country, France, England, etc., as the case might be, the names under which these men described those of Greece and Asia, without knowing whether they are the same. We must explore each country, and collect, examine and compare the plants of the one with the other, for then only will we be in a position to distinguish them.

About 1536 the first botanical garden of modern times was establish in Italy, on the banks of the river Po, by Brasavola, but to the Germans belongs the honor of being the first to publish books founded, mainly on *actual observation*—Otto Brunfels, of Mayence, having issued such a work in 1530. It also contained the first cuts, but, as Willdenow remarks: "The drawings are not very good, and do not in the least correspond with his own descriptions." To Germany is also due the credit, in the Herbal of Jerome Bock, published 1532, of producing the first botanist, who replaced the old alphebetical order, in which plants had always been hitherto described, with an arrangement depending on their natural resemblances, that is the likeness which may be observed by the most unscientific persons in their general forms and characters. Crude as was his work it introduced a new principle which had the greatest influence in promoting the advancement of systematic botany. Up to this time botanists had blindly followed the ancient writers in classifying plants by their roots, herbage, time of flowering, place of growth, medical or economic uses, and other arbitrary distinctions, and it was not till about 1560 that Conrad Gesner, of Zurich, in his "Historia Plantarum," first suggested the existence, in the vegetable kingdom, of groups, or genera, each composed of many species united by similar characters of the flower and fruit. Gesner did not, however, establish any plan founded upon this principle, but, having formulated the idea, left its first application to Dr. Andrew Cæsalpinus, a physician of Pisa, Italy, who, in a work published in Florence, in

1583, proposed to form species into classes, and thus originated systematic botany. The characters which he employed for this purpose were the duration and size of plants, the presence or absence of flowers, the number of cotyledons, the situation of the seed, the adherence of the pericarp to the seed, the number of cells in the paricarp with the number of seeds in each of these cells, the adherence of the calyx to the germ, and the nature of the root, whether bulbous or filrous. This method was too imperfect to be adopted, however, and for nearly a century no one appeared to follow in the path which Cæsalpinus had opened. During this interval though, the science was gradually improved in its details, Clusius teaching botanists to describe accurately by discarding superfluous terms without the omission of any important characteristic, and the brothers, John and Caspar, Bauhin adding to their respective works a synonymy, or exact list of the different names which all previous writers had applied to the same plant. In the same period, too, flourished a number of other and less illustrious authors, some of them chiefly notable for the useless or laughable systems they proposed, to wit.: Du Pas, a Frenchman, suggested an arrangement of plants by their time of flowering, and Porta, an Italian, one from their relation to the stars, to men, and to other animals.

In 1680, Robert Morison, a native of Aberdeen, Scotland, and Superintendent of the Botanic Gardens at Oxford, revived and carried into practice the principle of Cæsalpinus, in his great systematic work, "The Universal History of Plants." Morison sets out with the division of plants, from their consistence, into ligneous and herbaceous, and founds his system on their fruit, blossoms, and habits. Two years later, John Ray, of Trinity College, Cambridge, proposed another system of classification in his "Methodus Plantarum Nova," a work amended and completed in 1703. He divided plants into thirty-five classes, formed on their habits and external appearances, their greater or less degrees of perfection, their place of growth, the number of seeds, petals or sepals to the flower, and the kind of fruit or inflorescence. The great merit of Ray's system was his division of herbs into flowerless and flowering, and the latter into dicotyledenous and monocotyledonous; its great fault the primary division of plants into trees and herbs. This division of plants into trees and herbs, referring the larger shrubs to the former the under-

shrubs to the latter, had been adopted by every botanical writer since the days of Aristotle, and by its antiquity had gained an importance to which it was by no means entitled. The first to note the great demerit of such a primary division, from its uncertainty and repugnance to the spirit of system, was Augustus Rivinus, Professor of Botany at Leipsic, who, eight years after the first publication of Ray's system, that is in 1690, discarded it and proposed a classification based wholly on the corolla.

Knaut, Herman, Bœrhave, Ruppius, and Ludwig were also prominent botanists of this, the seventeenth, century, but the next after Rivinus to advance a leading system was Joseph Pitton de Tournefort, a native of Provence, and Curator of the Jardin du Roi. Tournefort travelled through Spain, Holland and the East, collecting extensively, and published his method of classification, "Elements of Botany," in 1694. It was more definite but more artificial than that of Ray, being based, like Rivinus', almost wholly upon modifications of the corolla, but unfortunately it revived the old division of plants into trees and herbs, which the latter had so wisely discarded. Its great advance over previous systems was, that in it, genera, as we now understand them, were first established and defined, all the species then known being referred to them, so that, in one sense, Linnæus was right in calling Tournefort the founder of genera.

Many authors of note followed the lead of Tournefort, including Jussieu, Vaillant, Petit, Vallentin, Dillenius, Linden and Sloane, but it was not until 1735 that Linnæus, suddenly emerging from obscurity, offered to the world a system of botany so far superior to all others as to leave no room for dispute as to its comparative merit. Karl Linne', or, as he is more commonly styled Linnæus, was born on the 23rd of May, 1707, at Rashult, in Sweden. His father, a clergyman, had designed his son for the same sacred calling, but the boy's teachers seeing him pay less attention to Hebrew and theology than to the study of natural history, advised him to apprentice him to shoemaking or some other trade, as being quite unfit for any of the learned professions. Happily for the progress of science this advice was not acted upon by the disappointed parent, who, instead, accepted the offer of one Dr. Rothman, Professor of Medicine in the College of Wexio, to give him an education preparatory for his entering his own profession. For some time after

his matriculation at the University of Lund, in 1727, young Linnæus' struggle was a terribly uphill one. His endeavor to pursue both his botanical and medical studies, while relying for support on the instruction of private pupils, made his circumstances almost desperate His father was too poor to do anything more for him, and he was often indebted to his fellow-students for an occasional meal or cast-off garment. In 1729, however, just when his fortunes were at their lowest ebb, he was engaged by the Rev. Olaus Celsius, one of the Professors at Upsal, to help in a work he was preparing, illustrative of Bible plants.

A small work of Vaillant's, on the structure of flowers, now fell into his hands, and from the ingenious remarks of that writer on the existence of sex in plants, he conceived the idea of a system of botany founded on the stamens and pistils, a system on which were arranged nearly all his subsequent botanical contributions. About the same time a short treatise which he had composed, attracted the attention of Rudbeck, Professor of Botany, who, being old, was desirous of obtaining a competent assistant, and he assigned to him the office of demonstrating plants in the botanic garden, giving him also free access to his fine library. The clouds of poverty and obscurity were thenceforth gradually dispelled, and Linnæus became known to men of talent as a rising genius. In 1731 he was sent by the Royal Academy of Sciences at Upsal to investigate the natural history of Lapland, the results of which expedition he afterwards published in his "Flora Lapponica." In 1734 we find him acting as travelling tutor to the sons of Baron Renterholm, and in 1735 setting out to take his degree as doctor of medicine in Holland, where it could be procured at much less expense than in Sweden. While in Leyden he called upon the celebrated Dr. Gronovius, who, returning the visit, saw the manuscript of his "Systema Naturae," and was so astonished and delighted with it that he requested Linnæus' permission to get it printed at his own expense. The Dutch botanists received the work with the utmost cordiality, and immediately embraced and adopted the system, which was further amplified by the publication of the "Genera Plantarum." Linnæus next, in succession, visited England, where he made the acquaintance and secured the friendship of Sir Hans Sloane and the learned Dillenius, and France, where the Jussieus, uncle and nephew, showed him every courtesy. Returning to Sweden he settled in Stockholm

to begin the practice of his profession, and in 1739 married a Miss Moræus, to whom he had been long engaged, but whom he had previously been prevented marrying by his straitened circumstances. Soon after he was appointed to fill the chair of natural history in the Upsal University, and his great fame and extensive correspondence enabled him to enrich the academic gardens with an immense variety of plants. Jussieu and Van Royen sent him those of India, Haller and Ludwig European ones, and Collinson and Catesby specimens from the New World, while his pupils Thunberg, Hasselquest, Kalm, Osbeck and others gave him details and material from their travels in Europe, Asia, Africa and America. Riches now flowed rapidly in upon him, and in 1757 he was elevated to the nobility, taking the title of Von Linné. This speedy rise to wealth and honors did not, however, in anywise diminish his assiduity in study, and an extraordinary number of works were completed in various departments of natural history, all evincing the same clearness of ideas and precision of language which have made his writings so especially valuable. Toward the close of his life, Linnæus, who for many years had enjoyed excellent health, was attacked by apoplexy, which, in some degree, impaired his mental powers. The first attack occurred in 1776. In the succeeding year he had a second stroke, and, after a lingering illness, died on the 10th of January, 1778, in the seventy-first year of his age. A general mourning of the nation followed, while the king, Gustavus III., in a speech from the throne, alluded to his death as a public calamity, and ordered a medal to be struck expressive of the national grief at his loss. The best idea of the marvellous ability of this great man is gained from the title by which he has been honored by the scientific world, a far prouder one than any mere hereditary distinction, that of "Prince of Naturalists."

Linnæus' greatest work, the "Species Plantarum," which Haller has emphatically termed "Maximum opus et aeternum," appeared in 1753. To this all his other botanical productions were in some measure only preparatory.

The Linnæan or Sexual System is, briefly, as follows. All known plants are divided into twenty-four classes, the characters of which are formed on the number, or difference in situation or arrangement, of the stamens. The names assigned to these classes are of Greek derivation, and express their several distinctions, *e. g.*, Mon-

andria, Diandria, Triandria, etc Stamens and pistils exist in all the classes except the twenty-fourth, which embraces the Cryptogamia. The orders are founded, as far as possible, on a similar number, situation or arrangement, of the pistils. The strongest recommendation and the sole aim of the Linnæan artificial system was to help anyone to learn the name and history of an unknown plant, in the most easy and certain manner, and even after the recognition of the natural system, it was customary to prefix it to Floras as a key to the genera. It stands unrivalled as a convenient artificial classification of plants, and the impetus its introduction gave to the study of botany throughout the civilized world is without a parallel. Although its classes and orders have passed away, the Linnæan genera and species have stood the test of time most wonderfully, a fact owing to the remarkable exactness of the great author's descriptions, as well as his keen preception of the true relationships of plants.

Not least among the wonderful works of Linnæus was his introduction of a binomial nomenclature, or the method of distinguishing every plant by only two words. Prior to his time a whole sentence was often required to express the name of a plant, and to such a length had many of the names grown that had it continued the study of botany must have been abandoned from its mere unwieldiness. The terrible labor of handling these long names may be judged from the following extract from a letter of Dillenius to Linnæus.

"In your last letter I find a plant gathered in Charles Island, on the coast of Gothland, which you judge to be Polygonum erectum angustifolium, floribus candidis of Mentzelius, and Caryophyllum saxatilis, foliis gramineis, umbellatis corymbis of Bauhin; nor do I object. But it is by no means Tournefort's Lychnis alpina linifolia, multiflora, perampla radice, whose flowers are more scattered and leaves broader in the middle, though narrower at the end."

The poor plant, the object of all these opprobrious epithets, seems to have been *Gypsophila fastigiata*, L., a Swiss plant of the order Caryophyllaceæ.

Linnæus himself did not at first perceive the great value of a binomial nomenclature, and in his early works he distinguished species by the long explanatory phrases of the older botanists; thus, in his "Flora Lapponica," he names a violet, "Viola foliis subro-

tundis cordatis pedunculis radicatis," which translated would make the name of the plant, the violet with long-peduncled, subrotund, cordate root-leaves. This unwieldy title for the common European marsh-violet, he afterwards, in his "Species Plantarum," where he first used, as he terms them, *trivial* names, converted into *Viola palustris*, the name it still bears.

With Linnæus I will close what I have named the Artificial, and enter on the Natural epoch of botany, for though his system of classes and orders held sway for nearly a hundred years, and some of you probably studied it in one or more of the numerous authors who copied him, yet, even before his death, there had begun to spring up the natural system which is now in use That Linnæus himself recognized the importance and superiority of such a system we know by the following extract from one of his letters on the subject to the celebrated Professor Haller of Gottingen.

"I have never spoken of my sexual system as a natural method; on the contrary, in my Systema I have said, 'No natural botanical system has yet been constructed, though one or two may be more so than others; nor do I contend that this system is by any means natural. I do not deny that a natural method is preferable, not only to my system, but to all that have been invented. Probably I may, on a future occasion, propose some fragments of such a one. Meanwhile, till that is discovered, artificial systems are indispensable.'"

This expressed intention to attempt a natural classification was carried into effect by an effort to group the known genera under sixty-seven natural orders, Piperitæ, Palmæ, Amentaceæ, etc., but was afterwards abandoned.

The problem was taken up by a contemporary and correspondent of Linnæus, Bernard de Jussieu, a Frenchman and curator of the Royal Garden at Trianon, who, however, left nothing in writing but a bare catalogue of the gardens, and it was left for a pupil of his, one Michael Adanson, a native of Provence, to first publish, in his "Familes des Plantes," 1763, a complete system of natural orders. Under this system one class consisted of all plants with similar roots, another of all with similar stems, and a third of all with similar leaves as regarded form and situation, but the most important distinctions he considered as founded on the organs of fructification. The system of this ingenious botanist, whose name is pre-

served in the Adansonia or Calabash tree of Africa, was so cumberous and had such a barbarous nomenclature that it never found many supporters, and the fame of being called the founder of the natural system of botany has fallen to Antoine Laurent de Jussieu, to whom more than any other person the honor may be ascribed. This Jussieu, who was born at Lyons, France, in 1748, was the nephew of the Bernard de Jussieu mentioned before, whose pupil and assistant he became when still a youth. Like most of the distinguished early, and indeed later, botanists, this great genius had adopted the profession of medicine, to which even yet botany was only considered an accessory science, and the first few years of his life in Paris were devoted to the study of it. Afterwards appointed demonstrator of botany at the Jardin du Roi, now the Jardin des Plantes, he thenceforth gave his entire time and energy to his favorite science, and especially to the conditions necessary to the formation of a natural system. After nineteen years patient labor he published, in 1789, his "Genera Plantarum Secundem Ordines Naturales Disposita," in which one hundred natural orders of plants were first established and defined by proper characters, nearly all known genera being arranged under them. His primary division of the vegetable kingdom was into Acotyledones, Monocotyledones, and Dicotyledones, which were again subdivided into fifteen classes. The reception accorded to the system of Jussieu was not nearly as cordial as to that of Linnæus, the two systems being regarded as rivals, and many works were published endeavoring to show that the method of the former was not more natural than the Linnæan, while inferior as an artificial one.

The next great systematist was Augustine Pyramme de Candolle, another member of the medical profession, who was born at Geneva, in 1778, a year made memorable by the death of Linnæus, an event which occurred only about three weeks before the birth of one who stands only second to him in the same department of science. In his "Principes de Botanique" prefixed to the "Flore Francaise," published in 1805, he reversed the order of Jussieu, which proceeded from the lower to the higher forms of vegetable life, and began with the latter. On account of its convenience this order has been commonly followed ever since. In the Candollean system the primary division is into Vascular (more properly Phænogamous) plants, and Cellular (more properly Cryptogamous) plants.

These in turn are again divided, the former into Dicotyledenous or Exogenous and Monocotyledenous or Endogenous plants; the latter into Ætheogamous plants, those with sexual apparatus and vascular or cellular tissue, including Equisetaceæ, Filices, Musci and Hepaticæ, and Amphigamous plants, those destitute of sexual organs and composed of other than cellular tissue, including Lichens, Fungi, and Algæ. The great fault in this system was the non-recognition that plants of all orders are bisexual.

John Lindley, Robert Brown, and Stephen Endlicher, between 1827 and 1843, variously modified, and in some respects improved, the Candollean arrangement, and the "Genera Plantarum" of George Bentham and Joseph D. Hooker, the third and concluding volume of which was issued seven years ago, brings our history of botany down to the present day. These latter authors adopt in a general way the Candollean sequence of orders, with various emendations, and theirs is the system now generally followed. Begun in 1862 and finished in 1883, these volumes stand as the second great botanical work of the present century, the "Prodromus" of De Candolle being the first.

In the September, 1883, number of the "American Journal of Science," Dr. Gray compared the various published "Genera Plantarum" in the following way, which may be of interest to you: "Some idea of the progressive enlargement of the field may be had by a comparison of the number of genera characterized in these successive works. The phænogamous genera of

Linnæus,	"Genera Plantarum,"	published	1737,	were	887
Jussieu,	"	"	1789,	"	1707
Eudltcher,	"	"	1843,	"	6400
Bentham & Hooker,	"	"	1883,	"	7585

An estimate of the known number of species of each genus and higher group has been made throughout the work. In round numbers it may fairly be said that about one hundred thousand species of phenogamous plants are in the hands of botanists."

It will thus be seen that in a little less than one hundred and fifty years the number of genera has been increased from 887 to 7585.

I cannot close this brief, though I fear for your patience too lengthy, account of the history of botany, without calling to your attention the names of some of the most distinguished writers on

American plants, whose efforts have in more ways than one helped to bring the noble science of botany to its present advanced state. Among them are Bartram, Michaux, Muhlenberg, Pursh, Eaton, Nuttall, Torrey, Bigelow, and, last but greatest, the late, lamented Dr. Asa Gray, at whose death, so recently as January, 1888, our society expressed by unanimous resolution its deep regret.

"COINAGE AND MONEY."

BY H. B. SMALL, OTTAWA.

Read before the Hamilton Association, 10th April, 1890.

It has been said that if money has made men worse than they were before it, it has also introduced conveniences which previous generations did not possess.

When in the days of old there was no such thing as any currency of money, all transactions were carried on by barter—exchanging one thing for another, and it was to obviate the inconvenience of this, and to obtain a uniformity of value that coin was brought into use; first, in the unwieldy state of bullion, when payments were made by weight, and clipping off so much as was necessary, afterwards by pieces of metal rudely stamped with their weight, and finally in the medallion form, existing to the present day.

At one period of history cattle seem to have been the sole form of money in use, and from the Latin word *pecus*, which means cattle, the word pecunia (money) was derived, and so familiar nowadays in the expression pecuniary embarrassments, or pecuniary transactions. It is not so very long ago on this continent, that skins were used to represent a money standard, especially at the old Hudson Bay posts; whilst dried fish have stood in lieu of cash amongst the Newfoundlanders, and in the more primitive parts of Nova Scotia. The word money is derived from the fact of the early Roman coins being struck in the temple of Juno Moneta, that latter appellation coming from the word "monere" to warn, because that temple was built on the spot where Manlius heard the Gauls approaching to attack the city. Coin is derived from the word cuneo, to force in. All civilized nations have gold as the standard of money, and all other circulating media are but the representatives of that standard.

In Africa where the human race is very low in the scale, a small shell—a specie of cowrie—forms the circulating medium; in Abyssinia, salt, bricks and beads are used, whilst the ancient Britons employed iron and bronze rings for that purpose. The Greeks of

Phocoea in Ionia, in the 7th century before Christ, were the first to conceive the idea of stamping a design on coins, using their city arms, a phoca, or seal, to give the warranty of the state for the right weight and value of their money. Thence the art of coining spread rapidly to the other Greek towns of Asia Minor, and was transplanted to Ægina, Athens, and the Greek colonies in Africa and Italy. The weight of the most ancient gold coin, according to Max Muller, in all these countries, was originally the same as that of the old Babylonian gold shekel, or pound, only stamped with the arms of each country. This shekel, in spite of historical disturbances, has held its own through centuries. The gold coins of Croesus, Darius, Philip and Alexander, have all the same weight as the old Babylonian shekel, 60 of them going to one mina, and what is stranger still, our own sovereign, or pound, has nearly the same weight, and whilst 20 silver drachms or half shekels went to a gold shekel, 20 silver shillings are equal to one sovereign. On this basis was the ratio fixed between gold and silver.

The origin of the pound sterling is as follows :—In the days of William the Conqueror, the management of the currency was in the hands of the Jews, who thoroughly understood the principles of money. They took a certain quantity of silver, or a weight known as the "Tower" pound, something between a Roman pound and a pound Troy. This was the standard of measurement, the unit of value. Out of this pound were cut twenty separate pieces, from each of which were then cut twelve separate coins or pennies, whose weight was a pennyweight—the 240th part of a lb. Troy, and this became the actual coin in circulation, for shillings were not then coined for use. These silver pennies weighed each one-twentieth part of an ounce, and in modern money were worth about 2½¢. This system lasted till the reign of Edward I., or about the year 1300, when the Jews were banished, and their places as money merchants were taken by Italians who had been brought in to manage the coining operations of the mint. They introduced gold for coinage, and then the pound sterling ceased to be a pound weight of sterling silver, for the Tower pound was divided into thirty or forty parts, still called shillings, of which 20 made up a pound sterling, and the metal was debased by alloys so as to increase the circulating medium at the expense of the people. There was no standard for this new gold coinage, and this value had to be estimated in silver,

and it was not till 1717 that this value was fixed by law. Gold, in time, took its valuation from the quantity of silver it would purchase, and in due course of time the position was reversed, and gold became the standard by which everything was measured. The pound sterling of to-day is composed of 22 parts of pure gold to two of alloy, and the gold constituting it is fixed by law at £3 17s. 10½d. per oz. of gold bullion. The pound sterling now, although represented by a gold coin, is a mere figure of speech, representing what was originally an actual tangible thing. The first record of gold coin struck in England after the Roman sway, and that of the early British, occurs in 1257.

Thousands of ancient coins have been tested, and the result has been to show that a ratio between gold and silver was fixed from the earliest times with the most exact accuracy, and Dr. Bruysch shows that for international trade and tribute, the old Babylonian standard was maintained for a very long time, and the great political and commercial nations of the old world solved thereby the bi-metallic problem, and maintained for centuries a fixed standard between gold and silver. This standard, though influenced no doubt by the relative quantity of the two metals, by the cost of production, and by the demand for either gold or silver in the markets of that day, was kept up as a safeguard for the interests of the traders of that time. Modern financiers tell us that a change in the ratio between gold and silver cannot be entirely prevented, but it took place by very small degrees in early days. From the 16th century before Christ, or if we take only coined money, from the 7th century, B. C., to nearly to-day, the appreciation of gold has been no more than 1⅔, viz: from 13⅓ to 15, and any further disturbance, such as not long ago threatened, or partly took place, may be due to the resolution of certain governments to boycott for their own purposes the second most precious metal in the world. The term appreciation of gold is the purchasing power of money, taking it as the measure value of commodities, and itself measured by them. The depreciation of prices, and the appreciation of gold as the standard of value thus mean the same thing. But I am digressing, and this point of bi-metallism belongs to the sphere of political economy more than to our subject.

Gold, however, at last, came in a certain sense to be laid aside by the introdution of paper money, necessitated by the extension of

commerce, which required that money should be expressed in a small portable form. Hence, Bills of Exchange, Promissory Notes, Drafts, and other commercial paper media. Paper money, however, did not fill all that was wanted, and the worthy company of goldsmiths of London, as early as 1600, issued notes to pay for monies loaned them on security—the first banking institution in England, on record. In 1604, the Bank of England was projected, and went into operation, issuing its notes—and then came consols, stocks, and shares representing the National Debt of England, somewhere now about £800,000,000.

The numismatic researches which have been carried on with indefatigable industry by some of the most eminent scholars, may seem simply curious, but like all other historical studies, convey many useful lessons. Coins and medallions perpetuate the memory of great nations, and faithful to its change of fame the medal has transmitted events, the history of which must otherwise have long since perished. They comprise a compendious chart of history, chronology, and heathen mythology, a system of classic architecture, and they constitute an accurate commentary upon the more celebrated poems of Greece and Rome. It is not the metal, but the erudition that stamps the value of a coin in a cabinet.

The names of various coins are traceable with a little research, and show how ordinary adaptations have brought them into common use, without, very often, a thought being given to their origin. Some are from their weight, as the word "Pound"—the French "Livre"—Italian "Lira,"—others from the metal as "Rupee" from the Sanscrit word "Rupya"—silver; others from their design, as the "Angel"—the "Testoon" from teste, or "tete" a head; others from the State, as a "Sovereign," "Crown"; others from the proper name of the monarch, as the "Daric" from "Darius"—the "Louis d'or"—the "Napoleon." The Dollar, or Thaler is from the "Joachims Thaler," or money of the Joachims valley, where these coins were first struck in the 16th century. Guineas took their name from the country where the gold composing them was obtained, and the first guineas bore the impression of an elephant in token of their African origin. The "Franc" is an abbreviation of Franconum Rex. The "Sou" is from the Latin "Solidus." "Shilling" is derived from a word signifying "to divide" and the name is sometimes taken to signify the fraction of a larger coin, as "half-penny," "farthing," "cent" and "mill." The word

"Pound," as said before, originally was not a coin, but a pound of silver, or 240 pennies. The origin of penny is not known, but is said to be from "pender" to weigh. The word "sterling' as applied to money, was used in connection with the Easterlings or North German merchants, whose transactions were mostly of a monetary nature. In the reign of Henry I. of England, the legal tender money was frabicated out of wood. This instrument was called an exchange tally, and, by virtue of it, the holder was entitled to receive from the crown, the value inscribed thereon. It consisted of one-half of a four-sided rod on which was carved in tranverse notches, the sum it purported to represent. These signs were for the unlearned, whilst for the educated, the sum was written on two opposite sides of the rod, which being then split, one-half, called the tally or check, was given to the party for whose use it was intended; the other half, called the counter tally, was laid up in safe keeping till its corresponding tally should be brought in by the person who had last given value for it It was a current token of real money, and served to distribute it from man to man by this exchange. From this was derived the Exchequer Bill in 1696. The word "bill" was derived from the Norman word bille, a rod or staff. Soldiers are to day said to be billeted because formerly they tendered wooden billes, or tallies to those on whom they were quartered. Officers of the army, taken into the King,s own pay, were said to be "put on the staff," because they were paid with wooden tallies or billets.

Of gold coinage, that of England and the United States is probably as graceful and attractive as any that now exists, and the twenty franc pieces of Italy are also very handsome. Half, and quarter dollar gold pieces struck in California are the smallest gold coins known, but they were never in circulation. The most beautiful silver coinage is that of Russia, each piece being in itself a work of art, so finely and elaborately is the die cast. The ugliest silver coinage is that of Hamburg, the metal adulterated and poorly executed, and from its dirty looking condition it resembles a piece of refuse tin more than any other metal. The neatest paper money is that of Greece, and the old bank currency of America in its day was well executed. The worst is the Austrian 5 kreutzrer note, printed on a soft thick greyish paper, which has the faculty of rubbing away like ordinary blotting paper.

To enumerate the coins of antiquity, which grace various cabi-

nets, is not the object of this paper. Not unfrequently, when the real coins of a certain date are unobtainable by the collector, imitations of them are used, and these go by the name of Paduans and Beckers. Becker was an artist of Frankfort, who excelled in imitating coins, but never used his skill for the purpose of deception, honestly selling his productions as avowed copies, which are admitted into cabinets under the name of Beckers. Paduans derive their name from two brothers at Padua, celebrated for the same work as Becker. The shilling of Henry VII. is remarkable as being the first silver coin of that value ever struck. A silver groat of Perkin Warbeck, dated 1494, is a great rarity, having been struck by the order of the Duchess of Burgundy for Perkin Warbeck when he set out to invade England. The erroneous idea of a Queen Anne's farthing being scarce and of great value, arose through the advertisement of an old lady who had lost one, which stated that it was one of the only three known, and worth at least £100. There are several types of these farthings, but the only one intended for currency bears date 1714, the others being merely struck as patterns, and they are not un common. The farthing and the sixpence of Oliver Cromwell are much more scarce, for after he had stamped his head upon them he was afraid to issue them as currency. The crown piece of Cromwell is very scarce, and there is a tradition that the die became cracked across the neck after a few impressions were struck, which having been considered ominous, the issue was stopped and the coin recalled.

The large penny pieces of William IV. are scarce, owing to a rumor current, which caused the Jews to buy them up, that a crucible of gold had accidently been mixed with the copper composing those pieces during coinage, and that by remelting them this gold could be extracted. Whether such was the case or not history will never record, as the mysteries of the mint are kept sacred, and its records are never made public.

Until the reign of Charles II., the coinage had been struck by a process as old as the 13th century, when Edward I. invited skilled artists from Florence to improve the rude money then current, and the methods adopted by them were maintained. By these artists, or designers, the metal was divided by shears, and then stamped and shaped by the hammer, everything being left to the eye and the hand of the workman. Some pieces consequently were larger or smaller, few were exactly round, and the rims were not

milled. Clipping coin thus became an easy and profitable fraud. In Elizabeth's time this was high treason, and subjected clippers to the penalties for that offence. In consequence of this mutilation, a great improvement was suggested in Charles IInd's reign, and a mill which to a great extent superseded handwork, was set up in the Tower of London, and was worked by horse-power. Pieces turned out by it were not easily counterfeited. They were perfectly circular, and their edges were inscribed with a legend. But the hammered coins were not withdrawn, as the financiers of that day expected the new coinage would soon displace the old. But the reverse was the result, for when it was found out that a clipped coin went as far in the payment of debts as a milled edged one, the latter found their way into the crucible, or abroad. The wiseacres of the government of that day marvelled that people should be so perverse as to use light money in preference to that of full weight, and as each lot of new coinage appeared it as quickly disappeared. A writer of that day mentions the case of a merchant, who in a sum of £35 received only one-half crown in milled or new coinage. In 1695, five millions in nominal value of the coinages of Elizabeth, James I. and Charles I., were in circulation, with half a million of the new issue, and two-thirds of the whole was clipped. Coiners multiplied, and the extreme penalty of the law was continually enforced, the punishment then being death. At this juncture, when trade was all but paralyzed, Parliament took up the coinage question, and the debate lasted for several days. The result was as follows: The money of the kingdom was to be recoined according to the old standard of weight and finance; all new pieces were to be milled; the loss in the clipped pieces was to be borne by the public; that a time should be fixed after which no clipped money should pass except in payments to the government, and a later time was fixed after which no clipped money was to be passed at all. The loss was to be met by the imposition of a tax upon windows, which continued to be levied long after the immediate occasion had passed away. Until milled silver come into circulation a guinea passed for thirty shillings. When the former became plentiful, it fell to 21, 6, and finally to 21 shillings, which it ever after retained.

Pepys, in his diary in 1664, says: "The old law of prohibiting bullion to be exported, was a folly and injury, rather than good, for if the exportations exceeded the importations, then the value

must be brought home in money, which, when our merchants know cannot be carried out again, they will forbear to bring home in money, but let it lie abroad for trade, or keep in foreign banks; or if our importations exceed our exportations, then to keep credit the merchants will and must find ways of carrying out money by stealth, which is a most easy thing to do, and is everywhere done, and therefore the law against it signifies nothing. Besides it is seen where money is free there is plenty, where it is restrained, as here (England), there is great want."

It is a curious fact that paper should be the only article used to represent commerce, when leather or cloth would seem to be so much more durable. Yet bank note paper lasts a long time, and not unfrequently the Bank of England receives a note of extraordinary age. The Bank of Bengal, in India, was once called upon to pay several thousand pounds of notes so old that none of the present generation remembered the pattern. A traveller in France, not many years ago, found a 1,000 franc note pasted on the inside wall of peasant's hut as a pretty picture, which the man said he had picked up years before, and so firmly was it pasted on, that the brick to which the note adhered had to be taken to the bank where it was at once cashed, and is still retained as a curiosity. Leather, according to Socrates, was used in Carthage for coinage at one period, and in 1360, King John of France, having to pay Edward III., of England, 300,000 golden crowns for his ransom, was so impoverished as to be compelled to resort to a coinage of leather for the discharge of his household expenses. Seneca tells us that under Numa Pompilius, both wood and leather took the place of coin, being stamped of a certain value, a fact also put in practice by Frederick II. at the siege of Milan.

The Bank of England never issues a note a second time. When once it finds its way back to the bank to be exchanged for coin, it is immediately cancelled. The average life of a Bank of England note, or the time in which it is in circulation, is not more than five or six days. The returned notes average about 50,000 a day, and represent, one day with another, about one million pounds in value. Sorted and cancelled, these notes are packed away for five years, at the end of which they are consumed in a furnace, but so perfect is the system under which they are registered and stored, that any particular one, provided the number is asked for, can be

produced in a very few minutes. The Bank and its offices, including the printing rooms, for all its notes are printed on its own premises, cover nearly three acres, and it employs in town and country nearly 900 officials.

Over £11,000 worth of silver is wasted every year in the course of the circulation of the English silver coinage. Mr. Miller, a well-known authority on money, weighed, in 1859, one hundred sovereigns coined in 1820, and found a loss in weight by circulation of £1, 6s. 7d. In the numberless handlings a shilling has to submit to in the course of years, the loss arising therefrom becomes at last sensible to the ordinary balance. Coins suffer also from abrading each other when jingling in the pocket, and they are damaged each time they are rung on a counter. Every minute particle of matter removed in any way lessens the weight and makes coins look old, and in the lesser pieces which are much used, this proceeds to a marked extent. Several processes have been traced in England for abstracting a certain portion of metal from coins without defacing them; one of these, which was attributed to Jews, being known as "sweating." This was done by shaking together in a leather bag for some time a number of sovereigns, and then collecting the particles which the coins had lost. Another process was placing coin in contact with sulphur or in its fumes, which covered the pieces heavily with a coating which was subsequently removed by a chemical process, or by polishing, and which thus abstracted a certain value without defacing the coins themselves. Plugging with base metal and gilding or silvering the plug was another trick, and so largely was the process of boring a hole in silver pieces carried on that such bored pieces were finally refused; and in the United States no defaced coin will be taken in trade at any value whatever.

A paper was read in November last (1889) before the Institute of Bankers, in London, by Mr. R. H. Inglis-Palgrave, F. R. S., on the note circulation of England and Wales, urging the re establishment of paper money of the value of one pound. He alluded to the new issue of postal orders for small sums, which, supplemented by stamps when making up odd shillings and pence is required, as shewing the demand for such currency; and quite a discussion followed on this subject. He said: "New South Wales, Victoria, South and West Australia, Queensland, Tasmania, and New Zealand

are flooded with paper currency from one pound upwards. As a rule, indeed, the colonists prefer paper to gold; still the notes of one colony can only be cashed in another by the payment of a considerable discount; and if ever the dream of Australasian federation becomes a reality, the unity of currency will be as vital an element in the federal constitution as the unity of custom houses, postoffices and colonial defences." In the United States, again, gorged as are the national coffers and the bankers' strong rooms with gold and silver, paper is generally preferred to bullion. The latter is often contumaciously alluded to as "truck," and apologies are made when it is tendered in payment. It may be that there is something akin to vanity, or at all events to pardonable complacency, in this partiality to paper money. The American does not fail to remember that the old war greenbacks have been triumphantly redeemed, and that those securities, together with the almost innumerable local notes — many of them of a more or less "wild cat" order — have all been superseded by a national bank note, locally issued, but fully secured by funds deposited in the National Treasury at Washington. It is only in the Golden State of California that the feeling in favor of solid cash, as against paper promises to pay, has not entirely disappeared, and San Francisco is almost the only city in the Union where a lawyer does not object to receive his fees, or a merchant his account in a rouleau of twenty dollar gold pieces, splendid to look upon but somewhat cumbrous to carry. An analogous fondness for the doubloon, or "onza de oro," is to be found in Cuba, in Mexico, and in some states of South America. Returning to Europe, we find that in Italy, although the "corso forzato" has become a thing of the past and paper money is redeemable for cash at par, business is almost entirely carried on by means of large or small notes. Germany has got a new coinage and is getting rid of small notes; but Austria is yet subject to the boon or the bane of illimitable shin-plasters. In Spain it is very difficult to obtain gold for notes, and the whole Peninsula swarms with spurious silver "duros" and "pesetas;" while as regards Russia there is no exaggeration in saying that many millions of the people have never seen a nationally coined piece of gold or silver. Bank notes, generally ragged and horribly dirty, are the popular currency, and have been so ever since the time of the Crimean war; and of how many millions of the rouble and half-rouble notes in circulation

are forged, probably neither the minister of finance nor the national bank, nor the police, have the remotest idea.

Our French neighbors, like the Belgians, will tolerate a twenty franc note, but there in the descendent scale they inflexibly draw the line. Just after the Franco-German war of 1870-1, there was, for a short time, a terrible scarcity of hard cash. What ready money there was had been hidden or buried by the frightened possessors thereof. The Bank of France, in stress of gold and silver, was fain reluctantly and tentatively to issue five franc notes. After a very little while the public would have none of them. They feared a yet further descent in denomination. They dreaded franc, half-franc, twenty-five centimes notes. They shuddered at the gory spectre which seemed to be hovering over them—the phantom of the assignats; the awful "shin-plasters" of the Revolution, which were never redeemed, and the depreciation of which was aggravated by the cynical policy of Mr. Pitt, who, in order to hasten the bankruptcy of the Republic, caused assignats by the hundred weight, forged in England, to be smuggled into France. The Roman Emperor said that money had no odour. As a matter of fact, in sadly numerous instances it has had the smell of blood. The French assignat reeks with sanguinary memories; and little less ghastly is the history of the English one pound note.

There is extant a rare pamphlet, published in 1819, being a report of a Committee of the Society of Arts, relative to the mode of preventing the forgery of bank notes, and the publication of this curious document is justified by the remark that since 1815 the convictions before the Criminal Courts for bank note forgery had increased in an alarming ratio, while juries became more and more reluctant to visit with the extreme penalty of the law, a crime for the prevention of which no successful precautions had been taken. Added to this was the notorious fact that at many recent trials it had been shown that forged notes had passed, undetected, under the scrutiny of the Bank inspectors. Appended to the report are several models of one pound notes proposed to be issued, and so artistically and elaborately engraved, as, in the opinion of the Committee, to defy the skill of the most expert forger. Among these perhaps the most singular is a one pound note produced exclusively by means of typography and wood engraving, which it was claimed could never be imitated, inasmuch as to execute it there would be required the

co-operation of punch-cutters, matrix-makers, mould-makers, casters, breakers, rubbers, setters-up, compositors, readers, press-men, engravers, and engine turners, and it was beyond the reach of probability that such a confederation of skilled malefactors could be brought together for the consummation of a single fraud. The framers of the report, however, little dreamt of what was to be done in the future by photography and photogravure. The sheet-anchor of every bank note is now in the paper. Should we be quite sure of our anchorage in an ocean of new one pound notes?

It is only of late years that the fact has been ascertained that banking was carried on in very early ages. Mr. Hilton, F. G. S. of the Institute of Bankers, says that as far back as 2250 B. C., the Chinese and Hindoos carried on operations equivalent to it; and Mr. George Smith of the British Musuem, the great Assyrian authority, discovered tablets amongst the Assyrian marbles whose translation showed cheques, receipts and other records of a great firm of the name of Egibi, which flourished 507 B. C. A remarkable fact in connection with these was that each bore the day of the month, date and year of the monarch in whose reign the transactions were made. Among the tablets was also a bank almanac of the firm, containing the complete calendar of the Babylonian year. A form of cheque called the attribute or prescriptum was known amongst the Romans, but it is not recorded whether it was payable only to bearer or to anyone else. Recent discoveries in Pompeii have unearthed tablets used by a Roman banker, showing receipts for payments, and the registration of payments made to the public exchequer. No details, however, have been discovered, of any transactions beyond daily use, and no records have yet come to light, of promises to pay, or acceptances.

Up to the year 1707, Scotch coins were quite distinct from English, consisting of pistoles, marks, nobles, besides base money of Atkinson's or Achison's (8d.) bawbees, placks, and boddles. The Irish coins have always been made in England and sent thence to Ireland, there being no mint in that country, but their value was not as high, the shilling being only worth 11d, and their pound 18 shillings and four pence halfpenny. In like manner, in the Channel islands, the shilling is worth thirteen pence, and the pound 21s. Many of us remember the Halifax currency here, before the decimal currency was adopted, when 16s. sterling was called a pound.

The reason why coins are always struck, and not cast in a mould is from the fact that gold, silver and copper, sustain a contraction in their transition from the liquid to the solid state, and cannot therefore be cast to the figure of a mould, consequently their impression must be stamped.

The coinage of a country is ever on the change, a new coin being produced while another is called in. In England the following coins have disappeared—the silver groat and half groat, 4d. and 2d, introduced by Edward III., the testoon by Henry VII; Elizabeth's three half-penny and three farthing pieces; the mark, noble, royal, spur-royal, angel and angelet, and the tin-half pence and farthing coined by Charles II. Less than a century ago, five guinea and two guinea gold pieces, and twopenny pieces in copper, were in general circulation; guineas succumbed to the necessities of political ecomomy, whilst crowns and fourpenny "bits" have died out within quite a recent period. The florin is a comparatively new coin, but is not often seen in this country, whilst the seven-shilling gold piece is only found in the collections of the numismatist, or forming an ornament to a watch chain, along with the old spade guinea. Even the large copper penny of our father's time is supplanted by a smaller coin of bronze, and to give a more familiar illustration at our own door, it is quite within the memory of us all when our Banks had to recall all their paper issue under five dollars, and these notes were supplanted by a government issue of Dominion Notes of one, two and four dollars value respectively. The "Sous" of Lower Canada and the Bank token of Upper Canada are becoming scarce, with the larger coinage and circulation of the cent, and Canadian silver currency has now driven from trade the various silver coins which formerly were current all through our land.

The earliest coinage that can be called American was ordered by the Virginia Company, and was minted in the Bermudas in 1612, when, and for many years after, the standard currency of Virginia was tobacco. In 1645 the Virginia Assembly provided for the issue of copper coins of the denominations of 2d., 3d., 6d. and 9d. Seven years later, in 1652, the general court of Massachusetts passed an order creating a "Mint-House" at Boston, and which directed "the "coinage of 12d., 6d. and 3d. pieces, which shall be for form flat, "and stamped on one side with N. E., and on the other side with "12, 6, 3, according to the value of each piece, in Roman numerals."

This mint also produced the oak-tree and pine-tree shillings. During the reign of William and Mary, copper coins were struck in England for Carolina and New England; and for Maryland Lord Baltimore caused silver shillings, sixpences and fourpences, to be coined in London. In 1785, Connecticut and Vermont established their own mints for copper coinage, and New Jersey followed in 1786. The Act which established the United States Mint was passed in 1791, and the building was commenced in Philadelphia the following year. The first purchase of metal for coinage there consisted of 6 lbs. of old copper, and the first cents struck for circulation bear date 1793. The original mint was moved in 1831 to its present quarters on Chestnut street, and till 1835 was the only mint in the United States. In that year branches were established at New Orleans, at Charlotte in North Carolina, at Dahlonega, Georgia, and in 1854 another branch was opened in San Francisco, the coinage of each of which is denoted by an initial letter upon the face of the coin. Philadelphia, as the parent mint, uses no initial.

In 1794 the regular coinage of dollars began, and the coins of that year sell now for $100 each. It was an adaptation of the Spanish milled dollar or "piastre," a coin very popular wherever the Spaniards went. The Spaniards took the German name "thaler," which was acknowledged under Charles V. as the coin of the world, and pronounced by the North Germans as "dahler." It was corrupted eventually into dollar, Charles V. being entitled "Emperor of Germany, King of Spain, and Lord of Spanish America."

The Numismatic Society of Montreal has done much to shed light on the history of Canadian coins, and a catalogue published under their auspices by Mr. Sandham, is a standard authority on the subject. Dr. Leroux has also contributed to this research by means of an illustrated work, and Mr. R. W. McLachlan has brought out the most complete compilation in his recent volume. I must here quote from it a passage of interest in connection with the early French settlements. Speaking of the French American, and especially of that of 1755, which bore an impression of the golden fleece, he says: "Many were the Jasons in those adventurous days who set out for New France, expecting to return with the much coveted auriferous prize. But the *fleecing* of the poor habitants indulged in by some of the governors and intendants were the nearest approach to the *Golden Fleece* which they ever obtained. To this cause more

than to all others may we attribute the failure of French anticipations in the building up of a glorious empire in America."

It is perfectly astonishing to others than coin collectors, what enormous prices are sometimes paid for a rare coin, and the value is occasionally run up at sales when two or three wealthy collectors are vieing with each other for some unique specimen or piece which they eagerly desire to possess. The greatest sale on record, by public auction, was the collection of Lord Northwick in 1859 and 1860. The former consisted of Greek coins only, and realized £8,568; the latter, of Roman and later pieces, realized £3,320. A Greek coin of Camarina was bought there by the British Museum for £52, and a coin of Agrigentum brought £159. One Syrian coin, viz: "Cleopatra," Queen of Syria, was bought by the British Museum for £240. Lord Northwick, who lived to a great age, had spent his life collecting, and from 1790 to 1800 he spent these ten years in Italy collecting antiquities, with the assistance of Sir Wm. Hamilton, then ambassador at Naples. Since his sale there has been nothing to approach it.

Were it not for continually new discoveries in Europe of hidden treasure, the resources for collecting would soon pass into the hands of the few. But excavations and building operations frequently bring to light new finds, and very often in the most unexpected places. From the beds of rivers, around old foundations, on the site of Roman camps, and in the East Indies especially, where hoarding is to this day largely the practice, coins are constantly procured, and, as in olden times treasure was hidden at the approach of an enemy, or when its owner was anxious for its safety, pestilence, sudden death, or the carrying off into bondage of the owner without his return, caused the hiding place to remain unknown for centuries, and a vast amount of ancient wealth doubtless lies buried away for discovery in future ages.

And now I want to say something about the wealth of the ancients, those who lived in what was really the "golden age." We use the term to-day, "money king," but the wealth of our millionaires fairly pales before some of the recorded amounts of the old Greeks and Romans. History tells us that Ptolemy Philadelphus of Egypt, 283 B. C., amassed a sum equal to $1,000,000,000 of our money. Cicero, like all literary men, was impecunious, yet he gave $150,000 for a villa; Clodius, his bitter enemy, paid $550,000 for

his town residence on the Palatine, and Massala, who also wished to live in the same quarter, that being the fashionable part of Rome, bought Marc Anthony's old residence for $2,000,000. Seneca, the philosopher, lived on the income of $20,000,000, which Sullius charged him to have amassed by usury. Tiberius left $1,300,000 to be divided amongst his heirs. Cæsar, before going into politics, owned some $14,000,000, and we can understand why the objection was raised when he was appointed Governor of Spain. Marc Anthony, we are told, when quite young owned $2,000,000, through the extravagant life he led with Curio, and later in life, he at one time settled a debt of $1,500,000, by paying cash in fifteen days. Subsequently he managed to spend $800,000,000 of the public money in an incredibly short space of time, as recorded by Plutarch. A supper of Caligulus cost $400,000; his favorite horse was kept in an ivory stall, and fed from a golden manger, with gilded corn. Esopus, an actor of note, (not the fabulist), paid $100,000 for one dish. Heliogabalus used bedsteads of solid silver, his plates were of pure gold—his mattrasses covered with carpet or cloth of gold, and were stuffed with down from the under wings of the partridge. One Roman Emperor had a dish compounded of nightingales' tongues, and another of peacocks' brains, and the extravagance and lavishness that resulted in the ultimate downfall of the nation was satirized by Juvenal equally as well as by any critic of to-day. Varro speaks of one Ptolemy, a private gentleman, who kept 8000 horses, had generally 500 guests at his table, with a gold cup set before each, and which was changed with each course. Pythius, of Bithynia, feasted the whole army of Xerxes in one day at his own cost—1,700,000 strong. The public buildings of Rome, moreover, shewed the wealth of that day. Scarus built a theatre to hold 30,000 spectators, and adorned with 3,000 brazen statues. In the Circus Maximus, built by Tarquinius Priscus, 395,000 persons could be accommodated, and it was always full when sports were going on. Nine thousand public baths were maintained in Rome at one time. The Temples—the churches of that day—were treasuries of wealth. The Palace of Nero was overlaid with gold and embellished with gems and mother-of-pearl. Its ceilings were fretted with ivory coffers made to turn, that flowers might be showered down on the guests, and furnished with pipes for sprays of perfume. Time fails to add to this list, but Thebes, Alexandria, Athens, Ephesus and Carthage,

possessed buildings far surpassing any of modern times. In those days extremes met, the poor *were* poor, and the rich *very* rich. How their wealth was accumulated history is silent, but corruption was rampant amongst the upper classes of that day.

Mr. Griffen, the famous statistician, recently stated, when speaking of the accumulated wealth of Great Britain, that if the several countries were to be separated, England would be entitled to £308 a head, Scotland £243, Ireland £93. Making a comparison of the three richest nations of the world he said that the wealth per head of the population is as follows; Great Britain £270, or $1.276; France £190, or $912; United States £160, or $768.

Earl Russell, in an address made by him before the University of Aberdeen, alluding to the corruption which prefaced the fall of Rome, said such a state of things was not confined to Rome. We, he said, have not yet got quite so low, but we have arrived at a point where intellectual greatness ceases to be appreciated, and a low sensualism characterizes our habits. It is for this that money is needed, and the more that is acquired and spent the more is needed. It is through the eager desire for the acquisition of riches in the briefest space of time that our stupendous failures occur, our defalcations, and our records of destitution and pauperism so discreditable to national honor follow in their wake. In the pursuit of wealth commercial morality disappears, and he cited the anecdote of a Quaker whose ship was so long at sea that he went to effect an insurance upon it. The Company was equally wary. Pending the negotiation the merchant heard that his ship was lost. He wrote to the Secretary to this effect: "If thee hast not made out the policy, thee needest not, for I have heard from the ship." The Secretary filled up the policy at once, and handed it to the messenger, thinking what a stroke of business he had effected. The messenger returned with the reply—"Since thee hast made out the policy, it is all right, I have heard from the ship as I told thee—but—she is lost."

The late Henry Ward Beecher, in a lecture he delivered in Ottawa some years ago on the ministry of wealth, pointed out the different ideas of wealth as entertained by people in different stations of life, and delineated the pain of the avaricious millionaire, whose only thought was how to make his interest increase. A wealthy man, he said, should encourage and patronize Art and Beauty. The power to concentrate wealth had an influence on the suffrages of

electors, on the legislature, the courts of justice. The gigantic railway companies, he prophesied would eventually rule the destinies of this continent. The monarchy of wealth is an oppressive monarchy, and is becoming more so. Properly applied it would be the salvation of the nation, if not, it must be its downtall.

HAMILTON ASSOCIATION.

REPORT OF THE COUNCIL

Read at the Annual Meeting, held 8th May, 1890, for Session 1889-90.

The session now closed has been on the whole a successful one. The attendance has been satisfactory, and the papers read have been of a very superior character, while the interest manifested has been at least equal to that of former years.

Seven general meetings, and one special meeting have been held during the session, at which the following papers have been read, viz.:

1. The opening address of the President, Mr. B. E. Charlton, who set forth therein, in a very popular and practical manner, the pleasure and profit of scientific study to the business man and others. As the marvels revealed by science far exceeded the wildest flights of fancy portrayed by the novelist, its use as a means of recreation to all was urged.

2. "The Question of the Variation of Species" was treated by Mr. J. Alston Moffat, member of the Council of the Ontario Entomological Society.

3. "Indian Fable Literature," by Mr. H. B. Witton, Sr.

4. "Colors, Kromatics, and the Permanency of Pigments," by Mr. S. J. Ireland, Principal of the Hamilton Art School.

5. "Historical Botany," by T. J. W. Burgess, M. B., F. R. S. C.

6. "Coinage and Money," by Mr. H. B. Small, of Ottawa, an Honorary member of the Association.

7. "The River Valleys of the Niagara Escarpment," by Mr. D. F. H. Wilkins, B. A., of Beamsville.

The lease of our present premises having expired last May, the Council of the Association sought to obtain accomodation for Natural History specimens, and room for holding our meeti[illegible] the new Public Free Library Building. For that purpose a dep[illegible] tion appointed by the Association had an interview with the Trustees of the Library, but failed to come to any arrangement. Since then the Hamilton Art School having secured the upper story of the Library building, the Directors of that institution have made us the offer of a five year's lease of 1200 feet of floor space for the annual rental of $130.00. This offer has been accepted, and it is hoped that the first meeting of our next session, commencing in November, will be held in our new premises.

During the year many contributions have been made to the Museum and Library. To all the friends who have added to the value of these branches of the Association work we tender our best thanks.

The Council having been asked to consider the question of giving or lending the books of the Association to the Free Library, has concluded to give and lend them, under conditions which are set forth, and may be found in the abstract of the Minutes of the Association meetings. This proposition having been confirmed by the Association, and accepted by the Trustees of the Library, the books have been handed over for the use of the public, though still the property of the Association.

The Sections, especially the Biological and Geological Sections, have been in active operation during the year, and the reports of these will be presented and published in the Transactions of the Session.

We cannot close this report without expressing our great esteem for Drs. Burgess and Reynolds, and also our regret for the loss of their valuable services to the Association by removal from the neighborhood. Dr. Burgess, during his connection with us, has done much to awaken fresh interest in scientific study, especially in Botany. The Association is indebted to him for the commencement that has been made to form a complete collection of the Flora of Hamilton. Dr. Reynolds was for long the valued Secretary of the Biological Section, and his services in that capacity will be much missed. We desire to express our best wishes for their success and happiness in their new sphere of labor.

Your Council hope that the entering upon the possession of our new and better premises will be the means of increasing our membership, and infusing new life into all the departments of our work.

All of which is respectfully submitted.

B. E. CHARLTON,
President.

A. ALEXANDER,
Secretary.

ANNUAL REPORT

OF THE

BIOLOGICAL SECTION

SESSION 1889-90.

During the past season some fifteen meetings have been held in this Museum, and two—in June and July—by the kindness of Mr. Alexander, at his residence, where his beautiful garden proved an attractive resort on a warm summer evening, and some time was agreeably occupied in inspecting the results of his experiment in botany.

Few regular papers have been read, the meetings generally being of an informal but none the less enjoyable character, and many interesting subjects were brought up, leading to general discussions, whereby a good deal of valuable information regarding natural history items was elucidated. Some of the earlier meetings were given up to the exhibition of specimens.

At the meeting on Nov. 1, Mr. J. Alston Moffat reported for the Entomological division, having added twelve new species of moths to his collection, by no means a poor showing considering the poverty of insect life during the summer, owing no doubt to the peculiar weather experienced, an early spring followed by continued rains and killing frosts as late as the beginning of June.

At the meeting on March 7th, in the absence of Dr. Burgess, Mr. Alexander presented the report of the Botanical division, showing an addition of two hundred and nineteen species to the Herbarium, donated by Dr. Burgess and Messrs. Alexander, Walker and Morris, of this number two hundred and four were species new to the collection, and no less than thirty-three new to the Hamilton Flora as recorded by Logie and Buchan. A number of interesting plants

collected on an island in the Georgian Bay were shown by Mr. Alexander at one of the meetings.

The Conchological report presented on April 18, by Mr. Hanham, showed a total of ninety species of land and fresh water shells taken in this district up to the close of 1889, an increase of fifty per cent. on the list presented for 1888. There still remains much to be done in this line, not so much in the addition of many new species, but in the thorough working of the district—much of which is yet untouched—to learn the distribution, habits, and locality of the different species A careful exploration of Hamilton Bay and Dundas Marsh would without doubt double the number of the Unionidæ observed here, at present numbering only thirteen named species.

The following are some of the papers read:

Oct. 19. "Notes on Bumble Bees," J. Alston Moffat.

Nov. 1. "Botanical Notes, (Man's agency in plant distribution)" Mr. Alexander.

Dec. 20. "Arctic forms of life," J. Alston Moffat.

Jan. 17. "Notes on formation of Coral Islands," B. E. Charlton.

March 17. "Notes on birds wintering in district," Thos. McIlwraith. (Illustrated by many beautiful specimens from his collection.)

April 18. "The elasticity of the constitution of plants," Mr. Alexander.

Besides these the section stands deeply indebted to Mr. Wm. Yates, of Hatchly, Ont., for many interesting notes on botany, ornithology, entomology, etc., contributed from time to time, and especially for his valuable "Notes on Snakes" being the papers read on February 7th and 21st.

Special mention must be made of a visit to this city of Mr. Wm. McIlwraith, of Rockhampton, Queensland, Australia. On Oct. 19th he favored this section with an address on the Flora and Fauna of Australia, dealing in a most eloquent and instructive manner with the differences in the aspect of Australia as compared with this country.

No organized field days were held this summer, an intended trip to Lake Medad on 24th of May falling through owing to the inability to secure suitable conveyances on that day. A week later however, Dr. Burgess and Mr. Hanham tramped it, and were well

repaid for their long walk, not only by the beautiful scenery on route and at the lake side, but by the number of rare plants and other objects of natural history secured. The Albion Mills, Ancaster, Dundas Marsh, Waterdown Ravine and other points were visited at intervals during the season.

In conclusion reference must be made to the great loss sustained not only by this section but by the Hamilton Association, by the departure of Drs. Reynolds and Burgess from this city. Dr. Reynolds was for the greater part of the session the secretary of this section, and well and ably did he fulfill all the duties pertaining thereto. Dr. Burgess as a botanist has few equals in this Dominion of Canada, and during his stay here was instrumental in infusing new life into all the branches of natural history. By these removals from the ranks of our by no means numerous workers, this section especially suffers, and the members of the Hamilton Association and all lovers of nature and nature's wonder-land are earnestly invited to come forward and assist in carrying on the good work that is being done by this section.

A. E. WALKER,
Chairman.

A. W. HANHAM,
Secretary.

ORNITHOLOGICAL DEPARTMENT

OF THE

BIOLOGICAL SECTION

BIRDS WINTERING NEAR HAMILTON.

BY MR. THOMAS M'ILWRAITH.

The migratory habits of birds is a subject which at all times presents many attractions to those who are fond of out door studies, and in our northern latitude it is especially interesting. In tropical countries the birds do not often change their habitat and are said to attract less notice on account of their perpetual presence. With us the extremes of temperature are so great that with few exceptions all our birds are migratory. Those which are with us during the summer and raise their young in this locality are known as summer residents, but a great number of species spend the season of reproduction still further north, paying us only a passing visit in spring and fall. We are accustomed to hear all these called American birds, but it would be more strictly correct to style them Canadian, for Canada is the land of their birth, and they visit the United States only to avoid the severity of winter. Having no particular tie to any locality at that season, many go as far south as the West India Islands, and to a few, South America forms the turning point. There is still another class more boreal in their habits, which spend most of their lives to the north of us, and only occasionally, in winter, come as far south as the latitude of Hamilton, and it is to this class I should like to direct your attention on the present occasion. These are termed winter visitors; they are not here every winter, and are sometimes seen only for a few days in a season, but the very uncertainty of their appearance and disappearance makes them objects of greater interest.

In October, when the sharp frosts have cut off the supply of insect food, and the swallows and other insect feeders have gone south, among the first arrivals from the north is the great *Northern Shrike*, Lanius execubitor, who, as his name implies, is a veritable butcher among the birds. Not satisfied with killing enough to supply present wants, he tears his victim to pieces and impales the parts, usually on the spikes of a thorn bush, but here we have an instance of the way in which birds will avail themselves of any accidental convenience which may come in their way, for in the prairies, where game is abundant, and thorn bushes absent, the victims are found ranged in rows on the barbs of the iron wire fences.

These Shrikes were common in October and November, but were not observed during December, January, nor February, having apparently gone further south, to return again in March and April.

Shore Larks, of the variety praticola, were seen in small flocks during the winter, but the numbers were greatly increased by arrivals from the south early in February; these latter may be regarded as the first spring migrants.

Cow Birds are considered migratory, though occasionally a few males are observed to winter about some of our farm houses, roosting in the sheds above the cattle. During the present season large flocks have been seen at different places in December, January and February. Of *Meadow Larks* the same may be said, for it is only now and then that we find an individual here in winter. During the present mild season I have noticed groups of four or five at several different points, in the months already named.

Song Sparrows were frequently seen among the rushes along the bay shore, which is not their usual habitat.

Snow Birds were seen at the beach in October, but this species seems to be always associated with snow, and that being scarce during the winter the birds were the same.

Red Polls put in an appearance quite early, and were common in weedy places during the season. There are five varieties described in this group, all of which no doubt visit us, though they receive so little attention that they may pass unnoticed. Last winter I was fortunate in securing a pair of a variety I had not before encountered. They were the "acanthis linaria rostrata," or Greater

Red Poll, stout hardy looking birds, measuring six inches in length, the common kind being only four and a half inches. They were observed feeding in company with the common species.

Early in October the first *Snowy Owls* were seen, and by the end of November their migration was over. I heard of seven having been obtained here, but at Toronto about forty were killed. These birds like to be near water, and large numbers come down the Ottawa valley, and thence westward along the north shore of Lake Ontario. The island at Toronto is a place just to their liking, dead fish and "cowheens" being abundant, but at that season of the year the marsh there is bristling with fowling pieces in the hands of those who are well practised in their use, and the owl skins being always in demand, scarcely an individnal is allowed to escape. Therefore, it is only those which have run the gauntlet at Toronto which we see here at all. It was remarked this season that a large number of those obtained were females.

At Toronto a *Razor-bill*, several *Great Grey Owls*, and one or two *Hawk Owls* were obtained. Near Hamilton, in the woods, the usual groups of *Downy* and *Hairy Woodpeckers*, *Chicadees*, *Brown Creepers*, *Kinglets* and *Nuthatches* have been observed, and *Blue Jays* have been often seen. *Crows* have been more numerous and active than usual, and flocks of *Goldfiinches* in winter dress have been seen in their usual haunts, but the most interesting visitors we have had for many years have been the *Evening Grossbeaks*. These birds are natives of British Columbia, and so little has been known of their history that it was not till 1887 that any account of their nest and eggs was published. In June of that year Mr. Walter E. Bryant read before the California Academy of Sciences an account of a nest of this species, which was found in Yolo county, California. The nest was placed in a small oak about ten feet from the ground, and was built of twigs rather loosely put together and lined with fibrous bark and horse hair. It contained four eggs of a clear greenish color, blotched with pale brown. The name, *Grosbeak*, is a corruption of the French *gros-bec*, meaning thick bill. There are several members of the same family peculiar to the United States, and to distinguish this from the others it was named the *Evening Grosbeak*, from a belief formerly entertained that it sung most frequently at that time of the day. The migratory course of the birds has heretofore been down the Pacific coast as far south as Arizona,

but within the past year or two they have come east to the Mississippi, many having spent last winter near Minneapolis, and St. Paul in Minnesota. During December, 1889, about the time the birds would be moving southward, we were visited by severe gales from the west and northwest. Either the birds were caught in these and carried eastward against their wishes, or finding a warm moist belt extending far east into a new country where food was plenty, they came on, led by some daring leader ambitious of exploring new territory, and visited us in numbers far in excess of anything previously known in the history of the species.

My first knowledge of their presence among us was from a friend who, on the 19th of December, brought me a pair which he had shot on the north shore of the bay near the powder house. I took an early opportunity to visit the locality, and found a flock of 20 or 30, males and females here being in about equal unmbers, feeding on the berries of the red cedar. They were by no means shy, but when disturbed went off east with a peculiar rattling call note. A few days afterwards I found a flock again at the same place, and was at a loss to know whether the same birds had returned, but this lot also went off east, and subsequently I learned that they had reached Toronto. It was now evident that those we daily noticed here were flocks passing from west to east, and this movement was kept up steadily till the 1st of February, when the eastern migration ceased. I learned from newspaper notices and correspondents that they had been seen at every town and village along the north shore of the lake, and a few got as far as Quebec. The bulk of the migration passed over into New York State, and were very generally distributed, delighting the eyes of many a lover of birds by their sprightly presence during the dull days of winter, when bird life is at its lowest ebb. Finding things to their liking in the east they were in no hurry to return, though small flocks were observed moving westward during March and April. As late as the beginning of May some were seen among the evergreens near this city, which led to the hope that they might remain and make their home with us permanently. We should be greatly pleased if such were the case, because, besides being pleasing objects to look upon they are fine songsters, and being very powerful birds, they might serve to keep in check the increase of the English sparrow, which seems at present determined to drive every other bird of similar size from the country.

There is another member of this family named the *Pine Grosbeak*, which has long been known as an occasional winter visitant. The young males and females of this species resemble each other in their plain attire of smokey grey, but the adult male, blushed all over with purplish crimson, is a most pleasing object when seen against a background of the sombre Norway spruce which they frequent. They were very common along the north shore of the lake from Kingston to Toronto. At Hamilton very few were seen, and those few did not remain. The reason of this was the absence of the mountain ash berries, which is their favorite fare. The mountain ash trees are numerous around Hamilton, and last fall the crop of berries was large; but near the city there is now a great deal of shrubbery, among which the robins nestle and raise their young. As soon as the berries are ripe the robins use them daily. If the frost sets in early these birds retire to the south, leaving many berries on the bushes, but if the fall is open they remain till the last berry is used up; therefore, when the *Pine Grosbeaks* arrived, there was nothing for them to eat, and they went elsewhere in search of food.

The last of this species was seen on the 21st of February, which is about their usual time for returning to the north.

Another northern visitor which seldom comes our way is the *Bohemian Waxwing*. I found three of this species in company with the *Grosbeaks*, and secured two, the third going quickly out of sight. I rested my gun against a small dead tree and went about picking off some twigs of the red cedar with their beautiful glaucous colored berries for parlor decoration, when, on turning round, there was the missing waxwing perched on top of the bush against which I had rested my gun, and there he sat and preened his plumage in perfect security. Twice I tried to reach my gun, but he raised his crest and turned his full dark eye on me so reproachfully that I had to satisfy myself with admiring his many graceful attitudes till it pleased him to go off, which he shortly did in safety, and was seen no more.

During February there was quite a gathering of Eagles around the shores of the bay, which at that time was only partly frozen over. They were the bald-headed species, one or two having the white head and tail shewing maturity. As many as twelve were said to have been in view at one time, and I knew of four having been shot and obtained. They used to frequent the dead trees along the banks of the Niagara River, and were a marked feature in the wild

scenery of the place, but their skins being in demand and the birds being readily picked off by the rifle, they are now but seldom seen in their former haunt. Gulls have also been numerous on the bay, so long as it was open, their favorite resting place being the edge of the ice where it meets the water. They are mostly *Herring Gulls* with a few Kittywakes, but the great Black-backed and Ivory Gulls are also there occasionally. Towards the evening, of a quiet dull day, about the middle of March, the residents on the Beach were aroused by the loud trumpeting of a flock of twenty swans, which came up the lake and found rest in the sheltered waters of the bay. That night the condition of every available gun was examined, and a lively attack was expected in the morning, but the swans would not admit of a near approach, and all got off in safety save one, which fell before the rifle of Mr. Fillman. Nearly every season one or two are seen about the same period of the year, but so large a number as twenty had not before been observed.

The past winter has been unlike any other on record for the number and variety of northern birds which have been with us, and also for the number of our summer residents which have remained with us over the winter instead of going south as usual. This can only be accounted for by the fact that in the far north the weather was unusually severe, and the snow of more than average depth, whereas in southern Ontario the season has been the mildest on record.

The foregoing is by no means a full list of the birds which have spent the winter with us, but it may serve to show to what extent the movements of the feathered tribes are affected by the weather, and also how much there is even during the miserable weather of a sloppy winter to interest those whose eyes are open to observe the provision made for these wandering children of nature.

NOTES ON NATURAL HISTORY.

BY MR. WILLIAM YATES.

[These notes were furnished by Mr. Yates, of Hatchley, County of Oxford, Ont., and were read before the meetings of the Biological Section during the winters of 1888, 1889 and 1890. They only partly represent his many contributions, for many brief notes, particularly with reference to the various birds he had seen at different dates, have been omitted. The requirements of the transactions as regards space have also necessitated many omissions, and also a certain amount of condensation, while, in order to maintain the original line of thought, the original manuscript has been also rearranged. However, as far as possible, the original language has been preserved, thus giving an idea of the notes as presented from time to time. It will be seen that they comprehend nearly every branch of the work properly belonging to the Biological Section, while there are also some notes bearing more on Geology or Physical Geography. Attention must also be drawn to what can hardly escape notice, viz., Mr. Yates' great powers of observation, which, assisted by a splendid memory, and united to a wonderful appreciation of the beauties of nature and the lessons to be learnt from the study of its laws, make his contributions most entertaining and instructive.]

After the first autumnal frosts, patches of the Maiden-hair Fern turn white, and remain so for some days, and occasionally longer, if the season prove fine and dry, but soon after assuming this appearance wither away. At this time they present a most beautiful aspect in the dim shades where they are usually found. The Monotropa or Indian Pipe lives and grows in this normal condition of paleness, and at first sight might readily be mistaken for one of the Fungi.

Not far from Hatchley we find many specimens of the Northern Calla, with their noticeable white spathes just above the surface of the shallow water in the boggy neighborhoods where this and

similar aquatic plants delight to grow. Two or three summers ago, many specimens of this Calla growing hereabout produced three perfect spathes and spadices on the top of each scape or stem, and numbers also had two spathes, a state not mentioned in any botanical work that I have met with, and I have never known it to occur except in that one season. I think it was in June, 1885.

Another curious instance of instability in the color of blossom is found in the variations of tint in the Phlox divaricata, which in some of our woods may occasionally be met with bearing flowers of different shades, from deep bluish purple to a nearly pure white.

The occurrence of variegated foliage may also be referred to in the Rattlesnake Plantain, as the Goodyeara pubescens is sometimes called. Few can help admiring the pretty white reticulations that adorn the foliage of this common orchid of our beechen groves.

We have sometimes fancied that, in the case of the Canadian wild garlic, the partial bleaching of the leaves was caused by a sudden fall of atmospheric temperature just short of freezing. But in the cases of semi-albinism in some leaves—for instance, those of the turnip—the white portions are too artistically mixed and blended to permit that assumption to be a tenable one. There, at least, there is palpable evidence of design; nevertheless, utility seems to have been sacrificed on the altar of adornment, as, generally, plant specimens so particularized are infertile, and our attempts to propagate from the seed found in the white blossoms of the Trifolium pratense, and also from the corn with mottled white and green leaves, invariably proved abortive.

At this season, the berries of the Ilex verticillatus have nearly assumed their brilliant scarlet hue, and they add to the attractiveness of a walk on the now dry, peaty surface of the swamps on a fine autumnal day. These holly berries have but a very ephemeral existence, as the hard frosts of early winter cause them to fall from the sprays, and when the December snows have arrived, the branches of this interesting shrub have become bare and desolate. But the haws of the swamp Rose (R. Carolina), which is quite abundant in many localities of Burford, are far more persistent, and furnish nourishing food to many of the birds that stay here all the winter season. The Blue Jays may be seen feasting on these berries frequently in the severe weather of February, and the Cedar Birds, and more rarely the Pine Grosbeaks, may be seen eating them with evident relish.

Another pretty shrub that, at blossoming time, reminded one very much of the European Hawthorn, was once quite abundant in spots not far from here. I allude to the plum-leaved Spiræa, which is now becoming scarce, and seems likely soon to become extinct in these parts.

Also, as the forests are cleared, that interesting shrub, the American Euonymus (var. obovatus), with its brilliant red berries, is much less frequently met with than was the case in former years. We remember, on our first making enquiries as to the name and nature of this noticeable shrub, being assured by some of our pioneer neighbors that it was a connection of the Nightshade order of vegetables, and that its berries were a virulent poison. But this information proved somewhat inaccurate, as many times the Ruffled Grouse and also the Red Squirrel have been seen by our acquaintances carrying off or regaling themselves in the late autumn on the fruit of the Wahoo.

It is a well known tradition among keepers of singing canaries that, to preserve the purity of their color, they need to be furnished with food material of their own tint; accordingly a supply of saffron is placed at the bird's disposal. A trait or habit that we once noticed in a Scarlet Tanager would seem to prove the correctness and propriety of this use of the bird fanciers. An elder bush whose fruit ripens frequently in the month of June, and is of a fiery red color, was frequented by a Tanager many times in a day as long as the supply of elderberries lasted, although the bird had to traverse the distance of nearly a quarter of a mile to come to its chosen food from its usual habitat in the tall maple woods.

When these parts were first settled (perhaps forty years ago) grassy intervals, styled beaver meadows, were of frequent occurrence and although the herbage was rank, coarse and sedgelike, these areas were valuable, and were mown and the crop taken care of, and used as winter fodder for the cattle of the pioneer settlers, but the experience was general that as soon as the surrounding forest was cleared away, a sturdy growth of willows and cornel shrubs, and especially the red osier and white berried cornel invaded these morassy levels, and nothing short of the axe, and the grubbing hoe, supplemented by the labour of the ditcher, and ultimately by that of

the ploughman, made the conquest over these inveterate natural forces complete.

While walking along the highway through the Township of North Norwich, one day during the past autumn, some peculiarities in the growth of the Solidagos that bordered the roadway, set me thinking about the influence of soil, situation, and drainage on vegetable development. Those specimens of, I think, S. Canadensis that grew in the strong and fertile clay-loam of the district just referred to, had a burly robust appearance, much less tall and devoid of the gaunt scrawny air that seems to characterize their congeners in the more sandy soil and less windy situations, such as when in the shelter of the high rail fences of Burford Townsnip. The floral racemes, one fancied, gave indications of the circumstances or stimuli to which they had been subjected. The denseness and compactness of the flowers on the gracefully moving peduncles had a clotted and congested appearance; and although none of the specimens that grew near the beaten track of vehicles, had an altitude of more than three feet, their stems were clothed with about the same number of leaves that their taller, five to six feet high, nook situated congeners were equipped with.

Then also, it is an allowable surmise, that the influence of surroundings accounts for the fact that the much and slenderly branched form, known as Solidago ulmifolia (Wood) is the preponderant species in the wet and weedy peat boggy soils that occur so frequently along newly made roads in this part of our Province. This species has also fewer root fibres, and is marked by longer and slenderer branches, which probe their way to a share of sunlight, through the interstices of the leaves and branches of the swamp plants and bushes, with which this form has to sustain fierce competition.

The present autumn has been marked by our non-observance of those clamorously, noisy and agitated assemblages of crows that annually occur in semi-wooded districts towards the end of October and that mostly precede the departure of the bulk of the corvine community to more genial climes. Nevertheless several curious traits, illustrative of crow manners, may be perhaps not unfitly alluded to in this note.

One morning towards the last of July (1888), my son called my attention to a straggling stream of crows that seemed to be directing their flight with much cawing towards a point in the adjacent woods, less than half a mile distant, and judging by the continuous corvine outcries that reached our ears, from the objective point of assembly, the inference seemed a justifiable one that there was "some onpleasantness" occurring at the point indicated. So, gun in hand, he promptly sallied forth to investigate. Upon coming up to a large beech tree, he soon saw two crows' nests, a number of yards apart, amid the dense upper branches, and on an adjoining big maple tree three or four crows were cawing very excitedly, and their perturbation was evidently shared in by the continuous new arrivals. Upon scanning the large, high and forking branches of the maple, my son saw a large racoon trying to keep shady and flatly clinging to the side of the big limb with a demeanour that indicated a consciousness of having attained an unenviable notoriety. Two shots brought Mr. Procyon to the ground, to the infinite relief of the sombre-hued birds.

One of our most common impressions when roaming through the primeval forests of this country, has been a feeling of surprise that there should be so few relics, such a meagre amount of debris and refuse material left as evidence of the unremembered centuries that the sylvan garniture is supposed to have been a predominating feature in these regions. Some of the colossal oak trees that are still occasionably met with, give conclusive evidence that no appreciable climatic or topographical changes have occurred during the last five hundred years. Newspaper correspondents have occasionally disputed the accuracy of the testimony as to the age of trees, afforded by the annual rings of growth; but we have a confident conviction, formed after careful experiment and long observation, that such indications in the trunks of exogenous trees are perfectly reliable guides to the conclusions above referred to.

That hackneyed term, "the struggle for existence," conveys too an idea that is incessantly kept before the mind during a woodland stroll, and quite recently, in the course of our occasional experience as woodchoppers, we met with a most striking instance of the formative power of this principle in determining the height and contour of the leafy dome or pyramid of most of our forest trees;

to wit, an immense white oak (Quercus discolor of Gray or Q. bicolor of W.), with huge expanded branches overshadowing a number of neighboring trees. But, in particular, the outline of the dome-like expanse of oak branches had produced such an effect on the growth and development of a vigorous elm tree that was a competitor for nourishment and sunlight at a distance of ten or twelve yards from the oak, that the two organisms wore an appearance and an air of individual, or shall I say personal, hostility towards each other. The oak's attitude and whole physiognomy were very aggressive, like a bully bruiser of the prize ring, with fist extended and ready to plant a knock-down on the crown of his somewhat inferior sized opponent, the elm.

Yet the said elm seemed to be keeping close up to its formidable enemy, and watchfully, yet somewhat timidly, on the defence, with one huge branch thrown upward as an outwork or guard, and flanking skirmisher branches and reserves keeping up touch, but all with a slight leaning backward and expression of fear and indecision, as if it might come to a skip, yet not give in without a tussle.

The fury of the winds and air storms causes many trees to assume traits that one seems almost justified in styling personal. Maples planted in the clearing for purposes of shade in a majority of cases have a graceful inclination in their upper branches towards the north-east, caused by our most turbulent winds, in exposed situations, blowing from the south-west in April and October, when the earth about the roots is apt to be soft and yielding. And it is also well known to such as are observant of natural phenomena, that the direction and force of winds exercise a most potent influence on the base of the trunk of trees, as on all other vegetation, often forming buttresses and obviously bracing thickenings, and even supporting pillars, on the side opposite to that on which a destructive influence threatens the existence of vegetable structures.

In illustration of this view we might mention an incident that years ago came under our notice. We were chopping a fallow, and had a man hired to help us who was an experienced axe man, but who was somewhat illiterate and had not much of idealism about him. Yet on attacking the large beeches or maples with the axe, the roots sometimes hindered us from obtaining level and reliable foothold wherefrom to swing our axes with the most telling effect, and our companion would remark, "What savage holt these trees

take of mother earth," like the talons of a hawk with a deadly grip fixed in its prey. And a poet has said in reference to trees :

" Their gnarled roots type earnest Will,
That holds its purpose fast ;
Their ponderous arms may bend, but still
Regain their place at last."

A remarkable instance of the exhibition of the power of adaptation possessed by trees and herbs in common may be here related. On a piece of moist woodland on my farm a number of swamp elm trees are growing, and these trees, by the clearing up of an adjoining piece of land, became subjected and exposed to a new strain and a new danger, viz., violent south westerly breezes. Trees of this species are rapid growers and deposit woody tissue very energetically ; also they have a habit, where the soil is stiff and clayey, of forming roots on or partly above the surface of the ground ; and the peculiar efforts put forth by the specimens here alluded to would have convinced the most sceptical mind, as the Comtists say, "That there is an unknowable (not beneficent) Reality behind Phenomena." I myself was stricken with astonishment on observing, two years after, the changed conditions, the enormous development of buttress roots and propping supports that had so opportunely come to the rescue. The effect, to one who so well remembered the original forms of those trees, seemed little less than magical, and I may truly say that the process is going on still, for only a few of the trees have been cut down.

The maize plant (corn) also conspicuously shows wonderful resource in conservation of its living energies. All farmers know that as soon as the corn has grown sufficiently high to be swayed and bent over by the summer wind, haufterranean or above-ground roots emerge, two or three inches above the surface of the soil, from the stalk of the plant, and descend into the earth. They act and serve the purpose of hawsers and guy ropes, and give a firm basis to all the stalwart species of the Gramineæ or Zeas. Under some conditions, such as in instances of rank tall growth, and on exposed hills, some of the cereals, as wheat and oats, exhibit the same self-preserving device. This we assert from personal observation too ; in fact, "*Ex uno disce omnes*," if it exists in one, it is inherent to all.

Workers in a maple sugar bush are often puzzled to account for this circumstance, viz., that when a maple tree leans towards the

north-east, if you tap the same on the south-west side, comparatively little sap will be obtained. Or if the tree leans towards any other point of the compass the same rule is to be observed, the fluid currents are most copious where the deposition of woody fibre is most needed for the preservation of the structure. Some aver that mere gravitation sufficiently accounts for the fact, but the true cause seems somewhat obscure, as well as those causes that concur to influence the activity of the sap currents in certain meteorological conditions.

The peculiar sleety storms that sometimes occur in midwinter in these latitudes, and that clothe everything out of doors in a thick coating of ice, frequently prune and mutilate the forest trees with great severity, and large trees occasionally become bent, and their large branches wrenched out of symmetry on such emergencies, and the form of their boles so modified that their outlines in anteglacial times are only "things of memory."

Woodsmen find but little difficulty in identifying, even at a distance, the various species of deciduous trees, even in winter, by the curves or angles of the smaller branches or sprays. Those of the oak have a sturdy, continually repeated curve, and thickened, pronounced bark. Some aver that the angles that are made by the junction of the maple sprays are the same angles that are indicated by the midveins and veinlets of the leaves; oak spray curvatures answering to the sinuosities on their leaf margins. Maples, however, when planted in open places, generally assume an oval form in the outline of their branches, and exhibit many exuberant and seemingly independent centres of growth, similar to those well rounded, ebullient forms of dense vapor seen in cumuli clouds on a fine summer day. And in very truth, wherever the maple forest abuts the clearings in a straight line, the bold, heavy, richly rounded curves of the foliage tops seem to find their counterpart only in summer cloudland, or else in memorable paintings one has somewhere seen, representing mountain heights, such as the Tyrol, with an infinity of sky for a background. Only a photograph could convey an adequate idea of the so-called mental attitude; "*Nulla planta sine anima*," said Aristotle, of the two trees mentioned above. Everyone gave a smiling assent to the idea of two combatants, when drawn to notice the symbol in woody fibre. My two sons chopped down the big oak. It was five feet and more in diameter at the

stump, and we counted 380 distinct annual rings. There was a decayed hollow at the heart one foot in diameter. We found a living swarm of bees in the hollow crotch, and there were racoon debris and pheasant roostings in part of the hollow. Reference also might be made here, when speaking of the attitude of these trees, to a couplet in Pope's Windsor Forest, where the text reads in some versions:

"Tall trees arise that shun each others shades."

But in a recent American reprint, the twenty-first line of the poem is thus given:

"Thin trees arise that sun each others shades."

In taking note of changes that, since the year 1850, have taken place in the channels and banks of some of the streams that diversify this district, a clue is afforded towards tracing the cause of the peculiarities of contour and erosion-marks, that seem to have been brought into existence long before the advent of the white man.

In the outline of the western bank of the Grand River, less than a mile above the City of Brantford, extensive erosion by the impact of floating masses of ice during the floods at the breaking up of winter has been accomplished since the date above mentioned.

The slightly undulating surface of the south-west part of Burford Township is drained by Big Creek, that enters Lake Erie in Long Point Bay; and near the Village of New Durham, a survey of the course of this stream forces the inference that the volume of water once flowing lakeward between its banks must at some former time have been much greater than what we witness at the present day. For a stream, now only a few feet wide, meanders through extensive flats that are inclosed by banks that in some spots attain a height of 50 to 60 feet. These banks doubtless formed the shore of the ancient stream, and a line drawn diagonally across the bends of the creek strikes points where the argillaceous banks rise abruptly and nearly perpendicularly from the surface of the waterflow, and thus attests, in a convincing manner, that the impact of floating ice, which, through its acquired momentum, disregards curves in the streams, but strikes forcibly the steep shore, was impelled diagonally down stream to the opposite side, where its delving and disintegrating action was repeated. In those parts of the stream that are

situate between the points struck by the floating ice at the bends, the shores, though equally high, slope gently to the water's edge.

Many of the swales and morasses, whose surplus waters find an outlet to Big Creek, give indubitable evidence of having once been ponds or shallow lagoons, that in course of centuries have been gradually filled with indrifting and decomposing vegetable matter; also that their waters attained once a higher level than has been the case since the bush was first settled by white people. In connection with this idea one may as well mention here an illustrative incident. During the past dry summer (1888), a bush fire raged for a number of weeks in a partly cleared, extensive tamarack swamp. The three or four feet of black, superimposed peat was consumed by the heat and the resultant ashes were blown away by the wind. The unconsumable, sandy bottoms of the bog presented an interesting appearance and reminded one of the uneven, eddy-worn surface of a foreshore or muddy margin of the ocean, at some spot where the tide had lately receded.

On one occasion, whilst lately watching some ditchers at work in the above swamp, it was noticed that a large portion of the rotten vegetation, cut through by the spades of the workmen, consisted of the still easily recognizable roots of Menyanthes trifoliata, although in late years the watery element had not been in sufficient predominance for that plant to flourish or exist in much profusion.

The peculiar lofty knobs, mounds or isolated knolls that dot the slopes of the Grand River valley a mile above Brantford, and also occurring along the Mount Pleasant valley, are remarkable geologic phenomena, and have worked much curious speculation as to the agencies which aided in their formation and moulding.

The extensive levels known as Burford Plains, a rich, loamy area, 5 or 6 miles in diameter, resting on 50 to 60 feet of nearly horizontal beds of rounded gravel, said gravel strata reposing on the glacial or indurated boulder clay, have very distinct topographical features compared with what is known as the Burford timbered lands. The limits are defined by hilly land and ridges of mostly heavier soil, and the glacial clay is generally struck in digging wells on the timbered portions of Burford at a depth varying from 12 to 20 feet. The flora, too, changes abruptly, and in an unmistakable degree as the dividing line of the adaptations is crossed.

The hydrographic changes induced by clearing and cultivating

the land, in the regions about the sources of the Grand River, have been commented upon by the most indifferent observers that reside in this district, and have proved a source of much embarrassment to mill owners, bridge builders, etc.

The evidence seems pretty strong that Burford Plains were once covered by fresh water, the drainage of which seems to have been accomplished through sluiceways, marked now not far from where White Man's Creek joins the Grand River about five miles above Brantford city. And if, as some geologists assert, Lake Erie was formed by a rather sudden subsidence, the most of these lacustrine changes, including the formation of the isolated mounds, could be perhaps easily accounted for.

Since the acceptance of the theory of a glacial epoch by geologists, surmises have been put forth that a majority of our swampy depressions are the result of stranded ice masses melting slowly when surrounded by eddying volumes of fresh water. And if the formation of moraines gives any corroboration to such conjectures, it may be adduced in evidence that ridges and isolated heaps of rounded gravel are very frequently met with on the margin of our black ash and other swamps. One particular gravel mound of this kind occurs near here; the mound on the side toward the west sloped gently to the general land level, while on the side adjoining the edge of the swamp the heap of small rounded stones and coarse sand had a perpendicular face of thirty feet or more. The said mound was purchased some twenty-five years ago by the Municipal Council of Norwich Township and teamed away to improve the highways.

After a rapid winter thaw the waters of Big Creek swell to something like what have been assumed as prehistoric dimensions. Then frequently intense cold immediately follows and ice more than one foot in thickness covers the wide expanse. Towards spring another thaw accompanied by heavy rain is inaugurated, the ice breaks up and is piled in huge chaotic masses near some gorge or narrowing of the vale, and soon some of these jams are put in motion, and with irresistible force occasionally strike the shore or some slight eminence on the flats of the valley and carry off masses of earth, stone and sod, to considerable distances. Three years ago about an acre of rich meadow land near here, was stripped of its sward by a sudden break-up of this kind. These changes taking place before our eyes,

demonstrate the efficiency of similar elements on a vaster scale, in pre-adamite days, to plane down the rugged hills and to prepare the earth's surface as a dwelling place for intellectual beings.

Since the violent windstorm, accompanied by a fall of 5 or 6 inches of snow, that prevailed last Thursday morning (Jan. 10, 1889) large flocks of snow buntings have frequented our fields. And a curious trait that I have never seen mentioned in the books, has been again and again noticed in connection with these birds, namely, their nocturnal habit of feeding. Last Thursday night a flock of several hundred was seen by my son. The birds were passing just above the rather weedy surface of one of our fields, in loose go-as-you-please order, many of them occasionally alighting on grass panicles or dried stems of clover just above the slight covering of snow, the hour was about 10 p. m., moonlight but cloudy. Another large flock was seen next night near by under nearly similar conditions. Five or six years ago, I, one night, found myself in the midst of a flock of these birds, which were in scattered order, feeding in their normal way, although the hour was 7 p. m. in the month of February. Have they acquired this habit during their supposed residence in the twilight of the Arctic latitudes? That they fly and feed by night is now indisputable.

Having, not many months ago, to undertake the work of excavating a cellar under a portion of my dwelling house, I happened to become aware of facts and circumstances that convinced me that there is any amount of Philosophy connected with tree root development. The substance, dug through to the depth of five feet, was a very solid mass of reddish brown clay, very difficult to penetrate even with a newly sharpened pick. Yet into this compact stuff the roots of an apple tree, that was growing at a distance of about ten feet from the edge of the excavation, had thoroughly penetrated in every direction. Many of these roots were nearly of the thickness of an ordinary walking stick, and were of a wavy or spiral form, somewhat resembling one of the strands of a rope that has been untwisted. These roots must have insinuated themselves into the hard clay when very small, mere hair-like fibres, and then by secretion of vegetable sap reduced or dissolved and absorbed that portion

of the matrix to be occupied by the enlarging root. This theory, however, is only suggested for whatever it may be worth; any other explanation seeming beset with difficulties, for when portions of the roots were forcibly pulled out, the tunnels they had occupied remained intact, and the theory of mechanical uplifting force seems untenable.

Also, in digging holes into very dense strata of clay or marl, to the depth of four feet or more, the roots of the common elder shrub are frequently met with. Their power to burrow and penetrate into such intractable substances cannot fail to excite feelings of surprise. It is well known, too, that the Canada thistle roots have the faculty of travelling extensively at a depth of two or three feet underground, through the hard-pan subsoil. The roots frequently encroach in this way from the fields of a negligent, weed-permitting farmer by underground approaches, thus dodging the boundary fence and appearing again, or rather pushing up their superstructure in the field adjoining. These thistle roots too have the same auger-like form, and as no chips or borings are ever visibly left behind in their onward march, the theory of absorption and assimilation seems plausible.

When noticing these things, and similar almost unaccountable phenomena of vegetable growth and life, in the midst of summer fields and farm labor, we have sometimes felt inclined to ask the question: "Is there an extraneous force of Will which acts on matter in derogation of laws purely physical, or alters the balance of these laws among themselves?" (Gladstone.)

For instance, in the common unromantic work of thinning out turnips, if in the usual haste of this occupation one plant is not removed far enough, a single fibrous root, all but invisible in its gossamer-like tenuity, remaining to connect the plant with its former place in the earth. In spite of the scorching rays of a July sun the said plant is preserved from withering, and although its congeners, whose connection to mother earth has been totally severed, are withered to nothingness in a few hours, our plant, with this slender umbilical connection, will live and thrive, soon throwing out auxiliary roots, which go down into the soil, and so the organism is preserved and succeeds in becoming a continuer of its species. So, in such instances, we see that plant-life is not pulseless, and we can hardly conceive the activity of the vital currents that must pass to and

fro through the spider-line connecting link to support exhalation and inhalation in that heated and arid atmosphere.

In short, in many experiences about the growth of shrubs and vegetables, there are reminders of the methods and resources that inhere to animal existence. Thus we see, in the cultivation of many edible roots, that when such meet with accidental injuries, as from the gnawing of mice, or bites of trespassing animals, a prompt healing process sets in that is thoroughly remedial in its nature. Cellular growth becomes very active, similar to that occurring on the surface of the animal body after a burn or scald, and the vegetable organism, though somewhat deformed in shape, accomplishes the principal aim of its existence. On the other hand, when the nourishing underground fibrous appendages meet with bruises or abrasions, speaking of the mangel or turnip, there is a tendency to the production of tumors and unsymmetrical, wart-like accretions.

It is probable that departures and deviations from regularity of structure are of more frequent occurrence than many are aware of, as few are sufficiently observant to pay attention to such objects, or to report them. Only a few days ago I was invited to go and examine a peculiarity of development in a tomato plant which was described as having fourteen or fifteen ripe tomatoes all massed and united on the top of the stem, which, like the thistle curiosity, was devoid of branches, and an instance of the preponderance of the centripetal action on the structure.

The opposite tendency is the normal one, and can be detected in the branching sunflower, Helenium divaricatus or multiflorus, which we sometimes see growing wild in low sandy woodlands around Otterville. And occasionally in forest trees, when the first stem has been accidently bruised or destroyed, a number of offshoots branch from the crown of the root, and instead of one towering stem, eight or nine will immediately succeed to the function of the exterminated one.

Experiments with a view to test the morphologic powers of many of the hardy, weed-like plants would yield interesting, if not profitable results.

Lesions in the vegetable tissue are sometimes the result of bruises from the tramping of animals, and there is room for conjec-

ture whether, in the instance of the changed thistle growth, as the sample grew in a pasture field where horses roamed, the abnormalities had or had not been caused in that way.

One of my acquaintances was lately speaking to me about the unusual annoyance that he has lately suffered whilst ploughing up a rough piece of land for winter wheat, that had become much infested with colonies of humble-bees. These attacked and infuriated his plough team, so that he was compelled to go to work and destroy all the nests and exterminate the bees. Many of the nests he described as being of the size of his two fists, and often containing a pound or a pound and a half of pure honey.

A young man, who was picking berries, about six weeks ago, called my attention to several bees that had alighted on the edges of the leaves of an elm tree that grew near the spot where we stood, and under which some fine growths of Canadian golden rod were in full blossom. Upon capturing several of the bees they made a loud, angry buzzing, and assumed violently belligerent attitudes, but my friend assured me that however unquakerish in disposition, these bees had no stings, and that many children fearlessly handled them.

I noticed that several of the bees were loaded with the rich yellow colored pollen of the solidago flowers, and this fact seemed to make dubious the proposition or rather supposition of my informant that these individuals were drones or males of the humble-bee perched on the leaves of the elm as an advantageous look-out point for the queens of their species.

A curious instance of Parasitism in a dual form came to my notice twelve or sixteen days ago; that is, if we are to class the birds of prey as parasitical on animal life in the lump.

Here, close to our house, during the last of October, we were troubled by predacious nocturnal visits from the large horned owl, Strix Virginiana, to our hen roosts, so my son tried to capture some of the marauders. A reliable steel trap was set on the summit of a thin pole, erect and about thirty feet high, near the poultry roost, and one dark night soon afterwards, or rather among the sma' hours of the morning, a rather dolorous piece of bird minstrelsy smote upon our ears and awakened us to the consciousness that our trap

had embraced Minerva's representative fowl, who persistently, at brief intervals, voiced the syllables, to hoot, to hoot, to hoo. This signal of distress was soon responded to by an accomplice owl, who came and perched on a small tree at a distance of about twenty feet from his manacled coadjutor. The alternate outcries of the uncanny musicians continued for an hour or more, until dim dawn announced that the vanishing hour had arrived for spookish birds and spookish bird-notes. At this juncture my son went out, gun in hand, but the unimprisoned bird took a very precipitate departure, seeing that his unfortunate mate was past solacement, if not past praying for; No. 1 bird was now lowered, taken in and done for. It was a handsome sample of his kind, and his beautiful plumage and powerful adaptations were looked upon with a shuddering interest.

Here is the fitting place, perhaps, to allude to the circumstance of these powerful carnivorous birds being much infested with insect parasites. On preparing the body of this particular owl for taxidermical purposes, quite a few hemipterous creatures were found at the roots of the feathers, adhering by their suction tube or proboscis, and in a more numerous group near to the anus of the victimized bird. These insects bear a strong resemblance, in form and size, to those entomological pests that annoy the ovine race and are very commonly known as sheep ticks. The only obvious differentiation is that the owl ticks have large membranous wings. Years ago we had noticed that the large horned owl is much infested with these flying ticks, sometimes in great numbers, and sportsmen, who are close observers, and whose testimony is valuable, assure us that the common partridge or ruffled grouse, Tetrao Umbellus, is troubled and infested frequently by a winged tick that, to an ordinary eye, bears a very strong resemblance to those by which the owl's body is depleted or preyed upon.

Insects of that particular order are supposed by many to delight in forests, and decaying wood and leaves, as breeding places. We have frequently ourselves found a large bluish white tick pertinaciously fastened into the neck of the black and red squirrel; and not very rarely have found the common woodchuck or Canadian marmot similarly unwillingly appendaged and preyed upon.

I am also assured by some of my intelligent neighbors that children, after walking or playing in the primitive woods, frequently return home with tick-like creatures adhering to the bare parts of the

body. Little girls, whose arms and necks were generally bare, are especially liable to this unwelcome but seemingly painless annoyance. One mother of a family assured me that in summer-time she always had to examine the children carefully on their return from bush errands to rid them of these pests, as the little folks seemed unconscious of the insect intrusion.

The books most available many years ago to persons contemplating emigration to Canada, gave the assurance that no apprehensions need be entertained on the score of noxious reptiles. It was therefore with surprise that, on settling in the County of Lincoln, Niagara District, we learned from old residents that venomous rattlesnakes still infested the borders of swamps and the banks of streams, and were not to be recklessly intruded upon. Although, fortunately, during the summer of our residence there, we never interviewed one of these dangerous ophidians in the course of our frequent rambles, it was demonstrated that they were far from extinct by the number of people one met, who had the almost indestructible memento, the caudal rattle of the horrid reptile, in their possession, and kept it to exhibit to all who took an interest in such objects. A majority, too, of the inhabitants were very reluctant to travel along the forest paths after nightfall, and warned us to be very circumspect under certain conditions, and to be on the qui vive for the admonitory rattle. There was also a widely entertained belief that the hog was a formidable enemy of the rattlesnake, and would ultimately be an important factor in its extinction in that district. Such a belief seems to be well founded, for more than once we have seen the hog, when grazing, suddenly become aware of the presence of a garter or a milk snake, when he would become obviously enraged, and the chase and speedy destruction of the ophidian would result.

What chiefly renders the rattlesnake difficult of extinction in certain parts of the west is the presence of rocks on the earth's surface, whose fissures and crevices afford winter shelter and harbor, from which expulsion is an impossibility.

Another surprise to British settlers, on their advent to this country, was to observe the large proportions and girth of the common black snake of North America when compared with the common meadow snake of England and Scotland. During the hot

weather of July or August, in Ontario, it shows a penchant for frequenting the heated dust in the middle of the public roads, where we have frequently seen them. They are then in no hurry to escape when approached by an enemy, but seem to be in a state of drowsy enjoyment of the dust and the sun's scorching rays, and they often come to their death by being crushed by the wheels of passing vehicles. Some idea of the size of these snakes may be formed from the statement, that while often seven or eight inches are cut off or crushed by the wheels at one side, from the head end, as much of the opposite extremity is cut off by the wheels in the opposite ruts. This species of snake preys much on small birds, and persons engaged in raspberry picking, in July, in this neighborhood, are liable to unpleasant surprises by the movements of these snakes when twining about the shrubbery in quest of the birds, which come in numbers to feast on the berries at that season of the year. An acquaintance, a few years ago, while engaged with his sister in berry-picking, had an encounter with a black snake over six feet long. When first seen it was descending from among the branches of a Juneberry tree, Amelanchier, that grew amidst a dense clump of raspberry bushes. By cudgelling and shouting, my friend drove the snake out of his ambush, and when on clearer ground, encouraged his large dog, Bounce, to assist in the battle. The dog, nothing loth, closed on the fierce looking antagonist, who had erected himself on his nether extremities, but Bounce, with his teeth, grasped the snake savagely by the neck, when in an instant, Boa Constrictor like, it twined its body in several folds around the chest and ribs of the dog, which soon began to show signs of embarrassment and even panic upon finding itself thus tightly enfolded. He then began to jump up, bounding from the ground all four feet at once, but the snake refused to relax his spiral entanglement until the dog's jaws had loosened, when, in its attempt to regain the shelter of the bushes, it received a crushing blow from a stout stick in my friend's hands, which rendered further resistance feeble and of little effect.

Men who have been employed in the Hemlock woods in this township, bark-peeling in the heat of summer, tell of meeting with black snakes of incredible size, as thick as a handspike and between eight and nine feet long. Not a summer passes without my having brought to my notice one or several which measure over six feet. They are supposed to winter in burrows made by the marmot or

ground-hog, just deep enough in some dry sand or loamy ridge to be out of the reach of severe cold. About two years ago, some acquaintances of ours who were engaged digging out several badgers, skunks, which had sought a temporary refuge in a woodchuck's burrow, found a black snake of average size occupying a space in the deepest part of the excavation. His snakeship was reported as showing symptoms of languor, but was by no means in a torpid state, though the season was January and wintry snowstorms raged above ground. No unfriendliness was manifested moreover among the strange denizens of the burrow.

Mention might also be made of the alleged proclivities of black snakes for going into the water in pursuit of their prey, it being frequently asserted that this is a custom of theirs. Some of my acquaintances, however, say that the species most commonly seen in the water is somewhat darker in color than the variety most generally found in dry situations. At any rate, snakes larger than the milk snake, and of a very dark brown color, with almost an absence of striped markings, have been often seen by us pursuing and capturing the common crayfish that inhabit shallow streams and ditches. It is mostly the smaller fry of the crustaceans that they capture, and when they have seized one they generally go out of the water to some lurking place, under a log or stump, to enjoy their meal. Near these spots, the debris, consisting of refuse fragments of the young crayfishes' shelly covering or nippers, gives evidence of what has been going on.

The black and other snakes can move with considerable speed in the water, but their motions are undulating and have not quite the directness or celerity of the finny tribe.

Some years ago, my brother saw a large black snake pursue a frog, which took refuge in the water of a creek near by. He struck the snake with his fishing rod, severely bruising its body, as it swam on the surface of the stream, and the blood, which flowed from the wounded ophidian, was in such quantities as to redden the water for the space of several yards around.

A curious belief among bush workers is that the common bird eating black snake has a habit, when up among the tree branches in orchards and other similar places, of springing by bounds from branch to branch across an open space, and some individuals have assured me that they have repeatedly seen such a feat performed by it.

The reptile that is most noticeable in its coloring and brilliancy of skin adornment among the species of its kind, and most frequently met with, is the one known as the spotted adder or milk snake. The upper half of the milk snake has a series of saddle-shaped, dark brown spots, the whole length of its spine, on a light greenish ground, also along the sides an equal number of round or roundish dark brown spots, graduating in size, like the saddle-shaped ones, according to the tapering of the snake's body. A band of black runs around the margin of the upper jaw, which, with the sparkling and restless glare of the eyes, gives an expression of peculiar malice to this much hated snake. The under parts are beautifully chequered with blue and silvery white scales, and the purity of coloring and contrast always makes this snake an interesting object to observe. Although by no means scarce here in warm, moist summers, they are less frequently met with than the common garter snake, from which they do not differ much in point of size, although the milk snakes are slightly the larger, about three feet is the average of such as it has been our lot to meet with. It is oviparous, and we have occasionally found their eggs deposited in ground-squirrel burrows in sandy spots beneath the blackened roots or stumps of the pine tree, there being twelve to fourteen eggs.

Although there seems to be ground for supposing that some snakes have a relish for milk, there seems but little reason for the common traditions as to the milk snake's methods of obtaining it from the cows. The milk snake delights to inhabit an old straw stack near an old barn, and often deposits its eggs in such a place in hot weather. And as milch cows are also fond of reposing there to ruminate during summer nights, while, before arising to their feet in a morning, milk drops may be seen oozing from the distended udders, snakes, if in proximity, would naturally imbibe the liberated and nourishing fluid, and hence the tradition.

The milk snake also delights to haunt outside cellars and root houses, and a friend of mine, the wife of a new settler in the woods, upon going into her out-cellar on one occasion, was astonished to see a snake raise its head and neck above the surface of a tin pan full of new milk. Whether the warmth of the liquid had suggested to the reptile the desirability of a cosmetic bath, or the nutritious and palatable qualities of the fluid had been the temptation, may be a subject for conjecture.

Milk snakes also climb into bushes to rob birds of their unfledged young. Two or three years ago, my brother, while hoeing in his garden, heard cries of distress from a pair of bush sparrows that had a nest full of nearly fledged young ones in the forks of a bush near by. Upon going to the spot, a large milk snake was seen twined around the stem of the small tree, with its head raised just above the young birds, as if in the act of selecting the best one for his next victim. He at once killed the snake, and on opening its maw, found a young, recently swallowed bird and a half grown field mouse. In August, three or four years ago, my son, while ploughing a summer fallow, chanced to overturn the last fangs of an old pine stump, under which he found fourteen snake's eggs. They were rather larger than robins eggs, obtusely oval in shape, and with an outside resembling parchment in color and consistency. Upon giving one of them a rather rough shaking, it divided symmetrically by a line circling the small diameter, and a perfectly formed young milk snake, eight and a half inches long, emerged. It was interesting to see how neatly and skilfully the young ophidians were spirally coiled in their parchment-like integument, so that, at maturity, they had to exert but a little muscular force or contraction, when lo, the integument divided into two neat little leatherlike cups, and the whilom prisoner was free and as full of life as a young rooster chicken. It seems to be the habit for a brood of young snakes to keep near together for a considerable part of the first summer of their existence, for about three weeks after uprooting this nest, a group of young milk snakes was found. They measured eleven and a half inches in length, so had grown three inches in as many weeks.

The milk snake has the reputation of being one of the most agile of its tribe, and I have heard of their being found pursuing mice among hay or sheaves of grain mowed away in barns. Those who saw them believe that they had crawled up some angle of the boards that enclose the sides of the barn; however this may be, it is certain that the muscular energy that controls the scaly covering of the underside of the snake's body gives them power of rapid locomotion, as well as power to adhere to narrow surfaces. One acquaintance told me that he saw a milk snake moving rapidly along the edge of an inch board that formed the upper board of a straight fence, near one of the posts of which a peeewit flycatcher

had built her nest, and that when attacked, the snake scooted along the narrow board edge faster than he was able to walk.

The caudal termination of a milk snake is a hard, horny point, and it is averred that this is used as a means of defence, and that when this or similarly equipped ophidians are teased with a pine shingle, they will strike it with such force that the armature pierces the wood and is difficult to extract.

It is a common belief that the garter snake lays eggs, but Dr. Garnier's testimony proves this to be an error, while I myself once removed eleven young ones from the abdomen of a female garter snake, which I was convinced had never seen the light of day, and I felt sure that the garter snake was occasionally viviparous at any rate.

The garter snakes seem gregarious when hybernating, and I have found them occasionally ten or twelve together in underground holes near a morass, where they would surely be frozen and also surrounded with ice in wintertime. Like the hybernating quadrupeds, the ophidians are quick to perceive the genial influence of Spring, and on warm, sunny days in early April, and even sooner, crawl out of their winter retreats to lay coiled in a southern exposure and bask in the solar rays, even when the remains of deep snow-drifts exist only a few feet distant.

The garter snakes, like the milk snakes and others, are particularly gregarious in the earlier part of their life. On one occasion I found, on removing a pile of boards, thirteen half grown garter snakes, in a space not exceeding two feet square, luxuriating in the warmth in various curves and bendings of their elongated bodies, with the seeming sociability of a Quaker meeting. They had evidently assembled from a piece of fallen timber land adjoining.

I have occasionally witnessed the exciting chase of a garter snake in pursuit of a frog, the latter making its best jumps, and the snake, with elevated head and glittering eyes, watching for the opportune moment to strike in decisively. Sometimes the frog, as if paralyzed, rests for a moment amid a tuft of weeds, with flanks panting in abject fear, the snake gazing at the exact spot intently, and on the slightest movement of its victim, making the deadly spring, which closes the batrachian's career. When the chase is downhill, the frog sometimes escapes, and if a stream or a ditch or puddle be near, directs its course thitherwards, dives at once to the

bottom of the water, and instantly stirs up the mud, roiling the water as much as possible.

The garter snake is quite commonly captured in the summer with an unsightly protuberance in some part of its body, from which is extracted an undigested frog or even an unlucky toad. On one occasion, a friend assures me, he liberated seventeen vivacious young garter snakes that had evidently in a moment when threatened by danger sought safety in the parental interior. The young milk snakes have also been known to seek a similar place of safety.

Ophidians are quite often found in proximity to putrefying animal substance in the fields or forest, but whether in quest of the carrion loving insects or beetles that are attracted to such spots, or to regale on the substance itself, seems not very clear.

Like all wild animals, snakes assume a bold and defiant attitude when a seeming danger threatens the safety of their immature young. On one occasion, as I was busily engaged thinning and weeding field carrots which had a dense growth on top, I found myself, as I was stooping to the work, suddenly confronted by a semi-erect and evidently irate garter snake, with mouth open, head swaying, and tongue flickering, whose privacy had evidently been trespassed upon. I instinctively drew back and the snake ceased its belligerent demonstrations, and was soon lost to the eye amid the rank vegetation. A friend, to whom I narrated the circumstance, suggested that the snake must either have been disturbed when taking care of its young family, or else had been contemplating a speedy change of its scaly integuments, at which times, he averred, the serpentine irritability is excessive.

Snakes quite frequently fall a prey to the falcon tribe. When the latter are hard put to it to obtain a sufficient supply for their clamorous young, it is not an unfrequent spectacle in summer to see Falco nilvus, or hen-hawk, fly overhead with a snake in dangling contortions grasped in its claws, and steering in a direct line towards its hungry and screaming young ones.

All the snake family are fond of warmth, and we have frequently found them enjoying the artificial warmth of burning log heaps in the chilly air of early morn. The largest gartersnake I ever met with was found burned to death in the hot ashes resulting from a heap of burnt logs. The season was the month of April, and the snake seemed to have approached the genial warmth too

near during the darkness of the night, and on feeling the painful heat, instead of retreating had dashed right onward into the burning embers, and its crisp and contorted form in the morning bore evidence of its painful death.

There is a curious belief among some Canadians concerning a snake that they name the hoop-snake, which it is asserted has a habit of bending itself in the form of a hoop by placing its tail in its mouth and trundling along with greater speed than a man can walk, and it is earnestly asserted that the best way to get out of the way of these hateful pursuers is to walk around a tree, as these snakes can only make good headway in direct lines.

Another native ophidian, that seems to have given rise to a number of vague, and perhaps, somewhat mythical traditions or beliefs, is the Puff-Adder, sometimes called the Blowing Adder. This species is said to have been numerous thirty or forty years ago, but I believe is now rarely met with. It is, however, credited with having the power or habit of inflating the forepart of its body and emitting a blowing, defiant sound, when disturbed, something like the Cobra or Hooded snake of the East Indies. I have only seen this reptile once, although I have walked quite a distance on several occasions, on purpose to see one or gain information, but was generally too late to gain much satisfaction.

The one I saw was noticed on a hot day near the end of May, a number of years ago; it was lying in a roadway that led through a swampy thicket, and had evidently been killed an hour or two before we found it, as putridity was commencing in the hot sun, so that the body probably was more or less bloated. The snake had a rather small and tapering head, the body was of a sombre color, very thick in proportion to its length, being about as thick as a man's wrist, and much less tapering towards the extremities than ordinary, though this may be accounted for by the bloating referred to.

These snakes are said to be generally found, as this was, near small streams, and to live on the small amphibia as well as on insects, this one was probably crossing the highway from one part of the swamp to another, when killed.

A neighbor of mine killed a Puff-Adder near the town of Norwich, Ont., a year ago last August. It was crawling across the road, and appeared to have come from under the sidewalk. It had, he

said, a most repulsive look, and when attacked assumed the spiral attitude.

It was of a slate color, with lighter chequerings, had a broad head two inches wide, large eyes, a length of about two feet three or four inches, and body very thick. The caudal extremity was very blunt, shaped like the end of a man's thumb. It had a number of teeth, and not microscopical ones either, and a gape of mouth that could have found little difficulty in swallowing a common barn-door fowl's egg.

The little ringed snake, Diadelphus punctatus, which, according to Dr. Garnier, is viviparous, is hardly ever seen over twelve inches long, and is invariably found in the interstices between the loose bark and wood of decaying logs in the bush. It feeds on the earwigs, small beetles, and other small insects that harbor in such situations.

Many hints and suggestions come to the front whilst following one's ordinary avocations, and sometimes lurking and elusive truths become manifest and give rise to a train of constructive thought. The other day, while felling and splitting up a large oak tree, a peculiarity of growth was observed in the timber that characterizes a certain percentage of the oak trees. In splitting the trunk, the surface of a section, from the circumference towards the heart or centre of the tree, presents a rippled or wavy surface instead of the even flat cleavage so much desired by mechanical workers in this kind of wood. The fibres, instead of the direct upward tendency usual in symmetrical or free-splitting trees, are interlaced and woven in amongst each other, giving to the wood the character known as gnarliness. The object seems to be to give the tree the maximum of power to resist strains, and the stress of adversity, such as winds and blows from falling trees, that may go down or be overthrown in the vicinity. This peculiarity of structure would seem to show that a tree represents a dominant idea that is superior to the lapse of time. For the unity, comprehensiveness, and integrity of design, are imbedded in the cotyledon from the first sprouting of the acorn, and are unvarying through the centuries clear to the solidification of the last layer of sap deposited on the terminal sprays of the summer of 1889, the pertinacity and fidelity seen in the adherence to the generic formula of growth being remarkable in these samples of

oak. And if we look at the crest of one of the undulations, that twenty annual rings of growth are requisite to form, twenty more years having to elapse before the rhythmical depression of the curve line is produced, the patient and unostentatious carrying out of purpose here evinced can scarcely fail to give rise to emotions in one's mind akin to the reverential. For do we not see the workings of a principle, or a beneficent, conserving energy, to which the amplitudes of space and time are but toys?

Most of the large oak trees illustrate what has been written about as the spiral tendency of all vegetation. Many have the twist in the direction of the sun's motion from east to west, and then the spiral becomes more pronounced as the trunk ascends. But sometimes the spirals run up the tree in the opposite direction, from west to east, and then, as a rule, the spiral tendency diminishes towards the tree top, this being the reported opinion of woodcutters and foresters in this country.

The sap, in ascending, seems to tend to the same vortical motion as an upper eddy of wind or a waterspout. The uprising sap seems to move by pulsations or throbs, and like all moving liquids seems to flow easiest in undulatory lines. In many trees the undulations are external deviations, or crossings of the perpendicular line of ascent, as if in hesitancy which spiral course to follow. There seems to be a centripetal tendency in the spiral growths, and the trees with twisted trunks, which have usually numerous, but not very large branches proportionately. Those that have straight grained stems, and which can, most of them, be split with ease, are generally bifurcated near the top of the trunk into two very large branches, which with their sub-branches form the tree top, and in these the centrifugal tendency seems to have preponderated.

Curious woodlike malformations are sometimes formed about the roots of beech trees, which have assumed fantastic forms. In several instances the flattened masses, in their foldings and size, bore a striking resemblance to a mass of eviscerated animal entrails, with all the imitations of the mesenteric puckerings. These accretions first seemed to be a sort of ligneous fungi, but they were covered with bark similar to the trees at whose base they had grown, and consisted interiorly of a hardish grey substance, somewhat softer

than the natural beechwood and without its fibre. They seemed to have grown from exudations of beechen sap, from wounded buttresses, or above-ground roots of the trees to which they were attached, the trees themselves still growing and thriving.

Among the various species of fungi found in Canadian forests, one appears on decaying, prostrate tree trunks in moist summer weather having a gelatinous or soft leathery appearance, looking like tripe, and in masses that would often more than fill an ordinary pail. Stray horned cattle search for them and devour them with great eagerness.

Another interesting species, the edible morel, which used to be found in considerable abundance about the roots of rock-elm trees that had been killed by the woodman's process of girdling, were only to be found during the last half of the month of May, and only in the early stages of the decay of the tree under which they grew, as if favored as to growth conditions by the decomposed sap in the roots of the tree. They are yet occasionally found about the roots of apple trees in old orchards, and especially about trees that show signs of decadence and of having seen better days. These morels are carefully gathered, when found by knowing ones, are quite wholesome, and when properly dished up are a real delicacy, and are justly relished by epicures.

A relative of the toadstools, less welcomed when met with, is sometimes discovered among the rank grass around old fences in the autumnal months, its proximity being sometimes made known by the number of buzzing flies, attracted to the mephitic production by its powerful putrescent odor; it is known as the Phallus. It resembles the toadstools in its mode of growth, but the pileus or cap is very much the shape of the old candle extinguisher.

A peculiar effect was noticeable in the fall of 1889, so peculiar for its long succession of clear sunny days, in the tinting, with red or maroon, of the usually white flowers of Eupatorium perfoliatum. A large proportion of its white cymes assumed these hues towards the end of September or beginning of October, and the fact attracted our attention that such specimens as were found growing in the shade of woods, as a rule had been able to preserve the whiteness

of their blossoms. Many specimens, that we thought had reddened their blossoms, in certain reflections of light, almost imitated the tints of E. purpureum or E. maculatum. This does not seem extraordinary when we remember that along side of the Eupatoriums, by the margins of most of our roads, are many species of asters with tints varying from white and purple topped petals to every shade of blue and azure.

Report of the Botanical Division of the Biological Section.

HAMILTON ASSOCIATION,

FOR THE SUMMER OF 1889.

The mounting of the joint collections of Mr. Alexander, Mr. Walker, Mr. Morris and myself has been completed, and the specimens catalogued and deposited in the Society herbarium. The section is to be congratulated on the excellent showing made.

The number of specimens mounted was 219, of which 204 are species not before represented in our herbarium. This 204 species represents 28 additional orders and 118 additional genera.

The number of species new to the Hamilton Flora, as recorded by Logie and Buchan, is surprisingly large, being no less than 33, of which the following is a list:

Camelina sativa, Crantz.
Raphanus sativus, L.
Viola renifolia, Gr.
Cerastium nutans, Raf.
Lathyrus maritimus, Bigel.
Melilotus, alba, Lam.
Melilotus officinalis, Willd.
Trifolium hybridum, L.
Vicia sativa, L.
Potentilla pilosa, Willd.
Prunus, Pennsylvanica, L.
Sedum acre, L.
Epilobium palustre, var. lineare, Gr.
Lonicera glauca, Hill.
Lonicera Tartarica, L.
Symphoricarpus racemosus, var. pauciflorus, Robb.
Centaurea Cyanus, L.
Hieracium Gronovii, L.
Petasites palmata, Gr.
Tragopogon porrifolius, L.
Veronica Buxbaumii, Tenore.
Euphorbia Cyparissias, L.
Betula lutea, Mx. f.
Aplectrum hyemale, Nutt.
Asparagus officinalis, L.
Juncus Balticus, Delh.
Juncus nodosus, var. megacephalus, Torr.
Carex laxiflora, var. intermedia, Boott.
Carex pedunculata, Muhl.
Carex tenella, Schk.
Carex vaginata, Tausch.
Eliocharis tennuis, Schult.
Avena striata Mx.

T. J. W. BURGESS.

Report of the Conchological Division of the Biological Section.

HAMILTON ASSOCIATION.

LIST OF THE LAND AND FRESH WATER SHELLS OF THE HAMILTON DISTRICT TO THE END OF THE YEAR 1889.

BY A. W. HANHAM.

FAMILY LIMACIDÆ.

Some three species of slugs have been observed in this locality. They have yet to be examined and identified.

GENUS ZONITES, MONTFORD.

(*Section Mesomphix, Rafinesque*).

ZONITES FULIGINOSUS, *Griff.*

Generally distributed around Hamilton, found burrowing in moss and loose soil, also buried under decaying leaves; frequents banks; a difficult shell to find; must be considered one of our rarer species.

(*Section Hyalina, Fer.*)

ZONITES NITIDUS, *Müll.*

Common under logs and stones in damp places; very plentiful around Dundas marsh.

ZONITES ARBOREUS, *Say.*

Common, frequents old stumps and decaying wood.

ZONITES RADIATULUS, *Alder.*

Same situations as last, but not so widely distributed.

ZONITES INDENTATUS, *Say.*

Taken in moss and under bark on old stumps, sometimes on the ground; seldom more than two or three specimens found in same spot. Rare.

ZONITES MINUSCULUS, *Binney.*

Has been taken in but one locality around Hamilton, a ravine off the Flamboro' road; occurred there in great abundance, colonies of thirty or more being found under sticks, etc.

ZONITES EXIGUUS, *Stimpson.*

But three specimens taken, locality unknown.

(*Section Conulus, Fitzinger*).

ZONITES FULVUS, *Drap.*

Local; may be taken along the foot of the mountain under pieces of rotten wood in moist places; not abundant.

(*Section Gastrodonta, Albers.*)

ZONITES ———.

Rare; a few specimens taken; locality unknown; identification not complete.

FAMILY HELICIDÆ.

GENUS PATULA, HELD.

(*Section Anguispira, Morse.*)

PATULA ALTERNATA, *Say.*

A common shell; prefers moist situations; sometimes observed in colonies under logs.

(*Section Discus, Fitzinger.*)

PATULA PERSPECTIVA, *Say.*

Rare; a few taken along side of mountain under bark and logs.

PATULA STRIATELLA, *Anthony.*

Very plentiful throughout this district in woods and moist situations.

SUB-GENUS HELICODISCUS, MORSE.

PATULA LINEATA, *Say.*

Occurs in rotten wood; scarce.

GENUS PUNCTUM, MORSE.

PUNCTUM PYGMÆUM MINUTISSIMUM, *Lea.*

Our smallest shell; owing to minute size difficult to find, a few taken on the under side of a board in one of the ravines off the Flamboro' road.

GENUS HELIX, LINNE.

SUB-GENUS POLYGYRA, SAY.

(*Section Mesodon, Rafinesque*).

HELIX THYROIDES, *Say.*

Local; fond of shady hillsides.

HELIX ALBOLABRIS, *Say.*

A larger shell; more abundant, and also more widely distributed.

HELIX SAYII, *Binney.*

Very local; taken in some abundance in November under dead leaves on a steep bank formed by the railway intersecting one of the branches of the Waterdown ravine, confined to a very limited extent of ground.

(*Section Stenotrema, Raf.*)

HELIX MONODON, *Rack.*

Rare on dry banks.

HELIX MONODON FRATERNA, *Say.*

Common; prefers dry situations.

(*Section Triodopsis, Raf.*)

HELIX TRIDENTATA, *Say.*

Common generally around Hamilton.

HELIX PALLIATA, *Say.*

Rare; may be found in sheltered spots under stones and logs on banks, and along side of mountain; appears to be solitary in its habits

(*Section Vallonia, Risso*).

HELIX PULCHELLA, *Miill.*

Plentiful under logs in damp meadows.

SUB-GENUS STROBILA, MORSE.

HELIX LABYRINTHICA, *Say.*

Rare; a few taken in a run in a small piece of open wood towards the Beach.

FAMILY PUPIDÆ.

GENUS PUPA, DRAP.

(*Section Pupilla, Leach*).

PUPA FALLAX, *Say.*

Common on dry bank of railway track towards Valley Inn.

PUPA CORTICARIA, *Say.*

Rare; occurs under bark on old stumps, and on the ground in moist places.

PUPA ARMIFERA, *Say.*

Very common; same locality as *Pupa fallax*.

PUPA CONTRACTA, *Say.*

Generally distributed throughout the district under logs, etc., in marshy spots.

SUB-GENUS ANGUSTULA, STERKI.

PUPA MILIUM, *Gould.*

Our smallest *Pupa*; a few taken in same locality as *Punctum pygmæum*.

GENUS VERTIGO, MULLER.

VERTIGO OVATA, *Say.*

A few large specimens taken at Lake Medad under logs; also found in company with *Pupa milium*.

VERTIGO VENTRICOSA, *Morse.*

One specimen taken with *Pupa milium*.

VERTIGO PENTODON, *Say.*

Under bark and in marshy situations; not common.

FAMILY STENOGYRIDÆ.

GENUS FERUSSACIA, RISSO.

SUB-GENUS CIONELLA, JEFFREYS.

FERUSSACIA SUBCYLINDRICA, *Linn.*

Common, fond of grassy railway banks.

FAMILY SUCCINEIDÆ.

GENUS SUCCINEA, DRAP.

SUCCINEA AVARA, *Say.*

A few taken near Dundas Marsh, and near stream through open woods.

SUCCINEA OBLIQUA, *Say.*

Common, moist spots on banks and in woods.

SUCCINEA OVALIS, *Gould.*

Common along edge of Dundas Marsh.

SUB-ORDER LIMNOPHILA.

FAMILY AURICULIDÆ.

GENUS CARYCHIUM, MULLER.

CARYCHIUM EXIGUUM, *Say.*

Common in decaying leaves, moss, and under sticks, etc., in swampy localities.

FAMILY LIMNÆIDÆ.

GENUS LIMNÆA, LAM.

SUB-GENUS LYMNOPHYSA, FITZ.

LIMNÆA STAGNALIS, *Linn.*

Common; Dundas Marsh.

LIMNÆA PALUSTRIS, *Miill.*

Common in streams and creeks around Bay and Marsh; very variable in size.

LIMNÆA HUMILIS, *Say.*

On rocks in streams; Chedoke Gorge and Dundas Ravine.

LIMNÆA DESIDIOSA, *Say.*

Not common; found in some streams around the city.

LIMNÆA CAPERATA, *Say.*

Common in some streams through open woods.

LIMNÆA GRACILIS.

Nearly 150 specimens taken Nov. 24 on Carroll's Point, thrown up in driftweed after a storm, not easily distinguished from the weed.

GENUS PHYSA, DRAP.

PHYSA GYRINA, *Say.*

Variable in size and color; may be found in streams, and generally around the bay.

PHYSA HETEROSTROPHA, *Say.*

Variable in size; same situations as *P. gyrina.*

GENUS BULINUS, ADAMSON.

BULINUS HYPNORUM, *Linn.*

A few very fine shells taken at Port Dover in a stagnant pond; may be found in some of the streams in woods; not so abundant as the two former species; is of very delicate structure. Ours are small as compared with those taken at Port Dover.

SUB-FAMILY PLANORBINÆ.

SUB-GENUS PLANORBELLA, HALDE.

PLANORBIS CAMPANULATUS, *Say.*

Common, Hamilton Bay and Dundas Marsh.

SUB-GENUS HELISOMA, SWAINSON.

PLANORBIS TRIVOLVIS, *Say.*

Variable in size and structure, common in the Bay.

PLANORBIS BICARINATUS, *Say.*

Hamilton Bay, not so plentiful as the two former species. Some specimens from near Ottawa are three times the size of any found here.

SUB-GENUS GYRAULUS, AGASSIZ.

PLANORBIS ALBUS, *Say.*

Two or three dead specimens from Dundas Marsh; a special search may prove it to be plentiful.

PLANORBIS DEFLECTUS, *Say.*

Dundas Marsh and Hamilton Bay.

PLANORBIS EXACUTUS, *Say.*

Dundas Marsh, and occurs sometimes in streams on decaying leaves.

PLANORBIS PARVUS, *Say*.

Common along shores of Bay and Marsh, and in some streams.

PLANORBIS NAUTILEUS.

Occurs in a small piece of marsh at the junction of Hamilton Bay and the Desjardines Canal. A very tiny shell, the smallest water shell known to me; is hairy. The Rev. G. W. Taylor in naming it states that it is identical with the English *P. nautileus*; from its small size is difficult to find; if an introduced shell it would be interesting to know by what agency it reached its present habitat; do not know that it has been taken anywhere else in North America.

SUB-GENUS PLANORBULA, HAIDE.

SEGMENTINA ARMIGERA. *Say*.

Has been taken in some abundance in the marsh toward Dundas, attached to dead leaves lying in the water.

SUB-FAMILY ANCYLINÆ.

GENUS ANCYLUS, GEOFFROY.

ANCYLUS RIVULARIS, *Say*.

Occurs in the Dundas Marsh and Hamilton Bay, a small colony found attached to sunken sticks in a small stagnant piece of water.

ORDER PECTINIBRANCHIATA.

FAMILY VALVATIDÆ.

GENUS VALVATA, MULL.

VALVATA TRICARINATA, *Say*.

Hamilton Bay, common.

VAVATA SINCERA, *Say*.

Hamilton Bay and Dundas Marsh, not so common as the last.

FAMILY VIVIPARIDÆ.

GENUS MELANTHO, *Bowditch*.

MELANTHO DECISUS, *Say*.

Hamilton Bay. Some very fine specimens taken from the Ancaster Creek, near its junction with the marsh. A few reversed specimens have been taken.

FAMILY RISSOIDÆ.

SUB-FAMILY HYDROBINÆ.

GENUS AMNICOLA.

AMNICOLA LIMOSA.

A few specimens from Dundas Marsh.

Two species of *Amnicola* not yet satisfactorily identified

SUB-FAMILY POMATIOPSINÆ.

GENUS POMATIOPSIS, TRYON.

POMATIOPSIS LAPIDARIA, *Say.*

Occurs in places around the marsh and in some of the ravines where damp; is terrestrial in its habits.

FAMILY STREPOMATIDÆ, HALDE.

GENUS PLEUROCERA, RAF.

PLEUROCERA SUBULARE, *Lea.*

Common, Hamilton Bay.

GENUS GONIOBASIS, LEA.

GONIOBASIS LIVESCENS, *Menke.*

Common, Hamilton Bay.

ORDER CONCHIFERA.

FAMILY CYCLADIDÆ, WOODWARD.

GENUS SPHÆRIUM, SCOPOLI.

SPHÆRIUM SULCATUM, *Lam.*

Hamilton Bay, common.

SPHÆRIUM RHOMBOIDEUM, *Say.*

Hamilton Bay, rare.

SPHÆRIUM TRUNCATUM, *Linsley.*

Hamilton Bay, rare.

SPHÆRIUM PARTUMEIUM, *Say.*

Occurs in a stream towards the Beach. Some very fine specimens of this shell were taken in stagnant ponds in woods at Port Dover.

SPHÆRIUM STRAMINEUM.

Ancaster Creek, near marsh; very plentiful.

SPHÆRIUM OCCIDENTALE, *Prime.*

Taken in Canal near Dundas; also in streams running through open woods, among and under the dead leaves.

GENUS PISIDIUM, PF'R.

PISIDIUM ABDITUM, *Prime.*

Hamilton Bay and Dundas Marsh.

PISIDIUM COMPRESSUM, *Prime.*

Dundas Marsh; only two or three specimens taken.

A THIRD SPECIES, as yet unnamed.

The *Sphæria* and *Pisidia* live in the mud in ditches, streams, etc.; the latter from their small size are seldom noticed, or are mistaken for young shells.

FAMILY UNIONIDÆ.

SUB-GENUS UNIO, RETZIUS.

UNIO ALATUS, *Say.*

Occurs in the Bay; a few large shells have been picked up on the shore between Willow and Carroll's Points.

UNIO GRACILIS, *Barnes.*

One very large specimen found on Carroll's Point.

UNIO GIBBOSUS, *Barnes.*

Have seen some valves supposed to have been picked up at the Beach; is likely to occur there.

UNIO COMPLANATUS, *Sol.*

Very common; Hamilton Bay.

UNIO NASUTUS, *Say.*

Occurs at Carroll's Point, and at other places around the Bay.

UNIO LUTEOLUS, *Lam.*

Very common around Hamilton Bay; very variable in size, colour and markings; some shells are very handsome.

UNIO SUBOVATUS, *Lea.*

A few dead shells have been taken near Carroll's Point belonging most likely to this species.

UNIO PRESSUS, *Lea*.

A few specimens from the Canal, near Dundas.

SUB-GENUS MARGARITANA, SCHUM.

MARGARITANA MARGINATA, *Say*.

A specimen of this shell was given to me as having been taken at the Beach.

SUB-GENUS ANODONTA, BRUG.

ANODONTA OVATA, *Lea*.

A few specimens from Dundas Marsh.

ANODONTA PLANA.

Carroll's Point, common.

ANODONTA BENEDICTII, *Lea*.

Common, same locality as last.

ANODONTA FLUVIATILIS, *Dillwyn*.

Occurs at Carroll's Point, and in some of the creeks running into the Bay.

Some *Anodons* from the Marsh, when determined, may add two or three species to this list.

THE HALF-YEARLY REPORT

OF THE

GEOLOGICAL SECTION

OF THE

HAMILTON ASSOCIATION,

ENDING APRIL 30TH, 1890.

HAMILTON, May 8th, 1890.

The Section, in submitting this report, is pleased to notice the active interest manifested in the work by the younger members. Although the members have not, as formerly, devoted so much of their time to the classifying, labelling and arranging of the large number of specimens now in the possession of the Section, for the reason that the specimens will require shortly to be moved to the more commodious apartments in the new Library building, which is now nearing completion, when a rearrangement will be necessary.

The members, however, have not been inactive meanwhile. Some, under the direction of our worthy chairman, Col. C. C. Grant, have been working on the Barton beds as well as giving daily attention to the various quarries under operation in the Niagara formation. The Barton beds are highly fossiliferous, presenting occasionally some new surprise, and what is always a source of gratification to collectors, the specimens found are usually in a good state of preservation. The various outcrops of rock in the vicinity of the city of Hamilton place the geological workers here in an enviable position. Dr. Spencer refers to it as the richest in fossil remains of all the districts he has ever met with, the number of graptolites collected from this district alone exceeds in variety and preservation the combined product of all other places in Canada. The upper beds of the Niagara supply us with many new forms of fossil sponges, which Prof. Head, of Chicago, says are peculiar to this district.

The Section is much indebted to the indefatigable exertions of our chairman, Col. C. C. Grant, for the many additions of new specimens made from time to time within the last year to the Palæontological museum; also for the papers given during the last six months.

The members of the Section have read several papers of geological interest, which have been the means of elucidating many points heretofore only partially understood.

The Section has held six meetings, the first on November 22nd, 1889, was devoted to the election of chairman and secretary, and other business in connection with the work of the Section. The second meeting was held December 27th, 1889, when Mr. A. E. Walker read a very interesting paper on the "Structure of Corals and Life of the Polyp." After referring briefly to the modern corals respecting their mode of growth and process of multiplication, forming colonies, which in turn form the well known reefs, barriers, etc. He then took up the Palæozoic corals, and from specimens showed that the process of petrifaction was owing to the presence of carbonates, sulphates, and silicates, and that their preservation up to the present time was in a more or less state of perfection, according to the nature of the permeating element. On January 24th, 1890, Mr. Henry Moore read a paper on the Niagara escarpment. He dealt more particularly with the outcrop at Niagara in an ascending order, begining with the Medina formation, giving the various thickness of the different strata, rock composition, and the fauna peculiar to each of the fossiliferous deposits.

Februray 28th Col. C. C. Grant read a paper, being the first of a series of geological notes entitled:

NOTES ON "BEATRICEA"—(BILLINGS.)

A NIAGARA AND JAMBRO-SILURIAN FOSSIL OF ANTICOSTI.

Perhaps no fossil (Eozoon Canadense excepted) has led to a greater difference of opinion among Palæontologists than the very remarkable one I have selected as the subject of a few brief remarks on the present occasion,—The "Beatricea of the late Mr. Billings.

Its classification still remains a matter of dispute. The tree-like appearance presented first led to its being considered a plant, but when sections were prepared for microscopical examination that

idea was found untenable, and Billings came to the conclusion it represented an extinct order of corals. Other Palæontologists suggested the possibility of an alliance with the gigantic "Sessonias" found on the rocky coasts of the Faulkland Islands near the Strait of Magellan. Their growth resembles that of a tree; the stem is about ten feet long and as thick as a man's thigh, terminating in a crown of leaves from two to three feet long.

Others, again, expressed their opinion that it was related to the modern "Macrocystes," detached by storms off Tierra del Fuego, and described by Professor Meyen, who remarks: "By the exertions of five men we succeeded in hauling the enormous mass on board. It was impossible to disentangle it; we could only detach some sixty feet of what we considered to be the main stem. We estimated the plant at, or about two hundred feet in length. A Toronto professor who examined a few specimens of Beatrecea I brought from Anticosti considered it an extinct Fucoid, adding 'It is by no means unusual to find the Colossal Algæ of the Pacific hollow in the interior.' It was more recently put down as a gigantic Stromatopora by an American friend of mine who examined prepared sections under the microscope. I doubt if Mr. Walker would feel disposed to recognize it as a member of that family."

Finally, Professor Hyatt, of Harvard University, asserted the Beatricea were the internal bones of Cephalopods. From his (Hyatt's) observations, "it seems probable," remarks Dana, "they are like straight branches of a tree, with irregularly fluted or uneven exterior, and have been described as plants; they possess 'a cone' in cone structure, with cellular interspaces about the centre, the plates in contact towards the sides." About five or six miles north of Fox Bay, on the east side, an unbroken perpendicular cliff presents itself, extending for a distance of seventeen miles. (This was a portion of the coast unexplored by Richardson owing to stormy weather). When the sea is perfectly calm you can land on a narrow strip of sand as the base, varying from a few yards to twenty paces broad. I had the good fortune to enjoy exceptionally fine weather during that portion of my trip around Anticosti, and travelled almost the entire distance on foot, and it was there I first saw this extraordinary fossil in situ.

The description given by Richardson respecting its appearance projecting from "the cliff" in tiers at "Battery Point" is also appli-

cable along the entire way almost to Salmon River, but at this locality the cliff is low—about sixty feet, and the fossils are more accessible and readily obtained. They are exceedingly brittle and difficult to extract, even though the matrix here is more shaly than in other places. *In not a single instance was Beatricea found erect*, although hundreds were seen, whereas the associated Corals and Stromatopora were frequently found fossilized as they grew, and entombed in the sediment which had gathered around them.

I recollect only two instances where the base of the fossil was displayed. I succeeded in getting one all right; the other was badly fractured. It resembles a Mesozoic Belemnite in outward appearance. The base is so slight that I felt convinced it could never have supported Beatricea in an erect position. When I returned from Anticosti I pointed out to Mr. Whiteaves that I thought my old friend Mr. Billings was mistaken in considering it a "coral," and that its proper classification would be among the "Cuttle-fishes." Mr. Whiteaves, in reply, mentioned he had received a communication from Professor Hyatt two years before to the same effect, and on examining the revised edition of Dana's Manual, I found a paragraph regarding the fossil previously unnoticed.

I made a close examination of the Niagara beds at Gamache, or Ellis's Bay, where Richardson found a Beatrecea 10½ feet long, 6 inches in diameter at larger end and 5 inches at the other, but I failed to discover there or elsewhere specimens of the size given in the Geology of Canada. The largest I saw was under 6 feet, but I was informed that a few years before I arrived, a party of American gentlemen from Boston had landed near Salmon River and carried off a fossil "as long as a boat-hook."

Probably some of the section may not have seen an account of a modern Cuttle-fish which had gone ashore in 1876 at Newfoundland. The Rev. Moses Harvey, a well-known naturalist (who recently discovered seals, young and old, living in inland fresh water lakes in the island, many miles from the sea), made a careful examination of this "great devil fish," erroneously so styled. The measurements were as follows: Of the ten arms the two long ones measured 30 feet in length, 5 inches in circumference at the thinner portion, 8 inches at the broad end; the short arms were 11 feet long and 17 inches in circumference; the body was 9 feet 6 inches; the

head 4 feet in circumference; the diameter of the eyeball 8 inches; the flap of the tail measured 2 feet 9 inches across. Another giant Squid was described by Professor Verrill in the *American Naturalist* in 1875 from the same locality. Surely in the face of such well authenticated facts it is rather amusing to read the following remarks of the author of "The Sea and Its Living Wonders," Dr. Hartwig, of Gottengen, whose work has been translated into many languages:

"According to trustworthy testimonies, some species of Cephalopods attain an astonishing size. Peron saw a Sepia near Van Dieman's Land with arms like snakes, 7 feet long. But not satisfied with reality, some writers have magnified the cuttle-fishes to fabulous dimensions. Pliny notices one monster with arms 30 feet long." Well, considering all we have recently learned from the Rev. M. Harvey and others, perhaps the elder Pliny was not so unreliable a naturalist after all as some suppose. It does not appear incredible that cuttle-fishes, when the family and its allies were "Lords of Creation," may have attained an extraordinary size. As far as we know they had nothing to contend against when the "Hudson River" beds were deposited. During the earlier ages of geological history, they appear to have been the magnates of the sea. Geikie remarks, "An Orthoceras, from 8 to 10 feet in length has been discovered in the Bala beds" (our Hudson River rocks). Professor Chapman, of Toronto, pointed out to me a fragment of one he discovered—now in one of the cases of the "University Museum"—comparable in thickness with any Beatrecea (one or two excepted) I met with in Anticosti.

Some years ago, I showed Dr. Spencer, in a quarry at the "Jolly Cut," an Orthoceras which covered the surface of four large limestone flags. On one of them I counted 65 Septa.

In conclusion, while I entertain precisely the same views as Professor Hyatt regarding the fossil, it is only fair to remark that very little is known yet of the Silurian Plant remains, and the Fucoids themselves present no internal structure. The Palæophycus of Hall, and two or more undescribed ones in the Clinton rocks of Hamilton, Ontario, undoubtedly possess a conical root, not unlike the base of a Beatrecea.

Through the kindness of my friend, Mr. Walker, I am enabled to submit for your examination two polished specimens (longitudinal and transverse sections) of the fossil. As far as I know, the

late Mr. Billings described only *two* species from Anticosti, whereas I noticed *four* there. One, however, by some Palæontologists, may be considered a variety only. The other is undescribed as yet. The external surface is covered by what at first seems a "Bryozoon." Possibly this may be only a deceptive appearance, and it may prove to be an outer portion. An epitheca, as it were, of the fossil.

March 28th, 1890, Col. C. C. Grant read a paper on the color of Shells, stating that a short time ago, in a paper on "Silurian Colored Lingula of Hamilton" he had ventured to express a doubt as to the usually accepted belief that the color of shells was solely owing to the action of light, but may possibly be partly due to other causes as well. His views were endorsed by Prof. Agassiz, who accompanied the little band of scientists in a recent American scientific expedition on board the steamer Blake, who observed that the Abyssal Shells possessed the predominant tints, viz: White, Pink, Red, Scarlet, Orange, Yellow, Violet, Purple, Green and allied colors. In deep water types the variety among them of coloring is quite as striking as that of better known marine animals. There is as great diversity of color in the deep water Star fishes as there is in those of our rocky or sandy shores. The Actinae (Sea Anemone) of deep water possesses stripes and tints as abundantly as the more common ones in shallow water. The Genus Trochidae are largely represented in Abyssal regions, brilliantly colored and pearly spiral shells. Marginella, Mitra, Typhis, Cancellaria, etc., have also been found at considerable depths.

On the same evening the secretary read a paper from Prof. D. F. H. Wilkins, B. A., of Beamsville, entitled, "Borings for Gas," and the occurrence of impure salt in the Medina group. The first part of the paper dealt with the various rock strata passed through in sinking two wells in the neighborhood of St. Catharines, one to a depth of 1,582 feet, the second to 2,450 feet; both wells were abandoned. The second part of the paper treats upon the saline nature of the Medina rocks. The presence of these calcium and magnesium chlorides, which are so frequently met with in the boring of wells for water in the Medina clays, suggests that their presence is due to the sudden precipitation of rock matter in the turbid ocean. We shall not fail to see that it is altogether likely that some of the waters of the ancient sea would impregnate at least some of the strata. May not this withdrawal have been much

greater than has been hitherto imagined, and may not this go towards accounting for the fact that the salt of the Onondago group is so free from foreign matter? The writer, in saying this, knows that the presence of such quantities of dolomite as the Niagara, Guelph and Onondago groups present, represent also the withdrawal of large quantities of the bitter chlorides, as calcium and magnesium carbonates leaving sodium chloride disolved in the ocean. Still it is far from improbable that the red shales and sandstones of the Medina and Clinton groups may have carried down with them a large mass of the bitter, burning, tasting salts above mentioned. The chemist knows how barium sulphate, when precipitated from copper or iron sulphate solution, is apt to carry copper or iron with it, and many other like instances could be given. Why then may not an immense mass of red clay or sand in a turbid ocean, showing by its color the absence of organic life and rapid deposition? why may not this have carried down matter which, under other conditions, is not merely soluble but absolutely deliquiscent?

April 25th, 1890, Col. C. C. Grant read a paper entitled, "Is the Deluge a Myth?" He took the ground that from geological evidence it was impossible to accept the universality of the Deluge. The fact of finding coral shells on lofty eminences did not prove that their presence there was due to the so-called deluge covering those eminences. It was his opinion that the mythical deluge is to be looked for in the glacial period, when the great ice sheet was receeding—the period of the formation of vast inland lakes, and immense floods, covered by the melting ice, of the great and local glaciers—a period, too, of continental depression.

COL. C. C. GRANT, *Chairman.* A. T. NEILL, *Secretary.*

RIVER VALLEYS OF THE NIAGARA ESCARPMENT.

BY D. F. H. WILKINS, B. A., BAC. APP. SCI., HEAD MASTER, HIGH SCHOOL, BEAMSVILLE, ONT.

Read before the Hamilton Association, May 8th, 1890.

That salient feature of the landscape of Western Ontario known as the Niagara escarpment, in its course through the counties of Lincoln, Wentworth, Halton, Wellington, Dufferin, Simcoe, Grey, and Bruce, as well as on through the Manitoulin islands, possesses among other interesting characteristics, a large number of river valleys of all sorts and sizes. Some are recent; others, ancient: some tell the story of repeated submergence beneath the waves; others, again, are almost of yesterday. Some have gently sloping sides; others with their precipitous, picturesque, angular walls, resemble in miniature the canyons of the far West. In some the drainage of the upland is slowly but surely carving its way to the plain below; in others, the dried-up stream-bed and the bare rock-ledges speak of diminished rain-fall and of complete erosion. In some a jungle of tree and shrub clothes the entire glen; in others, the traveller pushes onward amongst grass and herbs only.

Of the valleys, the most important to the north is certainly that of the Sydenham, in Grey county; for a glance at the map shows that it, in former days, carved out that large and beautiful and now valuable expanse of water known as Owen Sound. There we find that the present unimportant stream, after winding on gently through field and forest, plunges down two or three picturesque falls, and flows onward through a flood-plain, its former valley, of which more anon. Moreover, the stream has excavated, after the manner of Niagara, a deep and narrow gorge in the limestone, the ledges of which have caused the cascades just referred to; and that this erosion is very recent, will be apparent to all who carefully study the district. The ancient valley just mentioned deserves here a little longer notice. Its breadth increases from a few hundred feet at the south end to over a mile at the present river-mouth, and it extends further as we go northward to a width of three miles. Its length,

as far as has been traced, is nine miles, six of which are under the water of the Georgian Bay, and three covered by the thriving, enterprising city of the north, Owen Sound. Its depth is very uneven. In some parts, not the deepest, the Niagara limestone is met with at the surface; in others rock is not reached until a depth of thirty or forty feet has been gained. The valley, too, has been filled with blue clay, brown clay, sand and gravel, by no means in regular sequence, often stratified, and all capped with a series of terraces, which reach the higher ground. However, to the writer's knowledge, no minute survey of the valley has been hitherto attempted; and it may be that if this were done, some of the facts above stated might be given more in detail. While, therefore, it were unsafe to speculate further, it may be stated that at present the region seems to indicate a former area of high elevation, and drainage by means of a river, the course of which greatly resembles that of the modern Sydenham, but the volume of which was vastly greater.

Apologising for digressing upon ancient river beds, let us take our journey southward, following the escarpment. Here a series of picturesque ravines and valleys meets us, some of which are due to water erosion, and the others to the action of sub-ærial causes upon the joints and fissures of the limestone. Referring particularly to the latter, it may be stated that large cracks and dangerous crevices have resulted, here separating areas of rock which sometimes exceed an acre, there tumbling down mass after mass of stone and boulder in inextricable confusion; in many cases too these crevices have in course of time become interesting ravines, steep-walled and moss-clad. Still, none of these rise to the dignity of true valleys, nor in fact does any one until we reach the Beaver river, which, plunging down a precipice of seventy-five feet at the Eugenia Falls, Artemesia Township, Grey County, has excavated for itself a beautiful fertile dale. The breadth of this valley is at its widest over three miles, and the length about eight. This valley, so far as examined, which examination has been but superficially done, appears quite modern in geological time. So far as known, the deposits upon its flood-plain are quite recent, and evidently have been derived from the highland above.

Traversing the highland in a general westerly direction at a distance of some twenty miles west from the above, and from ten to thirty miles south of the Sydenham, are the beautiful valleys of the

five or six streams of the Saugeen river. Of these one, the central or Big Saugeen, deserves especial notice, for its valley in some places exceeds a mile and-a-half to two miles in width and over a hundred feet in depth, its banks being ridges of stratified gravel. Here and there in its bed the rock reaches the surface; but while exposures are abundant on the more northern tributaries that flow through Durham and the Rocky Saugeen further north, as a rule these rock exposures are absent from the main stream, until Ayton is reached in Grey County and Walkerton in the adjacent County of Bruce. The valley of the branch in which Durham is situated is in like manner over two miles in width from mouth to mouth, and in depth over a hundred feet.

Returning to the escarpment's edge, the next valley of importance is that of the Credit in Caledon Township. This presents a great resemblance to the valley known as Glen Spencer, Dundas, but exceeds this both in breadth and depth. It is evidently a valley of erosion, the Credit having cut its way down through three hundred feet to the lower beds of the Medina rock, and in so doing formed a romantic fir and pine-clad glen of half a mile to a mile in width. From the fact that the superficial deposits seem, so far as noticed, to occur only sparingly, it would seem that in the Credit we have an ancient river, re-cutting its bed to a lower level.

The Grand River, with its tributaries, the Irvine, the Speed, and the Canestoga, presents picturesque valleys, especially the canyon of the Irvine at Elora, north of Guelph. There the river Irvine has excavated a narrow gorge to the depth of nearly a hundred feet in Guelph limestone, and from the fact that no recent deposits are found on the sides, one may infer that the gorge is of modern formation. Other picturesque valleys occur at various points along the line of the main stream, especially at Galt, where the ancient river-valley is plainly visible, and where the present diminished stream wanders through flats of its own making.

Again, coming eastward to the edge of the escarpment, the valleys of the Twelve and Sixteen Mile Creeks of Halton county are worthy of a brief notice. Deep and wide glens, wooded to their tops, visible from a long distance, both of lake and of land, break the uneven outline of the summit. Like the Sydenham, the Beaver and the Credit, too, the streams wander on through deep gorges cut far into the plains; that of the Sixteen Mile Creek being remarkable

for showing near its mouth at Oakville, the Loraine (or Lorraine) shales of the Hudson river group on the eastern side, and on the western, the red Medina shales and sandstones. Moreover, in the Twelve Mile Creek valley near Bronte Station, extends a bed of stratified gravel, now eroded, showing clearly the ancient character of the stream. This bed of gravel is about seventy-five feet thick, and is made up largely of Hudson River fragments.

Of similar formation are the gorges of the "Grindstone Creek," Waterdown, and "Glen Spencer," at Dundas—glens with steep, wooded sides, the former almost straight in its course, the latter much curved; glens carrying moreover upon these sides strips of stratified sand and gravel; glens of great breadth and depth.

Turning the escarpment at or east of Copetown, and continuing along the ridge to Niagara, we encounter a series of creeks, some larger, some smaller, which have cut their way down through Niagara, Clinton and Medina rock, and of course, through those overlying deposits known as the ancient Lake Beaches. They are known as the Albion Mills Creek, the Fifty, Forty, Thirty, Twenty, Sixteen, Fifteen and Eight Mile Creeks respectively. To these we must add sundry dried up torrent beds, which present similar features to the creeks; and these features are like those above referred to, namely—glens or canyons of large or of small size, cut into the rock, and winding, straight-walled valleys in the plain. From the sediment brought down by the Albion Mills Creek, Burlington Beach has been made; and at the mouth of each of the others, bars are being built of larger or of smaller volume, according to the usual conditions of more or less material, and the set of the Lake currents. Like the other creeks on the north side of the escarpment, too, the present streams exist in vastly diminished volume. Picturesque waterfalls, moreover, are another feature well marked in the still existing streams, while, in the dried-up watercourses, their action can be plainly noticed.

The canyon of Niagara, so well-known to all, and yet so sublime in its magnificent, ocean-like rapids, and its majestic sweep of water down the steep cliffs, should detain us for a moment. For here, before our eyes, we see the work of erosion and excavation going on; here we have the key to our lesser river-valleys, those excepted which have resulted from the slow-weathering of former joints and fissures. We must remember, too, that Niagara is, after all, a very

recent river; we must not forget the Post-Pliocene beds of Goat Island and of the river banks, through which this deep and dark stream has cut its way; we must not forget the former, now drift-filled, outlet from the present whirlpool to St. David's village.

But chiefly this magnificent mass of thundering water should recall to us the formation of, so far as known, the ancient valley of the escarpment, the valley at Hamilton. A valley diminishing in width from eight miles to one, and traceable, as has been most ably shown by Dr. J. W. Spencer, Director of the Geological Survey, Georgia, as far as Caledonia, thence southeastwardly to Lake Erie, thence across the present lake to Pennsylvania and to Western Virginia—such a valley as this makes Niagara dwindle into insignificance. What a landscape, too, of boiling rapids, tumultuous surges, mountain-like waves and noble falls this must have presented—a glorious spectacle, upon which no human eye ever gazed! Nor did the work of the waters end there, as the slopes and terraces at the bottom of Lake Ontario to-day bear witness. Yet this channel from Hamilton to Lake Erie is choked with drift, so that its very existence lay unknown till about ten years ago; upon the sand and the clay filling the channel, farming has been carried on for well nigh a century, and still goes on to-day.

With this scanty description of the valleys of the Niagara ridge, let us ascend to the summit, tracing these streams to their source; and in order to be more exact, let us consider the last described series of creeks first in order. Now when we ascend to the highland, we notice one or two features of importance; and of these the first is that the highest part of the escarpment is, in general, at or near the edge, that there is a general southwesterly slope, not exactly the same as the dip of the strata. Thus, while Queenston Heights is three hundred and sixty-seven feet above Lake Ontario, Buffalo, on Lake Erie, is but three hundred and twenty-seven feet; on the Welland railway, in like manner, there is a southerly slope of fifteen feet in the distance between Thorold and Port Colborne, and the brow of the escarpment at Hamilton is seventy-eight feet above Port Dover. True, in the last case, the "Summit," a short distance south of the escarpment, about five miles say, is about a hundred feet higher, and true it is that, between Jarvis and Hagersville, we have a slightly lower ridge; yet this does not lessen the value of the general statement, especially if we remember that the former-men-

tioned ridge is the summit of the Niagara limestone, and the latter a recent deposit of clay and sand. On the whole, it is perfectly safe to reckon a fall towards Lake Erie of fifty feet in twenty-five miles, or two feet to the mile southward, while the dip of the Niagara group is uniformly twenty-two feet to the mile. Moreover, throughout the greater part of this area, the underlying rock is conspicuous by absence, a few places near Buffalo, one near Hagersville, and one or two on the Grand River, affording the only known outcrops of Onondaga, Oriskany or Corniferous groups. This certainly points to an increase of sediment to the southward, as well as to an uplift making the escarpment the northern margin of the area now covered by South Lincoln, Welland, Monck, South Wentworth, and Haldimand counties, omitting for the present, counties lying further west. A second feature of interest is that ridges of clay or of sand cross this area from east to west or nearly so, between which lie stretches of marsh or swamp, in which these creeks take their rise, together with sundry other creeks now flowing southward. These marshy areas and sand and clay ridges point to a former northward extension of Lake Erie, of which, as has been already stated, the edge of the escarpment was the northern boundary. A third point of interest is that in no part of this area does the land rise higher than five hundred feet above Lake Ontario. The creeks referred to then, rise in a marshy area, cut off by sand and clay ridges from Lake Erie, and they have been thus compelled to take a northerly direction.

If we now similarly trace the creek running through Glen Spencer, and the Grindstone Creek, back to the summit, we shall find their sources in an immense rocky and stony swamp, known as the "Beverly Swamp," in which also rises Fairchild's Creek, flowing southwesterly through the extreme west of Wentworth and through North Brant to the Grand River. Moreover, the Twelve and the Sixteen Mile Creeks of Halton County may be traced to this same source. In this area, covering North Wentworth, part of Halton, part of Waterloo, and a small piece of South Wellington Counties, we find the same well-marked features as in the preceding, namely, the highest part of the surface at or near the the summit of the escarpment, and the slope greater than that of the strata; also a swampy area, diversified by ridges of stratified gravel, some stretching east and west, others north and south. As a contrast, however,

we have several lakelets remaining, although rapidly silting up; of these it is necessary only to mention Lake Medad, near Waterdown, and Puslinch Lake, east of Hespeler. Again, too, by way of contrast, this district attains an altitude varying from over five hundred feet to over seven hundred above Lake Ontario, thus showing us another more ancient extension of the present Lakes Erie and Huron.

Tracing the rivers of the first, the most northerly mentioned district to their sources, we find in the counties of Simcoe, Grey, Dufferin, North Wellington, North Perth and Bruce, the largest and most important area of all, possessing the same general characteristics—the highest part nearest the front of the escarpment, and a slope thence westward and northward; beautiful lakelets, bilberry and tamarack swamps, broken by ridges of stratified gravel, and fine, clear streams of pure water. Often the gravel ridges guide the course of the streams, suggesting as has been already remarked in the case of the Saugeen branches, a deep valley of erosion, a view dispelled by a more thorough examination. Often, too, where the land has been cleared and drained giving a fertile tract to the farmer, the view from one of these ridges is entrancing indeed. The cleared plain, through which the stream meanders, rolls away to the next distant ridge mayhap three, mayhap ten miles; here is a strip of uncleared swamp-land, the home of the Linnea borealis and of the pitcher-plant, and the haunt of the white-throated sparrow and of the blue jay; there is one of the many charming, tree-embowered lakelets that dot the landscape of this northern area. Here as before we see the extension still further of the present great lakes, or rather in the great lakes we see the remnant of a once great fresh-water sea which covered the whole western peninsula of Ontario. Now, bearing in mind that the last described area has a mean elevation of eleven hundred feet above Lake Ontario, and that the proof of this having been once submerged is evident, let us state the full significance of this and briefly recapitulate the steps by which our river-valleys, so imperfectly described above, have originated.

A submergence which would place the summit of our western peninsula, Dundalk, Grey Co., seventeen hundred feet above the level of the sea, beneath the waves, would cover not only the whole of Ontario as far as the "Height of Land," or the Laurentides north of the Ottawa, but would submerge all Quebec except the monntains

of the eastern townships, the Gaspe peninsula and the north shore. The lower-lying parts of Vermont, the whole of middle and western New York, northern Pennyslvania, a great part of Ohio, Indiana, Missouri and Michigan, leaving out other more remote provinces and states, would be buried under the waters of a lake whose probable boundaries would be the Laurentides on the north, the Adirondacks, and including Lake Champlain, the Green Mountains on the east, the Catskills and other Appalachion chains on the south-east, certain north-facing escarpments in Ohio and Indiana to the north, and certain other escarpments of Wisconsin on the west. That such a submergence did take place has been ably shown by the researches of Dr. Spencer, who has placed the existence of the resulting lake beyond a doubt, and has named it in honor of the famous American geologist, Lake Warren. By a succession of differential uplifts to the north and the east, the three areas of Western Ontario mentioned in the preceeding paragraphs were upheaved, leaving us when the St. Lawrence was lowered to its present level, our lake system as we understand it to-day. The movement of uplift was probably slow and gradual since we pass almost imperecptibly from area to area. Such area, too, is not of uniform level, the first varying from nine hundred to fourteen hundred feet in height above Lake Ontario, the second from five hundred to eight hundred, the third from three hundred and twenty to five hundred. As each area was separated from the great lake it became a subordinate sheet of fresh water ponded back by gravel ridges and by the escarpment; a body of water from which issued in greater volume than at present the streams which have carved out the river-valleys above described. As time went on the silting up of these bodies of water caused the formation of marshes and swamps, and the isolation of the lakelets before mentioned; in other words, each became in turn from a noble sheet of water, a tract of bog and swamp, with lakelets dotting the surface here and there. Finally, man appeared on the scene, and by stripping the country of forest and draining the land, reduced the volume of the streams to their present size.

There remain two questions to be answered. The first is that since the escarpment front offers the highest barrier to these swamps, why the creeks described have forced their way through the rock, rather than through the gravel ridges. The answer to this is

that the escarpment face is not an artificially-made, uniform wall, but a natural slope of more or less strength, thickness, hardness, etc., and therefore more susceptible to weathering in some parts than in others. It will be found, on examination, that the streams have invariably broken through weaker parts of their boundary, especially where they are traversed by faults, joints, etc. The second is the date, geologically speaking, at which this inland fresh water sea existed, from which the present system was evolved. With the small amount of information that we at present have, and in the present imperfect state of our knowledge of recent formations, we can only state definitely the later Post-Pliocene as the period when, by the series of uplifts, this lake was formed, and by the help of more of these. it was finally dismembered and drained.

HAMILTON ASSOCIATION.

Statement of Receipts and Disbursements for the Year ending May 1st, 1890.

INCOME.

Balance as per last report	$163 49
Government Grant	400 00
Subscriptions	120 00
Sale of Books	49 75
Interest	2 50
	$735 74

EXPENSES.

Books, Stationery, Printing and Advertising	$177 20
Postage, Express, &c	25 80
Gas	13 40
Rent	200 00
Insurance	12 50
Furniture, &c	20 10
Caretaker	10 00
Balance	276 74
	$735 74

RICHARD BULL,
Treasurer.

Audited and found correct.

A. T. NEILL,
Auditor.

May 7th, 1890.

OPENING OF OUR NEW PREMISES.

September 14th, 1890.

As intimated in the Report of the Council presented to the Association at the annual meeting held in May last, we have taken possession of our new room in the Public Library Building.

The specimens in the museum have all been removed and re-arranged in the cases in their new quarters.

The room is a great improvement on the one we have left. The location is better, and the room more commodious and airy, and it is better lighted.

The Association is much indebted to the Curator, Mr. A. Gaviller, Mr. A. E. Walker and Colonel Grant, who did the most of the work of packing up and re-arranging the specimens.

The room was formally opened on the same day as the Art School and the Free Library were inaugurated. On that occasion the Earl and Countess of Aberdeen, Sir Daniel Wilson, of the Toronto University, the Hon. G. W. Ross, Minister of Education, and others visited the room, and were received by the members of the Council and their wives.

At the subsequent meeting in the Library his Lordship, as well as our President, Mr. B. E. Charlton, advocated the claims of our Association before the citizens assembled. Setting forth at length its advantages in giving an impetus and aid to literary and scientific studies.

The prospects for the future of our Association are brighter than they have been for many years, though we have had several losses by removal of valuable active members whose places will be very difficult to fill.

Already many applications for membership have been received, and it is hoped that the members of the Association will do their best to bring the claims and advantages of the Association before their friends, and induce as many as possible of those who will take an active interest in its welfare to join us. For that purpose the Secretary or any member of the Council will be glad to supply "Forms of Application."

The first general meeting of the Association for the Session of 1890-91 will be held on Thursday, November 13th, 1890.

The Biological Section meets on the first and third Fridays of each month, and the Geological Section on the fourth Friday.

It is in contemplation to form a Philological Section, the time of meeting not yet fixed.

These Sections are open to all the members of the Association, and it is hoped that with the increased comfort of our meeting place there will be a more general interest taken in Section work.

A. ALEXANDER,
Secretary.

B. E. CHARLTON,
President.

HAMILTON, Nov. 10th, 1890.

ERRATA

FOR MR. MOFFAT'S PAPER ON "THE QUESTION OF THE VARIATION OF SPECIES."

Page 21, line 8 from top—for *on* the species read *of.*
" 22, " 7 " bottom—for *rectifying* read *modifying.*
" 25, " 3 " " —omit *have.*
" 25, " 1 " " —for *alone* read *alive.*
" 26, " 2 " " —for *ridiculous* read *pediculous.*
" 26, " 1 " " —for *existed* read *exist.*
" 28, " 16 " top—after some insert *means.*
" 28, " 11 " bottom—for *standing* read *steadily.*
" 29, " 16 " top—for *begets* read *by its.*
" 29, " 2 " bottom—for *naming* read *examining.*
" 30, " 1 " top—for *and* read *an.*
" 30, " 7 " " —for *sight* read *slight.*
" 30, " 10 " " —for *get* read *be yet.*
" 31, " 13 " bottom—for *effecting* read *expecting.*
The last line should be in quotation marks.