PROCEEDINGS

OF THE

Nova Scotian Institute of Science

SESSION OF 1917–1918.

(Vol. XIV Part 4)

56TH ANNUAL SESSION.

ANNUAL BUSINESS MEETING.

Civil Engineering Lecture Room, N. S. Technical College, Halifax, 10th October, 1917.

THE PRESIDENT, DR. D. FRASER HARRIS, in the chair.

Other members present: DR. E. MACKAY, DR. A. H. MACKAY, DR. H. L. BRONSON, PROF. D. S. MCINTOSH, D. M. FERGUSSON, C. B. NICKERSON, DR. J. CAMERON, G. W. T. IRVING, H. B. VICKERY and H. PIERS.

It was announced that Dr. Edward Blackadder, Halifax, has been elected an ordinary member on 26th September, 1917.

PRESIDENTIAL ADDRESS: by DR. D. FRASER HARRIS.

Speaking *extempore* the President referred to the general work of the Institute during the past year, its prospects for the present year, and called attention to the loss of two eminent members of whom brief biographical sketches follow:

ALEXANDER MCKAY, M. A., passed away at his home in Dartmouth on 8th April, 1917. He became a member of the Institute, 5th Feb., 1872, and for the most of the time thereafter was an active member of the Council. He was Recording Secretary for twelve years—from 12 Oct., 1881 to 12 Nov., 1894, except during the year Oct., 1885 to Oct., 1886; and was President from 8 Nov., 1897 to 20 Nov., 1899. The following brief sketch of his remarkable career as one of Nova Scotia's greatest educationists is from the *Journal of Education*, April 1917;—

"He was born at Earltown, Colchester County, 16th July, 1841; commenced teaching in Pictou County, 1856; graduated from the Normal School at Truro after two sessions, in 1859. He taught thereafter in the counties of Digby, Colchester and Kings, resigning the principalship of the Wolfville schools in 1872 for the principalship of the Dartmouth schools.

"In 1881 he was appointed to the department of mathematics and science in the Halifax County Academy; and in 1884 became Supervisor of the Halifax Schools which position he resigned at the end of 1916 owing to illness.

"He filled many other responsible positions simultaneously. As Advisory Commissioner for Nova Scotia, he installed the Provincial Education Exhibit at the World's Fair in Chicago, 1893; and in 1902 was appointed by the Provincial Government as a member of the Acadian Commission. He filled for many years such positions as Director of the Victoria School of Art and Design, Director of the Halifax Ladies' College, member of the Provincial Exhibition Commission, Secretary of the Provincial Education Association for about forty years, Lecturer in the first Technical Institute of Halifax in the seventies of last century, Lecturer in Education in Dalhousie University, President of the Summer School of Science, President of the Nova Scotian Institute of Science, President of the Temperance Alliance, a Provincial Examiner in Drawing and Educational Subjects.

"No citizen had been more actively and usefully interested in public affairs. The Halifax School Board raised a monument to his memory while he was yet living in the fine Alexander McKay School."

HENRY SKEFFINGTON POOLE, D. Sc., F. G. S., F. R. S. C., was born at Stellarton, Pictou County, Nova Scotia, 1 August, 1844, and was a son of Henry Poole, a well-known mining engineer of this province. He graduated from King's College, Windsor, as B. A. in 1865, as M. A. in 1874, and as D. Sc. in 1903; and became an associate of the Royal School of Mines, London.

As an eminent mining engineer he directed coal mining in Cape Breton, and silver mining in Utah, U. S. A. He was appointed inspector of coal mines in Nova Scotia from 1872 to 1878. He then became chairman of the Board of Examiners for Mining Certificates and general manager of the Acadia Coal Company from which he retired with a distinguished testimonial in 1901. He was president of the Mining Society of Nova Scotia, a member of the Canadian Society of Civil Engineers, a Fellow of the Royal Society of Canada, a Fellow of the Geological Society and a member of the Federated Institute of Mining Engineers. He was a contributor to various scientific and technical journals, to the reports of the Canadian Geological Survey, the Journal of the Geological Society, and especially to the Transactions of our Nova Scotian Institute of Science, the last contribution being on "*Senecio Jacobaea and Callimorpha Jacobaea* (The Cattle-Killing Ragwort and the Cinnabar Moth)" which will be found at page 279 of Volume XIII (Session of 1913-1914).

He became a member of the Institute of Science on 11 Nov., 1872, and was its President from 24 Nov., 1902 to 18 Oct., 1905. He retired to England, thereafter, where he died on 31 March, 1917, at his home in Guildford, Surrey.

The Treasurer, MR. IRVING, presented his annual report, showing that the receipts for the year ended 30th Sept., 1917, were $810.40; the expenditure, $383.40; and the balance on hand, $427.00.—The report was received and adopted.

The Librarian's report was presented by MR. PIERS, showing that 1,369 books and pamphlets had been received through the exchange-list during the year 1916; and 841 have been received during the first nine months of the present year 1917, namely January to September inclusive. The total number of books and pamphlets received by the Provincial Science Library (with which that of the Institute is incorporated)

during the year 1916, was 1,586. The total number in the Science Library on 31st December, 1916, was 57,975. Of these, 42,064 (about 72½ per cent.) belong to the Institute, and 15,911 to the Science Library proper. 126 books were borrowed in 1916 besides those consulted in the library No binding or purchasing has been done by the library directly, there being no money grant at its disposal.—The report was received and adopted.

The Council reported that on 26th September it had sent a resolution to the Dominion Premier and the Minister of Militia and Defence, requesting that in applying the Military Service Act very special efforts be made to ensure that such technically trained men as may be enlisted be drafted into that particular branch of the service for which they are most nearly fitted by their training and experience in civil life. Replies had been received, stating that the Institute's representation would have due consideration.—The Council's action was approved by the meeting.

Some discussion took place on a subject referred to in the President's address, and it was resolved that the question be announced as a subject for discussion at the next ordinary meeting, viz., Whether the Transactions be more particularly confined to the publication of papers on subjects bearing more or less directly on Nova Scotia, except in such non-local departments as chemistry and physics, as has been the practice in the past; or whether the publication of papers on non-local subjects generally be permitted.

The following gentlemen were elected officers for the ensuing year (1917-18):

President,— PROFESSOR DAVID FRASER HARRIS, M. B., C. M., M. D., B. Sc. (LOND.), D. Sc., F. R. S. E., F. R. S. C., *ex officio* F. R. M. S.

First-Vice President,—PRESIDENT ARTHUR STANLEY MACKENZIE, Ph. D., F. R. S. C.

Second Vice-President,—PROFESSOR CLARENCE LEANDER MOORE, M. A., F. R. S. C.

Treasurer,—GEORGE W. T. IRVING.

Corresponding Secretary,—PROFESSOR EBENEZER MACKAY, Ph. D.

Recording Secretary and Librarian,—HARRY PIERS.

Councillors without office,— ALEXANDER HOWARD MACKAY, LL. D., F. R. S. C.; PROFESSOR DONALD SUTHERLAND MCINTOSH, M. Sc.; CARLETON BELL NICKERSON, M. A.; PROFESSOR HOWARD LOGAN BRONSON, Ph. D.; WILLIAM HARROP HATTIE, M. D.; PROFESSOR JOHN CAMERON, M. D., D. Sc., F. R. S. E. ; and PROFESSOR ARTHUR G. NICHOLLS, M. D., D. Sc., F. R. S. C.

Auditors,—DONALD M. FERGUSSON, F. C. S., and HUBERT B. VICKERY, B. Sc.

FIRST ORDINARY MEETING.

Physiological Lecture Room, Dalhousie Medical College, Carleton Street, Halifax, 11th February, 1918.

THE PRESIDENT, DR. D. FRASER HARRIS, in the chair.

Other members present: DR. A. H. MACKAY, DR. E. MACKAY, DR. J. CAMERON, PROF. MOORE, PROF. MCINTOSH and MR. PIERS.

As H. B. VICKERY was out of town, the reading of his paper on "Isochlors of Nova Scotia, part 2," was deferred to a later meeting.

DR. J. CAMERON then took up his motion, of which due notice had been given at the last Annual Meeting; to the effect that the Transactions of the Institute be thrown open to any

scientific paper, even if not on a subject bearing on Nova Scotia. The motion was seconded by DR. A. H. MACKAY and supported by DR. E. MACKAY and PROF. MOORE. MR. PIERS opposed the motion, holding that the Transactions, as has been the ruling practice in the past, should continue only open to papers dealing more or less distinctly with Nova Scotian subjects, except in such essentially non-local departments as physics, chemistry, physiology, etc.; other non-local papers, when deemed worthy, being printed in the Proceedings.

DR. CAMERON finally modified his motion to read thus:— "Resolved that the N. S. Institute of Science throw open its Proceedings and Transactions to papers in all departments of science, provided they are contributed by persons working in Nova Scotia." The motion passed, MR. PIERS dissenting if the motion was construed as authorizing the publication in the Transactions of communications having no local bearing, except in the case of such subjects as had been previously referred to.

SECOND ORDINARY MEETING.

Physiological Lecture Room, Dalhousie Medical College, Halifax; 11th March, 1913.

THE PRESIDENT, DR. D. FRASER HARRIS, in the chair.

H. B. VICKERY, read a paper entitled "The Isochlors of Nova Scotia, part 2." (See Transactions, page 355).

WALTER H. PREST, read a paper "On the Nature and Origin of the Eskers of Nova Scotia." (See Transactions, page 371). The subject was discussed by PROF. MCINTOSH, DR. A. H. MACKAY, H. B. VICKERY and DR. E. MACKAY.

SPECIAL MEETING.

Legislative Council Chamber, Province Building, Halifax, 13th May, 1918.

THE PRESIDENT, DR. D. FRASER HARRIS, in the chair.

Among those present were: HIS HONOR the LIEUT.-GOVERNOR and MRS. GRANT, PRESIDENT A. S. MACKENZIE, PROF. E. MACKAY, DR. A. H. MACKAY, PROF. H. L. BRONSOB, C. B. NICKERSON, MAYNARD BOWMAN, CAPT. JOHN READ, MRS. READ, the MISSES READ, MRS. A. H. MACKAY, MRS. E. D. MACAVITY, MRS. A. LAWSON, H. PIERS, and other.

PRESIDENT D. FRASER HARRIS, speaking from the Chair, said:

"Your Honor, members of the Nova Scotian Institute of Science, ladies and gentlemen:

The Institute is fortunate in having acquired, through the generosity of a friend who wishes to remain unknown, a portrait of the late Professor J. Gordon MacGregor, a former President of this Institute. The portrait, which is about to be unveiled, was painted by the well-known artist, Mrs. E. D. MacAvity.

This evening we are further particularly fortunate in having with us the nearest male relative—a nephew— of the late Professor MacGregor, in the person of Capt. John Read, whom I shall ask in a few minutes to unveil the portrait. We hail this opportunity of welcoming Captain Read back to his native land after his period of active and honourable service against an active and dishonourable foe.

But we are also able to congratulate ourselves on having with us this evening a former student of Professor MacGregor, Dr. A. Stanley MacKenzie, President of Dalhousie University who will presently tell us something of the scientific life and

work of the late Professor MacGregor, work for which, as we all know, there was conferred on him the Fellowship of the Royal Society. I confess that I, for one, do not know which of his researches won for MacGregor that blue ribbon in Science: but I hope President MacKenzie will tell us about this, for I believe that there has been no public acknowledgement of the work and position of MacGregor since his death, if we except an obituary notice of him which appeared in the Transactions of this Institute.

I remember well MacGregor being elected to the Chair of Natural Philosophy at the University of Edinburgh, a chair made illustrious by its having been held by Sir John Leslie early in the 19th century and by Peter Guthrie Tait in our own day. Dr. MacGregor was one of the last men of science of whom I took farewell in November, 1911, a few days before I sailed for Canada. When I called on him, though he was evidently busy, he showed me over the department which had been provided for him out of the building that was formerly the Edinburgh Royal Infirmary. The famous "old Royal," the Infirmary of the second Monro, of Syme and of Lister; the Infirmary where Henley the poet lay convalescing when he wrote those virile lines on his surgeons and nurses.

Knowing that I had just come from St. Andrews, the home of the illustrious academic family of the Hunters.—my wife's family,—to which Sir John Leslie was related, MacGregor drew my attention to the instruments, carefully preserved, which Leslie had used. There, reverently preserved in a kind of museum, were his hygrometers and differential thermometers and other apparatus with which Leslie investigated the phenomena of the production of cold by artificial congelation, or "Leslie's phenomenon" as it is sometimes called.

Professor Tait, MacGregor's immediate predecessor, was my own teacher in physics. MacGregor told me something

about Halifax and about Dalhousie, and gave me kind advice. I left him to pay two more farewell calls; all three of those from whom I parted that day have since crossed the dark river.

I crave the pardon of this gathering if I have introduced too personal a note into these remarks; but if I have, it is probably due to my drawing near to that period of life which has been called one's "anecdotage."

I shall now ask Capt. Read to unveil the portrait."

CAPTAIN READ, after unveiling the portrait amidst applause, said how highly he appreciated the honor which the Institute had done him in asking him to unveil this fine likeness of his distinguished relative.

The President of the Institute then called upon the President of Dalhousie University to read his appreciation of the scientific work of the late Professor MacGregor.

JAMES GORDON MACGREGOR

By A. S. MACKENZIE, Ph. D., F.R.S.C., President of Dalhousie University.

This does not pretend to be a life of MacGregor, nor a proper appreciation of him as a scientist, but merely some hastily gathered facts, and some recollections and an opinion or two.

First of all a few dates, etc.—

1852 Born at Halifax, March 31st,—son of Rev. P. G. MacGregor. Educated at Free Church Academy, Halifax.

1867 Entered Dalhousie College, winning the Entrance Scholarship.

First Year: 1st prizes in Classics and Mathematics. 2nd prize in Elocution.

Second Year: 1st prizes in Classics, Mathematics and Logic and Psychology.

Third Year: 1st prizes in Classics and Natural Philosophy.

Fourth Year: 1st prizes in Classics, Ethics, History and Modern Languages. Sir William Young's Prize.

1871 Graduated, B. A., Dalhousie.
1871 Won Gilchrist Scholarship.
1871-6 Student at Edinburgh and Leipzig.
1874 Took degree of M. A., Dalhousie.
1874 Took degree of B. Sc., London.
1876 Took degree of D. Sc., London.
1876-7 Lecturer on Physics at Dalhousie.
1877-9 Lecturer on Physics at Clifton College, Bristol, England.
1879-1901 Professor of Physics at Dalhousie.
1882 Charter F. R. S. C.
1882 Elected F. R. S. E.
1888-91 President of N. S. Institute of Science.
1891 Appointed Dean of newly formed Faculty of Pure and Applied Science, Dalhousie.
1899 Elected F. R. S.
1901-13 Professor of Natural Philosophy, Edinburgh.
1901 Given degree of LL. D., by Glasgow University.
1901 Given degree of LL. D., by Dalhousie University.
1913 Died, Edinburgh, May 21st.

In order to understand MacGregor's place and importance in the field of Science in this country, it is necessary to understand the position of Physics in his student days. To put it briefly: Natural Philosophy, as it was than called, was a text-book study; a laboratory for students was unknown; a student never touched an instrument, but only looked at such

from the respectable distance of his seat in the class-room—and then at only a meagre lot. There was an Atwood's machine (perhaps only a large diagram of it), a Hero's fountain, a model force pump, an air-pump, a feather-and-guinea-tube, Magdeburg hemispheres, a syphon, a barometer, a friction electric machine, and some spark apparatus, a gold-leaf electroscope, Zamboni pile, Volta cup, Leslie's cubes, a thermometer or two, a tuning-fork set, a balance, some hydrometers, and a dozen or two more such instruments—and the "cabinet" was complete. It is true that in various large universities there were professors working at research, but the laboratories were not visible to the undergraduate, and the idea of a laboratory course of instruction was absolutely foreign to the British mind. What didactic instruction might be given in the ordinary college was just as likely to be given by the professor of Classics or History, as that of Mathematics or Astronomy. The idea of a separate chair of Physics was not yet general.

When MacGregor went abroad to study Physics there were few places in the Old Country where he could get the kind of instruction he needed; not at Cambridge or Oxford, or Glasgow, or Dublin, though in all of these were able professors, and professors doing research work; but no place for students wanting to do so. However, at Edinburgh, Tait was allowing as a great privilege a few selected, promising students to go into his own private laboratory and help him with his researches, and, as they became capable, undertake part of them by themselves. Here MacGregor was initiated into the mysteries and delights of research, and began to "find himself," as an independent worker. The very fewness of Tait's students thus privileged was a great advantage to them, for they were very close to him and his work, and had the benefit of almost private tuition from that great leader in physical thought.

The German Universities, on the other hand, had developed regular schools of experimental teaching, and shrewdly invited students to come to them from all parts of the globe, and gave a special degree of Ph. D. to denote the termination of such a course of training. And thus began that 'set' toward German training, especially for men from this side of the Atlantic, that gave German Science and German scientists an unwarranted prestige, which Germany fostered until it became almost a cult and required a world-war for its undoing. MacGregor spent some time at Leipzig, and became a staunch believer in the experimental method of teaching science, and at the same time he became more and more convinced of the part science was to play in the progress of the future, and of its educational value as well. When he returned to his native land, it was as an apostle, a missionary, an enthusiastic devotee of his beloved Physics. From that time forward he worked and fought for the introduction of more science into the schools and colleges, with an ardor that no amount of opposition and conservatism and temporary failure could subdue; and it was a long uphill fight. He formed societies for its cultivation, addressed gatherings of teachers and schools and colleges, preached from the platform and through the Press. He was not merely an advocate of pure science; but as truly as we see it today he foresaw the meaning and value of applied science, and even organized out of voluntary local talent a still-born Institute along the lines of our modern Technological Institutes. The result of his efforts within the University is seen after twelve years of constant fight, when he had a Faculty of Pure and Applied Science set off and differentiated from the Faculty of Arts. He was made its first Dean.

With all his work as a teacher, and in spite of drawbacks that would have overwhelmed the average man and turned him into a mere hack, he never ceased his research work, but, on the contrary, was remarkably productive. No

one knew better than MacGregor that one has almost got to be an investigator in order to be a success as an inspiring teacher. How he managed to do the work he did, with practically nothing to do it with, has always remained a mystery to me. One wonders whether he would have accomplished much more, and how much, if he had had even the modest equipment of our physical laboratory of today. This fact is to be borne in mind, that his going to Edinburgh was the end of his career as an investigator; I do not know of a single paper of a research nature that he published after leaving Dalhousie. He became a reformer there, and administrative work absorbed his whole energy—and killed him, a warning of a barren portion of life and its ending which some of us might well take to heart.

I was one of his students in 1883-5, and I have been trying to recall what his so-called laboratory was like in that old building on the Parade; but though I can well recall the little lecture-room with its sloping floor, I cannot remember any laboratory. Of course, we students took only lectures; there was no such thing as a physical laboratory course. There was a course in practical chemistry which a few curious beings elected. I was one whose curiosity was aroused; we had practically no instruction, but were given a book of directions, and shown the aerie in the attic called the laboratory, and left to ourselves. We tried many combinations of the contents of bottles whose properties we were profoundly ignorant of, and got many strange and unexpected "reactions," and explosions; but how the buildings and our lives escaped is one of those results which a prophet would not have foretold. I do not know what chemistry we learned in the process, but we came away with a profound respect for Physics. When in 1887 I came back as tutor in Mathematics and Physics, MacGregor was in his new laboratory in what we now call the Old Building on Carleton Street. He

had deisgned it with loving care, and it was in my eyes palatial. There I did my first experimenting. As I recall the equipment he had then been able to gather together after about ten years of effort, it seems truly pitiful that such a man should have had such lack of tools. You could put it all in a good-sized wardrobe. Most of my work was done with a primitive lamp-and-scale galvanometer and Wheatstone's bridge and a Kohlrausch box of coils, with some spools of wire, sealing wax, etc. I spent months rewinding the galvanometer, resilvering its crippled mirror, and calibrating a stretched piece of German-silver wire to act as a potentiometer. Then another three months were given to finding the inversion point of a thermo-couple. I must not forget formidable efforts which I made to rehabilitate an Atwood's machine, whose warped supports, upright in name only, not in morals, and cogwheels stained with verdigris, pathetically called for rejuvenation. I got it so that it would go on Saints' days, when one called out all his patience and other virtues. This was MacGregor's laboratory, and yet out of it came all that series of researches, as complete a list of which as I could make in a hurry I have appended to this. He had to cut his pattern therefore to suit his cloth; and had to choose lines of research which could be done with a few chemicals, glass tubing, a balance, a thermometer, and pluck, determination and brains. Most of his work at this stage of his career was in connection with the new ionization theory, which he did much to advance from certain standpoints. He always complained to me of the way he felt hampered by his lack of a thorough grasp of mathematical physics; when I came back from Johns Hopkins he would frequently tell me how envious he was of the training I had received on that side of physics. But I think he did himself an injustice, though it is true he never trusted himself in that region of investigation or with that implement of attacking physical problems.

fitting him for extending the subject he was considering, he yet seems to have given vent to his critical faculties, rather than to striking out into unknown regions. This will be evident in his philosophical flights, as when he applied his analytical powers to dissect the fundamental bases of abstract dynamics. His forte was in making knowledge his own, and passing it on to others, rather than in making his own knowledge.

As would be expected from the qualities I have presented, MacGregor was a very expert experimental investigator; with his skill and ingenuity he made anything into apparatus, and made a little go a long way, and made it give him precision too. It would shame any one of us to be asked to reproduce any of his results with the apparatus he used. With it all he had a kindly, warm-hearted and cheery disposition, and a true Scottish loyalty to his friends that made him a delightful companion. His interests were wide, and he had a taste for good things in literature and in art, and he could tell a story or incident well. As a consequence an evening spent with him in the clouds of discussion and of nicotine were hours of real enjoyment. Dalhousie has been fortunate in many things, but in no respect more than in the quality of those members of her staff who dug her ramparts and set up her bulwarks in her early pioneer years, and of these the name of MacGregor is not the least.

"Forget not the MacGregor."—(Rob Roy).

Nova Scotian Inst., of Science,

May 13, 1918.

PUBLICATIONS

BY PROFESSOR JAMES GORDON MACGREGOR.

On the Electrical Conductivity of Certain Saline Solutions, with a Note on the Density. (With J. A. Ewing). T. R. S. E., XXVII, 51-70, 1873.

If MacGregor's laboratory and library equipment was so mean and inadequate, his mental equipment was of the very best. The characteristic I should put first is alertness; he saw your point before you made it; he saw every side of it; and almost instantaneously saw the correctness or the flaws in it. His reply came back like a flash, and almost beat you with its suddenness; he fairly overwhelmed you with his arguments drawn from many points of view. This mental alertness, acuteness and keenness was a part of his whole, quick, nervous make-up; he was built of springs, bodily and mentally. Such an alert and nervous temperament meant that he was not satisfied until a physical conception was absolutely clear to himself; he possessed no misty or foggy notions; he either knew a thing or did not know it. This characteristic was chiefly the secret of his excellence as a lecturer, when combined, as it was, with a good command of fluent expression. He was probably the best lecturer on Physics I ever heard; even the dullest boy thought he understood mechanics while at MacGregor's lecture (but he didn't); the presentation was absoltely logical, the illustration was apt, and there were no superfluous words to becloud it all. This type of mind is usually extremely impatient of dullness of intellect; but MacGregor possessed the necessary patience to make him a great teacher. I would add to this quality an abounding energy and a great power of concentration and great tenacity of purpose. Given these and his enthusiasm, it is easy to realize that the cause of science was assured of progress in this part of the world, no matter how much opposition and stubborn stupidity and prejudice it had to encounter. We, who have followed him owe him an unpayable debt for the easy path left for us to tread.

I would not place MacGregor so high as an original thinker. Keen and analytical as were his faculties, enabling him to see the bearing of all his knowledge, and, therefore, seemingly,

Note on the Electrical Conducivity of Saline Solutions. P. R. S. E., 545-559, 1875.

Notes on the Volumes of Solutions. (With J. A. Ewing). Nature, 376, Aug. 30, 1877.

On the Electrical Conductivity of Stretched Silver Wires. P. R. S. E., IX, 79-85, 1878.

The Electrical Conductivity of Nickel. (With C. M. Smith). P. R. S. E., 120-123, 1878.

The Thermo-Electric Properties of Cobalt. (With C. G. Knott and C. M. Smith). P. R. S. E., 1878.

On the Thermo-Electric Properties of Charcoal and certain Alloys, with a Supplementary Thermo-Electric Diagram. (With C. G. Knott). T. R. S. E., XXVIII, 321-343, 1878.

On the Variation with Temperature of the Electrical Resistance of Wires of certain Alloys. (With C. G. Knott). T. R. S. E., XXIX, 599-608, 1880.

The Conditions of Scientific Progress. Inaugural Address, Dalhousie College Convocation, session 1880-81.

A Short Statement of the advantages of University Consolidation. Halifax, 1881.

On the Measurement of the Resistance of Electrolytes by means of Wheatstone's Bridge. T. R. S. C., 21-25, 1882.

On the Absorption of Low Radiant Heat by Gaseous Bodies. P. R. S. E., 24-45, 1883.

On the Resistance to the Passage of the Electric Current between Amalgamated Zinc Electrodes and Solutions of Zinc Sulphate. T. N. S. Inst. of Sc., 47-52, 1883.

On the Transition Resistance to the Electric Current at the bounding surface between amalgamated Zinc Electrodes and solution of Zinc Sulphate. T. R. S. C., 99, 1883.

On some Experiments shewing that the Electromotive Force of Polarization is independent of the difference of Potential of the Electrodes. T. R. S. C., 49-54, 1883.

On the Density and Thermal Expansion of Solutions of Copper Sulphate. T. R. S. C., 69-76, 1884.

Note on Temperatures of Maximum Density. T. N. S. Inst. Sc., 226-227, 1885.

On the Density of Weak Aqueous Solutions of Certain Salts. T. R. S. C., 15-19, 1885.

Report of the Committee of the Royal Society of Canada. P. R. S. C., 1885.

On the Relative Bulk of Certain Aqueous Solutions and their Constituent Water. N. S. Inst. Sc., VI, 261-264, 1886.

On the Measurement of Temperature and Time. T. N. S. Inst. Sc., VII, 20-23, 1887.

Elementary Treatise on Kinematics and Dynamics. 1887, (Macmillan).

On the Elementary Treatment of the Propagation of Longitudinal Waves. T. N. S. Inst. Sc., 89-92, 1888.

A Table of the Cubical Expansions of Solids. T. R. S. C., 3-16, 1888.

Opening Address. T. N. S. Inst. Sc., VII, 185-196, 1888.

On Carnot's Cycle in Thermodynamics. T. N. S. Inst. Sc., VII, 227-230, 1889.

On the Variation of the Density with the Concentration of Weak Aqueous Solutions of Certain Salts. T. R. S. C., 23-31, 1889.

Opening Address. T. N. S. Inst. Sc., VII, 319-336, 1889.

On Calculus Dodging and other Educational Sins—Address delivered at the opening of the Physical Classes of Dalhousie College, session 1889-90.

On a Noteworthy Case of the Occurrence of Ice in the Form of Non-Crystalline Columns. T. N. S. Inst. Sc., VII, 378-380, 1890.

On the Relative Bulk of Aqueous Solutions of certain Hydroxides and their Constituent Water. T. N. S. Inst. Sc., VII, 368-376, 1890.

On a Test of Ewing and MacGregor's method of measuring the Electrical Resistance of Electrolytes. T. R. S. C., 49-56, 1890.

On the Density of weak Aqueous Solutions of certain Sulphates. T. R. S. C., 19-37, 1890.

Presidential Address. T. N. S. Inst. Sc., VIII, i-v, 1890.

On the Variation with Temperature and Concentration of the Absorption Spectra of Aqueous Solutions of Salts. T. R. S. C., 27-41, 1891.

On the Density of Weak Aqueous Solutions of Nickel Sulphate. T. R. S. C., 15-17, 1891.

On some Lecture Experiments illustrating Properties of Saline Solutions. T. N. S. Inst. Sc., 71-75, 1891.

Presidential Address. T. N. S. Inst. Sc., VII, xxxi-xxxv, 1891.

On the Fundamental Hypotheses of Abstract Dynamics. T. R. S. C., 3-21, 1892.

On the Fundamental Hypotheses of Abstract Dynamics. Science, Aug. 5, 1892.

Contact-Action and the Conservation of Energy. Phil. Mag., 134-142, 1892.

On the Hypotheses of Dynamics. Phil., Mag., 234-264, Sept., 1893.

On the Definition of Work Done. T. N. S. Inst. Sc., IX, 460-464, 1895.

On the Hypotheses of Abstract Dynamics. T. R. S. C., I, (2), 85-95, 1895.

On the Calculation of the Conductivity of Mixtures of Electrolytes. T. N. S. Inst. Sc., IX, 101-119, 1896.

On the Calculation of the Conductivity of Mixtures of Electrolytes. Phil. Mag., 277-287, April, 1896.

On the Calculations of the Conductivity of Electrolytes. T. R. S. C., II, 1896.

On the Relation of the Physical Properties of Aqueous Solutions to their State of Ionization. T. N. S. Inst. Sc., IX, 219-245, 1896.

The Hypotheses of Abstract Dynamics and the question of the number of the Elastic Constants. Phil. Mag., 241-245, Sept., 1896.

Review of Carhart's Electrical Measurements. P. R., IV, 265-267, 1896.

Obituary Notice of the late Professor George Lawson. P. N. S. Inst. Sc., IX, 1896.

On the Relation of the Physical Properties of Aqueous Solutions to their state of Ionization. Phil. Mag., 47-109, Jan., 1897.

On the Calculability of the Results of Electrolysis in Solutions containing two Electrolytes with one Ion in common. T. R. S. C., IV, (2), 117-148, 1898.

On the Conductivity-Method of Studying Moderately Dilute Aqueous Solutions of Double Salts. Phil. Mag., 509-519, Dec., 1898.

On the Calculation of the Conductivity of Aqueous Solutions containing Two Electrolytes with no Common Ion. Phil. Mag., 151-157, Feb., 1898.

Note on the Variation with Tension, of the Elastic Properties of Vulcanised India-Rubber. P. N. S. Inst. Sc., X, 1898-99.

On the Applicability of the Dissociation Theory to the Electrolysis of Aqueous Solutions containing two Electrolytes with a common Ion. P. R., VIII, March, 1899.

On Finding the Ionization of Complex Solutions of given Concentration and the Converse Problem. T. N. S. Inst. Sc., X, 67-78, 1899.

Matter, Energy, Force and Work. P. R., IX, 59-64, 1899.

The Utility of Knowledge-making as a means of Liberal Training. Address delivered at the opening of the fortieth session of Dalhousie College, Sept., 1899.

On a Diagram of Freezing-Point Depressions for Electrolytes. T. N. S. Inst. Sc., X, 211-234, 1900.

Ueber die Bestimmung der Dissociation von zusammengesetzten Lösungen von gegebener Konzentration und uber das umgekehrte Problem. Z. f. Physik. Chemie, XXIII, 529-539, 1900.

On the Depression of the Freezing-Point in Aqueous Solutions of Electrolytes. T. R. S. C., VI, (2), 3-19, 1900.

Research in the Scottish Universities. Inaugural lecture delivered at the University of Edinburgh, October 15, 1901.

MacGregor's Research Students.

A. Stanley Mackenzie	1885	Dalhousie University.
E. Mackay	1886	Dalhousie University.
A. M. Morrison (deceased)	1888	
H. M. Mackay	1888	McGill University.
W. H. Magee	1891	North Battleford.
C. L. Moore	1891	Dalhousie University.
T. C. MacKay	1893	Arizona University, Tucson
H. V. Bigelow	1894	Regina.
C. C. A. Lange	1895	
D. MacIntosh	1902	University of British Columbia.
D. S. McIntosh	1892	Dalhousie University.
C. M. Pasea (deceased)	1900	
E. H. Archibald	1897	Univ. of British Columbia.
J. Barnes	1899	Bryn Mawr College
T. C. Hebb	1900	University of British Columbia.
R. S. Boehner	1901	
L. L. Burgess	1905	

Dr. A. H. MacKay, Superintendent of Education for the Province, desired to put on record the highly valued work of MacGregor for the Public Schools, as Provincial Examiner in the scientific subjects of the Provincial High School Program, from 1893 to his departure for Edinburgh in 1901.

The President on bringing the meeting to a close said:

Your Honor, ladies and gentlemen:—

Dr. Mackenzie has given us exactly what I hoped he would, an appreciation of MacGregor the man and an account of the work of MacGregor the scientist. Dr. Mackenzie has stated clearly to us the nature of the contributions to science made by MacGregor, as well as shown us that he had pronounced views on the Philosophy of Science.

As regards the place of science in education in Nova Scotia, Professor MacGregor seems to have been a pioneer; and it is fitting that we should remember the work of all pioneers, especially that of him who was one of the brightest ornaments of the premier University of this Province.

I consider it a privilege to have been entitled to be in the chair this evening, a chair once occupied by MacGregor himself, and I regard it as an honor that it has fallen to me to take some part in a ceremony that has been designed for the special purpose of honoring him.

On motion of the PRESIDENT, seconded by HIS HONOR the LIEUTENANT GOVERNOR, a unanimous vote of thanks was passed to the donor of the portrait.

THIRD ORDINARY MEETING.

Physiological Lecture Room, Dalhousie Medical College, Halifax; 15th May, 1918.

THE PRESIDENT, DR. D. FRASER HARRIS, in the chair.

PROF. JOHN CAMERON, M. D., D. Sc., F. R. S. E., read a paper on "Two Remarkable Skulls from the New Hebrides," with lantern illustrations. (See Transactions, page 403).

The subject was discussed by the PRESIDENT, DR. E. MACKAY (who gave results of a chemical examination of a painted clay mask attached to one of the skulls), PROF. MCINTOSH, G. W. T. IRVING, COLONEL CROLL, M. D., DR. A. H. MACKAY, H. PIERS and DR. S. T. RITCHIE.

DR. A. H. MACKAY, read by title a paper on "Phenological Observations, Nova Scotia, for 1917." (See Transactions, page 395).

HARRY PIERS,

Recording Secretary.