

THE DEPARTMENT OF CHEMISTRY, QUEEN'S UNIVERSITY, KINGSTON, ONTARIO

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The chain of lakes and rivers which constitute the Great Lakes of North America, making Chicago and Duluth ocean ports, although some 2,000 miles from salt water, is a unique occurrence in geographical structure. This waterway provided a means of access to the interior of the continent for the early explorers. It was on the shores of this system that the pioneers established their holdings, and it was the route followed by the traders. To protect this vital route from attacks by the Indians, Count Frontenac established a fort at the junction of Lake Ontario, the St Lawrence River and the Cataraqi River. The Canadian-American international boundary lies, to a large extent, in this waterway, some 200 miles of the boundary lying in the upper part of the St Lawrence River. After the establishment of the American Government, the Colonial and Imperial Governments were deeply concerned that trade along the river was within range of American guns. As a precautionary measure they constructed the Rideau canal system whereby freight could be sent from Montreal up the Ottawa River to Bytown (now Ottawa) and thence down to Lake Ontario via the canal. The Rideau canal system included the Cataraqi River, so that Fort Frontenac was now at the junction of the canal, the St Lawrence River and Lake Ontario. Fort Frontenac was rebuilt and new fortifications, Fort Henry and three Martello towers, were added. Fort Frontenac, for many years the base of the Royal Canadian Horse Artillery, now houses the Canadian Staff College and the National Defence College, while Fort Henry and the Martello towers are well-patronised tourist attractions. It was around these forts that the City of Kingston developed, and its importance as a military centre continues to the present time.

The early settlers in the eastern counties of Upper Canada were mainly of Scottish origin. A large proportion of the workmen, particularly masons, who were brought to construct the locks and dams of the canal came from Scotland. Following the completion of the canal, many of these workers settled on the land or followed their trade in the towns and villages. Those people living in the American colonies who remained loyal to England during the War of Independence had to leave the country and for many the

shortest route was across the St Lawrence River. Most of these United Empire Loyalists who settled in the vicinity of Kingston were of Scottish descent.

Thus Kingston became a town in an area populated by Scottish Presbyterians, who were most sincere and determined that their families should have adequate medical care, religious instruction and formal education. To train the youth of the country to undertake this work they resolved to establish a college or university. The proposal aroused violent opposition from the Anglicans, under Bishop Strachan, who claimed sole control over educational grants and the Clergy Reserves. Scottish determination was not to be thwarted and, after repeated rebuffs by the Provincial Government, they turned to the Imperial Government. There they received a more favourable reception and on 16 October, 1841, a Royal Charter was issued by Queen Victoria for the establishment of Queen's College, Kingston, Upper Canada; the first classes were opened in March, 1842, with the Rev. Dr Liddell as Principal.

The early records show that the founders took as their model the University of Edinburgh. Perhaps they were influenced by the fact that Edinburgh had been Protestant and Presbyterian from its beginning. The close association with Presbyterianism is further shown by the fact stated in the charter that "the site for the college buildings must not be more than three miles distant from St Andrew's Church, in the Town of Kingston, in the Province of Upper Canada." Also, under the terms of the Charter, the Principal had to be an ordained minister of the Presbyterian Church. This remained in effect until 1900, when separation of Queen's from the Presbyterian Church was approved by the General Assembly of the Presbyterian Church in Canada during June and by the Corporators of Queen's in November. On 1 April, 1912, Royal Assent was given to the Acts of the Dominion Parliament, which established Queen's University and Queen's Theological College in their present form and relationship. Clause two of the Act reads: "The management and discipline of the University shall be, in every respect, freed from all denominational restrictions." Under clause eight, the 'Corporators' are no longer the members of the Presbyterian Church in Canada, but the trustees, professors, graduates and benefactors. The Rev. R. Bruce Taylor, appointed Principal in 1917, was the last ordained minister to be Principal, and William Hamilton Fyfe, later Sir William, appointed Principal in 1930, the first layman. Principal Fyfe resigned late in 1935 to take up the appointment as Principal of the University of Aberdeen. He was succeeded by Robert C. Wallace, born in 1881 in Orkney, a graduate of Edinburgh University in 1901, the first scientist to hold the Principalship. Dr Wallace, who retired in September, 1951,

was succeeded by William A. Mackintosh, Professor of Economics, the first Queen's graduate to be appointed Principal.

At the beginning, instruction was given only in the Faculties of Arts and Theology, but Science, under the name of Natural Philosophy, was taught by the Rev. James Williamson, a graduate of Edinburgh, from 1842 to 1858. Chemistry, as a special subject, was not offered until 1854, when the founding of the Faculty of Medicine made it essential and lectures were given on "The Non-Metallic Elements and Their Compounds." In 1858, Dr George Lawson, a distinguished scientist from Edinburgh, became the first Professor of Chemistry and Natural History; the latter probably meant Botany and Zoology. His salary was \$1,700 per annum, while the other professors received only \$1,500. At the end of his first session one of his students received the first medal to be awarded. This medal was made of aluminium, a newly-extracted and precious metal costing \$17 per ounce.

In 1856 there was a serious disagreement between two members of the staff; one was dismissed and later sued the Board for wrongful dismissal. A long series of court actions followed, the final verdict being in the professor's favour, as the Court ruled that under the Royal Charter the Board did not have the right to dismiss a professor. Within the University much friction resulted, and Dr Lawson resigned to accept the Professorship of Chemistry at Dalhousie University. Early in 1864 Robert Bell was appointed Professor of Natural History in the Faculty of Arts and Professor of Chemistry and Practical Chemistry in the Faculty of Medicine.

In 1859-60, 'New Hall', the second building on the University Grounds, was erected, mainly for the Faculty of Medicine, but it housed the Chemical Laboratories because Chemistry had become the most ambitious subject in the University. Professor Lawson's syllabus on four finely printed pages used more space than those for all other subjects in Arts, Theology and Medicine combined. It sounds very modern: "The class for Practical Chemistry will be conducted in the laboratory under the personal superintendence of the Professor. All necessary apparatus, materials for examination and reagents are supplied free of expense. The student performs every experiment. Each pupil receives his instruction independently and not as a member of a class." Courses in Agricultural Chemistry were offered and, for those who wished to avail themselves of the opportunity, instruction in such vocational subjects as brewing, distillation and tanning was available.

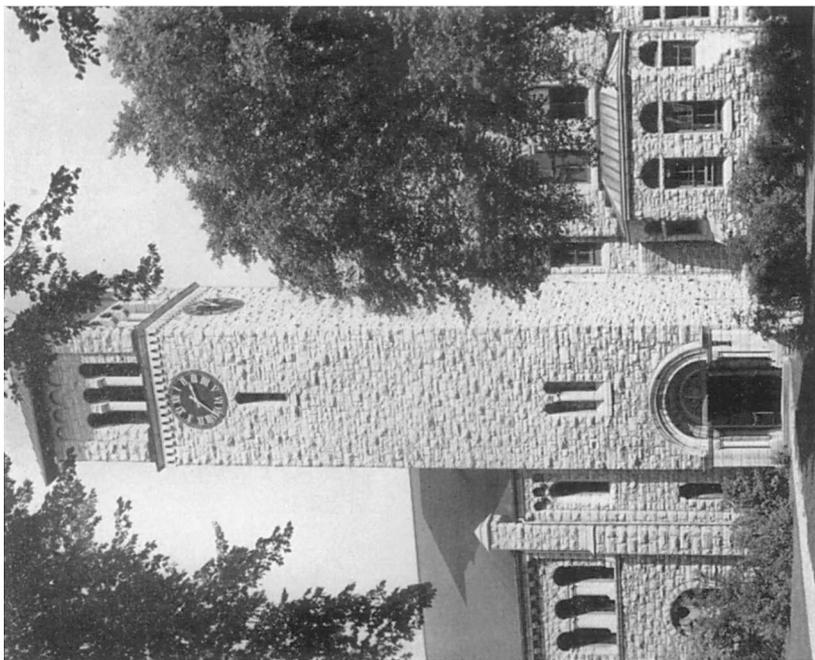
Dr Bell remained as Professor of Chemistry until 1868 when he became Professor of Geology, and a young Queen's graduate, Nathan F. Dupuis, was appointed Professor of Chemistry and Natural History. Nathan Dupuis was a most versatile man. He



The University, from the South
Gordon Hall—the Department of Chemistry—is the T-shaped building in the centre of the picture



Gordon Hall
The Department of Chemistry



Grant Hall
Convocation Hall

was born on a farm near Kingston, had little schooling as a boy and was apprenticed to a clockmaker in Kingston. He took instruction at Queen's when possible and was appointed 'observer' by Professor Williamson in 1863. When he retired he was Professor of Mathematics and Dean of the Faculty of Practical Science, which had been set up in 1894. He built many of the wooden crystal models still in use in Miller Hall and designed and built the clock installed in Grant Hall tower in 1902.

By 1891 the Faculty of Medicine had expanded to such an extent that more accommodation had to be provided. Fortunately, with the aid of a large gift from John Carruthers of Kingston specifically for a new Science Building, this was possible. Carruthers Hall was opened in the autumn of 1891 and all the science teaching was moved into it. The Queen's Calendar of 1891 paints a glowing picture of the laboratories, lecture rooms and offices in the new quarters.

The portion of Ontario, north of Kingston, that extends into the Precambrian Shield was known to be a veritable storehouse of valuable minerals. Its development could be achieved only by having personnel trained in mineralogy, geology and mining engineering. Principal Grant and his staff were of the opinion that the institution best equipped to provide this training was Queen's University, and they instituted a campaign to attain this end. Their efforts were successful and in 1893 the School of Mining was established with W. L. Goodwin, Professor of Chemistry, as Director, and a course leading to the degree of Mining Engineer was outlined. In the 1894-95 Calendar of Queen's, the Faculty of Practical Science, forerunner of today's Faculty of Applied Science, was first announced, and courses leading to the B.Sc. degree in Chemistry and Mineralogy were defined. Gradually other courses in civil engineering, metallurgical engineering and finally chemical engineering were included. In 1913 the Faculty of Practical Science became the Faculty of Applied Science. Thus the Department of Chemistry, which started in the Faculty of Medicine, gradually came to provide instruction in the Faculties of Medicine, Arts and Science.

William Lawton Goodwin, born in Bai Verte, New Brunswick, and educated at Edinburgh, came to Queen's in 1883 as Professor of Chemistry and Mineralogy. In 1893 he was made Director of the School of Mining; in 1911, on the retirement of Dean Dupuis, he was appointed Dean of Science and in 1916 the first Dean of the present Faculty of Applied Science. Professor Goodwin, in collaboration with Professors Willet G. Miller and William Nicol, made valuable contributions to the studies which led to the development of the silver, nickel, cobalt and gold mining industry of

Northern Ontario. Dean Goodwin retired in 1919. Associated with Professor Goodwin in the Chemistry department were John Waddell, W. D. Bonner and W. O. Walker. John Waddell taught for one year at the Royal Military College, Kingston, and in 1899 came to Queen's. From 1899 until his death in 1921 he had charge of the courses in quantitative analysis, at that time a very important subject. He was the author of three books: *The Arithmetic of Chemistry* (1899), *A School Chemistry* (1900) and *Quantitative Analysis in Practice* (1913). W. D. Bonner was in charge of the courses in qualitative analysis from 1909 to 1915, when he resigned to join the staff of the University of Utah, and W. O. Walker, those in organic chemistry from 1907 to 1918, when he accepted an appointment on the staff of McMaster University, then in Toronto but now in Hamilton, Ontario.

Upon the completion of Carruthers Hall it was thought that science had ample provision for many years. However, the enrolment in the science courses in the Faculty of Arts and in the Faculty of Applied Science as well as in the Faculty of Medicine had steadily increased, and all departments were overcrowded. The Province of Ontario solved the difficulty by providing the funds necessary to house the Physics and the Geology and Mineralogy Departments in Ontario Hall; in 1914, Gordon Hall, named after Daniel Gordon, Principal from 1903 to 1916, was built for the Department of Chemistry. In 1926 the Department of Geology and Mineralogy was transferred to Miller Hall and the space thus vacated in Ontario Hall was occupied by Chemical Engineering, which had previously been in Gordon Hall. Another 20 years saw the cramped conditions repeated, when an extension was built to Gordon Hall, part of which was occupied by the Department of Chemistry and part by the Department of Chemical Engineering. The increased registration, particularly in the Faculty of Applied Science and in the Natural Sciences in the Faculty of Arts, has already crowded the building, and the University has instituted a campaign to raise four million dollars, part of which is earmarked for increased space for the Department of Chemistry.

Kingston is known as the Limestone City, and in keeping with this theme all the University buildings are of limestone construction, which imparts a feeling of solidity and permanence yet presents a very harmonious effect.

Dr Goodwin was succeeded as Professor of Chemistry and Head of the Department by Arthur C. Neish in 1919. Dr Neish, a native Kingstonian and graduate of Queen's in 1899, had proceeded to Columbia University, New York City, for postgraduate work where he afterwards remained as a member of the staff. He specialised in the chemistry of the rare earths. His return to

Queen's coincided with the return of soldiers from the First World War and he was faced with the enormous task of finding accommodation for the influx of students. Dr Neish will be remembered particularly for his success as a lecturer in Freshman Chemistry and his lecture demonstrations. Many men now occupying important posts in the industrial and teaching fields received their inspiration in Neish's lectures.

In 1941 Neish retired and John A. McRae was appointed Head of the Department. John McRae, a Queen's graduate and Medallist in Chemistry in 1909, took postgraduate training at the University of Toronto in 1909-10 and then returned to Queen's. He occupied various posts before 1920, when he went to Manchester and there received his Doctor's degree in organic chemistry. He was a lucid and inspiring lecturer and director of graduate research. His contributions to the chemistry of the substituted succinic acids are widely recognised. Two of his students, R. H. Manske and E. H. Charlesworth, were winners of 1851 Exhibition Scholarships. Dr Léo Marion, Director of the Division of Pure Chemistry of the National Research Council, was a graduate student of his in 1927.

Professor McRae was succeeded in 1956 by Grenville B. Frost. As an undergraduate in Toronto, Frost's interest in physical chemistry was aroused by Lash Miller, and in 1920 he went to the University of California to study under Merle Randall and G. N. Lewis. He joined the Queen's staff in 1924 to take charge of the courses in quantitative analysis and later those in physical chemistry. Professor Frost's interest lies in the behaviour and composition of inorganic hydrates and in the field of adsorption. He has directed the studies of a considerable number of graduate students and has organised a well-equipped laboratory to conduct research in this field.

In 1921 G. Y. Chown, Registrar and Treasurer of Queen's, established the Chown Research Professorship in Physics or Chemistry. Dr A. L. Hughes was the first to be appointed to this Chair, in the Physics Department. He was followed by Dr J. A. Gray, F.R.S., also in Physics. In 1953, on the latter's retirement, J. K. N. Jones, then on the staff of the University of Bristol, was appointed in the Department of Chemistry. Dr Jones is a recognised authority in the field of carbohydrate chemistry and allied topics. So important have been his contributions in these fields that he has received grants from the National Research Council, the Banting Research Foundation and other groups to purchase equipment and provide scholarships for his graduate students, and he has recently been elected a F.R.S. Although his appointment is so recent, Dr Jones has already attracted an enthusiastic group of students.

In addition to Professors Frost and Jones, the present staff includes Professor L. A. Munro, qualitative analysis and colloid chemistry; Professor R. L. Dorrance, freshman chemistry and quantitative analysis; Associate Professors W. McF. Smith, physical chemistry, especially in the fields of electrochemistry and kinetics, R. Y. Moir, whose special interest lies in organic syntheses and stereochemistry, and K. E. Russell, investigating reactions involving free radicals; Dr R. A. Stairs, at present engaged in a study of surface phenomena in salt solutions; Dr R. C. Wheeler, who has made studies in shock waves and ionisation in flames, and Dr W. G. Breck, who is engaged particularly in the determination of transport numbers and other aspects of electrochemistry.

During the session 1955-56 students from all the provinces of the Dominion and from 27 foreign countries were in attendance. The total University registration was 2,438, of whom 98 were enrolled in the School of Graduate Studies.

At the present time instruction is given in the Department in inorganic, organic and physical chemistry to the first and second year medical students and in all branches of chemistry to students registered in the Faculties of Arts and Applied Science. In the session 1956-57 a total of 1,325 student courses were given.

From its humble beginnings with ten students and one building, Queen's University has developed into one of the leading Canadian universities and one well known and highly regarded internationally.

The Publications Committee express their thanks to the author and to Professor J. K. N. Jones, F.R.S., through whose interest this article was offered to the *Journal*. The Committee will be pleased to consider the publication of equally authoritative contributions from Departments of Chemistry in other Universities of the Commonwealth.