
BIOLOGY AT MCMASTER UNIVERSITY

1890 TO 1990

BIOLOGY
AT
MCMASTER UNIVERSITY
1890 TO 1990

STANLEY T. BAYLEY

Department of Biology
McMaster University
Hamilton, Ontario, Canada

Copyright © 2008 by Stanley T. Bayley and
The Department of Biology
McMaster University
Hamilton Ontario
Canada

All rights reserved.

Published in 2008 by
The Department of Biology
McMaster University

Printed by
The McMaster University Innovation Press



ISBN 978-1-926633-01-5

Cover Design by Steve Janzen, Media Production Services,
McMaster University

Printed and Bound in Canada

To all former Biology students

CONTENTS

Photographs	ix
Tables	ix
Preface	xi
1 The Toronto Years	1
2 First Years in Hamilton	22
3 The Postwar Years	35
4 The Department is Confronted by Change and the Medical School	56
5 The Department Reformed	71
6 The Matter of Space	86
7 Steady Progress and Retirements	97
8 Notes on Retirees and Departmental Staff	118
9 Conclusion	138
Appendix A Undergraduate enrolments	143
Appendix B PhDs awarded	144
Notes	155
Index	162

PHOTOGRAPHS

- Page 2 William McMaster.
- 10 McMaster Hall and Castle Hall. Castle Hall and Science Hall.
- 11 A Science lab in 1896. A Biology lab in the new Science Hall.
- 13 Chancellor McKay and Professor Smith, ca. 1907. Dr. L.O. Gaiser, ca. 1930. Dr. R.W. Smith in 1935.
- 23 Aerial view of the Hamilton campus in 1936.
- 27 Dr. A. Emerson Warren, ca. 1950.
- 40 The Department of Chemistry in 1948.
- 45 Aerial view of the campus in 1950.
- 52 The Biology Club in 1957.
- 53 Dr. Radforth riding his horse on campus.
- 86 Hamilton Hall in the 1940s.
- 88 The Research Greenhouse in 1955. Dr. MacClement with a biology student in the greenhouse.
- 89 The General Sciences Building in the 1960s.
- 93 The opening of the Life Sciences Building in 1972.
- 95 The Life Sciences Building in 1972.
- 102 The graduating class of 1976.
- 106 Dr. Esther McCandless.
- 117 Drs. Morton, Prevec and Dingle at their retirement party in 1996.
- 118-134 Retired faculty.

TABLES

- Page 54 Table 3.1 Calendar entries for Courses offered in Biology, Botany and Zoology in 1956-57 for the Honours program.
- 99 Table 7.1 Calendar entries for Biology courses offered in the Honours program in 1975-76.
- 114 Table 7.2 Calendar entries for Courses offered by the Biology Department in 1989-90 with Registrar's records of Class Enrolments for 1988-89.

PREFACE

The idea of this history originated at the turn of the century when Dr. Turlough Finan, Chair of the Department, realized that faculty members of long standing, some from the mid-1940s, were beginning to die, taking their memories with them. In the summer of 2001 he employed a student, Miss Jeannie Chandy, to interview several former members. At about the same time Dr. Louise Barber, a graduate of the Department as were her parents and grandmother, wrote some notes on its earliest years. Dr. Richard A. Morton became interested and in the summer of 2006 he persuaded me to write a fuller history.

This account traces the development of the Department from the opening of the University for classes in 1890 with courses given by a succession of individual lecturers, to the beginning of the 1990s when a series of retirements led to a major transformation of what was by then a sizable Department in its own building. Needless to say this is only an outline of the Department's history, as it would be impossible to describe more than a fraction of the contributions of all those who have passed through it or the influence it has had on innumerable students.

In writing of the Department's past, I felt it was important to set its development in the context of the growth of the University itself, as this determined how the Department evolved. In its early years the history of McMaster was quite dramatic, with the University Administration pitted against men with rigid, fundamentalist Christian views. It is a story of the success of Chancellors A.C. McKay and H.P. Whidden in managing to maintain a carefully circumscribed freedom of enquiry for the University in battles that have similarities to the present controversies over intelligent design. It is also the story of the support that Chancellor, later President, G.P. Gilmour and Dean C.E. Burke gave to changes that began the transformation of McMaster from a small, largely liberal arts Baptist University into the secular University of today. Above all, it is the story of

the tremendous contributions Dr. H.G. Thode made in initiating these changes before he became President and in being responsible for McMaster's growth while he was President.

One of the glories of nature is the enormous variety there is in the living world. The host of opportunities for exciting discoveries that lie there makes biology a fascinating subject for teaching and research. The problem with it, of course, is the complexity of living organisms, in their diversity and in the ways they function and interact. At the time this history begins, the major task in biology was cataloguing and describing these organisms. The Theory of Evolution, which had already been proposed, and Mendel's work, which was about to be rediscovered, gave the first hints of how different characteristics come about and are transmitted, but it was only in the latter half of the last century that much progress was made in discovering the processes that sustain life.

Teaching and research in the Department of Biology at McMaster reflected the growth of the subject. In its early years, the University offered a single general BA degree. The Biology courses in this program were devoted mostly to describing plants and animals, and were taught largely by one person. Beginning in the late 1920s, more specialized degrees in Science were introduced. Specialization increased still more after the Second World War, when the Department was expanded and new faculty with interests in different branches of the subject were appointed. As biological research advanced further, these branches became more specialized, making it impossible for someone trained in one area to provide up-to-date instruction in most of the others, even at an elementary level. The expansion of knowledge in biology during the last thirty years of this history led the Department to spend a great deal of time discussing the balance of the undergraduate curriculum, and the choice of areas in which new faculty should be appointed, for the benefit of both teaching and research.

The major event that all biology departments had to contend with sooner or later was the development of molecular biology from the 1950s on. This was a factor, though not the only one, that contributed to major changes in the composition of the Department in the second half of the 1960s. Progress in biology, particularly in molecular genetics, also had a dramatic effect on student interest. Beginning in the early 1970s enrolment in Biology programs increased significantly, until by the 1980s the majority of Science undergraduates were in Life Sciences, a marked change from earlier times.

Writing this history has been a challenge but it has also been interesting – in discovering details of the University’s and the Department’s past; in recalling events I had been aware of but had long since forgotten; and in gaining a better perspective on how past events have influenced the growth of the Department and the University. One factor that helped me maintain momentum in the writing was the long-standing habit a group of former colleagues and I have of meeting regularly once a week in Westdale for coffee. This group includes Drs. Dick Morton, Lud Prevec, Steve Threlkeld, Al Dingle, Karl Freeman and Mr. Ray Procwat. At these sessions, the history of the Biology Department and the University became the subjects of a surprising amount of interest and useful discussion.

This history would have been impossible without a great deal of work by others. Drs. Morton and Prevec undertook much of the research, and I am indebted to them for the thorough searches they made of sources within the University and on the internet. Thanks are due to Miss Melissa Richer of the Baptist Archives in the Divinity College, and Carl Spadoni of the University Archives and his staff in the Mills Library, for their assistance.

The coverage of the more recent years of the history has benefited from personal reminiscences, and I am grateful to those who gave interviews: Dr. Louise Barber, Dr. Arthur N. Bourns, President emeritus, Dr. Douglas Davidson, the late Dr. Douglas M. Davies, Dr. Allan D. Dingle, Dr. Kenneth A. Kershaw, Dr.

Leslie Laking, Mrs. Jean (Dryden) Leaman, Dr. John N.A. Lott, Dr. Dennis R. McCalla, the late widow of Dr. John J. Miller, Mrs. Dorothy Jane Miller, Dr. Richard A. Morton, Dr. Ludvik A. Prevec, Dr. George J. Sorger, Dr. Stephen H.T. Threlkeld, Dr. Jean E.M. Westermann and Dr. Christopher M. Wood. For their help I also thank Mr. Marvin Gunderman, Ms. Pat Hayward, Dr. Doris E.N. Jensen, Dr. Charles M. Johnston, Ms. Hanna Lindemann, Ms. Kathy McIntosh, Dr. Stanley Mak, Dr. Andrew J. Rainbow, and from the School of Nursing, Ms. Joan Royle and Ms. Leila Ryan.

For much of the history of the University up to 1957, I have relied on Dr. Charles M. Johnston's two volume McMaster University. To make clear to him the use I'd made of his book, I gave him a late draft of my manuscript; to my pleasant surprise, he and his wife Lorna reviewed it very thoroughly. Various drafts were read by Drs. Dingle, Finan, Morton, Prevec, Sean Ward and Ms. Kathy MacIntosh. I am grateful to all these reviewers for their comments, criticisms and suggestions that helped improve the text significantly. I especially appreciate Dick Morton's efforts in finding pictures for the history and for formatting the manuscript for publication, which he managed to do despite the changes I kept making in the text. The contributions to the work of publishing and printing the book by John Lott, Barbara McDonald of Mills Library, and Mark Lefebvre of Titles Bookstore at McMaster are gratefully acknowledged, as is the support that Turlough Finan gave throughout this project.

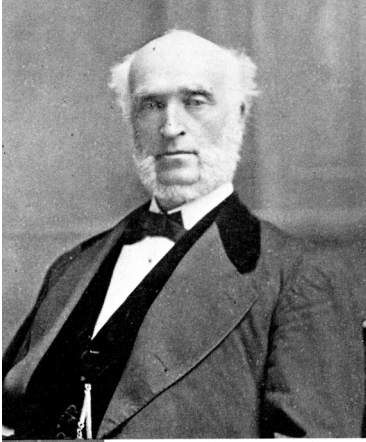
THE TORONTO YEARS

1887: McMaster University incorporated; Toronto chosen as its site. 1890: classes began in Toronto with a single general BA that included Biology, taught by a series of people, notably 1892-95: Willmott, Professor of Natural Sciences; 1895-98: Piersol, a demonstrator; 1899-1935 Smith, Professor of Biology. 1905: McKay became Chancellor and had the Science Hall built by 1907. 1904-10: a dispute over theological teaching; the curriculum was revised. A proposed move to a north Toronto site was delayed by the First World War. 1922-26: a battle with Rev. Shields over fundamentalism. 1925: Lulu Gaiser appointed to Biology. 1927: Hamilton chosen as the new University site. McMaster compared to the University of Chicago.

On 22 April 1887, a bill was passed into law by the Ontario Legislature incorporating a new University. To get the bill accepted, Senator William McMaster had drawn up a new will leaving essentially all his estate to the University as an endowment to secure it financially. Exactly five months later on 22 September, McMaster died suddenly, leaving the new McMaster University some \$900,000 and charging that it was to afford ‘the best possible facilities for a thoroughly practical Christian course of education.’ The University had been incorporated and it had a name and an endowment, but few other details had been settled. It had not even been decided where in Ontario it should be established.

William McMaster was an Irish immigrant and an entrepreneur who built a flourishing dry goods business in Toronto. He helped found the Bank of Commerce, the Toronto counterpart to the Bank of Montreal, and became its first President, and he was appointed to the new Canadian Senate in 1867. Above all he was an ardent Baptist. The Baptists are a Protestant, evangelical Christian denomination. In Canada in the nineteenth century,

BIOLOGY AT MCMASTER



William McMaster

they were practical people and concerned about education, not only in the training of ministers for their church but for the population generally. To this end, in 1858 they created the Canadian Literary Institute in Woodstock, later renamed Woodstock College, a coeducational preparatory school with literary and theology departments. In 1881, the Baptists moved the theology department to a new college they established

in Toronto, aptly named the Toronto Baptist College, over which, unlike Woodstock College, they had complete control. It was financed in large part by McMaster, who also built McMaster Hall on Bloor Street West to house it.

Baptists felt strongly that instruction in secular subjects was essential to the proper training of their ministers. To provide students at the Toronto Baptist College with access to instruction in these subjects that the University of Toronto could provide, they began negotiations for some form of affiliation of the College with the university. Baptists were divided on the wisdom of this, and in the meantime they were encouraged by McMaster's generosity and wealth to consider founding a fully independent university of their own. In March 1887 they introduced a bill into the Provincial Legislature to unite the Toronto Baptist College and Woodstock College and incorporate them as McMaster University.

Once this bill had become law, Baptists were faced with two contentious issues. Even though they had been given power to establish a separate university of their own, the idea of an association with the University of Toronto still persisted. It was finally defeated at a Baptist Assembly in March 1888 with the motion that the 'University be organized and developed as a

permanently independent school of learning, with the Lordship of Christ as the controlling principle.’ The more difficult issue this Assembly faced was whether Woodstock College or Toronto Baptist College was to be expanded into McMaster University. After much discussion, the Baptist College was chosen because it was in Toronto – a thriving metropolitan city and a centre of trade with cultural advantages and technological advances such as electricity and telephones. It was also judged that McMaster himself would have favoured Toronto, and this was an important consideration as it was his bequest that had made the University possible.

Neither of these decisions had been easy to reach as in both cases there was strong support on each side. Many Baptists were deeply unhappy with the outcomes, and these feelings were exacerbated when it was decided to remove the ladies’ department from Woodstock College and establish it in Toronto as Moulton College, named after and financially supported by McMaster’s widow, Susan Moulton, and occupying his mansion. Woodstock College was eventually closed in 1926.

The Assembly went on to elect a Board of Governors and a Senate, the members of both being drawn from a body with representation from all Regular Baptist congregations in Ontario and Quebec, that later became the Baptist Convention of the two provinces. By the Act of 1887, faculty in Arts, that is the secular part of the University, had to be members in good standing of an evangelical Christian church, while Theology faculty had to be members specifically of Regular Baptist churches. For the student body, the Act declared that ‘no compulsory religious qualification, or examination of a denominational character shall be required from or imposed upon [it] ... other than in the Faculty of Theology.’ The organization of the University was completed in time for it to open for classes in 1890.

Until the nineteenth century, almost all university curricula had been based on the classics, but late in that century widespread efforts were made to introduce subjects of more

immediate relevance in society – subjects such as English literature, political history, economics, sociology and the natural sciences. Senator McMaster's emphasis in his will on the need for the University to provide 'a thoroughly practical Christian course of education' was consistent with these moves, and when McMaster University opened, its curriculum covered a range of subjects, including Mathematics, Physics and Natural Sciences, consisting of Biology, Chemistry, Geology and Mineralogy. All Arts students took the same general four-year BA program, in which the Science courses were: Year I, Mathematics, Biology; Year II, Mathematics, Physics, Chemistry; Year III, Mathematics, Physics, Geology; Year IV, Mathematics, Physics, special work in Natural Sciences.

In the first year the University was open, 16 students, 14 men and two women, were admitted, of whom 15 took Year I Biology. The numbers of students taking this course rose slowly; in 1895-96 there were 25 men and 4 women in Arts and 11 men in Theology, and by 1924-25, 36 men and 25 women in Arts and 24 men in Theology. These figures suggest that for many years Theology students were required to take Year I Biology. The Arts program allowed some flexibility beyond Year I and smaller numbers of students took further Biology courses in their later years. During the early years of the University there were strong leanings among Arts students towards the Baptist ministry: in his report to Senate in May 1896, the Chancellor wrote that 11 out of the 16 who graduated in Arts that year were intending to train to become ministers.

Until 1899 Biology was taught by a succession of instructors, all but one of whom had short term appointments. When the University opened, Thomas MacKenzie BA, MB was appointed Lecturer and taught the Biology courses for the first two years. He was replaced in 1892 by Arthur B. Willmott, MA, who had done graduate work in Geology at Harvard. He was appointed lecturer in Natural Sciences and taught courses in Chemistry and Geology as well as Biology. A year later he was promoted to

The Toronto Years

Professor. Willmott looked after the Biology courses until 1895. Between 1895 and 1898 they were all taught by William H. Piersol, BA, and then in 1898-1899 by Ebenezer Ralph Hooper, BA, MB. Piersol and Hooper were both appointed demonstrators in Natural Science, and it is possible that while they and MacKenzie were teaching at McMaster, they were also pursuing medical studies at the University of Toronto. Piersol certainly was as he received his MB there in 1899. Later he became a lecturer in Biology and Histology at Toronto, progressed to Professor of Histology and Embryology and gained a fine reputation as lecturer and teacher. Hooper also earned a medical degree and later became Professor of Anatomy at Toronto. These attainments of Piersol and Hooper reflect the quality of the instructors McMaster employed in its early years.

Teaching loads were heavy for decades after the University opened. In 1895-1896 for example, in hours per week Willmott spent 10½ in lectures and 12½ in labs and Piersol, three in lectures and nine in labs. At that time, there were no teaching assistants to help supervise labs.

It is clear from examination papers in the Sciences and Mathematics of this period that these subjects were taught at the elementary levels that have long since been covered in high school. As examples, the following questions appeared on the Year I Biology examination in 1894:

Discuss the connection between living and dead matter.

Describe the structure of a stoma and explain its use.

Compare the structure of a salamander with that of a lizard.

Explain fully why the whale is not considered a fish.

Some, though, are challenging even now:

Classify and describe the principal chemical compounds found in living beings.

What is meant by the term 'species'? Is it a definite concept? Why?

BIOLOGY AT MCMASTER

These examination papers each carried a second name besides that of the instructor: with MacKenzie there was H.B. Spotton, BA, and with Willmott, A.P. Coleman, PhD. Coleman was known to have been appointed an external examiner and Spotton probably was too. During its formative years McMaster was concerned to establish a high academic standard. It seems likely that course contents at that time paralleled those at the University of Toronto, and that McMaster appointed external examiners from there to ensure appropriate levels of work.

In 1895, Willmott had a gymnasium in the basement of McMaster Hall converted into three Science rooms – a lecture room, a laboratory and a storeroom. In his report to Senate for 1895-96, the Chancellor stated that the change ‘has given sufficient space for present needs.’ Other aspects of these facilities were less satisfactory. Willmott reported that the ventilation of the laboratory was ‘wretched’ and the hoods were not a success, while Wallace Patten Cohoe, the University’s first MA in Chemistry, later described the conditions of the Sciences at that time as ‘primeval’. For the scientists, this situation was compensated to some extent by having the University in Toronto, a city that ‘great leaders of scientific thought’ made a point of visiting. In 1897, the British Association for the Advancement of Science held its annual meeting there. Cohoe was impressed by Henri Moisson’s demonstration of the production of fluorine and by the presence of the great nineteenth century physicist Lord Kelvin, who dominated the meeting.

From 1899, Biology instruction was taken over by Roger Wilson Smith, BA, PhD, who became the first McMaster graduate to join the faculty, and who began a long career at McMaster when he was appointed lecturer in Biology and Physics at the age of 39. Smith had begun as a teacher in public school and then at Woodstock College, before taking his BA at McMaster in the University’s second graduating class of 1895. He then went on to study for his PhD at the University of Chicago with John Merle Coulter, a prominent botanist. In a letter to the Chancellor in

1897, Willmott wrote that Smith was ‘distinguishing himself at Chicago.’ His thesis on ‘The Structure and Development of the Sporophylls and Sporangia of *Isoetes*’ was published in 1900 in *The Botanical Gazette*. On completing his PhD, he was offered a position in research but instead decided to join McMaster, which knew of his work as a teacher and was keen to attract him.

Willmott left McMaster in 1901 to develop a career as a mining engineer; he died in 1914 aged 47. In Willmott’s place, Smith was promoted to Professor of Biology and Experimental Physics. At the same time, Cohoe returned from Harvard to become Professor of Chemistry and Geology. These professorial titles clearly reflected not just the areas in which these men had expertise but those in which they had to teach as well, so that titles changed with duties. In May 1904, when Smith was still teaching Physics, he reported to the Chancellor that he looked forward to the time when ‘Physics shall receive adequate treatment from another instructor.’ His wish was granted the following year, but then instead of Physics he taught Geology, which he found ‘better suited to my special subject.’ He was still teaching it in 1909 when he told the Chancellor proudly that ‘this year for the first time I have given all the courses in Geology as outlined four years ago.’ Even with his responsibilities in other Sciences, Smith took his duties in Biology conscientiously. For example, in his report to the Chancellor for 1900-1901 he wrote about preparing microscope slides for class. ‘It has taken a large part of my time to prepare these slides but the results have been so satisfactory that I am content with the sacrifice. The slides already prepared would cost if bought ready-made more than \$40.00 – more than the whole outlay for the subject last year and these are better slides too!! Come and see them!!’ Starting in 1909, Smith was listed solely as Professor of Biology. This may in fact mark the beginning of a separate Department of Biology, as before that Biology appears to have been a part of Natural Sciences.

In its first decade, McMaster grew slowly but steadily. In 1892, the student body numbered 62 and by 1898 in Arts alone there

were 140. Financially though the University was facing problems, particularly with rural and small town congregations on which it depended for support. These were disenchanted with the University after it was established in Toronto to the neglect, as they saw it, of Woodstock College. The University Board of Governors hoped to mollify these churches when in 1895 they appointed the Rev. Oates C. Wallace as Chancellor. He was an outgoing, friendly man, a football and tennis player and a person with a good rapport with young people. He worked hard stressing the value and importance of the University to the denomination in outlying churches, but by his own admission with small rewards. In his inaugural address as Chancellor however, he may have created more problems for the University than he solved when he declared that 'McMaster exists for the teaching rather than the pursuit of truth' – a flawed view of a university's role, but one that probably mollified those who feared what scientific enquiry might discover about the origins of man and the universe. On the other hand, McMaster graduates who had gone on to further studies at the University of Chicago praised McMaster for what it had given them. Smith wrote that if he were to sum up a comparison of McMaster and Chicago, 'I would say Chicago tends to develop intellect, McMaster to develop manhood, character.' Another wrote in similar vein that although he took pride in McMaster's general course, it was not its intellectual training he valued most but 'your nurture of true personality.'

In the early years of the twentieth century, the University had further problems when increases in the student population created a pressing need for more high calibre faculty and better facilities, particularly in Science, as Smith and Cohoe pointed out. In 1905, Cohoe wrote that as it was, it did not seem possible to do the work required with justice to the student, much less find time for demanding new work, adding that he was 'not really proficient to teach some of the subjects advertised and much might have to be swatted up.' The same could well have been said by Smith. When the University appealed to the denomination

for financial support, one prominent Baptist responded that McMaster should build a strong Arts program and let Science go. Many Baptists suggested again that McMaster should federate with the University of Toronto. In 1905, Alexander Charles McKay became Chancellor and with support from Baptist leaders he managed to defeat the idea of federation, but it continued to surface until the University moved to Hamilton in 1930.

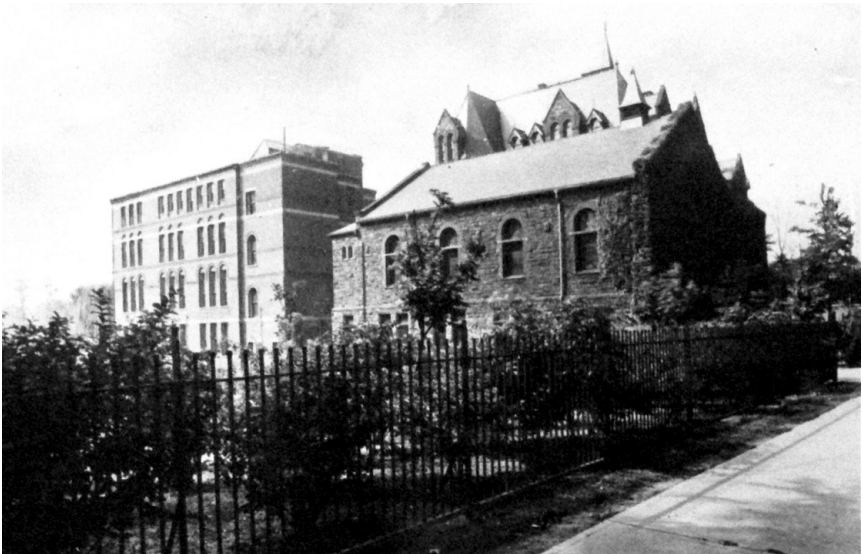
McKay had a scientific background; in 1890 he had been appointed Professor of Mathematics and Physics, he received an MA in 1895 and an LLD in 1902 and had become Dean of Arts in 1904. As Chancellor he led a move to improve the Science facilities at McMaster. In 1906 he and the Chairman of the Board appealed to the American philanthropists Andrew Carnegie and John D. Rockefeller for financial help in building a Science Hall. Regardless of what the outcome of these requests would be, the Administration decided to go ahead with the building, believing that if the Americans and the denomination failed to provide money, 'a few people of fair means among us' would. Early in the following year, the risk they had taken proved justified when Rockefeller donated the \$60,000 they had requested. To meet a demand from the Board of Governors, the architect produced a plan for 'a plain workshop ... [with] nothing to burn except the fittings and furniture.' The building consisted of four floors containing 24 laboratories for Physics, Chemistry and Biology, six rooms for faculty and a small greenhouse, and was completed in 1907. In his report to Senate in May 1909, the Chancellor quoted Smith as saying that 'the facilities afforded by the new laboratories continue to be a source of satisfaction' and that he now had space for an herbarium and hoped to make a collection of the complete flora of Ontario.

Expanding the University was the type of work that appealed to McKay, but during much of his time as Chancellor his energy was sapped by the first of two prolonged and debilitating battles over its religious teaching that the University was forced to fight while it was in Toronto. These pitched fundamentalists against

BIOLOGY AT MCMASTER



A view from Bloor Street of McMaster Hall (right) and (left) Castle Hall, built in 1901 to house the library and an assembly hall.



Rear of Castle Hall on the right with Science Hall on the left.

The Toronto Years



A posed Science lab in 1896.

Left to right, standing: Piersol, Newman, Cohoe, Dryden, Eby, Willmott
sitting: Simmons, MacNeill, Imrie, Baker.



Smith oversees a student making a dissection in the Biology lab
in the new Science Hall.

modernists and either battle could have changed McMaster irrevocably. In 1904, two theologians were charged with unorthodox views acquired from their studies at the University of Chicago. In 1909 a Senate committee chaired by the Chancellor declared the charges to be unfounded, and the University issued a statement that McMaster 'stands for the fullest and freest investigation, not only in the scientific realm but also in the realm of Biblical scholarship ... consistent with loyalty to the fundamentals of the Christian faith.'

McKay resigned as Chancellor in 1911 to become Principal of the Technical High School in Toronto. His resignation was a serious loss to McMaster as his time as Chancellor had been rewarding for the University; the number of graduate students had increased, so had salaries, while enrolment in Arts had risen from under 135 to about 225 (Appendix A, Figure 1). John L. Hogg in Physics praised him for the 'productive environment' he had created especially in science, which had resulted in Science Hall and had encouraged active research by Hogg and Henry Franklin Dawes in Physics, and by Cohoe and his replacement John Bishop Tingle in Chemistry. McKay clearly recognized the importance of research when he reported to Senate in May 1907: 'One great danger in a smaller University is that Professors become merely teachers and will not cultivate that alertness and spirit of research which characterize the modern great University. It is a pleasure to report that several of our Professors are engaged in higher work ... and spend nearly all of the vacation time in seeking to extend ... the boundaries of knowledge.'

During McKay's time the curriculum was revised. In 1909 Smith wrote to him that 'the changes in the curriculum in the last five years have been the most important steps in ... the direction of what modern education ought to be ... and credit for these changes is due to you who initiated them.' Throughout its early years McMaster prided itself on giving a general education, and this was reflected in its general BA program with its limited choice of electives. As time passed however, there was

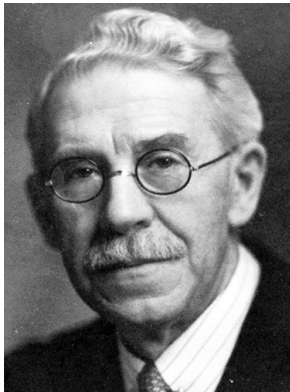
The Toronto Years



Chancellor McKay and Professor Smith with the
McMaster Band, ca. 1907



Dr. L.O. Gaiser, ca. 1930.



Dr. R.W. Smith at the time
of his retirement in 1935.

increasing pressure for more specialization particularly from industry in Chemistry and Physics, and the changes initiated by McKay were shown in the calendar for 1910-1911. In addition to the general program, this offered special programs that focused on particular subjects, including Science and Biology, but still required studies in other areas as well. As an example, the Special Program in Biology for 1920-1921 required the following courses over the four years: seven in Biology; one in Mathematics; two in English; two in the Bible; one in Latin or Greek; one in a modern language; three more in languages; and one in Philosophy. Eight elective courses had to be taken, all of which could be chosen from the other Sciences and Mathematics, although subjects such as Economics and Sociology were available as well. It is difficult to gauge the load students carried in this program, because courses could be rated as Major, Half Major or Minor, each with different numbers of lectures and laboratories for either one or two terms, but it would seem that students interested in Science could have spent up to about two thirds of their time on Science and Mathematics.

The calendar for 1910-11 also gave an incoming student an impression of what to expect in the year ahead. Classes began on 28 September and ran until 22 December. Students spent the Christmas vacation with midyear examinations hanging over them, as these were held when they returned on 6 January. The second term lasted from 16 January until 21 April, the beginning of Spring examinations. Lectures began at 8:15 am and most ended by 4:00 pm. There was Chapel at 10:15-10:30 and a break between 12:30 and 2:00 pm.

McKay was succeeded as Chancellor by Abraham Lincoln McCrimmon, who initiated the purchase in 1912 of a site in north Toronto for a new University campus. This was to replace the one in Bloor Street that was becoming increasingly limiting as the University expanded. An appeal was to be made to the denomination under the title 'Forward Movement' to raise the necessary

funds, but before these plans could be put into effect, they had to be postponed because of a recession followed by the First World War.

In 1909 when the Canadian Defence League was created in response to threats of war in Europe, the Baptists were the only denomination that refused to join, but they had a sudden and complete change of heart when the Germans invaded Belgium in 1914 at the outbreak of war. As students began to enlist, McMaster's enrolment and its income fell, but it managed to avoid closing as many similar institutions were forced to do. During the war a strong feeling developed in the general population against all immigrants of German origin. One of these was Müller, a professor of German at the University of Toronto who also taught at McMaster. Toronto relieved him of his duties, but to its credit McMaster reaffirmed his appointment. By the end of the war, 237 McMaster students had enlisted, of whom 22 had died.

Soon after the war ended enrolment had reached prewar levels (Appendix A, Figure 1), and in 1921 Wallingford Hall was opened as a female residence. To raise funds for buildings and equipment at the proposed north Toronto, or Eglinton, campus, the Forward Movement was launched in 1920. John D. Rockefeller was approached again but this time he failed to respond. The response from the denomination was slow; despite McCrimmon's efforts, many Baptists still refused to give money to the University because of doubts raised by the theological controversy over its religious teaching. These doubts underlay a second and much fiercer battle between modernists and fundamentalists that was about to erupt.

A new Chancellor, Howard Primrose Whidden, was appointed in 1923. His appointment was opposed by the Rev. Thomas Todhunter Shields, known as the 'Battling Baptist'. The theological battle that ensued reached its climax at a Baptist Convention in 1926 that endorsed the University by an overwhelming vote. This victory ensured continued freedom of enquiry at McMaster

but in other ways the University suffered serious consequences from Shield's attack. It had reinforced the resentment against the University among members of the denomination, so that they failed to increase their financial support, and eight years after it was launched, the Forward Movement was still a quarter of a million dollars short of its target of one and a half million. The battle had also distracted the Administration from planning a move to a more extensive site with space for enlarged academic and particularly athletic facilities, and in turn the limitations of the Bloor Street site and the attack itself were creating difficulties for the University academically in its teaching and in its ability to attract new faculty.

By the late 1920s, there were over 20 faculty and about 330 Arts students. Arts itself had expanded into new areas such as political economy and some well trained people had been appointed to the faculty. Nevertheless good people had left, there were vacancies in the faculty, the enrolment had not increased appreciably, and as the Chancellor reported to the Senate for 1924-25, Professors Smith in Biology and Dawes in Physics were overloaded. In that year, Smith had taught six undergraduate courses, with 85 students in Year I Biology. At the same time he had supervised an MA student, Miss Kathleen Hull, who was completing her degree in Botany and had been awarded a fellowship at the University of Chicago.

To assist Smith, Dr. Lulu Odell Gaiser was appointed to the Department of Biology in 1925, and became the first woman to join the McMaster faculty. She had graduated from the University of Western Ontario and then obtained an MA and PhD at Columbia University in plant pathology and cytology. She published her thesis research 'Chromosome numbers and species characters in *Antherium*' with the Royal Society of Canada in 1927. The Chancellor's report for 1925-26 shows that in her first year at McMaster, Gaiser taught 12 hours per week in courses with a total enrolment of 78, while Smith taught 28 hours per week to 153 students.

The Toronto Years

Soon after she arrived, Gaiser offered suggestions for improving students' experiences at McMaster. In the spring of 1926, she wrote to the Chancellor suggesting that outside speakers should be invited to replace the occasional class party. She wrote the following year to tell him they had had a visiting speaker for which there was a good attendance, but she wished it had been larger because there is a 'greater need for training our students to have an appreciation for such matters rather than for little social parties only.' She also wished 'facilities for study and reading could be increased', and felt that students were allowed too much slack – lab books handed in late for example. And both men and women needed a gymnasium.

Gaiser showed a particular concern for women students, both for the limited number of professions open to them apart from teaching, and for the conditions they faced at McMaster. Women had not been altogether neglected by the University, however. A report of the Faculty of Arts in October 1891 stated that 'The private parlor which the Board set apart for lady students has been tastefully and suitably furnished ... There is thus proper provision for lady students both in respect of their comfort and the maintenance of efficient discipline in the movement and intercourse of students within the building.' In her 1926 letter, Gaiser showed that more could be done – the library should be open for women students on Saturday afternoons, and the porter at Wallingford Hall, the Women's Residence, should have the room numbers of students so he needn't shout from the foyer. In 1927, she went further in suggesting there should be more women on faculty to give courses suitable for women – music, art, religious education, household science (bacteriology) – and there was a need for a Dean of Women.

In a letter in May 1926, Smith told the Chancellor that he had been ill for much of that year, and he thanked Gaiser, as well as Professor Piersol of the University of Toronto and a Mr. Willison for help in lectures and labs. In this same letter, he went on to show how clearly he recognized all the contributions Gaiser was

making. ‘Miss Gaiser has proved herself to be a great acquisition not only to the department of Biology but also to the University at large. Of her interest in the young women and her unselfish service for them as well as the affection and respect with which she is regarded I have abundant evidence. [The response to her work] has shown how necessary it was to have a woman on the staff of this University and how quickly and efficiently Miss Gaiser has found and filled her place.’

Smith sounds genuine and generous in this tribute, but nevertheless it could not have been easy for him to adjust to her. When she joined the Department, he was at the normal retirement age of 65 and in poor health, and he had been teaching a whole degree program in Biology single-handed for 26 years. Even with a heavy teaching load, he must have settled into a comfortable routine by that time, and although he was generally regarded as an excellent, devoted teacher, his teaching must have grown somewhat stale. Then Gaiser arrived like a breath of fresh air – in the prime of life, energetic, enthusiastic – and demanding. Such attributes would be hard for many elderly men to take, especially coming from the first woman to join the faculty and in an age and atmosphere where male chauvinism prevailed. Other faculty members were not as kind as Smith and she was soon branded as a rabid, vociferous feminist.

A glimpse of what life was like for a student studying Biology at McMaster in the late 1920s was provided by Mrs. Jean (Dryden) Leaman, who graduated in 1929. She was an Arts student who minored in Biology, and her memory of Biology classes was largely of lab work that consisted of drawing from dissections and microscope slides. Her impression of Smith was that he was a pleasant, quiet man who said little in the lab. She remembered Gaiser as being more helpful and someone she could turn to, but both Gaiser and Smith maintained a rigid separation from their students as did other faculty.

From 1926 on, interest grew in the idea of a New McMaster on a new site – a ‘Fresh Start’ – and with it the possibility of moving

to Hamilton. To many, the site in north Toronto had serious limitations. Furthermore, the University's years in Toronto had not been rewarding ones for McMaster. Despite offering instruction in a variety of subjects besides Theology, it was regarded by most Torontonians either as a minor denominational college – 'a little school for Baptists' – or as part of the much larger University of Toronto. In 1920 McMaster alumni and students from Hamilton organized a group to promote the city as a new site for the University – its economy was prospering, new industries were being established, its population was growing, and it was the only major city in the province without a college or university. In addition, there were Baptists in a large surrounding area to whom it could appeal for support. With the backing of this group of alumni and students, together with local Baptist churches and the Chamber of Commerce, a campaign was launched to bring McMaster to Hamilton.

Discussions between the city and the University were slowed in the mid-1920s by a slump in Hamilton's economy and the Shields affair at the University. Late in 1926 when these problems no longer existed, negotiations were reopened. They were complicated by a rule of the Baptists that to ensure they retained complete control over education at McMaster, they refused to accept any money for this purpose from outside the denomination. To avoid this problem but still give the University financial help to move to Hamilton, the Hamilton committee offered the University a plan in which the city donated the site and private individuals raised half a million dollars as a free gift towards a Science building that was to become Hamilton Hall. The University agreed to this proposal and the Eglinton site was sold.

To finance construction of the rest of the University and the move itself, Whidden proposed a New McMaster Campaign to raise \$1,200,000 from the denomination and \$300,000 from McMaster supporters in the United States. In view of McMaster's experience with the Forward Movement campaign, this was very optimistic. Nevertheless the University report proposing the

move was adopted at the Baptist Convention of October 1927, after which planning and construction of the new campus for 650 students went ahead. It is not clear how much money was raised in the New McMaster Campaign. Because of the Stock Market crash of 1929, many people reneged on their pledges and some ambitious plans, notably for athletic facilities, had to be dropped, but the funds were sufficient to complete essential buildings, the landscaping and the move.

It is interesting to compare the growth of McMaster to that of a university with Baptist roots and one to which McMaster had some connections – the University of Chicago. That University was founded at about the same time as McMaster with a grant from John D. Rockefeller to the American Baptist Education Society. Its first President, like the first McMaster Chancellor, was a Baptist clergyman. Chicago started classes in 1892 with 120 Faculty and 594 students. Some 35 years later, McMaster still only had about two dozen faculty and a student body of about 400.

What accounted for the difference? Undoubtedly money was a key factor. As already explained, McMaster University was restricted to financial support from Baptists alone. The University of Chicago, however, was nondenominational from its foundation. This enabled it to raise money not only from Baptists but from other sources such as the Chicago business community. It was particularly lucky in having continuing support from Rockefeller, the wealthiest Baptist in America, who by 1910 had donated \$35 million. Among the features this University could afford were buildings for science and salaries for a world class science faculty. This included Albert A. Michelson, founder of the Physics Department in 1892 and winner of a Nobel Prize with Edward Morley in 1907 for disproving the existence of an ether.

Another factor that affected the growth of McMaster compared to Chicago was in the freedom of enquiry the two

universities were allowed. The difference that this made is clear from the theological battles described earlier that McMaster suffered, and is reflected in their mottos: McMaster's is 'Ta panta en Christoi synesteken' ('All things cohere in Christ'), whereas Chicago's is 'Crescat scientia; vita excolatur' ('Let knowledge grow from more to more; and so be human life enriched'). For the Department of Biology, McMaster's statement of 1909 that the University 'stands for the fullest and freest investigation ... in the scientific realm ... consistent with loyalty to the fundamentals of the Christian faith' was particularly important. It was clearly wise at that time to tread carefully in discussing such matters as the Theory of Evolution. In May 1926, Smith wrote the Chancellor a long letter, part of which concerned the theological controversy that was to end a few months later in victory for the University. 'Our denomination needs to be educated and if the University does not lead in this respect then who can?' but he added that he tried to keep controversy out of his lectures and he did not 'make acceptance [of views that are attacked by Fundamentalists] compulsory on my classes. [A charge] that I have led any student away from the faith ... is so far as I know absolutely untrue.' As a student, Mrs. Leaman heard nothing about evolution as it did not seem to have been discussed in Biology courses, and she was unaware of the trial in 1925 of Scopes, a high school teacher in Tennessee, for teaching evolution. If evolution was mentioned in class at all at McMaster, it must have been done very circumspectly.

It was to be 70 years after it was incorporated before McMaster University enjoyed the financial and intellectual freedoms with which the University of Chicago began.

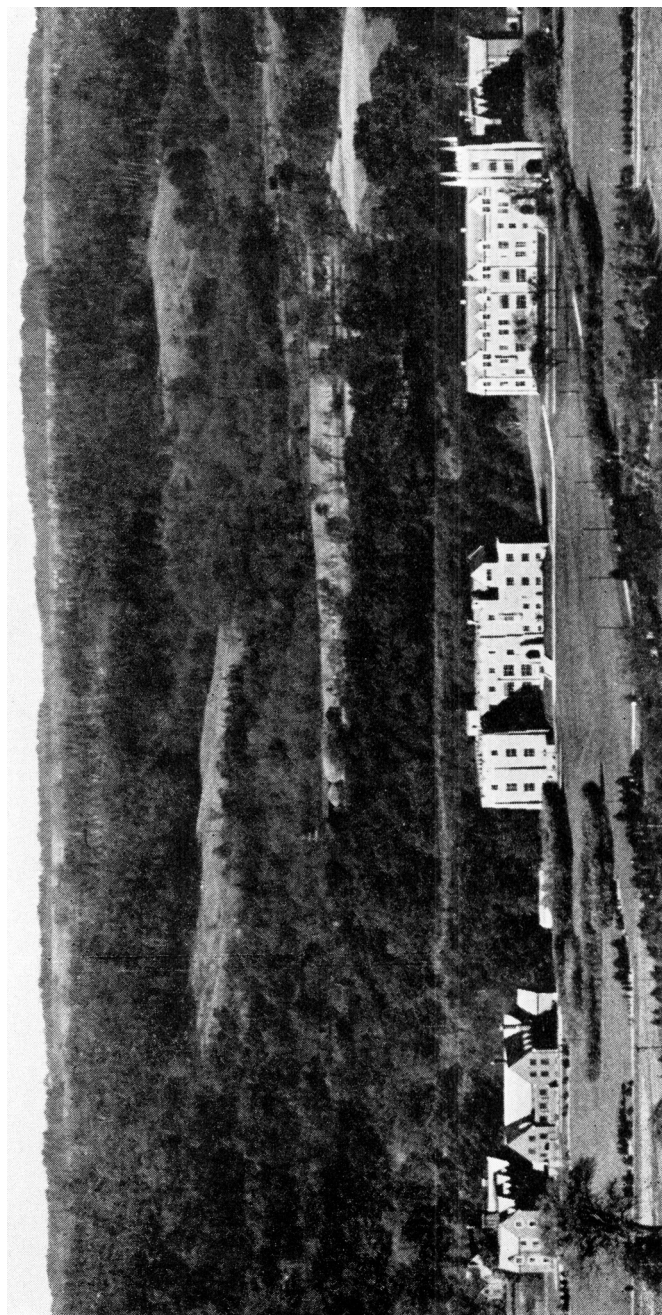
FIRST YEARS IN HAMILTON

September 1930: classes began at the Hamilton campus. 1935: Smith retired; effects on the University of the Depression and a labour dispute. 1933: Warren appointed in Biology. The curriculum was revised and new Honours degrees introduced. 1941: Premedical and Nursing programs began. 1939: Thode was appointed in Chemistry and did secret research during the Second World War. Wartime conditions. 1939-41: Radforth, Acting Lecturer in Biology. 1942: friction between Gaiser and Warren splits the Department into Botany and Zoology. Gaiser as Head of Botany.

The new campus in Hamilton was completed in time for the University to move in and begin a new academic year in September 1930. It was officially opened on the following 14 November. Hamilton Hall and University Hall were built in what was called the Collegiate or Modern Gothic style; one observer declared that the two buildings formed one of the best Gothic groups in Canada. Hamilton Hall housed the science departments including Biology, and on the whole the faculty were satisfied with the facilities. Smith declared ‘I have seen laboratories more extensive than ours but never ones more beautifully or more conveniently equipped.’ Inevitably though there had been a few problems. As first designed the building lacked a separate lab for zoology, which the architect provided after Smith complained. The Gothic style of Hamilton Hall, more suited perhaps to alchemists than chemists, presented problems in the labs, and after the building came into use a proper ventilation system had to be installed.

The plans for Hamilton Hall included a small greenhouse which Gaiser, by then an Associate Professor of Biology, was relying on for her work. Carey Fox, a prominent member of the University Board, was surprised to find that this greenhouse was in danger of being dropped from the list of equipment being

First Years In Hamilton



Aerial view of the Hamilton campus in 1936.
Buildings from left: Wallingford Hall, Refectory, Greenhouse, Hamilton Hall, University Hall and Edwards Hall.

ordered by what he felt was pique on the part of Smith. Perhaps Smith's normal tolerance of Gaiser had temporarily worn thin because of what a colleague called Gaiser's 'difficult and prickly personality'. Fox decided this was foolish and since the Chancellor reported that she would not stay at McMaster unless she had a greenhouse, it was provided.

Gaiser particularly wanted a greenhouse to use for a course on Natural History, one purpose of which was to prepare women graduates as teachers of nature studies in local schools. McMaster's site 'ought to make the development of such a course more delightful.' She also felt that a course on plant pathology would be valuable for students from the horticultural areas of the Niagara peninsula. These ideas of hers reflected the general feeling in the University at the time that having moved to Hamilton, McMaster should actively support the region in any way it could.

Smith underwent a major operation in 1930 and retired in 1935. On his retirement, McMaster conferred on him an honorary DSc and the title of Professor Emeritus, the latter being a distinction then and not automatic as it is today. He died in 1942. Among the memorial tributes paid to him, W. Findlay, Professor of Mathematics and an old friend of Smith's, recalled the sacrifice Smith had made in research so as to devote his whole life to teaching undergraduate biology at McMaster. Gaiser described how, at the meeting of the Royal Society of Canada held at McMaster in 1935, distinguished botanists from across Canada paid tributes to Smith on hearing the news of his retirement. She also described her trepidation on her first visit to McMaster at meeting the head of the Department of Biology, made worse by having only just learned that she was 'the first invasion of McMaster's faculty by a woman.' Her fears were set at rest by the reception she received from Smith. She concluded 'I could not have worked with a finer, kinder Christian gentleman than Dr. Smith.' This tribute sounds genuine and reflects well on Smith and on her.

During the first year McMaster was in Hamilton, a Science Club was formed by Dr. Charles Edward Burke, head of the

First Years In Hamilton

Department of Chemistry. He was a graduate of Woodstock College and McMaster and had obtained his PhD in Chemistry at the University of Illinois in 1911. He taught at the Universities of California and Vermont and then worked for the DuPont Company until he returned to McMaster in 1930. The Science Club was intended mainly to bring Science students together, and it organized lectures by visiting scientists, as well as visits to industrial plants in Hamilton and southwestern Ontario to give students ideas and contacts for employment. Early in 1932 the Club with faculty support inaugurated an annual Science *Conversazione* open to the public. The main attractions of these were scientific demonstrations, and the one in 1934 drew over a thousand visitors to see displays, including chemical luminescence, live chick embryos and the exposed, beating heart of a turtle. These *Conversaciones* were the forerunners of University Open Houses, and the success of the Science Club led to the formation of other clubs in the University.

A peak year in enrolments for the 1930s was reached in 1933-34 with 700 full- and part-time students, compared to about 350 in the late 1920s (Appendix A, Figure 1). Of the total in 1935, over 300 were evening students, largely teachers working towards a degree. As these figures show, the economic depression of the 1930s had little effect on enrolment. One reason for this was that southwestern Ontario did not suffer in the way western Canada did from drought and the collapse of world grain prices. Another was that most of the students came from more affluent, middle class families. Nevertheless money was short and this seriously affected financial support for the University. Plans to improve the pension plan for faculty were shelved in 1933 and salaries were reduced by 5% for those earning less than \$4,000 a year and 6% for those earning more. Salaries remained at these lower levels for the rest of the 1930s and left many faculty in need. If they had no private income or other financial resources, they had to take on extra teaching at a time when there were more students than they could reasonably handle.

BIOLOGY AT MCMASTER

Throughout the 1930's, there was a low representation of students from working class families at McMaster, and in fact it declined from 18 per cent of the undergraduates in 1930 to less than eight in 1939. No doubt the depression had a lot to do with this, together with a feeling of isolation among working class people from what a university had to offer. In 1937 attitudes towards McMaster were made worse by a labour dispute when its stationary engineers went on strike. The Local of the Operating Engineers' Union tried to intervene, but its Secretary was told that the Administration would not discuss 'problems with the men concerned ... through organizations outside ... the University.' Carey Fox on the Board of Governors called members of a Christian Fellowship who attempted to speak for the engineers 'a bunch of idle busybodies', and told the Secretary of the Hamilton Trades and Labour Council that 'in my opinion there is ... nothing to negotiate and the men are regarded as leaving our service.' Nothing further was done but labour organizations 'bitterly complained [that they] had given money to relocate the Christian McMaster in Hamilton, only to have strikebreakers from Toronto brought in to fill jobs.' They asked 'isn't a living wage the Christianity of McMaster?'

Because of Smith's health problems, Dr. A. Emerson Warren, a zoologist, was appointed in 1933 to assist him. Warren graduated from Acadia in 1923 and obtained his PhD from Harvard in 1933. In 1932, he published a paper in the *Proceedings of the U.S. National Academy of Sciences* and had two in press, one in the *American Journal of Anatomy*, the other in the *Journal of Experimental Zoology*. In 1939, he published another in *Roux's Archiv für Entwicklungsmechanik der Organismen*. By 1937 with Smith retired, the Department was listed as Biology (Botany and Zoology) with Gaiser as Professor of Botany and Warren as Professor of Zoology.

In his report to the Chancellor for 1934-35, Burke, then Associate Dean of Science, wrote: 'we are all agreed that McMaster

should maintain a broad cultural education, building for character rather than for vocations.’ Despite this emphasis on generalized education, there had been a move during the 1920s towards more specialized degrees. Smith and Dawes had pointed out at that time that there was a need to raise the quality and content of Science programs. In 1925, the Biology curriculum was much the same as



Dr. A. Emerson Warren, ca. 1950

it had been in 1910: Year I, Elementary Botany and Zoology; Year II, Botany and Invertebrate Zoology; Year III, Botany; Year IV, Vertebrate Zoology and Embryology, and Laboratory Techniques of Microscopy. There was no hint in the Calendar of evolution or genetics.

To avoid repeating material covered in high school, the University eliminated what had been Years I of degree programs (although it kept them for some time as Preliminary Years that allowed students to make up subjects they lacked at the honours level of matriculation but required for the degree programs they wished to enter). As well as offering what then became three-year degrees, the University gradually introduced new four-year Honours degrees, in which Year IV was devoted almost entirely to the area of specialization. By the time of the 1930-1931 Calendar, for example, there were four-year degrees in Science and in Biology with Chemistry, in both of which roughly three quarters of the course work was in science. The Honours Biology with Chemistry degree would have been important to Smith, who always emphasized the necessity of chemistry in the study of biology, but in the calendar for 1941-1942 it was replaced by Honours Biology, which by 1944 had become Honours Botany

and Zoology. Honours Biology with Chemistry was reintroduced later however, and it remained in the Calendar until it was withdrawn in the mid-1960s when a more flexible Honours Biology program allowed the same courses to be taken.

One notable feature of the 1941-1942 Calendar was two new offerings, the background to which was as follows. Throughout the 1930s and early 1940s, there were few graduate students and the main activity of Science departments was teaching undergraduates, many of whom were potential high school teachers. These potential teachers were particularly important for the Department of Biology. In his report to the Chancellor in May 1940, Dean Burke wrote 'there is a comparatively small demand for students specializing in Biology, except in the teaching profession, and if the [program] in Honours Biology were not recognized ... for the science specialist [teaching] certificate, very few students would take [it] and [this] would almost certainly mean [its] ultimate elimination from the curriculum.'

This situation obviously gave the Department of Biology cause to worry about its position in the University, but this was strengthened somewhat by actions Burke himself took. By 1941 he had helped devise two schemes that provided a number of Biology courses with extra students. One, which Burke had had in mind since 1934, was to take advantage of what he called the 'ready adaptability of our courses in Biology and Chemistry' by offering a three-year Premedical program. This was introduced as a variant of an existing three-year Science program that included many of the same Biology and Chemistry courses as Honours Biology.

The second scheme was in response to the wartime demand for nurses and was the result of discussions between Burke, members of the School of Nursing at the Hamilton General Hospital and members of the local medical community. In this, University faculty and staff at the School of Nursing collaborated in a 5-year program towards a BA from McMaster and an RN diploma from the Hospital. Nursing students took the first two and

First Years In Hamilton

a half years of the three-year Science program at McMaster and another two and a half years and all the summers training at the Hospital. This program was not entirely satisfactory and in 1946, when the School of Nursing moved to McMaster, it was replaced by a BSc Nursing degree. In the first years of this program students took Biology courses in Plants, Microbiology and General Zoology, although one nursing instructor remarked that studying the anatomy of the dogfish wasn't a great help in understanding human anatomy. By 1951 these Biology courses had all been replaced by ones in the Nursing School more relevant to health care.

In the curriculum changes of the 1930s, the introduction of Honours programs gave departments an opportunity of offering a range of specialized courses at least in Year IV. Unfortunately Science departments were unable to take much advantage of this for lack of faculty; for example, for the whole of the 1930s the Department of Biology never had effectively more than two members at one time. As a result, courses remained largely surveys of general interest to all the students in a program. This prevented students from specializing, it limited the value of the degree and it kept McMaster at a level in Science little better than that of an average Arts college. Fortunately though, there was hope for the University as it was about to make a significant appointment.

In the late 1930s Burke decided that the Department of Chemistry needed a physical chemist. The person chosen was Dr. Henry G. (Harry) Thode, who graduated with his BSc and MSc in Chemistry from the University of Saskatchewan, took his PhD in Physical Chemistry at the University of Chicago, and was a postdoctoral fellow at Columbia University studying isotopes with Harold C. Urey, a Nobel Prize winner. After he had accepted the position, Thode visited McMaster and was encouraged about the University by everyone he met except Warren, who was probably soured with the University after his experiences with Gaiser. Thode took up his appointment in September

1939 – a fateful month for the world with the outbreak of the Second World War but a fortunate one for McMaster with the arrival of the man who over the following 33 years was to leave an indelible mark on the University.

During the Second World War, Thode carried out important secret research in Hamilton Hall, using a mass spectrometer he had constructed to study isotopes, much of it for the atomic bomb project. At one point he produced a sample of oxygen-18, portions of which were distributed to the Departments of Chemistry, Physics and Biology. It is not clear what use Biology made of it.

During the war interest in science increased among undergraduates; by 1943 enrolment in Science programs reached a record 250, over 40% of the total, although there were fewer women. Both the increasing dominance of science in the University and the smaller numbers of women taking it caused concern. In 1945, there were 95 in the graduating class, the lowest number since 1933.

Throughout the war, students in Science and in some Arts programs were exempt from military service. Students in nonexempt Arts programs were exempt if they did well, but commencing in 1943 students who performed badly received the following notice:

The new government regulations require us to make a report of all students in nonexempt courses whose average standings on examinations put them in the lower half of the year, and I am sorry to say that your name had to be included in the report.

It is probable, therefore, that in the near future you will receive instructions to report for military training.

The uncertainties created by the war, especially for young people, affected the morale and behaviour of students, giving the McMaster authorities concern. Burke complained about

the ‘anything but satisfactory relations between the sexes.’ The consumption of alcohol, a particular horror for Baptists, was a problem at times in men’s residences, even though it could have led to expulsion. An alternative drinking place was Paddy Greene’s, a pub on Main Street opposite Westdale High School, that was a favourite watering hole for students and others from McMaster for many years. The authorities did relent on the matter of dances however, allowing alcohol-free proms and formals on the campus in 1942 for which the Drill Hall, completed in 1943, became an attractive site.

In the late 1930s and early ’40s, faculty in the Department of Biology were augmented with a part-time lecturer from the University of Toronto. The lecturer changed from year to year but for the sessions 1939-40 and 1940-41, he was Dr. Norman William (Bill) Radforth, a paleobotanist who graduated from Toronto with a BA in 1936 and an MA in 1937. He finished his PhD at Glasgow University in 1939 and then took an appointment at the University of Toronto. In his report to the Chancellor in May 1940, Dean Burke wrote that Radforth ‘has done especially good work ... and the students have most thoroughly enjoyed his work.’ Half way through the 1940-41 session however, he was released because the enrolment of full-time students was smaller than anticipated and the University was short of money.

Following his remarks about Radforth, Burke went on to say ‘there has been some friction in the [Biology] department, but it has not been as serious as in past years, and we hope it will gradually die out.’ The source of this friction was Gaiser’s relations with Warren and Radforth, which did not run smoothly. Some suggestion of what these three were like and the difficulties they had in working together is given in the reports she and Warren wrote for the Chancellor at the time.

Gaiser was concerned about the part-time assistants who changed every year: ‘This year has brought one [Radforth] who wanted to change 1st and 2nd year work to his liking (types of

examination, text books included) without knowing how such would fit into the scheme of things in later work.’ This complaint sounds reasonable and, as good as Radforth’s work was to others, he may well have taught the same material at McMaster as he taught in Toronto, regardless of whether it suited Gaiser’s program or not. The situation between her and Radforth did not auger well for what was to happen in 1946. In her report, Gaiser also gave an indication of her own contribution to the Department by describing the quality of the students she had trained in her 15 years at McMaster. Nine had got MAs, of whom seven went on to PhDs elsewhere, while three others went on to PhDs without MAs.

Warren, in two somewhat verbose reports he wrote in 1940 and 1941, expressed fulsome praise for Radforth’s work, especially for ‘impressing upon the students the oneness of biological knowledge and thought.’ He acknowledged that ‘the records of Dr. Gaiser’s students speak for themselves’, but complained that ‘the same “mill” that grinds out good botanists seems to suppress the development of good zoologists.’ He attributed much of this to a course Gaiser gave in Cytology that was compulsory for all Biology students and demanded much of their time. He also complained that she had more student assistants for her laboratories than he did so that he had to rely on sophomores, and that students took their problems to her more than they did to him. ‘Ours is chiefly a Department of Botany,’ he concluded. Burke’s hopes that the friction would die out were not to be realized, because in 1942 the Department was split into separate Departments of Botany and Zoology, with Gaiser and Warren, respectively, as heads.

Johnston remembered Gaiser from this time in a first year Biology course he took in about 1944-45: ‘She didn’t enter a lecture hall so much as explode into it, with gown flying and black eyes (to match her black hair) piercing the assembled undergrads. She was a dramatic and colourful lecturer, who obviously loved her subject. As a campus character she was, in my opinion, in the

same league as the legendarily absent-minded historian, Chester New.’

When the Department was divided, Chancellor Gilmour had no choice but to appoint Gaiser Head of Botany, although she could not have been an easy person for him to deal with. As Head, she sent him a series of letters about problems with part-time instructors and teaching assistants, the heavy load of courses, a break-in in her office that damaged some of her books, and the need for an increase in her salary. He replied to her letters politely and although money was short during the war, he gave her a raise of \$100.00. Rarely did she write to Dean Burke but when she did, his reply was direct: another instructor was out of the question; part-time instructors from Toronto were expensive and unsatisfactory; and she could adjust the work load as other science departments had done by cutting classes from three to two per week and staggering senior courses.

At the time she became Head, Gaiser was offered a position as head of a department at Wheaton College, a ladies’ college near Harvard University. Gilmour encouraged her to take it. ‘[It will] give you more authority and scope than seems likely here for some years. Situated as McMaster is in an area of heavy industry, our most marked development will be in Physics and Chemistry and work in Biology will be somewhat subordinate. ... Do not feel your duty to us need stand in the way of such a real advancement.’ She declined the offer however, saying she had deep roots here and she was concerned about the health of her father. A year later and without her knowledge, Gilmour wrote to the National Research Council in Ottawa and to Columbia University in New York about possible openings for her. In his letter to Columbia, he spoke of her as ‘one of your brilliant graduates’ and of ‘her brilliant work as a research botanist.’ He acknowledged that she had trained many outstanding graduate students but went on to explain that ‘The problem for us [is] that this University is not primarily a research institution and Miss Gaiser seems not to be best fitted for undergraduate teaching. The consequence is

BIOLOGY AT MCMASTER

that she is frequently in a state of tension, which is wearing for her and discouraging for many undergraduates. I am coming to feel that she will find her greatest happiness and usefulness if a research post can be found for her.' Neither of his enquiries bore fruit, but it was unfortunate that the strain of administration had spoiled the excellent relations Gaiser had previously had with undergraduates.

THE POSTWAR YEARS

Postwar issues: low salaries; the influx of veterans; the financial support of Science exceeding Baptist resources. 1948: Hamilton College was created to receive Government funding. 1950: the University introduced PhD programs; heads of departments were replaced by chairs; the unit system was adopted for course loads; loads in Honours Biology were reduced. 1946: Radforth appointed Head of Botany and Director of RBG. 1949: Gaiser retired. 1946-53 cooperation with RBG. 1947-56: appointments of Miller and MacClement in Botany; Judd, Davies and Kleerekoper in Zoology; Nace to Biology. 1950: PhD program in Botany began; operation of the Department. 1953: Botany and Zoology recombined with Kleerekoper as Chair. Dingle's comments. 1957: the University became independent of the Baptist Convention.

In 1944 as hopes of an end to the war grew, the University began to consider the problems it would face and the changes it had to make in the postwar years. These changes were to be far more extensive than probably anyone imagined at the time, and over several decades they transformed McMaster into an extensive, research-oriented University. Once the war was over, as Chancellor George Gilmour described many years later, the immediate problem McMaster had to tackle 'was a matter of survival even more than of expansion, because salaries were desperately low, pension provisions were precarious and academic reputation in danger.' In 1947-48, McMaster had about 25 senior faculty, almost all full professors, and 43 assistant professors, lecturers and instructors, many part-time; they were paid roughly \$4,000 at the full, \$3,500 at the associate and \$3,000 at the assistant professor level. Faculty endured low salaries for many years and in an effort to improve them, the Canadian Association of University Teachers was formed at McGill in 1951. In May that year an affiliate of CAUT, the Faculty Association,

was established at McMaster. At first Gilmour accepted it with caution but later he came to regard it as a good thing. In 1953, the Faculty Association revealed that in a CAUT survey of salaries in Canadian universities, McMaster lagged behind many universities in all ranks except lecturer, while for full professors it was only one place from the bottom. It was to be the mid-1950s before salaries began to improve.

There were other issues for McMaster at the end of the war as well. It faced an influx of veterans whose university education had been interrupted or postponed by their wartime service. This surge in enrolment stretched the University's resources, although some help came from the generous support the Federal Government provided for veterans' education. In 1940, there was a wartime low of 515 Arts students registered, but in September 1945 there were 975. For the three following years, enrolment reached almost 1100, many more than the University could conveniently handle, but after the veterans graduated, it declined to under 900 (Appendix A, Figure 1).

A more serious problem for the University was with faculty in Science, notably the chemists and particularly Thode, who were anxious to introduce much more specialized undergraduate programs than had been the accepted practice in the past, and to exploit the opportunities that would open up in their fields of research after the war. The financial burden these moves were to impose was so large that it meant the University had to seek new sources of income, including governments. This matter was certain to cause the Baptists great distress as they feared that with government money would come government control of education at McMaster. There was also a difficulty with the Senate. Under the University's Charter, Senators had to be in good standing in Regular Baptist churches. If money were to be accepted from non-Baptist sources, the Senate would be legally obliged to include representatives from those sources whether they were Baptists or not.

The Postwar Years

To solve the problem, the University proposed a radical and innovative change in its structure that involved the creation of a separate College of Science to be affiliated with the University and to teach Science beyond the second undergraduate year. The College, later called Hamilton College, was to have its own Board of Governors that would solicit funds from industry and the Provincial Government. However the academic work of the College was to be controlled by a Senate with members drawn from both the University and the College. The University itself was to consist of University College for the Arts and a Divinity School for Theology.

Both the University Board and the Senate accepted this proposal, but before it could be presented to an assembly of the Baptist Convention a group of critics mounted strong opposition. They were led by V. Evan Gray, a McMaster alumnus, a Toronto barrister and a person Gilmour described as ‘an important graduate’, who claimed that any expansion would undermine the basis on which the University was founded, it would dehumanize the University and it could lead to godlessness. By this time a widespread view had developed that the University had been designed primarily as a theological or ‘mission’ school. While assuring Baptists that Theology and Arts would not be neglected at McMaster, the University Board countered both this view of the University and the arguments of their critics by drawing attention to a statement in Senator McMaster’s will. As Johnston points out, McMaster was a business man with experience of the world and he intended the University to be a Christian institution that taught practical, secular subjects as well as religion, or in his words quoted earlier, to provide ‘the best possible facilities for a thoroughly practical Christian course of education.’ In presenting the proposal to the Baptist Convention at their assembly of June 1945, Gilmour went on to stress the need for the University to adapt to the realities of postwar conditions. The proposal was accepted by the assembly with a clear majority and Hamilton College was formally incorporated and affiliated with

the University in January 1948. Burke was the senior scientist in the Administration, having been made Dean of the Faculty of Arts and Science in 1941 when that Faculty was created, and he became the first Principal of Hamilton College. Unfortunately he died the following year. The position was taken by Thode, who also became Director of Research.

Having created Hamilton College so that it could receive outside funds, the next task McMaster faced was persuading governments to provide them. The Federal Government was already giving grants for research through the National Research Council of Canada (a function taken over much later by a newly created Natural Sciences and Engineering Research Council). However Hamilton College also needed sizable support for its teaching function and this came under the jurisdiction of the Provincial Government. The Government of the time was reluctant to act, but when the economy improved during the 1950s, it was persuaded to provide Hamilton College and other universities with appropriate funding. Between the mid-1940s and the early 1950s, faculty numbers rose from 44 to 83, of whom 36 were in Hamilton College.

During his wartime research at McMaster, Thode had been impressed that some of his students were capable of advanced graduate work. This convinced him that the presence of PhD students would raise morale and that McMaster should introduce PhD programs as soon as possible. In this he had the support of Dean Burke, who in a report to the Chancellor in 1946 emphasized the value of research in 'teaching ... graduate students [and] in developing the resources of the community', adding that 'research has become a very definite part of the program of this University ... [McMaster] is not merely passing along to students information which has been gleaned by others, but she is also attacking ... the secrets of nature, and adding ... to the sum total of the knowledge of mankind.' This statement was important as it countered the view held by some who opposed the idea of PhD programs in Science, and who felt that advanced

research and graduate work should be left to other universities such as Toronto. The Arts faculty were divided. The opposition were concerned about the costs of the program and the consequences it would have for Liberal Arts and the balance in the University. One of the opponents was the prominent McMaster historian, Chester New, who was well known for his opposition to any expansion of Science and had been against the creation of Hamilton College. Among those who welcomed the program was Togo Salmon, another senior Arts man, who later recalled that 'if doctoral programs came to Science, they were bound to come to Arts as well ... and some of us relished the challenge.'

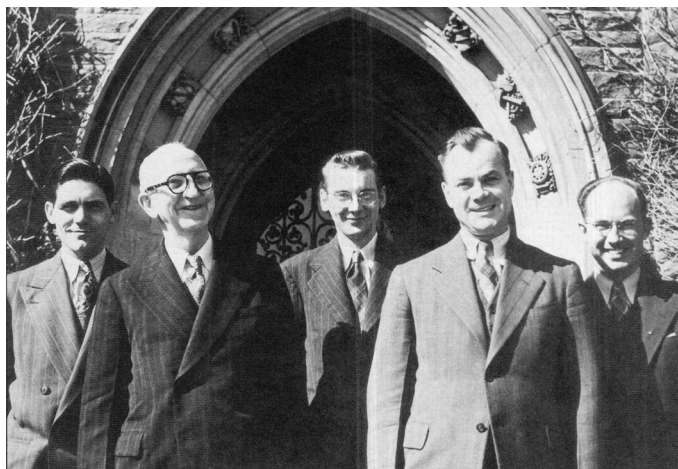
Chancellor Gilmour was hesitant at first but eventually he was persuaded to support the program by the strong letters in its favour that Thode received from distinguished chemists, including Dr. E.W.R. Steacie, President of the National Research Council of Canada, and Dr. H.C. Urey of Columbia University with whom Thode had worked in the 1930s. In the fall of 1949 the proposal was debated in Senate. Among those who spoke in support was Radforth, by then Head of the Department of Botany, who stated that 'those outside McMaster were surprised that [advanced] work had not been undertaken earlier ... and *that it is high time such work was begun.*' The Senate approved a proposal to offer PhD programs in departments considered competent and it accepted the program in Chemistry in principle. This opened the way for other Science departments to seek approval for their own programs.

Thode's pleasure at having the PhD program approved was short-lived as he immediately faced the task of getting regulations for the degree accepted. The program was to require an adequate reading knowledge of two foreign languages, usually French and German. One of the things Thode had to resist was the demand by the Language departments that they, rather than Science departments, conduct these requirements; this would have opened the door to continuing difficulties. Another was the view that the program should follow the practice in many

BIOLOGY AT MCMASTER

American universities that required two or three years of course work followed by only nine months of research. The chemists regarded the PhD as a research degree with a minimum of course work. In private correspondence, Steacie supported them by stating that ‘a PhD in science is granted for research ... [it] is given for doing something, not for knowing something,’ while Urey told him that ‘there is much too much emphasis put on formal course requirements in the United States ... it was not necessary to sit in on formal lectures in order to acquire knowledge.’ Armed with these comments and the results of searches in the scientific literature, Thode persuaded Senate early in 1950 to accepted regulations with a requirement for at least two full courses beyond the MSc. A year after students began PhD studies, they also had to pass a qualifying examination in areas related to their research.

With the establishment of Hamilton College and the introduction of a PhD program, the late 1940s had been years of accomplishment for Thode, and the roles that he and the Department of Chemistry had played gave them dominant positions in the University for many years to come.



The Department of Chemistry in 1948. Left to right:
Dr. Laurie Craig, Dean Charles Burke, and Drs. Arthur
Bourns, Harry Thode and Ron Graham.

The Postwar Years

The developments just described were by no means the only changes the University introduced at this time. Both its administrative structure and the curriculum were revised, no doubt as consequences of comments made in reports to the Chancellor by Dean Burke. In his report for the year 1946-47 he criticized heads of departments and the lack of clear lines of administrative responsibility in the University. 'Too many departmental heads feel little or no responsibility toward anything except their own personal work.' He proposed an administrative scheme in which faculty members worked through their departmental heads and heads worked through their deans. 'Under a scheme of this kind, heads would have to take responsibility for the growth and development of their departments. They should be given this responsibility and a definite budget to work on. This would ... extend their horizons ... and mean they would take a much broader view of their work.' More flexibility and some democracy and accountability were introduced into the running of departments when Thode instigated the replacement of heads by chairs appointed for a limited time. At a higher administrative level, McMaster was brought into line with other English-speaking universities by renaming the head of the University, at that time Gilmour, President and Vice-Chancellor and making the Chancellor a titular position.

In his Report to the Chancellor in 1948, Burke wrote that when the University was small 'each department largely made its own curriculum, but now there are larger numbers of staff and students, they must conform to some general rules.' To reorganize and improve the curriculum, a Curriculum Policy Committee was set up, chaired by Chancellor Gilmour. To encourage more uniformity between degree programs, the Committee grouped them into five areas of study: General and Philosophy; Language and Literature; Social; Biological Sciences and Physical Sciences; later, these last two areas were combined as Science. Each of the groups offered its own Year I that replaced those of individual degree programs. This meant that students did

not register in a degree program until their second year. Other changes the Committee made included renaming 3-year programs 'Pass' instead of 'General', and designating the Bachelor degree in all Science subjects as BSc rather than BA, beginning in the 1951-52 Calendar.

One of the main topics the Committee considered was student workloads, which appeared to be heavier in Science than in Arts. Workloads were put on a more quantitative basis when the Committee decided that in place of major and minor courses the University should adopt the unit system, with a unit defined as one lecture or one 3-hour lab per week for one whole term. This led to a noticeable lightening of the load in Honours Biology. The 1948-49 Calendar listed most of the courses in the unit system, and with reasonable estimates made for the unit equivalent of the few remaining courses, the unit load in each of the four years comes to between 39 and 45 units, with a total of up to 165 units for the whole program. By 1950-51 however, the total had fallen to a maximum of 136 units, with 30-32 units in each of Years II to IV. (In both cases, the required Physical Training in Years I and II has not been included.) This decrease was achieved almost entirely by reducing the numbers of units in individual courses in Years II to IV. The load in these years stayed at 30-32 units throughout the 1950s, but there was no reduction in Year I which remained at 40 or more units during the same period – perhaps as a way of weeding out weaker students. (It was only in the 1980s that Natural Sciences I was reduced to 30 units.)

In 1946 Radforth was appointed Head of the Department of Botany. At the same time he gained a second administrative position as well. Plans to establish the Royal Botanical Gardens were developed in the early 1940s and by late 1945 its board was discussing senior appointments. It was decided that for RBG to have scientific and educational strengths, it had to be headed by a scientist. Chancellor Gilmour, a member of its board, stated that

the University had decided that it needed a new Head of Botany, and he suggested the idea of this person having a dual role as both Head of Botany and Director of RBG. In May 1946, the RBG board unanimously agreed that Radforth should be appointed Director of RBG in addition to his position at McMaster.

Gilmour must have considered replacing Gaiser as Head of Botany for some time. As compensation for her losing this position, he named her Senior Professor of Botanical Research. There appears to be no record of Gaiser's reaction to Radforth's appointment. Some of her former students felt she had been slighted. One of them, Dr. F.E. Beamish at the University of Toronto, wrote to Gilmour that he'd heard there had been 'certain difficulties' with her. He hoped his letter was not an impertinence, but he wrote to acknowledge the 'splendid influence and inspirational teaching' he had experienced from her. Gilmour replied that 'the problem hinged on the undue strain [on her of] administrative work. There was [no] reflection on [her]. The decision was an administrative one and has apparently been accepted happily as such.' In January 1949 Gaiser asked Gilmour for a year's leave of absence with full salary beginning February 1, 1949 and for leave to retire on August 31 of that year. Both were granted and their letters to one another were polite to the end. She spent her leave at the Gray Herbarium, Harvard University. Her retirement must have been a serious loss to the Botany Department and to McMaster as she had served both well.

When Radforth became Director of RBG in 1946, Mr. Leslie Laking was appointed to a senior position there, and also became a Special Lecturer in the Department of Botany at McMaster to teach a course on Pedology (the development of soils). Radforth resigned as Director of RBG in 1953 because of the demands of his muskeg research at McMaster and Laking was promoted to the position the following year.

After the Second World War, Gaiser began a botanical survey of Carolinian species in four counties along the north shore of Lake Erie. When she left, Laking supervised the completion

of this survey as a joint project of McMaster and RBG. At the end of it three sets of herbarium specimens were prepared, one each for McMaster, RBG and the University of Toronto. (In early 1963, the Department considered moving its main herbarium to RBG's headquarters.) Laking also took over a Plant Taxonomy course that Gaiser had taught and he continued to teach this at McMaster until 1979, when Dr. James S. Pringle at RBG assumed the responsibility. Laking retired as Director of RBG in 1981 and was awarded an Honorary Doctorate by McMaster.

The botanical survey was one of several projects undertaken jointly by McMaster and RBG while Radforth was Director. A degree program on Conservation and Recreation Planning was organized that involved the Departments of Botany, Zoology, Geology and Geography at McMaster and staff at RBG. This program was listed in Calendars in the late 1940s and early 50s; it required three academic years at McMaster and two summer courses at RBG, it led to a Pass BA and a certificate from RBG, and three students completed it. Radforth and Laking also gave lectures at McMaster to RBG members and to the public.

Warren in the Department of Zoology collaborated with RBG as well. Early in the 1940s, he began experiments on mosquito control by *Gambusia* minnows in Cootes Paradise Marsh. RBG was interested in this study and with them Warren built a fisheries research lab and a boathouse on RBG ground on the south-eastern shore of the marsh. This was a two story building; the lower floor had storage for boats and equipment for field work and a dock where boats could enter through a door to be loaded and unloaded within the building. The upper floor consisted of a large general lab and a smaller one for chemical analyses and for incubating eggs and cultivating larvae of aquatic animals. In the early 1960s construction of Highway 403 required it to be moved and RBG gave the Department of Biology another site for it on the north-eastern shore.

By 1951 the Departments of Botany and Zoology had expanded with new appointments. In Botany Dr. John J. Miller, a mycologist, joined in 1947 and Dr. W. Donald MacClement, a



Aerial view of the campus in 1950

BIOLOGY AT MCMASTER

plant virologist, arrived in 1949. These appointments allowed the range of Botany courses to be enlarged, and in his report to the Chancellor for 1947-48, Radforth states that a year III course on Plant Physiology and Biochemistry had been given by Miller, as well as year IV courses on Ecology by Radforth and on Genetics by Gaiser. At the time the Department had five graduate students, two with Gaiser, two with Radforth and one with Miller.

In Zoology Dr. William Judd, an entomologist, joined in 1946. He graduated from McMaster in 1938, earned an MA from the University of Western Ontario in 1940 and a PhD in Zoology from Toronto in 1946, and during the Second World War he was a meteorologist with the Royal Canadian Air Force. He was at McMaster until 1950 when he moved to UWO, where he stayed until he retired in 1980. He made major contributions in natural history and conservation and was inducted into the McMaster Alumni Gallery in 1999. Judd was replaced as entomologist by Dr. Douglas M. Davies from the Ontario Research Foundation, who had also been a meteorologist with the RCAF during the war and became interested in the way the behaviour of insects was affected by the weather. He obtained his BA and PhD from Toronto and was a specialist in black flies. Davies was a shy, diffident man, and when he first arrived he found lecturing a daunting experience and was glad of a desk in front of him as he lectured to hide his shaking knees. Dr. Herman Kleerekoper was appointed in 1948; he was a graduate of the Agricultural School of the Netherlands and had an MA from the University of Michigan, where he was completing his PhD when he joined the Department. He was a limnologist and kept several large fish tanks in the basement of Hamilton Hall; he was also funded by the US navy for work on shark repellants. In January 1951, Warren died and his teaching was taken over by Mr. D. Delzell from the University of Michigan.

Throughout the 1940s and early 1950s, faculty in the Departments of Botany and Zoology received grants from the Ontario Research Council for research and for hiring summer students.

The Postwar Years

Reports to the President from the Chairs of Botany and Zoology show that in the year 1950-51, members of these Departments had collectively received grants as well from the National Research Council, the Defence Research Board, the Department of Agriculture, the Department of Health and Welfare and the Ontario Cancer Treatment and Research Council.

When Radforth spoke in the Senate debate on the introduction of PhD programs, he was already preparing a case for one in Botany. Once Senate had accepted the proposal, he was able to present Botany's program to Graduate Studies for approval. Thode, who was Chair of Graduate Studies, had asked Dr. Arthur N. Bourns to be chair of a committee to make decisions on these applications. Bourns is a chemist who graduated from Acadia University, obtained his PhD at McGill and joined McMaster in 1947; he accepted the position of chair with some trepidation as some of the committee members held strong views and were far more senior than he was. One was the historian Chester New who had passed the program in Chemistry because of the strong support it had. However he adamantly refused to accept any more, believing that they would destroy McMaster as a Liberal Arts institution. Fortunately for Botany's case, Chester New's view was overridden by the rest of the committee with the support of another senior member from the Humanities, Roy M. Wiles, a Professor of English, and the program was accepted. At about the same time, a PhD program in Zoology was accepted as well.

Minutes still exist of faculty meetings in the Department of Botany from early October 1950 and continuing with a reunified Department of Biology from July 1953 on. The early minutes were extensive and handwritten in hard-cover notebooks by the appointed Secretary, Miller until September 1960, then Davies until March 1966. In November 1961, the Department decided the Minutes should be briefer and typewritten.

The meeting of October 5, 1950, attended by MacClement, Miller and Laking with Radforth as Chair, marked a new chapter in the Department of Botany that reflected the changes already

described. The Minutes begin: 'It was decided that this and subsequent meetings should be conducted in a more or less regular manner and hence it seemed advisable to appoint a secretary, who would be responsible for keeping confidential records.' Confidentiality made it necessary for a faculty member to be appointed secretary, a position that Miller accepted.

Radforth evidently had a potential PhD student in mind when Botany's PhD program was passed, because the minutes explain that 'The major topic of discussion was the procedure to be followed in the first PhD preliminary oral examination to be given in the Department, that of Mr. A.M. Adams, which was scheduled for 9.00 am on October 6.' There then followed the decisions on what knowledge the candidate should be expected to demonstrate in Botany and how the examination would be conducted. From the discussion, the Department did not appear to have given much thought to this matter before the meeting, nor was it giving Mr. Adams much warning of what was expected of him. The minutes of the meeting for the examination the following day, however, show that he passed. (He completed his PhD in 1952, see Appendix B.)

The minutes of an evening meeting the following October 11 and attended by the same four members give an idea of the conditions under which the Department of Botany operated in Hamilton Hall. The first minute concerned 'Inconveniences involved in the use of the Department office.' Radforth as Chair of the Department shared the office with a secretary and the meeting decided that conditions in the room could be improved by separating them with a partition. Upon discussing this proposal however, they realized it could not be carried out as there was nowhere to store the cupboards and shelves from the office while the partition was being built. Another minute criticized the state of the building – there were leaky taps, locks that didn't work and a broken window. Under 'New Equipment needed', the meeting declared that 'the problem of microscopes and microscope lamps is an acute one.' Concerning 'Technical Assistance in

The Postwar Years

Teaching and Research ... the suggestion was proposed (sic) that the department could be rendered more efficient by employing a full-time laboratory technician. Agreed to by all. A regrettable lack of university funds for such an appointment make it necessary to shelve the idea ... A temporary expedient would be to have class [teaching] assistants help with the washing up.' The meeting adjourned 'after general agreement that staff meetings should be held about once a month.' Little positive action seemed likely to come out of these discussions, and even on the last item the minutes show there were no further meetings until the following May.

Throughout the 1950s Departmental budgets slowly increased; that for the Department of Botany for 1952-53 was recorded in the minutes as follows:

Lab Equipment	\$1900
Lab Assistants	1900
Lab Supplies	1500
Sundries	150
Travel	300

The payment per term to lab [teaching] assistants was \$100 for graduate students. As these were in short supply, some Year IV and even Year III undergraduates were employed as well at \$65 and \$50 per term, respectively. In this year the need for technical help was alleviated by money becoming available for two part-time lab assistants. These were paid at \$1.00 per hour, one for 10 hours per week of general lab work, the other for 4 hours per week for washing up. For travel to scientific meetings, full-time staff were allowed \$50 each. By 1954 the budget had improved enough for money to be found for a small workshop.

In the Spring of 1951, the University decided to recombine the Departments of Botany and Zoology, so that in a single Department the two undergraduate programs could be better integrated and the larger faculty could provide a stronger nucleus for graduate work. Bringing the two Departments back together proved

not to be simple, and for the 1952-53 session Thode, Principal of Hamilton College, had to appoint MacClement and Kleerekoper as Acting Chairs of Botany and Zoology respectively, with instructions 'to solve the problems hindering integration into one efficient Department.' In March 1953 Thode wrote that progress had been made, and he was recommending to Senate and the Board of Hamilton College that the two Departments be combined into one with Kleerekoper as Chair. On being recombined in July 1953 they formed a Department of seven, the members from Zoology being Kleerekoper, Davies and Delzell. The number increased to eight in 1956 with the appointment of Dr. Paul Nace, an embryologist and histologist.

With Kleerekoper as Chair, the frequency of Departmental meetings increased. The minutes show that it was the practice for the whole Department to deal with all Departmental matters at these meetings, from conducting graduate student examinations to budgets, graduate student applications, the assignment of teaching assistants and revisions to the undergraduate curriculum, down to details on the use of the photographic equipment and darkroom, the operation of the storeroom and the use of chemicals. To ease the work some committees were formed but they still reported to the Department before decisions were taken. One of these committees had help achieving its aims almost immediately after it was set up. Because of the Department's continuing concern to establish the importance of biology in the University, a standing committee was formed in September 1954 'to investigate all possibilities for expansion of interest in biological sciences and for increasing the potentialities for student enrolment.' In that same year a bequest to the University from L.E. Redman, an industrial chemist, was used to establish the University's Redman Lectureship, under which distinguished scientists were to be invited to give a series of lectures. Early in the following year, the first Lecturer was the biologist George Wald from Harvard University, who in 1967 shared the Nobel Prize for Physiology and Medicine for his biochemical work on vision.

The Postwar Years

At a meeting in September 1958, Nace complained that ‘too much time is spent in our meetings discussing and settling new matters, as a result of which we fail to complete other projects which are essential for the proper functioning of the Department.’ In reply, Kleerekoper as Chair defended the democratic way in which the Department of Biology conducted its affairs compared to that of the Department of Chemistry. That department, he said, held only two or three meetings a year, departmental business being run by small committees with power to act. These dealt with such matters as scholarships, examinations of incoming students and the assignment of teaching assistants. The minutes record no discussion of this statement and the business of the Department continued as before. But it was democracy at a price. In an interview, John Miller’s widow, Dorothy Jane Miller, said Miller ‘hated the tedium of administration. He spent hours at meetings and it bored him. He found microbiology, yeast cells and students more interesting.’ This is understandable when he had been taking detailed minutes at these meetings for ten years.

After Radforth became Chair again in 1961, however, there were some small compensations in attending the meetings. Radforth did not take a narrow view of life, and in the early 1960s he combined many of the meetings with lunch or other refreshments by holding them in Wentworth House on campus, the Hamilton YMCA or the Collins Hotel in Dundas. A problem with Wentworth House was the high noise level in the dining-room that hampered discussion. To have the noise level reduced, the meeting instructed Radforth to send a memo to the Superintendent of the Buildings and Grounds Department asking for carpeting or other sound-deadening material to be installed. The minutes do not record whether this was done, but the Department continued to meet there for several months.

Dr. Allan Dingle, who joined the Department as a faculty member in 1965, was an undergraduate at McMaster from 1954 to 1958. Between 1945 and 1958, the total number of undergraduates fluctuated between about 900 and 1100 (Appendix A,

BIOLOGY AT MCMASTER

Figure 1). In Dingle's year, he and another student took Honours Biology and Chemistry, there were three in 3-year Pass Biology, five in 3-year Premedical, and four or five in each of Honours Chemistry, Geology, Physics and Mathematics. One feature that struck him and Dr. Westermann, who appears later in this history and who took her degree at the University of Western Ontario in the same era, was that almost all the science courses they took had labs, and these filled all available space in the timetable.



The Biology Club in 1957. Nace (front row, left) was the faculty advisor. Dingle is next to Davies who is front row right.

In an interview, Dingle gave his assessments as an undergraduate of members of the University and the Department in the 1950s. Until 1962, even after McMaster had become a secular University (see below), time was still set aside each morning for chapel, and there was a mandatory course on the Bible for year I students taught by President Gilmour. At the time Gilmour had presented the proposal to create Hamilton College to the Baptist Convention in 1945, one observer said he spoke 'most eloquently' and another that his address was 'most effective.' When Dingle took his Bible course, he was much less impressed

The Postwar Years

with Gilmour's oratory. He described Radforth as projecting the image of a tweedy Professor but a good teacher. Others tell stories of Radforth as a character; on one occasion he rode his horse onto campus. In the years after the Second World War while the University was still quite small, the whole faculty gathered periodically to hear talks from their members. Bourns remembers how, when Radforth spoke, he gave part of his talk standing on his head – clearly his presentation was memorable for that if nothing else. Dingle had great respect for Kleerekoper, who was research oriented, a demanding teacher and a martinet, but he found MacClement to be weak as a teacher. Dingle's mentor as an undergraduate was Nace, a big, bluff American who did not hold a high opinion of the Biology faculty. He spent much of his time with Dr. Richard Tomlinson in the Department of Chemistry in a group President Thode formed to study the use of radioisotopes in medicine and biology.

It says much for the Department that when Dingle went to the US for graduate work, he found that the grounding he had in science at McMaster put him in good standing compared to students from prestigious American universities.

In the postwar period up to 1957, the balance between science and non-science courses required in the Honours Biology degree program varied little, with 70% or more of the load in science and about 25% in non-science. Although there was some choice



Dr. Radforth riding his horse on campus for a fund-raising activity. The student pictured is Beth Johns, daughter of Professor Martin Johns of the Physics Department.

BIOLOGY AT MCMASTER

Table 3.1 Calendar entries for courses offered in Biology, Botany and Zoology in 1956-57 for the Honours program

1. Biology		
* 1a6	<i>General Biology</i>	MacClement and Davies
* 2a4	<i>Functional Plant Morphology</i>	Radforth
* 2b4	<i>Comparative Anatomy of Vertebrates</i>	–
* 3a4	<i>Biotechniques</i>	MacClement and staff
* 3b4	<i>Biogenetics</i>	Miller
* 3c4	<i>Bioecology</i>	Kleerekoper and Radforth
* 3d4	<i>Plant Taxonomy</i>	Laking
* 3e4	<i>Invertebrate Zoology</i>	Davies
* 4a4	<i>Cytology</i>	MacClement
4b4	<i>Advanced Genetics</i>	Miller
4c4	<i>Limnology</i>	Kleerekoper
2. Botany		
* 4a4	<i>Developmental Morphology and Anatomy</i>	Radforth
4b4	<i>Palaeobotany</i>	Radforth
4c2	<i>Dendrology</i>	Radforth
* 4d4	<i>Plant Physiology</i>	Miller
4e4	<i>Advanced Plant Ecology and Geography</i>	Radforth
4f4	<i>Microbiology</i>	Miller
4g4	<i>Plant Pathology</i>	Miller
4h4	<i>Algology</i>	MacClement
4j4	<i>Pedology</i>	Laking
3. Zoology		
* 4a4	<i>Embryology</i>	–
4b4	<i>Natural History of Vertebrates</i>	–
4c4	<i>Entomology</i>	Davies
* 4d4	<i>Animal Physiology</i>	Kleerekoper
4e4	<i>Advanced Animal Ecology</i>	Kleerekoper
4f4	<i>Economic Entomology</i>	Davies
4g3	<i>Animal Parasitology</i>	Davies
4h3	<i>Aquatic Invertebrates</i>	Davies
4j4	<i>Fisheries Biology</i>	Kleerekoper
4k3	<i>Ichthyology</i>	Kleerekoper

Total 30 (117 units)

* Required courses, including all those required in three different options for Year IV

The Postwar Years

in required courses, there were few electives. Throughout this time, in addition to the mandatory course in Biblical Literature or Religious Studies already mentioned, Physical Training and a course in French or German were required. From 1948-49 on, the Department with six or seven faculty members offered about 120 units of teaching. Table 3.1 lists all of the courses for 1956-57, and indicates the required courses for Honours Biology. In Honours Biology with Chemistry, the units required in Years II to IV differed from those in Honours Biology by eight fewer in Biology and 16 more in Chemistry; instead Honours Biology required six in Geology and two in Mathematics.

Once Hamilton College had been created, giving Science access to outside funding, Arts at McMaster by comparison was at a serious disadvantage. In the early 1950s Arts was expanding with the formation of new departments such as Psychology and Sociology, and this was putting an increasing financial burden on the University. By 1955 the University recognized that its financial needs would soon outstrip the resources of the Baptist Convention and that to survive, McMaster had to change its structure so as to allow it to seek new sources of support. The solution was to create yet another new form of McMaster that would be publicly funded and completely independent of the Baptist Convention. This was to be achieved by combining Arts, that is University College, with Hamilton College to form the University, and making the Board of Hamilton College into the Board of the University and its Principal, Thode, into Vice-President of the University. The Divinity School was to become the McMaster Divinity College, affiliated with the University but still governed by the Baptist Convention. This time there was little opposition to the proposed changes, and the bills bringing them about were ratified by the Ontario Legislature and came into effect on 1 June 1957.

THE DEPARTMENT IS CONFRONTED BY CHANGE AND THE MEDICAL SCHOOL

1950s: university expansion, increased research grants, discovery of DNA structure. 1962-66: the Research Unit in Molecular Biology, Biochemistry and Biophysics was formed; Biology complained of the need for more faculty and better facilities; appointments of Threlkeld, Takahashi, McCandless, Dingle, Jensen, Oaks, Westermann, Stewart and Sorger; the curriculum reviewed; the Medical School was created, causing concerns in Biology.

The 1950's were a unique decade in the history of the Department, the reason being that its subsequent growth was shaped to a great extent by three developments in the world at large that occurred during this time. The 1950s were boom years in Canada. Industries and businesses grew and public services expanded, increasing the demand and the opportunities for well trained and educated people. With their increased tax revenues, provincial governments were able to meet this demand by expanding their university systems, and across the country existing universities were enlarged and new ones built, from Memorial in Newfoundland to Simon Fraser and Victoria in British Columbia. By the mid-1960s the Government of Ontario had created Brock, Lakehead, Laurentian, Trent, Waterloo and York Universities and converted the Ontario Agricultural College in Guelph and Carleton College in Ottawa into full universities. As well, McMaster, Ottawa, Windsor and Waterloo Lutheran Universities with religious affiliations had been allowed to become provincially supported by severing these connections, with the last changing its name to Wilfred Laurier. After McMaster made the change in 1957, it was able to expand with new buildings, larger academic departments and larger student enrolments. This expansion continued until 1969 and was reflected in the

Change and the Medical School

development of the Department of Biology. For many members of the University, however, the most visible effect of the expansion was to turn the campus into a shifting building site for 15 years.

The second influential factor was the launching of the Sputnik satellite by the Russians in 1957, an event that shocked western nations out of their belief in their own superiority in science and technology and forced their governments to recognize the need for increased support for these areas. One outcome of this was the US success in landing men on the moon in 1969. I remember watching it on television with Ken Kershaw during a visit he made here before deciding to join the Department. The landing itself was arguably not of great significance to the future of our Department, but what was important were the increased federal funds for individual research that became available in Canada from about 1960 on. For example, in the ten years from 1958-59 to 1967-68 the overall budget of the National Research Council for University Research Grants and Scholarships increased over eight-fold. Within this budget, research grants in Biology, Chemistry and Physics together increased over five-fold (both figures are corrected for inflation). These increases meant that many more members of the Department had access to the resources they needed for research of an international standard.

Lastly there was the discovery by Watson and Crick of the structure of DNA in 1953. Few at the time could have recognized the full potentialities of this event that provided the key for ultimately unlocking the molecular mechanisms for the development and control of all living processes and for revealing many of the details of evolution. The news of Watson and Crick's work and the earlier demonstration by Avery that DNA was the genetic material were slow to register with many biologists. In 1956 for example, Dr. Threlkeld, who later joined the Department, asked a senior wheat geneticist at the University of Alberta about the chemical basis of the gene and was told 'You're wasting your time worrying about that – a gene is just

an abstract quantity.’ Some biologists who had heard about the structure of DNA regarded developments in molecular biology as a mere distraction, and it took until the 1980’s and later before the potentialities of this new field could be convincingly demonstrated. In the meantime, nevertheless, these advances were to change the Department.

By the late 1950’s, significant discoveries had been made in areas such as *Drosophila* genetics, the structure of cells at the level of the electron microscope, the growth of bacteriophage, and the way proteins are synthesized using DNA as a template. At the same time, strenuous efforts were being made to solve the genetic code. Thode, by then President, realized that advances such as these in biology and in interdisciplinary areas of biology with chemistry and physics had to be reflected in teaching and research at McMaster; in this he had the support of other senior scientists in the University such as Dr. Martin Johns, Chair of the Department of Physics. Members of the Department of Biology did not seem to share the same concern. They did become acquainted, if they were not already, with the value of radioactive tracers in biology and with the biological effects of radiation, when the nuclear reactor on campus officially came into operation in April 1959 in the presence of the Prime Minister, John Diefenbaker. This event was marked academically by a Nuclear Reactor Seminar Program, to which the Department of Biology was invited to contribute talks on its relevance to biology. This episode aside however, few of the recent advances in biology seem to have been incorporated into the teaching or research of the Department.

Two items from Departmental minutes reveal something of members’ attitudes on this issue. The first of these was at meetings in November 1958, when Kleerekoper as Chair declared that the Department badly needed a new faculty appointment, pointing out that ‘we have had no increase in staff since we became a united department, whereas other departments have had increases.’ He went on to suggest that the appointment should

Change and the Medical School

be in genetics 'as we have not developed this important area of biology [in which] Botany and Zoology have common need.' Radforth replied that 'the new staff member should ... rather be a plant physiologist. ... We ought to emphasize physiology more, because it is basic to so many things.' Nace contended that 'students were expressing no interest in graduate work in genetics and we should not run ahead of the field.' The same lack of interest had been evident at the undergraduate level; in revising the undergraduate Calendar a couple of months earlier, the Department had withdrawn the Year IV course in Advanced Genetics as it had rarely been given. Nace also expressed the view that 'there are important respects in which the Department is deficient and these should be given priority [over a new appointment].' The other members were divided on the matter. Despite this, they voted unanimously to send a brief to the Vice-President urgently requesting both a geneticist and a plant physiologist. The following April, Kleerekoper reported that he had been told unofficially that 'we should soon be able to start looking for another staff member, though not for the coming year, [but there is] agreement in principle that we should have another staff member.' Radforth commented that 'we definitely need two new men and ... we should not allow this to be overlooked.' (During 1961, the Department gained both a geneticist and a plant physiologist, but not in the way they expected.)

The second item relating to advances in biology is from a meeting in February 1961 during an examination of the whole Biology program. The Chair, Radforth, asked whether descriptive biology, what he called 'classical' biology, should be relegated to a secondary position behind physiological or 'modern' biology. Kleerekoper's view was that 'classical biology is important in an age of faddism, where there is undue appeal and prestige from the elaborate tools of science.' Kleerekoper had a point in emphasizing the importance of descriptive biology as it was being widely neglected in universities in North America at that time. On the other hand, to refer to the use of 'elaborate tools of science' as

faddism was a serious misjudgment. In some instances prestige may have been a factor, but a deeper and more important justification for their use was that new equipment such as the electron microscope enabled biologists to learn about features of living organisms that were beyond the scope of older tools.

Thode was a determined man, as we shall see again later, and he decided he would introduce modern aspects of biology in his own way, by creating a Research Unit in Molecular Biology, Biochemistry and Biophysics. Later, he explained the thinking behind this in his Report to Senate for 1962-63:

There are exciting new discoveries to be made in interdisciplinary areas ... Molecular Biology is one [in which] biophysicists, biochemists, geneticists and biologists with interests in common can benefit from discussions with each other and often from direct collaboration. Although some work was being done at McMaster in this area, it was felt that some formal organization was necessary to facilitate interplay and cooperation between specialists. [Senate authorized establishment of a] unit in biophysics, biochemistry and molecular biology, which has as its major aim to contribute to the study and the understanding of the biochemical mechanisms of the process whereby genetic information controls the behaviour of molecules in living systems.

This Unit was to consist of new and existing faculty with appointments in the appropriate Departments of Biology, Chemistry or Physics where they were to do their undergraduate teaching, but their graduate research would be performed in the Unit, for which it would be granted its own PhD program. Thode began carrying out his plan in August 1959 by announcing to the Department of Biology that he intended to appoint a geneticist to Hamilton College; Biology could have this position if they wished but otherwise it would go to the biochemistry section of the Chemistry Department. Biology accepted it. To head the new Unit Thode invited Dr. John Unrau, a wheat cytogeneticist

Change and the Medical School

from Alberta, and he in turn recommended two young scientists as members of the Unit, Dr. Stephen F.H. Threlkeld, a geneticist, and Dr. Dennis R. McCalla, a biochemist, both from the University of Alberta. Unrau unfortunately died suddenly and unexpectedly before he could take up his appointment. Threlkeld and McCalla arrived in 1961.

On March 15, 1962, the President chaired a meeting to discuss the proposed Research Unit, attended by Dr. Howard Petch as Principal of Hamilton College, the Dean of Graduate Studies and faculty members Miller, Nace and Threlkeld from Biology; McCalla and Dr. Ian D. Spencer, an organic chemist, from Chemistry; and Dr. Douglas O. Schneider, a radiation physicist, from Physics. As Thode clearly intended, 'the members were unanimous in their view that such a Research Unit ... should be formed.' At the conclusion of the meeting it was added that 'Members of the group felt that acquaintance with the corporate opinions of the Biology, Chemistry and Physics Departments would be useful to them in their further deliberations.'

The Department of Biology voiced its opinions at a Departmental meeting in April when Threlkeld, who had already been appointed Chair of the Unit, reported on its formation. The minutes show that 'Kleerekoper felt strongly about the manner in which this Unit was organized ... all members of the most vitally concerned Department, Biology, should have been consulted.' MacClement agreed, complaining that 'several matters have been decided at the top and then presented to Departments.' Radforth as Chair said that 'he would convey to the President that we are happy this Unit has been formed,' adding 'we cannot comment on the way it was formed ... it is not our business.' Kleerekoper sent Thode a strongly worded letter of protest and he ceased attending Departmental meetings for several months. In his report to the President for the year, Radforth explained that one reason for Kleerekoper's absence was the illness of his wife; then he continued: 'Dr. Kleerekoper has been very unsettled. ... His interest in his own research never appears to wane. It is my

hope that in future he will be better motivated with respect to the affairs of the Department.'

Threlkeld regards the creation of the Unit as 'a very important and far-sighted move on the part of McMaster, as the biology in most Canadian universities at that time was concerned with whole organisms and had not developed any depth in molecular biology. It caused a profound change in the philosophy of the department.' McCalla felt that being allowed its own PhD program gave the Unit a tremendous boost in research. Dingle, a cell and developmental biologist appointed to the Unit and Biology in 1965, was enthusiastic about the concept. Other biologists to join it were Dr. Jon Zeevaart, a plant physiologist, in 1961, who left a couple of years later and was replaced in 1965 by Dr. B. Ann Oaks; Dr. Iwao (François) Takahashi, an expert in bacteriophage, in 1963; and Dr. George J. Sorger, a microbiologist, in 1966. The other members of the Unit were Drs. Karl B. Freeman, a biochemist, McCalla and Spencer in Chemistry, and Schneider in Physics.

Although appointments to the Research Unit met some of the requirements in modern biology and biochemistry, they did nothing for classical areas of biology. In November 1962, Radforth as Chair 'reported more favourably than has been possible before on the possibility of the administration considering additional staff; Dean Duckworth [Burke's successor] and the President are disposed to study the matter.' The following January 'Miller reported on a survey he had been asked to make of the relationship between numbers of staff, students and courses as shown by other Canadian universities, and a comparison of the Department of Biology with other Science departments in McMaster.' The information he presented was discussed at length 'with a general conclusion that the Biology Department at McMaster was overworked, overcrowded and understaffed.' In view of the generally reserved nature of the people involved, the boldness of this conclusion is an indication of their frustrations. In November 1963 Radforth was able to say that 'Petch believed

Change and the Medical School

the Biology Department had been neglected, that additional staff was required at the junior level, especially with the greater number of students expected, and that three additions to staff were proposed for next year.' By this time there were 16 students in the Honours Biology program, and registration in all Biology degree and Premedical programs had reached 63 (Appendix A, Figure 2).

At last the Department was allowed new positions. Three more women were appointed to join Oaks: in 1964 Dr. Esther McCandless, an animal physiologist, and in 1965 Drs. Doris E.N. Jensen, a parasitologist, and Jean M. Westermann, an histologist. In an interview, Westermann said that at that time, there was a shortage of suitable male candidates for faculty positions and this gave women opportunities, at least where they were not excluded by hidebound tradition. She felt that on this score the Faculty of Science and the Department of Biology at McMaster treated women well. In 1965 Nace resigned to return to the US and a botanist, Dr. John Stewart, joined; he had graduated from the Department in 1959 and obtained his PhD under Radforth in 1963. By 1966, the complement of the Department reached 14.

In the first months of 1958, the Senate initiated a period of soul-searching when it appointed a Committee on Curriculum Review, chaired by Dr. J.E.L. Graham from the Economics Department. This committee addressed the following three questions to all Departments for their opinions and recommendations:

- 1. What do you think should be the function of McMaster University?*
- 2. What do you think should be the admissions policy of the University?*
- 3. Do you have any particular questions to which you feel the Committee should give consideration?*

These open-ended questions provoked plenty of discussion and the Department devoted four full meetings to them. The minutes summarized members' answers which included giving students a core of general knowledge including Biology, teaching them to think, and emphasizing the need to keep student to faculty ratios at reasonable levels. However the recorded comments of Nace and Radforth, although cryptically brief in places, were more far reaching. From Nace:

The first function is the discovery of new principles.

The second is training in research.

Third, undergraduate training.

Fourth, training in behaviour of undergraduates.

From Radforth:

(1) Training at the graduate level is of such fundamental importance to the purpose of this University that it is questionable whether it should be divorced even as a matter of convenience from the undergraduate program.

(2) The purpose of the University is to cultivate the absorption of fundamental knowledge and to cultivate the development of wisdom in the use of this information.

(3) All professional people must have a liberal background in their education pertinent to their profession. [For this to be possible,] a high degree of flexibility is desirable in presenting the Humanities program.

(4) To do research and disseminate the results. It should be possible to do research at an undergraduate level.

(5) Undergraduate and graduate programs should be designed to take a more active part in our national and industrial development.

(6) The University should stimulate the enhancing of cultural levels within communities of all sizes.

Change and the Medical School

In a preliminary report to the President in December 1958, the Graham Committee made the cogent point that ‘the University should always have as a general objective the raising of the academic level of the student body. [For this objective] to be met, admission requirements and academic standards must be raised. We consider this a matter of the utmost importance and urgency.’ One of its recommendations that were implemented was to have three divisions in the University – Humanities, Natural Science and Social Science, each with its own common Year I program. The committee also felt that all students should be required to take the equivalent of two courses in the two divisions other than that of their concentration.

Following the Graham Committee’s report, the Department devoted at least ten meetings during the 1961-62 academic year to discussing the Biology curriculum. One all-day meeting declared that ‘a teaching load of 12 units is thought to be reasonable for each staff member.’ At the beginning of November, the Department formed a ‘Committee Concerned with the Teaching of Biology (CCTB), to explore and develop policy concerning the kind and emphasis of subject matter in the light of new trends and the programs of the larger North American universities.’ Threlkeld, the newest member of the Department, was appointed chair with Davies and Nace as members. Specific tasks the Department set CCTB were ‘to increase the effectiveness of Year I Biology and elevate it to university level, instead of the present “high-school” course; to organize Years I and II Biology offerings to more truly represent modern biology; and to provide the greatest possible flexibility in Years III and IV.’

Early in December, CCTB presented a report recommending a different plan from the one the Department had in mind in November, and it met with opposition. This set the pattern for discussions on the curriculum in the Department that continued at intervals until 1966. The problem lay in establishing a central core of courses in the Honours program from which other branches of biology would be developed. The CCTB proposal

that was rejected was that this core be introduced in Year I with four main topics – Cells, Differentiation, Genetics and Ecology. The issue was not resolved and instead Calendars from 1962-63 to 1965-66 told students that courses for years II to IV were ‘to be decided by individual consultation with members of the department and approved by the chairman.’

Discussion of the curriculum was reopened in April 1964, when Threlkeld proposed a series of courses that all Honours and perhaps Pass Biology students should have. These were: Year II Cell Biology; Years III and IV Genetics, Ecology, Physiology and Developmental Biology. This proposal was accepted at the time but then rumblings of opposition developed. In a memo in November Radforth wrote ‘I sense some apprehension in the Departmental discussions lest in our zeal for the core we overemphasize the significance of, say, molecular biology to the detriment of other aspects of biology we are loath to see dropped.’ At the meeting that followed, it was decided that core courses in Years III and IV should be reconsidered in further discussion of the whole Biology curriculum. In December, a new committee consisting of Threlkeld as chair, Davies and Jensen was set up to consider Year III core courses. Discussion on these courses continued throughout 1965, until in the November another Committee on Undergraduate Courses consisting of Threlkeld, again as chair, Takahashi and Dingle recommended that the core courses should be Year I Biology 1a6; Year II Genetics; Year III Cell Biology; and Year IV one of Physiology of Plants, Animals, or Microorganisms. Threlkeld’s patience with revising the curriculum must have begun to run out by then, because his Committee concluded its report with the comment that ‘it would be unwise to make further specific changes at this time.’ Modifications were in fact suggested but the meeting finally voted to adopt the Committee’s recommendations without alteration, and they appeared in the Calendar for 1966-67, together with ‘additional [year IV] courses to be decided by consultation with the department.’ As we shall see, after all the effort that went into arriving at it this program was to be short lived.

Change and the Medical School

A major concern of the Department in the early 1960s was the prospect of a Medical School at McMaster and the effects it would have on Biology. A passing reference to a ‘possible association [of the Department] with a Medical Faculty’ appears in the Departmental minutes in early 1957. The idea of a Medical School had been thought of years before this, however. In the 1930s, prominent local doctors and citizens had hoped one would be built in Hamilton. In 1948, when McMaster was pressing the Provincial Government for financial support for Hamilton College, Premier George Drew showed more interest instead in a Medical School for Hamilton. Gilmour and Thode were opposed to the idea at that stage in McMaster’s development. Quoting from a recent survey of medical education in North America, which maintained that a prerequisite for such a step was a ‘stable and flourishing university’, Thode wrote that it would be ‘utter folly [to proceed] until Hamilton College ... is established and adequate facilities ... provided for the Arts and Natural Sciences’. Nevertheless Thode was sympathetic to a medical school and in the meantime he initiated the research on the clinical use of radioisotopes referred to earlier. By the early 1960s, it was becoming clear that Ontario needed a new medical school and the Ontario Government invited McMaster to make a proposal. Thode, now University President, submitted a brief and in 1964 McMaster was awarded the project.

Thode faced considerable opposition both in the community and in the University to the creation of a Medical School. After consulting a landscape architect, he settled on a site for it facing Main Street. This required blocking off King Street and destroying a popular local feature – the Sunken Gardens belonging to the Royal Botanical Gardens. The public was outraged at the effect a huge Medical Centre would have on the Westdale area and especially for the loss of the Sunken Gardens. Within the University, there were objections to the whole idea of the Medical School both for these reasons and on academic grounds, and these came from faculty in both Arts and Science. Even Petch,

Principal of Hamilton College, had serious misgivings about it. For much of McMaster's existence, academic studies had been its major concern, but with the creation of a Medical Faculty, this would be rivalled by professional training with its different approach to knowledge. (Professional training had in fact already been introduced in 1958 when the Faculty of Engineering was created.) Members of the Department of Biology expressed the same concern at a meeting in November 1963, when 'they felt that Biology ran the risk that its scientific approach was going to be overshadowed by the medical approach to biology when the new school started.'

Thode, however, was determined to override all opposition. Dingle remembers a Departmental meeting at which Petch announced the plan for the Medical School that several in the Department opposed. Petch returned later in a petulant mood to tell the Department it had to accept the proposal. As he talked he became quite emotional and Dingle had the impression that tears came to his eyes. (Petch resigned from the University in 1967 to become Vice-President at the University of Waterloo and later President of the University of Victoria.)

At a Departmental meeting in October 1965, members raised a number of concerns over the association the Department would have with the Medical School or more accurately the Faculty of Health Science. How much control would that Faculty have over faculty appointments in Biology? How would their concept of human biology fit in with that of the Department? Would non-medical students be submerged in Health Science's plans instead of in their own fields? Would this association affect teaching loads and would it have positive advantages for the Department? These questions suggest that members feared that association meant absorption into the Faculty of Health Science, and the meeting decided to seek reassurance from the Dean of Medicine, Dr. John R. Evans.

Change and the Medical School

There is no record of any response from the Dean, but in February 1967 he met with Thode and Petch to discuss the future of the Departments of Nursing, Biochemistry and Biology. Regarding the Department of Biology, the summary of the meeting's conclusions prepared by Evans states:

Although Human Biology will be active in the Faculty of Medicine, this should be managed on a cross appointment basis. Biology ... has its major responsibility to the Dean of Science for academic matters ... administrative responsibility for [it] should be through the Dean of Science to the Vice Presidents of Science and Health Science. Deliberative activity of the Department should be in the Councils of the Faculty of Science, Division of Science and the Division of Health Science, and possibly in the Faculty of Medicine to a lesser degree.

The summary of the whole meeting concluded:

The logical goal towards the end of the decade might be the evolution of a Faculty of Life Sciences, including Biology, Biochemistry, Psychology, and possibly Physiology, Genetics or other Biological Science Departments. The geographic grouping of facilities and the Biomedical Library would favour such a concept.

This suggestion was never developed. As for the qualms of the Biology faculty, the Department was to suffer no major administrative problems with the Medical School. In fact when I became Chair of Biology, the Faculty of Health Science invited me on to the Faculty Council. From the time the Medical School began, Biology also received help in undergraduate teaching from their faculty. Dr. Fraser Mustard, Chair of Pathology, contributed to an important Year III course from 1967 until 1972 when the Health Sciences Centre opened. Another was Dr. James Anderson, Chair of Anatomy, an interesting man who started a Cool

BIOLOGY AT MCMASTER

School in Hamilton for youths like a son of his who didn't fit into the normal, regulated high school. He gave a course on Human Ecology and Evolution throughout the 1970s that attracted substantial numbers of students. Other faculty members in Health Science contributed in later years, including Drs. Rick Butler, Jack Gauldie, Ken Rosenthal and Jim Smiley.

THE DEPARTMENT REFORMED

1966: Stich became Chair. 1967: Mak, Prevec and Bayley appointed; RUMBBCBP disbanded. 1968: Stich, Kleerekoper and Radforth resigned, MacClement retired; Bayley became Chair. 1969: Stewart resigned; Davidson, Lott, Morton, Chapman, Kershaw and Harris appointed. 1967-68: the University Administration was reorganized; students were admitted to membership of the Senate and University committees; the Faculty Club and a student pub opened. 1969: the Biology curriculum was extensively revised; the Provincial Government adopted Formula Financing and the University budget was tightened. 1973: the problem of a replacement for Chapman; Longstaff appointed. 1974: the National Cancer Institute of Canada established a Cancer Group at McMaster and Graham was appointed to the Department; Davidson became Chair.

In the years immediately before 1966, the Department was affected largely by changes that impinged on it from the rest of the University. For the next several years there were to be radical changes within the Department itself, the first and one of the most important being the appointment of a new Chair.

After Radforth's many years as Head and Chair of Botany, his six-year term as Chair of Biology expired in 1966. He had been elected a Fellow of the Royal Society of Canada in 1959, mainly for his major contributions to an understanding of muskeg, but this research took him away from campus a good deal and it had become more concerned with the mechanical rather than the botanical aspects of muskeg. Kleerekoper had been Chair of Biology for seven years, and although he was an excellent fish physiologist, he was spending much of his time analyzing bottom sediments from Cootes Paradise for chemicals excreted by aqueous animals. Although no records appear to have been kept of discussions regarding a new Chair, it is easy to imagine senior members of the University, such as Thode and Petch, insisting

that someone active in a modern field of biology should be appointed to revitalize the Department. One of the people whose advice they may have sought was Dr. Louis Siminovitch, a senior cell biologist at the Ontario Cancer Institute in Toronto. At the time, Siminovitch had a close working relationship with Dr. Hans Stich in the Biology Department at Queen's University in Kingston, and it may well have been on Siminovitch's recommendation of Stich that McMaster decided to appoint him.

Stich persuaded Dr. Stanley Mak in the same department at Queen's to move with him to McMaster. Stich's research interest at the time was in the role chromosomal damage might play as a cause of cancer. A promising model for this was a human adenovirus that caused chromosomal damage in rodent cells and Mak moved into this area by first spending a year in an adenovirus lab in St. Louis, Missouri.

On arriving in the Department, Stich set about strengthening molecular biology by recruiting Dr. Ludvik Prevec, a post-doctoral fellow at the Wistar Institute in Philadelphia, and me from the National Research Council labs in Ottawa. The two of us and Mak joined in 1967. Like Mak, Prevec worked on an animal virus and McCalla remarked that people in the Department felt Stich pulled it towards virology. There might well have been just as much concern over the fact that all three of us had undergraduate degrees in Physics; Mak and Prevec went on to take their PhDs at the Ontario Cancer Institute in Toronto; I took mine at King's College, London, in the biophysics group best known for the X-ray work of Wilkins and Franklin that Watson and Crick used in arriving at their model for DNA.

To the disappointment of several of its members, the Research Unit in Molecular Biology, Biochemistry and Biophysics was disbanded in 1967, the justification being that the Unit competed directly for personnel and space with Stich's plans for the Department of Biology. Another factor contributing to the Unit's demise might have been the creation of the Department of Biochemistry, which came into being the same year from a nucleus

The Department Reformed

of biochemists from the Department of Chemistry with Dr. Ross Hall, a new appointee, as Chair.

In December 1967 Stich announced that he was resigning as Chair of the Department of Biology, and by the following May he had left for a research position in a cancer group in Vancouver. His resignation was followed by a spate of others. In July 1968 Kleerekoper took a position at Texas A & M University, MacClement retired to British Columbia, and Radforth moved to the University of New Brunswick. In the course of his muskeg work at McMaster, Radforth had created an interdisciplinary Organic and Associated Terrain Research Unit. In June 1964 he had asked Thode to have this recognized by the University as a Research Unit but without success, and the position at UNB promised him a better chance of expanding his research. Also in 1968 Stewart announced his intention to leave, moving a year later to a position in Manitoba. The previous few years had been unsettling times in the Department that probably contributed to the decision of the senior members to move elsewhere, but their departure represented a significant break with the past, particularly in Radforth's case. The effect of all these resignations, though, was to leave the Department badly depleted.

Here was an excellent opportunity to rebuild a Department of Biology that should have attracted a biologist with ideas. In the 1960's however, the expansion of universities generally had created a buyer's market for academics, and although the University advertised the position of Chair widely, there were few applicants and none who were judged suitable. The administration then asked whether I would be willing to serve as Acting Chair. My reaction was that it would take me just as long to learn the job of Acting Chair as it would for Full Chair and if they wanted me they should make me Full Chair. They did and I assumed the position in late May.

The University was taking a risk in appointing me. Until I joined McMaster the previous year, I had never worked in a biology department; my only experience after leaving King's College

in 1952 had been 15 years in the Biosciences Division of the National Research Council Laboratories in Ottawa. My main concern in taking the Chair, despite my lack of experience, was over the decisions that had to be made in rebuilding the Department and in planning the new Life Sciences Building. I felt it was important for a member of the Department to serve as Chair to ensure that these decisions took proper account of the needs and wishes of the Department – and I was willing to do so if no one else was.

When I was first appointed, John Evans, Dean of the Medical School, invited me for a meeting at which he recommended that I should tour the US to identify the most promising areas of biology on which to build the Department. Such a tour was not possible, but before I became Chair, the Department had already decided the direction it should take rather than leaving it for the new Chair to do. The choice was cell and molecular biology and mathematical ecology. Molecular biology had already been strengthened with the arrival of Prevec, working on the molecular biology of vesicular stomatitis virus, an RNA virus, Mak with his work on a DNA virus, and myself studying the molecular biology of an extremely halophilic bacterium, which was a curiosity then but later was one of the first organisms to be recognized as a member of the archae. In cell biology, the needs were for an electron microscopist working on the fine structure of cells, particularly of plants. Undergraduate teaching required someone to teach animal physiology and it was decided to seek an animal ethologist able to do this. At the same time as these discussions were going on, the Faculty of Science decided to extend work in biophysics and to this end the Department was allowed to appoint two biophysicists.

In early summer 1968 we advertised all of these positions in North America and as a result Dr. John N.A. Lott, a plant anatomist, and Dr. Richard A. Morton, a biophysicist working on cytochrome c, were appointed. An application from Mr. Harold Chapman, an animal physiologist, presented a problem. He was

The Department Reformed

working on his PhD at the University of Pennsylvania on a visa and was unable to leave the US, so a delegation from the Department interviewed him in Buffalo airport. He was appointed and all three new members joined the Department in July 1969. In the meantime, negotiations were completed with Dr. Douglas Davidson, a plant cell biologist, and he arrived on January 1, 1969.

Our advertisements in North America for a mathematical ecologist brought no response, but there were several applications from advertisements we subsequently placed in the UK. Early in 1969 I flew to London to screen the candidates. I had asked the office of the Association of Commonwealth Universities to provide facilities in which to hold interviews. I was greeted at their office by an official who apologized that all their rooms were booked and so he had to put me in the Annex. I had visions of holding interviews in a converted storeroom. Instead the Annex turned out to be Marlborough House, a former royal residence where Queen Mary, grandmother of the present Queen, had lived before her death in 1963. I was led up a wide, sweeping staircase surrounded by murals of the Duke of Marlborough's battles into a large, high room with floor to ceiling windows overlooking the Mall, the processional route to Buckingham Palace. This was where the interviews were to take place and I worried that candidates might gain a false impression of what they could expect at McMaster. Two of the applicants I saw there were chosen – Dr. Kenneth A. Kershaw as full professor and Dr. Graham P. Harris as assistant professor, the latter having just completed his PhD with Kershaw at Imperial College, London.

Kershaw, a quantitative plant ecologist, was attracted by the CDC 6400 computer at McMaster, which was one of the more advanced computers of its time. In appointing both a professor and his former student, we recognized the risk we were taking but Kershaw and Harris were by far the best candidates. Unfortunately the worst happened. They had intended to continue to collaborate in research at McMaster, but they were both

strong-willed individuals and within a few months of arriving they had a disagreement and went their separate ways.

The Department was not alone in undergoing changes during this time. Between 1967 and 1968 the University was reorganized into Divisions, each under a Vice-President, and the Faculty of Arts and Science was divided into several new Faculties. The splitting of this Faculty had been proposed in 1956 to strong protests from across the University. It was considered again in 1962, when members of the Department of Biology felt that it 'would be particularly bad for biologists as we often have more receptive ears in Arts departments than in other Science departments.' But times had changed, especially in Biology which now became part of the Faculty of Science within the Division of Science and Engineering.

In the 1960s students also helped bring about change. It was a time of student discontent in many countries with students protesting their treatment by universities. Sometimes they used rather drastic means – in the spring of 1968 in Paris, they rioted. At McMaster undergraduate and graduate students petitioned Senate to allow them to participate in University government, with representation on Senate and on committees across the University. In the fall of 1968 they were granted membership on all of these bodies except for matters where their presence was inappropriate. In early 1969 the Department of Biology voted to allow as observers two graduate students and one undergraduate at Departmental meetings that were not closed, and one each at curriculum committee meetings. Two PhD students, Barbara Harvey with Oaks and Ken Johnston with McCandless, attended their first Departmental meeting in April. By October 1970 the Biology Club had been reestablished and an executive elected, and in November it began sending a representative to Departmental meetings. The next month, in response to students' demands, the Department made all the student representatives full members with the right to vote and introduce motions.

The Department Reformed

Barbara Harvey and Bert Rima, a PhD student with Takahashi, were the most politically conscious students I ever met in the Department. They were both NRC Scholarship holders, very intelligent and a pleasure to talk to – Bert Rima used to lecture me on how I should deal with the Administration. After completing their PhDs, the two of them left for Queen's University in Belfast, Northern Ireland in the early 1970s. This was at the beginning of Northern Ireland's 'troubles', which over the next 30 years would have given them plenty of exposure to politics.

All of the changes at McMaster at this time were accompanied by another important development but of a different kind. In September 1967, the University was still small enough for the whole faculty to gather in a single lecture hall for the first meeting of the new academic year. There the Vice-President Administration, Mike Hedden, announced the opening of the Faculty Club (later the University Club) in the Alumni Building. The most memorable part of this announcement was when he went on to explain that a licence for selling liquor had been applied for, but it had been delayed and for the moment the Club would operate on a temporary licence. He apologized profusely that under the temporary licence the bar could only be open a few days a week. Whatever its temporary limitations, the sale of liquor in the University was a momentous change that must have caused the founders of the University to turn in their graves, when alcohol consumption on campus had been abhorrent to them for so long. (One feature of the bar of the Faculty Club in its early days was an elderly Hungarian barman who could pour 12-layered *pousse cafés*.) But faculty were not alone in gaining access to liquor on campus. In November 1968, students acquired their own outlet when the McMaster Students' Union sponsored a pub, the Rathskeller (the 'Rat'), in the basement of the Refectory Building. This was joined in 1972 by the Downstairs John and the Graduate Student Lounge, both in Wentworth House.

Throughout this time the undergraduate curriculum continued to occupy a great deal of the Department's attention as it had

in previous years. The introductory course, Biology 1A6, was presenting problems. One was the size of the class, which had reached 262 by September 1967 compared to 115 in 1962-63. To accommodate this number of students in the lab space available, labs had to be held in mornings as well as afternoons. As an alternative, MacClement made a case for open labs running 12 to 15 hours a day. These would involve self-directed learning with students working at study carrels equipped with audio tapes and videos or film clips, but this idea was not pursued.

A more serious problem was with Biology 1A6 itself. It was a survey course taught by several different instructors and students complained that it was difficult adjusting to a variety of lecturing styles. They also complained the labs were not well organized. Furthermore there were students in the course who had taken high school biology and others who hadn't, which made it difficult to choose subject matter that challenged both groups. To solve this latter problem the Department proposed that students who had done well in high school biology should be allowed to replace Biology 1A6 with Year II Biology courses. This was rejected by the Administration as it conflicted with the rule that entering students take a common Natural Sciences Year I. As time passed, the Department felt that more and more students were regarding 1A6, rightly or wrongly, as a repetition of high school biology with the real work beginning in Year II. The result was that they were entering Year II with little better understanding of biology than they had had at the beginning of Year I.

The solution the Department chose in 1969 was to abolish Biology 1A6 and replace both it and the existing Year II Biology courses with the following four 6-unit courses:

1B6 *Cell Biology and Physiology*

1C6 *Genetics*

1D6 *The Plant Kingdom and Ecology*

1E6 *The Animal Kingdom and Ecology*

The Department Reformed

In their first two years, Biology students were required to take 1B6, 1C6 and either 1D6 or 1E6 in whatever order they chose. In 1D6 and 1E6, the Ecology portion was common and the parts of these courses were offered separately as 1D3 The Plant Kingdom, 1E3 The Animal Kingdom, and 1F3 Ecology. By 1972-73 there was a total of 746 students in all these courses, two of them having over 200 each.

The curriculum for Years II, III and IV, which had been arrived at after so much effort in 1965 and gave students almost complete freedom of choice, only lasted for the year 1966-67. This arrangement had required each student's selection of courses to be decided in consultation with members of the Department and then approved by the Chair. This was a daunting prospect for the Chair, and under Stich the curriculum reverted to the normal pattern that specified all courses except a few electives. However the idea of students being given freedom in the curriculum had not died, because in 1970 the Department discussed another scheme that appeared in the Calendar for 1972-73 as follows:

For students who have demonstrated high academic potential, a program of unstructured work is available in Years III and IV. "Unstructured" implies work not necessarily defined by the description of Biology course(s) in the Calendar, although the work will be in the general area(s) represented by the course title(s).

This high-minded arrangement is surprising for two reasons; firstly that it was passed by the generally conservative curriculum committee of the Faculty of Science, and secondly that it survived in the Calendar for four years. It was not a success – only two students were accepted into the program; this was in the second year it was offered but it was not long before it became clear that they had no concept of independent study. Another arrangement was introduced in 1973 when students in Honours Biology interested in interdisciplinary studies were allowed, after consultation with the Chair, to take some selected

courses from other departments in place of Biology. It was later pointed out that with this measure the Department was giving away some of its income, a not unimportant consideration as we shall see below.

With contributions from the new faculty members, the range of courses offered by the Department expanded significantly and by 1972-73 there were in Years I and II altogether six courses for a total of 31 units; in Year III, 15 for 66 units; and in Year IV, 14 for 43 units. One of the new offerings given in the summer of 1973 is particularly worth noting. With members of the Geography Department, Kershaw had earlier received substantial support from the Arctic Land Use Research Program of the Federal Department of Indian and Northern Affairs for studies in the Arctic, and in the summer of 1973 he held a field course at the research base he had established. In my report as Chair to the President that year I stated that

Perhaps the most significant (certainly the most expensive) event in the undergraduate program of the year was the Year IV Field Course in Ecology, which was held at Kershaw's research site on Pen Island on the shore of Hudson Bay. Seventeen senior undergraduates participated and were uniformly enthusiastic about their experiences. They all regarded it as a significant educational experience and well worth the investment McMaster made, in addition to what it cost the students themselves. It was a pity the University did not capitalize on this venture by publicizing it more; it was much more sound scientifically than some of the exercises in "Environmental Studies" at other universities.

A major improvement made to the curriculum at this time was to give Year IV Honours students an opportunity to work on a project in a research lab under the direction of a faculty member. In the Calendar for 1974-75, students had two ways of doing this: they could take 4F4 *Selected Topics in Biology*, later

The Department Reformed

renamed *Senior Project*, or if they had first class standing, they could undertake a more substantial project in a new course, 4C8 *Senior Thesis*. This thesis course was particularly successful and over the years some of the students who took it had their work published in refereed journals. The 1974-75 Calendar also introduced a new, ambitious course taught by Harris and faculty from other departments: Science 3B6 *Environmental Studies – interdisciplinary investigation into the physical, biological, chemical, geological, economic, political and medical problems in today's society*. A specific topic was to be chosen each year.

Since 1969, the Department had offered a Science course specifically for students in Humanities and Social Sciences, who were required to take 6 units outside their own field. This was Science 2B6 *The Nature of Living Matter: Analysis of processes in living systems and ideas interpreting these processes with emphasis on the relationship between man and his environment*. It was initially given by Doris Jensen, who later shared it with Chapman. Among the unofficial names by which it became known was Sex and Sewage, with Jensen dealing with sex in the first term. Her lectures turned out to be eye-openers for many students, particularly the men who sought explanations from women students in the course for the more obscure points. In 1969-70, the enrolment was between 700 and 800.

With the new faculty appointments, membership in the Department reached 18 for 1969-70, which was the same as it had been in 1967-68 before the resignations. Nevertheless the position for a second biophysicist was still vacant as we had been unable to find a suitable candidate, and in the spring of 1969 there were prospects of further increases in the numbers of both biologists and biophysicists. However this was not how the Department was to develop, because towards the end of that year the Administration announced that economy measures had to be introduced. Bourns, Vice-President of the Division of Science and Engineering, stated that the University was no longer in an expanding situation and the Division had no reserve funds. For

1970-71 there were to be no further faculty appointments and the Departmental budget was to be cut. It is an interesting reflection of those times that we were also asked to confine long-distance phone calls to urgent matters because of their cost.

The cause of McMaster's financial squeeze was the decision by the Provincial Government to introduce Formula Financing, under which a university's income was determined by the number of Basic Income Units (BIUs) generated by each registered student, ranging in Science from one unit for a Pass BSc up to 6 for a senior PhD student. This move marked the beginning of a long, steady decline in Government funding of Ontario universities. The solution for McMaster was to offer more courses and to that end Senate committed the University to Adult Education, partly in the belief that the local population could support a full BSc program by part-time study. Bourns' opinion as Vice-President was that Departments should be less parochial in their attitudes and he asked them to consider giving courses in the twilight zone, 5:30-8:30 p.m. The Department responded by offering in summer 1972, Biology 1C6 taught by Threlkeld, and in winter 1972-73, Biology 1D3, 1F3, and 3A4 *The Structure and Function of Plants*, all taught by Lott and Harris.

Having lost the prospect of further faculty appointments in 1969, the Department now learned a disturbing fact about its existing complement. Formula Financing made it possible for the Administration to estimate from the number of students taught whether a department was paying its way. In June 1972 Biology was informed that, while other Science departments were understaffed, we had one too many members. To illustrate the Department's position, I distributed the results I got from applying the Administration's formula to each faculty member, without identifying them individually. Out of the 18, the teaching loads of only six generated a full faculty position or more. As a further example, I showed that a hypothetical member teaching two 4-unit courses, one to 20 students, the other to 30, and supervising two MSc students and one PhD, a teaching load that

The Department Reformed

at the time I considered reasonable, generated only two thirds of a faculty position. I concluded that ‘from the point of view of good education the formula is wrong, but under the present conditions, large first year classes and service courses heavily subsidize the rest of our program.’

It was unfortunate that the Department had to face this situation at this particular time. While Chapman had been at McMaster, he was distracted by an unpleasant divorce and his performance had suffered, so that when his initial appointment ended in 1973 he was not reappointed. The Department felt strongly that he should be replaced by an animal ecologist to strengthen ecology and balance the undergraduate program, but persuading the Administration to grant this was clearly not going to be easy. When McCalla, then Dean of Science, was asked he pointed out that it was difficult for him to allow us to replace Chapman when the Department of Psychology could justify a 50% increase in faculty. One factor that contributed to that Department’s favourable position was its Introductory Psychology course which was attracting unusually large numbers of students – unusual for that time, that is.

To strengthen our case the Department agreed to further courses in Adult Education, and over the following eight years it offered six or more units every winter, and six units in each of three summers. Most of these were Year I courses but in winter they included two Year III 6-unit courses, *Cell Biology* taught by Dingle and Davidson, and *Comparative Anatomy and Evolution of Vertebrates* taught by Westermann. Each year during the same eight year period, Biology also offered in the regular Calendar up to 11 units of Science courses for non-Science students: Jensen’s *The Nature of Living Matter*, later replaced by *Parasites, Animals and Man*; Sorger’s *Man’s Supply of Food*; Prevec’s *Viruses and the Nature of Life*; and from a later arrival in the Department, Dr. Rama S. Singh, *Heredity, Man and Society*. Two other factors weighed in our favour. One was the wide diversity of topics that had to be covered in a Biology degree program

compared to those in other Sciences, all of which required specialists to teach them properly. The other was the steadily rising enrolment in Biology (Appendix A, Figure 2). Considerations such as these, together with the promise of the extra courses, convinced the Administration to allow us a position in animal ecology. After advertising extensively in the US and the UK, in 1973 the Department appointed Mr. Barry Longstaff, who was completing his PhD at the University of York in England.

In the Spring of 1973, the University accepted an offer from the National Cancer Institute of Canada to establish a Cancer Group at McMaster in the Pathology Department of Health Sciences. This was to study oncogenic viruses and to be headed by Dr. Bill Rawls. As the Department of Biology already had Mak and Prevec working on animal viruses and in Mak's case on an oncogenic virus, Dr. Fraser Mustard, Dean of Medicine and Chair of Pathology, offered to appoint a senior member of this Group jointly to the Departments of Biology and Pathology with their lab in Biology. The conditions for the appointment were that NCIC had to guarantee support for six years, but if at the end of that time it decided to withdraw support, the Department had to provide the virologist with a tenured teaching position.

This offer presented an opportunity for the Department to expand intellectually, to strengthen research in virology and to increase the number of graduate students. On the other hand, because the NCIC imposed a limit on the amount of teaching members of the Group were allowed to do, the appointee would enjoy the full privileges of membership in the Department while teaching less than others. There were differences of opinion on the proposal but it was accepted on condition that the Department receive a written commitment that the person appointed would not be counted as part of Department's teaching strength, and that should tenure be considered it should not be given on research alone, but should take into account the person's teaching ability and their potential teaching contribution in the Department. The

The Department Reformed

person chosen for the position was Dr. Frank L. Graham, who had a background in physics, having obtained an MSc at the University of Toronto in Theoretical Physics before moving to the Ontario Cancer Institute for his PhD. He joined McMaster in January 1975. Fortunately the selection committee did its job well in selecting him, as the NCIC and the Department had no problem with his appointment six years later.

In 1974, my term as Chair ended and Davidson assumed the position.

THE MATTER OF SPACE

1946: cramped quarters in Hamilton Hall. 1963: some relief in the General Sciences Building. 1966-74: the economic design and construction of the Life Sciences Building.

While the Department consisted of one or two people, space at the Toronto campus and in Hamilton Hall was not a major concern. This changed after the Second World War when the Department expanded, enrolment increased, and the School of Nursing moved to McMaster and was given accommodation in Hamilton Hall. Nursing remained there until it moved into the new Medical Centre in the summer of 1971. The shortage of space in the Department of Botany was illustrated in the minutes of the Departmental meeting in October 1950 described in Chapter 3. Davies related that when he joined the Department of Zoology, he had to convert an undergraduate lab in the summer for his research.



Hamilton Hall in the 1940s

The Matter of Space

In the mid-1950s though, the newly combined Department of Biology did gain some extra facilities. One was a new greenhouse, built south of Scholar's Road opposite the Refectory. At a Departmental meeting in 1955 to discuss its operation, Radforth thanked MacClement for his work during the planning and construction of it. In 1954 the Departments of Chemistry, Physics and Mathematics moved into the newly completed Burke Sciences Building. This made room in Hamilton Hall for the Department of Biology to acquire constant temperature rooms; it also allowed the Geography Department to move in from a temporary building on campus, and gave the Nursing School better accommodation. To prepare for these changes, Hamilton Hall was renovated to remove what *The Silhouette* in 1955 called 'outmoded facilities, dusty wooden floors and poor lighting' that had made 'delicate lab work' virtually impossible. The writer was evidently unaware of the microscopy that biologists, and particularly Smith, had successfully carried out there over the previous 25 years. One improvement these renovations did not include was to the power supply. In the room Threlkeld occupied when he first arrived, his microscope lamp dimmed whenever the refrigerator came on.

Even with the gains the Department had made, space and facilities continued to be a concern for the biologists. Over the years that followed, the Administration proposed a series of arrangements to give the Department more room. In March 1957 hopes were raised when the Chair asked members to estimate what space they would require in a new building for their teaching, research and graduate students by 1960. These hopes were dashed in May 1958 when it was announced that the science building being planned was not slated for Biology or Geology. In December 1958, the possibility was discussed of making Hamilton Hall a Biology building. Construction of the Engineering Building began that year, and early in 1959, in answer to a strong brief to the Administration, the Department was asked for a statement of its space needs 'with an eye to the use of room available

BIOLOGY AT MCMASTER



The Research Greenhouse in 1955



Dr. MacClement with a biology student, Ann Turner, in the new greenhouse

The Matter of Space

in the Engineering Building during the next few years.’ The Department had reservations about this arrangement, but relief in another form was in sight in September 1959, when the Chair was able to state that the Department of Geography was moving into the Engineering Building and Biology was getting most of the space they were vacating. It was agreed the Chair should allocate this space; Kleerekoper declared later that it had been an extremely difficult and thankless task. The space allowed some larger undergraduate labs, extra research labs, offices for graduate students and three rooms for Threlkeld, the newly appointed geneticist.



The General Sciences Building in the 1960s

In 1963 the General Sciences Building was completed and all the members of the Department of Biology who were in the Research Unit were given labs and offices there. The labs had been tailored to the needs of individual biologists. Nace occupied two of them, in which he had running well water and electrical outlets every few feet along benches and walls. After he left, Threlkeld took over one of them and now declares that he never had a nicer lab in his life. When Stich arrived, he established

the Departmental office and his own lab in GSB, together with an RCA transmission electron microscope. Later, Mak, Prevec, Davidson, Lott, Morton and I were accommodated there as well.

In the mid-1960s, the University decided to construct a building to accommodate a Tandem Accelerator for the Physics Department at the rear of the General Sciences Building, on the site occupied by the greenhouse of 1955. The University compensated Biology by replacing this greenhouse and the one from 1930 with the present one next to Hamilton Hall, completed in 1967. There appears to be no record of how the design of this greenhouse came about, but when Lott arrived in 1969, it became a continuing problem for him as its open plan prevented plants from being grown under different conditions of light, temperature and humidity. In addition, part of the basement had been designed as an electron microscope laboratory, but it was useless for this purpose because of the humidity and dust in the building. Nevertheless by the early 1970s, Alec McCrory, the greenhouse man then, had developed a fine display of plant species in the main area. It was vandalized once, probably by a disgruntled assistant McCrory had fired. The incident was reported in *The Silhouette*, which then had an imaginative editor, Dave Thomas, one of several undergraduates at the time, including Eugene Levy, Martin Short and Ivan Reitman, who went on to make successful careers in television and films. To show off McCrory's display, *The Hamilton Spectator* photographed an attractive red-haired secretary from Biology seated among the plants, wearing a modest bathing suit.

In 1964 meanwhile, Petch agreed to provide Hamilton Hall with an animal room and he appointed Radforth and Miller to a planning committee to consider future accommodation up to 1970 in a proposed Life Sciences Complex. By 1966 the University's intention to provide Biology with a new building of its own together with a budget for new equipment had become firm, and late in 1967 the Department was given a figure for the space that

The Matter of Space

would be available in the building and asked to decide what its needs were and how the space should be used.

At the beginning suggestions were made for labs meeting individuals' own requirements. Bourns, Vice-President of Science and Engineering, soon made it clear, however, that the practice of providing tailored labs as happened in GSB was an expensive luxury when later they had to be altered to serve different needs. (This was the case after the Department of Biology left GSB, when the space it vacated was assigned to mathematicians and all the fine lab features were torn out.) The Biology building, he affirmed, was to be designed and built within a limited budget. For the Department this was an unfortunate consequence of having it start after the Provincial Government had ended the generous funding it had given universities in the 1960s and replaced it with Formula Financing, the much more stringent system based on student numbers that was described in the previous chapter.

Stich gave Mak the task of assembling the Department's estimates of its space needs and negotiating with the two firms of architects that had been appointed by early 1968, one to design the overall form of the building and its exterior, the other the interior. The initial plan for the building was not satisfactory and Bourns had the two firms exchange responsibilities. (The final design allowed for up to two more wings to be added later so that the building could eventually form a hollow square. So far, this has not happened.)

The total area that Mak initially calculated to meet the Department's requirements exceeded what the budget allowed. To reduce this so that construction could go ahead, the sizes of the animal facility and the core facilities on each floor were decreased and the number of undergraduate labs was cut from twelve to eight. Eight labs, however, were not sufficient to accommodate all of the undergraduate classes requiring them. The solution was to use spare research labs on the third and fourth floors. Research labs were of two sizes, 600 and 900 square feet,

and were planned by a lab designer for different types of lab work, with predominantly high or low benches and with or without a fume hood.

Space that contributed directly to the primary function of the building was termed assignable space. When the building was designed, Bourns insisted that this had to be increased as much as possible and the space that was not assignable, such as corridors and staircases, decreased. This is the reason that LSB lacks a formal entrance and staircase, and the staircases and corridors are narrower than those in older science buildings on campus. There were other economy measures as well. Two elevator shafts were installed but the second elevator was not fitted until a number of years after the Department moved in. The building was also designed to have glass windows along the whole exterior walls of the offices, but to save money Bourns had alternate panes of glass replaced by metal panels. A year or two later he announced that extra money was available and if we wished we could have the metal panels replaced with glass, but the faculty voted to spend the money in other ways.

Construction began in 1970 and the Department moved into the completed building in May 1972, to be greeted by an interior painted in the fashion of the 1970s with bright but different primary colours on each floor. Also typical of 1970s was the bold, simple exterior. This was not to everyone's taste but at least the building held its own against the giant Health Sciences Centre next door that was built concurrently. It has been suggested that Evans, Dean of Medicine, was responsible for the Biology building being built next to the Centre with a bridge connecting the two. Whether or not this was the case, Biology was given a desirable site and the last one available facing the open area in the centre of the campus. Furthermore the bridge made it easy for people to have contact and to collaborate with those in the adjacent building for both teaching and research (and, of course, for everyone in LSB to have access to the cafeteria, coffee shop and gift shop in the Medical Centre). The Life Sciences Building

The Matter of Space

was officially opened by Dr. Harry Thode, University President from 1961 to 1972, on 14 September 1972, with a lecture in the evening by Dr. T.M. Sonneborn of the University of Indiana.



The opening of Life Sciences Building in 1972.

Left to right: Dean D.R. McCalla, Dr. S.T. Bayley, former President Harry Thode and Dr. T.M. Sonneborn.

The move into LSB went smoothly except for one thing. Safety regulations required that all laboratories have access to eyewash fountains and showers in case anyone became contaminated with a corrosive chemical. To meet these requirements, fountains and showers were fitted in the corridors of the building. However, in an effort to save money, it was decided not to install drains in the corridor floors and not to provide the showers with automatic shut-off valves. The flaw in this arrangement became apparent as soon as we started moving into the building, when equipment occasionally snagged the chain that controlled the shower

and started it. The shower was turned off by another pull on the chain, but this wasn't immediately obvious to everyone. There was also the temptation for people to deliberately leave showers running, which was the cause of a number of serious floods in the building. We had the showers disconnected and later replaced by hand showers in each lab. The eye fountains are still there.

Despite the very economical way in which the Life Sciences Building had been constructed, it provided facilities that, together with equipment covered in the budget, were a great improvement on what the Department had before. In the basement was an extensive electron microscope facility equipped with one of the best transmission electron microscopes of the time, a Phillips 300. There was a central preparation room for undergraduate labs, plant growth chambers, animals rooms, a glass-washing facility, dark rooms for light microscopy and photography, cold rooms, freezers and the tools of molecular biology at the time, ultracentrifuges and scintillation counters for measuring radioactivity. There was also a sizable lounge and a meeting room in 213 and 213A. At Westermann's suggestion, a reading room was created for faculty and graduate students in Room 216. The move did create one problem as it separated the Department from the greenhouse. This was not unexpected since it was made clear when the University first decided to build LSB that it would not include a greenhouse. The result though was that Lott, over the many winters he taught the undergraduate plant anatomy course, either had to transfer plants to LSB in heated vans or have students transfer themselves to the greenhouse.

A notable effect of the Department being in LSB was an improvement in the quality of undergraduate education. Lab sessions gained from having the teaching labs adjacent to the preparation room, and the contact students had with faculty was much better with student labs and faculty offices in the same building. Contacts were further improved by more activities of the Biology Club.

Inevitably there were changes in the use of space in LSB from

The Matter of Space



The Life Sciences Building in 1972.

The bridge to the Health Sciences Centre can be seen in the lower picture.

what was planned. The original intention had been to have a storeroom in the basement, where supplies could be bought on research accounts. As a temporary arrangement when the building was first occupied, the storeroom in the Health Sciences Centre was used. This proved satisfactory and one was never set up in LSB. For a number of years there were secretaries in separate offices on each of the third, fourth and fifth floors to serve the

faculty on those floors; eventually these secretaries were moved to the main office on the second floor. Initially there was space to spare in the building, and on a temporary basis offices on the third floor were used by the University Research Accounts Department. Room B123 in the basement was originally a store-room for Operations and Maintenance; it was then occupied by the McMaster Credit Union before it became a molecular biology facility (see Chapter 7).

Unallocated research labs were taken over by faculty. As more faculty were appointed it became necessary to use space more effectively, and in the spring of 1982 a Space Committee was formed with Morton as chair, charged with reviewing the use of space annually. One of the main tasks this Committee had to perform, and a thankless one, was prising loose space in research labs from professors whose numbers of graduate students were declining. To accommodate further increases in personnel, part of the lower entrance hall and a lounge on the first floor were converted into offices. By the late 1980s, spare space had long since become a thing of the past, and with increasing enrolments and extra faculty, the restrictions placed on the size of the building when it was planned began to create ever more serious problems.

Soon after it was occupied, the University granted money for art in the building. A selection committee was set up with Davidson as chair. The pride of the collection they made is the Inuit prints in the seminar room, Room 213A. Other, cheaper prints were mounted on corridor walls. Some time later we arrived to find the corridor walls bare. An officious member in the Building and Grounds Department of the University had discovered that we had never obtained permission to mount art on corridor walls and he had it removed. He was sacked and the damaged prints roughly nailed back up. Fortunately the prints in 213A had been overlooked and were not touched.

STEADY PROGRESS AND RETIREMENTS

1973: An undergraduate drop-in centre was formed. Pohl, Procwat and Service were made Instructional Assistants. Biology enrolments still increased, and the diversion of students into other Sciences was considered. 1975-89: Years I and II courses were revised; new joint programs were introduced, including a co-op in Biology and Pharmacology. 1977: Threlkeld became Chair. 1975-80: appointments of Singh, Wood, Chen, Sonstegard, Rollo replacing Longstaff, and McDonald. 1983: McCandless died. 1984-87: appointments of Nurse, Finan, Rainbow, O'Donnell and Lee. Resignations in 1983 of Harris and in 1988 of Chen. 1983: Mak became Chair; Sonstegard's appointment was not renewed and he left in 1985. 1986: Threlkeld became Chair again. Members of the Department relaxed with baseball, hockey, Chinese meals and Christmas parties. 1984: an internal review found good and bad qualities in the Department. 1985: the Institute of Molecular Biology and Biotechnology (MOBIX) was formed. 1984-90: there was heated debate over the future of Department following the retirements in 1984-92 of Davies, Miller, Kershaw, Davidson, Mak, Oaks, Westermann, Threlkeld, Takahashi and Bayley. 1988-1992: appointments of Kolasa, Jacobs, Schellhorn, White as Chair, Gibbs, Weretilnyk, Chow-Fraser and Campos. 1994-2005: retirements of Jensen, Dingle, Morton, Prevec, Graham, Sorger and Lott.

Having undergone years of change, the Department of Biology now began a period of steady but small growth in faculty numbers. This was driven largely by substantial increases in undergraduate enrolment, notably from 1970 to 1976 and again from 1983 to 1990 (Appendix A, Figure 2). To provide tutoring and other help for students in their studies, particularly in the junior years, a resource room and drop-in centre was set up in 1973 in Room 215. When it was first opened, it was staffed by Dr. Elizabeth Mills; later Mr. Ray Procwat took over and is still there. He, Mr. Herb Pohl and Mrs. Margaret Service were appointed Instructional Assistants. Mrs. Service acted as a tutor to Year I students and she was well liked by them. It was sad when

she died some years later from leukemia; in her memory the graduate students set up an award in the Department for service to teaching. As her replacement, Ms. Beryl Piccinin, who had obtained her MSc with Harris, was appointed in 1987. It was sad that in 2008 she also died after a long fight with cancer. To help senior students a system was begun in 1969 in which students were assigned randomly to a faculty member as an Advisor. This worked moderately well as long as the Department was small, but by 1983 it had become larger and more impersonal and the scheme was ended.

In graduate research, faculty offered courses covering the broader aspects of their research interests, as was always the practice. In some areas, students were able to widen their choice of courses by taking an appropriate one in another department. For many years the Departmental qualifying, or comprehensive, examination required PhD students to answer four or five questions, which were chosen from two areas of biology by agreement between the student and his or her supervisory committee. The student was given an hour alone to prepare answers and was then examined on them by a panel of faculty members. The Department had a continuing series of seminars with outside speakers, and for a time lunchtime seminars by faculty and graduate students were very successful. There were also journal clubs and work-in-progress sessions in specialized areas such as fish physiology, ecology, molecular biology and virology, often attended by members from other departments.

The courses the Department offered in the Honours program for 1975-76 are listed in Table 7.1. By 1975 enrolments in undergraduate Biology programs were causing McCalla, then Dean of Science, a concern that was the opposite of the one Dean Burke had had in 1940. Of all the students in Honours Science, 35-40% were now in Life Sciences and McCalla worried that these programs were becoming oversubscribed. He was considering channeling Years II and III students elsewhere. One way he thought of doing this, was to require that all Year I students take

Progress and Retirements

Table 7.1 Calendar entries for Biology courses offered in the Honours program in 1975-76

Year I (24 units)	1B6 <i>Cell Biology and Physiology</i> (Davidson, Mak, Sorger) 1C6 <i>Genetics and Evolution</i> (Davidson, Threlkeld) 1D6 <i>The Plant Kingdom and Ecology</i> (Lott, Harris) [1D3 <i>The Plant Kingdom</i> (Lott)] 1E6 <i>The Animal Kingdom and Ecology</i> (Longstaff, Harris) [1E3 <i>The Animal Kingdom</i> (Longstaff)] [1F3 <i>Ecology</i> (Harris)]
Year II (13 units)	2A3 <i>Radiation Biology</i> (Rainbow) 2H4 <i>Biological Application of Mathematical and Computing Techniques</i> (Morton, Kershaw) 2J6 <i>Human Ecology and Biology</i> (Anderson)
Year III (57 units)	3A4 <i>Structure and Function of Plants</i> (Lott) 3C3 <i>Biochemical Microbiology</i> (Takahashi) 3E3 <i>Introductory Microbiology</i> (Miller) 3F6 <i>Comparative Anatomy and Evolution of Vertebrates</i> (Westermann) 3H6 <i>Cell Biology</i> (Dingle, Mak) 3K6 <i>Animal Histology</i> (Westermann) 3L2 <i>Laboratory</i> (Staff) 3M4 <i>Form, Function and Life History of Invertebrates</i> (Davies) 3N4 <i>Developmental Biology</i> (Dingle) 3P3 <i>Cell Physiology</i> (Morton) *3T2 <i>Mechanisms of Genetic Variation</i> (Threlkeld) 3U2 <i>Chromosome Evolution</i> (Davidson) *3W3 <i>Ecology of Northern Plant Associations</i> (Kershaw) 3X3 <i>Animal Populations and Community Ecology</i> (Longstaff) 3Y6 <i>Comparative Physiology</i> (McCandless, Oaks)
Year IV (76 units)	4A2 <i>Genetic Analysis of Behaviour</i> (Threlkeld) 4B6 <i>Plant Physiology</i> (Oaks) [4B3 <i>Plant Physiology</i> (Oaks)] 4C8 <i>Senior Thesis</i> (Staff) 4F4 <i>Selected Topics in Biology</i> (Staff) 4G6 <i>Molecular Genetics</i> (Takahashi) 4H2 <i>Plant Development</i> (Davidson) 4I3 <i>Immunology</i> (Prevec, Gauldie, Perey) *4J3 <i>Field Course</i> (Kershaw) *4K6 <i>Methods in Plant Ecology</i> (Kershaw) 4L2 <i>Advanced Laboratory</i> (Staff) 4O4 <i>Biophysics</i> (Bayley, Morton) *4R3 <i>Entomology</i> (Davies) 4S6 <i>Vertebrate Physiology</i> (McCandless) 4T2 <i>Animal Parasitology</i> (Jensen) *4U3 <i>Fresh Water Invertebrates</i> (Davies) 4V3 <i>Virology</i> (Prevec) 4W3 <i>Mycology</i> (Miller) 4X4 <i>Plant Taxonomy</i> (Laking) 4Y3 <i>Ecology of Inland Waters</i> (Harris, Glooschenko) 4Z3 <i>Experimental Systematic Botany</i> (Pringle)

Total 170 units

Courses in brackets are smaller versions of the courses preceding them and have not been included in the total units given for each year.

* Given in alternate years

Biology 1B6, and then limit enrolment in the Pass, but not the Honours, Biology program on the basis of students' performances. The idea of Year I students taking 1B6, rather than the other Year I courses available to them as described in Chapter 5, was not new. Year II students had complained at having to share Year I Biology courses with Year I students, and perhaps to reduce these complaints Dr. Ron Graham, Associate Dean of Science Studies, had been in the practice of directing Year I students into 1B6 rather than giving them a choice.

Whether all Year I students were directed into Biology 1B6 is not clear, but the size of the class continued to increase. As the course was attracting students from Physical Education and Social Science, the Department decided in 1976 to relieve the pressure on it by creating Biology 1G6 *Introduction to Biology* for non-Science students. Even so, by 1977 enrolments in 1B6 and in the common Ecology term of Biology 1D6 and 1E6 had reached the point where both had to be split into two sections. This was done by doubling the number of instructors who taught both sections, which meant that students in 1B6 then had four instructors. Inevitably their reaction was similar to what it had been to Biology 1A6 years earlier. After the sectioned 1B6 had been given for only a year, the Biology Club reported wide dissatisfaction with it – the course was too disorganized, there were too many instructors, the material was in too much depth, and it was putting students off biology. In 1979 the Department decided to return to a single Year I Biology course, but one based on a theme rather than being a survey of the whole subject. It was organized by Harris and appeared in the 1980-82 Calendar as Biology 1A06 *Adaptation in the Biological World: A course in introductory biology which stresses the adaptation of form and function at the levels of molecules, cells, organisms and populations*. The other former Year I courses appeared in Year II with modifications.

In contrast to the increasing enrolment in undergraduate Biology programs, the enrolment of graduate students in the

Progress and Retirements

Department remained remarkably constant for long periods between 1958 and 1990, with an average from 1967 to 1990 of 19 MSc and 17 PhD students. It was fortunate that numbers were not falling, because the Department had been told that this would have serious consequences for its budget. On the other hand numbers stubbornly refused to rise, despite a wide distribution of leaflets and brochures on the opportunities for graduate work in the Department, and in the 1970s a set of attractive posters describing the different areas of research. The problem was not the reluctance of faculty to take more students, as most of the time there were vacancies, but rather a lack of qualified applicants. There was also a perception that candidates were put off by the reputation Hamilton had in the rest of Canada.

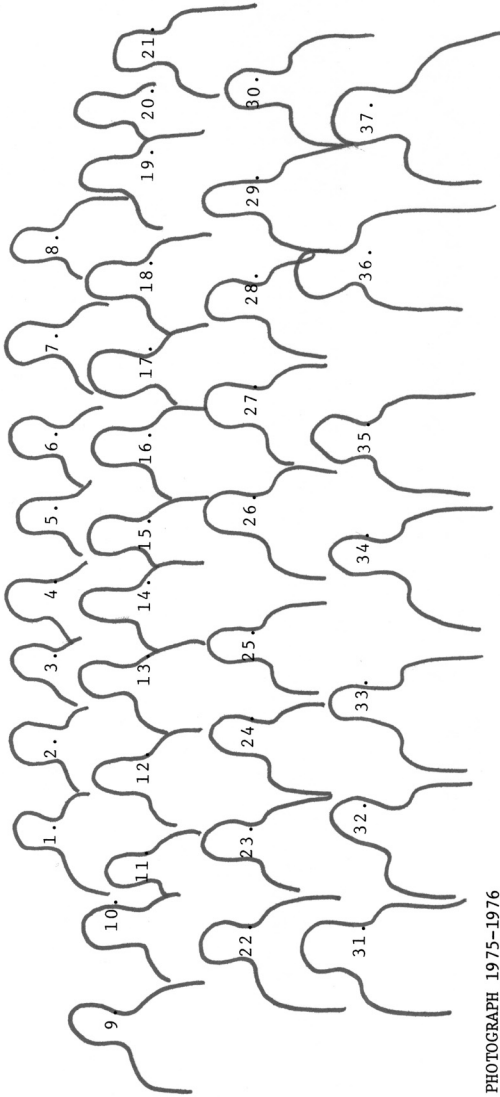
A significant feature of the 1980s was the introduction of several new undergraduate degree programs. At Westermann's suggestion the Department had proposed a 4-year Major program in Biology in 1971, but the Deans rejected it as they felt the problems of such a program outweighed its advantages. It was proposed again in 1979 and accepted, appearing in the 1980-82 Calendar along with new programs in Honours Biology and Geology; Honours Biology and Philosophy; and Honours Biology and Psychology, the last two with strong support from Threlkeld. Honours Biology and Psychology immediately attracted large numbers of students, but Honours Biology and Philosophy drew very few. An Honours program in Molecular Biology and Biotechnology was introduced in 1986, although the Department was not directly responsible for it. During the 1980s McMaster's select Arts and Science program was being extended to 5-years to include other subjects, and in 1988 one in Honours Arts and Science with Biology appeared. In 1981 the Department decided to make the Pass program distinct from Honours and Major, and for this purpose two 6-unit Year III courses were offered solely for Pass students: *Current Topics in Biology* and *Laboratory Techniques: Projects in Cell and Molecular Biology*. Later on, students who had taken these courses were upset at not being

BIOLOGY AT MCMASTER



The graduating class of 1976.

Progress and Retirements



GROUP PHOTOGRAPH 1975-1976

- | | | | |
|-------------------------|------------------------|--------------------------|----------------------|
| 1. Dr. S. T. Bayley | 9. Dr. B. C. Longstaff | 22. Dr. D. E. N. Jensen | 31. Harold Schroeder |
| 2. Ron Burns | 10. Henry Solow | 23. Sheelagh Kemp | 32. Ian Finlayson |
| 3. Dr. D. Davidson | 11. Andrew Sebestyen | 24. Kathy Kimberley | 33. Richard White |
| 4. Shalin Khosia | 12. Bruce Stadyk | 25. Dr. J. E. Westermann | 34. Stuart Armstrong |
| 5. John Greenwood | 13. Dr. J. J. Miller | 26. Cathy Smider | 35. Cathy Legedza |
| 6. Dr. A. D. Dingle | 14. Mark Tysiaczny | 27. Dr. A. Oaks | 36. Dr. D. M. Davies |
| 7. Richard Parascandolo | 15. Michael Rechazy | 28. Deborah Lee | 37. Gord Laurie |
| 8. Terry McNaughton | 16. Richard McKenzie | 29. Valerie Barnard | |
| | 17. Thomas Morris | 30. Dr. S. Mak | |
| | 18. Paul Reid | | |
| | 19. Dr. I. Takahashi | | |
| | 20. Dr. L. Prevec | | |
| | 21. Dr. R. Singh | | |

allowed to use their results to support their cases when they attempted to transfer into the Major program, as many did. It became evident that most students in Pass programs would have preferred to be in Honours even though they failed to meet the standard, and the feeling grew in the University that the 3-year degree should be abolished. Westermann's opinion was that if students were worthy of a degree, it should be one requiring four years. By June 1989 the Faculty of Science was discussing replacing existing programs with Specialist and Generalist Honours.

A major innovation in undergraduate degrees at McMaster was a 5-year Co-op program in Honours Biology and Pharmacology that involved academic terms interspersed with terms spent in related work elsewhere. Discussions on this began in 1986 with Dr. Daniels, Chair of Pharmacology in Health Sciences. He justified linking the program with Biology rather than Biochemistry because there were relevant topics that Biology could provide. To emphasize the value of making this a Co-op program, the example was cited of the University of Waterloo, which pioneered Co-op programs in Ontario and to which some of its best students were attracted. The program was introduced in the 1989-90 Calendar: its enrolment was limited to 25; three terms had to be spent off-campus in work related to pharmacology, toxicology or pharmaceuticals; and all pharmacology courses except one were to be taught as problem-based, self-directed learning. In its initial years at least, the program was never short of students.

Davidson was only willing to serve one three-year term as Chair and when it ended in 1977, he was succeeded by Threlkeld. (He was the third of the three of us who served successively as Chair and were known as the English mafia.) Until the late 1980s, there was some turnover in faculty as well as new appointments. In 1975 Dr. Rama S. Singh, a population geneticist, joined, followed in 1976 by Dr. Christopher M. Wood, a fish physiologist,

Progress and Retirements

and in 1977 by Dr. Thomas T. Chen, a molecular biologist studying growth hormones. Dr. Ron Sonstegard, who held an NCIC Research Associateship at the University of Guelph and was interested in tumours of fish, applied to Rawls to join the NCIC Group at McMaster. Rawls felt Biology was the suitable Department for him, and after Mak reported that Sonstegard collaborated with many in the US and seemed productive and Wood supported him, he was accepted and joined in 1978.

When Longstaff arrived in the Department, he was still completing his PhD thesis. Rather than taking the short time he expected, the work stretched into well over a year, during which he taught but was unable to begin any research. At the end of his probationary period, he was not reappointed and the Department was in the market for an animal ecologist once more. It selected David Rollo who was finishing his PhD at UBC, and after spending a year as a postdoctoral fellow in the lab of his supervisor, Dr. Wellington, he joined the Department in 1979 as a University Research Fellow (URF) of the Natural Sciences and Engineering Research Council (NSERC). URFs were paid by NSERC but could only teach half a load; they could hold the Fellowships for a maximum of six years after which the University was expected to give them tenured appointments. When Rollo had been in the Department a year, he received an Honorable Mention for his teaching, and in 1987 he received the University Award for Teaching. Another URF in the Department was Dr. Gordon McDonald, a fish physiologist, who joined in 1980.

Esther McCandless was a Type 1 diabetic and one of the first to receive insulin. By controlling her diet carefully she had led a full and active life, but early in the summer of 1983 trouble she had been having with a foot became serious enough for her to enter hospital, where it had to be amputated. A day or two later she died. Esther was a Quaker with strongly held views but she was kind and considerate and a good influence in the Department. Many members attended her Quaker funeral and several spoke about her. When she died she had been working on



Dr. Esther McCandless

the immunological properties of carrageenan, the polysaccharide from the alga, Irish moss. The Department established a Memorial Prize in her name.

McCandless' death opened a tenure track position in the Department for an animal physiologist, and in 1984 Dr. Colin Nurse, an electrophysiologist, was appointed, providing the Department

with expertise it had long wanted. In the same year Dr. Turlough Finan, a molecular microbiologist, joined the Department. In 1985 Dr. Andrew J. Rainbow was given a joint appointment in Biology and the Department of Radiology in Health Sciences. This was not his first connection with Biology as he obtained his PhD in 1970 with Mak, having taken his earlier training in Physics, and in 1973 he became an Associate Member after joining the Radiology Department. Two more URFs were also appointed: in 1986 Dr. Michael O'Donnell, a cell physiologist, and in 1987 Dr. Raymond Lee, a molecular biologist working on muscle development.

In 1983, Harris went on sabbatical leave and a few months later he resigned. He was bright, self-assured and a very promising scientist. He developed projects in limnology, including ones in Coote's Paradise and in Hamilton Harbour at a time when people and politicians were showing little concern about polluted waters. For several years he had taught much of Biology 1A06 on his own and the experience appeared to have made him disaffected with the Department. It was time for him to move on and he left for Tasmania, where he built a fine reputation. In 1988 Chen went on sabbatical leave and resigned while he was away. He had had a hard time teaching Year I students as he was

Progress and Retirements

oriented towards research. He had been using recombinant DNA techniques to study the gene of a growth hormone in fish, and he moved to the Johns Hopkins University in Baltimore.

In 1983 Threlkeld's 6-year spell as Chair ended and Mak took over. Mak was conscientious but he had a hard time as Chair; he served for three years and in 1986 Threlkeld resumed the position once more.

Within a few months of becoming Chair, Mak faced a difficult problem with Sonstegard, whose NCIC Associateship had lapsed in April 1982. From then until the following December McMaster had provided his salary, after which it granted him an appointment without salary until the end of March 1984. The University refused to consider any further extension and there appeared to be no justification for an academic appointment. Sonstegard's situation only became generally known in the Department when it was presented at a meeting in October 1983 by Wood and Westermann, who made a motion to extend his appointment in Biology without payment from the University. Sonstegard had done some good work; at McMaster he identified a fish oncogene that Chen studied and some felt he was not properly appreciated. Mak pointed out, however, that an academic appointment, together with space and facilities, would require a case to be made to the Administration, and he suggested instead that Sonstegard could become a research associate. After more discussion at a meeting in January 1984 the motion was passed, but when no arrangements had been arrived at for him to stay, he left in 1985.

During the 1970s and 80s, discussions on the affairs of the Department were not the only activity that members of the Department engaged in together – occasionally they relaxed. In the summers, Biology fielded baseball teams of graduate students, staff and faculty, with the *Mutants* in a friendly league, and the *Biohazards* in a more competitive league. For a time these leagues were organized by Jim Downey, a graduate student

of mine. Players included Dingle, Graham, Lott, McDonald, Morton, O'Donnell, Prevec, Rollo and Wood from the faculty, Judy Grenville, Betty Monaco, Doug Brown, Betty Singh, Debbie Bernardo, Rob Gillies and Kathy McIntosh from the staff and a number of graduate students. Many of the games were held on a field at the corner of Main Street West and Coote's Drive that is now a parking lot. In winter Morton, Prevec, Graham, Procwat, graduate students such as John Bell, Earl Brown, Mike Evelegh, Jim Downey and John Kennedy, and Dr. Phil Branton and some of his students from the Pathology Department played hockey for an hour each Friday morning, usually at the Olympic Rink in Dundas. These sports were not without cost, though. In baseball, O'Donnell had some teeth knocked out and John Kennedy had his cheek badly slashed in hockey.

In the late 1970s, Stanley Mak and his wife Irene organized several gourmet Chinese meals for faculty and wives at different Chinese restaurants in Toronto. They went to great trouble choosing the menus personally and during excellent meals we were introduced to such delicacies as Peking duck and octopus.

Christmas was the excuse for a number of celebrations. Chris Wood and Gord McDonald held a Fishnog party, and Marvin Gunderman from the prep lab and Kathy Greaves from the office toured the Life Sciences Building dressed as Santa Claus and his elf, handing out candy canes and spreading holiday spirit. For many years the Department held a party in the lounge, with food and drink followed by entertainment – Ray Procwat played his accordion and one year a graduate student gave remarkably good vocal impersonations of prominent members of the Department. Then there were skits. One of these was organized by my lab in which I played a PhD candidate taking his final thesis exam. To my mind the most outstanding skit was put on by Lud Prevec's lab soon after we moved into LSB and was based on the Wizard of Oz. The main characters were students with the Tin Man played by an RCMP officer, Doug Legault, who was working on his MSc. During the skit the mention of the new building led

Progress and Retirements

Lud Prevec to exclaim ‘I get high on LSB!’ Immediately Doug Legault stripped off the aluminum foil of his costume to reveal his full dress RCMP uniform and then arrested Prevec – a great finale.

The Department was reviewed three times during the 1980s, twice for the Ontario Council for Graduate Studies and once for the McMaster Board-Senate Committee on Academic Planning. Of the three, the last is the most interesting because it covered all aspects of the Department’s work and it was held in 1984 at a critical time for the Department. The reviewers were Dr. Dennis Parkinson, Director of the Kananaskis Centre for Environmental Research, University of Calgary; Dr. Emöke J.E. Szathmary, Professor of Anthropology, McMaster University; and Dr. Bradley N. White, Professor of Biology and Paediatrics, Queen’s University and the first PhD student I had when I joined McMaster in 1967. Their final conclusion was that the Department was excellent overall, with a strong record of research funding and an impressive list of publications. Parkinson stated that, although relatively small, it was very strong and justifiably enjoyed a high reputation for the quality of its teaching and research. Szathmary reported that undergraduate and graduate students spoke very well of the education they received in the Department and she thought its two-pronged foci, one in molecular biology and genetics, the other in ecology and environmental physiology, were unique and indisputably relevant. White declared that the Department contained a very high proportion of faculty with international reputations and at the research level it ranked as one of the best biology departments in Canada. As welcome as these comments were, however, the bulk of all three reports was devoted to the Department’s weaknesses and the criticisms were penetrating and unsparing. Before these are discussed, though, it is convenient to deal with another matter the reviewers commented on that concerned the Department at the time. This was the development of molecular biology and biotechnology at McMaster.

At the beginning of the 1980s, pressure grew in the University for the creation of an Institute of Molecular Biology that would increase the extent of research in the field, encourage interaction between those with interests in it and provide technical support. The idea was promoted by Dr. John Bienenstock, Vice-President of Health Sciences, and Dr. Jim Morrison, Director of the Institute for Material Sciences at McMaster. It was discussed in the Department and supported by Threlkeld, Prevec, Mak, Graham and myself, who all felt it should be located in LSB. As the proposal wound its way through the University bureaucracy, it became an Institute of Molecular Biology and Biotechnology and concern for Biotechnology began to outweigh that for Molecular Biology.

All three members of the Review Committee felt strongly that Biotechnology should be developed in the Department of Biology. Although Szathmary and White sensed there were pressures to orient it towards Health Sciences, they and Parkinson believed there were exciting and promising possibilities for developing biotechnology in areas other than medicine, and very good arguments for locating it physically in Biology, with a senior individual and two or more junior positions to provide leadership and the necessary impetus. White said the work should either complement the fish genetic engineering in the Department or more logically strengthen the plant program. This remark must have struck a chord with a number of members of the Department, because the following January, Chen, Lott, Oaks, Finan, McDonald, Rollo, Westermann and Wood submitted a proposal that appointments should be made in the Institute to cover an expanded version of both the areas White had suggested: 1) the study of the genes for pituitary hormone in fish and of the gene products as probes in toxicology; and 2) the study of the interactions of soil microorganisms and crop plants.

The University approved the Institute in 1985, Dr. Ron Childs, Dean of Science, and Dr. Brian Underdown, Associate Dean of Research in Health Sciences, were put in charge of its formation,

Progress and Retirements

and I was made Interim Director until a full-time Director was appointed. Labs and offices on the third and fourth floors of LSB were assigned to the Institute, as well as space in the basement for a technical facility. As Interim Director, my only significant contribution to the Institute was the creation of this facility with the help of Graham and Prevec. Dr. John Hassell was appointed Director in 1988 and gave the Institute the name MOBIX. His interests were in another small DNA tumour virus and he developed the Institute into what in effect was largely an extension of the work of the NCIC Cancer Group.

When the Institute was set up, it was decided that all those appointed to it were to become members and teach in one of three Departments: Biology, Biochemistry or Pathology. Of these Biology had by far the heaviest teaching load, with what had become service courses in Years I and II for all Life Science students. The consequence was that no one appointed to the Institute chose to join Biology except for Hassell, who became a member *ex officio* as Director of MOBIX. Therefore, although the Department provided accommodation, it gained relatively little from the Institute's creation beyond access to the technical facility. This in itself was not a minor achievement, however, as it provided essential ingredients in the work a number of us were doing at the time. Ironically, about the only notable biotechnology done in the ensuing years was by faculty already in the Department of Biology. Graham engineered adenovirus to make it a convenient vector for introducing genes into mammalian cells, Prevec developed a vaccine against rabies using this technology, and a mutant of adenovirus made in my lab was used by two commercial firms in the US in work on cancer.

We return now to the review of 1984. Beginning in that year and extending into the 1990s, the Department was faced with the retirement of all its most senior members, forcing it to decide on its future direction, the balance to be given to the undergraduate curriculum and the areas in which new appointments were to be made. These were troubling issues for the Department and they were brought into stark relief by the review.

The undergraduate curriculum was heavily criticized as needing to be reorganized and rationalized, and the number and unit loads of courses reduced – criticisms that Threlkeld had in fact made towards the end of his term as Chair in 1983. Szathmary's view was that the issue of what constituted good undergraduate education in Biology, as a whole rather than some branch of it, had been overlooked. She and White suggested that the undergraduate curriculum committee of the Department should rigorously examine the curriculum and the philosophy of biology teaching, rather than being concerned only with Calendar copy. With the large number of senior courses offered, students complained it was difficult making choices because of timetable conflicts and the lack of good counseling at convenient times; Parkinson found that in trying to choose, students floundered. The reviewers recommended that these issues should be resolved by defining more streams in the Honours program as well as reducing the number of courses. White pointed out that many senior courses reflected the specialities of professors and attracted few students and he suggested ways of reducing the units taught in 1984-85 by 40-50 units from the 176 planned.

At the time, Kershaw had relieved himself of his teaching responsibilities through an arrangement with the Administration by which he paid postdoctoral fellows from his grants to do his teaching for him. Szathmary and White both criticized this arrangement. Szathmary pointed out that it set a precedent, and the Chair and the Administration should decide whether it was in the interests of the Department to have teaching done by fellows who were not selected by the Department and were not under its jurisdiction. White thought that anyone wanting to be relieved of teaching should be required to take a leave of absence for a minimum of three years.

Another major concern in the review was a decision to advertise a tenure-track position for a developmental biologist and the way this decision was reached. This had created an atmosphere of mistrust and acrimony in the Department, with several members

claiming that the matter had not been properly discussed. The reviewers had heard complaints from both undergraduate and graduate students about the inadequate range of courses offered in Ecology and Environmental Physiology, due to the lack of faculty in one of the areas of concentration in the Department, and they thought that a tenure-track position should have been used for an ecologist. It seemed to White that when decisions on new appointments had been made no one had stepped back to consider what was best for the Department.

Reaction in the Department to the review was mixed and the written response from the Department to the Administration had to be redrafted. This was not unexpected after the remarks Threlkeld made on the curriculum in 1983 had provoked heated debate. Steps were taken to meet some of the reviewers' recommendations, but although there was a slight reduction in the number of undergraduate courses offered between 1975-76 and 1989-90 (cf. Tables 7.1 and 7.2), with the average teaching load per member falling from 8 units to 7, progress in reforming the curriculum was difficult. As I had experienced when I was Chair, some faculty fought hard to prevent any reduction in the unit loads of their courses and others refused to compromise in other ways. To some extent, however, it had to be recognized that members were justified in resenting being told how to teach their own subjects.

The comments the review made on new appointments were particularly pertinent to the most pressing problem the Department faced at that time and the cause of its greatest concern, namely the series of replacements it had to plan following the retirements of an appreciable number of the faculty. The first were those in 1984 of Davies and Miller, the members who had served in the Department longest. The occasion, without precedent for most of the Department, was marked by a dinner at which Radforth reminisced.

These retirements were soon to be followed by others, beginning with Threlkeld's due in 1989, Takahashi's in 1991, and

BIOLOGY AT MCMASTER

Table 7.2 Calendar entries for courses offered by the Biology Department in 1989-90 with Registrar's records of Class Enrolments for 1988-89

Courses under Biology

Year I (15 units)	1A06 <i>Adaptation in the Biological World</i>	586	
	1G06 <i>Introduction to Biology</i>	253	
	1J03 <i>Human Physiology</i>	244	
Year II (15 units)	2B03 <i>Cell Biology</i>	383	
	2C03 <i>Genetics</i>	368	
	2D03 <i>The Plant Kingdom</i>	236	
	2E03 <i>The Animal Kingdom</i>	298	
	2F03 <i>The Fundamentals of Ecology</i>	292	
Year III (78 units)	3A06 <i>Structure, Function and Development of Plants</i>	16	
	3AA3 <i>Fundamental Concepts of Pharmacology</i>	36	
	3C03 <i>Microbiology II</i>	53	
	3D03 <i>Animal Parasitology</i>	28	
	3E03 <i>Microbiology I</i>	81	
	3F06 <i>Comparative Anatomy and Evolution of Vertebrates</i>	43	
	3H03 <i>Subcellular Structure and Function</i>	72	
	3HH3 <i>Cell Proliferation and Cell-Cell Interaction</i>	85	
	3I03 <i>Cytogenetics</i>		
	3J03 <i>The Genetic Basis of Evolution</i>	120	
	3K06 <i>Animal Histology</i>	45	
	3MM3 <i>Introduction to the Biology of Invertebrates</i>	16	
	3N06 <i>Developmental Biology</i>	32	
	3O03 <i>Microbial Genetics</i>	114	
	3P03 <i>Cell Physiology</i>	76	
	3Q003 <i>Radiation Biology</i>		
	3SS3 <i>Population Ecology</i>	42	
	3T03 <i>Tutorial in Biology</i>	5	
	3TT3 <i>Community Ecology</i>	26	
	3U06 <i>Principles of Animal Physiology</i>	67	
	3W03 <i>The Ecology of Northern Plant Associations</i>	46	
	Year IV (54 units)	4B06 <i>Plant Physiology</i>	
		[4B03 <i>Plant Physiology</i>]	16
4C08 <i>Senior Thesis</i>		6	
4D03 <i>The Ecological Designs of Organisms</i>			
4E03 <i>Population Genetics</i>			
4F04 <i>Senior Project</i>		31	
4H03 <i>Plant Development</i>			
4I03 <i>Immunology</i>		140	
4J03 <i>Field Exercises in Ecology</i>		18	
4M03 <i>Molecular Aspects of Eukaryotic Chromosomes</i>		11	
4MM3 <i>Replication and Recombination</i>		4	
4N03 <i>Gene Expression</i>		9	
4V03 <i>Virology</i>		66	
4X03 <i>Environmental Physiology</i>		7	
4Y03 <i>Ecology of Inland Waters</i>		34	
4Z03 <i>Systematic Botany</i>	7		

Total 162 units

Courses under Science

(9 units)	2G03 <i>Man's Supply of Food</i>	86
	2H03 <i>The Molecular Basis of Life</i>	76
	2K03 <i>Heredity, Evolution and the Environment</i>	

Course 4B03 in brackets was a smaller version of 4B06 and has not been included in the total units for the year.

Progress and Retirements

mine in 1992, until by the early years of the new century the Department would have lost all its senior members. In fact several of these later retirements came much sooner than expected when the University offered a generous early retirement scheme. Davidson and Kershaw took it in 1988 and Mak, Oaks and Westermann in 1989. The Department was given some replacements for these early retirements, but the appointment of more faculty was becoming urgent as much larger enrolments in Biology programs were driving up the student to faculty ratio dramatically. For 1969-70 it had been 6.3 and by 1979-80 had only risen to 8.5, but from then until 1989-90, when enrolments increased more than two and a half times, the ratio climbed to over 20.

As Chair, Threlkeld first called the Department's attention to the need to consider its future as early as March 1983. He did so again in September 1987 when a committee to consider future appointments was formed with McDonald as its chair. This recommended that the Department appoint an ecologist and a microbiologist to tenure track positions and advertise for URFs in all areas of biology but with an eye on the Department's areas of strength. In January 1988 Threlkeld sent copies of a memo to the Dean of Science, Dr. R F. Childs, and to the Department suggesting that the Department should increase its strength in Neurobiology, in Developmental Biology, and in Ecology and Environmental Physiology. This memo was a somewhat muted appeal for more faculty, to which Childs replied that he agreed that student numbers had increased, compounding the problems of mounting undergraduate and graduate programs, and that operating budgets and support staff had not kept pace, but he concluded that overall the Life Sciences at McMaster had fared extremely well. There was in fact one new appointment in 1988, when Dr. Jurek Kolasa, an ecologist, replaced Kershaw.

Together with the need to fill the other vacancies left by retirees, there was also the necessity of appointing a new Chair when Threlkeld retired. Dr. Leslie J. King, Academic Vice-President, and Childs attended a Departmental meeting in December 1988

that discussed the Department's uniqueness in the University for the number of retirements it had, the challenge of increased enrolments, and the opportunity to build for the future. It was agreed that a new Chair should be someone from outside the University with interests in either developmental or environmental biology.

At this point debate on the future of the Department became more acrimonious. At a meeting in January 1989, three motions to define areas for future appointments were violently disputed as tying the hands of the future Department. In a memo of January 1988, Threlkeld had floated the idea of not continuing to develop Plant Biology as an area of specialization. In February 1989 this was hotly contested in a memo from Lott and Wood, who felt it was essential for balanced undergraduate education in Biology. A few days later, a case for a structural biologist with interests in animal development from McDonald and Dingle further divided the Department.

In an attempt to arrive at a plan that most members would support and that could be presented to the Administration, the Department formed a Futures Committee ('Futures' as in the Stock Market). Finan, O'Donnell, Wood and I were elected to the Committee and at its first meeting they appointed me chair. Our recommendations were based on the Department's obligations to the undergraduate program, for which we made two assumptions. First, that we should offer a balanced four-year program, the core of which was taught by full-time Biology faculty. This was necessary because at the time the Department was relying on faculty from other Departments and temporary help to provide material previously covered by retirees. Second, to maintain balance in the program we should offer courses in each of five areas: Cell and Molecular Biology and Microbiology; Genetics; Animal Biology, Animal Development and Animal Cell Physiology; Plant Biology; and Ecology. Analyses of faculty numbers, undergraduate courses offered and course enrolments in these areas showed that Plant Biology and Ecology were weak with only two faculty members each. We felt every area should have at least three faculty. With this and the addition

Progress and Retirements

of a new Chair, the total came to 24, the number the Department had had for ten years. This was an absolute minimum however, as it was imperative to increase the faculty in order to section large classes in Years I and II and increasingly in Year III (Table 7.2). Furthermore, new appointments were urgent as Threlkeld, who taught much of Year I Cell Biology and Genetics, and I, the only full-time member teaching Cell Biology in Years II and III, would be retiring shortly.

The situation improved after this. Dr. Roger Jacobs, a developmental biologist, and Dr. Herbert Schellhorn, a molecular bacteriologist, were appointed in 1989. In 1990, Dr. Bradley N. White, who was applying DNA analyses to a variety of environmental issues, arrived as the new Chair, bringing with him from Queen's University Dr. Lisle Gibbs who studied bird populations. In the same year Dr. Elizabeth Weretilnyk, a plant physiologist, was appointed, followed in 1991 by Dr. Patricia Chow-Fraser, an ecologist, and in 1992 by Dr. Ana Campos, a developmental biologist. This influx of fresh young blood marked the beginning of a new era in the Department. Threlkeld delayed his retirement to continue as Chair until White arrived in 1990. It was followed by Takahashi's and my retirements in successive years as planned, and over the following years other long-time members retired: Jensen in 1994, Dingle, Morton and Prevec in 1996, Graham and Sorger in 2003 and Lott in 2005.



Drs. Morton, Prevec and Dingle at their retirement party in 1996

RETIREES AND DEPARTMENTAL STAFF

The following are brief sketches of long-time faculty who had retired by the time this history was written, and a list of full-time staff in the Department up to about 1990.

Faculty



Douglas Davidson, Professor Emeritus
Appointed. January 1, 1969; retired 1988

Davidson taught Year I Biology and senior courses on Chromosomal Evolution and Plant Development, and he continued to teach long after he retired. His research included studies on cell growth, cell division and cell populations in root meristems of plants. In 1980-81 he served as Acting Dean of Science. At meetings of small groups he lubricated discussion with generous amounts of sherry, which made the meetings enjoyable but the decisions reached uncertain. Wood was taken with him on his first visit to McMaster. When he was interviewed by him as Chair, Davidson first tucked in Wood's shirt and then straightened his tie. Davidson has a wide range of interests in the theatre, opera, oriental rugs and paintings, and he made a major contribution to the Department by chairing the committee that chose original works of art for the Life Sciences Building.

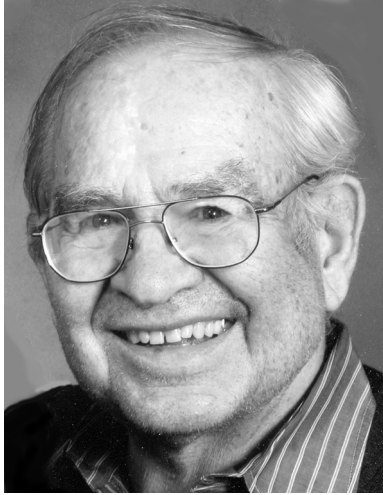


Photo 2005

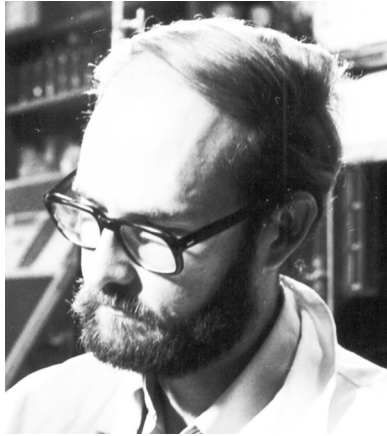
Douglas M. Davies, Professor Emeritus
Appointed 1950; retired 1984; died 2008

Davies was an entomologist and a classical biologist. Over the years he taught a wide variety of courses related to entomology. He was a world authority on black flies and he built up a fine collection of them, not only from within Canada but from Sri Lanka and other parts of the world as well, many of the species being ones he discovered. The collection still exists and also includes hundreds of specimens representing the major orders of insects; it is actively used in the Department for teaching and research.



Allan D. Dingle, Associate Professor Retired
Appointed 1965; retired 1996

Dingle introduced cell biology as a distinct subject into the undergraduate curriculum and taught senior courses in it and in developmental biology. He served in the Department as a counsellor for undergraduates and as an advisor for the Biology Club. His research was in development of animals at the cellular level, particularly in the amoeba, *Naegleria*. Leisure activities: squash and fly-fishing.



Frank L. Graham, Professor Emeritus
Appointed January 1, 1975; retired 2003

Although Graham did little formal teaching, he had many graduate students and he was generous with his time and with DNA constructs he made in helping others in their research. He was a driving force in developing graduate research in molecular biology in the Department and in the University. In research, he was the first to find a way of introducing DNA into mammalian cells, while his work on human adenovirus type 5 made it useful both as a model system for studying oncogenic transformation of cells and as a convenient vector for introducing genes into cells. In 1998 he received the Noble Award from the National Cancer Institute of Canada and was made a Distinguished University Professor at McMaster. He was elected a Fellow of the Royal Society of Canada in 1999. Leisure activity: tennis.



Photo 1992

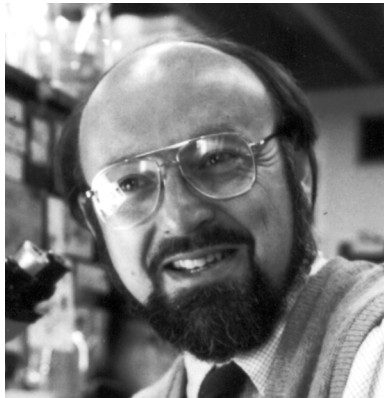
Doris N.E. Jensen, Associate Professor Retired
Appointed 1965; retired 1994

Jensen taught a course in parasitology throughout her time in the Department; she also taught one in ecology and the popular one for non-Science students described earlier. She was concerned with the environment and studied the effect of pollution on sea gull populations around Hamilton. For 14 years before she retired, she was the Associate Dean of Science Studies. In retirement she became an expert on orchids.



Kenneth A. Kershaw, Professor Emeritus
Appointed 1969; retired 1988

Kershaw said of himself “I’m not a team person, I’m a solo person.” He became an expert on lichens during his work in the sub-Arctic, for which he commanded large grants, and he collaborated with members of the Departments of Geography, Anthropology and Economics. He was elected a Fellow of the Royal Society of Canada in 1980. He taught a junior course with Morton on the application of mathematical and computing techniques to biology as well as two senior courses on plant ecology, and he conducted field courses on Hudson Bay and at Churchill, Manitoba. In an interview, he praised McMaster as a good university for undergraduate teaching and for its attitude to research, adding that it gave him ‘a chance to have a great research career.’ He had interests outside the University and for much of his time he was most widely known on campus for the business in old maps and prints he ran in Ancaster.



John N.A. Lott, Professor Emeritus
Appointed 1969; retired 2005

Lott's *Plant Kingdom* course at Year I and II levels became the largest plant course in Canada, and the course on *Cell Ultrastructure* he taught for over 30 years was the most consistently given graduate course. Besides these, he also taught a senior undergraduate course on the structure and function of plants. His research was on the ultrastructure and physiology of protein storage bodies in seeds. In collaboration with other departments at McMaster, he was instrumental in building up the electron microscope facility in LSB to enable it to offer scientists in the University and elsewhere a range of techniques for observing and analyzing a wide variety of samples. Leisure activities: travelling and photography.

Retirees and Staff



Stanley Mak, Professor Emeritus
Appointed 1967; retired 1989

Mak has great enthusiasm — physically he is small and one student described him as having more bounce per ounce than anyone else in the Department. During the planning of the Life Sciences Building, he made a major contribution in evaluating the Department's requirements and reconciling them to the limitations of the budget. The main courses he taught were in cell biology at junior and senior levels. In research he studied the action of proteins produced by an oncogenic adenovirus in the infection and transformation of cells. Leisure activity: cooking.



John J. Miller, Professor Emeritus
Appointed 1947; retired 1984; died 1994

Miller's research interest was in the factors that determine whether nuclear division in the yeast *Saccharomyces* is by mitosis or meiosis. Until the late 1960s, he taught a wide range of courses in microbiology, mycology, genetics and the physiology, biochemistry and pathology of plants. Once the Department had expanded, his teaching was confined to senior courses in introductory microbiology and mycology. He was proficient in several languages. He was also extremely shy but despite this, shortly before he retired he became University Beadle, a position given to the longest serving Professor in the University. The principal duty of the Beadle is to carry the Mace in procession at Convocations, the Mace being the symbol of authority – in the University's case, the authority to confer degrees. Leisure activity: skiing.



Richard A. Morton, Professor Emeritus
Appointed 1969; retired 1996

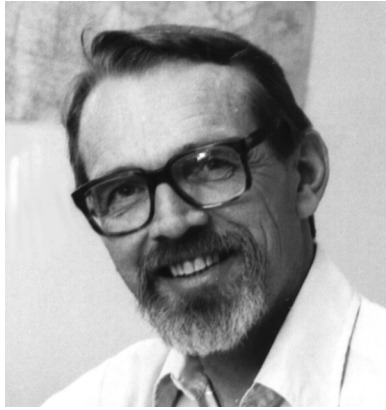
Morton has an extensive fund of knowledge on scientific matters and is able to turn his hand to a variety of problems, helping many in the Department with their research. He taught a variety of topics, including the application of mathematical and computer techniques to biology with Kershaw at the junior level, and at the senior level, biophysics and cell physiology, and he took an active part in the Honours Biology and Philosophy program. He continued teaching after he retired. During his career at McMaster, he changed his research from proteins to genetics, studying the genetic basis of insecticide resistance in *Drosophila*. Leisure activity: fossil hunting.



B. Ann Oaks, Professor Emeritus
Appointed 1965; retired 1989; died 2006

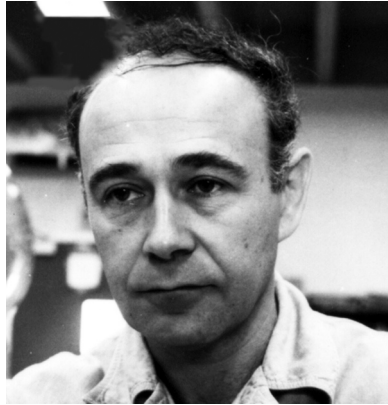
Oaks worked on amino acid metabolism and nitrate reductase, mainly in corn (maize). She was elected a Fellow of the Royal Society of Canada in 1986, and after she retired the University awarded her an honorary degree. She had the distinction of being invited to write an autobiographical essay that appeared in the *Annual Review of Plant Physiology and Plant Molecular Biology* for 2000. In describing her professional career, she remarked that ‘the years at McMaster were not really comfortable ones.’ There were difficulties and many in the Department who had dealings with her would say those years were not comfortable for them either. Most of her teaching was in senior courses in plant physiology and, with McCandless, comparative physiology.

Retirees and Staff



Ludvik A. Prevec, Professor Emeritus
Appointed 1967; retired 1996

Prevec gave virology courses at both graduate and undergraduate levels throughout his 29 years in the Department. These were augmented with one in immunology, taught in later years in collaboration with faculty from Health Sciences. In research, he studied RNA animal viruses and at least eight of his graduate students went on to professional careers in virology or related fields. In the late 1970s, he was a member of the editorial board of the *Journal of Virology*. Leisure activities: geology and fishing.



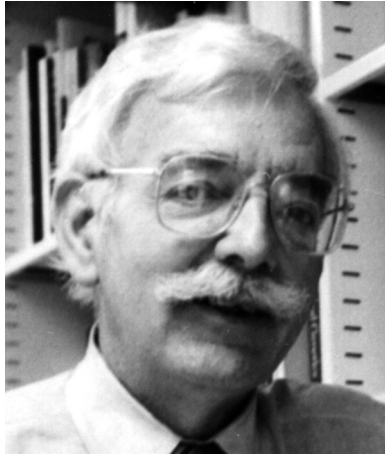
George J. Sorger, Professor Emeritus
Appointed 1966; retired 2003

Sorger taught first-year biology and he introduced a senior undergraduate course on bioenergetics. He also introduced a graduate course in which students were assigned research papers in molecular biology to present and criticize. For several years I shared it with him. In those days faculty received no credit for teaching graduate courses, but despite this most of us enjoyed doing it. In this course the students were intelligent, discussions were interesting and all of us learned a lot. Sorger's main research was on nitrate reduction in *Neurospora*. Later he trained high school students to analyze water samples from Hamilton's streams and water basins for evidence of pollution. During the war in El Salvador in the 1980s, the university there invited Sorger to spend two to three weeks each summer measuring coliforms in guerrilla settlements. He also taught at the university and was there when it was surrounded by soldiers, who killed over 100,000 during this period, including professors, students and priests who opposed the Government; and they shot to wound foreigners – not a healthy environment to be in.



Iwao (François) Takahashi, Professor Emeritus
Appointed 1963; retired 1991

Takahashi introduced modern microbiology and bacteriophage studies to the Department, and was responsible for acquiring and running an analytical ultracentrifuge. In the 1960s and 1970s, he did pioneering work on a phage of *Bacillus subtilis*. Later he studied the genetics and biochemistry of sporulation and differentiation in this bacterium. He trained several excellent graduate students. At the undergraduate level he taught senior courses in biochemical microbiology and molecular genetics. Leisure activities: tennis, skiing and languages.



Stephen F.H. Threlkeld, Professor Emeritus
Appointed 1961; retired 1990

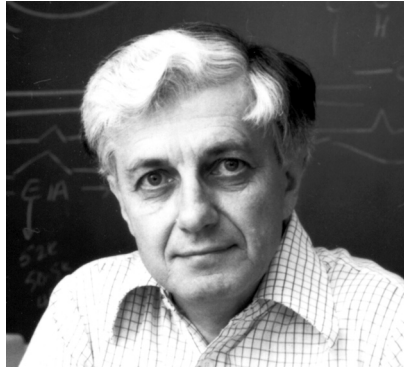
As this history shows, Threlkeld was a prominent member of the Department from the time he joined McMaster, including serving a total of ten years as Chair. In his early years he was responsible for drawing the Department together. He gave solid support to the introduction of molecular and cell biology into the Department and to the creation of the Institute of Molecular Biology and Biotechnology (MOBIX). He also initiated the degree programs in Biology and Psychology and in Biology and Philosophy. In research he worked on yeast genetics and the genetics of insecticide resistance and behaviour in *Drosophila* (fruit flies). Much of his teaching was in genetics at both junior and senior levels. Leisure activities: scuba diving, kayaking, and writing poetry.



Jean E.M. Westermann, Professor Emeritus
Appointed 1965; retired 1989

Westermann is a classical cell biologist and histologist, with research interests in haemopoietic tissues and rodlet cells in fish. Throughout her career at McMaster she taught anatomy and histology, most notably *Comparative Anatomy and Evolution of Vertebrates*, and *Animal Histology* in Year III. For essentially all of the 1980s, she performed the arduous task of serving as chair of the Departmental committee on the undergraduate curriculum. In a recent interview she declared that she had been happy at McMaster.

Finally myself –



Stanley T. Bayley, Professor Emeritus
Appointed 1967; retired 1992

Much of my teaching was in Cell Biology in Years I and II, and in a Year IV course on the structure of nucleic acids and proteins. When I joined McMaster my research was on a halophilic bacterium, but after my time as Chair, I worked on the same human adenovirus as Graham, studying the protein that initiates the infection and transformation of cells. Leisure activities: photography and listening to classical music.

Departmental Staff

The running of Departments of the size Biology was after the Second World War depends on support staff. Few records are normally kept of these people, so that it is mainly those within living memory who can be acknowledged.

The first mention of a member of staff by name in the Departmental minutes was in May 1957: Mr. Kuntz had evidently been employed some months earlier to look after the Departmental storeroom.

The Office

During the 1960s and possibly earlier, Eleanor Athawes was secretary to Radforth until he left in 1968; she then transferred to another University department. Other secretaries in Hamilton Hall were Lynn Simioni and Marjory Waymouth. Marilyn Wasserman worked in GSB. The secretary to Stich as Chair was Jane Sicurella, and on his resignation she left for a position in the Health Sciences Centre. When I became Chair, I appointed Hanna Lindemann as my secretary. She came to McMaster originally in June 1962 as a member of a secretarial pool in Hamilton Hall that served the Departments of Biology, Geology and Nursing. The pool was later divided and Hanna joined Biology, working mainly for Kleerekoper. After that, she was secretary to the Research Unit (RUMBBCBP).

Two other appointments were made in the office shortly after Hanna's. One was Patricia Hayward who joined from high school as a Departmental secretary in 1969. Except for leaving to have children, she worked in the Department almost the whole time until she retired in 2008 after 34 years' service. The second appointment was more senior. On becoming Chair, I was allowed an Administrative Assistant and the man appointed was Bryce Ewens, an ex-naval commander. He was a great help during the planning of the Life Sciences Building and organizing the move into it, but for much of my last two years as Chair he was out of

action. While working on the roof of his house he fell off the ladder, breaking both arms and a leg and wounding his head. After he returned and the Department had settled into the new building, much of his work was dealing with undergraduate students and other academic matters, which he found he was unable to do. He left in 1976 to be replaced by Hanna Lindemann, who served as Administrator in the Department for over 26 years until she retired in 2002.

Those who also served in various capacities as Departmental secretaries up to 1990 were:

Diane Allen, Marg Biggs, Sherry Calligan, Mary Anne Farmer, Kathy Greaves, Judy Grenville, Mary Haight (married to a graduate student, Murray Haight), Nancy Lyons (who married Kim McCann, a graduate student), Kathy McIntosh, Betty Monaco, Carmela Melo, Marsha Monster and Barb Reuter.

Preparation Room for Undergraduate Labs

Paul Hoffman and Ian Giles worked there from the early 1970s until they retired in 2006 and 2007 respectively. Others were Ella Kieraszewicz, Leslie Gyorkos, Lillian Wisniewski, A. Seong Cheong, Sharon Stray and Marvin Gunderman. Giles and Gunderman both graduated from the Department in 1974 and 1983 respectively, and Gunderman completed an MSc with Rollo in 1989. From 1968, Herb Pohl supervised the preparation room; later he was made an instructional assistant as well and he held both positions until he retired in 1994. Pohl's education was interrupted by the war and he completed it with a BSc in the Department in 1968 and an MSc with Miller in 1975.

From 1986 until 1991 I taught the Year II Cell Biology course each fall; this had classes of 300-400 students and I relied on Herb to look after the labs. He did this well but I had one concern about him. He was an avid, capable and intrepid canoeist, and each summer he set off by himself on a three to four week trip through remote parts of Quebec, Labrador or the North West Territories. He had some close calls but to my great relief he

returned every year fit and ready to face the course in September. After he retired he continued making these travels, and then in July 2006 after a trip through Northwestern Ontario, his overturned canoe was found in Michipicoten Bay in Lake Superior near Wawa, and next day his body was recovered. He had died at age 76 doing what he loved.

Workshop

The Department has several important facilities, one of which is the workshop. Among the first to work there was David Vogt. When he left in 1973, Rob Gilles was appointed. For 34 years before retiring, he saved the Department and individual research grants money by repairing equipment and designing and building apparatus for faculty and graduate students. In the 1980s, he was made Departmental Safety Officer and charged with the onerous task of implementing the Workplace Hazardous Materials Information System (WHMIS) and ensuring that faculty, along with others, complied with its requirements.

Glass-Washing Facility

Debbie Bernardo began washing glassware in individual research labs in the Department in 1971, but from the time of the move into LSB until she retired in 2007, she was in sole possession of this facility, and saw to the washing of the glassware from all undergraduate and research labs.

Greenhouse

Alec McCrory was in charge of the greenhouse beside Hamilton Hall from the 1960s until the 1970s. He was succeeded in turn by Peter Denee, Thelma Leech and Art Yeas.

Electron Microscope Facility

Jim Darley was employed to run the electron microscope in GSB and he supervised the move of the facility into LSB. He left in 1976 to be replaced successively by Doug Brown, Betty Singh, Joanne Carson and Klaus Schultes.

CONCLUSION

Throughout the period of this history, the Department of Biology was concerned not with a single science so much as with a rather loose collection of several life sciences – so loose that during my darker moments as Chair, I worried that the Department was about to break apart under my watch. I would have worried more had I known then that a split had in fact occurred a generation earlier. The result of the diversity in the Department was that the concern all faculty feel for the place their subject is given in departmental affairs was multiplied several fold over what it was in most other Science departments. This made it more difficult to arrive at a proper balance in the way Biology used its resources. With so many areas to cover, it was inevitable that to mount a balanced undergraduate program and serve the varied interests of the students, the number of courses the Department of Biology offered was always larger than in other Science departments. The Faculty of Science often criticized the Department for its numerous courses. And of course they increased the teaching load; the minutes of a Departmental meeting in June 1984 reported that the average in Biology was 8.4 units per member compared to an average of 5.8 ‘for several science departments’.

In research, it meant the Department was never able to speak with a single voice in enlisting support from the University for new initiatives. In at least two cases, however, the solution was to collaborate with other departments, as happened with the development of the electron microscope facility and the facility for molecular biology created as part of MOBIX. In this respect a distinct advantage McMaster enjoys is the absence of the sort of historical barriers between departments that prevent cooperation in some other universities.

Conclusion

It was always possible to suspect the Administration of being insensitive to the peculiar problems the Department of Biology faced. Such suspicions would have been lessened had the Department had representation in the higher levels of Administration. Unfortunately this never occurred, except for one year when Douglas Davidson deputized for the Dean of Science, and for the years Doris Jensen was Associate Dean of Science Studies. However the Department was represented in the Faculty Association by Kleerekoper, Jensen, Westermann and Lott, who were each on the Executive for several years; and by Kleerekoper, Lott and Threlkeld who each served as President.

There were occasions in the 1980s when Biology might have improved its situation had it had a stronger voice. As was normally the case, the Physical Sciences dominated thinking and decisions in the Faculty of Science, and this became noticeable as increasing numbers of undergraduates registered in Life Science programs. The Faculty of Science initially regarded this increase as a temporary anomaly, but it soon became clear that it represented a major shift in the interests of incoming students. Although it would be gratifying to think that these students were driven by a genuine interest in biology, the ambition of many was, as always, to be accepted into medical school. Regardless of their motives however, these students had to be taught. The Department was given some new faculty positions and extra resources but it was hard pressed to deal with the influx.

Another problem was with maintaining faculty complement. As a result of the general expansion of North American universities during the 1960s, the demographic of faculty members meant that large numbers were due to retire in the 1990s and shortly thereafter. With these retirements, demand for good young candidates to fill their places was certain to increase, and in the case of biologists it was likely to outstrip supply, making it difficult to attract good people with training in the areas we required. In the early 1980s there was a shortage of jobs for fresh PhDs, and it would have been prudent to anticipate the impending demand by

creating positions for new people ahead of time. In the Department of Biology at least this did not happen, and the situation was made worse in the late 1980s when, in an effort to cut costs, the University offered a very generous early retirement plan, so generous that it put the University in financial difficulties. For the Department the result was to hasten the problem of staffing as explained earlier, and by 1990 the appointment of new faculty, including a new Chair, became critical.

At least one member of the Department has spoken of a division between molecular biologists and virologists on one side and organismal biologists on the other, that few could bridge. It took well over thirty years from the discovery of the structure of DNA for molecular biology to develop far enough to provide the understanding of genetics that now links all branches of biology, as well as to provide the background for the kind of DNA studies on a variety of animals that White introduced to the Department in 1990. While molecular biology was growing however, it had little to offer other biologists. Nevertheless work on small DNA tumour viruses such as those studied in the Department was important for its growth, partly for facilitating the development of recombinant DNA techniques, but also for providing an understanding of viral genomes that was relevant to the much larger genomes of eukaryotes. As an example, exons and introns – important features in the expression of genes – were discovered in an adenovirus almost identical to the one Graham studied. It was unfortunate that those of us working in this area used particularly arcane jargon that discouraged everyone else from trying to follow what we were doing. This was just part of a general lack of communication between people busy with their own research and teaching. Efforts were made to encourage members to meet for morning and afternoon coffee but they failed. Despite all this and despite occasional outbursts, several members felt that the atmosphere in the Department was no worse than in any group of people, particularly when they are ambitious as many members of the Department were – which is as it should be in any good academic department.

Conclusion

What can be said of teaching and research in the Department between the mid-1960s and 1990? A notable feature of the undergraduate degrees the Department offered was the coverage they gave to the latest advances in cell and molecular biology and mathematical ecology. This was greater than in programs at many other biological science departments across Canada, and was made possible by several advantages our Department enjoyed. One was the legacy of the Research Unit in Molecular Biology, Biochemistry and Biophysics. Another was the decision to appoint faculty in rapidly developing areas of biology. A third was that as a single integrated Department, it was able to introduce advances in molecular biology and ecology that involved all branches of biology more effectively than was generally possible at universities where biology was subdivided between separate departments. The Department also introduced a number of new, innovative undergraduate programs, notably that in Biology and Psychology and the co-op program in Biology and Pharmacology.

Teaching loads were reasonable during these years, and class sizes at senior levels small enough for meaningful interactions with students. It was particularly rewarding to supervise capable students in the senior thesis course, in which they did individual projects in research labs. In research, competition for grants was not fierce, and faculty who were productive and wrote solid applications could obtain support from NRC and later NSERC for a variety of pure and applied projects. These grants were not generous but money was available for work in specific areas from other agencies. For many faculty in the Department of Biology, this was a rewarding time and we felt fortunate to be paid for work we enjoyed.

The final question that can be asked is what has Biology at McMaster achieved in its teaching and research in its first 100 years? A broad and balanced assessment is beyond the scope of this history, but one well-defined measure is the PhDs earned by Biology students and those earned under the supervision of

BIOLOGY AT MCMASTER

members of the Department. These are listed in Appendix B, in which the dates have been extended to include all those supervised by the retirees mentioned in the previous chapter.

Appendix A

Enrolments of undergraduate students at McMaster University

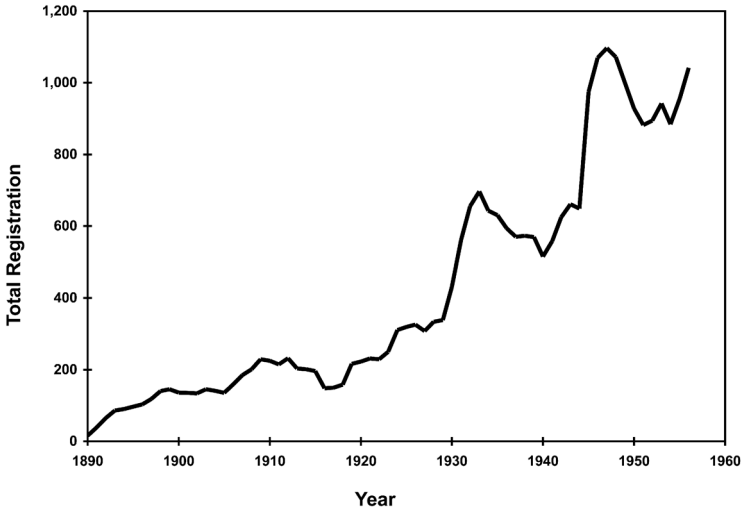


Figure 1 Numbers of full- and part-time undergraduate students from 1890-91 to 1956-57.

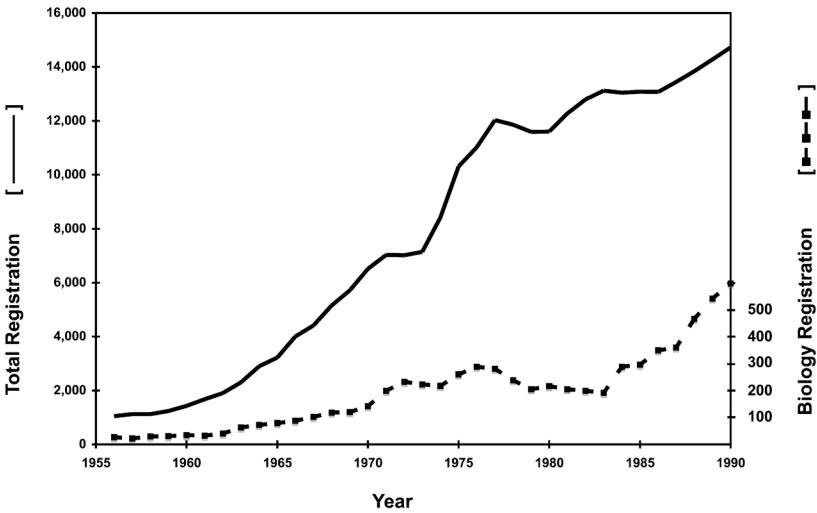


Figure 2 Solid line: numbers of full- and part-time undergraduate students from 1956-57 to 1990-91. Dotted line: numbers of undergraduate students in Biology programs, 10x scale.

Appendix B

PhDs awarded to students in the Departments of Biology,
Botany and Zoology

Compiled by Ludvik A. Prevec and Richard A. Morton

The list gives the date of the award, the candidate's name, the supervisor and the title of the thesis, and it has been extended to include all the PhDs supervised by the retired faculty members mentioned in Chapter 8.

Also included are A.N. Jelsma (1989) and J.S. Mymryk (1993), who did their research in the Department of Biology but were registered in the Department of Biochemistry.

- 1952 **Adams, Angus Macaulay**, J.J. Miller
Studies on ascospore formation in *Saccharomyces meyen*.
- 1955 **Musgrave, Anthony John**, J.J. Miller
A study of the association between two weevils (*Sitophilus oryza* L., and *Sitophilus Granarius* L.) and the micro-organisms of their mycetomes.
- 1955 **Terasmae, Jaan**, N.W. Radforth
A palynological study relating to the Toronto formation (Ontario) and the Pleistocene deposits in the St. Lawrence lowland (Quebec).
- 1956 **Rouse, Glenn Everett**, N.W. Radforth
The disclosure and paleobotanical evaluation of plant microfossils from selected cretaceous coal-bearing strata of Canada.
- 1957 **Botan, Edward Allen**, H. Kleerekoper and J.J. Miller
Micro-organisms isolated from fresh water and their role in the decomposition of nitrogenous organic matter.
- 1957 **McGregor, Duncan Colin**, N.W. Radforth
Spores and other plant microfossils from selected Devonian sedimentary formations of Canada.
- 1959 **Iyengar, V. K. S.**, D.M. Davies and H. Kleerekoper
The relationships between *Chironomidae* and their substrate in ten freshwater lakes of southern Ontario.
- 1960 **Mook, Leonard Jan**, D.M. Davies
Grasshopper populations at low density.
- 1960 **Bonga, Jan Max**, N.W. Radforth
Potentiality for growth and differentiation in the embryo-gametophyte complex of *Pinus nigra* var. *austriaca* as season advances.

Biology PhDs

- 1961 **Aimer, Valerie Margaret**, H. Kleerekoper
Some observations on teleost respiration with emphasis on the gill filament musculature and the respiratory centres of the brain.
- 1961 **Pontefract, Roderic Donald**, J.J. Miller
A study of physiological and morphological changes in sporulating cells of *Saccharomyces cerevisiae*.
- 1961 **Riddell, Robert Thompson**, N.W. Radforth
Tissue ontogeny in the potato tuber relative to metabolic state and scab disease.
- 1962 **Demelker, Jack**, H. Kleerekoper
A study of distribution of digestive enzymes in the ammocoete and adult of *Petromyzon marinus*.
- 1962 **Eydt, Henry Ronald North**, N.W. Radforth
An assessment of the component tissues of peat in their in situ arrangement.
- 1963 **Morrison, Paul Elmor**, D.M. Davies
The first and subsequent ovarian cycles of the house fly, *Musca domestica* L., in relation to chemically defined nutritional requirements of the adult.
- 1963 **Wood, Donald Montgomery**, D.M. Davies
An interpretation of the phylogeny of the Eusimulium-group (Diptera: Simuliidae) with descriptions of six new species.
- 1963 **Stewart, John Martin**, N.W. Radforth
Interpretation of organic terrain by the cuticular components of peat as applied to Copetown bog.
- 1963 **Suguitan, Lynda Santos**, N.W. Radforth
Evaluation of five muskeg landscape patterns with similar types of vegetal cover utilizing pollen analysis.
- 1965 **Banerjee, Satyendra Nath**, N.W. Radforth
Experimental examination of growth and differentiation in the embryo-gametophyte complex of *Pinus resinosa* and *Ginkgo biloba*.
- 1965 **Marimuthu, Kodumudi M.**, S.F.H. Threlkeld
The mode of chromosome duplication during meiosis and mitosis in *Haplopappus gracilis*.
- 1966 **Garg, Bhagwan Dass**, E.L. McCandless
Collagenous growth induced by lambda carrageenan in an avascular tissue, the cornea.

BIOLOGY AT MCMASTER

- 1966 **Radford, Alan**, S.F.H. Threlkeld
A genetic analysis of the pyridoxine auxotrophs of *Neurospora crassa*.
- 1967 **Bhar, Dilbagh Singh**, N.W. Radforth
Morphogenetic and in vitro studies of the shoot apices of *Pharbitis nil* Chois, strain *violet* in relation to photoperiodic induction.
- 1967 **Usik, Lily**, N.W. Radforth
Analysis of growth rings in black spruce (*Picea mariana*) in relation to site and climatic factors.
- 1967 **Griffiths, Anthony J. F.**, S.F.H. Threlkeld
An investigation into the control of genetic recombination in some strains of *Neurospora crassa*.
- 1967 **Mishra, Nawin C.**, S.F.H. Threlkeld
Genetic studies in *Eudorina* and *Neurospora*.
- 1968 **Yang, Yong Jin.**, D.M. Davies
A study of ingestion and digestion, emphasizing the peritrophic membrane and digestive enzymes in adult simuliids (*Diptera*) fed blood, blood-sucrose mixtures and sucrose.
- 1968 **Kapoor, Narinder Nath**, H. Kleerekoper
Locomotor patterns of teleost fish under constant conditions of light and darkness.
- 1968 **Brideaux, Wayne Wilfred**, N.W. Radforth
Palynology of the lower Colorado group (late lower Cretaceous) and its lithological equivalents in central and west-central Alberta, Canada.
- 1968 **Cooper, John Ernest Keith**, H.F. Stich
The effects of infection with adenoviruses on the chromosomes of human cells and Syrian hamster cells.
- 1968 **Tomita, Fusao**, I. Takahashi
Biochemical studies of bacteriophage PBS 1.
- 1969 **Lall, Suresh Behari**, D.M. Davies
Contact chemoreception in haemotophagous tabanids
- 1969 **Stoltz, Donald Bruce**, D.M. Davies
Observations on naturally occurring viruses in larvae of the midge *Chironomus plumosus*.
- 1969 **Wilfong, James Albert**, N.W. Radforth
A study of growth and morphogenesis in *Oedogonium cardiacum*.

Biology PhDs

- 1969 **Subden, Ronald Ernest**, S.F.H. Threlkeld
Some studies on loci associated with carotenogenesis in *Neurospora crassa*.
- 1969 **Ball, Alan John Stuart**, E.R. Tustanoff
The control of energy metabolism in the yeast *Saccharomyces cerevisiae*.
- 1970 **White, Bradley Neil**, S.T. Bayley
Aspects of protein synthesis in vitro in *Halobacterium cutirubrum*.
- 1970 **Rainbow, Andrew James**, S. Mak
A correlation of molecular damage and biological functions of human adenovirus following UV and gamma irradiation.
- 1970 **Korpijaakko, Erkki Olavi**, N.W. Radforth
Aerial interpretation of muskeg.
- 1971 **Liao, Shuen-Kuei**, D.H. Carr
Induction of active immune state by multinucleate tumor cells in mice.
- 1971 **Banerjee, Maya**, J.J. Miller
The role of carbohydrate in the germination of yeast ascospores.
- 1971 **Kang, Chil-Yong**, L.A. Prevec
Vesicular stomatitis virus: Studies of viral proteins and autointerference.
- 1971 **Chow, Charles Tai-Chien**, I. Takahashi
Biochemical investigations on an asponogenous mutant of *Bacillus subtilis*.
- 1971 **Johnston, Kenneth Harper**, E.L. McCandless
Studies on the activity of carrageenases from *Pseudomonas carrageenovora*.
- 1971 **Mylyk, Orest Martin**, S.F.H. Threlkeld
A genetic study of female sterility in *Neurospora crassa*.
- 1972 **Liptay, Albert**, D. Davidson
Analysis of growth patterns in barley coleoptiles.
- 1972 **Thomson, Alan John**, D.M. Davies
The ecology of *Pollenia rudis* (Diptera: *Calliphoridae*) and its host earthworms (*Lumbricidae*), with special reference to the host parasite relationship between *P. rudis* and *Eisenia rosea*.
- 1972 **Agnew, David Alexander**, L.D. Skarsgard
Radiosensitization of anoxic mammalian cells.

BIOLOGY AT MCMASTER

- 1972 **Palcic, Branko**, L.D. Skarsgard
Sedimentation studies of ionizing-radiation damage in mammalian DNA.
- 1973 **Galet, Helene**, L.A. Prevec
Studies on a RNA polymerase induced in L cells infected with vesicular stomatitis virus.
- 1973 **Haight, Murray E.**, D. Davidson
Cell cycle analysis in developing cercariae of *Trichobilharzia ocellata* (Trematoda: *Schistosomatidae*).
- 1973 **Harvey, Barbara Mary Roberta**, B.A. Oaks
Hydrolysis of endosperm proteins in germinating maize.
- 1973 **Herrington, Muriel Bella**, I. Takahashi
Temperature-sensitive mutants of bacteriophage PBS 2.
- 1974 **Rima, Bertus Karel**, I. Takahashi
Pyrimidine metabolism in PBS 1-infected *Bacillus subtilis*.
- 1975 **Ghosh, Jaya**, D. Davidson
Nuclear volumes: An analysis during a cell cycle.
- 1975 **Milos, Nadine Constance**, A.D. Dingle
Dynamics of lateral stripe formation in the zebrafish, *Brachydanio rerio*.
- 1975 **Larson, Douglas William**, K.A. Kershaw
Aspect of the ecology of coastal tundra raised beach ridges in northwestern Ontario.
- 1975 **Pater, Mary Maryam**, S. Mak
Cellular DNA metabolism after infection by adenovirus type 12.
- 1975 **Levine, Marc**, I. Takahashi
Suppressor-sensitive mutants of bacteriophage PBS 2.
- 1975 **Tu, Yu**, D.R. McCalla
The mode of action of nitrofurazone on bacteria.
- 1976 **Pater, Alan**, S.T. Bayley
Studies on the purification and properties of some halophilic enzymes.
- 1976 **Ezoe, Hisanori**, S. Mak
Biological and molecular studies of a low oncogenic mutant of human adenovirus type 12
- 1976 **Peterman, Branko Franc**, R.A. Morton
Electron transfer reactions of cytochromes C.

Biology PhDs

- 1976 **Sengupta, Sutapa**, L.A. Prevec
A study of the pseudotypes of Vesicular Stomatitis Virus and Murine Leukemia Viruses.
- 1976 **Chang, Henry Chen-Ping**, G.J. Sorger
Study of the regulation of nitrite reductase in *Neurospora crassa*.
- 1976 **Bentley, Michael Martin**, S.F.H. Threlkeld
Genetic studies of some spontaneously arising differences in aerialogenesis between *Neurospora crassa* strains.
- 1977 **Smiley, James Richard**, S. Mak
Physical studies of the organization and transcription of the genome of human adenovirus type 12.
- 1978 **Larson, Dawn Ewings**, A.D. Dingle
Development of the flagellar rootlet of *Naegleria*.
- 1978 **Lee, Kwok Ching**, S. Mak
Integration of viral DNA sequences in infected and transformed mammalian cells.
- 1978 **DiNinno, Vincent Luigi**, E.L. McCandless
Chemistry and immunochemistry of carrageenans.
- 1979 **Zarull, Michael Anthony**, G.P. Harris
Spatial and temporal heterogeneity in phytoplankton communities.
- 1979 **MacFarlane, John David**, K.A. Kershaw
Physiological ecology and stress responses in the genus *Peltigera*.
- 1979 **Jackson, Susan Gail**, E.L. McCandless
Biosynthesis of carrageenans in haploid and diploid plants of the red alga *Chondrus crispus*.
- 1980 **Thomas, James Ernest**, D. Davidson
An analysis of cell growth and division in germinating and mature root meristems of *Vicia faba*.
- 1980 **Eveleigh, Michael John**, E.L. McCandless
Immunostimulatory properties of carrageenans.
- 1980 **Lassam, Norman John Errington**, S.T. Bayley
Studies on tumor antigens of adenovirus type 5.
- 1981 **Brown, Earl Garnet**, L.A. Prevec
Vesiculovirus comparisons of abnormal N protein of the vesicular stomatitis New Jersey D, temperature sensitive mutant.

- 1981 **Jeeves, William Patrick**, A.J. Rainbow
Radiation enhanced reactivation of irradiated human adenovirus type 2 in human cells.
- 1982 **Harnish, Delsworth Godfrey**, Rawls, William E.
Characterization of virus specific polypeptides during Pichinde virus infection in cell culture.
- 1982 **Pluthero, Frederick Gordon**, S.F.H. Threlkeld
The genetics of the behavioural and physiological responses of *Drosophila melanogaster* to the insecticide malathion.
- 1982 **Golini, Victor Italo**, D.M. Davies
Cytology, taxonomy and ecology of species in the genus *Hellicheilla* (Diptera: *Simuliidae*).
- 1983 **Armstrong, Stuart William**, D. Davidson
Mitotic asymmetry: differential behaviour of sister nuclei.
- 1983 **Sanborne, Paul Michael**, D.M. Davies
Classification, zoogeography and phylogeny of the genus *Sinophorus foerster* (Hymenoptera: *Ichneumonidae*).
- 1983 **Rowe, David Thomas**, F.L. Graham
Characterization of the transforming proteins of adenovirus type 5 synthesized in infected human cells.
- 1983 **Goudy, James Stephen**, G.P. Harris
Chemical and physiological investigation of heavy metal-phytoplankton interactions.
- 1983 **Coxson, Daryn Stanley**, K.A. Kershaw
The ecophysiology of surface cryptograms from alpine tundra and semi-arid grassland of SW Alberta.
- 1983 **Lai Fatt, Richard Bernardo**, S. Mak
Characterization and mapping of a DNA degradation function (cyt) in adenovirus.
- 1983 **Bilinski, Carl Anthony**, J.J. Miller
Regulation of nuclear division and ascosporeogenesis in apomictic strains of *Saccharomyces cerevisiae*.
- 1983 **Misra, Santosh**, B.A. Oaks
Glutamine and asparagine metabolism in developing endosperm of corn.
- 1983 **Bell, John Cameron**, L.A. Prevec
Studies on NS the phosphoprotein of Vesicular Stomatitis Virus.

Biology PhDs

- 1983 **Downey, James Frederick**, S.T. Bayley
Studies on some early polypeptides encoded by adenovirus type 5.
- 1983 **Trimbee, Annette Marie**, G.P. Harris
The phytoplankton population dynamics of a small reservoir.
- 1984 **McKinnon, Randy Donald**, F.L. Graham
Construction and characterization of insertion and deletion mutations in the transforming genes of human adenovirus type 5.
- 1984 **Sun, Dongxu**, I. Takahashi
Catabolite resistant mutants of *Bacillus subtilis*.
- 1984 **Metcalf, Christopher David**, R.A. Sonstegard
Genotoxic and carcinogenic activity of oil refinery effluents.
- 1985 **Barber, Dorothy Louise**, J.E.M. Westermann
Studies on the identity of rodlet cells in teleost fish.
- 1985 **Cleland, Glen Barry**, R.A. Sonstegard
Immunomodulatory studies of dietary consumption of halogenated hydrocarbon-contaminated great lakes Coho salmon.
- 1986 **Agellon, Luis Benn**, T.T. Chen
Molecular cloning, characterization and expression in *E.coli* of a cRNA encoding the growth hormone in rainbow trout (*Salmo gairdneri*).
- 1986 **Haj-Ahmad, Yousef**, F.L. Graham
Development and characterization of a human adenovirus type 5 cloning vector.
- 1986 **Laurén, Darrel Jon**, D.G. McDonald
Mechanisms of copper toxicity and acclimation to copper in rainbow trout (*Salmo gairdneri* R.).
- 1986 **Rastogi, Vipin Kumar**, B.A. Oaks
Hydrolysis of storage proteins in barley endosperm: role of gibberellic acid.
- 1986 **Bennett, Craig**, A.J. Rainbow
Ultraviolet enhanced mutagenesis of adenovirus in human fibroblasts.
- 1986 **Coulhart, Michael Bruce**, R.S. Singh
Variation and evolution in proteins of the *Drosophila* male reproductive tract.
- 1986 **Brown, Douglas G.**, K.A. Kershaw
Seasonal changes in photosynthesis in the lichen *Peltigra rufescens*.

- 1987 **Choudhary, Madhusudan**, R.S. Singh
Genetic structure and species divergence between populations of *Drosophila melanogaster* and its sibling species, *Drosophila simulans*.
- 1987 **Ockenden, Irene Eelnurme**, J.N.A. Lott
Studies of calcium and other storage minerals in embryos of *Cucurbita maxima*, *Cucurbita andreana* and their reciprocal hybrids.
- 1987 **Spry, Douglas John**, C.M. Wood
Zinc uptake in the rainbow trout *Salmo gairdneri* (Richardson), as affected by dietary and waterborne zinc and waterborne calcium.
- 1989 **Bautista, Diosdado S.**, F.L. Graham
Isolation and characterization of insertional mutants in the early region 1A of adenovirus.
- 1989 **Hale, Lawrence Richard**, R.S. Singh
An analysis of population genetic structure and species history of *Drosophila melanogaster* and *D. simulans* using restriction length fragment polymorphism of mitochondrial DNA.
- 1989 **Janus, Lorraine Lee**, R.A. Vollenweider
Nutrient residence times in relation to the trophic conditions of lakes.
- 1989 **Jelsma, Anthony N.**, S.T. Bayley
Sequences in the adenovirus 5 E1A gene that are required for transcriptional activation, enhancer repression, and oncogenic transformation.
- 1989 **Playle, Richard Colin**, C.M. Wood
Physiological effects of aluminum on rainbow trout in acidic saltwater with emphasis on the gill microenvironment.
- 1989 **Reid, Scott Douglas**, D.G. McDonald
Metal-gill surface interactions in rainbow trout (*Oncorhynchus mykiss*).
- 1990 **Charles, Trevor Carlos**, T.M. Finan
Construction of a genetic linkage map of the *Rhizobium meliloti* 1600 kilobase megaplasmid pRmeSU47b, generation of defined megaplasmid deletions, and study of megaplasmid-borne genes.
- 1990 **Egan, Catherine R.**, P.E. Branton
Characterization of cellular proteins found in association with early region 1A polypeptides of human adenovirus type 5.
- 1990 **Schaller, Michael D.**, S. Mak
The role of E1b products of adenovirus serotype 12 in lytic infection and transformation.

Biology PhDs

- 1991 **Zhang, Shiyun**, S. Mak and P.E. Branton
Construction and characterization of E1B mutants of adenovirus type 12.
- 1991 **Gysbers, John W.**, S. Mak
DNA degradation by adenovirus in permissive and non-permissive infections.
- 1991 **Long, Deborah Marie**, B.A. Oaks
Nitrate reductase in maize roots: Localization and molecular characterization.
- 1992 **Howe, John Allan**, S.T. Bayley
Control of gene expression and cell cycle regulation by adenovirus 5 E1A proteins.
- 1992 **Jelinek, Mary Anne**, J.A. Hassell
Requirement of Ras proteins in transformation by polyomavirus middle tumor antigen.
- 1992 **Stea, Anthony Jean**, C.A. Nurse
Investigations of chemosensory mechanisms in cultured glomus cells of the rat carotid body using patch clamp/whole-cell recording.
- 1993 **Mymryk, Joseph Stephen**, S.T. Bayley
Induction of gene expression by the 243 residue E1A protein of adenovirus type 5 in relation to the biological effects of this protein.
- 1993 **Jelinek, Tomas**, F.L. Graham
Genetic analysis of the tumorigenic properties of human adenovirus serotypes 5 and 12.
- 1993 **Zeng, Ling-Wen**, R.S. Singh
Haldane's rule and the genetic basis of hybrid male sterility in *Drosophila simulans*, *Drosophila mauritiana* and *Drosophila sechellia*.
- 1994 **Yarosh, Oksana Katherine**, L.A. Prevec
Recombinant human adenovirus type 5 vaccine vectors expressing rhabdoviral glycoproteins.
- 1994 **Long, Anthony Douglas**, R.S. Singh
The genetic basis of variation in a polygenic character.
- 1994 **Smibert, Craig Alan**, J.M. Smiley
Regulation of viral and cellular gene expression in cells infected with herpes simplex virus.

BIOLOGY AT MCMASTER

- 1994 **Wilkie, Michael Patrick**, C.M. Wood
The physiological adaptations of two salmonids, the rainbow trout (*Oncorhynchus mykiss*) and the high pH tolerant Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), to highly alkaline environments.
- 1995 **Driscoll, Brian Thomas**, T.M. Finan
Genetic and biochemical characterization of the NAD⁺ and NADP⁺ malic enzymes of *Rhizobium meliloti*.
- 1995 **Muthuswamy, Senthil Kumar**, W.J. Muller
Role of the Src family tyrosine kinases in mammary tumorigenesis.
- 1995 **Pereira, Daniel Sousa**, F.L. Graham
Characterization of rat cells transformed by hybrid adenovirus type 5/12 E1A genes.
- 1995 **Bett, Andrew James**, F.L. Graham
Construction and characterization of recombinant human adenovirus type 5 vectors.
- 1995 **Sonnenfeld, Margaret Jean**, J.R. Jacobs
Neuron-glia interactions in the nervous system of Drosophila embryos.
- 1995 **Gallichan, William Scott**, K.L. Rosenthal
Evaluation of immune responses and protection in mucosal tissues following intranasal immunization with a recombinant adenovirus vector expressing glycoprotein B of herpes simplex virus.
- 1995 **Kajjura, Lovaye Jocelyn**, C.D. Rollo
Resource allocation in giant "Supermice" genetically engineered with extra rat growth hormone genes.
- 1995 **Wang, Yuxiang Sean**, C.M. Wood
The dynamics of lactate and ammonia in rainbow trout (*Oncorhynchus mykiss*) white muscle.
- 1996 **Fieldhouse, Daniel Gordon**, G.B. Golding
Evolutionary rates and patterns in rodent *APRT* sequences.
- 1996 **Webster, Marc A.**, W.J. Muller
Mechanisms of polyomavirus transformation of the mouse mammary gland.
- 1997 **Bardin, Sylvie D.**, T.M. Finan
Phosphate uptake in *Rhizobium meliloti*.
- 1997 **Addison, Christina Lynn**, F.L. Graham
Construction and characterization of adenoviral vectors expressing cytokines for cancer immunotherapy.

NOTES

The general sources of information used were:

Chapters 1 to 3 – the Baptist Archives

Chapters 3 to 9 – the Department of Biology, McMaster University

Chapters 4 to 7 – the McMaster Archives

Interviews carried out by Ms Jeannie Chandy are indicated by JC; the others were by the author.

Abbreviations:

BM Minutes of meetings of the Botany and Biology Departments, McMaster University.

CMJ 1 Johnston, Charles M. *McMaster University Volume 1: The Toronto Years*. The University of Toronto Press, Toronto, 1976.

CMJ 2 Johnston, Charles M. *McMaster University Volume 2: The Early Years in Hamilton, 1930-1957*. The University of Toronto Press, Toronto, 1981.

ZML Zack, M., L. Martin and A.A. Lee *Harry Thode: Scientist and Builder at McMaster University*, McMaster University Press, 2003.

Chapter 1 The Toronto Years

p 2 *'University be organized'*: CMJ 1 p 52 ref 26.

p 3 *McMaster himself would have favoured*: CMJ 1 pp 53-54.
By the Act of 1887: *ibid.* p60.

p 4 *In the first year the University*: report of Faculty in Arts, October 12, 1891.

in 1895-96: report by Willmott for the Natural Sciences Department, 1895-96.

by 1924-25: Chancellor's report to Senate, May 18, 1925.

Thomas MacKenzie BA, MB: report of Faculty in Arts, October 12, 1891.

Arthur B. Willmott, MA: CMJ 1 p 64.

p 5 *Between 1895 and 1898*: Chancellor's report to Senate for 1898-99.

Piersol certainly was: E. Horne Craigie *A History of the Department of Zoology of the University of Toronto up to 1962*, 1965, p 30.

MB: Bachelor of Medicine, which was the original name of the undergraduate degree required to qualify as a physician.

Teaching loads were heavy: Chancellor's report to Senate, May 1896.

BIOLOGY AT MCMASTER

- p 6 *A.P. Coleman, PhD*: he was a geologist and had a distinguished career. He became Professor of Geology at the Universities of Victoria and Toronto, he was elected a Fellow of the Royal Society of Canada, he was awarded a number of Honorary Degrees and he had a mountain in Alberta named after him: University of Victoria Library.
In 1895, Willmott: Chancellor's report to Senate, May 1896.
ventilation of the laboratory: report by Willmott for 1895-96.
From 1899, Biology instruction: Chancellor's report for 1890-99.
- p 7 *Isoetes*: quillworts, aquatic plants.
Willmott left McMaster: obituary, May 9, 1914.
Smith was promoted: one of Smith's students was Cyrus Eaton, who entered McMaster in 1901 and received his BA in 1905. He was a very successful businessman and a Baptist, but it is not clear whether he ever gave substantial financial support to the University. Late in life he funded the Pugwash Conferences, founded in 1957 by Joseph Rotblat and Bertrand Russell to study ways of reducing the threat of nuclear conflict, and he worked for peaceful relations between the US and the Soviet Union, receiving the Lenin Peace Prize in 1960.
- p 8 '*McMaster exists*': CMJ 1 p 71.
'*your nurture of*': CMJ 1 pp 71-73.
'*much might have to be*': CMJ 1 p 83 ref 49.
- p 9 '*people of fair means among us*': CMJ 1 p 85.
- p 12 *Smith wrote to him*: CMJ 1 p 121 ref 31.
- p 18 *rabid, vociferous feminist*: CMJ 2 p 106.
Mrs. Jean (Dryden) Leaman: interview by Morton and Dingle, May 2007.
- p 19 '*little school for Baptists*': CMJ 1 p 75.
- p 21 *If evolution was mentioned*: A box of Smith's papers and books in the Baptist Archives suggests that he was aware of the Theory of Evolution. In an e-mail to the author in June 2008, Chuck Johnston pointed out that among the sages honoured in Convocation Hall is none other than Charles Darwin. Johnston said that when writing his book, he was unable to find any indication in the Baptist Archives of who made the decision to include Darwin, and whether there had been any opposition. He commented that in any case the University was obviously serving notice that they were on Darwin's side.

Notes

Chapter 2 First Years in Hamilton

- p 24 *'difficult and prickly'*: CMJ 2 p 25.
she had a greenhouse: *ibid.* pp 20, 25 refs 67,68.
course on plant pathology: *ibid.* p 25 ref 69.
head of the Department of Chemistry: *ibid.* p 34; Alderson, Henrietta J., *Twenty Five Years A-Growing: The History of Nursing at McMaster University*, McMaster University, Hamilton, 1976, p 10.
- p 25 *other clubs*: Johnston, Charles M., and John C. Weaver. *Student Days: Student Life at McMaster University*. McMaster University Alumni Association, 1986, p 47.
from more affluent: *ibid.* pp 57, 59.
could reasonably handle: CMJ 2 p 40 ref 5.
- p 26 *'Christianity of McMaster?'*: CMJ 2 pp 79-80 refs 204-206.
- p 28 *potential high school teachers*: CMJ 2 p 61 ref 109.
Premedical program: *ibid.* p 61.
an RN diploma: Alderson, Henrietta J., *op. cit.*, pp 12-17.
- p 29 *relevant to health care*: *ibid.* pp 39-42; 133-5.
- p 30 *dominance of Science*: CMJ 2 pp 105-6.
following notice: *ibid.* p110.
- p 31 *Paddy Greene's*: *ibid.* p 113 ref 145.
- p 32 *Johnston remembered Gaiser*: e-mail to the author, June 2008.
- p 33 *to appoint her Head*: Gilmour to Gaiser April 15, 1942.
his reply was direct: Burke to Gaiser, April 29, 1942.
Gilmour encouraged her: Gilmour to Gaiser, April 27, 1942.
letter to Columbia: May 11, 1943.

Chapter 3 The Postwar Years

- p 35 *Gilmour described*: CMJ 2 p 121 ref 1.
In 1947-48: *ibid.* p 167.
- p 36 *Gilmour accepted*: *ibid.* pp 213-5.
Government provided: *ibid.* pp 150-151.
conveniently handle: *ibid.* p 141.
- p 37 *'mission' school*: *ibid.* p 132.
- p 38 *taken by Thode*: *ibid.* p 186.
persuaded to provide: *ibid.* p 187.
faculty numbers rose: *ibid.* p 200.

BIOLOGY AT MCMASTER

- p 39 *Togo Salmon*: *ibid.* p 180.
Radforth: *ibid.* p 181 ref 46.
- p 40 *two full courses*: *ibid.* pp 183-4.
- p 41 *a titular position*: CMJH 2 pp 170-171; E. Carey Fox was appointed the first Chancellor.
students did not register: CMJ 2 pp 167-8.
- p 43 *Radforth should be appointed*: Laking, L., *Love, Sweat and Soil: A History of Royal Botanical Gardens from 1930 to 1981*, Royal Botanical Gardens Auxiliary, 2006, p 49.
Senior Professor: CMJ 2 p 161 ref 103.
Dr. F.E. Beamish: Beamish to Gilmour, January 14, 1947.
Gilmour replied: Gilmour to Beamish, February 27, 1947.
- p 44 *two story building*: Kleerekoper to Thode, April 8, 1959.
- p 47 *Fortunately for Botany's case*: interview with Bourns, May 2007.
a PhD program in Zoology: ZML p 56.
- p 50 *In March 1953*: Thode memo, March 12, 1953.
George Wald: CMJ 2 pp 236-7.
- p 51 *Dorothy Jane Miller*: interview by JC, June 2001.
- p 52 *courses they took*: interviews with Dingle and Westermann, August 2006.
At the time Gilmour had: CMJ 2 pp 135,136.
- p 55 *on 1 June 1957*: *ibid.* p 261.

Chapter 4 The Department is Confronted by Change and the Medical School

- p 56 *businesses grew*: Gidney, R.D. *From Hope to Harris: The Reshaping of Ontario's Schools* University of Toronto Press Inc. 1999, pp 25-27.
- p 57 *the overall budget*: NRC Annual Report for 1967-68.
Threlkeld: interview, July 2006.
- p 58 *the nuclear reactor*: McMaster was the first university in the British Commonwealth to have a reactor; this was another of Thode's major achievements: ZML pp 67-74.
- p 59 *Department had withdrawn*: BM September 29, 1958.
- p 60 *Thode began carrying out*: memo filed with BM.
- p 61 *On March 15, 1962*: report of meeting filed with BM.
Kleerekoper sent Thode: Kleerekoper to Thode May 11, 1962.

Notes

- p 62 *Threlkeld regards the creation*: interview, July 2006.
McCalla felt: interview, June 2006.
Dingle: interview, August 2006.
- p 63 *This committee addressed*: filed with BM.
- p 64 *four full meetings*: BM March 13-21, 1958.
comments of Nace and Radforth: BM March 13, 18, 1958.
- p 65 *In a preliminary report*: filed with BM.
- p 67 *In the 1930s*: CMJ 2 p 61 ref 111.
a recent survey: this was the *Dolman Report on a Survey of Medical Education in Canada and the United States, 1946*.
CMJ 2 p 189 ref. 81.
'utter folly': CMJ 2 p 189 refs 81,82.
in 1964 McMaster: ZML p 94.
- p 68 *serious misgivings*: *ibid.* p 109.
Thode... was determined: *ibid.* pp 96-97.
Dingle remembers: interview, August 2006.
- p 69 *in February 1967*: report of meeting filed with BM.
Vice Presidents: this reference reflects changes in the University administration described in the next chapter.

Chapter 5 The Department Reformed

- p 71 *Kleerekoper had been Chair*: interview with Bourns, May 2007.
- p 72 *Siminovitch had a close*: interview with Mak, June 2007.
the justification being: interview with Threlkeld by JC, June 2001.
- p 76 *The splitting of this Faculty*: CMJ 2 pp 97, 257.
considered again: BM, April 10, 1962.
- p 81 *Bourns, Vice-President of Science*: Bourns memo, filed with BM.
- p 82 *In June 1972*: letter from Bourns to the author as Chair, June 1, 1972, filed with BM.
To illustrate: memo of 12 December 1972, filed with BM.
- p 83 *When McCalla*: BM November 15, 1972.

Chapter 6 The Matter of Space

- p 86 *Davies related*: interview by JC, June 2001.
- p 87 *Hamilton Hall was renovated*: CMJ 2 p 231 ref 130.
room Threlkeld occupied: interview by JC, June 2001.
Construction of the Engineering Building: Calendar for 1960-61.

BIOLOGY AT MCMASTER

- p 90 *When Lott arrived*: interview with Lott, September 2006.
- p 92 *It has been suggested*: interview with Threlkeld by JC, June 2001.
- p 93 *in an effort to save*: e-mail from Lott to the author, December 4, 2008.

Chapter 7 Steady Progress and Retirements

- p 98 *By 1975 enrolments*: BM April 15, 1975.
- p 101 *numbers were not falling*: BM January 25, 1973.
- p 105 *a good influence* : see Oaks, A., *Annu. Rev. Plant Physiol. Plant Mol. Biol.* 2000, vol 51, p 8.
- p 107 *Sonstegard had done*: interview with Prevec, August 2007.
- p 109 *high on LSB!*: As many readers will recognize, this was an allusion to LSD, lysergic acid diethylamide, an illegal hallucinogenic drug.
- p 110 *submitted a proposal*: undated memo filed with BM.
- p 112 *decision to advertise*: BM January 18, 1984.
- p 113 *written response*: the submitted response and the reviewers' report are filed in the Biology Department.
- p 115 *Threlkeld sent copies of a memo*: January 18, 1988, filed with BM.
Childs replied: February 10, 1988, filed with BM.
- p 116 *Our recommendations*: notice of motion, BM June 15, 1989.

Chapter 8 Notes on Retirees and Departmental Staff

- p 123 *'In an interview'*: by JC, 2001.
- p 126 *duty of the Beadle*: Graham, R.P. *The Insignia of McMaster University* McMaster University Press, 1985.
- p 136 *he returned*: In the Department after a trip, Pohl described his experiences with wit and striking landscape photographs he had taken. He wrote a book on his journeys: *The Lure of Faraway Places* (Natural Heritage Books, 2007) which was published posthumously.

Chapter 9 Conclusion

- p 138 *The Faculty of Science*: BM June 7, 1984.
- p 139 *in the Faculty Association*: *MUFA's First 50 Years: The Presidents Reminisce*, B.W. Jackson, editor; The McMaster University Faculty Association, November 2001.

Notes

PHOTO CREDITS

Pages 2, 10, 11, 13 (Dr. L.O.Gaiser, ca. 1930, Dr. R.W. Smith in 1935), 86, 88, 89. The Canadian Baptist Archives at McMaster Divinity College.

Page 13 Chancellor McKay and Professor Smith, ca. 1907 from: Student Days: Student life at McMaster University from the 1890s to the 1980s by Charles M. Johnston and John C. Weaver, McMaster University Alumni Association ca. 1986.

Pages 23, 45 The McMaster University Undergraduate Calendar.

Page 27 Marmor, McMaster University, 1951.

Page 40 from Harry Thode: Scientist and Builder at McMaster University by Manuel Zack, Lawrence Martin and Alvin A. Lee, McMaster University Press, 2003.

Page 52 Marmor, McMaster University, 1957.

Page 53 The Toronto Star, Nov. 6, 1963. Reprinted with permission-Torstar Syndication Services.

Page 93 Contact, Vol. 4, No. 4, McMaster University, Department of Information and Publications, 1972.

Pages 95, 102, 106, 117 The Department of Biology.

Pages 118-135 Retired Faculty from The Department of Biology except:

Page 120 Douglas M. Davies from a family photograph, courtesy of Ian Davies (with permission).

Page 123 Doris N.E. Jensen from a photograph in the collection of The University Club of McMaster University.

Page 127 John J. Miller from The Insignia of McMaster University by Ronald Powell Graham, McMaster University Press, 1985.

The help of Marvin Gunderman, Matt Lowe, Brian R. Morton and Herb E. Schellhorn in preparing digital copies is gratefully acknowledged.

COVER NOTE

The cover design incorporates drawings from R. Wilson Smith's 1900 paper, "The Structure and Development of the Sporophylls and Sporangia of Isoetes", in the *Botanical Gazette*, and an electron micrograph from John Lott of pollen grains.

INDEX

The bold numbers indicate pages with photographs

- Baptist Assembly/Convention, 2-3, 15, 20, 37, 52, 55
 Denomination, 1-3, 4, 8-9, 15-16, 19, 20, 21, 36
- Bayley, Stanley T., xi, 57, 69, 72, 73-75, 80, 82-83, 85, 90, **93**, 99, **102**, 104, 108, 110, 111, 115, 116, 117, 130, **134**, 135, 136, 147, 148, 149, 151, 152, 153
- Biology, xii, xiii, 4, 25, 50, 53, 57, 58, 59-60, 68, 100, 112, 116, 138, 141
 Department, xi-xii, xiii, 7, 16, 18, 21, 22, 28, 30, 32, 33, 44, 47, 49-50, 51, 53, 56-57, 58, 59, 60, 61, 62, 64, 65, 67, 68, 69, 71-72, 73-75, 76, 77, 80, 81, 82, 83, 84, 85, 86, 87, 89, 90, 91-94, 97, 98, 101, 105, 106, 107, 108, 109, 110, 111, 112, 113, 115, 116, 117, 119, 120, 121, 125, 127, 128, 131, 132, 133, 135, 136, 137, 138, 139-140, 141, 142
 Club, 76, 94, 100, 120
 Enrolment, xiii, 4, 16, 28, 51-52, 63, 78, 79, 81, 83, 84, 86, 97, 98, 100, 101, 114, 115, 116, 117, 139, 143
 Faculty, xii, 4-5, 6, 29, 31, 51, 53, 57-59, 60, 62, 63, 68, 69, 72-75, 79, 81-84, 97, 101, 104-105, 109, 111, 112-113, 115-117, 138, 139, 140, 141, 142
 Graduate Studies and Research, xii, 28, 32, 33, 57, 59, 84, 98, 100-101, 106, 115, 121, 124, 130, 141
 Greenhouses, 9, 22-24, 87, **88**, 90, 94
 Head/Chair, 24, 50, 51, 66, 69, 71-72, 73-74, 79, 104, 107, 112, 113, 115-116, 117, 135, 138, 140
 Relationship to the Medical School, 67-70
 Relaxation, 107-109
 Review of 1984, 109-110, 111- 113
 Student Participation, 76
 Teaching, xii, 5, 8, 9, 16, 18, 68, 78, 94, 97-98, 100, 109, 111, 112, 113, 115, 123, 138, 140, 141
 Undergraduate Curriculum, xii, 5-6, 14, 27-29, 31-32, 52-55, 58, 59, 63-66, 68, 74, 77-81, 82, 83, 84, 98, 100, 101, 106, 111-112, 113, 114, 116, 117, 120, 124, 130, 131, 133, 138, 141
 Undergraduate Degree Programs, 14, 27-29, 42, 53-55, 66, 83-84, 98, 100, 101, 104, 112, 115, 116, 127, 132, 138, 141
- Botany Department, 32, 42-43, 44, 46-49, 86, 144
 Curriculum, 46
 Faculty, 44-45, 46
 Graduate Studies and Research, 46-47, 48, 84
 Head/Chair, 33, 39, 42, 43, 47, 48, 71

Index

- Bourns, Arthur N., xiii, **40**, 47, 53, 81, 82, 91-92
Burke, Charles E., xi, 24-25, 26, 28-29, 30-31, 33, 38, **40**, 41, 62, 98
Canadian University Expansion, 56
Cancer Group *see* National Cancer Institute of Canada
Chapman, Harold, 74-75, 81, 83
Chemistry Department, 24-25, 29, 30, 39, 40, 51, 53, 60, 61, 73, 87
Chen, Thomas T., 105, 106-107, 110, 151
Childs, Ronald F., 110, 115
Davidson, Douglas, xiii, 75, 83, 85, 90, 96, 99, **102**, 104, 115, **118**, 139, 147, 148, 149, 150
Davies, Douglas M., xiii, 46, 47, 50, 54, 65, 66, 86, 99, **102**, 113, **119**, 144, 145, 146, 147, 150
Delzel, D., 46, 50
Dingle, Allan D., xiii, xiv, 51-**52**-53, 62, 66, 68, 83, 99, **102**, 108, 116, **117**, **120**, 148, 149
Evans, John R., 68-69, 74, 92
Evolution, Theory of, xii, 8, 21 and note, 27, 70
Faculty of Health Sciences *see* Medical School
Finan, Turlough M., xi, xiv, 106, 110, 116, 152, 154
Formula Financing., 82-83, 91
Fox, E. Cary, 22, 26
Gaiser, Lulu O., **13**, 16-18, 22-24, 29, 31-34, 43, 44, 46
General Sciences Building (GSB), 89-90, 91, 135, 137
Gilmour, George P., xi, 33-34, 35-36, 37, 39, 42-43, 52-53, 67
Graham, Frank L., 85, 108, 110, 111, 117, **121**, 134, 140, 150, 151, 152, 153, 154
Graham, Ronald, **40**, 100
Hamilton Hall, 19, 22, 30, 48, **86**, 87, 89, 90
Harris, Graham P., 75-76, 81, 82, 98, 99, 100, 106, 149, 150, 151
Health Sciences Centre, 67-68, 69, 86, 92, 95, 110, 135
Hooper, Ebenezer R., 5
Institute of Molecular Biology and Biotechnology *see* MOBIX
Jensen, Doris E.N., xiv, 63, 66, 81, 83, 99, **102**, 117, **122**, 139
Johnston, Charles M., xiv, 32-33, 37
Judd, William, 46
Kershaw, Kenneth A., xiii, 57, 75-76, 80, 99, 112, 115, **123**, 127, 148, 149, 150, 151
Kleerekoper, Herman, 46, 50, 51, 53, 54, 58-60, 61-62, 71, 73, 89, 135, 139, 144, 145, 146
Laking., Leslie, xiv, 43-44, 47, 54, 99
Leaman, Jean (Dryden), xiv, 18, 21
Lee, Raymond W.H., 106

BIOLOGY AT MCMASTER

- Life Sciences Building (Complex)(LSB), 74, 90-**95**-96, 108, 110, 111, 118, 124, 125, 135, 136, 137
- Liquor on Campus, 31, 77
- Longstaff, Barry, 84, 99, **102**, 105
- Lott, John N.A., xiv, 74, 82, 90, 94, 99, 110, 116, 117, **124**, 139, 152
- McCalla, Dennis R., xiv, 61, 62, 72, 83, **93**, 98, 100, 148
- McCandless, Esther L., 63, 76, 99, 105-**106**, 128, 145, 147, 149
- MacClement, W. Donald, 44, 46, 47, 50, 53, 54, 61, 73, 78, 87, **88**
- McDonald, D. Gordon, 105, 108, 110, 115, 116, 151, 152
- McKay, Alexander C., xi, 9-**13**-14
- MacKenzie, Thomas, 4, 6
- McMaster Hall, 2, **10**
- McMaster University, xi-xiii, 2, 7, 18, 19-21, 22, 24, 25, 26, 27, 29, 30, 31, 35-41, 43, 44, 53, 63-64, 65, 67-68, 71, 75, 77, 80, 121, 123, 124, 126, 128, 133, 138, 140
- Foundation, 1, 2-4, 6
- Administration, xi, 9, 16, 31, 33-34, 38, 41, 59, 62, 65, 69, 72, 73, 74, 76, 77, 78, 79, 81, 82, 83, 84, 87, 90-91, 96, 101, 104, 107, 109, 110, 112, 113, 115, 116, 118, 122, 138, 139
- Enrolment, 4, 7-8, 12, 15, 16, 20, 25, 26, 30, 36, 50, 56, 143
- Faculty, xii, 3, 4, 16, 17, 18, 20, 22, 24, 25, 29, 35-36, 38, 53, 56, 77
- Finances, 1, 3, 8-9, 14-15, 16, 19-20, 21, 25, 31, 35-37, 38-39, 41, 55, 81-82
- Freedom of Enquiry, 8, 9, 12, 15, 20-21
- Graduate Studies and Research, 28, 33, 36, 38-40, 47, 57, 62
- Hamilton Campus, 9, 18-20, 22, **23**, 24, **45**
- Hamilton College, 37-38, 39, 40, 50, 55, 60, 61, 67, 68
- Heads/Chairs, 41
- New Toronto (Eglington) Site, 14, 15, 16, 19
- Nuclear Reactor, 58
- Science Facilities in Toronto, 6, 8, 9, **10**, **11**, 12, 22
- Student Participation, 76
- Theological Controversies, xi, 9, 12, 15-16, 21
- Undergraduate Curriculum, xii, 3-4, 6, 8, 12-14, 27, 29, 36, 41-42, 52, 63-65, 68
- Undergraduate Degrees, xii, 4, 12, 14, 27, 36, 41-42, 104
- University College, 37
- University Expansion, 56-57
- University Reorganization, 36-37, 52, 55
- McMaster, William, 1, **2**, 3, 4, 37
- Mak, Stanley, xiv, 72, 74, 84, 90, 91, 99, **102**, 105, 106, 107, 108, 110, 115, **125**, 147, 148, 149, 150, 152, 153

Index

- Medical Centre *see* Health Sciences Centre
Medical School, 67-70, 129
Miller, John J., xiv, 44, 46-48, 51, 54, 61, 62, 90, 99, **102**, 113, **126**, 144, 145, 147, 150
MOBIX, 96, 109-111, 132, 138
Molecular Biology, xiii, 57-58, 60, 62, 66, 72, 74, 94, 98, 101, 109, 116, 121, 132, 138, 140, 141
Morton, Richard A., xi, xiii, xiv, 74, 90, 96, 99, 108, **117**, **127**, 148
Mustard, J. Fraser, 69, 84
Nace, Paul, 50, 51, **52**, 53, 59, 61, 63, 64, 65, 89
National Cancer Institute of Canada Cancer Group, 84-85, 105, 111
New, Chester, 33, 39, 47
Nurse, Colin A., 106, 153
Oaks, B. Ann, 62, 63, 76, 99, **102**, 110, 115, **128**, 148, 150, 151, 153
O'Donnell, Michael J., 106, 108, 116
Petch, Howard E., 61, 62-63, 67-68, 69, 71-72, 90
Piersol, William H., 5, 17
Prevec, Ludvik A., xiii, xiv, 72, 74, 83, 84, 90, 99, **102**, 108, 109, 110, 111, **117**, **129**, 147, 148, 149, 150, 153
Radforth, Norman W. (Bill), 31-32, 39, 42-44, 46-48, 51, **53**, 54, 59, 61-62, 63, 64, 66, 71, 73, 87, 90, 113, 135, 144, 145, 146, 147
Rainbow, Andrew J., xiv, 99, 106, 147, 150, 151
Rawls, William E., 84, 105, 150
Research Unit in Molecular Biology, Biochemistry and Biophysics (RUMB-BCBP), 58, 60-62, 72, 89, 135, 141
Rollo, C. David, 105, 108, 110, 154
Royal Botanical Gardens (RBG), 42-44, 67
School of Nursing, xiv, 28-29, 86, 87
Science Hall, 9, **10**, **11**, 12
Singh, Rama S., 83, **102**, 104, 151, 152, 153
Smith, Roger W., 6-7, 8, 9, 12, **13**, 16, 17-18, 21, 22, 24, 26, 27, 87
Sonstegard, Ronald A., 105, 107, 151
Sorger, George J., xiv, 62, 83, 99, 117, **130**, 149
Stich, Hans F., 72-73, 79, 89-90, 91, 135, 146
Stewart, John M., 63, 73
Takahashi, I. (François), 62, 66, 77, 99, **102**, 113, 117, **131**, 146, 147, 148, 151
Thode, Henry G. (Harry), xii, 29-30, 36, 38, 39-**40**, 41, 47, 50, 53, 55, 58, 60, 61, 62, 67-68, 69, 71-72, 73, **93**
Threlkeld, Stephen F.H., xiii, xiv, 57, 61, 62, 65-66, 82, 87, 89, 99, 101, 104, 107, 110, 112, 113, 115, 116, 117, **132**, 139, 145, 146, 147, 149, 150

BIOLOGY AT MCMASTER

Toronto, 3, 6, 8, 9, 14, 19, 26
University of Chicago, 6, 7, 8, 12, 20-21, 29
University of Toronto, 2, 5, 9, 15, 17, 19, 31, 32, 33, 39, 43, 44, 46
Warren, A. Emerson, 26, **27**, 29, 31-32, 44, 46
Westermann, Jean E.M., xiv, 52, 63, 83, 94, 99, 101, **102**, 104, 107, 110,
115, **133**, 139, 151
Whidden, Howard P., xi, 15, 19
White, Bradley N., 109, 110, 112, 113, 117, 147
Willmott, Arthur B., 4-6, 7
Wood, Christopher M., xiv, 104, 105, 107, 108, 110, 116, 118, 152, 154
Zaevaart, J.A.D., 62
Zoology Department, 32, 49-50
Faculty, 44-47
Graduate Studies and Research, 44, 47, 86

