PHYSIOLOGY, Our History

Written by: Professors Harold L. Atwood and Mladen Vranic
Editor: Professor Stephen G. Matthews
Design: Eva Eng

PAST CHAIRS OF THE DEPARTMENT OF PHYSIOLOGY

R. Ramsay Wright (1887-1892)
Archibald Byron Macallum (1891-1908)
Thomas G. Brodie (1908-1916)
J.J.R. Macleod (1918-1928)
Charles H. Best (1929-1965)
Reginald E. Haist (1965-1975)
John T. Murphy (1975-1980)
Harold L. Atwood (1981-1991)
John F. MacDonald (2001-2008)
A Message from the Chair

I am delighted to introduce to you ‘Physiology: Our History’. The following pages describe the history of the Department of Physiology over the past 125 years. As you will read, the Department of Physiology has a long and illustrious past in research and education including the discovery of insulin. Further, the Department of Physiology awarded the first PhD at the University of Toronto. This comprehensive account was written by two former Chairs of the Department, Professor Harold Atwood (1981-1991) and Professor Mladen Vranic (1991-1995). I would like to thank them for their tremendous effort and memories!

Today, we are one of the largest Basic Science Departments in the Faculty of Medicine, and one of the largest Physiology Departments in North America. We are committed to excellence in both our research and education programs. There are currently over 120 Faculty and almost 300 Graduate Students and Post-Doctoral Fellows, organized in four major research platforms:

- Cardiovascular and Respiratory Sciences
- Endocrinology and Diabetes
- Neuroscience
- Reproduction and Development

In 2008, we were able to capture all of the Chairs of Physiology from the past 30 years together in a photograph (back cover). All remain members of the Department of Physiology today. It is a great privilege to be Chair of such an outstanding Department. I hope that you enjoy reading the account of our past 125 years.

If you would like to find out more about the Department of Physiology at the University of Toronto, please visit our website: www.physiology.utoronto.ca.

Stephen G. Matthews PhD
Ernest B. and Leonard B. Smith Professor and Chair
Department of Physiology
A Brief Historical Account of the Department of Physiology
University of Toronto

Harold L. Atwood and Mladen Vranic (2008)

The Department of Physiology is best known as the site of the discovery of insulin and its therapeutic values in 1921 and shortly thereafter. This work led to one of the most dramatic medical advances ever realized, and to prolongation and improvement of the lives of millions of people suffering from diabetes. The discovery was recognized by the award of the Nobel Prize in Physiology or Medicine (Canada’s first) to F.G. Banting and J.J.R. Macleod. Both before and after this landmark event, the Department of Physiology fostered a strong record in research and education, which continues to the present day. The Department remains positioned to contribute in many ways to advancing knowledge and education.

The Department’s course was set by its earliest leaders, who led by example. They established a strong tradition in research and teaching and created the physical and intellectual environment that made the discovery of insulin and subsequent research possible. Their successors have endeavoured to remain on course, keeping in view the two main objectives of the Departmental mission: research and education.
Early Development of the Department of Physiology, 1887 - 1921

The early evolution of both the Department of Biology and its off-shoot, the Department of Physiology, was guided by Robert Ramsay Wright, a Scotsman who had a strong Oxford influence superposed upon his Edinburgh origin and education. He came to Toronto in 1874 at the age of twenty-two, from an assistant professorship in the Department of Zoology of the University of Edinburgh. He was appointed Professor of Natural History at the University of Toronto, a title later changed to Professor of Biology and Physiology. In 1887, when the new Medical School was established, Ramsay Wright directed Physiology for five years. Thus, it was largely under his direction that the Departments of Biology and Physiology took shape at the end of the 19th century and the beginning of the 20th century.

He excelled in the three important arenas of academic life: teaching, research and administration. He was an accomplished and popular lecturer, who had “the remarkable ability to make two different drawings on the blackboard simultaneously, one with his right hand and the other with his left, and did not scorn to win the applause of a student audience by displaying this unusual accomplishment.”(1) He placed high importance on the proper training of future research scientists in laboratory work, and together with Professor James Loudon, later President, he established advanced facilities within the University of Toronto for the future of practical science instruction. Biological laboratories were established first in the School of Practical Science and later in the Biological Building, and a Biological Museum was added as an adjunct to practical teaching. This was an important part of his legacy at the University of Toronto.

Ramsay Wright was an avid proponent of original research, and stated that “the university has a higher function than the education of its own undergraduates, namely the advancement as well as the diffusion of learning.”(2)

His research papers were diverse, covering aspects of anthroplogy, comparative vertebrate anatomy, parasitology, and protozoology; his contributions to the anatomy and biology of fishes were particularly significant. He supported the views of Charles Darwin on evolution, which were not universally accepted by the biologists of that era. In addition to his research interests, he devoted time to languages, classical studies, and music, in all of which he excelled. A thumb-nail sketch of this interesting and influential academic pioneer has been left by University of Toronto zoologist A.G. Huntsman: “Coupled with his thoroughness in scholarship and his keenness and vision in discovering new things, was a most unusual power of clear, stimulating, and indeed brilliant exposition of his subject, which attracted students of every character. His lectures to students who had just entered the University were Wonderful in matter and presentation and superbly illustrated with the newest materials and methods. The museum which he started in the building erected for his department in 1889 developed into perhaps the foremost instructional museum in the world for its time. His influence was an outstanding factor in the development of the biological sciences in this country, throughout which (and
in the United States as well) his students have been scattered. The influence which this brilliant teacher and investigator exercised in his own Department of Biology in the University of Toronto and in the closely related Faculty of Medicine makes him one of the most memorable figures in the history of Canadian education”.

In fact, it was one of Ramsay Wright’s students, Archibald Byron Macallum, who became the first head of a separate department of Physiology. Raised on an Ontario farm, he obtained his undergraduate degree from the University of Toronto and his doctoral degree from Johns Hopkins University in Baltimore. University of Toronto historian Robin Harris writes: “Macallum’s greatest contribution to the University of Toronto was the establishment of research and scholarship as essential functions of the University. In the 1880s, when he first joined the faculty, the University was a reputable teaching institution concerned with the preservation and dissemination of knowledge, but not with its advancement.” He was certainly among the most distinguished scientists that Canada has produced.

Macallum was initially appointed by Ramsay Wright as his first lecturer in Biology in 1883, and designated lecturer in Physiology in 1887. In due course, a separate Department of Physiology emerged from the Department of Biology (in 1891), with Macallum, now Professor, as its head. His appointment was transferred to the reconstituted and renovated Faculty of Medicine, and the completion of a new Medical Building in 1904 made it possible for the Department of Physiology to be removed from its birth-place in the Biological Building. Both of these buildings were dismantled in the late 1960’s to make way for the new Medical Sciences Building, in which the present-day Department of Physiology is located.

Macallum excelled in research, development of academic institutions, and in mentoring future scientists, but unlike Ramsay Wright, he was not an inspiring instructor for undergraduates. “Work away at research – it is the only thing that gives lasting satisfaction” was his motif. Indeed, his research work received international acclaim, particularly his studies of kidney function and blood composition, showing that animals and therefore humans had their evolutionary origins in the ocean. He received honorary degrees from Aberdeen, McGill, Toronto, Trinity College, Dublin and Yale, and became the first University of Toronto graduate to be elected to the Royal Society of London.

In 1908, a Chair of Biochemistry was established for Macallum at the University of Toronto – only the second of its kind to be established in the British Empire. In 1917, he moved to become Chairman of Biochemistry
at McGill for a further eight years. He was also the first Chairman of the National Research Council of Canada.

Macallum’s impact on the development of the Departments of Physiology and Biochemistry both at Toronto and McGill was enormous. He fought hard and completely succeeded in transforming the University of Toronto’s Medical School into one of the leading schools in North America. He was also largely responsible for a fundamental change in the view of the University as primarily a teaching institution.

Macallum’s legacy was the establishment of research as an indispensible complement in all departments. This was promoted by the development of graduate studies at the doctoral level. Physiology led the way in this direction: Macallum supervised the first student to obtain his PhD at the University of Toronto (Fredrick H. Scott, PhD 1900). He also appointed the first woman lecturer in the University, Clara Benson, who later became a founding member of the Faculty of Household Science.

“Macallum’s monument is the Medical School of Toronto,” stated his Royal Society obituary. Through the generosity of the Macallum family, the annual Macallum Lectureship was established in the Department of Physiology in 1976.4

Following Macallum’s assumption of the Chair of Biochemistry in 1908, the noted British physiologist Thomas G. Brodie was recruited as head of Physiology. He led the Department until his untimely death at age 50 in 1916. Brodie had been educated at the University of Cambridge and had studied medicine in London. Before coming to Toronto, he had held positions in the Department of Physiology in King’s College London, London Hospital Medical School, and at St. Thomas’s Hospital Medical School. At 36 he became a member of the Royal Society of London. He was considered one of the leading experimental physiologists of the English-speaking world.

In Toronto, he published research on the physiology and pathology of the kidney. During the First World War he contributed studies on the physiological effects of wounds on the respiratory system. His contributions have been summed up by Macallum: “Dr. Brodie began to develop the Department along biophysical lines, with the result that at his death, the laboratory ranked among the three leading laboratories of physiology on either side of the Atlantic.” Since his time, physiological biophysics has been important in research related to neurophysiology, cardiovascular and respiratory physiology, and dynamics of metabolism.4
Following the death of Brodie, another eminent British physiologist, J.J.R. Macleod, became head of the Department of Physiology (1918-1928). Macleod had finished Medical School at the University of Aberdeen, and post-graduate studies in Physiology in Leipzig, Germany and in Aberdeen. He had held positions in Physiology and Biochemistry at the London Hospital Medical School and at Case Western Reserve University in Cleveland, where he served as head of the Physiology Department (1903-1918). When he came to Toronto, he was an expert in the field of carbohydrate metabolism and had done extensive work on factors that regulate blood glucose concentration, including the role of the nervous system, dietary factors, and the adrenal gland in liver glycogen control.

He also studied abnormalities of glucose utilization in diabetic dogs. Of particular importance, in 1915 he published a paper entitled: “Rapid and accurate clinical method for the estimation of sugar in small quantities of blood”. Establishment of this methodology in the Department of Physiology was crucial in the work leading to the discovery of insulin. Macleod gained his international reputation not only through his original publications, in the field of carbohydrate metabolism, but also through the publication of a classic textbook, Physiology and Modern Medicine. With the experience gained in leading British and American Universities, Macleod was in a position to know what constituted a state-of-the-art Department of Physiology, and he worked to bring Toronto’s Department of Physiology to the level of other leading departments throughout the world.\(^4\)

### THE “GREAT EVENTS” OF 1921-1923

The discovery of insulin in the Department of Physiology and its rapid development in Toronto as a therapeutic agent for treatment of diabetes was a collaboration initiated by Dr. Frederick Banting, a medical doctor practicing in London, Ontario. He approached J.J.R. Macleod with the idea of trying to isolate an active agent using dogs as experimental subjects. Macleod advised and directed the work, provided the facilities for its execution, the services of a research student, Charles H. Best, and later, the expert assistance of a biochemist, James Collip, who first successfully isolated insulin in a form that could be used in human patients.

The details of the discovery, and the subsequent struggles amongst the collaborators for glory and for control of the production and use of insulin, have been fully explored in two books by University of Toronto historian Michael Bliss\(^5\), and more briefly by University Professor Martin J. Friedland in: “The University of Toronto: A History”\(^2\), from which a brief excerpt is presented:

“Banting came to Toronto in the summer of 1921 and was given facilities on the top floor of the medical building and use of Macleod’s two summer research assistants. The research assistants apparently flipped a coin to see who would start working with Banting. Charles Best won the toss. The 21-year-old Best started his
work with Banting the day after finishing his last exam in the honours program in physiology and biochemistry. Banting and Best worked assiduously over the summer, trying to extract insulin from dogs, and achieving promising preliminary results. They continued their work in the fall with involvement from Macleod and with help from a professor from the University of Alberta, James Collip. Collip, who had completed his PhD in 1916 under the supervision of A.B. Macallum, was on leave for the year to work with Macleod. Collip’s task was ‘to purify the pancreatic extract so that it might be quite safe for use in therapeutic trials.’ The first successful injection of insulin was administered to an emaciated 14-year-old charity patient, Leonard Thompson, at the Toronto General Hospital on January 23, 1922, with ‘spectacular’ results.

In October 1923, it was announced that Banting and Macleod had been awarded the Nobel Prize in Medicine. Banting was incensed that he was to share the prize with Macleod and not with Best, and had to be dissuaded from turning it down. He was the first Canadian to win a Nobel prize. He split his share with Best, as did Macleod with Collip.

There has been considerable controversy over the years as to who should have received the prize. Bliss(5) rightly takes the position that all four deserve credit for the discovery: ‘Insulin emerged in 1921-22 as the result of collaboration among a number of researchers, directed by J.J.R. Macleod, who expanded upon and carried to triumphant success a project initiated by Banting with the help of Best. The single most important technical achievement was that made by Collip in the purification of the extract. On their own, Banting and Best would probably not have reached insulin’. In his 1922 annual report, President Falconer was diplomatically careful to give all four credit: ‘This remarkable and now widely known discovery has been due to the persistent and imaginative efforts of Dr. Banting, together with Mr. Best and Dr. Collip, aided by others, chiefly in the Physiological Laboratory, in which Dr. Macleod put his wide knowledge and experience at their disposal.’

The discovery of insulin was, of course, of immense benefit to those suffering from diabetes. One patient, 6-year-old Ted Ryder, weighed only 26 pounds when he first received insulin in July 1922. In 1990 – in his seventies – he attended the ceremony at the University of Toronto at which a plaque was unveiled at the medical school celebrating the discovery of insulin.

Following the successful establishment of insulin therapy, Banting received large amounts of money for research, but was not successful in achieving other noteworthy discoveries. ‘Banting’s only success at the University in these post-insulin years,’ Bliss pointedly notes, ‘was in continuing to blacken the reputation of J.J.R. Macleod.’

By 1927, Macleod had had enough – he and Banting apparently did not speak to each other – and decided to take a position as professor of physiology at his alma mater, the University of Aberdeen.”(2)
Charles H. Best as Head of Physiology, 1929-1965

Charles Best completed a medical degree at Toronto and went to the University of London for a doctorate, and then returned to teach and conduct research at Toronto. After Macleod left for Scotland in 1928, Best was appointed to the chair of physiology, where he continued to do good work. One of his early successes was in purifying the anticoagulant heparin, which was first used in clinical practice by the surgeon Gordon Murray at the Toronto General Hospital in 1935. Heparin made possible such later procedures as kidney dialysis and open-heart surgery. He also conducted good research on histamine, choline as a dietary factor, and development of infusion media for war casualties; and he continued to promote research on insulin, appointing a number of faculty members in endocrinology, and attracting outstanding post-doctoral researchers from abroad, some of whom became faculty members in due course. In addition to research, Charles Best contributed greatly to medical education, putting the Department of Physiology in the vanguard with his outstanding text-books: “The Human Body and Its Functions” (Best and Taylor, 1932), and “The Physiological Basis of Medical Practice” (Best and Taylor, 1937). The latter book went through many editions up to the present, and has been translated into many languages.

Best received many honours for his contributions including election to the Royal Society of London, Foreign Associate of the National Academy, Fellow of the Canadian and British Royal Societies, Companion of the Order of Canada, and 25 honorary degrees. On Banting’s death in 1941, at the age of 49, Best was appointed to the chair of medical research at the University. A separate research institute had been established, and Best became its director, as well as being head of Physiology. In 1950, the Best Institute was constructed beside and connected to the Banting Institute on College Street; and for some years, the Department of Physiology had its research facilities in that building.
During the Second World War, the Department of Physiology contributed research in several relevant areas, including treatment of war injuries, hypothermia, and night vision. Some members served overseas. One of these was Dr. Jacob Markowitz, who attained his MD in 1923 and PhD in Physiology at the University of Toronto and had worked on experimental surgery under the direction of Dr. Charles Best. He was a faculty member of the Department of Physiology from 1947 to his retirement in 1967, and Professor Emeritus until his death in 1969. During the War, he was a member of the RAMC (Royal Army Medical Corps), was taken prisoner by the Japanese army during the fall of Singapore, and was sent to the isolated POW camp at Chungkai, 60 miles northwest of Bangkok. There, mortality rates were high with 165,000 (both captives and Japanese soldiers) dying from the labour, disease and malnutrition in one year. The RAMC captives had the difficult task of caring for the sick under these conditions. They contended with cholera, malnutrition, and with tropical ulcers and infections which often required limb amputations to save a life. Amputations were done using boiled hacksaws to cut through the bone; tin cans for muscle retractors; and cotton thread for stitching wounds. Only small quantities of disinfectants and anaesthetics were available, sometimes obtained from guards for a bribe. A leg amputation was done in 12 to 20 minutes. One hundred and fifteen thigh amputations were performed on prisoners, and about 50 of them survived to the end of the war. Dr. Markowitz and his colleagues are credited with saving over 2000 lives. In later years, he was honoured with the Order of the British Empire for his efforts. Clemson University (U.S.A.) instituted the Jacob Markowitz Award for outstanding research in surgery.60

Reginald R. Haist: Chairman, 1965-1975

Reginald Haist was a senior member of the Department who became Chair in 1965 when Best stepped down. His area of expertise was endocrinology - he had worked and published with Charles Best - and he appointed several faculty members in the area of endocrinology, including Mladen Vranic, who would later in turn become Chair of the Department. The early 1960’s saw the post-Sputnik expansion of faculty throughout the University, and Haist was able to appoint faculty members in the area of neurophysiology; in fact, he became convinced that this was an area in which the Department should be strengthened. This decision had a major effect on subsequent development of the Department.

During Haist’s chairmanship, the Banting and Best Department of Medical Research was set up as a separate Department with its own Chair, Dr. Irving Fritz, who recruited some outstanding researchers. The Physiology Department moved to its new location in the present-day Medical Sciences Building. Modern laboratories, each tailored to the research field of the initial occupant, were available in 1969-70, and have been used continuously since then (with some grumbling about lack of windows by occupants of certain windowless laboratories).

Haist also presided over important changes in University regulations guiding appointments and tenure. The revised regulations became known as the ‘Haist Rules’ - important building blocks in the emerging re-definition of the relationship between the University and its faculty members.
John T. Murphy: Chairman, 1975-1980

John Murphy, MD, PhD, a relatively young faculty member who had trained earlier with Nobel Laureate Sir John Eccles, assumed the chairmanship in 1975. He had developed an outstanding research program in neurophysiology, focused on motor control in higher mammals including primates; several excellent graduate students and post-doctoral fellows were trained in his laboratory. He promoted the area of neuroscience, but recognized the importance of other areas of physiology. Under his direction, the Department was organized into three “Research Groups”: Neurophysiology, Endocrinology and Integrative Physiology (which included respiratory, cardiac, autonomic, and kidney functions). Each Group held its own periodic meetings and in some cases social events. The Groups also took turns selecting the lecturer for the annual Archibald Byron Macallum Lecture, which was initiated in 1978. The Groups promoted interactions with, and guidance of, graduate students. In modified form, the Group concept has continued to the present day.

In addition to its research commitments, the Department maintained a strong presence in the teaching program of the Medical School, especially in the first two years. Also, a strong undergraduate training program in the Faculty of Arts and Science, already in existence in the early part of the 20th century, was sustained. Additional teaching commitments in the Faculties of Nursing, Pharmacy, Dentistry, and Physical and Health Education added to the burden of instruction supported by the Department. In mitigation, some new and/or joint appointments accrued to the Department during the regimes of Haist and Murphy. Nevertheless, the burden of teaching was considerable. Concerns developed around the loss of research funding due to heavy teaching commitments. Given the wide scope of Physiology and the problem of having knowledgeable experts in all its branches, the Department increasingly added cross-appointed members from other Departments and from affiliated hospitals to bolster areas of Physiology in which expertise among primary appointees was thought to be insufficient, and to lighten the teaching load for primary appointees.

Uneasy relationships with emerging Hospital Research Institutes began to develop. Several of the Hospitals in particular, the Toronto Western Hospital, the Mount Sinai Hospital and the Toronto General Hospital began to establish research institutes along the lines of the one that had been set up earlier at the Hospital for Sick Children. These institutes became staffed with basic scientists, many of whom had outstanding research credentials. Cross-appointments were sought by these individuals in the established Basic Science Departments of the Faculty of Medicine, so that they could recruit and train graduate students. Resolution of the requirements for cross-appointment and the duties demanded of cross-appointees became a major preoccupation for all subsequent Chairs of Physiology.

John Murphy relinquished the chairmanship in 1980 in order to pursue specialist training in neurology. After a few years, he gave up his research program and his affiliation with Physiology, and left Toronto. Following his resignation as Chair, there was a lengthy search for a new Chair. During this period, Professor Donald Clarke, a senior member of the Department without research responsibilities, became Acting Chair. He served again as Acting Chair in 1987-88 during an administrative leave taken by the next Chair; and he also served as Associate Dean for Basic Sciences in the early 1980s.
Harold L. Atwood: Chairman, 1981-1991

Although there were several well-qualified applicants for the Chair’s position within the Department of Physiology, and others from outside, the Search Committee was unable to agree on any of them, and became deadlocked. Finally, one of the Search Committee members presented a new candidate from the Department of Zoology, who was recruited as the next Chair of Physiology.

Harold L. Atwood was an unusual choice, since he had no formal connection with traditional Departments of Physiology, and his most significant research was on invertebrate organisms. “You are the first invertebrate to impress the ‘mammals’” wrote a colleague from Bristol on learning of the appointment. A comparative physiologist, he had studied Biology and Comparative Neurophysiology at the Universities of Toronto, California, Glasgow, Oregon, and the California Institute of Technology. In the Department of Zoology, he had developed an internationally recognized research program on synaptic transmission of invertebrates, with a secondary focus on mammalian neuromuscular physiology. He had also initiated advanced courses in neurophysiology which attracted undergraduate and graduate students from both Zoology and Physiology Departments. His research was recognized by election to the Royal Society of Canada.

In the Department of Physiology, Atwood continued the “Three Research Group” tradition inherited from John Murphy. In particular, he elected to strengthen the Endocrinology Group with new appointments rather than letting it fade away through impending retirements. He also appointed more women to faculty positions than had previously been done: three of his first four initial appointees were women. One of them, Valerie Watt, was the first to bring modern research approaches based upon molecular genetics to the Department. Another new recruit, Milton Charlton, brought recently developed approaches to physiology based on optical indicators for observing intracellular calcium dynamics. As a whole, the Department’s intake of research grants, and the sophistication of research approaches, increased steadily during the 1980s.

Atwood continued and enlarged two Departmental administrative procedures initiated by John Murphy: a Senior Advisory Committee which met periodically to advise the Chair on important decisions affecting the Department; and an annual “Retreat”, usually off-campus, at which general issues could be thoroughly aired and discussed by the entire Department. Policy directions were sometimes decided at these Retreats. Both traditions have been continued by subsequent Chairs.

Among the many research contributions that emanated from the Department of Physiology during this period, the most widely recognized was the discovery of atrial natriuretic factor (ANF). A collaboration between Harald Sonnenberg and A. De Bold (Queen’s University) showed that this peptide is synthesized and released from the cardiac atria, and contributes to homeostasis of blood pressure. This work led to a Gairdner Award for the collaborators, and stimulated a great deal of research world-wide.
Another area of research that became prominent was the investigation of Alzheimer’s disease, vigorously pursued by Donald McLachlan, Umberto De Boni, and collaborators. In addition to research, these investigators promoted awareness of the increasing prevalence of this neurodegenerative disease in aging human populations. In the mid-1980’s, a donation from the Tanz family led to establishment of the Centre for Research in Neurodegenerative Disease, in the renovated Botany Building next to the Medical Sciences Building, with Donald McLachlan as its first Director. After his retirement, one of his former postdoctoral fellows, Peter St. George Hyslop, became the Director and the Centre achieved great success using modern genetic approaches in the study of several neurodegenerative diseases.

During the 1980’s, the graduate students of the Department increased in number and prominence, and stimulated a lot of debate about the procedures of the Department’s training program, which became progressively modified in consequence. Led by a student with organizing ambitions, in 1981 the graduate students initiated the annual research day, “Frontiers in Physiology (FIP)”, with the Chair’s support. In due course, the annual Macallum Lecture came to be held in conjunction with FIP, enhancing the visibility of both events. The graduate students also formed their own association, Graduate Association of Students in Physiology or GASP, which is represented in various decision-making meetings and committees within the Department. The trend towards increased numbers of cross-appointments continued as the hospital research institutes gained momentum. The Playfair Institute at the Toronto Western Hospital was especially closely linked to Physiology because its second Director, William Tatton, had obtained his PhD in the Department and recruited several members with interests in neuroscience who were given appointments in Physiology. Relations between the Department and the Playfair Institute were at times fractious, but the link was maintained. One of the Playfair researchers, John MacDonald, moved to the Physiology Department, and eventually became its Chair, thereby illustrating the value of cross-fertilization within the Toronto Medical School complex.

After serving two terms as Chair, Atwood led a successful group application to the Medical Research Council of Canada and formed the Medical Research Council Group in Nerve Cells and Synapses. The Group included members from the Departments of Physiology and Medicine and the Faculty of Pharmacy. New approaches in research, such as confocal microscopy, increased collaboration among Group members, and involvement in the Networks of Centres of Excellence program with support for research facilities and training programs were among the features fostered by this research-based association. The Group continued, with changing membership, into the next century; John MacDonald became its new Director in 2000.

After Atwood’s departure from the Chair’s Office, an Acting Chair, elected by the Senior Advisory Committee, presided over the Department for the next nine months. Dr. Uwe Ackermann, a cardiovascular physiologist and an eloquent teacher, kept the Department running smoothly while the Dean of Medicine, John Dirks, attempted major changes in the organization of the Faculty. Ackermann instituted a more refined and systematic method for assessing the contributions of faculty members and their annual merit-based salary increases, and his system has been retained, with modifications, by subsequent Chairs. Meanwhile, a Search Committee engaged in selecting the next Chair.
Mladen Vranic: Chairman, 1991-1995

With a background in medicine and physiology acquired in Croatia, Mladen Vranic had come to Canada as the last post-doctoral fellow of Charles Best, and was appointed to the faculty in 1965 by Reginald Haist. He had then established a productive and internationally recognized research laboratory focused on endocrinology and diabetes, which produced trainees who became successful scientists at universities in Canada and in other countries.

Links between the Departments of Physiology and Medicine were strengthened during Vranic’s chairmanship. An agreement was reached with the Chairman of the Department of Medicine, Dr. Arnie Aberman (who soon thereafter became the new Dean of Medicine) to add a faculty member in the area of diabetes research, with space in the Department of Physiology and salary from the Department of Medicine. Other positions in diabetes-related research were obtained with partial support from the Banting and Best Diabetes Centre.

Strengthening of research related to endocrinology and diabetes arose also from an international connection. The Department of Physiology and the Banting and Best Diabetes Centre organized a number of symposia, initially between Toronto and the Karolinska Institute in Stockholm, and later between Toronto, Stockholm and Zagreb. These initiatives were strongly supported by the Director of the Banting and Best Diabetes Centre, where Dr. Vranic served as the head of International Relations. The Department of Physiology and the Banting and Best Diabetes Centre also co-organized the celebration (in 1996) of the 75th anniversary of the discovery of insulin in the Department of Physiology. (Dr. Vranic chaired the organizing committee). An endowed lectureship (Best Lecture) was established by Dr. Jack Davidson, who had obtained his PhD degree under the supervision of Charles Best. These activities helped to bolster the Department’s academic strength in the areas of endocrinology and diabetes.

Administratively, the Department continued to operate with a Senior Advisory Committee and with two Associate Chairs, one for graduate education and the other for undergraduate education. The Chairman, with advice from the Senior Advisory Committee, considered major issues, departmental responses, and initiatives. The annual Departmental Retreat was maintained; at this event, important issues arising during the previous year were debated and reports of Departmental committees presented. At one of the Retreats, modifications to the Department’s Group structure were confirmed: in place of the original three very broad groups, more specialized ones were set up. These included neurophysiology, endocrinology, cardiovascular and renal physiology, respiratory physiology, and theoretical physiology. A major goal of the groups’ arrangement was to bridge, in the widest possible sense, molecular, cellular, organ and integrative approaches. With time, molecular and cellular aspects of physiology were increasingly emphasized in Toronto, while other universities (Queens, University of Montreal, University of Alberta) emphasized integrative physiology especially in the neurosciences. The number of groups expanded to 8 during the next chairmanship, but not all proved viable in the long term, and consequently the number was eventually reduced to 4. The groups had responsibilities for seminars, aspects of graduate student training and examination, and fostering exchange of scientific information.
With increasing numbers of cross-appointed members, the Department had about 70 faculty members during this period. Only about 20 of these were primary appointments located in the Medical Sciences Building; the rest were located in other Departments (both Basic Science and Clinical), and in hospital research institutes. The Department was able to maintain its ‘core’ of primary appointments through external salary awards and creative arrangements with other departments, despite financial difficulties brought on by yearly budget cuts from the University. The overall ratings of the department have been excellent, as indicated in the OCGS reviews of the graduate program and in the LCME reviews of the medical program.

Vranic’s research was recognized by election to the Royal Society of Canada, Canadian Academy of Health Sciences, and the Croatian Academy of Arts and Sciences. He is a laureate of the Canadian Medical Hall of Fame, he was appointed Officer of the Order of Canada and the Order of Ontario, and received the Queen Elizabeth II Diamond Jubilee Medal.

**John Challis: Chairman, 1995-2000**

When Mladen Vranic had to leave office due to the University’s requirement for official retirement at age 65, Dean Aberman launched a search for a new Chair. The result was recruitment of Dr. John Challis from the University of Western Ontario (UWO). Educated in England (PhD, Cambridge University), he had moved to Canada and developed a remarkably successful and prolific research program in the area of reproductive and developmental physiology (not previously well represented in the ‘core’ of the Physiology Department in Toronto). His research is foundational to our current understanding of endocrine development and control of the birth process. His research was recognized by election to the Royal Society of Canada together with numerous other awards. He had attained major administrative positions at UWO: Vice-President Research, St. Joseph’s Health Centre; Scientific Director, Lawson Research Institute; Director, Medical Research Council Group in Fetal and Neonatal Health and Development. (As Dean Aberman remarked after reading his credentials: “Hey – This guy is a heavy hitter!”).

John Challis inherited a department with a rich tradition in excellence, particularly in neuroscience and in endocrinology–diabetes and a history of discovery in insulin. But he was willing to explore methods that could further modernize the traditional physiological mode. He undertook development of a new strategic plan, examining ways to enhance relationships with colleagues and cross-appointed members in the hospitals and hospital-based research institutes. Thus, he promoted closer relationships with clinical departments (particularly
Obstetrics and Gynecology) and with hospital-based research institutes. New faculty appointments in the ‘core’ Department strengthened neuro-endocrinology, developmental physiology, and integrative sensory-motor physiology. Core and non-core faculty members were equally appreciated, and participated more in the life of the Department. Departmental cohesion was also enhanced by institution of a weekly newsletter (PhysioLINK) distributed by e-mail. Due to close collaboration with the hospitals, the faculty complement for Physiology grew from 75 to about 100, with all primary and cross-appointed members having equal voting rights. In parallel with the increase of faculty membership, the number of graduate students grew considerably.

Administrative innovations included more formal and rigorous scrutiny of applications for research grants before submission. A Research Committee, chaired initially by Harold Atwood, regulated the internal review process. The Senior Advisory Group became the Chair’s Advisory Group, comprising Senior Associate Chair, heads of the Undergraduate and Graduate Programs, Chair of the Research Committee, a hospital representative, and two other members. Meetings were held weekly. A training initiative in developmental physiology led to an agreement with Karolinska Institute in Stockholm to hold annual meetings, alternating between Toronto and Stockholm, for graduate students, post-doctoral fellows and clinical fellows. This initiative spearheaded by Dr. Stephen Matthews (current Chair of the Department) continues today with 500 alumni and recently has led to other initiatives including the Mats Sundin Fellowship in Developmental Health.

A much-needed boost for the Department’s financial well-being materialized in the form of an endowment for the Chair (October, 1996). In recognition of a gift to the University by Ernest Smith, the Chair of Physiology was named “The Ernest B. and Leonard B. Smith Chair in Physiology”. At the turn of the century, when John Challis left office to become the Director of a newly formed Institute of the Canadian Institutes for Health Research, the Department of Physiology had become larger and more diversified than its counterparts at other Canadian universities, and continued to maintain excellence in research and education.
While a search committee set up by the Dean of Medicine, David Naylor, considered a selection of a new Chair of Physiology, Dr. Patricia Brubaker was the Acting Chair (2000-2001), and the Department maintained a stable trajectory. The search committee recommended John F. MacDonald as the next Chair of Physiology. He was trained in Physiology and Neuroscience at the University of British Columbia (PhD), the University of St. Andrews, McGill University, and the National Institutes of Health in Bethesda, Maryland. Initially appointed at the University of Toronto as a faculty member in the Department of Pharmacology with his laboratory at the Toronto Western Hospital, he moved to the Department of Physiology in 1990 to become a founding member of the MRC Group in Nerve Cells and Synapses. By coincidence, his selection as Chair of Physiology occurred almost exactly a century after another Canadian-born scientist of Scottish ancestry, Archibald Byron Macallum, had become the first Chair of the newly independent Department.

John MacDonald’s impressive credentials in research as an independent faculty member at the University of Toronto include discovery (in 1980-81) of voltage-dependence of a new class of receptors for the neurotransmitter glutamate in the mammalian brain. These receptors (eventually termed NMDA receptors) were later found to be required for long-term synaptic modifications (long-term potentiation), thought to underlie some forms of learning. After many successful studies of glutamate receptors, he and co-workers uncovered a role for calcium-permeable non-selective cation channels in ‘delayed cell death’ of nerve cells in the brain affected by stroke. These studies point the way to development of new protective agents that will be effective for many hours following the stroke itself. John MacDonald’s laboratory has trained a number of outstanding graduate students and post-doctoral fellows. His research contributions have been recognized through election to the Royal Society of Canada.

John MacDonald had served as Graduate Coordinator of the Department during the Chairmanship of John Challis. Once Chair, it soon became evident that he was a superb long-range strategic planner for the Department. More than any previous Chair, he invested a great deal of time in predicting the ‘worst-case scenarios’ for the Department’s finances (brought on by budget cuts imposed by the University) and for a likely diminished complement of faculty members - and then looked for creative solutions to ward off impending doom. By way of explanation of his tendency to look for the worst outcomes, coupled with an unusually keen financial eye, he would comment: “I am a Scotch Presbyterian!”

By anticipating the worst, John MacDonald achieved the best. During his Chairmanship, the Department recruited new faculty members through external awards and partnerships with research institutes and clinical departments in the Faculty of Medicine - thus continuing and enhancing the approaches initiated by previous Chairs. The Department as a whole obtained 11 Canada Research Chairs, 3 CIHR New Investigator awards, 1 Heart and Stroke Investigator Award, and the highly prestigious Michael Smith Chair in neurosciences and
mental health (held by Dr. Min Zhuo). This unprecedented growth and level of support occurred at a time when several other basic science departments were closed or merged in an effort to deal with ongoing fiscal constraints. The area of cardiovascular physiology was greatly strengthened by new appointments. The Research Groups in the Department now comprise: Endocrinology and Diabetes, Neurosciences (B.R.A.I.N. Group), Reproductive and Developmental Physiology, and Cardiovascular Physiology.

The Graduate Program in the Department increased from 100 to about 150 students, while the training program was altered to include more participation-based, seminar style graduate courses. The Undergraduate programs were sustained; and significantly, a new agreement between the Faculty of Medicine and the Faculty of Arts and Science has led to financial compensation for the Department due to the large teaching load in the undergraduate program in Arts and Science. The undergraduate Arts and Science students have their own association, Undergraduate Physiology Students’ Association (UPSA), supported by the Department.

The Department of Physiology’s achievement in research, grants in support of research, awards, publications, and educational programs have assured its rating as one of the best of the Basic Science Departments of the Faculty of Medicine. It has become the largest and most comprehensive Physiology Department in Canada.

References


Chairs - Department of Physiology - from 1981 to present

Seated: H.L. Atwood, M. Vranic