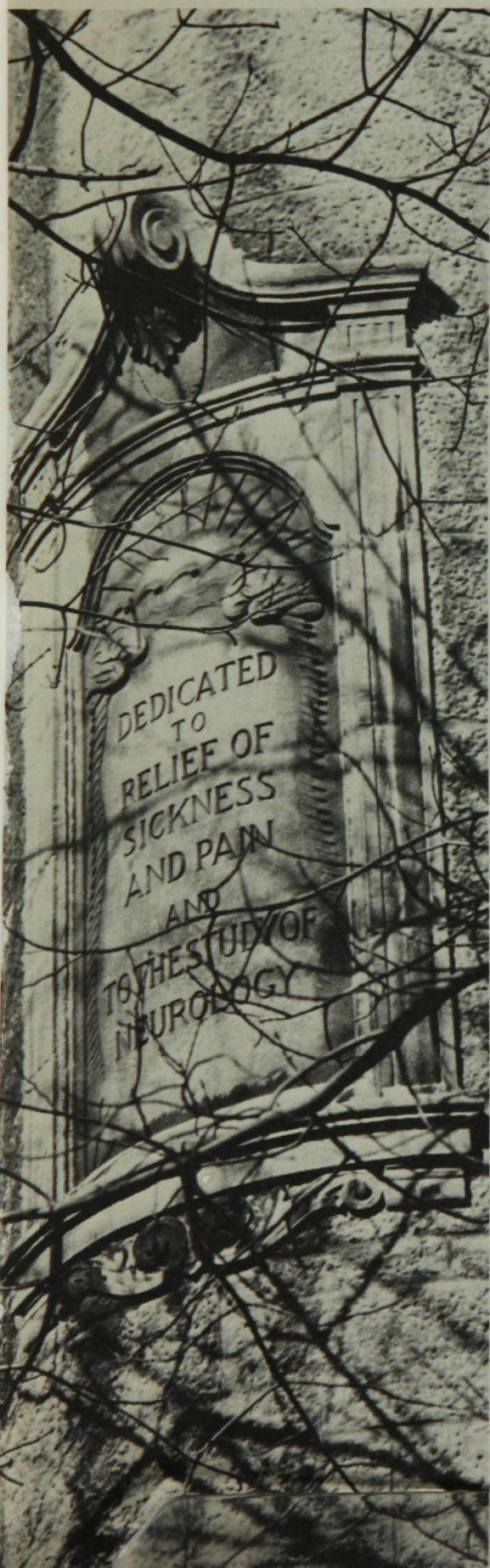


8th Annual Report

MONTREAL NEUROLOGICAL INSTITUTE
MONTREAL NEUROLOGICAL HOSPITAL



and the
DEPARTMENT
of
NEUROLOGY
and
NEUROSURGERY

of
McGill University

1972-73

38th Annual Report

MONTREAL NEUROLOGICAL INSTITUTE
MONTREAL NEUROLOGICAL HOSPITAL

and the

DEPARTMENT of NEUROLOGY

and NEUROSURGERY

of McGill University

1972-73

Contents

	Page
Editorial Note	7
Plate I	8
Report of the Director	9
Board of the Corporation	18
Board of Directors	19
Neurosciences Advisory Council	20
Clinical and Laboratory Staff	21
Consulting and Adjunct Staff	23
Administrative Staff	24
Supervisory Officers	24
Teaching Staff	26
Board of Management and Executive Committee	27
Executive Staff	27
Resident Staff	28
Nursing Staff	25
Women's Auxiliary	25
Clergy	25
Plate II—Medical and Scientific Staff	30
Plate III—Nursing Staff	31
Neurology	32
Neurosurgery	37
Graduate Studies and Research	40
Administration	46
Financial Report	47
Nursing Department	49
Social Service	51
Clinical Laboratories & Departments	52
Neuro-Anaesthesia	54
Neuroradiology	56
Neurochemistry	58
Electroencephalography & Clinical Neurophysiology	64
Electromyography Laboratory	71
Experimental Neurophysiology	74
Neuropathology	83
Neuro-Isotope Laboratories	85
Neurological Research	88
Neuropsychology	91

Neuroanatomy	93
Tumour Registry	94
Library	95
Montreal Neurological Society	95
Fellows' Society	96
MNI Wives' Society	97
Clinical Training Opportunities	98
Courses of Instruction	99
Publications	101
Hospital Financial Statements	106
Institute Expenditure Summary	109
Endowments and Grants	110
Donations	111
Statistics	116

EDITORIAL NOTE

We appreciate again these summaries of our year's activities provided by members of the staff and I am grateful to Mrs. Joy Shannon and Mrs. Rose Slapack for their expert editorial help. Mrs. Paul Blanchart, who, sadly, is not with us now, would have been pleased, I think, by the accuracy and care devoted to this report which was always a hallmark of her work.

The past year has seen the deep involvement of our two institutions in changes deriving from Bill 65 and its regulations, that have affected every aspect of medical care and hospital organization. We are all much preoccupied with the problem of dollars and cents of the health care system. But the real test of the new legislation is whether the quality of care for the individual patient within that system will be bettered, and whether medical teaching and research, which provide the groundswell for all future advances in such care, will not suffer neglect in competition with the more politically visible spindrift of short-term targets in health care "delivery".

As our reporting year ends we are installing the first EMI computerized brain scanner in Canada and have received approval for our new renovation and extension which has undergone long gestation in the government womb. All this gives us a sense of urgency and excitement that makes it fitting to quote Pierre de Ronsard, the 16th-century French poet, who wrote (in a somewhat more amorous setting than institutional administration).

" . . . n'attendez à demain
Ceuillez dès aujourd'huy les roses de la vie".

W.F.
Editor



DR. THEODORE RASMUSSEN
DIRECTOR, MONTREAL NEUROLOGICAL INSTITUTE
1960-1972

Copy of an oil portrait painted by Mr. Lynn Buckham made possible by donations from former Fellows of the Institute who were contemporaries of Dr. Rasmussen.

Report of the Director

DR. WILLIAM FEINDEL

This Annual Report covers the activities of the Montreal Neurological Hospital for the year 1972 and those of the Montreal Neurological Institute and the Department of Neurology and Neurosurgery of McGill University for the academic year 1972-73. For the Hospital, there have been many changes during this time. The extensive reorganization of regional health services under Bill 65 has involved a review of the internal organization of the Hospital, a change in the makeup and method of appointment and election of the Board of Directors and the institution of association with the new Regional Council. Another major undertaking has been the changeover to the new global budget. Still another has been the extensive revision of our restoration and new construction plans. These three features alone have demanded unusual efforts from the staff and, in particular, have taxed the time and talents of our financial and personnel staff. This first year as Director has thus been one in which I have appreciated the loyal support, as well as the considerable indulgence, given to me by all the members of the staff, by Mr. Jean de Grandpré, the President of the Corporation, and by members of the Board. The Support Services, directed by Vice-Principal Stanley Frost, have been most helpful during this year. I am grateful, in particular, for the devoted help of the administrative staff of the Hospital and Institute, particularly in the Director's Office and in my private office.

The highlights of the year's activities are enumerated here. Some of them will be referred to in more detail in the text of my report and in those reports from the other members of staff.

1) Beginning in October 1972, meetings and discussions were held with representatives of the Provincial government and at their request a complete revision of our renovation and new construction plans for the Penfield Wing was made in order to bring the plans and the costing estimates up to date from the baseline established in October, 1969.

2) Global budgeting was introduced to the Hospital. A Budget Committee was set up to provide frequent reviews of our fiscal problems and to meet with a budget representative from the Provincial government.

3) Approval was received from the Department of Social Affairs of the Province of Quebec to purchase an EMI brain scanner, the first in Canada, which was supported in part by private donations through the Webster Research Fund.

4) The first lectureship named after Dr. Thomas Willis (1621-1675), a famous Oxford neurologist, was given in November by Dr. James Ambrose of London, England, a neuroradiologist who has developed the clinical application of the new EMI brain scanner.

5) A number of renovation projects to improve our teaching and research facilities were started. The sixth floor was modified to enlarge the administrative space, to provide a new radioisotope instrument laboratory, to modernize the muscle research laboratory and the seminar teaching room. New research space was provided for Psychology, for EEG research fellows and for the studies in neurogenetics. The capacity of the lecture theater required expansion to accommodate the incoming undergraduate medical classes and plans for this are underway. Special display cabinets in the main corridor were designed with the help of Mr. Clifford Williamson of the McCord Museum. A systematic program of redecoration of the Hospital wards and rooms was undertaken under the direction of our new Administrator. A transfer of the second floor central supply depot to the fifth floor, to allow for more efficient control, was discussed at the planning stage. The vacated space will be used for the new Neuro-Ophthalmology Unit.

6) Mrs. Joy Shannon took over as Director of Administrative Services following the resignation of Mr. Christian Primavesi. Mr. Harry G. Marpole was enlisted as Planning Officer. Mr. Charles Gurd has taken on the task of cost analysis and review of special budget projects.

7) An editing manuscript unit for scientific papers and improved handling of interdepartmental communications was set up.

8) Two staff colloquia, one on research and one on teaching, were held as weekend retreat sessions in the country, with a thorough review made on each occasion of these topics by some 30 members of staff. Stemming from this, an extension of our undergraduate teaching program in Neurology and Neurosurgery was arranged for the third and fourth years of the medical course.

9) Two splendid portraits, by the distinguished artist Mr. Lynn Buckham, of the previous directors, Dr. Penfield and Dr. Rasmussen, were commissioned and received, both sponsored by former fellows of the MNI. A portrait of the President of our Corporation, Mr. Jean de Grandpré, has also been commissioned, sponsored in part by Bell Canada, of which he is President.

10) Plans were developed with Dr. Sean Murphy and Dr. Sam Adams of the Department of Ophthalmology, in discussion with Dr. Bert Cosgrove, for a neuro-ophthalmology unit, located in the Hospital and Institute. Dr. Brian Younge was appointed as our first neuro-ophthalmologist.

11) Substantial additions were made to our endowment fund with the establishment of the Brain Research Fund in the memory of Senator Lorne Webster and Mrs. Webster, in addition to generous bequests from the Letang and Campbell families, as well as numerous continuing donations from friends of the Institute and friends and relatives of patients.

Staff Changes

Dr. Gilles Bertrand became Neurosurgeon-in-Chief and has taken over from me the Chairmanship of the Clinical Committee. Dr. Robb continues as Neurologist-in-Chief and has further developed the excellent organization of neurological postgraduate residency training program. These two men have provided great strength during the past year and have carried a heavy load in supervising the work of the two major clinical departments within the Hospital and Institute.

Dr. Jasper was given the distinction of being appointed Officer of the Order of Canada.

We congratulate Dr. Brenda Milner in being awarded recently another five year term as Medical Research Council Associateship, an honor which she shares here at the Institute with Dr. Leon Wolfe. Both neuroscientists have added to the reputation of the Neurological Institute and to the medical research contributions of this province by their outstanding achievements. It is realistic to note that the review teams who recommended their awards were most critical of the physical difficulties under which these two scientists and their staff have to work, and indeed presented a note of conditional approval pending modernization and enlargement of their working areas.

We welcome to our consultant administrative staff Dr. Ashton Kerr, who was recently appointed Medical Director of the Royal Victoria Hospital. We congratulate Dr. Donald Baxter, Chief of the Neurological Division of the Montreal General Hospital, for adding two further Medical Research Scholars to his staff, Dr. Michael Rasminsky and Dr. Leo Renaud. They will strengthen the already active clinical and research combination which Dr. Baxter has developed in the Department of Medicine headed so ably by Dr. Douglas Cameron.

Following the resignation of Mr. Christian Primavesi in October, Mrs. Joy Shannon agreed to act as the Administrator of the Montreal Neurological Hospital. At the annual meeting of the Board of the Corporation on May 7, 1973, her appointment as Director of Administrative Services of the Montreal Neurological Hospital was confirmed. She will also be Assistant Director of the Montreal Neurological Institute in charge of special projects. Mrs. Shannon, as many of you have recognized, has already initiated a colorful imprint on the hospital wards and corridors, has reviewed policy problems with many groups of the staff and has brought her administrative experience to improving the hospital organization generally. She has been a member of the Board of the Corporation of the hospital for over a year. Her appointment will allow me to devote more attention to the purely medical and professional affairs of the hospital and to the research and teaching aspects of the Institute. I am glad to report also, that it relieves me of the inappropriate position in which I occasionally found myself when, as director of the hospital, I received letters from the Department of Social Affairs and others addressed to me as "Reverend Sister"! It is, of course,

quite fitting that a woman should be running the administrative side of the hospital, particularly in Quebec, where this has long been a tradition. Most of the famous hospitals in this province were initiated by women—the Hotel Dieu by Jeanne Mance, the Grey Nuns Hospital by Mme. D'Youville and the Montreal General Hospital by the Montreal Ladies Benevolent Society under their first directrice, Mrs. Alistair F. Mitchell, dating back to 1815. Added to this is the fact that more than three quarters of our staff are women. I can vouch, however, that my male colleagues have also shown an enthusiastic response to Joy Shannon's appointment and we look forward to her continuing contributions to our welfare.

Global Budget

Mr. de Grandpré, Mr. Thomas and Mrs. Shannon make reference to some of our severe budget problems. We face more and more stringent control over hospital financing and have had excellent rapport with representatives of the government, especially Mr. Robert Dallaire, in this direction. The global budget, it should be emphasized, allows for a degree of flexibility, but it does not indicate that the Department of Social Affairs is giving away the earth. Indeed, 70% of the budget consists of salaries and wages, the rates of which are adjusted by direct negotiation between representatives of the various members of the staff and the government, so that the total amount paid out of this major category is, for the most part, beyond our control. There are, however, other areas which present a challenge for economy, including particularly, laboratory tests, drugs, medical supplies and administrative costs. It is in this area that Mr. Charles Gurd has been most helpful to Mr. Thomas and ourselves in making cost analyses of laboratory sections and bringing his expertise to our Budget Committee weekly reviews. We must remind ourselves that some of King Lear's madness stemmed from the fact that early in the game he lost control of his budget when he gave away his armies and his kingdoms. Each member of Staff will therefore help retain our sanity by becoming increasingly aware of the ways in which costs can be reasonably trimmed while at the same time maintaining adequate quality and excellence. I would ask all of you to cooperate in this most important aspect of our fiscal activities.

The new Committee on Stay under Dr. Preston Robb's Chairmanship will also be examining the effectiveness of our admission and discharge policy and we will be seeking to streamline and improve the management of patients within the hospital.

McGill University

The University, in the past, has been generous in carrying the year-to-year financial commitments of hospital operations. In 1960, this included a deficit of some \$600,000, which has now been reduced to less than \$80,000. This brings welcome fiscal relief to the University as well as to the hospital Board and is a great credit to the careful husbandry of

Dr. Rasmussen, Mr. Gurd, Mr. Thomas and their staff over the past decade.

The hospital payroll is now processed by the joint hospital computer center after preparation by Mr. Heavysege and his staff, rather than through McGill. Since this represents some 70% of our total hospital budget, it again reduces the financial load previously carried by McGill. We note again, however, that the financial operation of the Institute and the Department of Neurology and Neurosurgery, in regard to teaching salaries, including pensions and fringe benefits, is supported from our own research endowment funds, with the exception of grants provided through the University by the Department of Education for the partial support of geographical, full-time teaching faculty. So far, we have thus made very little charge upon the general operating funds of the University or the budget provided to the Faculty of Medicine.

Bill 65

In December 1971, the National Assembly of Quebec sanctioned an Act respecting health services and social services labelled Bill 65. This provided for a wide-sweeping organization and reorganization affecting hospital centers of all categories. First, the internal hospital organization had to be reviewed to conform with the legislation. We have almost completed this, although the plan need not be submitted to the government until the end of this calendar year. I would like to point out the newly formed Professionals' Advisory Council, which gives representation to the members of the staff who are not M.D.s, but who are concerned with patient care. This council has its own executive committee, and elects a representative to the new Board of Directors of the Hospital. An enlargement of the Committee Structure of the Council of Physicians and Dentists has also been instituted. We have also formed a "Neuro" Committee to coordinate our administrative and policy activities. Secondly, the Board of Directors of the hospital was reconstituted, being enlarged from ten to fifteen members elected or appointed, according to law. This wider membership will be welcome, but at the same time it will bring with it under new legislation, increasing responsibility for the Directors.*

We are pleased that a number of the members of the former Board of the Corporation were able to be included in the new Board of Directors so that their background and experience can be applied over the period of transition. Among those who could not feel they could continue as members of the new Board was Senator Carl Goldenberg, who has given us the advantage of his expert counsel over several years. We appreciate that his very busy schedule between Montreal and Ottawa as a Government Consultant presents a heavy commitment, but we hope that he will continue to feel welcome to take an interest in our activities.

*The new Board of Directors as appointed or elected since this report was given will be found at the beginning of the printed report.

Special Projects

As noted in the catalogue of activities for the past year, one of our major priorities has been the reactivation of negotiations with the Department of Social Affairs regarding the long recognized need for new hospital, research and teaching space. On October 10th we had a formal meeting with six representatives from the Department and senior members of our own staff to review this project. A complete revision of the original preliminary plan was made by our own Building Committee and subcommittees with much help from our planning officer, Mr. Harry Marpole and from Mr. Charles Gurd. By the end of March we were able to provide the government with all the data requested by them. We had much expert help from the planning and engineering departments of the government in reviewing this material. Mr. Douglas Elliott, the Director of the McGill Physical Plant, and Mr. Michael Elwood, the architect assigned to this project, gave us the advantage of their expert support. We have been recently reassured by the announcement by the government that grants of \$5,000,000 each (somewhat less than our own request for the overall renovation and new construction here) has been approved for construction in relation to the two Institutes of Cardiology in Montreal and Quebec City. These institutes compare with ours in many ways, as specialized regional centers for investigation, detection and treatment of disorders affecting a particular organ. They function as provincial and indeed extra-provincial referral centers. Compared to the heart, however, which is, of course, an essential pump, the brain has significance covering a far wider sweep. Being the only organ of intelligence, the knowledge and understanding of brain function is of infinitely more significance, quite above the important therapeutic and medical problems relating to brain disorders which are still unsolved. The systematic development, modernization and provision of adequate facilities at the Neurological Hospital and Institute is entirely appropriate to the regionalization program favored by the present policy of the Ministry of Social Affairs in Quebec. Since the outset, the "Neuro" has served as a provincial referral center for brain and nerve disorders. It has been in the vanguard of advances relating to the nervous system. It has been a training center for medical and surgical specialists dealing with the nervous system and for scientists who must continue to investigate the so far untreatable diseases and mysteries of the mind. Monetary support of this Institute must thus represent a political and certainly a medical bargain.

We have welcomed the approval by the Department of Social Affairs for several projects which will allow advances in medical diagnosis and treatment of brain disorders. The first of these includes approval for the purchase of electronic devices that can control pain intractable to relief from drugs. This will allow a study supervised by Dr. Hansebout and Dr. Trop to go forward for the evaluation of this interesting new approach to the management of pain problems. The approval of the new EMI brain

scanner which has caused such interest and excitement in the field of neurological diagnosis, was also welcomed. This will allow us to be the first center in Canada where this apparatus can be applied. In brief, by scanning the head by a slender beam of x-rays transmitting many thousands of x-ray readings to a computer, the apparatus is capable of displaying on what appears like a radar screen, a horizontal section of the head with extraordinary details of brain structure and any abnormal areas such as tumors or hemorrhages.

Support from the Webster Brain Research Fund provided the initial fiscal impetus for the purchase of this equipment. Mr. Howard Webster accompanied our research team on the evaluation of this device in London at the research laboratories and at the hospital, where the first apparatus is being applied. Mr. Colin Webster, one of the members of our Board of the Corporation, gave further generous support. This is an example which we must hold up to the government as an important aspect of support from the community and interested citizens. In this instance, it has allowed us to acquire the facility for bringing about a significant advance in the diagnosis of brain disorders and thus to maintain the quality of the medical care that can be offered to the citizens of Quebec in this particular field. The establishment of research foundations for hospital centers by the government was a wise move and if this view is maintained it will encourage contributions in all forms by interested citizens toward hospital support. There is no doubt that if the hospital system becomes completely governmentalized, such as the post office, or the military service, there will be little tendency for the ordinary citizen to devote his personal interest or wealth to it. Thus the protection of initiative, of community interest, must be clearly defined among the many issues now being considered within the health system, so that the leaven of community support continues to provide means by which refreshing new approaches to medical care can be initiated.

An excellent example of this leavening support is provided by the Killam Scholarships of the Montreal Neurological Institute which have been available since 1967, supported by the Izaak Walton Killam Memorial Endowment. Ten Killam Scholars have so far been appointed in Neurosciences or in Clinical Neurological Research. This has enabled a number of projects to be initiated with topics ranging from the investigation of Muscle Disease to Electronic Computer handling of E.E.G. data, telemetering of brain wave potentials in epileptic patients, neurophysiological investigation of the complex, deep connections within the brain, chemical analysis of transmitting substances in nervous tissue, and anatomical studies of intracerebral pathways. This team of physician-scientists has brought stimulating new views and information to our research activities and has already in a number of fields developed new experimental techniques, new diagnostic methods which lend greater understanding to our treatment of brain and nerve disorders.

I will conclude by adding only a brief note on several other items of the year's activities. Two neurosciences colloquia were held at Hovey Manor, each consisting of a long weekend retreat of many of the members of staff with reviews of activities and active discussions. These were most successful in providing communication among the staff, outlining our needs in research and teaching and in emphasizing those areas where we have developed strength. I wish to thank all the staff for their hard work in the organization of these colloquia. For my part, they provided a fine opportunity to have an overall review of the research and teaching program of the Hospital and Institute.

The annual buffet luncheon for all the staff of the Hospital and Institute sponsored by Mr. Sam Reitman, again brightened our holiday season in December. This occasion, which has now become one of the traditions at "The Neuro", was graced by the attendance of Mr. Reitman and his family. This event is held in memory of Ruth Reitman who had long been a devoted friend of the Institute. It is one of many examples which I could cite of the warm interest shown in our activities by members of the community and which we consider provide a special atmosphere at "The Neuro".

In November of last year Dr. James Ambrose, the senior consultant radiologist at the Atkinson Morley's Hospital in London, England, delivered the first Thomas Willis lecture. Dr. Willis, who is often called the founder of neurology, was an Oxford physician in the 17th century, and began the first systematic review of the anatomy of the brain and nerves. In this memorial lecture, Dr. Ambrose described the results of the first 150 patients examined with the new EMI scanner. This was an exciting occasion scientifically, and fulfilled the function of these Willis lectures admirably, which is to bring to our attention new advances in the diagnosis and treatment of neurological disorders.

The members of the Neurosciences Advisory Council have now been selected and a meeting is intended for next spring.* In the meantime, Professor MacIntosh and Professor Sourkes, two members from McGill University, took part in the first neurosciences colloquium in which a review of our research programs was made.

The Question of Quality

As we close this review of our activity, two aspects of the new legislation on health care cause us great concern. The first of these is that we lack, for the most part, any means or indeed any directive, so far, for controlling the quality of medical care within this legislation. Despite the excellent and detailed regulations set out by the government, and subjected to comment and revision after discussion with numerous committees representing the medical schools, teaching hospitals and the professional bodies, there still remains no assurance

*A complete list of the Council appears in the first part of the printed reports.

that quality will be guaranteed. I believe this is one of the crucial problems which the government and the medical profession, working together, must face as a high priority.

Secondly, there has been apparent a trend to downgrade the significance of supporting medical research. This has been evident in reports deriving from the federal as well as the provincial levels. Some of this approach has undoubtedly been an honest effort to emphasize the urgent need for medical care in the community as opposed to that in large, highly developed hospital centers. But Canada's medical research is only just coming of age when we compare our quality and output with that of other modern nations. Research and teaching provide the groundswell for medical advances which ultimately give us new knowledge to treat the individual patient. The family doctor who uses penicillin and insulin, or his patient who is treated with such drugs, has no need to be told this. To compare with the support per capita of medical research in the United Kingdom and in the United States, we must do better in Canada than our low contribution for research of only one percent of the total health care budget.

In closing, I wish to thank Principal Bell for his skillful and gracious Chairmanship of our Annual Meeting, Mr. Jean de Grandpré for his wise comments and summary of the state of the hospital and the friends and staff of the Institute for their attendance and attention. We look forward optimistically to our next Annual Meeting when approval of our expansion program will have been granted.

MONTREAL NEUROLOGICAL HOSPITAL

BOARD OF THE CORPORATION

A.J. de GRANDPRE*, Q.C., *President*
B.C.L. (McGill)

WILLIAM FEINDEL*^o, *Vice-President*
B.A. (Acad.), M.Sc. (Dal.), M.D., C.M., D.Phil. (Oxon.),
D.Sc. (Acad.), F.R.C.S. (C), F.A.C.S.
Director, Montreal Neurological Institute

ROBERT E. BELL*^o
M.A. (U.B.C.), Ph.D., F.R.S., F.R.S.C.,
Principal and Vice-Chancellor, McGill University

R.F.P. CRONIN,*
M.D., C.M., M.Sc., M.R.C.P. (Lond.), F.R.C.P. (C), C.N.P.Q. (Card.)
Dean, Faculty of Medicine, McGill University

The Hon. CARL GOLDENBERG, O.C., O.B.E., Q.C.,
B.A., M.A., B.C.L., (McGill)
Honorary LL.D. (McGill, Montreal and Toronto)

G. ARNOLD HART, M.B.E.

PRESTON ROBB*
B.Sc., M.Sc., M.D., C.M.
Representative of the Medical Board

MRS. JOY M. SHANNON, D.B.A. (Toronto)

COLIN WEBSTER
B.A. (McGill), LL.D. (Sir George Williams University)

*Member of the Executive Committee
^oEx-officio Member

BOARD OF DIRECTORS
as of June 30, 1973.

MR. JEAN de GRANDPRE, *President**^o
Q.C., B.C.L (McGill)

DR. MAURICE McGREGOR, *Vice-President**
M.D., B.Ch., M.R.C.P. (Lond.)

MRS. JOY M. SHANNON, *Secretary**
D.B.A. (Toronto)

DR. ROBERT E. BELL, M.A., (U.B.C.)
Ph.D., F.R.S., F.R.S.C.

MR. ALFRED CAMPBELL, R.N.

MR. ROBERT CUMMINGS

DR. JOSEPH EPPS, B.Sc., M.D.

DR. WILLIAM FEINDEL*^o B.A., (Acad.), M.Sc., (Dal.)
M.D., C.M., D. Phil. (Oxon.), D.Sc. (Acad.),
F.R.C.S. (C), F.A.C.S., F.R.S.C.

MISS JOY HACKWELL,* R.N., B.N.

MR. ARNOLD HART, M.B.E.

MR. PETER LEGGAT^o, C.A.

MRS. JILL PRICE

DR. PRESTON ROBB*, B.Sc., M.Sc., M.D., C.M.

MR. COLIN WEBSTER^o
B.A. (McGill), LL.D. (Sir George Williams University)

*Member of the Administrative Committee

^oAudit Committee

**MONTREAL NEUROLOGICAL INSTITUTE
NEUROSCIENCES ADVISORY COUNCIL**

ARNOLD S.V. BURGEN, M.B., M.D., F.R.C.P., F.R.S.
Director, National Institute for Medical Research
Medical Research Council of Great Britain

**RONALD V. CHRISTIE, M.B., Ch.B., M.Sc., M.D., D.Sc., F.R.C.P. (London and Canada)
F.A.C.P.**
Emeritus Dean of Medicine and former Professor of Medicine, McGill University

MARC COLONNIER, M.D., Ph.D.
Professor and Chairman, Department of Anatomy
University of Ottawa

PIERRE R. GENDRON, C.C., B.Sc., Ph.D., LL.D., D.Sc., F.C.I.C., F.R.S.C.
President, Pulp and Paper Research Institute of Canada

FRANK C. MacINTOSH, B.A., M.A., Ph.D., F.R.S.C., F.R.S.
Joseph Morley Drake Professor of Physiology,
McGill University

ROBERT Q. MARSTON, B.S., M.D., B.Sc.
Former Director, National Institutes of Health,
Department of Health, Education and Welfare,
United States of America

GUY L. ODOM, M.D.
Professor of Neurosurgery, Duke University School of Medicine
Chairman, American Board of Neurological Surgery

T.L. SOURKES, B.Sc., M.Sc., Ph.D., F.R.S.C.
Professor of Psychiatry and Director of Neurochemistry Research Unit
McGill University and Allan Memorial Institute

MONTREAL NEUROLOGICAL HOSPITAL

CLINICAL AND LABORATORY STAFF

Director

WILLIAM FEINDEL, B.A. (Acadia), M.Sc. (Dal.), M.D., C.M., D.Phil., (Oxon)
D.Sc., (Acadia), F.R.C.S.(C), F.A.C.S., F.R.S.C.

Honorary Neurosurgeons

WILDER PENFIELD, O.M., C.M.G., M.D., D.Sc., F.R.C.S.(C)
Hon. F.R.C.S. (Eng.), F.R.S.C., F.R.S., (Lond.), Hon. F.R.C.P. (Eng.)

ARTHUR R. ELVIDGE, M.D., C.M., M.Sc., Ph.D., D.C.L. (Bishop's), F.R.C.S. (C)

Honorary Consultant in Neurochemistry

K.A.C. ELLIOTT, M.Sc., Ph.D., Sc.D., F.R.S.C.

Consultant in Neurophysiology

HERBERT JASPER, Ph.D., D. ès Sci. (Paris), M.D., C.M., F.R.S.C.

Senior Consultant in Neurology

FRANCIS McNAUGHTON, B.A., M.Sc., M.D., C.M., F.R.C.P. (C)

Neurologist-in-Chief

PRESTON ROBB, B.Sc., M.Sc., M.D., C.M.

Neurosurgeon-in-Chief

GILLES BERTRAND, B.A., M.D., M.Sc., F.R.C.S. (C)

Neurologists

J.B.R. COSGROVE, M.D., M.Sc., M.Sc. (Cantab.)
IRVING HELLER, B.Sc., M.D., C.M., M.Sc., Ph.D., F.R.C.P. (C)

Associate Neurologists

FREDERICK ANDERMANN, B.Sc., M.D.
BERNARD GRAHAM, B.A., B.Sc., M.D., C.M.
ALLAN SHERWIN, B.Sc., M.D., C.M., Ph.D., F.R.C.P. (C)

Assistant Neurologists

ANDREW EISEN, M.D., M.R.C.S., (Lond.), L.R.C.P. (Eng.), F.R.C.P. (C)
GEORGE KARPATI, M.D., F.R.C.P. (C)
IVAN F. WOODS, M.B., B.Ch., B.A.D., M.Sc., F.R.C.P. (C)

Neurosurgeons

WILLIAM FEINDEL, B.A. (Acadia), M.Sc. (Dal.), M.D., C.M., D.Phil., (Oxon)
D.Sc., (Acadia), F.R.C.S.(C), F.A.C.S., F.R.S.C.
THEODORE RASMUSSEN, B.S., M.B., M.D., M.S., F.R.C.S.(C)

Associate Neurosurgeons

ROBERT HANSEBOUT, M.D., M.Sc., F.R.C.S. (C)

Assistant Neurosurgeons

CARL DILA, B.A., M.D., M.Sc.
ANDRE OLIVIER, B.A., M.A., Ph.D., F.R.C.S.(C)

Radiologist

ROMEO ETHIER, B.A., M.D.

Associate Radiologist

DENIS MELANÇON, B.A., M.D.

Assistant Radiologist

GARRY BELANGER, B.A., M.D.

Electroencephalographer and Neurophysiologist

PIERRE GLOOR, M.D., Ph.D.

Associate Electroencephalographer

FREDERICK ANDERMANN, B.Sc., M.D.

Assistant Electroencephalographer

IVAN F. WOODS, M.B., B.Ch., B.A.D., M.Sc., F.R.C.P. (C)

Electromyographer and Assistant Electroencephalographer

ANDREW EISEN

M.D., M.R.C.S., (Lond.), L.R.C.P. (Eng.), F.R.C.P. (C)

Biomedical Engineer

JOHN RICHARD IVES, M.Sc.

Computer System Engineer

CHRISTOPHER THOMPSON, B.Sc., M.Sc.

Anaesthetist

RICHARD G.B. GILBERT, M.B., B.S., F.R.C.P. (C), D.A.

R.C.S. & R.C.P., F.F.A.R.C.S., F.A.C.A.

Associate Anaesthetist

DAVY TROP, B.A., M.D., F.R.C.P. (Cert.)

Assistant Anaesthetists

JENNIFER BARNES, M.B., Ch.B. (St. Andrews, Scot.)

GILLES COSSETTE, B.A., M.D., C.S.R.C.

ELIZABETH WILKINSON, M.B.B.S., L.R.C.P., M.R.C.S., F.F.A.R.C.S.

Neurochemist and Medical Research Council Associate

LEONHARD S. WOLFE, B.Sc., M.Sc., (N.Z.), Ph.D. (Cantab.), M.D.

Associate Neurochemist

HANNA PAPIUS, M.Sc., Ph.D.

Neuropathologist

GORDON MATHIESON, M.B., Ch.B., M.Sc.

Associate Neuropathologist

STIRLING H. CARPENTER, A.B., M.D.

Neuroanatomist

DONALD G. LAWRENCE, B.Sc., M.D.C.M.

Neuropsychologist and Medical Research Council Associate

BRENDA MILNER, Ph.D., Sc.D. (Cantab.)

Associate Neuropsychologist

LAUGHLIN TAYLOR, B.Sc., B.Ed., M.Sc.,

Clinical Assistants, Neuropsychology

MARY KAY AJERSCH, M.A. (Western Ontario)

ENDA McGOVERN, B.A. (Dublin), Dip. Psych. (Dublin)

Clinical Psychologist

CLARA STRUASS, B.A., M.A.

MONTREAL NEUROLOGICAL HOSPITAL

CONSULTING AND ADJUNCT STAFF

- Consulting Pathologist.* Robert H. More, M.D., M.Sc., F.R.C.P.(C)
- Honorary Consulting Psychiatrist.* Robert Cleghorn, M.D., D.Sc., F.R.C.P.(C)
- Consulting Psychiatrists.* Maurice Dongier, M.D.
Heinz Lehmann, M.D., F.R.S.(C)
- Honorary Consulting Neurologists.* Roma Amyot, B.A., M.D.
Arthur Young, M.D., C.M., F.R.C.P.(C)*
- Consulting Neurologists.* André Barbeau, B.A., B.P.C.B., M.D.
F.R.C.P.(C)
Claude Bélanger, B.A., M.D., F.R.C.P.(C)
Guy Courtois, B.A., M.D., M.Sc.,
F.R.C.P.(C)
Jean-Léon Desrochers, B.A., M.D.,
F.R.C.P.(C)
Normand Giard, B.A., M.D., F.R.C.P.(C)
Raymond Lafontaine, B.A., M.D.
Israel Libman, B.A., M.D., C.M.,
F.R.C.P.(C)
Charles Olanow, M.D., F.R.C.P.(C)
Arthur Schwartz, B.A., M.D.*
- Adjunct Neurologists.* Albert Aguayo, M.D., F.R.C.P.(C)
Donald Baxter, M.D., C.M., M.Sc.,
F.R.C.P.(C)
Garth Bray, M.D., F.R.C.P.(C)
Morrison Finlayson, M.B., Ch.B.,
F.R.C.P.(C)
Peter Humphreys, B.Sc., M.D., C.M.
Joseph Martin, B.S., M.D., F.R.C.P.(C)
Stanley Rothman, A.B., M.D., C.M.
William Sheremata, B.Sc., M.D., F.R.C.P.(C)
William Tatlow, M.D., M.R.C.P.,
F.R.C.P.(C)
Danica Venecek, M.D.
Gordon Watters, B.A., M.D.
- Honorary Consulting Neurosurgeon.* Jean Sirois, B.A., M.D.
- Consulting Neurosurgeons.* Claude Bertrand, B.A., M.D., F.R.C.S.(C)
Maurice Héon, B.A., M.D., F.R.C.S.(C)
F.A.C.S.
Harold Rosen, B.Sc., M.D., C.M.,
F.R.C.S.(C), F.A.C.S.
- Honorary Adjunct Neurosurgeon.* Harold Elliott, B.Sc., M.D., C.M.*

*Died 1973

<i>Adjunct Neurosurgeons</i>	John Blundell, M.A., M.D., M.R.C.P.(Lond.), F.R.C.S.(Eng.) Robert Ford, B.A., M.D., F.R.C.S.(C) Robert Hollenberg, M.D., F.R.C.S.(C) Joseph Stratford, M.D., C.M., M.Sc., F.R.C.S.(C)
<i>Honorary Consulting Anaesthetists</i>	Harold R. Griffith, M.M., B.A., M.D., C.M., F.A.C.A., F.I.C.A., F.F.A.R.C.S. (Eng.), F.R.C.P.(C)
<i>Consulting Anaesthetists</i>	G. Frederick Brindle, B.A., M.D., C.M., F.R.C.P.(C) Philip Bromage, M.B.B.S., M.R.C.P., L.R.C.P., F.F.A.R.C.S.(Eng.)
<i>Adjunct Physiologist (Anaesthesia)</i>	Kresimir Krnjevic, B.Sc., M.B., Ch.B., Ph.D.
<i>Consulting Radiologists</i>	Robert G. Fraser, M.D., F.R.C.P.(C) Jean L. Léger, M.D. Jean Vézina, B.A., B.M., M.D.
<i>Honorary Consulting Radiation Therapist</i>	Jean Bouchard, M.D., F.A.C.R., F.R.C.P.(C)
<i>Consulting Radiation Therapist</i>	J.J. Hazel, M.D.
<i>Consultant, Employee Health Service</i>	Walter Gregory, M.D.
<i>Honorary Consulting Executive Director</i>	J. Gilbert Turner, M.D., C.M., M.Sc. F.A.C.H.A.
<i>Consulting Executive Director</i>	Douglas MacDonald, B.Eng.
<i>Consulting Psychologist</i>	M. Sam Rabinovitch, Ph.D.
<i>Consultant in Veterinary Medicine</i>	Leslie Lord, B.Sc., M.Sc., D.V.M.

ADMINISTRATIVE STAFF OF THE MONTREAL NEUROLOGICAL HOSPITAL

<i>President</i>	A.J. de Grandpré
<i>Director</i>	William Feindel, M.D.
<i>Administrative Consultant</i>	Charles S. Gurd
<i>Director, Administrative Services</i>	Mrs. Joy M. Shannon
<i>Administrative Assitant</i>	Winston Rochette
<i>Registrar</i>	Bernard Graham, M.D.
<i>Assistant Registrar</i>	Danica Venecek, M.D.
<i>Director of Finance</i>	Geoffrey Thomas
<i>Director of Personnel</i>	Hector Heavysege
<i>Director, Social Service</i>	Miss C. Griffin
<i>Planning Officer</i>	Harry Marpole

SUPERVISORY OFFICERS

<i>Admitting</i>	Mrs. M. Bernard
<i>Dietician</i>	Miss S. McDonagh
<i>Employee Health Service</i>	Mrs. J. Mallory, B.N.
<i>Librarian</i>	Mrs. M. Boski, B.A., B.Ls.
<i>Medical Records</i>	Mrs. R. Slapack
<i>Services (Oxygen & Inhalation)</i>	Wilfred Garneau

NURSING STAFF

<i>Director of Nursing</i>	Miss C. Joy Hackwell, R.N., B.N.
<i>Assistant Director of Nursing</i>	Miss Irene MacMillan, B.A., R.N., (M.Sc., App.)
<i>Assistant Director of Nursing (Night)</i>	Miss Elizabeth Barrowman, B.N.
<i>Nursing Supervisors (Night)</i>	Miss Lillian McAuley, R.N. Miss Margaret Smeaton, R.N.
<i>Nursing Supervisors (Day)</i>	Miss Anne Carney, B.N., R.N. Miss Annie Johnson, R.N.
<i>Nursing Supervisors (Evening)</i>	Miss Cecilia Largo, R.N., B.Sc. (N) Mrs. Barbara Petrin, R.N.
<i>Assistant Director of Nursing Education</i>	Miss Helena Kryk, B.N., R.N.
<i>Clinical Coordinator</i>	Miss Geraldine Hart, B.N., R.N.
<i>Clinical Instructor</i>	Miss Elizabeth Roll, B.N., R.N.
<i>Operating Room Supervisor</i>	Miss Norma Isaacs, B.N., R.N.
<i>V.O.N.</i>	Mrs. Francoise Vanderland, R.N., B.N.

HEAD NURSES

Miss Alice Cameron, R.N.	Miss Delta Macdonald, R.N.
Miss Mary Cavanaugh, R.N.	Miss Flora McCormack, R.N.
Miss Lucy Dalicandro, R.N.	Miss Noelene McGuire, R.N.
Miss Marion Everett, R.N.	Ms Nympha Sison, B.Sc. (N), R.N.°
Miss Patricia Furlong, R.N.	Miss Ursula Steiner, R.N.
Ms Georgette Jotic, R.N.°	Ms Helene Tracz, R.N.°

°Operating Room

THE WOMEN'S AUXILIARY OF THE ROYAL VICTORIA HOSPITAL

<i>President</i>	Mrs. Elizabeth Taylor (to Apr. 1973) Mrs. Robert B. Spence (from Apr. 1973)
<i>Chairman, M.N.H. Coffee Shop Committee</i>	Mrs. Jack Brunt

CLERGY

Rabbi Mordechai Glick	<i>Jewish</i>
Reverend Father Francis X. Johnson, S.J.	<i>Roman Catholic</i>
Reverend Father E. Lalande, S.J.	<i>Roman Catholic</i>
Reverend S.M. McDowell	<i>United</i>
Reverend Lionel Temple-Hill	<i>Anglican</i>

MONTREAL NEUROLOGICAL INSTITUTE AND McGILL UNIVERSITY TEACHING STAFF

Department of Neurology and Neurosurgery, Faculty of Medicine

<i>Chairman of Department and William Cone</i>	
<i>Professor of Neurosurgery</i>	William Feindel
<i>Professors, Neurology</i>	Donald Baxter Francis McNaughton Preston Robb
<i>Professors, Neurosurgery</i>	Gilles Bertrand Theodore Rasmussen Joseph Stratford
<i>Associate Professors, Neurology</i>	Albert Aguayo Frederick Andermann J.B.R. Cosgrove Irving Heller Allan Sherwin Gordon Watters
<i>Assistant Professors, Neurology</i>	Garth Bray Andrew Eisen Morrison Finlayson Bernard Graham George Karpati Israel Libman Joseph Martin W.F.T. Tatlow Ivan F. Woods
<i>Lecturers, Neurology</i>	Peter Humphreys Charles Olanow Stanley Rothman Arthur Schwartz* William Sheremata
<i>Associate Professor, Neurosurgery</i>	John Blundell
<i>Assistant Professors, Neurosurgery</i>	Carl Dila Robert Ford Robert Hansebout André Olivier
<i>Lecturer, Neurosurgery</i>	Robert Hollenberg
<i>Assistant Professor, Neurosurgical Research</i>	Lucas Yamamoto
<i>Professor, Neurophysiology</i>	Pierre Gloor
<i>Assistant Professor, Neurophysiology</i>	Stanislav Prelević
<i>Assistant Professor, Clinical Neurophysiology</i>	Katherine Metrakos
<i>Lecturers, Neuroelectronics</i>	John Richard Ives Christopher Thompson

*Died Apr. 4/73

<i>Professor, Neurochemistry.</i>	Leonhard Wolfe
<i>Associate Professor, Neurochemistry.</i>	Hanna Pappius
<i>Associate Professor, Neuroradiology.</i>	Roméo Ethier
<i>Assistant Professors, Neuroradiology.</i>	Denis Melançon
<i>Lecturer, Neuroradiology.</i>	Garry Bélanger
<i>Professor, Anaesthesia.</i>	Richard Gilbert
<i>Associate Professor, Anaesthesia.</i>	Davy Trop
<i>Assistant Professors, Anaesthesia.</i>	Gilles Cossette Elizabeth Wilkinson
<i>Associate Professors, Neuropathology.</i>	Stirling Carpenter Gordon Mathieson
<i>Professor, Clinical Psychology.</i>	Brenda Milner
<i>Lecturers, Clinical Psychology.</i>	Clara Strauss Laughlin Taylor
<i>Associate Professor, Neuroanatomy.</i>	Donald G. Lawrence
<i>Assistant Professor, Neuroanatomy.</i>	Allan Morton
<i>Lecturer, Neuroanatomy.</i>	Charles Olanow

*Representative to the Council of the Faculty
of Graduate Studies and Research*

Professor Pierre Gloor

BOARD OF MANAGEMENT OF THE
MONTREAL NEUROLOGICAL HOSPITAL
and
EXECUTIVE COMMITTEE OF THE
MONTREAL NEUROLOGICAL INSTITUTE

William Feindel, *Chairman*

Roméo Ethier, M.D.	Gordon Mathieson, M.D.
Gilles Bertrand, M.D.	Preston Robb, M.D.
Pierre Gloor, M.D.	Leonhard Wolfe, M.D.
Francis McNaughton, MD.	Mrs. Joy. M. Shannon, <i>Secretary</i>

EXECUTIVE STAFF OF THE
MONTREAL NEUROLOGICAL INSTITUTE

<i>Director</i>	William Feindel, M.D.
<i>Director, Administrative Services</i>	Mrs. Joy M. Shannon
<i>Assistant Director (Education)</i>	Preston Robb, M.D.
<i>Assistant Director (Research)</i>	Pierre Gloor, M.D.
<i>Executive Secretary</i>	Mrs. Sophie Malecka

RESIDENT STAFF—JULY 1972 THROUGH JUNE 1973

Senior Neurosurgical Resident Leon Ravvin, M.D. (McGill)

NEUROLOGICAL SERVICES

Residents: 6 mos. on this service

M. Aubé, M.D. (Univ. of Mtl.) 4 mos.	J. Romine, M.D. (Univ. of Arkansas)
M.L.D'Amour, M.D. (Univ. of Mtl.)	A. Ross-Chouinard, M.D. (Univ. of Mtl.)
J. Dawlings, M.D. (Univ. of Brit. Col.)	S. Roumani, M.D. (Beirut Univ., Lebanon)
A. Rhi-Sausi, M.D. (Univ. of Nuevo Leon, Mexico)	4 mos.

Assistant Residents: 6 mos. on this service

G. Fortin, M.D. (Univ. of Mtl.)	L. Renaud, M.D. (Univ. of Ottawa)
A. Gagnon, M.D. (Univ. Laval)	N. Schaul, M.D. (State Univ. of N.Y.)
T. Greer, M.D. (McGill)	M. Svarc, M.D. (Univ. of Zagreb)
R. Hyatt-Williams, M.D. (Univ. of London)	A. Trottier, M.D. (Univ. of Ottawa)
Y. Lapierre, M.D. (Univ. of Mtl.)	

Royal Victoria Hospital Residents:

M. Aubé, M.D. (Univ. of Mtl.) 2 mos.	S. Roumani, M.D. (Beirut Univ., Lebanon)
I. Leppik, M.D. (Univ. of Penn.) 6 mos.	2 mos.
	N. Schaul, M.D. (State Univ. of N.Y.)
	2 mos.

RVH Rotators:

M. Hayward, M.D.	C. McMillan, M.D.	N. Postone, M.D.	I. Salit, M.D.
S. Kasakura, M.D.	L. Noel, M.D.	J. Pringle, M.D.	R. Silverberg, M.D.
S. Margulies, M.D.	A. Pont, M.D.	B. Rowat, M.D.	A. Sullivan, M.D.
			C. Tai, M.D.

Montreal General Hospital Resident

L. Renaud, M.D. (Univ. of Ottawa)

Montreal Children's Hospital Residents:

6 mos. on this service

H.S. Chuang, M.D. (Nat. Defense Center, Taiwan)	N. Schaul, M.D., (State Univ. of N.Y.)
-------------------------------------------------	----------------------------------------

Jewish General Hospital Residents: 6 mos on this service

R. Hyatt-Williams, M.D. (Univ. of London)	A. Rhi-Sausi, M.D. (Univ. of Nuevo Leon, Mexico)
-------------------------------------------	--------------------------------------------------

Montreal General Hospital Assistant Residents:

1 year on this service

J. Romine, M.D. (Univ. of Arkansas)*	Y. Lapierre, M.D. (Univ. of Mtl.)
T. Greer, M.D. (McGill)	L. Terry, M.D. (Lab.) (Marquette Univ. Med. School)
A. Gagnon, M.D. (Univ. of Laval)	

Montreal Children's Hospital Assistant Residents:

6 mos. on this service

M. Aubé, M.D. (Univ. of Mtl.)

M.L.D'Amour, M.D. (Univ. of Mtl.)

G. Fortin, M.D. (Univ. of Mtl.)

A. Perez de Leon, M.D. (Univ. of Santiago de Compostela, Spain) EEG

G. Remillard, M.D. (Univ. of Ottawa)

A. Ross-Chouinard, M.D. (Univ. of Mtl.)

NEUROSURGICAL SERVICES

Residents: 6 mos. on this service

D Fewer, M.D. (McGill)

D. Mercer, M.D. (Dalhousie Univ.)

H. Tutt, M.D. (Univ. of N. Carolina)

Assistant Residents: 6 mos. on this service

A. Altuzarra, M.D. (Univ. of Valladolid, Spain)

E. Bastarrica, M.D. (Univ. de la Republica, Montevideo, Uruguay)

M. Dogali, M.D. (McGill)

A. Drake, M.D. (Univ. of Chicago)

J. Epps, M.D. (Howard Univ.)

E. Kuchner, M.D. (Univ. of Chicago)

J. Musgrave, M.D., (Queen's Univ., Belfast)

H. Ortegon, M.D. (Univ. of Mexico)

RVH Rotators:

J. Levitan, M.D.

C. Milne, M.D.

J.G. Villemure, M.D.

Y.C. Woo, M.D.

Montreal General Hospital Resident:

L. Stern, M.D. (Univ. of Man.) (1 yr.)

S. Wohl, M.D. (McGill) (6 mos.)

Montreal General Hospital Assistant Residents:

6 mos. on this service

E. Bastarrica, M.D. (Univ. de la Republica, Montevideo, Uruguay)

A. Ginde, M.D. (Bombay Univ.)

A. Drake, M.D. (Univ. of Chicago)

Montreal Children's Hospital Residents: 6 mos. on this service

M. Dogali, M.D. (McGill)

P. Murray, M.D. (Royal Coll. Surg., Dublin)

Neurological Research

Calvin Melmed, M.D. (Univ. of Manitoba)

Neurosurgical Research

Louis Bouchard, M.D. (Univ. of Ottawa)

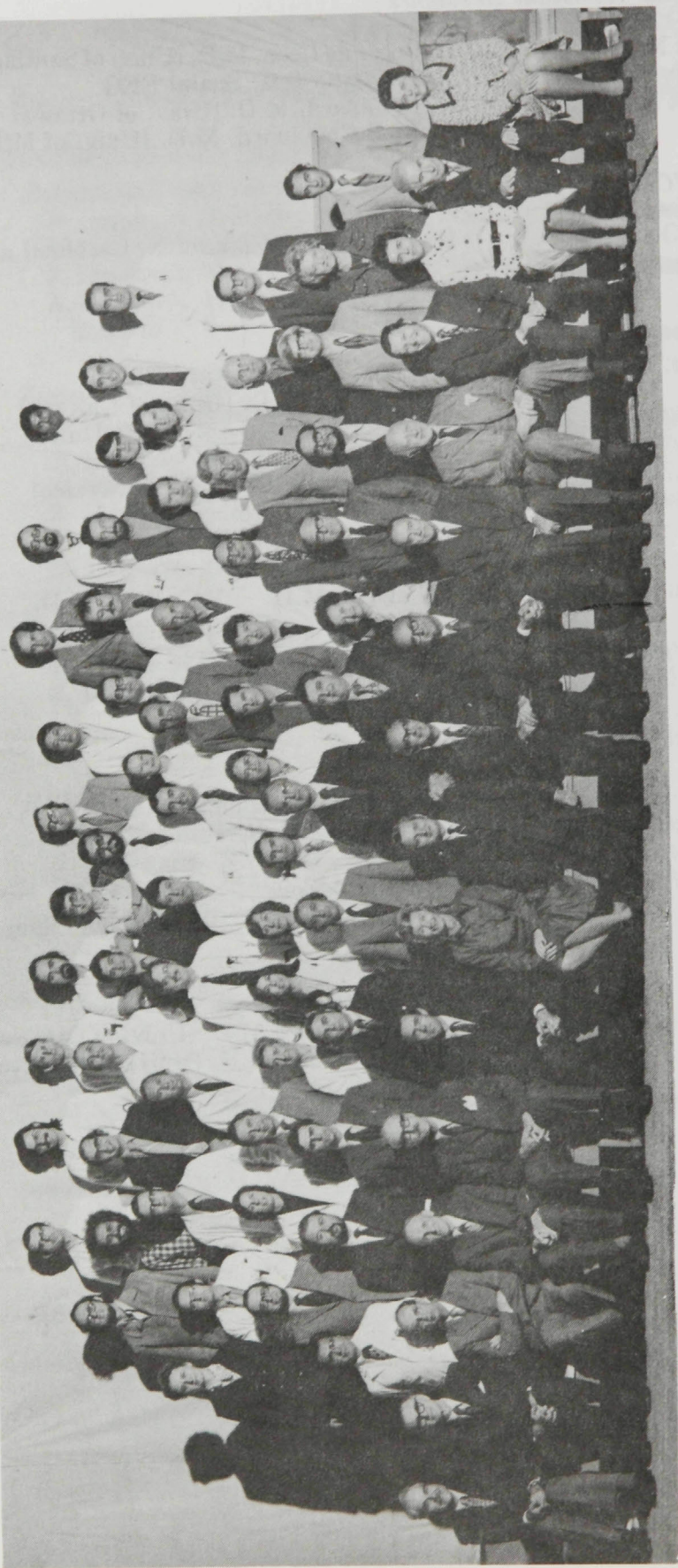
Terence Myles, M.D. (Univ. of Alberta)

University of Montreal Rotators in Neuropathology

(4 mos. on this service)

Andre Lauzon, M.D.

John Magown, M.D.



Bottom Row: Drs. P. Gloor, J. Cosgrove, B. Graham, F. McNaughton, P. Robb, Dean R. P. Cronin, Mrs. J. Shannon, Prin-
 cipal & Vice-Chancellor R. Bell, Dr. W. Feindel, Mr. A. de Grandpré, Q.C.* Drs. T. Rasmussen, W. Penfield, G. Bertrand,
 Miss J. Hackwell, Dr. A. Elvidge, Miss C. Griffin
 Second Row: Drs. L. Yamamoto, F. Andermann, A. Olivier, S. Rothman, C. Dila, I. Heller, G. Karpati, B. Milner, Mr. L.
 Taylor, Mr. G. Thomas, Drs. I. Woods, H. Pappius, A. Eisen
 Third Row: Drs. D. Trop, Elizabeth Wilkinson, R. Hansebout, Jennifer Barnes, Miss M. Jones, Miss M. Ajersch, Dr. L.
 Ravvin, Miss J. Robbins, Drs. D. Lawrence, A. Wilkins, A. Sherwin, L. Wolfe, G. Mathieson, T. Sourkes
 Fourth Row: Mrs. M. Bostk, Drs. H. Ortegon, W. Ray, L. Quesney, I. Leppik, J. Romine, A. Guberman, S. Prelevic, E.
 Meyer, P. Murray, G. Remillard
 Fifth Row: Mr. D. Skuce, Mr. J. Gotman, Mr. J. Ives, Dr. M. Burnham, Mr. G. Ball, Drs. A. Altuzzara, A. Chouinard, E.
 Kuchner, D. Mercer, G. Cossette, N. Ng, S. Roumani, A. Silk
 Top Row: Drs. J. Musgrave, G. Cressey, A. Trotter, T. Greer, M. Svarc, P. Milette, M. Chiu, M. Jacoby, H. Tutt, A. Ginde



Bottom Row: Miss A. Johnson, Miss L. Dalicandro, Miss M. Cavanaugh, Miss I. MacMillan, Miss J. Hackwell, Miss H. Krylk, Miss G. Hart, Miss A. Carney, Mrs. L. Fletcher
 Second Row: Mrs. M. Chance, Mrs. J. Mallory, Mrs. L. Gorman, Miss A. Cameron, Miss E. Roll, Miss N. Siddons-Grey, Miss U. Steiner, Mrs. P. DuBen, Mrs. R. Boyer
 Third Row: Miss V. Omega, Miss R. Lepage, Miss N. McGuire, Miss G. Senico, Miss L. Carswell, Miss M. Everett, Miss E. Jose, Miss E. Spencer, Miss W. Hawkins, Mrs. S. Panicker, Miss M. Depaymos
 Fourth Row: Miss L. Marcoux, Miss J. Jerry, Miss A. Thomas, Miss M. Gertsch, Miss D. Donnelly, Miss C. Ribaya, Miss J. Oidi, Miss E. Henoch, Miss B. MacLean, Miss L. Maruska.

Neurology

DR. PRESTON ROBB

This is a report to the Director on the activities of the Department of Neurology for the year 1972-73. It includes the activities on the clinical services for 1972 and the teaching program of undergraduate and graduate and research activities.

Clinical Services

Neurology continues to operate three separate services, each with their own special interests. The services have been supported by an excellent group of residents and elective students. Each year as the annual report is prepared, the same problems seem to emerge: how can one expedite the investigation of patients, and what can be done to facilitate the placement of patients in convalescent hospitals or institutions for the care of the chronically ill.

Although excellent neurological services have developed throughout the Province, the M.N.H. continues to attract patients from across Canada and the United States. Because of the other neurological services which handle most problems, the type of referral you are seeing has become more and more complicated, and increasingly difficult to unravel. One is reminded of the slogan on President Truman's desk "the buck stops here". We are often called on to solve problems where no satisfactory solution has been found before. This is another reason why patients are in longer than they were in the past.

During 1972, there were 1,180 admissions to the neurology service, a decrease of 38 over the previous year. The average length of stay for the whole hospital was 19.7 days. This represents a decrease of half a day over the previous year, but still is too long. In July, Dr. Irving Heller returned from a sabbatical year in the United Kingdom and the services were reorganized. Dr. McNaughton, after years of excellent leadership, relinquished the responsibility for the "A" Service. Dr. Robb moved up, Dr. Cosgrove took over the "B" Service, and Dr. Heller the "C" Service.

Special studies in epilepsy, metabolic disorders of children, demyelinating diseases, headache, and muscle disorders, as well as the regular neurological problems have occupied the staff. I would be remiss if I did not mention the team work and harmony that exists on all of the services and the sincere desire on the part of all to improve the welfare of patients. It is so easy in this day of rapid scientific advance, to forget that our chief purpose is to help patients. We are all concerned about the difficulty in finding adequate placement for the chronically ill. If the Institute is to continue to grow and expand its services to the public, it must do so by increasing the turnover of ward patients and increasing out-patient diagnostic facilities.

Out-patient clinics are held in the Royal Victorial Hospital five days a week. Each service has its own general neurology clinic. As well there are special clinics for epilepsy, multiple sclerosis, muscle disorders, and headache. The difficulties of operating in the limited facilities of the R.V.H. are recognized by all. We look forward to the anticipated physical changes that are about to take place and the opportunity to integrate our special services into the out-patient clinics of the Royal Victoria Hospital. During the year, there were 4,399 clinic visits, of which 914 were new patients, 4 Workmen's Compensation patients, and 3,481 return visits. We have no record of the many consultations seen in the Emergency Department at all times of the day or night.

The delay necessary before patients can be seen is of concern to all. Hopefully, with the re-organization this can be reduced to an absolute minimum. Mention should be made of an emergency consultation service, which has been established in the neurology offices. A staff neurologist is available every day for any patients referred to the Institute. If a physician is concerned about a patient and wants him seen promptly, this can be arranged on the same day by a telephone call or within a day or two, whichever seems appropriate.

The problem has been to get diagnostic tests done on out-patients. Both the x-ray and EEG Departments are overworked and getting appointments requires undue delay. Hopefully, it won't be too long before these problems can be solved and patients have most of their investigation done on an out-patient basis in the same or less time that it takes for in-patients.

In a hospital such as ours, we are called on to treat patients after the disorder or disease has been established. There is little opportunity for prevention. Nevertheless, I feel as a group we should be seriously considering in what areas neurological disorders could be prevented, particularly, in the field of epilepsy. Through genetic counselling and the better care of infants and children, having serious seizures, perhaps the prevalence of chronic recurring epilepsy can be reduced. In the field of muscular disorders, and congenital abnormalities, surely with genetic counselling and antenatal diagnosis the incidence could be reduced.

The pressure of day to day activities tends to keep our eyes focused on problems within the Institute. We have a responsibility to provide leadership and advice outside of the Institute. The members of our staff play active roles in many of the voluntary health agencies, contributing their time and energy in active and advisory roles. It would be well if the Provincial Government developed a council of Neurologists to consider the epidemiology of neurological problems in Quebec and the best way of handling them. Prevention is essential in modern medicine, nevertheless, there is no way that all neurological disorders can be prevented. Like the poor, they will always be with us. There is urgent need for collaboration between government and those delivering services so that

he standards of health care can be improved without adding to the cost.

Teaching

During the present academic year, definite advances have been made in the undergraduate teaching program. Under the direction of Dr. McNaughton the C.N.S. Course ran smoothly and the general feeling was that it was a success. All those who participated worked hard and with great enthusiasm. Dr. McNaughton has completed his term as Chairman and Co-ordinator of the C.N.S. Course and is to be commended for the tremendous amount of effort that he put into it. We are pleased to welcome Dr. Donald Lawrence to our staff. As well as directing our Laboratory of Neuroanatomy, he has assumed the Chairmanship of the C.N.S. Course and is already marshalling his troops and introducing new ideas.

Dr. Sherwin organized the neurological part of the introduction to clinical science at the Institute. Although the time allotment was too brief to adequately cover the subject, the reports from the students would indicate that the effort was appreciated.

We continue to be concerned about the inadequate exposure to clinical neurology for McGill undergraduates. In order to meet the problem, a guide was prepared and presented to all second-year students on the completion of the C.N.S. Course. This guide includes an outline for history taking and neurological examination. It also includes an outline of special tests, suggestions as to how to investigate the various neurological disorders and suggested reading. There is also an outline of how to take a pediatric history in French and a seizure history in French. It is hoped that throughout the undergraduate's clinical years, this guide will help and encourage the student to make a comprehensive review of neurology before he graduates.

We are grateful for the work Dr. Lawrence is doing with the McGill curriculum committee. Hopefully, with the new curriculum it will be easier for McGill students to get an adequate exposure to Neurology.

During the year we have had an excellent group of elective students from McGill, other Canadian Universities, the United States, and the United Kingdom. They have stimulated us, and have felt that the electives were profitable. Each elective student has carried out an individual project. He has written up some subject of his choice in the form of a scientific paper. These projects have been remarkably good. A prize of a suitable textbook of Neurology has been presented to Mrs. Shelley Doumani for the excellence of the report which she submitted. We expect to make the Neurology prize an annual event.

The postgraduate training goes beyond the walls of the Montreal Neurological Hospital. It is a McGill effort and the Montreal General Hospital, the Montreal Children's Hospital, the Jewish General Hospital, and the Montreal Neurological Hospital have cooperated to provide a

rotating type of training for our residents. The different types of Neurology seen in each Institution provide an opportunity for an excellent training for residents as they rotate through the hospitals. The organization of these rotations is very time-consuming, but a worthwhile effort. We continue to have more applications than we can handle for postgraduate training and the changing situation in the United States is likely to increase the number of applications which we receive. We presently have 25 postgraduate students in our training program. This does not include the rotators from other services who come for a short period to work in the Neurology Departments of all hospitals.

Research

The details of our research efforts will be described in detail elsewhere in the Annual Report. For the most part our efforts have been directed towards, in some way, improving diagnostic facilities or care of patients. Dr. Sherwin's studies in gas liquid chromatography of anticonvulsants have become known across the country and he has been in great demand to present his work. Dr. Andermann continues to carry on extraordinary studies in metabolic disorders and other heredo-familial diseases of children. The excellence of the work of Dr. Karpati is well recognized. He has become an authority on the histochemistry of muscle, and working with Dr. Stirling Carpenter has come across many interesting and new discoveries. Dr. Eisen continues his work in electromyography and disorders of peripheral nerves. Dr. Woods, with the aid of the new telemetering device, has been carrying on interesting studies in patients with absence seizures and working with Dr. Sherwin relating their findings to serum levels of anticonvulsants. Dr. Robb continues his long-term study on patients with absence seizures and anticonvulsants. Dr. Willaim Sheremata is studying the degree of activity of multiple sclerosis in patients with this disorder by means of special lymphocytic immunological studies. We welcome Dr. Heller back. He has instituted a special clinic for headache and is presently carrying on neuropharmacological studies with compounds aimed at relieving patients of migraine and other types of vascular headache.

Plans for the Future

We look forward to the day when more teaching and research space will be available in the new wing. As well, more space is needed for the care of patients on an out-patient basis. The planning for this new wing has taken a great deal of time and is likely to continue to do so. Nevertheless, we must do all we can to maintain our present programs and continue to move ahead. We feel the staff should be increased by one or two neurologists with special skills to add to our present program. We are concerned about undergraduate teaching or the lack of it at a clinical level, but feel confident that this will be remedied with the new curriculum. We expect the pattern of out-patient clinic services will

change with the reorganization of the Royal Victoria Hospital. We look forward to cooperating with them and hope that we will be able to meet the demand and reorganize our residency training program so that they can participate in this venture.

We are particularly pleased with the service which Dr. Leppik has been doing in the Royal Victoria Hospital. As our resident there, he has served the hospital well both in patient care, and the initiative that he has shown in teaching.

Finally, the extraordinary advances in medicine with the use of antibiotics, artificial respiratory support, and artificial feeding, have created many problems. I do not feel that the ability to cope with these problems has kept pace with the advances in medicine. There is urgent need for us to reconsider the patient with extensive irreversible brain damage, with coma or reduced awareness. All patients must be treated with the utmost kindness and care. At the same time we should not be prolonging the lives of those who because of age, cancer, strokes, cardiac arrests, have sustained such serious damage that life can no longer hold any reward or pleasure for them, and maintaining life can only be done by artificial means. In our hospital we are faced with the most difficult of decisions. This is being compounded by the remarkable success of the transplant service, particularly as related to kidney transplants. We welcome the work that Dr. Hansebout is doing for the relief of pain, but we must remember that pain can be more than physical pain. It is incumbent on us to consider the patient and his relatives and treat him with the utmost kindness and sympathy. Indeed we must rededicate ourselves to the relief of sickness and pain, and to the study of Neurology.

This report would not be complete without the mention of two distinguished neurologists who died in the past few months.

Dr. Arthur W. Young died on February 20, 1973. When the Montreal Neurological Institute opened its doors in 1934, Arthur Young was appointed by the staff as Associate Neurologist. He had been on the Royal Victorial Hospital staff as Neurologist and Psychiatrist since 1927. He took an active part in the affairs of the Institute, what with ward rounds, clinics and teaching. He was an excellent clinician, working with speed and amazing depth of perception. In 1955, because of ill health, he retired from the active role he had played. Fortunately, he was able to attend rounds and his helpful comments were always appreciated. Arthur was a good friend of the Institute and those of us who knew him were aware of his warmth and kindness that he hid behind his outward shyness.

Dr. Arthur Schwartz died on April 4, 1973, at the peak of his career. Arthur, a former fellow of the Institute, was a Neurologist at the Jewish General Hospital, and on the McGill teaching staff. He did outstanding work in the treatment of Parkinsonism, and it was a pleasure for all of us

at the M.N.H. to be able to cooperate with him. He was an excellent teacher, clinician, and a prodigious worker. His courage and strength of character in the face of a fatal illness was an example for us all.

Neurosurgery

DR. GILLES BERTRAND

Since 1952, I have sat in this amphitheater and listened with interest and admiration to the Neurosurgeon-in-Chief's annual reports. The late Dr. Cone, Dr. Elvidge and, for the last 10 years, Dr. Feindel have held their audience captive with reports which were not only informative but often polished literary masterpieces, artistically illustrated.

I shall not attempt to compete with my predecessors in this exercise and will only outline briefly some of the activities of the neurosurgical service during the past year.

Neurosurgeons do not work in a vacuum and a great deal of their accomplishments are in fact due to the cooperation of many people. In the short time allotted to this report, I will be able to give only token credit to those without whom our task would have been impossible.

Our special gratitude goes to the Operating Room Staff under the supervision of Miss Norma Isaacs, seconded by Miss Nympha Sison who has unfortunately left Montreal for the United States and is being replaced by Miss Patricia Furlong.

Our Resident Staff headed by Dr. Leon Ravvin. Dr. David Mercer and Dr. Henry Tutt now replacing Dr. Derek Fewer and their Assistant-Residents have kept the three services running smoothly and all have shouldered a tremendous amount of work and responsibility involved in the treatment of our patients.

I should also like to thank all our colleagues from the Neurology Services, and the Clinical Laboratories and particularly Dr. Gilbert, Dr. Ethier and the members of the Departments of Anaesthesia and of Neuroradiology on whom we make seemingly incessant demands.

But the collaboration of all these people would have been quite useless without the unfailing devotion of our ward nurses who, under Miss Joy Hackwell's direction have continued to give our patients the constant, skillful and personal care that so many of them remember and write us about long after.

Services

In 1972, there were 971 admissions to the neurosurgical services and 756 operations were performed in our operating theatres. 246 of these were major craniotomies and 183, major laminectomies. In addition, there were 620 major X-Ray procedures requiring Anaesthesia.

Five post-operative infections were reported, 0.6%.

The total number of operations has changed little in the past few years as pointed out by Dr. Feindel in his last report but there has been a progressive change in the type of procedures performed. Understandably, as a result of the proliferation of neurosurgical services throughout the City and the Province, there has been a decline in the number of trauma cases admitted to our services, and a greater proportion of our work is elective surgery. The number of cases operated upon for epilepsy has remained remarkably stable but the number of brain tumors has diminished whereas there has been a sharp increase in the incidence of operations for cerebral aneurysms and arteriovenous malformations. Pituitary fossa surgery is now done mostly through the transphenoidal route with the use of the operating microscope. The magnification and superb illumination provided by this instrument are no doubt responsible also for the renewed popularity of the posterior fossa approach to trigeminal rhizotomy for tic douloureux.

Stereotaxic procedures which had declined in number with the introduction of L-DOPA in the treatment of Parkinson's disease are becoming more frequent again as more cases fail to be satisfactorily controlled by medical means alone and as new applications of the stereotaxic technique are being developed, particularly in the realm of epilepsy. Spinothalamic tractotomies for pain are also on the increase and a fair percentage of these are done by a percutaneous method.

In general, one has the impression that an ever greater proportion of the patients referred to us present with complex problems for which investigation is very time-consuming and treatment often rendered more difficult and delicate by previous operations.

Neurosurgical Staff Activities

As usual, members of our surgical staff have been involved in a good many extramural activities during the past year.

Dr. Theodore Rasmussen has continued to represent the American Association of Neurological Surgeons on the American Board of Neurological Surgeons and still serves on the Neural Prosthesis Committee of the N.I.H.

Last January, he was invited to participate in a Seminar on the organization of the Cerebral Cortex at the University of California in Los Angeles. More recently, he delivered the 10th Penfield Lecture at the Paediatric Hospital of the National Medical Center in Mexico City and was one of the main speakers at the 3rd Mexican Congress of Neurosurgery in Acapulco where the theme was Epilepsy. On the way back from Mexico, our former colleague, Dr. Charles Branch, invited him to open officially the new Neurological and Neurosurgical Department in the South West Texas Methodist Hospital.

Dr. William Feindel was invited to speak on "Microcirculation" at one of the Medical Faculty Lecture series at Dalhousie University last

February. He was also a guest of the Erie County Historical Society at the New York State University in Buffalo where he lectured on Thomas Willis. He continues to be a delegate from the American Academy of Neurological Surgery of the World Federation of Neurosurgical Societies and has recently been elected to the Royal Society of Canada.

Dr. Robert Hansebout was one of the invited speakers at a Symposium on Cerebral Oedema and Steroids at the University of Gutenberg in Mainz, Germany, where he reported on his research activities on Spinal Cord Oedema. He has been our representative with Dr. Davy Trop at the Pain Clinic of the Royal Victoria Hospital and has recently started some clinical trials of pain control by means of implanted dorsal column electrical stimulators.

Dr. Gilles Bertrand was one of the guest speakers at the Denver meeting of the Congress of Neurological Surgeons where he spoke on some aspects of Syringomyelia and Intervertebral Disk surgery. He was also invited to take part in a Breakfast Seminar on the Management of Malignant Brain Tumors at the recent meeting of the American Association of Neurological Surgeons in Los Angeles. He is now taking Dr. Feindel's place as Chairman of the Clinical Committee of this Hospital.

There seems to have been a great deal of traffic between Montpellier in France and Montreal in the last few years and, since Dr. Gilbert's return from his sabbatical year in Montpellier, Dr. Trop visited this sun-drenched city at the invitation of l'Association des Anesthésistes Français to lecture on the problems of Respiratory Physiology.

It is from Montpellier also that Dr. Gilles Cossette came to join the ranks of our Anaesthesia Staff. Formerly from St. Jerome, he had also spent a sabbatical year in that well known French Medical Center.

Research Activities

I shall not report in detail the research activities of the various members of the surgical team since this will no doubt be reviewed in Dr. Gloor's presentation. I will only mention briefly the continuing studies on Fluorescein Angiography and Arterio-venous Malformations by Dr. Feindel, Dr. Lucas Yamamoto, Dr. Terry Myles and Dr. Louis Bouchard.

Dr. Carl Dila, now a Fellow of the Royal College of Surgeons of Canada has also been studying the circulatory disturbances associated with brain trauma.

Dr. Henry Laurelli has received the degree of Master of Sciences for his thesis on the Venous Circulation of the Brain.

Dr. André Olivier's laboratory to study the Stereotaxic Anatomy of the primate and human brain by histochemical techniques is now in full activity. The beautiful anatomical material obtainable by these methods will undoubtedly prove very useful to other fields of clinical research in which he is also involved, the study of epileptic discharges by implanted

electrodes in the amygdala and hippocampus and our continuing work on electrophysiological mapping of the human thalamus and the computerization of stereotaxic surgical techniques.

Staff Changes

Dr. Steve Nutik has joined the Department of Neurosurgery of the University of Sherbrooke as Assistant-Professor, and Dr. Terry Myles will soon be going to Calgary in the Neurosurgical Service at the Foot-hills Hospital with our former colleague, Dr. Frank LeBlanc.

Both Dr. Nutik and Dr. Myles successfully passed the examinations of the Royal College of Surgeons this year.

Dr. Derek Fewer who terminated his senior residency on our Service in December is now busily engaged in the practice of Neurosurgery in Winnipeg.

We wish them all success and satisfaction in their beginning careers.

Graduate Studies and Research

DR. PIERRE GLOOR

The yearly task of reviewing progress in research at this Institute has been made somewhat easier this year by the reports presented by members of our staff at the Hovey Manor Neurosciences Colloquium held during a glorious autumn weekend on the shores of Lake Massawippi. As one speaker after the other presented his report on his research activities of the past five years and spoke of his plans for the future, one could only feel gratified at the solid strength of neurological research and the collective enthusiasm to pursue it, which exists among the group of men and women working together as a team here at the Montreal Neurological Institute. It also became obvious that even though basic science techniques are used in a number of laboratories, the interest in the different fields of research never strays very far from the central area of our common concern: the care of the neurologically disabled and sick.

A simple statistical review of the numerous research reports presented at the Hovey Manor Colloquium points up some interesting facts. They are presented in a table included with this report. Thus over the past five years, 22 researchers or teams of investigators were engaged in research activities at this Institute. Some of these teams consisted of only two or three persons, others included several staff members with Fellows and Graduate Students. These 22 teams carried out research on 61 projects. This figure is a little arbitrary, but definitely conservative. One could make a case that the actual number of projects is even greater, but for the sake of simplicity, those that were obviously closely

related to each other were lumped together. If we look more closely at these projects, we can describe 27 of them as basic science research — this includes the study of disease models —, 28 can be regarded as clinical research and 6 as applied research in some technological field related to neurology or neurosurgery and/or allied sciences. The table which shows the breakdown into the various sub-groups clearly illustrates that our research activities are numerous and far ranging. It also demonstrates that this Institute assembles under its roof a remarkably active group of research workers having a surprising breadth of expertise. It constitutes the cornerstone of strength of neurological research at McGill, which is further complemented by the very active and productive research group at the Montreal General Hospital, with whom we shared the stimulating experience of the Hovey Manor Colloquium.

Since this is an annual report, one may perhaps wonder how many of these 61 projects pursued over the last five years were still alive during this past year. This is difficult to tell with accuracy, but looking over the list of projects presented at the Hovey Manor meeting, I would guess that at least 80% of the projects dealt with ongoing areas of interests which are still being actively investigated at the present time.

Another fact that emerged clearly from this analysis was that there is hardly a member of our staff who is not, in some way or another, involved in research. This statement could be turned around to say that there is hardly a research worker in this Institute who does not have some kind of clinical commitment. This dual role all of us fulfill to a greater or lesser degree is our source of strength, but it is also a potential area of danger. In order to remain fully productive and creative in our research, clinical and other non-research commitments should be kept within reasonable bounds. Many of us cannot claim that the division of time allocated to clinical activities on the one hand and to research activities on the other (not to mention the numerous administrative activities many of us have to fulfill) do represent an ideal division of time in terms of continued and sustained scientific creativity. Expert outside observers of the functions of the Institute have in fact voiced surprise at the magnitude of the clinical or service load of our staff members who have a large stake in research. They have expressed surprise that in the face of this rather difficult situation, the output of new contributions to neurological knowledge from this Institute has been as good as it was.

I believe that one of the problems that we must tackle is to improve the situation in this regard. I realize that at the present time when governments and the public emphasize the need for increased immediate service to the community by physicians, this is a somewhat unpopular statement to make. However, the quality of medical services of the future cannot be better than the quality of knowledge that those who render the services accumulate throughout their lives. Quality of service is therefore crucially dependent upon continued and sustained clinical and basic research. Without this fountain of eternal youth, the care of

the sick will wither and become second-rate. Obviously not every medical practitioner can be involved in research, even if he is a specialist, but it is the *raison d'être* of an institute like ours to provide an oasis of freedom where clinical work can meaningfully be combined with research. I think we should be ever watchful in this area to assure that the necessary elbow-room to do creative research is maintained for all the members of our staff.

In his closing remarks at the Hovey Manor Colloquium our Director, Dr. Feindel, in summing up the impressions he obtained after listening to the outpouring of our problems and of our dreams about the future, remarked that if all our wishes were granted, the size of the Institute would have to be increased to match that of the Banff Springs Hotel. Obviously in planning for the future the sky cannot be the limit, but I would submit that the present walls of this Institute should not constitute the limit either, and this brings me back to reiterating a statement which returns with somewhat discouraging monotony throughout all of the annual reports of the last few years, namely the dire need for additional research space.

When reviewing the research activities over the past year, a number of focal points on which our research endeavors are concentrated emerge quite clearly. As in the past, epilepsy, the great teacher, has absorbed the interests of a number of investigators. This Institute is still unequalled as a place where one of the greatest concentrations of experts in the study of epilepsy is to be found. Experimental research in this area has concentrated on the study of generalized penicillin epilepsy in the cat, which resembles human myoclonic petit mal in its clinical and EEG manifestations. The studies have further clarified the role of cortical and brainstem structures in the mechanism of this disorder, and have suggested a possible disturbance in cholinergic mechanisms as one of the pathogenic factors in this form of epilepsy. The use of this animal model for pharmacological studies on the action of anticonvulsants suited for the treatment of absence attacks appears promising. Generalized epilepsy in man has been the object of studies in the EEG Department, especially in the Telemetry Laboratory, and in the Clinical Neuropharmacology Laboratory. A better understanding of the relationships between seizure incidence, control of attacks and the metabolism and distribution of anti-convulsant drugs in blood and brain has been obtained in these studies. Neurogenetic investigations on epilepsy have continued, and now that Dr. Rasmussen has been freed of his administrative duties, he has been able to pursue with greater vigor his research into the mechanisms and the natural history of human epilepsy on the basis of the unparalleled fund of experience at his disposal. Some of the results of this research are the subject of this year's Hughlings Jackson lecture presented by Dr. Rasmussen.

Another large area of research in this Institute is that of neuromuscular disorders. A group of research workers exhibiting an excel-

lent team spirit and representing various areas of expertise has cooperated very successfully in studying these problems, as had been the case in the past. Clinical neurophysiological, neuropathological, electronmicroscopical, histochemical and biochemical techniques have been combined in a concentrated attack on a variety of experimental and clinical problems in this area. New insight into the relationship between muscle ischemia and myopathy, as well as into the so-called "trophic" functions of nerves supplying muscle has been obtained.

A further area of concentrated strength is the Department of Neurochemistry in which research on lipid storage diseases, on the synthesis of brain glycoproteins and on the role of prostaglandins in central nervous system function has been carried out. New insight into the complex chemical mechanism of lipid storage in various genetically determined encephalopathies has been obtained. Research on water and electrolyte disturbances in cerebral and spinal cord edema has been continued. Interest in this work has been directed to a relatively new area, namely the mechanism by which cerebral edema is resolved. It is only appropriate at this juncture to congratulate Dr. Hanna Pappius for the recent publication of the book "Brain Electrolytes and Fluid Metabolism" which she wrote in collaboration with Dr. Katzman of New York. This monumental work represents undoubtedly the most up-to-date and best documented treatise on this problem.

In the Cone Laboratories of Neurosurgical Research, further intensive studies have been carried out on cerebral circulation, combining scientific strength, technological sophistication and colorful esthetics into one neat package. Converging interests between this laboratory and that of neurochemistry have led to the study of the mechanism of vasospasm, a serious complication in subarachnoid hemorrhage. The possible role of prostaglandins in the genesis of this spasm has been investigated. The work in this laboratory thus increasingly takes on a greater significance with regard to important clinical problems, and this is also evident from the studies done on disturbances of cerebral circulation in experimental head injury.

The Department of Psychology has been extremely active in extending its studies of the relationship of a number of complex cognitive functions with some particular areas of the cerebral cortex. This department, one of the real pillars of strength of our scientific establishment, keeps pouring forth an abundance of new and valuable information on higher cerebral functions, especially with regard to frontal and temporal lobe functions and hemispherical specialization.

We are pleased that research in Neuroanatomy, which has laid fallow for several years for the lack of a staff neuroanatomist, has been reactivated under Dr. Lawrence's direction. The work in this laboratory will be mostly devoted to neuroanatomical studies of the motor system.

Last, but not least, the great help that a number of research activities have obtained from our Computer Laboratory should be mentioned. The

Computer Laboratory has assisted in the performance of stereotaxic neurosurgery, in the measurement of cerebral blood flow in the laboratory and operating room, and in neurophysiological research on the relationship between normal activity, pathological slow wave activity and single cell discharges in the EEG. Foremost among the activities of the Computer Laboratory has been the development of a program to subject the clinical electroencephalogram to precise frequency analysis with the aim of developing methods that will increase the accuracy of EEG interpretation, as well as the means of presenting in a compressed and visually easily intelligible form data that are now scattered throughout the length and breadth of an EEG recording. The initial steps in this direction have been most rewarding. The particular configuration of our computing system, its easy accessibility to clinical source material and the high level of computing skill represented by our computer experts puts us in a position of potential leadership in this area. It is up to us to exploit this opportunity to the fullest extent.

Teaching at the postgraduate level has continued along similar lines as in the past. Seven Graduate Students were involved in our M.Sc. and Ph.D. programs. The backbone of our postgraduate teaching is the individual Graduate Student's work in the research laboratory. This is supplemented by the Neurosciences Seminars which have been particularly successful this winter. A number of local experts and visiting lecturers from other universities have contributed to a most exciting program which has attracted a great audience and has been very well received.

Before closing this report, we should perhaps mention that for those of us who are engaged in the daily struggle involved in accumulating new knowledge in the neurosciences, it is at times easy to forget that a very legitimate research interest is also that concerned with the history of science and of its institutions. It is therefore a pleasure to know that our first director, Dr. Penfield, pursuing his second career in the quiet seclusion of the 6th floor office, is busily compiling a history of our Institute. We are all looking forward to the final outcome of his endeavors, particularly after our sense of anticipation has been aroused a few months ago when he gave us a first glimpse into this fascinating history during a lecture on this subject.

The present year will bring to a close the long association Miss Mary Roach has had with our Neurophysiology Laboratory as its supervisor. To a long line of distinguished research workers, Fellows and Graduate Students, Miss Roach has been a true friend, sometimes mother confessor and often the embodiment of the voice of conscience and of unflappable common sense. We are all sorry to see her go and from our heart we wish her all the best for the years to come.

MNI—RESEARCH ACTIVITIES 1968-1972

Number of Investigators and/or teams	22	Number of Projects:	61
--------------------------------------	----	---------------------	----

Basic Science Research: 27 (including disease models)

Neuroanatomy	2	Cerebral Circulation	4
Neurophysiology (including Neuromuscular Physiology)	5	Psychology	6
Neurochemistry	5	Neuropathology (Including Pathology of Muscle)	3
Immunology	1	Computer Science	1

Clinical Research: 28

Neurology	6	Neuropathology	1
Neurosurgery	5	Anaesthesia	4
Neurochemistry	3	Neurogenetics	3
Clinical Neurophysiology	5	Clinical Pharmacology	1

Applied Research: 6

Biomedical Engineering and Computer Science	4	Radioisotope Technology	2
------------------------------------------------	---	-------------------------	---

Administration

MRS. J.M. SHANNON

The biggest change since our last meeting is the coming into law of Bill 65. All of us involved in hospital administration have read, reread and continue to read and interpret the intent of the Bill. It will be changed and modified, indeed it already has been, and we must function within its framework. For the most part it is a good bill, well conceived and will not I believe stifle initiative or progress. Indeed it is essential for us to utilize all our efforts towards finding better and more efficient ways to do things. At the Neuro we intend to be the initiators of change, not its victims!

Two changes brought about by the Bill are staff representation on the Board of Directors and the formation of the Professionals' Advisory Council. Miss Joy Hackwell, our Director of Nursing, has been elected by the Professionals' Advisory Council and will represent not only the Nursing Department but all professionals with the exception of doctors operating within the hospital. The affairs of the Professionals' Advisory Council will be conducted by an executive consisting of the Executive Director or his representative, the Director of Professional Services, a representative from the Council of Physicians and Dentists plus three members from the Council elected by them. These elected members are Miss U. Steiner, Department of Nursing; Mr. L. Taylor, Department of Psychology and Mrs. W. Wason, Department of Nursing.

I am optimistic regarding the contribution this Council will make towards our hospital. The unionized non-professionals in the hospital also have the privilege of electing a representative to the Board and this is under way.

Our statistics concerning patient care remain reasonably constant. For 1972 occupancy was 87.3%, number of patients 2,151, average length of stay 19.7 days, number of patient days 43,123.

The Neuro could be compared to a well-bred "dame d'un certain âge". She badly needs a bit of rejuvenation but she must live within a very restricted budget. We are doing the best we can to help her within the limits of money and good taste; that is, not trying to pretend she is young again but making the most of her best points and there are many. We have painted certain areas, wallpapered others, bought new curtains and we will continue to do as much as we can. I am of course only referring to the physical aspects. The spirit of the Neuro remains young. The dignity, experience and achievements of our Institute and Hospital speak for themselves.

An administrator of a hospital might better be called a coordinator. I spend a considerable amount of my time trying to look at the total picture and to piece together the individual parts in order to create an acceptable whole. To do this, I depend on a great number of people and I

am perhaps more aware than most of my colleagues of the efforts of a small army of people who keep the Neuro running efficiently from day to day.

A great deal of this goes on without recognition and I would like to take this opportunity of acknowledging their efforts. Our capable dietitian, Miss Sheila McDonagh and her staff, the orderlies, the porters and the cleaning staff, the housekeeping staff, Mr. Ludvig Killar, our carpenter, who creates miracles in an impossibly short time, Mr. August Hillenbrand, who with his paint brush almost singlehandedly is bringing about the rejuvenation I mentioned, and Mr. Keith Wilson who solves the plumbing problems which seem to me insoluble. Mr. Heavysege, our Director of Personnel, has the respect and affection of everyone in this hospital.

The secretarial staff are an unsung group of heroines who manage to keep us all on an even keel. Mr. Rochette, our Director of Auxiliary Services is the man who deserves thanks for most of the things for which I get credit. I acknowledge my gratitude and my indebtedness to him. Time does not permit me to mention everyone by name, much as I would like to but I cannot end this report without a special "thank you" to Miss Dorothy Lawson. It is my good fortune to have her help. Her efficiency, her sense of humour and her vast knowledge of hospital affairs have provided me with relatively smooth sailing during my first few months.

I consider it a great privilege to be a part of the Neuro family and I look forward to the coming year with confidence.

Financial Report

MR. GEOFFREY F. THOMAS

In 1971, the Ministry of Social Affairs of the Province of Quebec introduced the Global Budgeting concept to 23 institutions. By 1972, all hospitals and institutions under the jurisdiction of the Ministry were active participants.

Global Budgeting, vis-a-vis the previous method of itemized budgeting, has as its principal object to provide freedom of management and to allow all types of initiatives to be used to reduce costs and increase efficiency in the use of human and material resources.

Although the approval of Global Budget is based on a definite programme of expenditure, and hospitals may make changes as between supplies and salaries and between departments, the amount of money originally approved may not be overspent, and no reduction in service or no new services may be initiated without prior approval from the Ministry. Any budget authorization is essentially restrictive and to exceed an approved budget is an explicit violation of the law. It should be

recognized also that a budget is an estimated forecast, therefore mechanisms are provided for claiming and negotiating legitimate increase in costs due to increased activities or other factors which were not anticipated and could not be covered by savings in other areas.

The Global Budget entails an attempt to simplify and streamline the procedures for the approval of funds, to provide adequate cash flow to hospitals, to give hospitals more control over the use of these funds, and to provide incentives to improve the efficiency of patient services.

Having given a bird's eye view of global budgeting, I will now mention a few highlights of the financial operations.

In 1972, the hospital assumed responsibility for its own payroll which was formerly produced through McGill University. This is now processed through the computer facilities of the Joint Hospital Computer Services at the Royal Victoria Hospital.

The operating expenditure for the year 1972 amounted to \$4,890,692, an increase of 7.2% over the preceding year and 3.1% over the approved budget. This does not include retroactive salary payments which amounted to \$211,513 for 1972 and \$59,687 for 1971.

It is interesting to note that while in 1971 salaries and wages represented 74% of expenditures, in 1972, this item consumed 69% of costs. One can conclude that this element of cost has been contained and that a shift has taken place to account for increased consumption of other items of expenditures.

The net allowable cost for 1972 was \$105.45 per day compared with the approved budget of \$100.55. Although the hospital operations for 1972 record a shareable deficit of \$304,529, actual income was \$151,096 less than the approved budget. This shortfall in income is recoverable from the Department of Social Affairs and the hospital will end up with a net deficit of \$146,602. The hospital has recently received \$249,125 as final settlement for 1971 and providing the excess of expenses over the budget is accepted by the Ministry, the accumulated deficit of the hospital will stand at \$79,378.

Our first year's experience with global budgeting presents an improved overall financial picture. But, as mentioned previously, the excess of expenditures over the budget amounted to 3%. This is an unhealthy situation and efforts must be made to contain costs.

An economic health service is the joint responsibility of governments, unions, physicians and department heads. Health costs are influenced by inflation—a government prerogative; salary and wage agreements based on union demands, utilization of services and facilities ordered by the doctor, control exercised by department heads and the proper use of supplies by employees. The interaction of these forces need not be at cross purposes. The provincial government is not in a position to contain inflation but, it must voice its philosophies to its senior partner — federal government. Employees must be well paid for their work but productivity must increase. The physician, department heads and employees — all

employees — seem to have the most direct influence on costs. Since the doctor is the key figure in requesting services, a lot of blame has been tagged on him for unnecessary admissions, prolonged periods of hospitalization and unwarranted use of services. I invite all employees to share the blame attached to the physician and to examine their own role in relation to the effect their attitudes and behaviour have on increased costs — this means, the use of medical and surgical supplies, disposables, pencils, soap, wax, paper, pens, and so on.

We are well into 1973. The latest financial report is not impressive. I ask you — doctors, nurses, auxiliary nursing staff, maids, cleaners, technicians, clerical staff, department heads — to do your bit to help to reduce cost and eliminate a deficit in 1973.

I like working with figures. I was hoping to translate these into a humourous presentation. Unfortunately, or fortunately, I have not succeeded, so please forgive me for presenting the bare facts.

In closing, I would like to thank the members of my staff, the administrative team, the doctors, nurses and all who work here for their cooperation and support. Special mention must be made of the personnel and payroll staff, who, under the able direction of the Director of Personnel, Mr. Hector Heavysege, performed admirably and under great strain to effect payment of retroactive salaries within the specified delays. Special thanks are also due Mr. Robert Dallaire, financial representative in the Department of Social Affairs, for his guidance and help over the past years. Mr. Dallaire has been promoted and I am sure, you join me in congratulating him.

Nursing Department

MISS C. JOY HACKWELL

I am pleased to present the Annual Report of the Department of Nursing.

Resourcefulness during the past year has been a priority to enable us to provide the best care for our patients. A workshop for all Head Nurses was planned with the McGill Teaching Hospitals to discuss ways of providing for the most effective utilization of our nursing staff. Emphasis has been placed on the importance of utilizing staff in areas of patient care where they will be required to use their specific knowledge and skills, as well as plan for priorities in the delivery of care.

The appointment of unit secretaries to three of our nursing units has been one means of providing the opportunity for nurses to concentrate more fully on patient care.

We have recognized the need to give the registered nurses the responsibilities for providing the care for which they have been prepared.

They indeed appreciate the freedom to apply their knowledge and skills in assessing, planning, and providing care. We hope to be able to place more emphasis on the independent functions of nursing.

It has been necessary to continue our active recruitment campaign this year. We have advertised in our own Province, and eastern Canada, as well as our usual advertising nationally and internationally. A brochure has been printed to enable nurses to gain a better understanding of our Hospital and the nursing opportunities available. These brochures are available in French and English, and they have been circulated to our CEGEPs Province-wide, as well as to university Schools of Nursing within and out of the Province.

We have held an "Open House" on several occasions for university and CEGEP nursing students. The response was favourable, and we are looking forward to having some of the new graduates join our staff this summer.

Clinical experience has been provided for student nurses from Plattsburg, Valleyfield, Dawson College, McGill and the University of Toronto. We have all enjoyed our association with the students. Next fall we expect John Abbott College to be using our clinical facilities for their students.

Twenty-seven graduate nurses successfully completed our post-graduate clinical course in 1972. During the last two months of the programme, the students are given an opportunity to become the primary nurse, planning care for several patients. This includes collaboration with the other members of the health care team. The approach has proved valuable for the nurses, and very satisfying to the patients.

The nursing staff was invited to participate at the Neurosciences Colloquium II held in February. We were pleased to be given the opportunity to discuss our Inservice Education programme and post-graduate course with the members of the medical staff who were present. It was a very valuable exchange.

Speaking generally for a moment, I believe that during this period of nursing shortage for some hospitals in this Province, it is important for us to have the understanding and support of all health care professions, if we are to achieve our common objectives. We must propose a joint course of action to provide solutions for the problems which confront us.

I know that I am conveying the feelings of every nurse in the Department, when I express our deep gratitude for the support from the administration, medical staff, and all members of the hospital team during the year. The support given us by Dr. Feindel and Mrs. Shannon has been deeply appreciated. We are pleased to welcome Mrs. Shannon to her new position, and to say how much we are enjoying our association with her.

I would like to record my personal thanks to the nursing staff for their loyalty and determination to strive for greater heights in the delivery of health care to our patients.

Social Service

<i>Director</i>	Miss Cynthia Griffin, B.A., M.S.W., P.S.W.
<i>Social Workers:</i>	
Miss Ann Chant, B.A., M.S.W., P.S.W.	Mrs. Irena Liebich, B.A., M.S.W., P.S.W.,
Mrs. Saroj Gupta, B.A., M.S.W., P.S.W.	Miss Kathleen Macdonald, B.A., B.S.W., P.S.W.
Mrs. Pierrette Letarte, B.A., M.S.S.*	Miss Noella Vaillancourt, B.A., M.S.S.

*Resigned Sept. 1972

This year, as we are on the threshold of a new era, it seems more pertinent to speculate about the future than to try to enumerate accomplishments (however valid) of the past.

Last year I ended my report with a recognition of the existence of the Act Respecting Health Services and Social Services (Bill 65 of '71). Today, there is still much that is uncertain, but a few facts are emerging. We know, for example, that on next January first, the group of over 400 hospital social workers in the province are scheduled to become administratively responsible to the social service centres, with our services in the hospital centre dependent upon a negotiated contract. We now know, too, that a tremendous amount of planning went on regarding future policies for all social workers without any representation from hospital social workers. Concern about the implications of the act led us to participate actively on committees with social workers from a variety of hospitals and recently, also, with representatives of the Ministry of Social Affairs and others in the community. We were included, too, among the members of the Extended Care Committee who visited Boston to learn from the social workers at the Massachusetts General Hospital, also grappling with the "placement" problem; our special extended care problem continues to be with the large group of chronically-ill patients under 60 years of age.

Implications of Bill 65 for social work coverage of non-hospitalized patients will depend upon the future programme for ultra-specialized groups such as seizure and multiple sclerosis patients with ever-present related personal and family problems requiring help either periodically or continuously. How much will be provided in this centre? In general hospitals? In local health centres?

Statistics! Whether figures required of us by the government are "contacts with or on behalf of patients" or the number of patients with or for whom we have had "activity", it sounds confusing and is not very enlightening. It is agreed that more meaningful sets of statistics with well-defined terms must be developed. To this end, a committee is working as part of a project related to Bill 65, with broad membership from French and English, active treatment and chronic care hospitals and the Provincial Mission of the Ministry of Social Affairs. Hopefully, we shall be able to influence the type of statistical data to be required of

all social workers in the province—data which will more nearly reflect the actual needs and services.

The ward conferences have been useful, *but* (and I think I speak for nurses, physiotherapists and occupational therapists as well as social workers) to be really fruitful, the conferences must somehow be modified, so that at planned intervals all disciplines, *including* doctors, can meet, share information and opinions, and decide upon a definite course understood by all. We have had a few examples of just how productive such sessions can be.

I hope, too, that the positive development of multi-discipline conferences before the Wednesday Seizure Clinics may continue, with the same emphasis on a three-way programme; case conferences, management conferences and sessions with invited authorities such as the recent one with Miss McNaughton from Manpower Service regarding employment problems.

Inflation has reached into our department, too, and has affected our ability to give either direct or indirect financial aid to patients, for, as we all know, costs such as for taxi-fares have increased steadily—unfortunately, donations have not; therefore, we are especially grateful to all those who have been so generous with their contributions. Contributors of funds include R.V.H. Women's Auxiliary, multiple sclerosis associations, Dalse Club, In His Name Society and MNI Wives; contributors of time include the ever-faithful RVH volunteers giving invaluable service in the clinics, and the Volunteer Bureau of Montreal whose cooperation with V.O.N., social workers and others in helping to postpone institutionalization of an M.S. patient is an excellent example of service.

We have had continuity except for the loss of Mrs. Letarte to St. Luc's Hospital; however she left M.S. patients a fine legacy of a special type of volunteer who comes with an R.N. in her background as well as an R.F. ("Raising Family")

In these trying months and years of transition, the Social Service Staff has been loyal and hard-working.

If there is a message in this report, I think it is that it is incumbent upon us, on all levels, to meet together for joint planning. I hope that we shall have the wisdom to recognize the good aspects of the new and to work collaboratively to integrate the best of the two systems towards the common goal of service to the patients and their families.

Clinical Laboratories & Departments

DR. GORDON MATHIESON

It may be deduced from a reading of Herodotus that the ancient Persians owed much success in war to the habit of planning their strategy at nightly carousals and revising it in the morning when they

were sober. Second thoughts thus disciplined soaring imagination. I am not aware of any recent nightly carousals here but this Annual Meeting is certainly an appropriate occasion for reappraisal and review.

My report must necessarily be a mosaic, for it aims to describe briefly the activities and needs of the clinically oriented laboratories, piecing them together to form a picture of the diagnostic resources of the hospital in their laboratory aspect. As in any mosaic, the whole is greater than the sum of its parts. This mosaic however is constantly changing, and what is more important in terms of this report, growing. The picture that emerges is one of great activity, but there lurks in the background a serious problem, to which I will return later in this report.

In EEG, although the total number of examinations has decreased slightly, the actual work involved has increased greatly because of the use of complex procedures, such as drug activation, all night recordings, and implanted electrode studies. Computer analysis of the EEG record is moving across the ill defined border between research and clinical application. Dr. Gloor reports the need for a further full time electroencephalographer to exploit these developments fully. The electromyography laboratory continues its upward trend of about twenty percent more examinations per year. The opening of EMG labs in affiliated hospitals by neurologists trained in these techniques by Dr. Eisen, may eventually reduce this rate of growth.

The brain scan laboratory had a temporary dip in activity, while being re-equipped, but since then, there has been a surge of activity with a brisk increase in brain scans, and cerebral hemodynamic studies.

Turning to biochemical aspects, assays of anticonvulsant blood levels are being performed on an increasing number of outpatients, with a consequent improvement in seizure control. The number of patients involved is large. On the other hand a relatively small group of patients and their relatives with rare, but devastating inherited neurological diseases, require an increasing range of enzyme assays for precise diagnosis. A new facility is required for this, and for the culture of fibroblast cell lines from such patients. At the present time the only way in which some of these procedures can be done is through consultation with Dr. Wolfe, the cost falling upon research grants.

The radiology department rejoices in new tomographic equipment and the completion of its consultation room facility, marking the culmination of several years of planning and re-equipment. Likewise the psychologists are more adequately housed and have added two or more clinical psychologists to their staff, although they still are unable to fulfill all requests for patient assessment.

Studies in tissue morphology continue to emphasize peripheral nerve and muscle with correlation of histochemical and electron microscopic observations.

The general theme of these reports on the activities of the laboratories

over the past several years (I am tempted to say many years), has been the need for more facilities to meet increased demand for service. For more skilled personnel, more space, and more equipment. All these cost money. All contribute to increasing diagnostic precision, and therefore to the possibility of curing or alleviating illness. They are therefore inherently desirable. But can this rising curve of expectation and demand be sustained indefinitely? Clearly there is a limit, although it is hard to say how close to it we now are. Mr. Castonguay said recently that by extrapolation from 1960 to 1968 figures, the whole of the gross national product would be absorbed by health and education services by the end of the century. This is surely not intended as a serious prediction but as an indication of concern at seemingly uncontrollable growth.

A review of the activities of individual laboratories shows that the increase in work load results not so much from an increase in patient numbers, as an increase in the complexity and sophistication of diagnostic techniques available. Clearly we must be most rigorously selective in their use. Only then will we achieve what is currently called maximum cost effectiveness.

In a much older and more vivid terminology, we may recall the history of Agag, King of the Amalekites, (the reference in the literature is to 1st Samuel, chapter 15) and tread even more delicately, lest we share his fate. If we do not, there can be no doubt as to who would be cast in the role of Samuel.

This steady increase in laboratory sophistication and its attendant increase in cost is clearly a serious long term problem, and by its very nature is likely to get worse with the passage of time. We in this hospital can however face it with a clear conscience and the knowledge that our closely knit structure with intermingling of clinicians and laboratory workers puts us in an excellent position to maintain control, and weigh the problem of cost against our essential concern, the welfare of the patient.

Neuro-Anaesthesia

- Anaesthetist* R.G.B. Gilbert, M.B., B.S. (London), F.R.C.P. (C)
F.F.A.R.C.S., F.A.C.A., C.S.P.Q.

- Associate Anaesthetist* . . . Davy Trop, M.A., M.D., (Ghent), M.Sc. (McGill)
F.R.C.P.(C), C.S.P.Q.

- Assistant Anaesthetists* . . . Jennifer Barnes, M.B., Ch.B. (St. Andrews, Scotland)

- Gilles Cossete, M.D. (Laval), F.R.C.P. (C), C.S.P.Q.

- Elizabeth Wilkinson, M.B., B.S. (London), F.F.A.R.C.S.
(England)

Residents—six months on this service

N.M.K. Ali, M.D. (Univ. of Alexandria)

O. Calvillo, M.D. (Univ. of Mexico)

C. Deveaux, M.D. (Clermont-Ferrand Univ.) (until Mar. 31)

O. Gazeau, M.D. (Univ. of Angers) (until Mar. 31)

V.A. Ladores, M.D. (Univ. of Santo Thomas)

J.B. Smith, M.D. (McGill)

C. Vaysse, M.D. (Univ. of Toulouse) (from April 1)

J.B. Wearing, M.D. (Univ. of Birmingham)

K.F. Wells, M.D. (Univ. of Capetown) (Part-time)

Following the changes of the previous year, the staff is once again up to strength, so that teaching and research have resumed. Dr. Trop began various studies in anaesthesia and multidisciplinary areas. Dr. Elizabeth Wilkinson continues her work as Chairman of the Medical Faculty Educational Resources Committee. During the year she made a number of visits to other centers to investigate various aspects of audio-visual instructional aids.

The volatile agents have now been entirely eschewed and satisfaction expressed with a variety of intravenous agents. Pavulon is gradually replacing curare. Application has been made to the Food and Drug Department in Ottawa to use Althesin which has been satisfactorily applied for several years in Europe. Sodium nitroprusside has replaced other drugs as an agent of choice for hypotension.

More pneumoencephalograms are now being done under anaesthesia and the methods and results of this technique are now being studied. Increases were noted in the number of cerebral angiograms (363) and surgical procedures under anaesthesia (758).

In the Intensive Care Unit one of our staff members is assigned full time. Miss McGuire and her staff are to be complimented for their work, especially when they have been, at times, short of staff. The Unit affords the anaesthetists much clinical interest and we have participated actively in the supervisory work, as well as in the monthly meetings which have done much towards the solution of many of the day to day problems. As one of the main organizers of the management of the Unit, I continue to feel very much at times as Robert Louis Stevenson must have felt before he obtained a goad for Modestine.

Total procedures in the Anaesthesia Laboratory were 4,185 representing 130,199 units, and 63,454.8 units, according to the 1971 and 1972 specifications respectively. Clinical procedures (3,604) represent 86% of the year's work, while research procedures (581) represent 14%.

In Inhalation Therapy we are fortunate to have the services now of Mr. Mike Dougherty as assistant to Mr. W. Garneau. The equipment is most thoroughly cleaned and sterilized for daily changing. We have found it awkward that the two technicians, because of labor union rulings, are unable to cover on weekends. The anaesthetic staff thus pay for the services of a trainee for weekends, who works under the direction of the anaesthetist on call.

Research activities included studies on:

1. Normalization of low arterial CO₂ tension resulting from mechanical ventilation with a new CO₂ valve (in process).
2. Effect of Ketamine HCl on the EEG of the child (in process).
3. Effect of a new intravenous steroid anaesthetic agent—CT 1341, Althesin—on the cerebral circulation of the cat.
4. Effect of continuous positive pressure breathing on regional distribution of ventilation and perfusion in the human.
5. Ventilatory response to hypercapnia and resistive loading in conscious and anaesthetized patient.
6. A new anaesthetic technique for posterior fossa pneumoencephalography in the adult.
7. Evaluating pain with electroanalgesia—the effect of the cutaneous stimulation device and the dorsal column stimulator.
8. Objective evaluation of low back pain and peripheral nerve root compression with the spinal electrogram.
9. Evaluation of the “streamlined anaesthetic system” with a mass spectrometric method.
10. Epidural steroid treatment of the low back pain syndrome.

Neuroradiology

Radiologist..... Romeo Ethier, B.A., M.D.
Associate Radiologist..... Denis Melançon, B.A., M.D.
Assistant Radiologist..... Garry Bélanger, B.A., M.D.

Fellows:

Ming Chi, M.D. (Nat. Taiwan Univ.) (6 mos.), M. Jacoby, M.D. (Chic. Med. School)
P.C. Milette, M.D. (Univ. of Mtl.)

Neurology Residents:

I Leppik, M.D. (Univ. of Penn.) G. Scotti, M.D. (Univ. of Milan)

Neurosurgery Residents:

E. Bastarrica, M.D. (Univ. de la Republica, H. Ortegon, M.D. (Univ. of Mexico)
Montevideo, Uruguay)
J. Musgrave, M.D. (Queen's Univ., Belfast) H. Tutt, M.D. (Univ. of N. Carolina)

RVH Rotators: 4 months rotation

M. Dang, M.D. J. Hanallah, M.. M. Mazer, M.D.
M. Graham, M.D. M. Hauser, M.D. D. Turner, M.D.

Elective: Mr. V.C. Smart-Abbey

Chief Technician: Joan Broadley, R.T.

The Neuroradiology Unit had another busy year with three clinical fellows, six residents from radiology, four from neurosurgery, two from neurology and one elective. The teaching duties deriving from this active group occupied the interests and talents of Dr. Denis Melançon and Dr. Gary Bélanger, and they are to be complimented for their devoted attention in this field.

For our progress in the past few years and our future plans, we are grateful to the dedicated members of the Department of Social Affairs, who have been sympathetic to our needs and have made helpful and appropriate recommendations.

Last summer our consultation room was completed, with the addition of multiviewers and an electronic subtraction device, so that it now provides an extremely useful and efficient setting where residents and staff can communicate and discuss cases.

We had a minimal reduction in the total number of examinations because one of our x-ray rooms was out of commission for many months preparatory to the installation of our sophisticated tomographic apparatus. This will enable us to achieve a degree of precision never before obtained in this department, not only for plain examinations, but also for pneumoencephalography, positive contrast cisternography, air myelography and possibly angiotomography. At present, we are finalizing the plans for the installation of a sensational new piece of diagnostic equipment, the EMI-Scanner. This computerized axial transverse tomographic apparatus will provide a new approach to neuroradiological diagnosis. Together with our adaptations over the past few years, and with the completion of a pneumoencephalographic system which has been modernized, our facilities now are unique and will improve our services for patients, undergraduate and post-graduate teaching and for investigation.

To all members of the department, I extend my sincere thanks for their enthusiastic attitude toward their work and their great concern in the care of patients — their efforts are much appreciated.

Neurochemistry

Honorary Consultant

K.A.C. Elliott, M.Sc. (S. Africa),
Ph.D., Sc. D. (Cantab.), F.R.S.C.

Neurochemist and Medical Research Council Associate

Leonhard S. Wolfe, M.Sc., (N.Z.), Ph.D.
(Cantab.), M.D., F.R.C.P. (C)

Associate Neurochemist

Hanna M. Pappius, M.Sc., Ph.D.

Assistant Neurochemist, Clinical

Irving H. Heller, B.Sc., M.Sc., Ph.D.,
M.D., C.M., F.R.C.P.(C)

Fellows:

W. Carl Breckenridge, M.Sc., Ph.D., Univ. of Toronto, Medical Research Council Fellow
(until October)

N.M.K. Ng Ying Kin, B.Sc., Ph.D., Univ. of Wales, Research Fellow

R.G. Senior, B.Sc., M.Sc., Ph.D., Univ. of Sydney, Medical Research Council Fellow
(until August)

Technicians:

Mrs. M. Rostworowski

Mrs. P. Skelton

Mrs. H. Szylinger

Mr. L. Weniger

The work performed on the seventh floor Neurochemistry Laboratory on spinal fluid, blood, urine, and the preparation of nupercaine solution for the wards remained at a level comparable to recent years. We have had numerous requests for colloidal gold determinations from out of town and out of province hospitals.

The third floor ward laboratory technicians draw all the hospital bloods. In addition, our technicians perform the early morning blood sampling so that patients may be available for breakfast and diagnostic procedures. The level of work has not changed appreciably this year. In addition to the hematological and urinalyses done here, a large number of blood samples are taken for analysis at the Royal Victoria Hospital and Provincial laboratories.

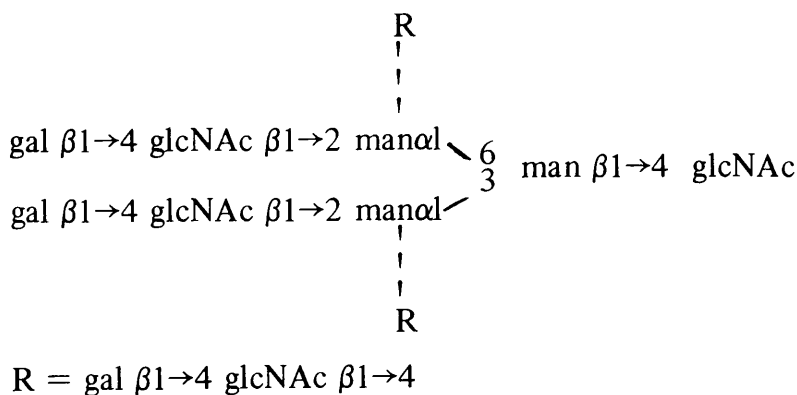
DONNER LABORATORY OF EXPERIMENTAL NEUROCHEMISTRY

Principal research accomplished during 1972-73 by L.S. Wolfe and associates.

A. Sphingolipidoses — inherited defects in the catabolism of membrane glycolipids.

1. G_{M1}-gangliosidosis Types I and II are fatal inherited diseases of children in the infantile or late infantile periods. The complete or partial

deficiency of β -galactosidase activity to synthetic β -galactosides as well as to the β 1 \rightarrow 3 Terminal galactose of G_{M1}-ganglioside (galactosyl β 1 \rightarrow 3-acetylgalactosaminyl β 1 \rightarrow 4[α 2 \rightarrow 3 N-acetylneuraminyll]-galactosyl β 1 \rightarrow 4 glucosyl 1 \rightarrow 1' ceramide) accounts for the accumulation of this ganglioside in brain, peripheral ganglia and to a lesser extent in non-neural tissues. A conspicuous pathological feature of these diseases is the presence of numerous vacuoles in lymphocytes and many peripheral tissues particularly the renal tubular epithelium, liver and sweat glands. These vacuoles are filled with non-lipid, highly water-soluble carbohydrate-containing material. Our earlier reports suggested on the basis of the galactose and N-acetylglucosamine content that this material resembled undersulfated forms of keratan sulfate. Re-examination of the water-soluble glycopeptides and oligosaccharides of the liver from three of the children who died of the Type I form of this disease by rigorous chemical methods indicates that these substances are unrelated to keratan sulfate and probably derive from specific glycoproteins. Purification and fractionation was achieved by repeated Biogel P6 chromatography. The structures of the oligosaccharides were determined by periodate oxidation, optical rotation, infrared spectroscopy, 100 and 220 MHz proton magnetic resonance spectroscopy, gas chromatography, mass spectrometry of the partially methylated and acetylated alditol and aminodeoxy alditol acetates before and after initial reduction with sodium borohydride and finally, specific enzymatic digestions and analysis of the structure of the products. The structure of the M.W. 1800 fraction is



The M.W. 1400 fraction contains one less galactose-N-acetylglucosamine residue. Higher molecular weight fractions present in smaller amounts contain similar oligosaccharide sequences glycosidically linked through N-acetylglucosamine to small peptide fragments. These oligosaccharides resemble the side chains of MN active erythrocyte stromal glycoproteins and other liver glycoproteins. They accumulate due to the inability to cleave the non-reducing β 1 \rightarrow 4 linked terminal galactose residues because of the deficiency in the β -galactosidases.

2. In collaboration with Dr. Karpati and Dr. Carpenter, chemical studies were carried out on splenic tissue following splenectomy in an unusual juvenile form of Niemann-Pick like syndrome. It was found that besides increases in triglycerides and cholesterol, sphingomyelin was present in double the normal amounts and also the unusual phospholipid, lysobisphosphatidic acid. Sphingomyelinase activity was normal.

B. Non-gangliosidotic cerebromacular degenerations.

In collaboration with Drs. Andermann, Karpati and Carpenter, further attempts have been made to uncover the specific biochemical defects in this important group of inherited diseases. Evidence suggests that there may be defects in the ability of the tissues (neural and non-neural) to remove peroxides which then react with a variety of cellular constituents to form fluorescent, insoluble lipofuchsin deposits. A start has been made in the complex area of measurements of tissue peroxidases. Using the hydrogen donor guaicol leukocyte peroxidase activity has been measured in a number of control subjects. Two children with the late infantile disease type exhibiting pathologically curvilinear profiles in neurones and in cells of several other tissues showed markedly reduced activity. However, no defect was found in a case of the juvenile Spielmeyer-Vogt disease type. It is much too early to come to conclusions but a more comprehensive study of tissue peroxidases is being prepared.

Chemical studies were also made on a 16-year old girl who died from a syndrome of juvenile cerebromacular degeneration. By electron microscopy characteristic accumulations in tissues of granular osmophilic deposits were seen. We have failed to identify the nature of these deposits principally because of their insolubility.

C. Prostaglandins

1. A highly specific and sensitive (to less than 1 nanogram) method for the analysis of prostaglandins E_2 and $F_2 \alpha$ has been developed using deuterated carriers. The ratio of protium to deuterium of selected fragment ions is measured in the LKB-9000 gas chromatograph-mass spectrometer linked to a Varian MAT-computer at the Royal Victoria Hospital Mass Spectrometry Center run by Dr. Orval Mamer. Plasma levels of natural prostaglandins have been measured in normal male and female subjects (pregnant and non-pregnant). When precautions were taken to avoid release of prostaglandins during venipuncture or from platelets, the basal levels are below 100 picograms per ml of plasma—the limit of the method for blood samples less than 10 ml. However, significant increases were found in two cases of medullary carcinoma of the thyroid. Prostaglandin $F_2 \alpha$ levels have been measured in CSF obtained at routine pneumo-encephalography. 'Normal' CSF does contain measurable amounts of $PGF_2 \alpha$ in the range of 100-200 picograms/ml. In a 'seizure' group and a 'sub-arachnoid' hemorrhage group, elevated levels were found in some patients; however, there is considerable variability. It is

clear that many more samples must be analyzed before clear-cut conclusions can be made. A method for the analysis of the major urinary metabolite of $\text{PGF}_2\alpha$ and PGE_2 is being developed and this will enable monitoring changes in prostaglandin production during various clinical conditions (seizures, sub-arachnoid hemorrhage, migraine attacks.) It is clear that blood levels of the natural prostaglandins is of little value since metabolism by the lung, liver, kidney and other tissues is so rapid and efficient.

2. In collaboration with Drs. Feindel, Yamamoto, Myles and Mr. Hodge, further studies have been carried out on the vasoconstrictive effect of PGE_1 and $\text{PGF}_2\alpha$ on small epicerebral blood vessels. A method for sub-arachnoid infusion through a cannula into the cisterna magna of the dog has been developed by Dr. Myles and PGE_1 has been shown to reduce cerebral blood flow and vessel diameters by this route. Plans are under way to directly test the prostaglandin content of platelet rich blood samples and see if there is any correlation with their vasospastic activity.

3. In collaboration with Dr. Pappius, the formation of $\text{PGF}_2\alpha$ by various brain regions is being measured and also the binding and/or uptake of prostaglandins to brain tissue. Current views are that prostaglandins act as modulators of neurotransmission in the peripheral as well as the central nervous system.

D. Lipid intermediates in the biosynthesis of brain glycoproteins.

Mannose has been shown to be incorporated from guanosine diphosphate mannose by an enzyme system in chick embryonic brain and rat brain into a lipid that has the properties of a polyisoprenylphosphoryl-mannose. We found that dolichols isolated from pig liver and chemically phosphorylated greatly stimulated the incorporation of mannose from GDP-mannose by embryonic chick brain into a mannosyl lipid. We decided to isolate and chemically characterize the polyisoprenols from bovine and rat brain. We obtained 10-15 mg/kg of a 98-99% pure polyisoprenol fraction. Reversed phase thin layer chromatography and gas liquid chromatography indicated four major polyisoprenols corresponding to the C-90, C-95, C-100 and C-105 species. Infrared and 100 MHz proton magnetic resonance spectra of brain and pig liver dolichols were superimposable. We also applied for the first time to these compounds carbon-13 fourier transform magnetic resonance spectroscopy and obtained excellent spectra which greatly assisted confirmation of the structure of the isoprenoid units and the degree of *cis-trans* isomerism. After conversion to monophosphate derivatives bovine brain and pig liver dolichols stimulated 2-5 fold the incorporation of mannose from GDP-mannose into mannosyl lipid in post-nuclear membrane fractions from 14-day old chick embryo and adult rat brain. Mn^{2+} and a protein to Triton X-100 ratio of 2 were required for maximum mannosyl lipid synthesis. The mannosyl lipid formed in the presence or absence of exogenous dolichol monophosphate

were identical and similar in chemical and chromatographic properties to dolichol monophosphate hexose. When the partially purified mannosyl lipid was incubated in Tris-Triton X-100-EDTA buffer with 14-day old embryonic chick post-nuclear membranes, 7% of the radioactivity was transferred to protein and 48% into water soluble compounds (mean values of 4 experiments). The results suggest that the polyisoprenol mannosyl lipid in brain can serve as an intermediate in mannose transfer to brain glycoproteins.

E. Fluid and electrolyte distribution in nervous tissue (Dr. Pappius and associates).

Major effort is being directed to a study of kinetics of the exchange of ^{24}Na between blood and brain. This work has evolved within the context of a working hypothesis that astrocytes may be involved in the resolution of cerebral edema in a manner not unlike that of cells of the gastrointestinal tract or in kidney tubules whose active transport of solutes results in transfer of fluid against an apparent concentration gradient. The overall goal is to study mechanisms by which edema is resolved and to search for ways to stimulate its resolution.

Preliminary results indicate that distribution of ^{24}Na is altered by injury to the brain and by furosemide, a renal diuretic said to inhibit sodium transport. Effects of dexamethasone and of acetazolamide on ^{24}Na distribution are also being investigated. Dexamethasone is used to test the possibility that steroid therapy diminishes cerebral edema by an action on electrolyte metabolism. Acetazolamide is included in the study to indicate whether carbonic anhydrase is involved in the mechanisms of sodium exchange at blood brain interface. There is evidence that sodium exchange at blood/CSF interface is in part controlled by this enzyme. The distribution ratio under these various experimental conditions is now being measured at different time intervals after injection of the isotope to establish which components of the exchange process (efflux or influx) are affected to produce the changes noted.

At the same time several collaborative studies are in progress on fluid and electrolyte distribution in nervous tissue under pathological conditions. In spinal cord injury (with Drs. Hansebout and Mercer) effects of dexamethasone on potassium content in injured cat cord and on functional recovery of these animals can be reproduced in the dog. With Dr. Eisen, dry weight and sodium and potassium are being measured in crushed nerve of rats to show whether changes in electrolyte content can be correlated with the return of the function. In view of the results in injured spinal cord, effects of dexamethasone-treatment on crushed nerve are also under study. Measurement of electrolytes in ischemic gerbil brains is in progress (with Dr. Klatzo and associates at NINDS). This is of particular interest in view of the findings of the NIH group that increase in water content of ischemic brain appears to precede the breakdown of the blood-brain barrier to proteins.

Finally, with Dr. A Yates, Department of Pathology, a correlation between cerebral edema measured chemically and as assessed by histological means is being attempted. Water and electrolytes are measured in autopsy cerebral tissues on which standard histology is done. When a sufficient number of cases has been accumulated it will be possible to determine whether chemical changes due to edema *in vivo* can be demonstrated in the presence of changes which occur postmortem and to what extent histologically described edema correlates with chemical measurements.

General approach and needs of the Department of Neurochemistry

The general approach of this Department is to continue to develop and expand chemical investigations of neurological diseases in collaboration with other Departments of the Institute and to train people for neurochemical research in a hospital environment. The emphasis is always on in-depth research of particular disease entities which are or become amenable to study where needed to set up special non-routine, often sophisticated and complex biochemical diagnostic procedures to aid the clinicians in the Hospital and others elsewhere in Quebec and Canada. studies on brain constituents, the chemical factors involved in the control oriented research, we continue to further develop fundamental chemical studies on brain constituents, the chemical factors involved in the control of synaptic activity, cellular contacts and differentiation. In brief, our Department will generally assist all members of the Institute and Hospital when consulted and further the leading position of the MNI-MNH in basic research in neurology and neurosurgery in Quebec, across Canada and internationally.

Having said all this, we do indeed have some problems. Apart from being crowded, the laboratories require considerable modernization which cannot be delayed for two or three years without seriously jeopardizing our productivity. The problem is so serious that M.R.C. on-site visitors raised this issue in their report.

National and international Meetings

Dr. Wolfe was a member of the organizing committee of the First International Conference on Prostaglandins in Vienna in October and organized two symposia on Prostaglandins for the Joint Meeting of the Canadian Society for Clinical Investigation and the Royal College of Physicians and Surgeons and for the American Society of Neurochemistry. Also invited lectures were given at M.I.T., University of Toronto and to various Departments at McGill and the University of Montreal. Dr. Wolfe was elected to the Council of the International Society for Neurochemistry, Canadian Society of Biochemistry and admitted a Fellow of the Royal College of Physicians and Surgeons under the Medical Scientist category.

Dr. Pappius chaired a session at a Workshop on Effects of Steroids on Cerebral Edema at Mainz, West Germany in June 1972, at which time five papers from our group were presented. She was also a member of the editorial board of the proceedings which were published within six months of the meeting as "Steroids and Brain Edema". Dr. Pappius discussed various aspects of her work at seminars given at the NINDS and at the Toledo Medical School, Toledo, Ohio, as well as at the NIH Annual Workshop on Cerebrovascular Disease in Phoenix, Arizona. The book "Brain Electrolytes and Fluid Metabolism" by R. Katzman and H.M. Pappius was published in February 1973.

Electroencephalography & Clinical Neurophysiology

<i>Consultant</i>	Herbert Jasper, M.D., C.M., Ph.D., D. ès Sci., F.R.S.C.
<i>Electroencephalographer and Clinical Neurophysiologist</i>	Pierre Gloor, M.D., Ph.D.
<i>Associate Electroencephalographer</i>	Frederick Andermann, M.D., M.Sc.
<i>Assistant Electroencephalographers</i>	Ivan Woods, M.D., M.Sc., F.R.C.P. (C) Andrew Eisen, M.D., F.R.C.P. (C)
<i>Biomedical Engineer</i>	John Ives, M.Sc.
<i>Computer Systems Engineer</i>	Christopher Thompson, M.Sc.
<i>Assistant Computer Engineer</i>	Jean Gotman, Engineer (ESE, Paris) M.E., (Dartmouth College)
<i>Senior EEG Fellows:</i>	Jean Lavigueur, M.D. (Univ. of Mtl.)* Walter Ray, M.D. (Univ. of Florida)*
<i>Fellows:</i>	
Alberto Altazarra, M.D. (Univ. of Valladolid)*	Luis Felipe Quesney, M.D. (Catholic Univ., Chile)
Robert Hyatt-Williams, M.D. (Univ. of London, Eng.)*	Walter Ray, M.D. (Univ. of Florida)*
Adolpho Perez de Leon, M.D. (Univ. of Santiago, Spain)*	Guy Remillard, M.D. (Univ. of Mtl.)
<i>Chief Technician:</i>	Mrs. K. Crystal, R.N.

*Six months on this service

Report on Clinical Service Functions

A total number of 3,419 electroencephalograms were recorded in 1972. This number is slightly smaller than the 3,755 figure of the previous year. (The figure of 4,546 "Electroencephalograms" mentioned in last year's report included the electromyograms and electrocorticograms, and should have read "total number of examinations".) Of these examinations 1,839 were performed on patients hospitalized at the Montreal Neurological Hospital, 375 on out-patients referred from the out-patient department of the Royal Victoria Hospital and 684 on patients referred from private offices. In addition 54 electrocorticograms were performed during neurosurgical procedures for the relief of intractable epileptic seizures.

In spite of the slightly smaller number of EEG examinations, the total work load has, however, increased because of the larger number of time-consuming diagnostic procedures which are being requested: greater use has been made of such diagnostic tests as intravenous Pentothal or Brietal activation for the demonstration of epileptogenic foci and for the differentiation between primary and secondary bilateral synchrony in patients with generalized epileptic discharges. Also a greater emphasis has been laid on prolonged day and night time EEGs in order to record the electrical concomitants of actual clinical seizures. It becomes increasingly apparent that the recording of such ictal events provides the most reliable information as to the area of onset of the patient's epileptic attacks and this is a most important guide for the surgical treatment of focal seizures. The number of intracarotid sodium amytal and metrazol tests has remained about the same as in previous years.

An increased number of bedside recordings in intensive care units for the determination of irreversible brain damage has further added to our work load. In view of the active kidney transplantation program going on at the Royal Victoria Hospital, the need for this kind of service is likely to increase still further.

RESEARCH ACTIVITIES

(A) *Computer Analysis of the Clinical Electroencephalogram* (P. Gloor, C. Thompson, J. Gotman, J. Ives, D. Skuce, W. Ray)

Research in the Laboratory of Electroencephalography and Clinical Neurophysiology has made great strides during the last year as our familiarity with the application of computer techniques to the analysis of the clinical electroencephalogram increased, and we obtained a better "feel" for the potentials of this powerful research tool. The close mutual collaboration of computer experts (Mr. Christopher Thompson, Mr. Douglas Skuce and Mr. Jean Gotman), biomedical engineer (Mr. John Ives) and clinical electroencephalographers (Drs. P. Gloor, Ivan Woods and Walter Ray) has been one of the main sources of strength in this exciting program. We are well aware that this factor and the particular configuration of our computing system put us in a position of potential leadership in this area. It is up to us to exploit this opportunity to be at the forefront in this important and rapidly developing field. Our general aim is to devise means of using the computer as a clinical tool in the service of the clinical interpretation of the electroencephalogram. Our ultimate aim is to develop a package in reading clinical EEGs and/or in monitoring cerebral activity during critical periods in patients where continuing brain wave monitoring may be of importance, such as during prolonged or all night recordings on epileptic and other patients, during neurosurgical operations for focal epilepsy or during carotid endarterectomy. An additional aim of our project on computer use in clinical EEG is to present EEG information in a compressed and visually easily intelligible form useful to the clinician responsible for the patient's management.

Our initial steps in this direction were to devise on-line programs for spectral analysis of 16 EEG channels and to compute "canonograms" i.e. frequency ratios which are clinically meaningful and can be displayed in a topographically intelligible form. Presently a study is in progress to test the effectiveness of this approach against the traditional method of interpreting electroencephalograms in patients with localized destructive supratentorial brain lesions.

Further applications of computer techniques have assisted us in the analysis of EEGs obtained by telemetry. Two areas especially have been fruitful: (1) the quick reading of an all day 8-hour EEG recording obtained in patients with absence attacks and the quantification of seizure discharges in relation to drug intake and behavioural variables in these patients, (2) the monitoring of round-the-clock or all night EEG recordings in patients with the stereotaxically implanted electrodes. Computer programs have been written which recognize the patient's seizure and make the identification of seizure episodes less dependent upon direct observation by nursing personnel during the night. Although the program needs further refinement, it has been efficient enough in one patient to identify all seizures occurring during computer monitoring and

to recognize several attacks which had not been recognized by the nursing staff.

We feel that we have rapidly made good progress in the application of computer technology to EEG analysis. It is quite apparent to us that, should we succeed in devising effective programs that will meaningfully assist the clinical EEG diagnosis, the actual implementation of such techniques for the patient's benefit would only become fully efficient if the EEG laboratory had unlimited control of its own computer unit. The day for acquiring a separate computer for the EEG laboratory may not have come yet, but should progress be fairly rapid in this area, this need could arise much sooner than we presently expect.

(B) Stereotaxic Depth Electrode Exploration of Complex Seizure Problems (P. Gloor, A. Olivier, J. Ives, C. Thompson, J. Gotman, D. Skuce)

In collaboration with Dr. André Olivier we have initiated a well-controlled study of stereotaxic exploration of deep temporal structures in patients with medically intractable temporal lobe epilepsy in whom the standard EEG diagnostic procedures proved insufficient for making a clear lateralizing or localizing diagnosis of seizure origin. A detailed protocol for the investigation of such patients has been devised. Five patients have so far been investigated and much valuable information as to the potentialities offered by this method of exploration has been obtained. We became rapidly convinced that this approach represents a very powerful method of investigating epileptic problems and that often much more precise and rational methods of surgical treatment can be proposed on the basis of these findings than on the basis of standard scalp recordings. The main bottleneck preventing a wider application of these methods at the moment is the time-consuming nature of such studies which require daily, often round-the-clock recordings in one single patient for periods of several weeks. It is in this area that we hope that computer analysis and other biomedical engineering techniques may greatly help in rationalizing the procedure. Our biomedical engineering laboratory is in the process of developing a multiplexing system which in conjunction with telemetry would be capable of monitoring simultaneously as many as 64 contacts in the brain. The computer would be programmed to detect ictal discharges.

(C) Correlation of Epileptiform Discharges in the EEG with Blood and Brain Anticonvulsant Drug Levels (A. Eisen, A. Sherwin)

Dr. Eisen in collaboration with Dr. Sherwin has correlated the number of epileptiform discharges in the surface of electrocorticogram taken during neurosurgical procedures for the relief of focal epilepsy with measured levels of phenobarbital in the excised epileptogenic brain tissue and in the blood. No clear correlations have so far

emerged, possibly due to the heterogeneity of the patient material and the impossibility to use each patient as his own control. Studies correlating blood levels of anticonvulsant drugs with standard scalp EEG recordings are presently in progress.

(D) The Application of Telemetry Recordings of the Electroencephalogram to the Clinical Management of Epilepsy (J.F. Woods, J.R. Ives, P. Gloor)

The development in recent years of a practical means of recording the electroencephalogram (EEG) by radiotelemetry has greatly facilitated research into various aspects of epilepsy. The ability to record the EEG continuously on freely moving subjects has been especially useful in observing the influence of environment and behaviour in patients with absence seizures.

Prolonged telemetry recording can also provide information which is extremely valuable in the investigation of clinical problems. There are several advantages to these telemetry recordings rather than standard EEG recordings. The patient is able to carry on with his ordinary daily activities in the hospital rather than being restrained by the EEG machine. The recording may thus be continued for as long as necessary until an adequate number of seizures have been recorded on tape. This may require several hours or several days.

We currently use a light weight (300 gm) 8 channel system which has been assembled into a functioning unit by our Neuroelectronics Laboratory and this has proven to be quite reliable and stable over prolonged periods. The range of our present system is about one hundred feet in the hospital and we find this quite adequate for almost all purposes.

A digital clock is used to visually present the time in minutes and seconds from the start of the recording. This time is written out at the top of the EEG paper every ten seconds. This enables correlation between the time of the event influencing the patient and the EEG recording.

The record may be written out on paper directly at the time of recording or may be stored on analog magnetic tape. The digital clock also has an output to the magnetic tape, thus allowing the recording of the time so that clinical events may be correlated with the EEG. If it is desired to record only during the night, this system can be started by a nurse on the ward as it requires pushing only three buttons; it then automatically shuts itself down after the eight and a half hour tape is completed. If the patient has a clinical seizure during the time of the recording, the time of the seizure is noted by the nurse and only this section of the tape is then played back for reading. Only six channels of EEG can be recorded simultaneously on tape. At present, means of recording more than six channels are being investigated.

This method of recording has proven particularly useful in the solution of two rather common problems related to epilepsy. The first is the

determination in patients with proven epilepsy of the site of origin of the seizures. The second is to determine the diagnosis in those patients with intermittent disturbances of consciousness or behaviour.

Since February 1972, thirty-four 8 channel telemetry recordings have been performed on twenty patients at the Montreal Neurological Hospital. The total recording time has been two hundred and ninety hours and twenty-five minutes or an average of fourteen hours and thirty-two minutes per patient.

The twenty patients reported here were known epileptics but the origin of their seizures was uncertain. Two of these patients had seizures recorded in the course of routine EEG recordings as well as by telemetry, while eighteen had seizures recorded by telemetry alone. In fourteen patients a total of seventy-five clinical seizures were observed during telemetry recording associated with EEG ictal discharges. In the remaining four patients in whom a clinical seizure was observed during telemetry recording, no EEG ictal discharges were seen accompanying the seizure.

In the fourteen patients in whom both clinical and EEG seizures were recorded, the origin of the seizures was clearly lateralized in seven, while in five they were seen to have no clearly lateralized origin. Electrodes and muscle artefacts obscured the recordings in two patients. A particularly valuable application of telemetry recording of the EEG in patients with intractable seizures has been the monitoring of electrical activity from deep structures of the brain by means of stereotaxically implanted electrodes.

(E) Correlation between EEG Seizure Activity and Ethosuximide Blood Levels (J.F. Woods and A. Sherwin)

In our management of epileptic patients the electroencephalogram plays an important role. Patterns of epileptic abnormality recorded in routine EEGs enable us to make a more precise diagnosis than is possible on clinical grounds alone. Persistence of epileptic activity in the EEG may influence our decision to reduce medication in a patient who has been seizure-free for some years.

The usefulness of the EEG would be considerably broadened if a quantitative analysis could be made which would show not only the presence and type of seizure activity but the amount in the course of a day. This would enable us to determine in a more precise manner the effectiveness of anticonvulsant drugs.

To obtain adequate EEG data for quantitative analysis we make prolonged recordings of the EEG by means of radiotelemetry technique. The advantages of this system are twofold: it permits continuous monitoring of the patient's EEG during extended periods of time and it allows the patient to move about and pursue activities of his own choosing.

The amount of epileptic activity recorded during a 6-hour period is

measured and correlated with the patient's blood level of anti-convulsants.

The characteristics of the discharges which were examined were as follows:

- 1) Total duration of discharge time (expressed as minutes per hour)
- 2) Frequency of discharges (expressed as number per hour)
- 3) Average duration of discharges (in seconds)

Each of these parameters was plotted against the blood level of ethosuximide. Results indicated a variability of response to ethosuximide by patients, all of whom were clinically diagnosed as having absence seizures. Of five patients studied in detail, the total discharge time was abolished in two, reduced in two, and unaffected in one.

For more precision the reduction of discharge frequency and average duration were also calculated. In all cases where the epileptic activity was reduced or abolished, there was a decline in discharge frequency with increasing blood levels of ethosuximide. The effect on discharge duration was more variable. In two patients it was reduced, in two there was no change and in one it seemed to be increased. In those patients in whom improvement was seen, in general increasing ethosuximide levels correlated with an improvement in the EEG, but each patient improved at his own rate. Thus high plasma levels achieve only partial control in some patients while much lower levels may achieve complete control in others. The degree of control depends on factors other than the plasma level of ethosuximide.

With this in mind, we attempted to correlate the characteristics of the EEG with the degree of control achieved. Those patients who responded most favourably displayed characteristic 3/sec bilaterally synchronous spike and wave discharges with abrupt onset and termination and a normal background activity. The patient who failed to respond to ethosuximide had less well regulated spike and wave discharges. He also displayed occasional irregular unilateral discharges and his background activity was poorly regulated. Although clinically his absence attacks were similar to those seen in primary corticoreticular epilepsy, his EEG suggested the epilepsy was secondary to an underlying brain disorder.

PROBLEMS AND FUTURE PROSPECTS

The main problem the research activities in EEG and Clinical Neurophysiology are confronted with is the lack of funds for a program which obviously over the next few years will require a fair amount of investment. Since this work is of benefit to our patients it should be possible to obtain some government support.

The addition of a full time electroencephalographer and clinical neurophysiologist to our professional staff is an even more urgent requirement. Presently the time the electroencephalographers can devote to research

is too much limited by the ever increasing commitments to clinical service functions, administration and teaching. The most urgently required relief in this area is to obtain additional professional manpower for recording electrocorticograms during surgical treatment for focal epilepsy.

TEACHING ACTIVITIES

Teaching activities have received a high priority in the work of our laboratory. Two such teaching programs exist: one for the training of physicians in clinical electroencephalography, and the other for the training of technicians to the level of standards required by the Canadian Association of Registered EEG Technologists. For the first time a structured didactic program has been offered to student EEG technicians undergoing training in EEG technology in the various laboratories of the McGill teaching hospitals. This has been a collaborative effort between our staff and Dr. Katherine Metrakos from the Montreal Children's Hospital.

The past year has been a highly successful one, especially for the impetus that EEG techniques have received from our biomedical engineering and computer colleagues. The enthusiastic and active cooperation we have received from Mr. Christopher Thompson, Mr. Douglas Skuce, Mr. Jean Gotman and Mr. John Ives in this area has been most gratifying. We wish also to thank our technician staff under the direction of Mrs. Kay Crystal for their conscientious and dedicated work. Last but not least, we wish to acknowledge the great help which has always been given to us, both in our service and teaching programs by Mr. Eddie Puodziunas and Mr. Gordon Evans in the electronics laboratory.

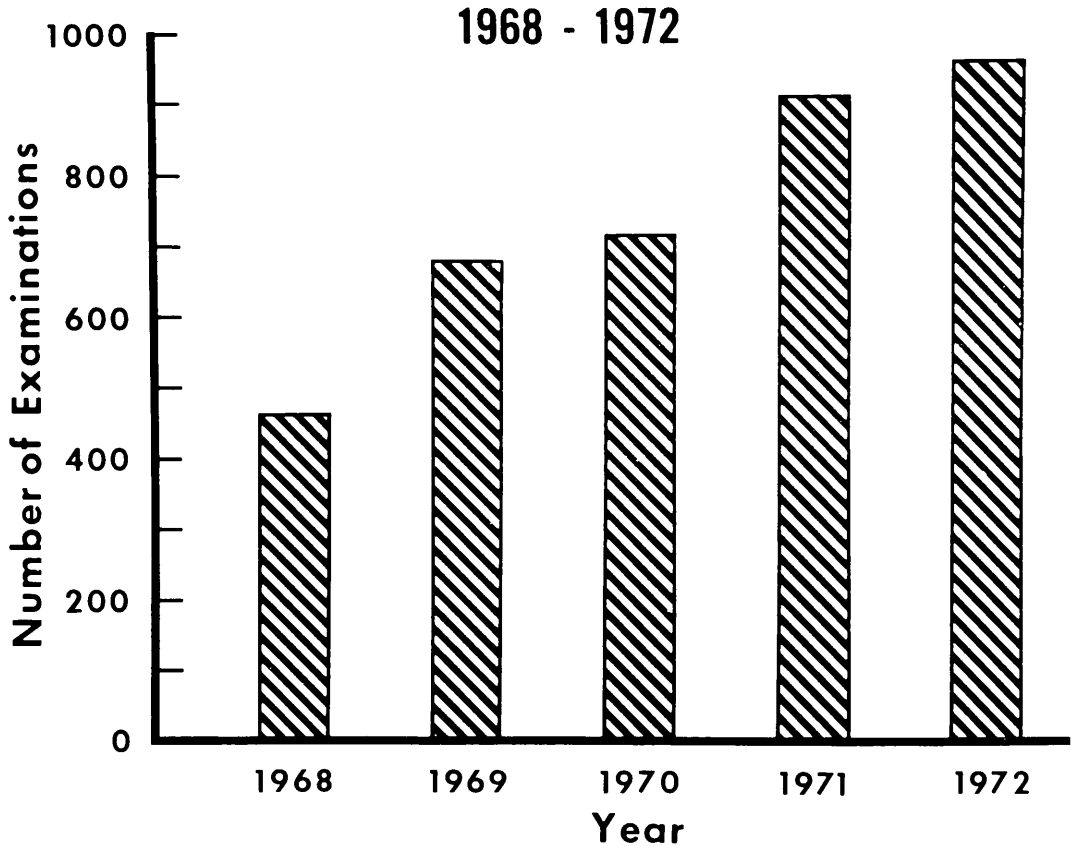
Electromyography Laboratory

<i>Head</i>	Andrew A. Eisen, M.D., F.R.C.P.(C)
<i>Fellows</i>	S. Bekhor, M.D. (Baghdad Univ.) July-Dec. 1972
	P. Humphreys, M.D. (McGill Univ.) Jan-June 1973
	H.S. Chuang, M.D. (Nat. Defense Med. Centre, Taiwan) Jan.-June 1973
<i>Technician</i>	Margo Henderson

Clinical Aspects:

The EMG laboratory in its present form began in 1968. Since then the number of examinations per year has more than doubled, there having been a steady upward trend of about a 20 percent increase per year (see fig.). 65 percent of referrals are from the MNH (hospital and private offices), whilst 35 percent of referrals come from other hospitals, outpatient departments and clinics.

NUMBER OF EXAMINATIONS OF EMG. LABORATORY



The interest of residents training in EMG at the MNH continues, and we are happy to report that as a result of this, laboratories are now operational at the Jewish General Hospital under Dr. C. Olanow, St. Mary's Hospital under Dr. S. Bekhor, and due to start again shortly at the Montreal Children's Hospital under the direction of Dr. P. Humphreys. There has been a healthy interchange of ideas between these, and other EMG laboratories as well as our own, a state of affairs we hope to encourage and expand.

In the clinical research field Dr. Eisen was asked to participate in the "Symposium of Hand Surgery" held at the RVH in September 1972, under the chairmanship of Dr. Martin Entin. Together with Dr. Humphreys we have correlated the clinical features and electromyographic findings of 25 patients with Guillain-Barré syndrome seen between the years 1968 to 1972. It is possible by this means to arrive at a reasonable prognosis

early in the disease. Dr. Eisen and Dr. Bertrand studied and reported a hitherto undescribed clinical entity of "Isolated Accessory Nerve Palsy of Spontaneous Origin". This work was presented at the 7th Canadian Congress of Neurological Sciences, Banff, June 1972. An investigation of the possible effects of long term dilantin therapy is underway with Dr. Ivan Woods. This study was commenced in March 1972, and is nearing completion, but analysis of data has not yet been undertaken. A new clinical project studying the effects of Vitamin B12 deficiency is presently being started with the cooperation of Dr. B. Cooper from the RVH.

Research Aspects:

Together with Drs. S. Carpenter, G. Karpati, and A. Bellavance a study has just been completed investigating the effects of muscle hypo- and hyper-activity upon nerve fiber diameters. It was shown that both intact and regenerating myelinated nerve fibre diameters of the nerve to the soleus in the rat, could be reduced and increased by respective underuse of the soleus muscle. To our knowledge nerve fiber hypertrophy of this type has not been previously described, and it is hoped that variations of the model developed will throw further light on the close inter-relations of nerve and muscle.

Investigation of some basic mechanism in denervation fibrillation is presently underway. Why a denervated muscle should fibrillate remains a mystery. There is good evidence that ACTH sensitivity is not the answer, and that some other "trophic" influence of nerve muscle must be found.

In association with Dr. H. Pappius, we are studying the effects of steroid therapy upon nerve "oedema" and rate of regeneration subsequent to crush injury. It is hoped thereby to add to the "oedema" story in relation to other parts of the neuro-axis, previously investigated by Dr. Pappius.

Under the direction of Dr. S. Carpenter, study of the effects of IDPN intoxication in rats is continuing. This compound produces lesions having some tempting similarities to human anterior horn cell disease. It is hoped that correlative electronmicroscopical and electromyographic studies in IDPN intoxication, fibrillation of denervation and effects of hypo- and hyperactivity of muscle upon nerve may all add to a better understanding of anterior horn cell (motor neuron) disease.

Experimental Neurophysiology

<i>Consultant</i>	Herbert Jasper, M.D., C.M., Ph.D., D. ès Sci., F.R.S.C.
✕	
<i>Neurophysiologist, Killam Scholar</i>	Stanislav Prelević, M.D.
<i>Biomedical Engineer</i>	John Ives, M.Sc.
<i>Computer Systems Engineer</i>	Christopher Thompson, M.Sc.
<i>Assistant Computer Systems Engineer</i>	Jean Gotman, Engineer (E.S.E., Paris) M.E. (Dartmouth College)
<i>Fellows</i>	
Graham Ball, M.Sc. (University of Manitoba)	Douglas Skuce, M.Sc. (McGill) Killam Scholar
McIntyre Burnham, B.A. (Cornell) Ph.D. (McGill)	Gianfranco Testa, M.D. (University of Padova, Italy)
Alan Guberman, M.D., (McGill)	
<i>Laboratory Supervisor</i>	Mary Roach, A.R.R.C., R.N.
<i>Chief Electronics Technician</i>	Edward Puodziunas
<i>Assistant Electronics Engineer</i>	Gordon Evans

The principal research objectives of the Laboratory of Experimental Neurophysiology pursued during the past year were as follows:

(A) *Studies on an Animal Model of Generalized Corticoreticular Epilepsy*
(With Drs. G. Testa and A. Guberman)

In 1969 Prince and Farrell presented a short report at the American Academy of Neurology Meeting in Washington which indicated that large intra-muscular doses of penicillin in the cat produce a transient epileptic state which, from the EEG and clinical point of view was reminiscent of human myoclonic petit mal. We have elected to investigate this animal model further and have confirmed Prince and Farrell's original observation. Detailed studies comparing the electrographic and clinical manifestations of this transient epileptiform disorder with human generalized corticoreticular epilepsy have convinced us that the similarities between the two conditions were indeed very great. Furthermore, it was found that the responses of the generalized epileptiform discharges in these animals to unilateral intracarotid injection of amobarbital and pentylenetetrazol and to intravertebral injection of these two drugs were identical to those seen in human patients with generalized corticoreticular

epilepsy: unilateral intracarotid pentylenetetrazol produced bilateral activation of spike and wave discharges leading to a generalized seizure, whereas amobarbital injection by the same route produced more variable effects; but as in man a frequent ipsilateral activation of spike and wave was elicited by intracarotid amobarbital. Conversely the intravertebral injection of pentylenetetrazol produced an arrest of the spontaneous bilaterally synchronous spike and wave discharges. The effect of intravertebral amobarbital depended upon whether the desynchronizing or synchronizing portion of the brainstem was more affected by the drug. Whenever the amobarbital produced a synchronized EEG, the spike and wave discharges increased, if it produced a desynchronized EEG they decreased.

These experiments have suggested that the reticular formation of the brainstem intervenes in the regulation of the bilaterally synchronous spike and wave discharge inasmuch as a reduced ascending desynchronizing reticular drive promotes bilaterally synchronous spike and wave discharge, whereas an increased desynchronizing reticular drive inhibits or even prevents the occurrence of spike and wave activity altogether. This hypothesis was further tested by local cooling of the midbrain reticular formation. Such cooling invariably produced an activation of the spike and wave discharge together with signs of reduced behavioral and EEG arousal.

These findings have been presented at the Annual Meeting of the American EEG Society held in Houston in October 1972.

In more recent studies we have investigated the possible role of cholinergic mechanism in this experimental model. It was assumed that since a reduction of desynchronizing reticular drive associated with increase of spike and wave activity may depend upon a decreased release of acetylcholine on the cortical level, it should be expected that the spontaneous occurrence of spike and wave activity in these animals would be inhibited by eserine and activated by anticholinergic drugs such as scopolamine. These predictions were fulfilled, except that eserine seems to have a biphasic effect with an initial inhibition of the epileptic discharge followed by activation of a somewhat modified epileptogenic abnormality which probably results from excess accumulation of acetylcholine which in itself is epileptogenic.

The effects of two common anticonvulsant drugs on this model were studied in collaboration with Dr. Sherwin's laboratory. It was found that ethosuxinimide (Zarontin) markedly diminishes the spontaneous occurrence of spike and wave discharge in these animals and that diphenylhydantoin (Dilantin) has much less effect upon this abnormality. These drug responses were obtained with blood levels comparable to those responses obtained during anticonvulsant therapy in man.

Further studies on this animal model of generalized epilepsy are planned in order to elucidate in more detail the mechanism of action of penicillin given by the systemic route and to analyse the involvement of various brain structures in the mechanism of the genesis and synchronization of the epileptiform discharges. It is also planned to investigate by computer methods the coherence function of the paroxysmal discharges in this form of

feline generalized epilepsy and to compare the results with those obtained in human patients with spike and wave discharges in their EEGs.

(B) Measurements of the convulsive threshold of a single hemisphere in the normal cat, and epileptic cat. (With Dr. G. Testa.)

In recent years the intracarotid amobarbital and metrazol test has been a useful adjunct in the EEG diagnosis of complex seizure problems, especially in patients with generalized epileptiform discharges which are suspected to be triggered from a unilateral cortical pacemaker form (so-called "secondary bilateral synchrony").

Some of the unresolved problems arising out of the intracarotid metrazol test are (1) whether one can assume that in a normal brain and in a brain affected by generalized epilepsy of the "primary synchronous type", the convulsive thresholds of the two hemispheres to intracarotid metrazol are indeed equal; (2) whether the injection of metrazol into one carotid and/or the subsequent induced convulsion alters the threshold of the injected and/or the contralateral hemisphere. The latter point is important in view of the fact that in the clinical test intracarotid metrazol injections on the two sides are carried out sequentially with an interval of at least one hour.

Experiments in normal cats, cats with generalized penicillin epilepsy (a good model of primary bilateral synchrony) and cats with focal cortical penicillin epilepsy have shown that: (1) The convulsive thresholds to metrazol of the two hemispheres are equal in normal cats and in cats with generalized penicillin epilepsy, they are significantly lower in the hemisphere with a penicillin focus as compared to that measured in the normal hemisphere. (2) Cats with generalized epilepsy have significantly lower hemispherical thresholds than normal cats. (3) After unilateral injection of metrazol there is a temporary decrease of the convulsive threshold of the contralateral hemisphere; this change in threshold lasts however for less than one hour. (4) After unilateral injection of metrazol followed by a convulsion, the threshold of the injected hemisphere to subsequent metrazol injection is raised.

The findings when extrapolated to the human situation indicate that the premises upon which the clinical test are based are sound, provided an interval of one hour elapses between sequential unilateral intracarotid metrazol injections on alternate sides. These results have been reported to the Eastern Association of Electroencephalographers at its Meeting in New York in December 1972.

(C) Unit Slow Wave Relationships in the Normal and Abnormal Electroencephalogram. (With Mr. Graham Ball)

The nature of the relationship between single cell unit discharges and the electroencephalogram has remained a subject where many uncertainties remain. It is fairly well established that the closest relationship between

single cell discharge and EEG phenomena are found in epileptic discharges. Fairly well documented are also those found during barbiturate-induced spindle activity. Next to nothing is known about the relationship of discharges of cortical neurons with pathological slow wave activity of the delta type, which is the most frequent EEG sign indicating the presence of a destructive brain lesion. During the past year it was possible to confirm the work of other investigators who demonstrated a statistical relationship between barbiturate spindle activity and cortical unit discharges. The elucidation of a relationship between pathological slow wave activity in the cortex and unit discharges was somewhat more difficult, because it was not easy to produce convincing delta activity reliably in an experimental animal. This initial difficulty has been overcome and two types of delta waves have been investigated, those produced in the cortex from a distant lesion in the midbrain, and those produced by a lesion in the immediately sub-cortical white matter. It seems probable from our results that lesions confined to the cortical grey matter alone do not produce delta activity; the latter only seems to arise when viable cortex is partially deafferented from inputs arising from subcortical sources. These delta waves showed a clear-cut relationship with cortical unit activity, indicating that they most likely represent summated synaptic events. Further studies are planned to elucidate in more detail the nature of the deafferentation process leading to the slow wave disturbance, the relationship to white matter edema and the type of synaptic activity underlying the pathological slow wave disturbance.

(D) An Electrophysiological Study of Amygdaloid Afferents in the Cat. (With Drs. S. Prelević and W.M. Burnham.)

Clinical studies on temporal lobe epilepsy and behavioural studies in animals suggest that the temporal neocortex is an important source of afferent input to the amygdala. Our study in the cat was aimed at investigating in more detail the response pattern of single amygdaloid neurons to excitation arising in the neocortex. Our preliminary studies using averaged evoked potentials and poststimulus time histograms (PSTH) in the amygdala of the cat showed that the activity of a significant proportion of neurons in the amygdala was modulated by stimulating the lateral preoptic region, the temporal neocortex and the septum. This study was the subject of a communication presented at the XVth Annual Meeting of the Canadian Federation of Biological Societies held in Quebec City in June 1972.

Since then, we have concentrated our efforts on closer examination of the neocortical influence on neuronal activities in the amygdala. Well over 300 single units have been recorded in the amygdala, PSTHs of single neuron discharges were computed, and histological checks of the microelectrode positions performed routinely. The following findings seem interesting to us:

(1) The temporal neocortex can synaptically influence unitary discharges within the amygdala.

(2) While both excitation and inhibition, as well as the combination of the two, are possible, the most commonly observed pattern was excitation

with the mean latency of about 10 msec followed by long-lasting inhibition of cell firing.

(3) Several cortical inputs can sometimes interact at a single neuron level.

(4) The effective cortical areas are homologues of the temporo-insular cortex in primates.

The results of this study are essentially in agreement with neuroanatomical studies. What is new and relevant is the demonstration of synaptic influence on the neuronal level with the use of a more refined method of recording and analysis, and also the description of the typical patterns of the possible synaptic influence of temporal neocortex on the amygdala.

We plan to pursue our interest in amygdaloid inputs in the future along several lines: (a) More precise and careful mapping within the amygdala; (b) internuclear relations amongst the various subdivisions of the amygdala; (c) closer examination of the subcortical influence on the amygdala, especially septal, which was signalled by our pilot study; (d) intracellular study of amygdaloid neurons under the influence of various cortical and subcortical inputs; (e) similar studies on the semichronic unanesthetized cats; (f) extension of these studies to other species, especially the monkey, where temporal lobe anatomy becomes more complex and closer to that of the human brain.

Meetings and Visiting Professorship

In the spring of 1972, Dr. Gloor was invited to a symposium on the "Neural Bases of Violence and Aggression" organized by the Houston Neurological Society with the assignment to review the contribution of electrophysiological studies in man and animals to our understanding of amygdaloid function. Dr. Gloor was also invited to present the physiologist's viewpoint on surgery of episodic behaviour disorders at the Annual Meeting of the American Association of Neurological Surgeons in Boston. In September 1972, Dr. Gloor spent a week as visiting MRC professor in the Department of Physiology at the University of Manitoba in Winnipeg.

Future Plans and Problems

The general orientation of our work in the future will undoubtedly be true to the tradition of this laboratory; the main aim will remain to investigate fundamental problems of neurophysiology related in some way to human disease and to the understanding of brain function in man. Even though some of the experimental work done in our laboratories may at first glance appear rather remote from the physician's concern at the bedside, many problems that preoccupy the neurologist's mind can obviously not be solved by investigations in man alone. Much of our understanding, for instance, of temporal lobe epilepsy has received continuous enlightenment from the findings accumulated over the years in our laboratories in the course of our experimental studies on limbic system functions, particularly that of the amygdala and hippocampus. The present research in this area continues this

tradition. The relevance of our studies on generalized epilepsy in the cat and those on the relationship between single cell discharge and slow wave activity in the normal and abnormal EEG have obvious bearing on clinical problems which need no further emphasis.

The problems we are faced with are the same that have plagued this department for the past few years: namely the lack of space, antiquated physical plant and the need for a larger permanent research staff. Although from the point of view of instrumentation we are well equipped, the necessity to share laboratories dating from another era with several other research teams impedes efficiency in the planning and execution of experimental programs. Recruitment of an additional senior neurophysiologist cannot realistically be contemplated until a solution to these problems is assured. We have been able to keep mutual stimulation of interests, and the discussion of new ideas alive, mostly through our medium of weekly informal discussion sessions on Friday afternoons. It is, however, obvious that we are operating dangerously close to the lower limit of the critical mass necessary to sustain the momentum of creativity in the presently highly competitive field of basic neurophysiological research. It is in this area that a new experienced staff neurologist could contribute most.

NEUROELECTRONICS

Over the past few years the engineering personnel at the Montreal Neurological Institute has increased to four and this is a direct reflection on the advancement of the research which now incorporates sophisticated computer and electronic instrumentation to extract relevant information from neurological sources.

(A) EEG Analysis on the Computer

(1) Introduction

The purpose of analysing EEGs with a computer is twofold: 1) to make a quantitative analysis which allows for comparisons not otherwise possible, and which, through mathematical methods, may reveal facts that are not obvious with visual inspection; 2) to improve the communication between the electroencephalographer and the clinician by concentrating the EEG into a picture which accentuates the abnormalities, simplifying the interpretation.

(2) Present System

For about 9 months we have been recording interesting EEGs in computer readable form. These have been mainly from patients with slow wave EEG abnormalities and a group of normal controls. Selected portions of these recordings have been subjected to spectral analysis. Further computations are then performed on these frequency spectra to produce a diagram of ratios (canonograms) which topographically displays the EEG abnormalities in an

easy to read form. The canonogram allows one to measure the asymmetries of both slow (large arrows), and fast (small arrows) waves in homologous head regions, and a weighted ratio of the slow to fast activity (polygons). Either a significant shift in the arrows from the center, or abnormally large diameter polygons are good indicators of EEG abnormality. A retrospective study is now underway to compare the interpretation of the canonograms with both reading of the EEG record and results of other tests (angiograms, brain scans) in patients with suspected supratentorial lesions. This type of lesion is normally associated with augmented slow waves (delta and theta), and diminished fast waves (alpha and beta) in the EEG.

In order to see what the time variation of the slow to fast ratios is in the EEG, we have also developed a "compressed spectral and ratio array" similar to that used by Bickford. Two important differences are that the spectra are computed and displayed "on line" as a topographic array, and beside each spectrum (corresponding to 5 sec. of data) the time corresponding to that appearing on the EEG record, and a line proportional to the slow/fast ratio are drawn. This gives an immediate assessment of the abnormality in the EEG while it is being recorded.

(3) Difficulties and Possible Extensions

The most important problems arise from the presence of unwanted activity (EMG or eye movements). As these activities are very difficult to eliminate in routine EEGs, we are trying to detect their presence automatically. Presently their occurrence is only indicated on the canonogram; eventually corrective action may be taken in order to make the canonogram a better representation of the "significant" components of the EEG.

Another direction of study of EEG activity is that of inter-channel analysis. This is mostly concerned with the relationship (the "shared activity") between 2 or more EEG channels. The coherence function gives a "coefficient of dependence" between 2 channels for each frequency. Certain normal rhythms are very coherent (dependent), and the presence of a lesion may disturb this organization. This method will also be used to study the interictal activity in patients with implanted electrodes.

(B) Visualization of Brain Maps during Stereotaxic Surgery (with Dr. G. Bertrand).

In the operating room, the computer graphic terminal displays cross-sections of the brain, in the 3 cardinal planes, scaled according to the size of the brain of the patient. The program also allows for display of the stimulating, recording and cutting probes on the cross-sections (the part "behind" the cross-section is shown in dashed lines). When a neuron is firing, the position of the probe and the cause of firing may be recorded and later be displayed, along with all previously recorded neurons (for one or several patients). This system has been in use for over two years.

(C) Telemetry

(1) Introduction

Telemetry allows one to monitor a patient remotely via a radio link and this frees the subject from trailing wires or monotonous positions.

(2) Present System

The 4 channel telemetry system has been in use now for over 2 years in Dr. Wood's study of the effect of anticonvulsant medication on patients with the 3 per second spike and wave in their EEG. The data acquisition system allows simultaneous recording on paper and analog tape which are time-locked by a digital clock to make the analysis of the 6 hour record much simpler. The analog tape can be played back by the computer which extracts the discharges for confirmation in a fraction of the time required when doing it by hand.

The telemetry system was expanded to 8 channel just over a year ago to aid in the recording of spontaneous seizures and has been extremely successful in capturing the ictal event. This system was also used to monitor the bitemporal lobe patients that were implanted with depth electrodes by Dr. Olivier.

Recently, for the first time, a computer was used to monitor a patient with depth electrodes via the telemetry link and automatically detect and record the electrical seizure. Over a 2 week period 13 seizures were obtained with this system which was a decisive factor in the final diagnosis and treatment of the patient.

3) Future Plans

A multiplexer is now being built to allow 16 channel EEGs to be recorded on a 7 track analog magnetic tape. These tapes can be played back into the computer at high speed. This will allow computer analysis and the collection of a greater number of EEGs than are now possible because the computer will not be required for data acquisition.

Two other multiplexing systems are being developed in order to replace the existing 8 channel telemetry system by a smaller, more compact unit. The first system will be a 16 channel device used to perform routine surface recordings on patients. The second will be a 32 channel system (which can be expanded to more channels) for monitoring the multi-recording sites that are being implanted in the temporal lobe of patients.

Plans have also been initiated to implement a simpler system for automatically monitoring, detecting and recording electrical seizures from ambulant patients without having to use the computer.

A pilot study will begin in June to evaluate a 4 channel 24 hour EEG cassette tape recorder weighing under 400 grams, so it can be conveniently carried by the person being monitored. The computer again will be used to perform automatic data reduction of the 24 hour record. Both the electrodes and the recorder themselves can be completely concealed which will allow the subject to leave the hospital environment without feeling conspicuous.

(D) Artificial Intelligence

Mr. Skuce is continuing his work in artificial intelligence concerning the problem of machine learning of natural language grammars, descriptions of simple data structures, and the problem of structuring these notions in a computer memory.

The general approach incorporates the following assumptions: 1) Within ten to twenty years, if we play our cards right, computers will be capable of performing many tasks which normally are considered to require a degree of intelligence; particularly, many of the information acquisition, planning and decision making aspects obtaining in medical diagnosis.

2) This will only be possible through a very eclectic approach to the general problem of constructing intelligent machines. Such an approach embodies fragments of knowledge, methods and philosophy from such diverse areas as mathematics, psychology, linguistics, computer science, philosophy, and possibly theoretical neurology.

- 3) In particular, attention is being directed to the following aspects:
- a) The machine should be capable of conversing in a natural language.
 - b) The machine should be able to receive information in some additional 'non-linguistic' form, e.g., as a stream of numbers.
 - c) The machine should be able to make logical inferences, and to handle imprecise data.
 - d) The machine should be capable of learning both things it is specifically told, and things it discovers for itself, without forgetting.

4) A very scaled down or 'microcosmic' model of the above notions can be obtained if we:

- a) Restrict our subject matter to trivial objects such as rows of letters of the alphabet;
- b) Restrict our grammar to a mathematically tractable form;
- c) Restrict our communication channel to the machine to be a teletype;
- d) Restrict our dictionary to several hundred words;
- e) Restrict our sentences to semantically simple ones; and
- f) Program this in a high-level language on an interactive computer.

While various programs have been written which incorporate one or two of the above criteria, none has attempted to consider a unified approach, as we do here. The price to be paid of course is that compared to any one program specializing in only one or two sides of the problem, the unified program will appear poorer. Such is the fate of the G.P. (General Program).

Neuropathology

Neuropathologist . . .

. . Gordon Mathieson, M.B., Ch.B., M.Sc.,
F.R.C.P. (C)

Associate Neuropathologist . . .

. . Stirling Carpenter, A.B., M.D.

Fellows: Six months on this service

Sushil Chandi, M.D. (Christian Med.
Coll. Vellore, India)

Michael Dogali, M.D. (McGill)

Arun Ginde, M.D. (Bombay Univ.)

Peter Humphreys, M.D. (McGill)

Calvin Melmed, M.D. (Univ. of Manit-
oba)

Patrick Murray, M.D. (Royal Coll. of
Surgeons, Dublin)

Pierre-Paul Noiseux, M.D. (Univ. of
Mtl.)

Stephen Nutik, M.D. (McGill)

Adnan Silk, M.C. (Univ. of Damascus)

Leslie Stern, M.D. (Univ. of Manitoba)

Stanley Wohl, M.D. (McGill)

University of Montreal Rotators [4 mos.]

André Lauzon, M.D.

John Magoun, M.D.

Chief Technicians:

Barbara Nuttall, B.A., A.R.T.

John Gilbert, R.T.

The work of this department is made up of many facets which fit together to form a mosaic. The pattern of this mosaic, however, changes through the years as some facets grow in importance, size and brilliance while others, for the time being at least, atrophy. One constant theme, however, is the role of the Department of Neuropathology as a quality control service for the patient care aspect of the hospital and institute. Unfortunately, in some instances, this takes the form of autopsy examination. During the calendar year 1972, we made detailed studies of 76 cases at autopsy out of a total number of 111 deaths in the institute. The autopsy rate was thus 68.5%. This is roughly comparable with last year's but is below our longterm average and a further analysis of the figures shows that during the year, there was a drop in this rate, i.e. the rate was higher than average at the beginning of the year and lower than average at the end of the year. More recently, communications problems have arisen in connection with the Medical-Legal autopsies on accident cases which are a regrettably frequent cause of death in this hospital. We hope, however, that this difficulty will soon be cleared up and that an abundant feedback of pathological information will be made available in these cases. Such studies are essential for the efficient and useful working of the Committee on Medical and Dental Evaluation in which the department of Neuropathology plays a prominent role. This is a new committee as set up under the Act Respecting Medical Services and Social Services, but in essence the functions of this committee in monitoring and controlling the quality of medical care in the hospital have gone on for many years and the change is one of title and format, rather than of function.

While the department plays a role in evaluation of medical care, the activities of this department itself are tabulated in meticulous detail, every block, slide and special stain being counted and a numerical value allocated in order to measure the work load. One hopes with the onset of global budgeting that the necessity for work we regard as statistical overkill will be eliminated.

The chapter on Postinfectious Perivenous Encephalitis and Acute Hemorrhagic Leucoencephalitis under the authorship of Stirling Carpenter and Peter Lampert has now appeared in volume 3 of Minckler's *Pathology of the Nervous System*.

Dr. Carpenter has continued his collaboration with Drs. Karpati and Eisen on neuromuscular studies in animals such as that demonstrating the development of nemaline rods and core-like lesions in the rat soleus muscle following Achilles tenotomy. He has made use of human material for ultrastructural studies of peripheral nerve and muscle, such as the nature of the lesion in the early stages of the Guillain-Barré Syndrome. Thanks are due to the Medical Research Council of Canada and the Canadian Muscular Dystrophy Association for financial support for these and related studies. The technical preparation of electron-microscopic material was under the direction of Miss Barbara Nuttall. Work using these techniques in such fields requires longer preparation and instruction than is generally possible during the periods of rotation that most of our residents spend whose ultimate goal is a clinical career in Neurology and Neurosurgery. Conflicts of this nature have, of course, occurred in the past, but are accentuated by the increasing sophistication of laboratory investigative procedures, both diagnostic and research.

In line with many other changes taking place in the Royal College of Physicians and Surgeons of Canada, the committee in Pathology of which Dr. Mathieson is a member, has been undertaking a radical examination of the training of pathologists and the evaluation of this training by examinations and other means. After several meetings had laid a general ground work, a working party was formed which met in the McLaughlin Center in Edmonton in November 1972, for an intensive study of the contents and methods to be used in a general principles examination applicable to all branches of pathology, including neuropathology. Should this venture succeed, as seems likely, then it will help in knitting together the different specialties and perhaps reverse the dangerous trend which seems to be developing of neuropathology getting further away from general pathology.

In closing this brief overview of the department's activities, I should like to make mention of the retirement at the end of this coming summer of Mrs. Wanda Kozicka. Mrs. Kozicka has been a valued member of our technical staff for many years and the numerous beautiful histological preparations, always of uniformly high quality, studied by a succession of fellows and filed in the Institute are a tribute to her skill and care.

Neuro-Isotope Laboratories

<i>Director</i>	William H. Feindel, B.A., (Acad.) M.Sc. (Dal.) M.D., D.Phil. (Oxon), D.Sc. (Acad.)
<i>Assistant Professor, Neurosurgery</i>	Y. Lucas Yamamoto, M.D., Ph.D., Hokkaido)
<i>Medical Research Council Trainees</i>	Louis M. Bouchard, M.D. (Ottawa), Leon J. Ravvin, M.D. (McGill) Terence Myles, M.D. (Alberta).
<i>Physicist</i>	Ernst Meyer, M.Sc. (Zurich)
<i>Summer Students</i>	Robert Vroom Jean Lemieux
<i>Research Assistant</i>	Andrea Duszczyszyn, B.Sc. (Loyola)
<i>Senior Brain Scan Technician</i>	Gloria Abrahamson, R.T.N.M., M.S.R., F.S.R.
<i>Assistant Brain Scan Technician</i>	John Fodor
<i>Electronic Technician</i>	George Lootus

In the Brain Scan Laboratory, the total number of examinations for 1972 was 4,264, reduced slightly from 1971 when there were 4,550. This was due mainly to the installation during a period of two months of the new Med II Gamma Camera digital computer system. Thanks to the prompt authorization of the appropriate sections in the Department of Social Affairs, our acquisition of this sophisticated device for evaluation was the first in Canada. It will provide for flexible data analysis on brain scans and new potential for quantitative studies on patients with circulatory disorders of the brain. This information, in turn, will complement the dramatic and novel approach to the diagnosis of brain hemorrhage and blood vessel occlusion which will be derived from the EMI-Scanner. We anticipate an exciting avenue will now be open for the detection and management of patients with cerebral vascular disorders which represent one of the most common neurological disabilities. During 1972, the increasing demand for diagnostic information on stroke patients has continued to increase so that the circulation studies went from 455 to 485.

Miss Gloria Abrahamson took over as senior technician at a particularly difficult time during the installation of this new apparatus after the resignation of Miss Helen Rojek. Mr. John Fodor replaced Mr. Ronald Miller as assistant technician. Miss Rojek completed, with Dr. Romero, a review of the patients with normal pressure hydrocephalus who had had brain scans and CSF circulation studies. This was presented at the annual meeting of the Nuclear Medicine Society.

THE WILLIAM CONE LABORATORY FOR NEUROLOGICAL RESEARCH

Studies supported by the Medical Research Council of Canada, the Cone Memorial Fund and the Pillow-Vaughan endowment have been further extended now by supporting resources of the Webster Brain Research Fund. A number of important aspects of cerebral circulation were investigated and in most instances our experimental approach was made possible by the application of two new techniques developed in our laboratories over the past decade, namely, fluorescein angiography of the brain, by which the large and small vessels of the surface of the brain can be visualized dynamically and the measurement of local cerebral blood flow by a miniature solid-state detecting system which is now fed into the PDP-12 computer.

(a) *Analysis of Experimental Strokes:*

The first phase of this study was completed with Dr. Leon Ravvin being the active protagonist. The aim here is to define the earliest possible changes in focal blood flow after closing one of the arteries on the surface of the brain — a model of experimental stroke which we introduced several years ago. This will further our understanding of this most common and important aspect of cerebral vascular disease. The analysis will also provide a baseline, not so far available, for evaluating possible therapeutic tactics in the treatment of experimental stroke. Dr. Ravvin held an MRC trainee grant during this investigation.

(b) *Venous Occlusion in the Brain:*

Dr. Henry Laurelli, working under a United States Public Health Fellowship, was awarded his Master of Science degree for his study on the immediate effects of selective occlusion of epicerebral veins in the dog brain. This work provides the first detailed information available on this topic, and has an important bearing on disturbance of venous circulation produced in patients as a result of increased intracranial pressure, trauma, tumors and in association with the complex problem of cerebral edema. Dr. Laurelli's thesis and his experimental findings provide what will be a standard reference in this particular subject.

(c) *Prostaglandins and Cerebral Blood Vessels:*

A large part of the efforts of our research team, collaborating closely with Dr. Wolfe's Neurochemistry Laboratory and engaging Mr. Charles Hodge and his Neurophotographic staff, was concerned with the analysis of the action of various prostaglandin derivatives on the blood vessels of the brain. The powerful vasoconstrictive effects of several types of prostaglandins, as they affect especially the microcirculation, were confirmed and the counter effect of ethanol was demonstrated. Further studies in progress aim at determining additional agents which have an antivasoconstrictive effect and one of the main ones thus far includes ethanol. Evidence indicates also that prostaglandins may play a role in the devastating vasospasm seen in patients with subarachnoid hemorrhage, so that the search for agents which counter this effect is of great clinical interest. Dr. Terence Myles completed his work toward a Master of Science thesis by extending the studies of prostaglandins to examining their effects when given by the subarachnoid route. His thesis will be submitted this summer.

Summaries of various phases of the prostaglandin investigations were reported at the International Conference in Vienna in September, 1972, and an International Congress for Cerebral Circulation in Philadelphia in June, 1973.

(d) *Computer Analysis of Cerebral Blood Flow Measurements:*

The interface with the PDP-12 computer in the Neurophysiology Laboratory, which is supported by MRC grants and was designed and built by the Instrumentation Section of the Brookhaven National Laboratory in Long Island, was now put into action. This was made possible by the close collaboration of Dr. Clive Hohberger, working with Dr. Lucas Yamamoto and Mr. Christopher Thompson. This now allows on-line values to be obtained for focal cerebral blood flow measurements at multiple sites over the cortex during the experimental procedure. In several instances the system was also used with success in the operating room during therapeutic surgery in patients with vascular lesions.

(e) *Cadmium-Tellurite Detector System:*

Dr. Yamamoto and Mr. Ernst Meyer have advanced further on the testing of these two solid-state detectors which theoretically provide more sensitivity and efficiency for gamma detection than the lithium drift and silicon detector systems. This technological advance will allow for lower levels of isotopes to be used and will eventually be an advantage in the experimental laboratory as well as in the operating room investigations. A secondary aim of this system is to produce a small enough detector which could be used for intravascular measurement of blood flow locally.

(f) *Cerebral Circulation in Trauma:*

Dr. Carl Dila and Dr. Louis Bouchard developed a method for producing controlled mild trauma to the cortex of the exposed dog brain. The immediate changes in local circulation were then examined by fluorescein angiography and measured by Xenon¹³³ studies. A significant finding in a number of animals was the rapid appearance of shunting with the presence of red veins. This interesting dynamic change in the circulation may be of significance in explaining transient neurological deficit and edema involving cerebral contusion. These studies will be continued under a Medical Research Council grant awarded to Dr. Dila.

Mr. Robert Vroom and Mr. Jean Lemieux initiated a most useful study of laminar flow in the epicerebral vessels during their tenure of summer studentship. Both these men, with a background in engineering, provided new insight into this fascinating problem of lamination or streaming in the cerebral blood vessels and brought together basic information in a bibliography which will serve as a useful background for further studies. We are again most appreciative for the expert help provided by Mrs. Andrea Duczyszyn, our research assistant, to Miss Pamela Bottomly, who has supervised the Brain Scan records, to Mr. George Lootus, who has been responsible for the expert maintenance of our electronic instrumentation and to Miss Cindy Delaney for her secretarial support in the research laboratory.

Neurological Research

LABORATORY FOR NEUROPHARMACOLOGY

<i>Head</i>	Allan L. Sherwin, M.D., Ph.D., F.R.C.P.(C)
<i>Post-Graduate Student</i> :... ..	Jill Fabricant-Hiatt, B.A., M.A. (Biology)
<i>Summer Students</i> :.....	David H. Gorman Christine L. White
<i>Technicians</i> :.....	Christine D. Sokolowski, B.Sc. (Chem.) Jacquelyn S. Loynd, B.A. Heather D. Hollis

The sphere of activity within our laboratory has widened in the past year to include the three main areas of interaction in the Institute and Hospital — service, training and research.

The laboratory performed quantitative gas chromatographic analysis of 1,800 blood samples from patients receiving anticonvulsant drugs. Some 300 of these samples were sent from other hospitals in Montreal as well as more remote areas of the Province. Since more than half of the samples are from out-patients, we are beginning to see a trend towards improved treatment of epilepsy on an ambulatory basis. Regular monitoring of blood levels of anticonvulsive drugs has been clearly shown in our laboratory and others to result in improved seizure control in many

patients with epilepsy. This year considerable renovations were carried out in the laboratory to improve its service function. Automation of the gas-liquid chromatography machine now enables samples from patients to be analyzed during the night, with results available the next morning. The efforts of Mrs. Shannon, Mr. Thomas, Mr. Rochette, and their expert staff in making these improvements possible are greatly appreciated.

Our laboratory has always trained neurologists in basic research — many of them for post-graduate degrees. In the coming year with the cooperation of Dr. Robb, we will also offer neurological fellows rotation in clinical neuropharmacology. This has proved to be of particular interest to neurologists who intend to work in the field involving the diagnosis and treatment of the epilepsies.

Basic research activities were also increased in the past year resulting in the completion of several major projects. Perhaps of greatest interest was the study showing a correlation of anti-convulsant drug levels in human plasma and the epileptogenic brain. This investigation — the first ever reported — was made possible by the cooperation of the entire team involved in the neurosurgical treatment of epilepsy. A significant correlation was observed between brain and plasma levels of phenobarbital and diphenylhydantoin, proving that drug levels in plasma can serve as an indicator of the actual concentration at their site of action—the cerebral cortex. Cortical electroencephalograms performed at the time of neurosurgical therapy were also analyzed by Dr. Eisen and compared with the actual brain drug concentration, determined independently by Miss Sokolowski. Mrs. Loynd and Miss White carried out studies on the degree of protein binding of anticonvulsants in new-born infants. The total blood levels were shown to be equal in mother and child. However, compared to adult plasma there was more free drug present in the infant owing to reduced protein binding of these drugs. Collaboration with Doctors Guberman and Gloor resulted in observations on the degree of therapeutic effectiveness of various anticonvulsant drugs on experimental epilepsy in the cat. This provides a new model for testing of recently developed anticonvulsants, especially those which may prove effective in the control of absence (petit mal) seizures.

Dr. Sherwin was co-chairman of the “Workshop on Laboratories for the Determination of Antiepileptic Drugs in Serum” held last November in New York City, and is serving in a similar capacity for the forthcoming International Meeting to be held in Germany next year.

LABORATORY FOR NEUROMUSCULAR RESEARCH

Head: George Karpati, M.D., F.R.C.P. (C)

Research Fellow: Calvin Melmed, M.D.

Technicians: Miss Carol Allen, B.Sc.
Mr. Robert White

Experimental study of skeletal muscle circulation has continued using morphological and physiological techniques. Dr. Melmed has started to evaluate methods which are best suited for the measurement of blood flow in skeletal muscle. The effects of a number of vaso-active agents, including two classes of prostaglandins, on skeletal muscle histochemistry and circulation are being evaluated. A model of chronic experimental skeletal muscle ischemia has been established in rats. Our experimental model of chronic motor neuronal overloading in rats has entered its third year. A systemic review of muscle histochemistry in our Duchenne dystrophy material was started and will be correlated with Dr. Stirling Carpenter's electronmicroscopic work on the same subject. A similar project on polymyositis is also underway. A study of peroxisomes and peroxidase systems in human skeletal muscle was initiated in the hope of establishing the role, if any, of these organelles in human muscle disease. The careful evaluation of our routine patient material continued to provide unusual and instructive research material, i.e. giant axonal neuropathy, phospholipid storage disease, etc.

The direct patient service of this laboratory has markedly increased and consisted of histochemical processing and interpretation of 152 muscle biopsies, 75 nerve biopsies and 84 skin biopsies.

MULTIPLE SCLEROSIS LABORATORY

Dr. J.B.R. Cosgrove

Dr. William Sheremata

Using the macrophage migration inhibition technique, we have accumulated evidence which suggests that there is a good correlation between cellular hypersensitivity to basic A-1 protein of human central nervous system in patients with acute exacerbations of illness in multiple sclerosis. The temporal sequence of events has been shown to differ from that seen with acute cerebral infarction, where sensitization occurs occasionally. Attempts to identify the portion of basic protein molecule responsible for such sensitization have been initiated. Hypersensitivity to basic protein of peripheral nerve in patients with Guillain-Barré Syndrome is also being studied. Virological investigations are being pursued in conjunction with the above studies.

Some of the above data will be presented at the International Neurological Congress in Spain, in September 1973.

With the cooperation of Dr. R. Hansebout, we have initiated a clinical study to determine the usefulness of the Bischoff's myelotomy procedure in the treatment of severe spasticity in multiple sclerosis. To date, ten patients have been studied and with more experience we hope to learn the optimum conditions for the proper selection of patients to undergo this surgery. At the time of operation, Dr. Hansebout has been able to obtain some biopsy material in some of the patients for electronmicroscopic

studies by Dr. Stirling Carpenter. Tissue has also been given to Dr. Somlo at the St. Mary's Hospital, where he has initiated studies to detect certain viruses.

In cooperation with the department of ophthalmology, a prospective study of retrobulbar neuritis continues.

Since Dr. William Sheremata has joined us and is helping in the multiple sclerosis clinic, we have tried to reorganize this clinic to make it a more multi discipline centre. Dr. Stillwell, from the department of physiatry and Dr. K. MacKinnon, from the department of urology are supplying their services on the same day as the clinic is held and this has led to better care for the patients, as well as better organization. A scheme has been initiated in the clinic, so that our records of clinical findings will be more consistent.

Problems

1. Power failure, due to power fluctuation has been a serious problem in our laboratory. With the expected use of air conditioners during the summer, these problems will no doubt increase.
2. Funding for research is becoming more acute. The granting agencies have smaller budgets to disburse and at the same time, wages and animal costs are soaring.
3. Space problems are acute.

Papers Presented

Sheremata, W.A.

Cellular Hypersensitivity in Multiple Sclerosis. (International Symposium on Immunosuppression in Multiple Sclerosis — by invitation). June 1973. Sponsored by the Merck Institute, Newark, N.J.

Sheremata, W.A. and Cosgrove, J.B.R.

The Role of Cell Mediated Hypersensitivity to Myelin Proteins in Multiple Sclerosis. (International Congress of Neurology, Barcelona, Spain). September, 1973.

Neuropsychology

Neuropsychologist and Medical

Research Council Associate.....

.. Brenda Milner, Ph.D., Sc.D. (Cantab)

Associate Neuropsychologist

.. Laughlin B. Taylor, B.Ed., M.Sc.

Canada Council Fellow.....

.. Giuseppe Scotti, M.D. (Milan)

Post-Doctoral Fellow.....

... Arnold Wilkins, Ph.D. (Sussex)
(from September 1972)

<i>Graduate Students</i>	Philip Corsi, M.A. (January-March) Marilyn Jones, M.A.
<i>Clinical Assistants</i>	Mary Kay Ajersch, M.A. (Western Ontario) Enda McGovern, B.A. (Dublin), Dip. Psych. (Dublin)
<i>Summer Students</i>	Ann Entus, B.A. (Sir George Williams) Monique Forget, B.A.

During the past year this department has played a prominent role in the research and teaching activities of the institute as well as in the clinical assessment of patients with focal cerebral lesions. In such cases the intracarotid Amytal technique continues to be an invaluable screening device, both for assessing preoperatively the lateralization of speech in left-handed and ambidextrous subjects and for evaluating possible risk to memory in the operation of unilateral temporal lobectomy in cases where there is evidence of bilateral temporal-lobe dysfunction. With Dr. Carl Dila, we have carried out over 50 such procedures this year, using the method of direct catheterisation of the internal carotid artery. We are most grateful to Dr. Ethier and his colleagues for their collaboration in this project.

One of our main goals has always been to assess the long-term effects of surgery for epilepsy in patients who are no longer having seizures. Dr. Milner has just reviewed the results for 42 such patients who were re-examined in follow-up study from 5 to 20 years later. She has demonstrated that the full-scale I.Q. is significantly higher in follow-up than it had been preoperatively, although there were residual highly specific deficits that varied depending upon the side and site of the original brain lesion. These findings provide further evidence of the harmful interfering effects of an active epileptogenic lesion upon the functions of neighbouring cortex.

Much of our research effort continues to focus on the memory functions of the temporal lobes. In August, 1972, Philip Corsi obtained the Ph. D. degree for his research on the role of the hippocampus in learning and memory. His discovery that the material-specific memory deficits associated with unilateral temporal-lobe lesions are aggravated by any extensive removal of the hippocampus indicates that where possible this structure should be spared in an unilateral temporal lobectomy.

This year, although the clinical load has increased, we have been better able to handle the service requirements, because two new clinical assistants, Mary Kay Ajersch and Enda McGovern, have joined the hospital staff. We were delighted that space could be provided for them on the fourth floor but our research staff are still experiencing great difficulty through overcrowding. Nonetheless, Dr. Arnold Wilkins has been able to set up some new experiments using rapidly paced tasks, which re-

quire the patients to process information as fast as possible. These techniques are already bringing to light subtle deficits that may have useful localising value in the clinic.

As in the past, we have benefited much from the interchange of ideas with colleagues from other countries and other disciplines. In particular, we were delighted to welcome Dr. Alvin Liberman, Dr. Norman Geschwind, and Dr. Hans Kornhuber, as visitors during the year. In July Dr. Milner took part in the Third International Programme in the Neurosciences at Boulder, Colorado, where she organized a series of papers on Hemispheric Specialization in Interaction. The choice of this topic reflects the lively interest aroused by the contrasting specialization of the two halves of the human brain. Dr. Milner and Mr. Taylor were therefore pleased to be able to return to California in March for an intensive testing period with patients who had undergone cerebral commissurotomy. We are indebted to Dr. R.W. Sperry for this opportunity to compare directly the memory capacities of the left and right cerebral hemispheres.

Neuroanatomy

<i>Neuroanatomist</i>	Donald G. Lawrence, M.D.
<i>Advisory Neuroanatomist</i>	Francis McNaughton, M.D.
<i>Teaching Associates</i>	Allan Morton, M.D., Ph.D. Charles Olanow, M.D., F.R.C.P.
<i>Graduate Student</i>	Janet Robbins, B.A.
<i>Technician</i>	Giovanni Gaggi

The traditional role of the neuroanatomy department in the organization, supervision and teaching of the CNS course was again this year under the devoted and tireless care of Dr. McNaughton. In this he was ably supported by Dr. Olanow who made a major contribution to the neuroanatomy lectures and tutorials. The assistance of many others, both lecturers and tutors, too numerous to mention, is gratefully acknowledged.

The CNS course will be taught largely in its present form to second year students in the fall of 1973. At the same time, however, the new curriculum will be introduced with the incoming first year class. Under the schedule for the new curriculum the CNS course is to take place in March through May of the first year, so that it will be given to first year rather than second year students. In view of this change in timing, it is felt that the scope and content of the CNS course must be reviewed and revised and this is now underway.

The research efforts of the laboratory are in an early stage of development. Dr. Lawrence came to the laboratory in January 1973 and with the invaluable assistance of Mr. Gaggi began the necessary task of cleaning out and reorganizing the rooms. Much of the equipment needed either to be cleaned and/or repaired or to have missing parts replaced. In addition it seemed essential to have some renovations made so as to provide adequate and well-lighted work areas. The renovations are in progress and the replacement parts are gradually arriving and being installed. In February, Mrs. Janet Robbins came to the laboratory following the completion of course requirements for an advanced degree in Anatomy. Since then work has been initiated on a study of the hitherto unknown efferent projections of a mesencephalic cell group which receives afferent projections from the motor cortex and globus pallidus. The study will be carried out using both silver and radioautographic methods for determining projection pathways. It is hoped that by this time next year there will be some results to report.

Tumour Registry

Dr. Arthur R. Elvidge

There were 229 cases, 86 new and 143 readmissions, of tumour and tumour suspect, directly and indirectly involving the nervous system, whose records have been processed by the Tumour Registry since 1972. These figures have been maintained at a fairly constant level over the past 3 years. They represent 10% of the total admissions to the Montreal Neurological Hospital. Seventy new and 25 recurring cases of tumour were verified on pathological examination. There were 82 surgical operations which figure includes 64 new cases and 18 readmissions. These form 10% of the total operative load of the hospital. Fifty-three patients, 36 new and 17 readmissions, were treated with roentgenotherapy. Of the 36 new patients, 11 were treated by radiation alone. There were 46 mortalities and autopsy was obtained in 14. The total number of clinic visits was 135.

The Tumour Registry was established in 1950, as a branch of the Central Tumour Registry of the Royal Victorial Hospital, under Dr. Tabah, and returns are made to the Central Tumour Registry of the Province of Quebec, which was established in 1961, and which has issued reports since 1962.

The function of the Tumour Registry is to obtain follow-up data upon all patients treated at the Montreal Neurological Hospital. Our follow-up is complete from 1950 for all types of tumour involving the Nervous System. In addition, for special projects, follow-up information has been obtained since 1928. This makes the study of long-term follow-up cases very important in the evaluation of treatment.

Throughout the years several Fellows have helped with problems of

tumour follow-up and much has been published. No further Fellow has been appointed as the Provincial Tumour Registry withdrew its financial support. Information is gathered from the clinics, offices of referring doctors and the Department of Demography of the province concerned by Mrs. Guthro, who is to be thanked for special talent and hard work in keeping the Registry files in order and contacting the various patients.

Library

Marina Boski, B.A., B.L.S.

The year just passed proved to be quietly busy. Conversion of the classification scheme went forward at a slightly slower pace than anticipated, due mainly to the amount of time which had to be devoted to purchasing and cataloguing new books, including the ever-growing number of books and periodical subscriptions ordered by almost all Departments.

A number of basic textbooks in various medical specialties was added to the collection and, judging by the amount of use, they seem to have filled a long-standing need.

The library staff was also kept increasingly busy providing loans and reference service in the field of neurosciences to other libraries in Montreal and beyond.

While in recent years lack of funds was our most pressing problem, another of almost equal importance must now be faced: a critical shortage of space. Some older materials have had to be stored in almost inaccessible places within the building, and yet the problem looms as large as before. At the current rate of expansion we shall be out of shelf space by the end of this calendar year.

Montreal Neurological Society

President Dr. J. Cartier-Giroux

Vice-President Dr. D.W. Baxter

Secretary-Treasurer Dr. R.R. Hansebout

The Society officers for the 1973-74 year are: President, Dr. D.W. Baxter; Vice-President, Dr. N. Giard; Secretary-Treasurer, Dr. R.R. Hansebout.

During the past year, meetings were held once a month from October 1972 through May 1973. The meetings were hosted by the Montreal Neurological Institute, the Notre-Dame Hospital, and the Montreal Children's Hospital. Following the meetings membership was entertained at brief social periods provided by the host hospital.

A meeting of the Society was held at the Chateau Frontenac Hotel in Quebec on the occasion of the regional meeting of the Royal College of Physicians and Surgeons of Canada. Members and guests gave talks on various subjects. Following this meeting, an informal dinner was held at Le Continental.

Papers read before the Society were as follows:

DR. GUY L. ODOM, Professor of Neurological Surgery, Duke University Medical Center, Durham, North Carolina: "Cerebral Vasospasm".

DR. JOHN E. BLUNDELL, Associate Professor in Dept. of Neurology and Neurosurgery, Director of Subdepartment of Neurosurgery, Montreal Children's Hospital, Montreal, Quebec: "Epidural Hematomas in Childhood".

DR. N. PAUL ROSMAN, Professor of Pediatrics and Neurology, Director of Pediatric Neurology, Boston University School of Medicine, Boston City Hospital, Boston, Mass.: "Effects of Hypothyroidism and Malnutrition on Developing Brain and Skeletal Muscle".

DR. PEDRO MOLINA-NEGRO, Professor Agrégé, Université de Montréal, Montreal, Quebec: "Etudes des réflexes musculaires et du réflexe H dans les hypertopies chez l'humain".

DR. THOMAS H. NEWTON, Chief of Neuroradiology, University of California, San Francisco: "Arteriovenous Malformations".

The Annual Dinner of the Society was held on May 25, 1973 at the Mount Stephen Club.

Fellows Society

President Michel Aubé, M.D.

Vice-President John Romine, M.D.

Secretary Alberto Rhi-Sausi, M.D.

The Fellows' Society completed the year without a financial deficit. The activities were restricted to the traditional functions, including the annual pool party organized by the Wives' Club, and a mid-year house-party.

The main event of the year was the Annual Fellows' Lecture and Banquet held in June, with Dr. Claude Bertrand, a former Fellow, now Neurosurgeon-in-Chief at the Notre-Dame Hospital, being the guest speaker. He reviewed his contributions in the field of stereotaxic surgery, and its application to a number of important neurological disorders. After a brief wine party at the M.N.I., the banquet was held at the Hotel Bonaventure with the wives being present as a new venture.

Dr. Leon Ravvin and Dr. Neil Schaul were representatives of the Fellows at the Joint Education Committee and Residents' Syndicate. Since several changes in the *modus vivendi* of the average Fellow have

occurred in the past few years, we believe it is time that the Fellows' Society might have a review of its status and field of interests. Elections of new officers will be held in September.

MNI Wives' Club

1972-73

President Eileen Fewer *Secretary* Cindy Musgrave

Vice-President Caroline Drake *Treasurer* Brenda Murray

The Wives' Club had another active year with a variety of activities. New Fellows and their wives were welcomed at the beginning of the year with a poolside barbecue. In September we held our business meeting at the home of Mrs. Feindel. At this meeting plans for the Silent Auction were discussed in order to raise funds for needy Neuro patients and their families. During our October gathering, held at the home of Mrs. Sherwin, further craft ideas were shared.

The auction was held in November in the MNH Conference Room and yielded \$285.00. Miss Cynthia Griffin, Social Service Director, gratefully received our contribution on behalf of the hospital and patients. The annual Children's Christmas party featured a ventriloquist, jolly Santa and Christmas goodies.

In February Mrs. Claude Bertrand, wife of the Chief of Neurosurgery at Notre Dame Hospital, treated us to an evening at her home to view her collection of French Canadian furniture. In March at a joint meeting with the Royal Victoria Wives' Club, Dr. Warnes, Chief of Psychiatry at St. Mary's Hospital led a discussion on the topic of "Doctors and Doctors' Wives". The final meeting, held at the home of Mrs. Gilles Bertrand, was the annual potluck supper.

Throughout the year our two interest groups: Visage Quebecois, led by Mrs. Andre Olivier, and the Book Club, organized by Mrs. Francis McNaughton, held several meetings.

We appreciate the efforts of Mrs. Gordon Mathieson who served as editor of the Femmemni (our Newsletter), Mrs. Theodore Rasmussen who was Chairman of the phone committee, and Mrs. Davy Trop who was the welcoming Chairman.

The Wives' Club would like to thank our advisers, Mrs. Feindel and Mrs. Rasmussen, for their assistance throughout the year.

The Officers for 1973-74 are:

President Pam Ball *Secretary* Sue Terry

Vice-President Joan Kuchner *Treasurer* Shirley Epps

Clinical Training Opportunities

NEUROLOGY

The Department of Neurology and Neurosurgery of McGill University offers opportunities for clinical training in Neurology in the four major McGill Teaching Hospitals — The Montreal Neurological Hospital, the Royal Victoria Hospital, the Montreal General Hospital, and the Montreal Children's Hospital — and the Jewish General Hospital.

Residency training is available at three levels and is open to graduates who have completed a year of internship and a year of Internal Medicine at approved hospitals:

Assistant Resident (1 year)

Resident (1 year)

Teaching Fellow (1 year)

The Assistant Resident and Resident appointments are each divided into two six-month periods, with rotations arranged among the McGill Hospitals.

The Teaching Fellow appointment offers a third year of clinical experience open to candidates who have completed their earlier training in this Department.

Laboratory training fellowships are available in Electroencephalography, Clinical Neurophysiology and Neuropathology. Appointments are usually made for periods of twelve months, though some appointments may be for six-month periods.

Other Departmental Laboratories will accept Fellows for graduate training by individual arrangement. Residents and Fellows may attend the graduate courses listed below by individual arrangement.

A limited number of training stipends are provided by the Quebec Hospital Insurance Service and from Institute funds.

Appointments are usually made about one year in advance, with July 1st, the usual starting date.

Applications for all the above appointments should be made to the Director, Montreal Neurological Institute, 3801 University Street, Montreal H3A 2B4, P.Q.

NEUROSURGERY

The Department of Neurology and Neurosurgery of McGill University offers opportunities for clinical training in Neurosurgery in three of the major McGill Teaching Hospitals, the Montreal Neurological Hospital, The Montreal General Hospital and the Montreal Children's Hospital.

The initial appointment is normally made to one of the Institute's Laboratories for a six or twelve-month period. An internship and/or a year of general surgical training in an approved hospital is required.

The Assistant Resident appointments are divided into six-month periods with rotation among the three Neurosurgical Services at the Montreal Neurological Hospital and the Neurosurgical Service at the Montreal General Hospital. The Resident appointments, six and twelve-months in duration, are rotated among the McGill Teaching Hospitals listed above.

The various Departmental Laboratories will accept Fellows for graduate training by individual arrangement. Residents and Fellows may attend the graduate courses listed below by individual arrangement.

A limited number of training stipends are provided by the Quebec Hospital Insurance Service and from Institute funds.

Appointments are usually made about one year in advance, with July 1st, the usual starting date.

Applications for all the above appointments should be made to the Director, Montreal Neurological Institute, 3801 University Street, Montreal H3A 2B4, P.Q.

Courses of Instruction

UNDERGRADUATE

The Department of Neurology and Neurosurgery cooperates closely with the Department of Medicine, Surgery, Pathology, Anatomy and Radiology in their undergraduate teaching. Thus the teaching of neurology, neurosurgery, neuropathology, neuroanatomy and neurological radiology is carried out as part of the regular course planned by the Chairman of each of the above departments. See McGill booklet "Faculty of Medicine". Electives are available in clinical and laboratory subjects. See McGill Booklet "Elective Catalogue".

GRADUATE

In the Faculty of Graduate Studies and Research, courses are offered leading to the degree of Master of Science and Doctor of Philosophy. See McGill booklet "Faculty of Graduate Studies and Research".

Throughout the year, the following elective courses are given for graduate students, Fellows and members of the house staff, and are open to undergraduates by arrangement.

NEUROSCIENCES SEMINAR

G531-602H This is a course of weekly seminars, given during the academic year, designed to present over a 2-year period a concise, up-to-date review of the basic neurological disciplines. Mondays, 4:30 — 6:00 p.m. Professors Gloor, Wolfe, Feindel, Sherwin and other members of the Departments of Neurology and Neurosurgery, and related McGill Departments

NEUROPHYSIOLOGY

- G531-610A Lectures, together with undergraduate Neurology and Neurosurgery Course 2A "Anatomy and Physiology of the Central Nervous System".
- G531-611A Seminars and group discussions in Neurophysiology. Professor Gloor

NEUROANATOMY

- G531-620A Advanced Neuroanatomy for selected group, by special arrangement.
- G531-621A Seminars and group discussions correlated with Course G531-602H Professors Lawrence and Staff

CLINICAL CONFERENCES

- G531-630H Colloquium in clinical and basic aspects of the nervous system. Wednesdays 8:30 p.m. monthly during the Academic Year. Staff and Visiting Lecturers
- G531-631 Seizure and EEG conference — alternate Thursdays 5:30 p.m. Professors Robb, Andermann, Rasmussen, Gloor, Milner and Ethier

NEUROCHEMISTRY

- G531-640H Seminars in Neurochemistry in addition to that provided in Course G531-602H. By special arrangement. Professors Wolfe and Pappius

NEUROPATHOLOGY

- G531-650H Six of twelve months laboratory work in Neuropathology.
- G531-651H Conference in Neuropathology, alternate Thursdays, 4:30 — 5:30 p.m.
- G531-652A Introduction to Histopathology of the Nervous System, a short basic course for a limited number. By special arrangement. Professors Mathieson and Carpenter

NEURORADIOLOGY

- G531-660H Practical instruction in techniques and interpretation.
- G531-661A Lecture demonstration (3 months in the fall), Mondays 4:30 — 5:30 p.m. Professors Ethier and Melançon

ELECTROENCEPHALOGRAPHY AND CLINICAL NEUROPHYSIOLOGY

- G531-670H Laboratory work in Electroencephalography (minimum-6 months with active participation, seminars and clinical conferences). Professor Gloor

NEUROPSYCHOLOGY

- G531-680H Training and research methods for selected graduate students. Professors Milner and Taylor

MONTREAL NEUROLOGICAL INSTITUTE
AND
MONTREAL NEUROLOGICAL HOSPITAL

Publications

1972-73

- ANDERMANN, F., ROBB, P.: Absence Status: A reappraisal following review of thirty-eight patients.
Epilepsia, v.13, 1972, pp. 177-187.
- BERTRAND, G.: L'activité cellulaire des noyaux ventral latéral et ventral postérieur du thalamus humain: ses rapports avec la fonction motrice normale et anormale.
Revue Canadienne de Biologie, v. 31, 1972, Spring Suppl; pp. 273-286.
- BERTRAND, G.: Dynamic factors in the evolution of syringomyelia and syringobulbia.
Clinical Neurology, v.20, 1973, chap. 26.
- BRECKENRIDGE, C., WOLFE, L.S.: The effect of dolichol phosphate on the synthesis of lipid bound sugars in embryonic chickbrain.
FEBS Letters, v. 29, 1973, p.66.
- CARPENTER, S., KARPATI, G., WOLFE, L.S., ANDERMANN, F.: A type of juvenile cerebromacular degeneration characterized by granular osmiophilic deposits.
Journal of the Neurological Sciences, v. 18, 1973, p. 67-87.
- CARPENTER, S., KARPATI, G., MELANCON, D., JOUBERT, M., ANDERMANN, F., ANDERMANN, E.: Familiar agenesis of the corpus callosum with anterior horn cell disease: a syndrome of mental retardation, areflexia and paraparesis.
Transactions of the American Neurology Association, v.97, 1972, pp. 242-244.
- CLARKE, J.T.R., GUTTMAN, R.D., WOLFE, L.S., BEAUDOIN, J.G., MOREHOUSE, D.D.: Enzyme replacement therapy by renal allotransportation in Febry's disease.
New England Journal of Medicine, v.287, 1972, p.1251.

- EISEN, A., BERTRAND, G.: Isolated accessory nerve palsy of spontaneous origin.
Archives of Neurology, v.27, 1972, p.496.
- GLOOR, P.: Temporal lobe epilepsy: its possible contribution to the understanding of the functional significance of the amygdala and of its interaction with neocortical-temporal mechanisms.
In: *Symposium on the neurobiology of the amygdala*, Bar Harbor, Maine, 1971. New York, Plenum Press, 1971, pp. 423-457.
- GLOOR, P.: Generalized spike and wave discharges: a consideration of cortical and subcortical mechanisms, of their genesis and synchronization.
In: *Synchronization of EEG Activity in Epilepsies*. Petsche, H., Brazier, Mary A.B., eds. Springer-Verlag, 1972, pp. 382-403.
- HECKER, A., ANDERMANN, F. RODIN, E.A.: Spitting automatism in temporal lobe seizures — with a brief review of ethological and phylogenetic aspects of spitting.
Epilepsia, v.13, 1972, pp.767-772.
- JELL, R.H., GLOOR, P.: Distribution of thermosensitive and non-thermosensitive preoptic and anterior hypothalamic neurons in unanesthetized cats and effects of some anesthetics.
Canadian Journal of Physiology & Pharmacology, v.50, 1972, pp.890-901.
- KARPATI, G., CARPENTER, S., EISEN, A.A.: Experimental core-like lesions nemaline rods.
Archives of Neurology, v.27, 1972, pp.237-251.
- KARPATI, G., CARPENTER, S., LARBRISSEAU, A., LAFONTAINE, R.:
The Kearns-Shy Syndrome, a multisystem disease with mitochondrial abnormality demonstrated in skeletal muscle and skin.
Journal of the Neurological Sciences, v.715, 1973; pp.133-151.
- LEBLANC, F.E., RASMUSSEN, T.: Cerebral seizures and brain tumours.
Handbook of Clinical Neurology, v.15, 1973.
- MILNER, B., TAYLOR, L.: Right hemisphere superiority in tactile pattern recognition after cerebral commissurotomy: evidence for non-verbal memory.
Neuropsychologia, v.10, 1972, pp.1-15.

- MILNER, B.: Disorders of learning and memory after temporal lobe lesions in man.
Clinical Neurosurgery, v.19, 1972, pp.421-446.
- MITRA, J., GLOOR, P., JELL, R.: Effect of nasopharyngeal temperature change on preoptic and anterior hypothalamic thermosensitive units.
Canadian Journal of Physiology & Pharmacology, v.50, 1972, pp.445-457.
- NUTIK, S.L.: Convergence of cutaneous and preoptic region thermal afferents on posterior hypothalamic neurons.
Journal of Neurophysiology, v.36, 1973, pp.228-249.
- NUTIK, S.L.: Posterior hypothalamic neurons responsive to preoptic region thermal stimulation.
Journal of Neurophysiology, v.36, 1973, pp. 238-249.
- PACE-ASCIAK, C., WOLFE, L.S., GILLETT, P.G., KINCH, R.A.: Disappearance of prostaglandin F_{2a} from human amniotic fluid after intra-amniotic injection.
Prostaglandins, v.1. 1972, pp. 469-477.
- PACE-ASCIAK, C.: Prostaglandin synthetase activity in the rat fundus. Activation by L-Norepinephrine and related compounds.
Biochemica et Biophysica Acta, v. 280, 1972, pp. 161-171.
- PAPPIUS, H.M.: The chemistry and fine structure in various types of cerebral edema. *Rivista de Patologia Nervosa e Mentale*.
In: *Symposium on selected topics in human chemical neuropathology*. Milan, Italy, Sept. 1969. International Society for Neurochemistry.
- PAPPIUS, H.M.: Evidence regarding the action of steroids in injured spinal cord.
In: *Steroids and brain edema*, New York, Springer-Verlag, 1972, pp. 153-155.
- PAPPIUS, H.M.: Effects of ischemia on water and electrolyte content of cerebral tissues.
In: *Steroids and brain edema*, New York, Springer-Verlag, 1972, pp. 123-125.
- PAPPIUS, H.M.: Studies on the mechanisms of action of steroids in traumatized brain.
In: *Steroids and brain edema*, New York, Springer-Verlag, 1972, pp. 147-151.

PAPPIUS, H.M.: Effects of steroids on cold injury edema.
In: *Steroids and brain edema*, New York, Springer-Verlag, 1972,
pp.57-63.

PENFIELD, W.: Herbert H. Jasper.
In: *International Symposium in Neurosciences in honour of Herbert H. Jasper. Colloque international en sciences neurologiques en hommage à Herbert H. Jasper*, Mont Tremblant, Québec, 1970,
edited by Jean Pierre Cordeau and Pierre Gloor. Amsterdam, Elsevier, 1972. (Electroencephalography and Clinical Neurophysiology, Supp. 31).

PENFIELD, W.: The electrode, the brain and the mind.
Neurology, v.201, 1972, pp.297-309.

RASMUSSEN, T., MATHIESON, G., LEBLANC, F.: Surgical therapy of typical and a forme fruste variety of the Sturge-Weber syndrome.
Archives Suisses de Neurologie, Neurochirurgie et Psychiatrie, v.3, 1972, pp. 393-409.

RASMUSSEN, T.: Dr. Wilder Penfield.
Surgical Neurology, v.1, March 1973, p.67.

RASMUSSEN, T.: Seizures with local onset and elementary symptomatology.
Handbook of Clinical Neurology, v.15, 1973.

ROBB, P., SHERWIN, A.: Clinical pharmacology of ethosuximide in absence seizures.
In: *Transactions of the American Neurology Association*, v.97, 1972, pp.338-340.

SHEREMATA, W.A., BEHAN, P.O.: Experimental Allergic Neuritis: A new experimental approach.
Journal of Neurology, Neurosurgery and Psychiatry, v.36, 1973, pp. 139-145.

SHEREMATA, W.A., SHERWIN, A.: Alcoholic myelopathy with spastic urinary bladder.
Diseases of the Nervous System, v. 33, 1972, pp. 136-139.

- SHEREMATA, W.A., DEONNA, T., ROMANAL, F.C.R.: Agenesis of corpus callosum and interhemispheric transfer of information. *Neurology*, v. 23, 1973, p. 390.
- VAN GELDER, N.M., SHERWIN, A.L., RASMUSSEN, T.: Amino acid content of epileptogenic human brain: focal versus surrounding regions. *Brain Research*, v.40, 1972, pp. 385-393.
- WOLFE, L.S., CLARKE, J.T.R., SENIOR, R.G.: Biochemical studies on G_{m1}-Gangliosidosis and ceramide trihexosidosis. In: *International Symposium on sphingolipids, sphingolipidoses and allied disorders*, 4th, Kingsbrook Jewish Medical Center, 1971. Edited by Bruno W. Wolk and Stanley Aronson. New York, Plenum Press, 1972, pp. 373-384.
- YAMAMOTO, Y.L., FEINDEL, W.H., WOLFE, L.S., HODGE, C.P.: Prostaglandin induced vasoconstriction of cerebral arteries and its reversal by ethanol. In: *International Conference on Prostaglandins*, Vienna, 1972. Proceedings. Edited by S. Bergstrom. (Advances in the Biosciences, v.9, p.359.).

AUDITORS' REPORT

To the Board of Management,
Montreal Neurological Hospital.

We have examined the balance sheet of the Montreal Neurological Hospital as at December 31, 1972 and the statements of operations, general fund deficit and plant fund capital for the year then ended. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

Except that payments to the Hospital under the Hospital Insurance Act are subject to adjustments arising from a subsequent review by the Minister of Social Affairs, as described in Note 1 to the financial statements, in our opinion these financial statements present fairly the financial position of the Hospital as at December 31, 1972 and the results of its operations for the year then ended, in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Montreal, Que.
May 3, 1973.

Touche, Ross & Co.
Chartered Accountants

MONTREAL NEUROLOGICAL HOSPITAL

(Incorporated by Private Act under the laws of the Province of Quebec)

BALANCE SHEET AS AT DECEMBER 31, 1972

GENERAL FUND

	<u>1972</u>	<u>1971</u>
ASSETS		
Cash	\$ 186,026	\$ 9,216
Accounts receivable—less provision for doubtful accounts	318,636	393,413
Due from Government of Quebec—retroactive pay —grant	56,200 90,000	— 90,000
Inventory of supplies at cost	115,384	71,924
	<u>766,246</u>	<u>\$ 564,553</u>
LIABILITIES		
Accounts payable	\$ 151,719	\$ 67
Due to Royal Institution for the Advancement of Learning		
Current account	614,527	564,486
Advances to cover deficit	633,032	336,161
DEFICIT (Note 1)	(633,032)	(336,161)
	<u>\$766,246</u>	<u>\$564,553</u>

PLANT FUND

ASSETS		
Cash	\$ 4,039	\$ 92,325
Due from Government of Quebec	41,866	—
Fixed assets, at cost (Note 3)		
Equipment	\$1,461,155	
Less: Accumulated depreciation	(740,347)	
	<u>720,808</u>	<u>636,466</u>
	<u>\$ 766,713</u>	<u>\$ 728,791</u>
LIABILITIES		
Due to Royal Institution for the Advancement of Learning	\$ 45,905	\$ 11,609
Advances from the Government of Quebec	—	80,716
Capital	720,808	636,466
	<u>\$ 766,713</u>	<u>\$ 728,791</u>

MONTREAL NEUROLOGICAL HOSPITAL

STATEMENT OF GENERAL FUND DEFICIT FOR THE YEAR ENDED DECEMBER 31, 1972

	<u>1972</u>	<u>1971</u>
BALANCE AT THE BEGINNING OF THE YEAR	\$ 336,161	\$ 600,826
Deduct:		
Settlements from Government of Quebec on account of 1968, 1969 and 1970	—	567,363
Advances from Government of Quebec on account of 1971	59,687	—
Adjustment of prior years' deficit	827	908
	275,647	32,555
Add:		
Salary adjustments retroactive to 1968, 1969 and 1970	—	22,971
Salary adjustment retroactive to 1971	59,687	—
Deficit for the year	297,698	280,635
BALANCE AT END OF THE YEAR (Note 1)	\$ 633,032	\$ 336,161

STATEMENT OF PLANT FUND CAPITAL FOR THE YEAR ENDED DECEMBER 31, 1972

	<u>1972</u>	<u>1971</u>
BALANCE AT BEGINNING OF THE YEAR	\$ 636,466	\$ 663,053
Increase in plant capital	175,664	57,983
	812,130	721,036
Less: Depreciation on equipment	91,322	84,570
Balance at end of the year	\$ 720,808	\$ 636,466

STATEMENT OF OPERATIONS
FOR THE YEAR ENDED DECEMBER 31, 1972

	<u>1972</u>	<u>1971</u>
INCOME:		
Revenue from Government of Quebec (Note 1)	\$ 3,456,365	\$ 2,757,403
Revenue from patients	1,172,974	1,346,201
Grants — Government of Quebec	90,000	90,000
— City of Montreal	67,500	67,500
Other income	17,668	20,198
	4,804,507	4,281,302
EXPENSES:		
Salaries and wages	3,729,026	3,371,756
Drugs, medical and surgical supplies	214,399	211,816
Services and Supplies	1,158,780	978,365
	5,102,205	4,561,937
Deficit for the year	\$ 297,698	\$ 280,635

NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 1972

1. Government of Quebec

Revenue under the Hospital Insurance Act is based on the 1972 global budget of expenditures and offset income as approved by the Department of Social Affairs. The revenue for the year represents only the interim payments and does not include the year-end adjustment of offset income, which will be recorded only when it is received. The Act provides that the Minister of Social Affairs may review the actual expenditures of the Hospital to determine the amount by which actual expenditures for insured services is greater or less than the interim payments received from the Service in respect of that year. The deficit for the year as shown in the financial statements is subject to adjustments arising from such review and determination. Adjustments of deficits up to and including the year 1970 have been settled with the Quebec Department of Social Affairs.

2. Contingent Liability

Employees' accumulated sickness benefits, which are recoverable from the Department of Social Affairs when paid, amounted to \$287,000 at December 31, 1972. These sickness benefits are payable when an employee terminates his services and are expensed at that time.

3. Commitments

The hospital has placed orders for radiology equipment to the value of \$363,000. This expenditure has been approved by the Department of Social Affairs and the funds will be recovered from the Department when spent.

**MONTREAL NEUROLOGICAL HOSPITAL
RESEARCH AND TEACHING EXPENDITURE SUMMARY
FOR THE YEAR ENDING DECEMBER 31, 1971**

	1972
M.N.I. — Endowment Funds.	\$ 420,293.
M.N.I. — Special Funds and Donations.	351,444.
General University Funds.	13,600.
Research and Fellowship Grants.	336,539.
	\$ 1,121,876.

ENDOWMENTS

- 1934 — Rockefeller Endowment
- 1951 — Donner Canadian Foundation Grant
- 1954 — Lily Griffith McConnell Endowment
- 1957 — Hobart Anderdon Springle Memorial Endowment
- 1958 — Rupert Bruce Memorial Endowment
- 1959 — Percy R. Walters Memorial Endowment
- 1960 — William Cone Memorial Endowment
- 1963 — Walter Chamblet Adams Memorial Endowment
- 1964 — MNI Research Endowment Fund
- 1966 — Izaak Walton Killam Memorial Endowment
- 1969 — Sophie M. C. Letang Memorial Endowment
- 1972 — Senator and Mrs. Lorne Webster Memorial Endowment

FELLOWSHIP ENDOWMENTS

- 1948 — Duggan Fellowship
- 1950 — Lewis L. Reford Fellowship
- 1956 — Dr. and Mrs. Charles F. Martin Fellowship
- 1966 — Izaak Walton Killam Memorial Fund for Advanced Studies

GRANTS FOR SPECIAL PROJECTS

- Medical Research Council of Canada Grants — Dr. Carpenter
 - Dr. Feindel
 - Dr. Gloor
 - Dr. Hansebout
 - Dr. Milner
 - Dr. Olivier
 - Dr. Pappius
 - Dr. Sherwin
 - Dr. Wolfe
 - Dr. Woods
- Medical Research Council of Canada Associateships — Dr. Milner
 - Dr. Wolfe
- Quebec Medical Research Grants — Dr. Olivier
 - Dr. Sheremata
- Muscular Dystrophy Association Research Grants — Dr. Carpenter
 - Dr. Karpati

DONATIONS TO SPECIAL FUNDS — 1972-73

ANAESTHESIA RESEARCH FUND:

BRAIN RESEARCH FUND:

Mr. A. Murray Vaughan	\$ 1,000.00
---------------------------------	-------------

CANCER CLINICAL RELIEF FUND:

In His Name Society	20.00
-------------------------------	-------

WILLIAM CONE MEMORIAL RESEARCH FUND:

Mrs. Hugh C. Bradley (in Memory of the Late Mrs. A.D. Crews)	20.00
------------------------------------------------------------------------	-------

Mr. Kenneth H. Brown	50.00
--------------------------------	-------

Mrs. Edith L. Dawson (in Memory of the Late Miss Gail Budd)	25.00
-----------------------------------------------------------------------	-------

Colonel Kennan B. Jenckes	150.00
-------------------------------------	--------

Mr. Hugh G. Seybold	50.00
-------------------------------	-------

Mrs. E. Percy Roberts (in Memory of the Late Miss Irene Rowe)	25.00
-------------------------------------------------------------------------	-------

COSGROVE RESEARCH FUND:

Anonymous	50.00
---------------------	-------

Mr. J.A. de Lalanne	200.00
-------------------------------	--------

DICK EPILEPSY FUND:

Anonymous (balance of May 1972 donation)	5,644.96
----------------------------------------------------	----------

GORDON LIBRARY FUND:

HARVEY CUSHING CLINICAL RELIEF FUND:

Women's Auxiliary of the Royal Victoria Hospital	2,500.00
------------------------------------------------------------	----------

Mrs. M. Blanchart	5.00
-----------------------------	------

Mrs. Maureen McAlary	15.00
--------------------------------	-------

M.N.I. Women's Society	280.54
----------------------------------	--------

Miss Lillian Sandler	35.00
--------------------------------	-------

Miss Janet Shapiro	15.00
------------------------------	-------

HOSPITAL EQUIPMENT FUND:

MARY MASSABKY FOUNDATION RESEARCH FUND:

MISCELLANEOUS SPECIAL FUNDS:

In Memory of the Late Mrs. Anna Andermann	25.00
-----------------------------------------------------	-------

In Memory of the Late P. Archambault	30.00
------------------------------------------------	-------

In Memory of the Late Mr. Edward Bates	15.00
--------------------------------------------------	-------

In Memory of the Late Mr. Max Bell	75.00
----------------------------------------------	-------

In Memory of the Late Mrs. Marjorie Blanchart	110.00
---------------------------------------------------------	--------

In Memory of the Late Mrs. Violet Edwards	10.00
-----------------------------------------------------	-------

In Memory of the Late Mrs. Margaret R. Ervein	10.00
---------------------------------------------------------	-------

In Memory of the Late Mr. Gus Garber	15.00
------------------------------------------------	-------

In Memory of the Late Mrs. Eleanor Gartrell and the Late Mr. Irving Gartrell	80.00
-------------------------------------------------------------------------------------------	-------

In Memory of the Late Rabbi Marvin Joel Goldfine (donated by Mrs. Jack Gottheil)	500.00
-----------------------------------------------------------------------------------------------	--------

In Memory of the Late Mr. Kevin Hanley	13.00
--------------------------------------------------	-------

In Memory of the Late Mrs. Marnie Hayes	5.00
---------------------------------------------------	------

In Memory of the Late Mr. Thomas Hilton	207.00
---------------------------------------------------	--------

In Memory of the Late Miss Rebecca Ann Howard	105.50
---------------------------------------------------------	--------

In Memory of the Late Mr. Albert Meyer	10.00
--------------------------------------------------	-------

In Memory of the Late Mr. James McGlynn.
In Memory of the Late Mr. Kenneth F. McNamee.
In Memory of the Late Mr. Randy Price.
In Memory of the Late Mrs. Ruth Reitman.
In Memory of the Late Fl./Capt. Lloyd George Scharfe.
In Memory of the Late Mr. Roy Taylor
In Memory of the Late Mrs. Mabel Dorothy Thomas.
In Memory of the Late Mrs. Grace Trudeau
In Memory of the Late Mrs. Louise Schoenfeldt.

M.N.I. BUILDING FUND:

M.N.I. NEUROSURGICAL RESEARCH FUND:

Mrs. Magda Nagylaki.
Mr. Joseph Barzyk.
Mrs. Ruth E. Van Luven.
In Memory of the Late Commander Rowland Stokes-Rees.
In Memory of the Late Stéphane Gendron.

M.N.I. PARKINSON'S DISEASE FUND;

M.N.I. STAFF LOAN FUND;

MULTIPLE SCLEROSIS CLINICAL RELIEF FUND;

Montreal Association for Multiple Sclerosis.
Multiple Sclerosis Golf League.
Mr. Norman V.J. Smith.

MULTIPLE SCLEROSIS RESEARCH FUND:

Miss Suzanne Huard.

McNAUGHTON NEUROANATOMY RESEARCH FUND:

FRANCIS McNAUGHTON NEUROLOGICAL RESEARCH FUND:

Anonymous.
Mrs. Rita Breitman.
Mr. F. Donald Graham.
Mr. Edward Norsworthy.
Mrs. Norman Ogilvie (in Memory of her Late Husband).
Dr. Preston Robb.
Mr. Sidney M. Ross.
Mrs. Mary Timmins.
Mr. J. Clare Wilcox.

NEUROLOGICAL RESEARCH FUND:

Estate of the Late Mr. Solomon Weitzman.
Miss Mildred Flynn.
Mrs. Peter M. Laing.
Mr. Bennett Little.
The J.W. McConnell Foundation.
Northern Engineering and Supply Co. Ltd. (Board of Directors and Staff).
Mr. A.G. Pryde.
Mr. Archie Richstone.

NEUROPHYSIOLOGY RESEARCH FUND:

NEURORADIOLOGY RESEARCH AND TEACHING FUND:

NURSING FUNDS:

EILEEN C. FLANAGAN NURSING BURSARY FUND:

M.N.I. NURSING EDUCATION FUND:

Women's Auxiliary of the Royal Victoria Hospital.

500.00

OAKLAWN FOUNDATION FELLOWSHIP FUND:

PENFIELD AWARD FUND:

PENFIELD PORTRAIT FUND:

Dr. George M. Austin

Dr. Claude Bertrand

Dr. Murray Bernstein

Dr. Allan Bird

Dr. W. F. Caveness

Dr. Carlo Cazzulo

Dr. Charles Cure

Dr. Kenneth Earle

Dr. Martin Entin

Dr. William Feindel

Dr. Herman Flanigan

Dr. Miller Fisher

Dr. J. Droogleever Fortuyn

Dr. E. M. Fountain

Dr. Henry D. Garretson

Dr. William Gibson

Dr. Ram Ginde

Dr. Bernard Graham

Dr. Jake Hanberry

Dr. Ira Jackson

Dr. Kristian Kristiansen

Dr. Revis Lewis

Dr. Choh Loh Li

Dr. James Markham

Dr. John Sterling Meyer

Dr. William Meacham

Dr. Sean Murphy

Dr. Francis O'Brien

Dr. Edwardo C. Palma

Dr. Theodore Rasmussen

Dr. Harold J. Rosen

Dr. Robert A. Sears

Dr. Julius Stohl

Dr. Joseph Stratford

Dr. Roy I. Swank

Dr. John M. Van Buren

Dr. Keasley Welch

Dr. Delbert Wollin

PENFIELD RESEARCH FUND:

RASMUSSEN PORTRAIT FUND:

Dr. Jesse Barber

Dr. Bartolo Barone

Dr. Emile Berger

Dr. Claude Bertrand

Dr. Gilles Bertrand

Dr. Charles Branch

Dr. Joseph P. Evans

Dr. E. M. Fountain

Dr. Henry Garretson

Dr. Leslie Geiger

Dr. William Gibson

Dr. Ram Ginde

Dr. M. Gueramy

Dr. J. Gybels

Dr. Fuad Haddad

Dr. E. Hurteau

Dr. Ellis Keener

Dr. Victor Kleider

Dr. Kristian Kristiansen

Dr. Revis Lewis

Dr. William Meacham

Dr. Guy Morton

Dr. Sean Mullan

Dr. Rosario Musella

Dr. Blaine Nashold

Dr. Francis O'Brien

Dr. Guy Odom

Dr. Armando Ortiz

Dr. Mark Rayport

Dr. Alan Rothballer

Dr. Richard Rovit

Dr. Prakash Tandon

Dr. Gordon Thompson

REUBEN RABINOVITCH MEMORIAL FUND:

REUBEN RABINOVITCH MEMORIAL LIBRARY FUND:

LEWIS REFORD FELLOW'S FUND:

SPECIAL PROJECTS FUND:

Anonymous.

30,000.00

R.V.H. WOMEN'S AUXILIARY FUND:

Donations to the Montreal Neurological Institute may be made to any of the above funds or for other purposes as specified by the donor. Receipts for such contributions are valid for income tax purposes in Canada. Donations from the United States will also qualify for income tax purposes if cheques are made out to the *Friends of McGill University, Inc.* and sent to the *Secretary, Mrs. Ernest Rossiter, Jr., Box 533, Hempstead, N.Y. 11551*, with the notation that they are for the Montreal Neurological Institute.

SUGGESTED FORMS OF BEQUESTS UNRESTRICTED

I give and bequeath the sum of dollars (or designated property or portion of estate) to the Montreal Neurological Institute, McGill University, both the principal and income to be derived therefrom to be used in such manner as the Board of Governors of the said University shall from time to time determine.

RESTRICTED ONLY AS TO PRINCIPAL

I give and bequeath the sum of dollars (or designated property or portion of estate) to the Montreal Neurological Institute, McGill University, to constitute part of its general endowment funds, the income to be derived therefrom to be used in such manner as the Board of Governors of the said University shall from time to time determine.

RESTRICTED AS TO PURPOSE

I give and bequeath the sum of dollars to the Montreal Neurological Institute, McGill University, both the principal and the income to be derived therefrom to be used for the purpose of (stating purpose) in such manner as the Board of Governors of the said University shall from time to time determine.

FOR FOUNDING FELLOWSHIPS AND STUDENT AID

I give and bequeath the sum of dollars (or designated property or portion of estate) to the Montreal Neurological Institute, McGill University, for the purpose of founding in the said University one or more fellowships or bursaries to be known as “ Fellowship or Bursary”, the net annual income from this fund to be awarded annually in such amounts, under such conditions and to such recipients as may be determined from time to time in accordance with the directions of the Board of Governors of the said University.

For information and suggestions, address
The Director
Montreal Neurological Institute
3801 University St.
Montreal H3A 2B4, P.Q.

STATISTICS

CLASSIFICATION OF DISEASES

<i>Nervous System Generally:</i>	
Multiple Sclerosis.....	89
Motor Neurone Disease.....	20
Demyelinating Disease.....	4
Miscellaneous.....	6 119
 <i>Meninges:</i>	
Acute Purulent Meningitis.....	7
Vertigo.....	5
Subdural Haematoma.....	23
Subarachnoid Haemorrhage.....	34
Extradural Haematoma.....	14
Intracerebral Haemorrhage.....	11
Adhesive Arachnoiditis.....	4
C.S.F. Rhinorrhea.....	5
Miscellaneous.....	9 112
 <i>Brain:</i>	
Congenital Anomalies.....	10
Hydrocephalus.....	20
Syncope.....	4
Head Injury (Contusion, Laceration, Traumatic Encephalopathy Concussion, Skull fracture).....	157
Epilepsy.....	365
Headache.....	59
Migraine.....	30
Parkinsonism.....	44
Thrombosis, Encephalopathy due to Arteriosclerosis.....	201
Aneurysms.....	29
Encephalitis.....	5
Amnesia.....	3
Lipid Storage Disease.....	7
AV Malformation.....	9
Miscellaneous.....	18 961
 <i>Tumours:</i>	
Astrocytoma.....	14
Glioblastoma Multiforme.....	11
Medulloblastoma.....	2
Chromphobe Adenoma Pituitary.....	15
Sarcoma.....	5
Hemangioblastoma.....	4
Schwannoma.....	7
Gliomas (ependymoma, spongioblastoma, oligodendroglioma, pinealoma).....	17
Meningeal Fibroblastoma.....	18
Metastatic Carcinoma.....	82
Brain Tumour Suspected.....	33
Miscellaneous Tumours.....	19 227

Spinal Cord:

Compression of Spinal Cord	4	
Guillain-Barré Syndrome	8	
Myelopathy	7	
Cervical Spondylosis	16	
Radiculopathy	28	
Spinal Arachnoiditis	3	
Spinocerebellar degeneration	3	
Spinal Stenosis	3	
Paraesthesiae	9	
Miscellaneous	16	97

Cranial & Peripheral Nerves:

Optic Neuritis	5	
Trigeminal Neuralgia	23	
Menière's Syndrome	5	
Compression Ulnar Nerve	23	
Carpal Tunnel Syndrome	25	
Other Neuralgias	8	
Peripheral Neuropathy	18	
Mononeuritis	4	
Miscellaneous	11	122

Muscles:

Myasthenia Gravis	11	
Muscular Dystrophy	10	
Spasmodic Torticollis	3	
Dystonia Musculorum Deformans	8	
Meralgia Paresthetica	4	
Muscular Atrophy	8	
Muscle Fatiguability	9	
Polymyositis	4	
Miscellaneous	4	61

Mental Disease

Mental Retardation	15	
Depression	11	
Anxiety State	15	
Conversion Hysteria	9	
Alzheimer's Disease	7	
Schizophrenia	3	
Drug Intoxication	7	
Behaviour Disorder	3	
Chronic Alcoholism	8	
Miscellaneous	8	86

<i>Other Systems:</i>		
Protrusion Disc—Lumbar	173	
Cervical	52	
Fracture and/or Dislocation Vertebral	28	
Back Pain	26	
Pain Miscellaneous	16	
Traumatic Lesions and Infections	25	
Rheumatoid Arthritis	6	
Diabetes Mellitus	6	
Kuff's Disease	4	
Hypertension	8	
Miscellaneous	21	365

CLASSIFICATION OF OPERATIONS

<i>Craniotomy and Craniectomy</i>		
and Biopsy	5	
and Decompression	5	
and Drainage of Abscess	1	
and Drainage of Subdural Hematomas	19	
and Drainage of Intracerebral Hematomas	9	
and Drainage of Extradural Hematomas	5	
and Elevation Depressed Skull Fracture	5	
and Excision of Epileptogenic Focus (lobectomy)	48	
and Excision, Clipping or Wrapping of Aneurysm	26	
and Hypophysectomy for Pituitary or Intracellular Tumour	4	
and Hypophysectomy (Transphenoidal) for Endocrine Control	1	
and Hypophysectomy (Transphenoidal) for Pituitary or Intracellular Tumour	8	
and Plastic Repair of Dura (CSF, Rhinorrhoea or Fistula)	1	
and Plastic Repair of Skull Defect (Plate, Bone or Plastic)		
and Plastic Repair of Skull Defect (Plate, Bone or Plastic)	8	
and Removal of Arteriovenous Malformation	8	
and Removal of Posterior Fossa Tumour	17	
and Removal of Cerebral Tumour	38	
and Trigeminal Massage or Decompression	1	
and Trigeminal Rhizotomy	15	
and Ventriculo-Cisternostomy (Torkildsen's)	1	225
 <i>Trepanation</i>		
and Biopsy	3	
and Drainage of Epidural and Subdural Space	21	
and Exploration	1	
and Ventriculography	7	32
 <i>Shunt Procedure</i>		
and Ventricular Caval	29	
and Ventricular Peritoneal	3	32

<i>Stereotaxic Procedure</i>			
and Ventriculography.....	7		
and Second Stage.....	15	22	
<i>Laminectomy and Hemilaminectomy</i>			
Anterolateral Cordotomy—Thoracic.....	8		
Biopsy.....	2		
Decompression or Exploration of Spinal Cord for Spondylosis (Dentate Ligament Section).....	3		
Decompression or Exploration of Spinal Cord (Trauma).....	2		
Decompression or Exploration of Spinal Cord Tumour or Vascular Malformation.....	4		
Discoidectomy—Lumborsacral.....	83		
Discoidectomy—Thoracic.....	1		
Discoidectomy—Cervical.....	7		
Incision and Drainage of Abscess.....	1		
Incision and Drainage of Intramedullary Cyst (Syringomyelia).....	2		
Removal of Tumour—Extramedullary, Intradural.....	6		
Removal of Extradural Tumour—Metastatic, Bone, Etc.....	5		
Rhizotomy.....	8		
Spinal Fusion with Bone Graft—Autogenous or Bone Bank.....	25		
Spinal Fusion with Wire or Plate.....	8		
Percutaneous Cordotomy.....	7		
Discoidectomy—Anterior Approach—Cervical.....	18	190	
<i>Nerve Explorations</i>			
Anastomosis or Suture.....	1		
Avulsion or Section.....	9		
Excision of Neuroma.....	1		
Neurolisis, Transplantation or Decompression.....	45	56	
<i>Artery Exploration</i>			
Endarterectomy (Patch graft).....	1		
Ligation.....	2		
Progressive Occlusion (Selverstone Clamp).....	5	8	
<i>Wound Re-opening</i>			
Evacuation of Haematomas.....	6		
Exploration.....	1		
Further Removal of Epileptogenic Focus.....	1		
Further Removal of Tumour.....	5		
Removal of Bone Flap, Tantalum Plate or Wire Mesh.....	3		
Repacking.....	4		
Resuturing.....	1	21	

Miscellaneous

Miscellaneous.....	25	
Nerve Blocks.....	165*	
Plaster Casts.....	2*	
Scalenus Anticus Muscle Section.....	1	
Suture of Laceration or Wound.....	1	
Tic Injection.....	2*	
Tracheostomy.....	26	
Muscle Biopsy.....	117	170
TOTAL.....		<u>756</u>

Radiological Procedures

Cerebral Angiography:		
—Percutaneous, Carotid, Vertebral or Subclavian.....	592	
—Catheterization (Brachial, Femoral or Carotid).....	191	
—Pneumograms under Anaesthesia.....	67	

*Not included in count

CAUSES OF DEATH

Head injury (concussion, contusion, hematomata, etc.....)	19	
Intracranial aneurysm (hemorrhage, hematomata due to aneurysm)...	23	
Cerebrovascular disease (thrombosis, infarction, hemorrhage).....	19	
Intracranial tumour, primary.....	13	
Intracranial tumour, metastatic.....	16	
Coronary Occlusion.....	9	
Other systems.....	12	
TOTAL.....		111

