Dalhousie University, Faculty of Dentistry

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The Good & Bad News

The total research funding approved for 1991 by the US government was $1.7 billion, 6.3% above the 1990 levels. However, this was much less than the requested budget. In spite of cuts in requested funding for research the National Institutes of Health (NIH) have been given a 9.6% increase for 1991. A new Senior Biomedical Research Service will be set up by NIH. The new service will be able to appoint some 350 new positions which can have salaries as high as $134,000 (US). This is good news for dental and biomedical science but could be bad news for Canada, since this could tend to accelerate the "Brain Drain" of our top scientists. Canada has already lost David Banting of the University of Western Ontario last September to NIH. At the time, David Banting was secretary/treasurer of the Canadian Association of Dental Research, his departure is a sad loss to Canadian dental research. Let us hope that these new NIH developments do not lure away any more of our top scientists.

It is interesting to see that the US Congress has asked NIH to abandon "down-ward negotiations" a process used in previous years in which funded grants took arbitrary cuts to save money. Researchers are worried that NIH may be forced to favour less expensive proposals and scientists at those institutions with low indirect costs.

GREETINGS OF THE SEASON AND BEST WISHES FOR A HAPPY NEW YEAR TO ALL OF OUR READERS.

RESEARCH SPACE.

The Physical Planning Committee of Senate responded to a plea from the Faculty of Medicine that they had 'A Space Crisis' by discussing the issue of space utilization on the Carleton Campus. President Clark has since set up a committee to review the present and future space requirements on the Carleton Campus. Our colleagues in the Faculty of Medicine have calculated that they require a further 4,300m^2 of space. The first of three possible solutions which the Faculty of Medicine put forward to solve their space shortage was: "Reallocation of space in the Faculty of Dentistry to reflect the current and future needs of both Faculties". However, this unilateral proposal by Medicine was made without consultation or knowledge of the current space usage and availability in the Faculty of Dentistry. The needs and utilization of space for research have always been a very important aspect of the development of the Faculty of Dentistry.

Since the Maritime Dental College was founded in 1908 and was quartered in rooms provided by Dalhousie University in the Forrest Building, the quality of our dental clinical teaching at Dalhousie has been very high indeed. At the Annual Meeting of Dalhousie University Faculty of Dentistry held in the Munro room in the Forrest Building on Wednesday, May 11th 1955, Dean J. D. McLean reported that one of the priorities and needs for the University was the establishment of a Department of Dental Research. However, in spite of Dean McLean's efforts the first facility built specifically for dentistry which opened in 1959 lacked sufficient space in which to develop a viable dental research programme. The Faculty of Dentistry under Dean McLean were keen to develop dental research at Dalhousie. This can be seen from an objective approved by the Faculty of Dentistry on February 27th 1961, which stated:

"An appreciation of, and interest in research must be fostered. To this end an opportunity must be provided for students to be made aware of research activity by direct contact with those conducting projects, and also by affording the opportunity for interested students to do research work."

Our expanded facility which was opened in 1981 had space planned to allow for an expansion of research activities which were not possible due to the constraints of the original 1959 building. The need to

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effectively use the kind and quality of space available to dentistry in the newly renovated dental building was an issue Addressed by our Academic Plan which allowed for a greater emphasis on research.

The Academic Plan:
The cornerstone of the Academic Plan of the Faculty was to expand the basic science teaching and to significantly expand research activities within the faculty. Since 1986 the University Academic Planning Committee have responded to the Dental Faculty academic plan by providing funding to appoint an epidemiologist, an endodontist and a microbiologist, the latter being a joint appointment with the Faculty Medicine. The epidemiologist is in place, the microbiologist will join the faculties in July 1991 and the endodontist will commence duties in 1992 following graduate training. In addition a position for an orthodontist and a Director of our Preiodontal diploma programme are currently vacant. The pressure on space utilization within the Faculty of Dentistry at Dalhousie University has increased and will continue to increase as the various phases of our academic plan take shape.

The Growth of Research:
Significant research development has taken place in our Faculty during the past few years. This has been clearly demonstrated by increased research funding and research presentations made at international meetings during the past 4 to 5 years. Over 80% of our funding from federal research agencies (MRC and NHRDP) has been obtained in the past four years. However, we clearly recognize that research productivity should not be measured in terms of research dollars alone. Indeed many research projects which are currently being conducted by faculty members do not require funding. It is time, not money, which is the main cost for the development of productive scholarly and research activities. Our Faculty has carried out a strong policy of facilitating research during the past four years; as a consequence the level of our research productivity has significantly increased. For example, the number of presentations given at the IADR and AADR meetings shows a dramatic increase. The reputation of Dalhousie University in the Dental field was emphasized at the 1990 IADR meeting at which 30% of all the Canadian papers were from Dalhousie. The percentage
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of Dental Faculty members now actively engaged in research is the highest that it has ever been in the history of Dalhousie Faculty of Dentistry. An indication of the rapid growth of our research in the faculty over the past 4-5 years can be seen from the graphs illustrated in Fig's 1 and 2. However, success in any field inevitably brings with it problems. This expansion in our research activity has essentially occupied all of the research space which is currently available, thus creating a future space problem. We have a high priority to foster clinical research studies and to further integrate the basic sciences to this end, collaborative relationships with basic science faculty have been encouraged while the successful research efforts of the Faculty have been kept focused and supported to the limit of available resources. The growth in our very extensive collaborative research activity in the Faculty of Dentistry is further encouraged by the designation of Health Studies as an 'Area of Special Emphasis'. Basic science research is the elemental foundation of the dental curriculum and provides the necessary support for dental faculty studies. Our recognition of the need to expand the oral biology area has resulted in the appointment of a microbiologist.

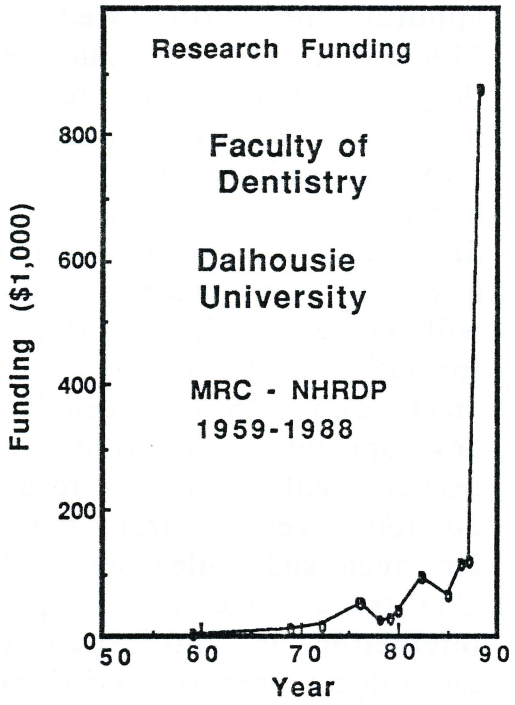

Fig 1.

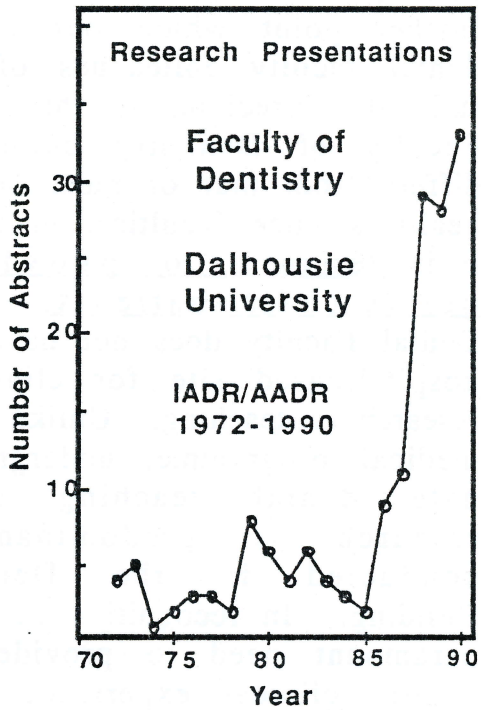

Fig 2.

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In the area of clinical research our faculty members recognize that an additional effort will have to be made to expand this deficiency in our research programme. Clinical research can improve the public image of the university since it can be seen to provide immediate outcomes for dentists, patients and the community. These efforts will require additional clinic space to be allocated specifically for this purpose.

Unique Dalhousie Facility: It is very important to recognize that our Faculty is the only university dental facility in Atlantic Canada a point which is often overlooked by our colleagues in other faculties. A further point which our non-dental faculty colleagues often fail to appreciate, is that the Faculty of Dentistry building differs from that of most other health science faculties, in that it is designed to provide treatment for patients. The Dental Faculty does not have a hospital-based site for clinical research or teaching. Unlike the medical programme, undergraduate dental teaching and research is predominantly conducted in the Dental Building. In recognition of the paramount need to provide a quality clinical experience for dental and dental hygiene students, the majority of space in our dental building (19%) is devoted to clinical teaching. Under the University policy our non-clinical teaching space is shared with the rest of the Dalhousie Community.

FUTURE RESEARCH SPACE NEEDS

Microbiology: The joint appointment of microbiologist Dr. Haroun Shah to the Department of Oral Biology in the Faculty of Dentistry and the Department of Microbiology, Faculty of Medicine, represents a major phase in the development of research and teaching of dental microbiology at Dalhousie University. This important microbiology position was funded through university redistribution money (a joint appointment with Medicine). The arrival of Dr. Shah means that consideration and reassignment of research space and some upgrading of space will have to be addressed. Significant laboratory space will have to be made available within the Faculty of Dentistry for the use of Dr. Shah. It is envisaged that significant development of microbiological research will occur as a result of collaborative research between Dr. Shah and colleagues in both dentistry and medicine. Specific interaction is anticipated with the subject area of Periodontics, this will become much more important with the upgrading of

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Bio-Medical-Engineering Institute.

The establishment in March 1984 of a Bio-Medical-Engineering Institute jointly between the Faculties of Medicine and Dentistry at Dalhousie University and the Technical University of Nova Scotia provides an excellent cooperative opportunity for obtaining federal, provincial and private funding. The development of a viable Biomedical Engineering Institute with a specific location close to the Faculties of Medicine, Dentistry and hospitals would provide a much greater stimulus to develop a "Critical Mass" of varied educational and research capabilities. The Faculty of Dentistry strongly support a proposal to establish as much of the Institute in one location as possible. We believe that our strong biomaterials research programme within the Faculty of Dentistry provides a sound base for the Biomedical Engineering Institute. In addition, we have strong research and interest in the use of laser technology for clinical applications. The Biomedical Engineering Institute can build on existing strengths in biomaterials and other areas. The establishment of a facility for the Institute would broaden the base of research at Dalhousie and TUNS and would further enhance the opportunities for cooperation among academic units, as well as with other outside institutions. The subjects of biomaterials and biocompatibility must be central to any Biomedical Engineering activity since all prostheses, devices and biomedical instrumentation make use of materials which contact the body tissues. The Faculty of Dentistry and the Steering Committee of the Bio-Medical-Engineering Institute (consisting of President Adams of TUNS, Deans Murray and Zakariasen of Medicine and Dentistry, and Drs. Dickson, Marble and Jones) have agreed that part of the unfinished area of the Dentistry Building on the 2nd floor level (449 m^2) could be developed as a suitable location for the Institute. This proposal looks even more attractive following the failure to relocate the TUNS campus adjacent to Dalhousie. The setting up of a Biomechanics research laboratory jointly between Medicine, Dentistry and TUNS located on the 4th floor of the dentistry building is an important step forward in the establishment of the Institute.

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National Dental Epidemiology Programme

Dalhousie University, Faculty of Dentistry is to be a Regional Centre for a major national dental epidemiology programme. Dr. Amid Ismail is a principal investigator, together with Dr. K. L. Zakariasen and other co-investigators across Canada. The programme represents the first national survey of oral health status and treatment needs of Canadians. The lack of data on oral health status, especially of adult and senior Canadians, has been recognized as a major problem facing health planners, dental educators and dental organizations for many years. The proposal has been approved and should receive funding in 1991. The survey instruments are futuristic in design and will provide information for this decade and the next century. Space will have to be made available for this important programme in the dental building in 1991.

The importance of this national epidemiology programme to the national needs can clearly be seen from the following statistics. Canada has 13,164 dentists and 6,064 dental hygienists, the ratio to population being 1,973 and 4,205, respectively. Canada's population increased by 12% in the period 1974-84, while the number of dentists and hygienists increased by 49% and 290% respectively. The average cost per person for dental treatment in 1985 was $86. It is interesting that in dentistry we hear so much about the ratio of dentist to population yet the figures for the medical profession are much more interesting with a total of 53,207 physicians or one per 479 of the population. Health care costs in Canada were 8.5% of the GNP in 1988 compared to 11.1% in the US, 9% in Sweden and 6.2% in UK. The total per-capita costs of health care in Canada in 1988 was $1,370 compared to $1,926 in the US, $1,195 in Sweden and only $711 in UK. However, what is more interesting is the government share of the total spending which was 76% in Canada, 40.8% in US, 90.9% in Sweden and 86.2% in UK. The total 1985 health care expenditures in Canada was $40 billion. Of this $40 billion total dentists received $2,178 million in professional fees. This works out at $165,451 per dentist. In comparison the total professional fees for physicians was $6,249 million. This works out at $117,447 per physician. However, in the case of the physicians the overhead costs would generally not be as high as in dentistry. The cost of

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drugs and appliances was $4,930 million, of which $2,178 was for prescribed drugs, and $157 million was for appliances and prostheses. Currently, senior Canadians comprise 11% of the population, but account for up to 40% ($16 billion) of the health costs. By the year 2039 Canada's seniors are expected to represent 25% of the population. Health care costs are therefore a major problem for the future. When we look at the dental statistics dealing with numbers of dental personnel, costs of treatment and projections for an aging population outlined above, we can clearly see the need for research to be conducted to demonstrate how the trends and developments in dentistry have influenced the dental health of the Canadian population. We also need research to be able to predict the dental needs of the future. The general public and politicians can easily misinterpret the above statistics if they are not backed up by adequate epidemiological clinical studies. The national epidemiological programme will be able to answer many of the outstanding questions. This need for information represents a real research challenge for our clinical dental faculty members. [Source of statistics: Health and Welfare Canada].

Lasers and Imaging.

Exciting developments have taken place during the past ten years in the area of biomedical optics. We have observed very rapid progress in the use of optics and electro-optics in medicine and biology. Most of these are related to the speedy progress in laser and in fibre optic systems which are adapted for medical use. Novel endoscopic imaging techniques have been developed for diagnostic and laser therapies. Integrated laser and fibre systems can now deliver laser energy into the body to cure cancer, to treat heart disease, to "weld" blood vessels, and to shatter gallbladder stones. These optical and electro-optical techniques are having a profound impact on many medical disciplines such as cardiology, gastroenterology, ophthalmology, gynecology, urology, orthopedics, neurosurgery, and cancer therapy. We are fortunate that in our Faculty of Dentistry at Dalhousie we are pioneering research in the use of lasers in dentistry. Our research has for example indicated that lasers can be used to provide increased resistance to dental caries, and can be used in endodontics as a means of preparing the root canal during restorative treatment. The field of biomedical optics is interdisciplinary by

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nature. It requires a strong collaboration among Clinicians, scientists, and engineers. Currently funding has been obtained from the private sector to support collaborative work being undertaken between Dr. Barry Paton in the Department of Physics and colleagues in the Faculty of Dentistry. The joint Physics/Dental project aims to develop a laser scanner/camera computer interface. The computer driven scanner will produce a 3-D optical profile of the object which will be stored for analysis and comparison. Applications to *in vitro* and *in vivo* analysis of wear patterns of dental restorative materials, cement loss from margins of restorations, and for movement of teeth in orthodontics provide exciting prospects for future research. Significant future developments will take place in imaging research. An imaging laboratory is being established in the Faculty of Dentistry which will ultimately require additional space.

Magnetic resonance imaging is rapidly becoming established to provide 3-D viewing of both bone and soft tissue. Radiation technologists are using new computer techniques to develop improved three dimensional images for pre-surgical operation planning or studies of the shape and structure of sound or diseased tissues. The system scans the body part in question and a computer inside the scanner records the data in sections called voxels for each layer of the body part being scanned. The computer stacks voxels to assemble a 3-D model. It is also possible to selectively filter out unwanted information from each voxel. A computer model of a specific part of the body such as the mandible or the complete skull can easily be produced. These 3-D images can be rotated or enlarged at will. The technology has the potential to revolutionize several aspects of dentistry such as orthodontics, maxillofacial surgery, prosth-odonstic, implantology, as well as craniofacial biology. The potential for this research is absolutely phenomenal. The recent demonstration of the 'Cerec' system showed that it is now possible to take the 3-D computer data and use the information to machine inlays or even implants to custom fit individuals. It is possible that in a few years time much more of our research in dentistry may make use of computers requiring additional space to compliment the traditional laboratory and clinical research.

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Mercury Toxicity Problem.

A Research grant has just been awarded in November 1990 to the Faculty of Dentistry to support a major study involving the use of mercury in dentistry. Funding should be available in the 1991 to allow the study to proceed. Although current scientific research indicates that the effects on humans of mercury from dental amalgams is negligible, claims have been made recently that the use of amalgam in dentistry may be harmful to patents. Practitioners from various parts of Canada have brought to the attention of the Canadian Dental Association concerns expressed by members of the general public about the use of silver amalgam as a restorative material. Claims reported in the media that amalgam restorations can lead to a variety of diseases and maladies ranging from multiple sclerosis to epileptic seizures are scientifically unsubstantiated and have alarmed impressionable members of the public. Since there is no conclusive scientific evidence to support such claims, this research project aims to provide background and base line data which will allow a better scientific assessment to be made of the toxicological risks involved. Collaborative investigators on the project from the Faculty of Medicine are involved in this very important laboratory and clinical research project. This research will require additional laboratory and clinical research space. Research space involving the toxic element mercury requires its own space separate from other research projects.

Other Space Requirements:

The recent discussions under the USSR Canada agreement of the proposed Dalhousie University/Mendeleev Institute cooperation could have some space implications. Professor Victor Zhilin and Professor Yury Korshak are very keen to undertake collaborative advanced materials research with our biomaterials group. The development of our proposed Graduate Programme in Biomaterials will inevitably require additional space. Other possible graduate programme offerings in the area of Prosthodontics and General Dentistry will impact on our research space requirements. The possible upgrading of our Diploma Periodontal Programme to Graduate status will inevitably result in a significant increase in the need for additional research space. We are currently advertising for a Director (PhD) for the programme.

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We anticipate a significant increase in the level of clinical research over the next few years. Our biomaterials research programme is developing new materials which will require clinical evaluation. All of these factors are placing and will continue to place increasing demand and pressure on the research space which we currently have available within the Dental Building.

The bar diagram Fig 3 illustrates the space in the Dental building which is allocated to the various functions. The area designated as mechanical space (6,584 m^2) is the largest area and comprises over 40% of the building. This space encompasses such essential areas as hallways corridors, washrooms, stairwells, elevator shafts, entrance reception/lobby space and other mechanical areas. The non-clinical teaching space (Lecture and seminar rooms on the 3rd and 4th floors) is space which we share with the rest of the Dalhousie Campus. As would be expected the second largest space in the building is devoted to our clinics on levels 1 & 2 which is 3,380 m^2 (19%). It may be surprising to some that we only have a total of 1,230 m^2 (6.7%) which is designated as research laboratory space.

The details outlined in this review are confined to addressing the research space utilization in our faculty, it should be recognized that other aspects of our space requirements are just as important in areas such as Continuing Education, and Graduate and Undergraduate teaching. A copy of the report ("SPACE —The Final Frontier— in Dentistry) prepared by the dental Research Development Office (Nov 20th 1990) can be borrowed from the RDO on request. This report is a statement of the current operating space requirements of the Faculty of Dentistry.

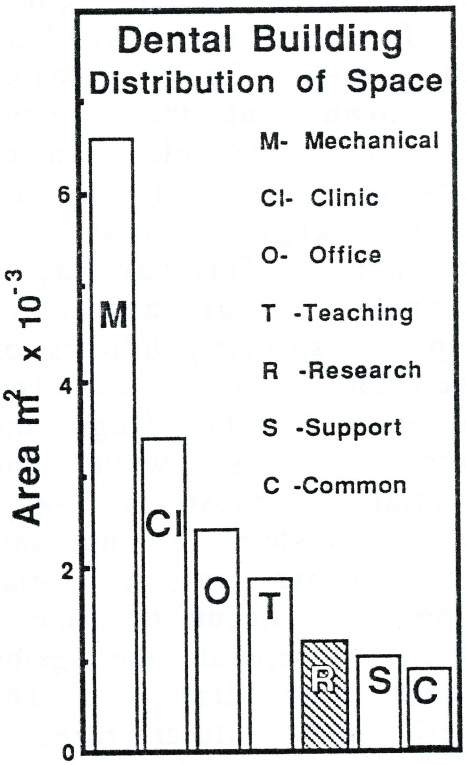

Fig 3

Gerontology Research

The US NIH tentative 1991 budget for Aging research increased by 36% to $325 million. This ranks 8th out of the Institutes programmes, with about 45% of the budget being dedicated to Alzheimer's disease. US Pharmaceutical companies are now spending almost 50% of their R&D dollars, a total of $3.6 billion on aging. Most scientists believe that the immune system becomes less effective with age. A major problem being the impairment of the T and B lymphocytes, as they become slower in responding to stimuli. One theory is that the aging immune system cells produce less T cell growth stimulator interleukin-2. Recent research has shown that the immune system of aging mice can be partly restored when they are given large doses of interleukin-2. This has lead to several pharmaceutical companies spending billions on research to develop interleukin-2 type drugs and other systems with the potential to boost the aging immune system in humans. Developments in molecular biology have begun to make it possible to separate the ageing process from disease. The genetic and cellular research into aging during the next few years may well increases life expectancy which will inevitable have a significant impact on dentistry and dental research. Our grandchildren may even be able to play a good game of tennis when they are 120 years old. A 100 year old may be a candidate for a fixed partial denture of even orthodontic treatment. At this point Geriatric Dentistry will have come of age. The life expectancy of North Americans has almost doubled in the past 125 years. However, it is estimated that further gains in life expectancy from traditional approaches are likely to be relatively small even if cancer and heart disease are eliminated which are the main causes of death.

Future

"Predictions are notoriously difficult to make especially when they concern the future."

Mark Twain.

Focused research

"Current research efforts by the medical community are focused on prolonging life rather than preserving and improving the quality of life. An obvious conclusion, therefore is that the time has come for a shift toward ameliorating the non-fatal diseases of aging."

S. J. Olshansky *et al.*, Science, 250: 634, 1990.