



Dental

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Research News

Stimulus & Challenge

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The voice of Dal Dental research

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Double Research Grant Successes

Our research funding story goes from success to success. Congratulations are due to two Faculty members. Amid Ismail has been awarded a grant by the NHRDP, valued at \$38,000. The title is "Evaluation of Dental Caries Prevalence of Children Participating in Fluoride Tablet and Fluoride Mouthrinse Programs in Northern Newfoundland and Labrador" (see p. 9 for details).

Jim Johnson has also been awarded an NSERC grant valued at \$16,000 per year to study the interfacial stresses between femoral implant materials and natural tissues.

Prohibition

"Every 'good' scientific theory is a prohibition: It forbids certain things to happen. The more a theory forbids, the better it is."

Karl Popper

Blood out of a Stone

Although our faculty have been very successful in recent months in obtaining research funding, many researchers believe that getting money out of the Federal Funding Agencies is like getting blood out of a stone. One researcher in the UK at least has been able to do just that. Dr. Philip Wilby a British paleontologist has identified blood cells by means of SEM in a fossilized fish estimated to be about 100 million years old. The process of fossilization replaces the blood cells by tiny crystals of calcium phosphate ranging in size between 50 - 300 nm.

Good Conduct

"Like Caesar's wife, universities must be above reproach in all conduct relating to research."

Walter E. Massey

Director National Science Foundation

Derek W. Jones

Assistant Dean

Footprints

"Lives of great men all remind us we can make our lives sublime; and, departing, leave behind us footprints on the sands of time; Footprints that perhaps another, sailing o'er life's solemn main, A forlorn and shipwrecked brother, seeing, shall take heart again. Let us then be up and doing, with a heart for any fate; Still achieving, still pursuing-learn to labour and to wait!"

Longfellow - A Psalm of Life.

Perhaps through our research publications and achievements we will be able to leave behind some footprints in the sands of time within the scientific dental literature.



Poetry and Science

"Poetry...is the impassioned expression which is in the countenance of all science."

Wordsworth



The Frontiers of Knowledge

"Teaching on the frontiers of knowledge, where most of Dalhousie's teaching occurs, can be done well by only those who are contributing to the advancement of that knowledge."

Donald Betts



Interpretation

"Statistical expressions may serve different purposes. Some, such as the standard deviation (SD), describe the dispersion of the observations, others, such as the standard error (SE), measure the precision of an estimate of a parameter (for example the true mean) of the underlying population, and yet others, especially P-values, help the research worker or reader to choose between alternative hypotheses. However, statistical analyses only serve these purposes if two conditions are fulfilled: the research worker must possess sufficient statistical knowledge to choose the proper statistical methods and the reader must be able to understand and interpret the results of the statistical calculations."

From: Scheutz F, Anderson B, Wulff H. R: What do dentists know about statistics? *Scand J Dent Res* 1988; 96: 281-7.

Toronto - Take a Lesson from Dalhousie

Dr. Amid I. Ismail, Department of Paediatric and Community Dentistry was an MRC Visiting Professor at the Faculty of Dentistry, University of Toronto on Thursday, February 27, 1992. The title of his presentation was "Decisions, Successes and Failures of Dental Treatment: Agenda for Clinical Evaluation Research in Dentistry."

25 Years of Abstracts

If we are able to submit at least 23 abstracts which get accepted for the IADR meeting in 1993 we will achieve the incredible record of 225 abstracts in the history of our Dental Faculty. Do you realize that you only have 20 weeks to produce your abstract which may qualify for the prize of being the 225th Dalhousie research paper presented at the IADR/AADR meetings in the past 25 years? In March 1993 it will be 25 years since our first abstract. It is most appropriate that the 1993 meeting should take place in Chicago, after all it was at Chicago way back in 1987 that we presented our 50th paper. It has been said that the Windy City is the most underrated city in North America. It is also the place where Sinatra tells us, he actually saw a man dance with his wife. Chicago has some of the most interesting architecture in North America; it even has the tallest building in the world - the Sears Tower. Although you will have to get through the busiest airport in the world to get to the IADR in 1993, it should be worth it to listen to our 225th paper? Having wasted 45 seconds reading this you now have 19 weeks, six days, 23 hours, 59 minutes and 15 seconds to complete your abstract. That is, if you don't take time to sleep and you work 7 days a week.

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Drawing Conclusions

"On every scientist's desk there is a drawer labelled UNKNOWN, in which he or she files what are at the moment unsolved questions, lest through guesswork or impatient speculation he or she should come upon incorrect answers that do more harm than good. The worst fault is opening the drawer too soon. The task is not to discover final answers but to win the best partial answers, from which others may move confidently against the unknown, to win better ones."

Homer W. Smith.

Predictions

"Theories are formulated, predictions are made from them, data are gathered, and the theories are tested by confronting their predictions with the data. Failure of data to support theories leads, in turn, to the formulation of new theories. It is generally agreed, however, that the actual sequences of events are less regular. Data may be gathered without clear theoretical preconceptions, and theories may be retained, especially in the absence of viable alternatives, even after some of their predictions have been disconfirmed."

Pat Langley *et al.*

Advanced Biomaterials in the News

The President of the USA has just announced a major thrust to increase research in the synthesis of new materials. Two years ago the Canadian government set up a special panel to develop a strategic plan for advanced materials. Two of the top scientific journals have published a series of feature articles on advanced materials and biomaterials in February and March 1992. The journal *Chemistry in Britain* carried a 21 page special feature dealing exclusively with biomaterials in the March issue (Vol. 23 No. 3, p. 233-256, 1992). The title was "Biomaterials: the Ultimate Interface with Man." The February edition of *Science* (Vol. 255, p. 1049-1112, 1992) carried a 37 page feature, "Frontiers in Materials Science." The editorial by John Brauman stated that "...we explore some advances in the science and technology of materials, in part because of the broad, interdisciplinary aspects of the field but also because of its relevance." It is pointed out that nature is a wonderful source of materials, we can learn much from the structure of natural materials and the way that nature has put them together. Living systems in nature construct ceramic and composite materials. Nature has evolved unique strategies for producing materials; some of the examples given were mother-of-pearl,

dentine, enamel, cartilage, bone and eggshell which are all materials which we may describe as bioceramics. The editorial by Brauman states that "Materials science is particularly interesting because of the close coupling between basic knowledge and applications."

According to Robert Pool, one of the contributors to the feature, "Over the past few years, materials researchers have played starring roles in some really "hot" scientific work, from high-temperature superconductors and buckyballs to biomaterials and high-performance composites." In January US President Bush announced the launching of a Presidential Initiative on Advanced Materials and Processing. The initiative calls for a 10% increase in the \$1.66 billion federal budget for materials research at a time when no increase in the discretionary budget is planned. Robert Pool writes that one of the major deficiencies of US research into advanced materials is the lack of emphasis in the synthesis and processing that yield new materials. Synthesis just happens to be the major theme of our biomaterials research at Dalhousie. According to Kumar Patel, executive director of research at AT & T Bell Laboratories, "We don't produce enough people who synthesize new materials."

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(cont. from page 4)

Advanced Biomaterials in the News

Some 40% of the increase President Bush is proposing for materials science funding would go into research on synthesis and processing. Pool states that "Materials Science is not a traditional discipline in the sense of physics or chemistry, but is rather what David Turnbull, an applied physicist at Harvard, has termed a "superdiscipline." Its boundaries are defined not by subject matter but by a particular goal, making materials with desirable properties, and so the field contains pieces of many different disciplines. For practitioners, that means learning how to collaborate across fields." Our biomaterials programme at Dalhousie ties together research involving materials science and engineering, chemical synthesis, chemical, physical and biological evaluation, pharmacological therapy and theoretical modelling. The themes of bioengineering, biocompatibility and theoretical modelling are shared amongst the individual projects. Our biomaterials "superdiscipline" research programme at Dalhousie brings together a unique group of researchers of diverse backgrounds and disciplines, with expertise in Materials Science, Metallurgy, Mineralogy, Polymer Chemistry, Surface Chemistry, Ceramics Science, Theoretical Physics, Computer Modelling, Histopathology, Pharmacy, Pharmacol-

ogy, Drug Release, Cell Culture, Clinical Prosthodontics and Orthopedic Surgery.

Canada was ahead of the US in recognizing the need for strategic planning for advanced materials. Derek Jones was appointed by the Federal Cabinet to a 14 member National Advisory Panel on Advanced Industrial Materials in June 1990. The panel is currently developing a strategic plan for advanced materials in Canada.

The biomaterials research being conducted at Dalhousie is recognized internationally as being unique. The reason for this uniqueness is that we are synthesizing biomaterials. Synthesis of advanced materials has now been recognized by President Bush as a major deficiency in the US. Our research in biomaterials at Dalhousie thus finds itself at the forefront of a scientific revolution.

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Dividends

"The dividends from the support of science are spectacular and remain one of our best investments."

John I. Brauman

A Chance Observation

".....for a continuance of basic scientific activity. I believe that the best that we can do in this direction is to carefully select our best prepared minds and ensure that a major proportion of their activity is sufficiently free to provide high probability of chance observation."

De Witt Stetten, Jr.

Time For Research?

A major legitimate complaint of many of our faculty members is the very limited amount of time they have for conducting research. One of the important first steps in most research projects is a thorough search of the relevant literature. The Dental Library is not very far away from our offices, however, it does take time especially in the winter months when the temperature is -25 °C. The chore of having to put on outer clothing and overshoes and make our way to the Tupper Building is just too much; it is far easier to stay in the Faculty Lounge and have a coffee.

Fortunately we live in the high tech computer age. You can now access the library from the nearest terminal connected to the VAX and get into the "NOVANET" system from the Dental Building. All you have to do is to go to the nearest HP terminal connected to the main frame and hit "Return" twice to get "Develswitch", then when the prompt asks "what system" simply type in "NOVANET". The system will then display information and comments required to complete your search of the library holdings, not only at Dalhousie but at other institutions. For those who are using the Macintosh system, it is possible to access the mainframe and NOVANET via MACSERVE. However, the most important advantage we now have is to be able to access

MEDLINE directly. This allows down loading of the references and in most cases abstracts of the papers into your very own ENDNOTE reference data base. How on earth did we conduct research before the advent of microcomputers, microprocessors, photocopiers, word processors and FAX machines? How many can remember what a slide rule is? The world is at your finger tips, you can access the scientific literature from the comfort of the Dental Building even on the coldest day in February. Go to it, but don't forget your coffee break, unless you want to become a workaholic!

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The Poetry of Science

"The truth is, that those who have never entered upon scientific pursuits know not a title of the poetry by which they are surrounded. Whoever has not in youth collected plants and insects, knows not half the halo of interest which lanes and hedgerows can assume. Whoever has not sought for fossils, has little idea of the poetical associations that surround the places where imbedded treasures were found."

Herbert Spencer

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Absolutely Necessary

The Swiss Animal Protection League introduced a referendum which was only narrowly defeated in February 1992; 56% of people voted against limiting the use of animals in research experiments. A change in the Swiss law includes a much clearer definition of what is meant by research that is "absolutely necessary for human or animal health." Scientists in Switzerland claim that a few outspoken anti-vivisectionists are manipulating the public opinion. It is clear that the use of animals in dental research will become much more difficult as the growing opposition to the use of animals in research becomes more of an issue.

A Unique Compound

Lithium niobate is a unique compound which has varied optoelectronic properties. The material has found use in a wide variety of applications, including surface acoustic wave devices (widely used in television sets), optical deflectors, tunable optical filters, laser modulators, Q-switches and transducers. Lithium niobate was first synthesized 25 years ago and has been the subject of a myriad of scientific studies ever since. The crystal structure is quite complicated. However, it is this complexity which is responsible both for its unusual properties and for the difficulties that manufacturers experience in preparing device-quality single

crystals. Our biomaterials research programme has been making use of lithium niobate crystals for ultrasonic testing for some time. Depending on the crystalline orientation it is possible to measure the shear or longitudinal wave velocities in various biomaterials. From this data the elastic moduli can be derived.

The increasing commercial market for lithium niobate has resulted in the recent publication of a book on the subject, "Physics and Chemistry of Crystalline Lithium Niobate", by A. M. Prokhorov and Yu S. Kuz'minov (Hilger, New York, 1990, 377 pp., \$130). Many of the known properties of LiNbO_3 are contained in this useful reference book.

Theory and Experiment

"Different sciences at different times exhibit different relationships between theory and experiment. One chief role of experiment is the creation of phenomena. Experimenters bring into being phenomena that do not naturally exist in a pure state. These phenomena are the touchstones of physics, the keys to nature, and the source of much modern technology."

Ian Hacking

Trivia Question

How much water will a 250 cm³ volume calibrated glass flask contain at 20° C?

Answer on Page 8

Recent Faculty Seminar:
"The impact of recent developments in Molecular Biology to the field of Oral Microbiology"

Techniques used in molecular biology are opening up new vistas in all fields of Biological Sciences. The universal nature of the genetic code means that nearly all new technical advances are mutually beneficial to most areas of science. Dental Sciences have also witnessed significant developments due to advances in molecular biology and its impact in one of these areas, Oral Microbiology, was the subject of a faculty seminar presented by Saheer Gharbia on Wednesday 19th February.

The tools of molecular biology include restriction enzymes which occur naturally in specific bacteria. Their use for genetic manipulations were discussed, together with methods used for cloning foreign DNA into various transport systems (shuttle vectors). Insertion of genetic elements (transposons) into specific gene sequences alter gene products and are powerful tools for studying gene expression and regulation. Most of these techniques were discussed in relation to the study of putative periodontal pathogens. The latter possess specific "adhesion" protein/complexes which enable them to adhere to specific receptors on host or bacterial cells. Many of these have been cloned

and sequenced and one such molecule is being developed for use as a possible vaccine for periodontitis in the USA. Nucleic acid probes are also being developed to aid the prognosis of periodontal disease. Developments in these areas are likely to continue and their possible future direction and application were aired in a lively discussion that followed the talk. It was the general consensus that molecular techniques will continue to find wide application in all areas of Dental Sciences. Many of these techniques are being used and developed in the Department of Oral Biology and several suggestions for possible joint projects emanated from this seminar. It is hoped that more faculty members and students will attend these seminars and help to broaden the discussions.



Answer to the not Quite so Trivial Question

If it was 'Grade B' glassware the flask would give $250 \pm 0.2 \text{ cm}^3$, something between 249.8 and 250.2 cm^3 . However, a 'Grade A' flask would have a $\pm 0.12 \text{ cm}^3$ tolerance limit. It is also important to be aware that pipettes have tolerance limits. For example, if you use a 25 cm^3 'Grade B' glass pipette it will have a tolerance of $\pm 0.06 \text{ cm}^3$.

Amid's Research Project

Amid Ismail's NHRDP funded research aims to compare the dental caries prevalence in children in two areas in Labrador and Northern Newfoundland. The first area, Goose Bay, is sub-optimally fluoridated (0.8 ppm F) and the children in the primary schools (primary through Grade six) rinse once weekly with a fluoride solution (0.2% NaF). The second area includes three non-fluoridated communities, where the children chew, suck and swallow a 0.5 milligram fluoride tablet once daily. The hypothesis to be tested is that caries prevalence (decayed, missing, and filled tooth surfaces) in children who participated for at least two consecutive years in each program is equivalent. Testing will be carried out using a linear multiple regression model accounting for the confounding effects of age, sex, native status, oral hygiene status, use of fluoride tablets or drops during the first six years of life, use of fluoridated toothpastes, and frequency of consumption of sugary foods and drinks.

The success of the Grenfell Regional Health Services in reducing dental caries in children living in that area is a good example of how collaborative, preventive and treatment programs will achieve excellent health gains. Dental caries prevalence in that area in 12 year olds is less than the

World Health Organization's postulated objective for the year 2000. Consequently, because of the low average dental caries prevalence the sample size required to detect a percentage difference of 18.5% with an 80% power and 90% confidence (Council on Dental Therapeutics Guidelines to claim bio-equivalence [1988]) is 500 for each area. All students (estimated at 618 and 689 in 1991 figures could be projected to 1993) in Grades two through six in the fluoridated and non-fluoridated areas will be targeted. The compensation for non-response and non-participation is 19 and 27 percent in the fluoridated and non-fluoridated areas, respectively.

This research project will provide data on the effectiveness of a fluoride tablet program which could be implemented in similar communities. The costs of transportation and storage of fluoride tablets are less than those of fluoride mouthrinses and given the remoteness of the Northern areas of Canada, fluoride tablets may provide a more efficient alternative to reduce the high caries prevalence in those parts of the country.

Personal Contribution

"Science, by its very nature, is a body of public knowledge, to which each research worker makes his personal contribution, and which is corrected and clarified by mutual criticism."

John Ziman

Four Students Awarded MRC Farquharson Scholarships

It was quite a relief to hear the good news from Ottawa that the Farquharson Summer Research Scholarships were to go ahead to be funded for the summer of 1992. Some fear had been felt that since the MRC funding for various programmes was under some stress, the scholarship programme might be in some danger. A total of four Dalhousie dental students have been awarded MRC FARQUHARSON Summer Research Scholarships for 1992.

Congratulations are due to the following four students who are the recipients for 1992:

Debi Bowser, 2nd year
Marco Chiarot, 3rd year
James Potvin, 2nd year and
Kristin Zakariassen 3rd year.

The following projects have been approved for MRC Farquharson Summer Research.

The 1992 Research Projects approved for these MRC students are as follows:

James Potvin, who will work on the project;

"The effect of plasticizers on the permeability of oral mucosa."

Supervisor: **W. C. Foong.**

Debi Bowser, who will work on the project;

"Treatment success as determined through a comparative analysis utilizing the Dental Aesthetic Index."

Supervisors: **W. K. Lobb**
and **A. I. Ismail.**

Marco Chiarot, who will work on the project;

"The Development of a Finite Element Analysis Model of the Tooth to Assess Cavity Preparation and Filling Materials."

Supervisors: **J. A. Johnson** and
D. W. Jones.

Kristin Zakariassen, who will work on the project;

"Scanning Laser Fluorescence Analysis for Caries Research and Diagnosis."

Supervisors: **K. L. Zakariassen**
and **B. Paton (Physics).**

Research Award for Neil Power

Neil Power, a 3rd Year DDS student, was the recipient of the 1992 Warner-Lambert Award for his demonstrated aptitude in research. This commendation by the Research Development Committee allowed Neil to attend the 28th Annual Dental Students Conference on Research. The meeting this year was held at San Antonio, Texas, April 4th - 7th. The basic objective of the conference is to expose outstanding dental students to dental educators, scientists and administrators and make them aware of the wide scope of careers available in dental research.

The Council on Dental Research of the ADA sponsors the annual orientation programme on dental research for one dental student from each dental school in the United States, Canada and Puerto Rico.

Other Summer Research Projects Approved for 1992

A total of 18 applications were received for the 8 fundable positions for summer students. The following projects were selected by the committee for summer student support.

1. "Effectiveness of Polishing Procedures on Different Metals for Maximizing Tarnish Resistance."

Supervisors: **M.G. Doyle,**
E.J. Sutow and A.S. Rizkalla

2. (a) "The effects of laser irradiation on fluoride-rich smooth surface enamel in a demineralizing solution."

(b) "The effects of thermocycling on laser irradiated versus non-laser irradiated smooth surface enamel."

[Project combined with # 4].

Supervisors: **T Boran,**
K. Zakariassen and
R.M. MacDonald

3. "Surface Area and Particle Size Analyses for Dental Biomaterials."

Supervisors: **A.S. Rizkalla,**
D.W. Jones and E.J. Sutow

4. "A comparison of laser etched and acid etched enamel surfaces with respect to bonding and prevention."
[Project combined with # 2].

Supervisors: **R.M. MacDonald,**
W. Lobb and K. Zakariassen

5. a). "Testing of dimensional stability of visible light cure (VLC) systems against the injection and trial-pack techniques."

b). "Testing a new acrylic resin material - Superacryl Plus."

c). "Water sorption and desiccation: a comparison of four acrylic resins."

Supervisors: **O. Sykora**
and E. J. Sutow

6. (a) "Determination of physical properties of currently used ear mold impression materials.

(b) "*In-vitro* comparison, dimensional accuracy, stability and compatibility of ear mold impression materials and dental impression materials."

(c) "Completion of *in-vitro* comparison of marginal adaptation of composite resin inlays made on flexible die materials."

(d) "Detail reproduction of flexible die materials when used with a separation."

Supervisors: **J. Gerrow,** R. Price
and D. Lyon (Fac. Health
Professions)

7. "Thermal Evaluation of Glass, Porcelain and Resin Composite Materials."

Supervisors: **D.W. Jones,**
A.S. Rizkalla and E.J. Sutow

8. (a) "Guinea Pig Response to Conventional and Liposomal Retinoic Acid Treatments."

Supervisors: **B.B. Harsanyi** and
M. Mezei (Pharmacy)

(b) "Allergenicity of Topically Applied Liposomes."

Supervisors: **B.B. Harsanyi** and
M. Mezei (Pharmacy)

(c) "Significance of Monotypic Plasma Cells in Lip Biopsies of Patient's with Rheumatic Diseases."

Supervisors: **B.B. Harsanyi**
and J. Lovas

- 9). "The Chemical Relationship of the Metal/Metal Oxide/Porcelain Interface and Percent Porcelain Retention."

Supervisors: **E.J. Sutow,**
D.W. Jones and A.S. Rizkalla

Not Scientific

"...clinical success, however noteworthy, are not scientific proof of cause and effect."

Norman Mohl *et al.*