Dalhousie University, Faculty of Dentistry

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Dental Research News

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Missed Opportunity!.

The exciting announcement on November 30th 1989 of a feasibility study for a 150 million dollar project between TUNS and Dalhousie could have been the most exciting news for the 1990's. The project would have provided a new location for TUNS adjacent to the Dalhousie campus which would have allowed increased opportunity for collaboration. 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 us with an excellent cooperative opportunity. The development of a viable Biomedical Engineering Institute with a specific location close to the Faculties of Medicine, Dentistry and hospitals would further enhance and stimulate the development of a "Critical Mass" of varied educational and research capabilities. The Division of Dental Biomaterials Science in the Faculty of Dentistry strongly support the proposal to establish the Bio-Medical Institute on a location close to Dalhousie. Our strong biomaterials research programme provides a sound base for the Biomedical Engineering Institute. In addition as reported elsewhere in this edition of Dental Research News we have strong research and interest in the use of laser technology for clinical applications. The establishment of a facility for the Institute would broaden the base of biomedical engineering research at both Dalhousie University and TUNS and would further enhance the opportunities for cooperation among academic units, as well as with other outside institutions.

The subject area of biomaterials is clearly central to any 'Biomedical Engineering' activity since all prostheses, devices and biomedical instrumentation make use of materials which contact the body tissues.

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The Impact of Computers on Research

Scientists and engineers have in the past provided much of the stimulus for improving computers and computing techniques. However, a dramatic shift in the relative cost and power of information processing technologies have now started to make startling changes in the pace and development of research.

As researchers we now have inexpensive versatile personal computers available. Across Dalhousie University campus most researchers have far more powerful systems available to them than 4 or 5 years ago. Researchers from all fields- arts, science and engineering routinely use computers to gain access to national and international networks. The advantages for scientific research are already apparent however, the future potential is far greater.

In the next few years, technology will produce computers which are capable of trillions of operations per second (teraflops). Computer networks will routinely transmit billions of bits per second, and storage capacity will expand many thousand-fold. Technology which currently exists in the computer field will be able to sustain the rate of advance for some years to come. For example photonic researchers, have already produced microscopic lasers with switching times measured in femtoseconds (10^{-15}), this is thousands of times faster than today's best electronic devices.

Dick Hamming a computer scientist at the Naval Post Graduate School, Monterey, California, noted in the 1960s that the purpose of computing is not numbers, but insight. Current developments in computer technology have exciting implications for supplying those insights. Developments will enable new applications of computing in every field of research, including more precise models of physical systems, better design of biomaterials and drugs, expanded access to scientific databases, control of remote clinical and laboratory instrumentation, and significant support for increased collaboration among distant researchers across Canada, the US and around the world.

The Dental Research Development Office aims to foster improvements in our research and information-processing infrastructure.
The Faculty Computing Planning and Development

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Committee have just developed new procedural guide-lines. The RDO strongly supports the initiative which has the potential to significantly enhance the efficiency and level of research within our faculty.

We need to develop an effective computing strategy for the Faculty of Dentistry. The RDO strongly supports the development of both new computing and networking technology and the human resources to use them effectively. Faculty and staff members will need to be able to operate these systems. National and international research and educational networks will become a major factor in the second half of the 1990's. Only by developing a computing and information infrastructure and the capacity of faculty and staff to operate it can the Faculty of Dentistry and Dalhousie University hope to be competitive as a creators and users of scientific knowledge as we approach the year 2,000.

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Scientific Studies

"A writer in so respectable and learned a publication as the *International Journal of Ethics* has called upon us to follow science in our quest for the good life, and the fact that he is a philosopher suggests that the cult of scientism has found members in the most unlikely places. For it must be clear that though we can and should use science to achieve social improvement, we cannot follow it to this destination. The reason is that science does not tell us where to go. Men may employ it for good or evil purposes; but it is the men that have the purposes, and they do not learn them from their scientific studies".

- Robert M. Hutchinson

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Science

"The rise of science is the most important fact of modern life. No student should be permitted to complete his education without understanding it. Universities should and must support and encourage scientific research. From a scientific education we may expect an understanding of science. From scientific investigation we may expect scientific knowledge. We are confusing the issue and demanding what we have no right to ask if we seek to learn from science the goals of human life and or organized society".

- Robert M. Hutchinson

1st WORLD ENDODONTICS CONGRESS IN MEXICO CITY

An international meeting subtitled: Endodontics World-wide, Yesterday, Today and Tomorrow, will be held from January 24-27th, 1990 in Mexico City.

Three years ago, in April 1986, during the meeting of the Foreign Affairs Committee of the American Association of Endodontics (AAE) in Boston, United States, many countries were represented, and it was in that place that delegates mentioned the need to create an international organization fostering a universal development of Endodontics. This idea came through when the International Federation of Endodontic Association (IFEA) was formed. The member countries of IFEA: are, Argentina, Canada, Spain, United States, Philippines, France, Israel, Italy, Japan, South Africa, and Mexico.

At the meeting in Mexico world renowned speakers, from member and non member countries of IFEA, will be presenting the main breakthrough advances and developments in endodontics which have implications for the general practice of dentistry. This will involve clinical, biological and dental materials research. The Congress will provide an open forum for new ideas in this important branch of dentistry.

Canada as well as Dalhousie University will be well represented when Kenneth Zakariasen makes presentations on Thursday 25th January entitled "Use of Sonics in Endodontics" and again on Friday 26th entitled "Use of Lasers in Dentistry with Special Emphasis on the Use of Lasers in Endodontic Therapy". The invitation to participate in this international meeting gives recognition to the research being conducted in our Faculty of Dentistry.

This First World Endodontic Congress of the IFEA, of AILAE and the Mexican Association of Endodontists is a major event, in the course of which distinguished specialists from the five Continents will share the latest advances in endodontic theory and practice. Mexico City, "The City of Palaces," which is the largest city in the world, provides a fantastic setting for the Congress. Through such meetings as this dentistry will be better prepared to meet the challenges of the future.

HIGHEST GOAL

"Out yonder there was this huge world, which exists independently of us human beings... The mental grasp of this extra-personal world hovered before me as the highest goal..."*Albert Einstein.*

DENTAL SPIN DOCTORS

Drs. Barry Pass, John E. Aldrich, together with Patricia Scallion have had the following paper accepted for publication in the journal:

Calcified Tissue International:

"An Analysis of Paramagnetic Centres in Irradiated Dentine Using Electron Spin Resonance"

The ESR spectra produced in irradiated dentine have been studied by this research group over a range of incident radiation energies from 50 kVp to 25 MVp. The behaviour of the dentine ESR signal strength is said to be similar to that of enamel as a function of the energy of the incident radiation. The magnitude of the dentine ESR signals are, however, up to 10 times smaller than the signals of dental enamel for a given radiation energy. The possible contributions of radiation interaction coefficients, chemical structure, and crystallite size to the differences in ESR spectra are important factors.

The research group has been studying the effects of radiation on dental enamel because of the importance of dental enamel as an indicator of total radiation dose received by an individual. They have shown that doses to soft tissue as low as 5 cGy can be measured using the electron spin resonance (ESR) signals as a measure of the concentration of radicals produced by radiation in human dental enamel. From a detailed study of the dependence of the ESR signal on incident radiation energy, and a study of the attenuation of the radiation across a tooth, they have developed a technique for distinguishing between radiation from diagnostic procedures (such as dental radiographs) and that from high energy sources such as natural background and nuclear accidents. The results produced have also been confirmed at other centres.

All measurements made to date have been made on teeth that have been lost in the normal course of dental treatment. Because of the desire to make measurements *in vivo*, the group have recently concentrated on the design of ESR cavities that can be used directly in the mouth. In this type of measurement, the proximity of a large mass of dentine so close to the enamel could confuse the measurement. Consequently, a detailed study of the characteristics of the ESR signals produced in dentine has been undertaken.

The method involves taking whole teeth, obtained from patients in the normal

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course of dental treatment. In order to investigate the effect of radiation on the ESR signal produced in dentine, whole teeth were irradiated such that the buccal dental enamel received a dose of 5 Gy over the energy range 50 kVp to 25 MVp. Doses were calculated using the interaction coefficients for dental enamel. Samples were prepared for ESR measurement by removal of the dental enamel and subsequent slow crushing of the dentine to the form of coarse grains. ESR measurements were made on dentine in quartz tubes using a Varian E-109B ESR spectrometer.

Signal amplitudes were determined by taking a peak-to-peak measurement of the signal component at g = 2.002. Interference by the signal at g = 2.005 was minimized by utilizing its apparently longer spin-lattice realization time (T_1). Microwave power of 200 mw was used in order to preferentially saturate this unwanted, nonradiation-dependent signal. This was especially important for the weaker signals from dentine.

Deproteination of dentine was carried out using a boiling aqueous (80%) mixture of ethylene diamine in a Soxhlet extractor. Chips of dentine, contained in a paper thimble, were replaced in the vapours of the ethylene diamine for 20-30 distillation cycles of 25 minutes each. The sample was then rinsed with distiled water, the glassware cleaned, and the sample replaced with the extractor. This exciting research by Barry Pass of Dentistry and John Aldrich of the Cancer Treatment and Research Foundation of Nova Scotia, clearly represents an important contribution to the future use of diagnostic radiation in dentistry.

De-mystify

"I think we really have a responsibility to de-mystify what we do. If the scientific community took that seriously, we'd have a much broader array of opportunities to spark interest in people about science—not as an ominous, mysterious subject that separates scientists from other people, but an interesting topic that connects frontiers of knowledge with everyday experience."

Linda S. Wilson

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"why?"

"To explain the phenomena in the world of our experience, to answer the question "why?" rather than only the question "what?" is one of the foremost objectives of empirical science".

Carl Hempel & Paul Oppenheim

BIOMEDICAL OPTICS

A top international meeting will take place from 14-19th January 1990, at Los Angeles, California. The meeting is titled BIOMEDICAL OPTICS '90

The major meeting will feature the following areas of research. A session on laser surgery: and advanced characterization, therapeutics, and systems will involve the following subjects: Low Power Laser Applications for Laser Fusion and Biostimulation; Urinary and biliary Laser Lithotripsy; Laser in Dermatology and Plastic Surgery; Lasers in Orthopedic Surgery; Laser Neurosurgery; and Lasers in Dentistry and Engineering Aspects of Medical Laser Systems

A further session on optical fibres in medicine, will include the following: Advances in Cardiovascular Laser Angioplasty; Fibres in Invasive Treatments/Surgery; Optical Fibres and Sensors in Medical Diagnostics; Catheter-Based Medical Diagnostics and Imaging; and Laserthermia and New PDT.

A further session on Tissue and Cell Characterization and PDT will include papers on the following: Laser-Tissue Interaction; Bioimaging and Two-Dimensional Spectroscopy; New Technologies in Cytometry and Molecular Biology; Photodynamic Therapy: Mechanism; and Time-Resolved Laser Spectroscopy in Biochemistry. A further session on Laser Eye Protection Technology will include papers dealing with: Eye Laser Safety, Eyesafe Lasers, and Laser Eye Protection.

Lasers in Dentistry

The session on lasers in dentistry will take place on Thursday 18 January 1990.

The Faculty of Dentistry at Dalhousie University is well represented as can be seen from the following programme:

Effects of various lasers on dental photocured composite resins,
H. Wigdor, Ravenswood Hospital Medical Ctr.

Heat effect of pulsed Er: YAG laser radiation on human teeth, R. Hibst, Institut für Lasertechnologien in der Medizin/Univ. Ulm (FRG); U. Keller, D.D.S., Univ. of Ulm (FRG)

Holodent system: a new technique for measurement and storage of dental cast, H. Ryden, Karolinska Institute (Sweden)

Temperature changes across porcelain during multiple exposure CO_2 lasing, J. Barron, K.L. Zakariasen and L. Peacocke, Dalhousie Univ. (Canada)

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Temperature changes across CO_2 lased dentine during multiple exposures, K.L. Zakariasen, J. Barron, and T.L. Boran, Dalhousie Univ. (Canada)

Effect of low level CO_2 laser radiation on the inhibition of smooth surface caries (in vitro study), T.L. Boron, K.L. Zakariasen, Dalhousie Univ. (Canada)

Ultrastructural changes of enamel and dentine following Er: YAG laser radiation on teeth, U. Keller, Univ. Ulm (FRG); and R. Hibst, Institut für Lasertechnologien in der Medizin/Univ. Ulm (FRG)

Lasers in soft tissue dental surgery, R.M. Pick, Northwestern Univ. Dental School

Effects of CO_2 laser on dentinal bonding, D.N. Dederich, K. Hinkelman, A. Albert, and J. Tulip, Univ. of Alberta (Canada)

Ablation of caries, tooth enamel, and dentine by near UV lasers,
O. Schoeniger and R.E. Brinkman, Medizinisches Laserzentrum Lübeck GmbH (FRG)

Effects on a pulsed Nd: YAG laser on dental hard tissues, T.D. Myers, Univ. of Detroit

Drilling in human enamel and dentine with lasers: a comparative study, E. Tasev, G.P. Delacretaz, and L.H. Woeste, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

Applications of the CO_2 laser beam in dentistry, J. Melcer, (France)

Mathematical model governing laser treatment of human tooth, B.S. Yilbas, Z. Yilbas, E. Karakas, M. Karatoy and A. Bilge, Erciyes Univ. (Turkey)

The information provided for the bio-optics meeting outlines the exciting developments which have taken place during the past ten years in the area of biomedical optics. During the last decade 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

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"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, opthalmolgy, gynaecology, urology, orthopedics, bron-chology, neurosurgery, and cancer therapy, we are fortunate that Dalhousie is now pioneering research in the use of lasers in dentistry.

The field of biomedical optics is interdisciplinary by nature. It requires a strong collaboration among physicians, scientists, and engineers, and close contact among the users of equipment and the manufacturers who develop this equipment. For the past six years SPIE has organized a series of conferences aimed at promoting interaction between research scientists and physicians so that they can discuss their clinical results. At these conferences various disciplines can make a concerted effort to communicate with each other, learn from each other, and collaborate with each other. The 1990 Biomedical Optics meeting will have more than 250 papers.

Get the Picture

"Research is part of a cumulative process in which knowledge is added to the existing knowledge base. When describing research, it may be useful to think of the analogy of a jig-saw puzzle: each new piece is fitted into the whole, until all the pieces are found and the picture is clearly exhibited".

Makrides &. Richman

Personalized

With the new craze to produce personalized car number plates in Nova Scotia, the Research Development Office have come up with a suggestion for a Faculty of Dentistry number plate which you may wish to make use of for your new pre GST car.