

Dental Research News

Research Development Office, (902) 424-1675

VOLUME III, NUMBER 8.

Science, Progress and the March of Time.

One of the themes highlighted by Air France in their April edition of the in-flight magazine Atlas dealing with the French Bicentennial celebrations in Paris of the revolution of 1789-1799, were the contributions made to science during this turbulent period of world history. Historians have neglected to recognize the major contributions and scientific developments by great men of learning made during the ten years of crisis. A scientific revolution was also taking place with contributions from men such as the chemist Antoine de-Lavoisier and the introduction of the decimal system of weights and measures based upon universal standards. It was Charles de Borda who expressed the meter as "the ten millionth

part of the earth's meridian". Two hundred years ago modern dentistry had its beginnings as an applied science in France. Thus modern scientific dentistry also has its roots in the French revolution 200 years ago.

"RESEARCH NEWS ITEMS"

Do you have any research news which you would like to share with your colleagues?. If so, please forward such items to the Research Development Office. It would help if submissions were produced on a (Macintosh) disc in Microsoft Word, or simply call 1675.

Genius and Talent?

"The discovery of scientific method required genius, but its utilization requires only talent."

Bertrand Russell.

The Dublin Inquiry

The opening ceremonies of the meeting were held in Ireland's beautiful National Concert Hall in downtown Dublin. Following the official ceremonies including presentation of the IADR Distinguished Scientist Awards a welcome reception was held in the National Concert Hall Foyer this featured Irish musicians and dancers. The Irish organized a "State Reception" hosted by the Minister for Health which was held at the 17th century Royal Hospital Kilmainham which is considered to be one of Dublin's finest buildings. The building is now a national centre for culture and arts. An Irish Night was also held in Trinity College's College Dining Hall Building, with its historic palatial dining hall, the evening was elegantly adorned with the antique College silver. Irish musicians, singers, dancers, and ballad groups provided entertainment during the evening.

The scientific programme for the IADR at Dublin contained a total of 1,266 research papers as well as nine symposia sessions. The topics for the symposia were:

1) AIDS & the Mouth, 1989;

- 2) Region-specific Aspects of Biology and Gene Expression in Oral Mucosa;
- 3 Studies of Changes in Dental Care Services Within Welfare Countries.
- 4) Dental Erosion.
- 5) Bone and Tooth Genomes.
- 6) Hydroxyapatite Coatings.
- 7) Root Surface Caries.
- 8) Salivary Gland Growth and Differentiation.
- 9) Recent Advances in Endodontic Postes.

The AADR meeting held in March in San Francisco had a total of 1890 papers. A further 1266 at the meeting in Dublin gives a combined number of 3,156 for the two meetings this compares with the total of 2,398 for the largest single IADR meeting ever which was in Montreal in March of 1988. The number of authors listed on the 1,890 papers presented at the AADR meeting was a staggering 3,878, the number of authors for the 1266 IADR papers was 2,693, this gives a total for the two meetings of 6,571 names listed at an average of 2.08 authors per paper. This is in spite of the ten author paper being presented by Crawford Bain. It was encouraging to find that our 18 papers in Dublin were well received and were a credit to Dalhousie University.

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Measures

During our scientific experiments we continually have to make measurements in order to collect data. The history of the units of measurement provides a fascinating insight into the development of science.

"During the reign of Ethelred the Unready", King of England from 968 to 1016 C.E., a statute appeared, approved by him and his witan. In bland, pious rhetoric not unlike that discernible in legislative texts for nearly a thousand years since, it urged that "hateful illegalities be earnestly shunned" throughout the realm. First among the illegalities mentioned were "false weights and wrongful measures."

In June 1215 C.E.. at the lovely Runnymede meadow, a reluctant King John under heavy pressure from the barons, set his seal to the famous Great Charter or Magna Carta. Among the reforms it promised was an important metrological policy; henceforth there should be but "one weight, one measure" for the realm- in other words, uniform units, recognized, reproducible and reproduced, on which buyers as well as sellers could rely.

"In Early 14th century England, during the reign of King Edward II, the inch was defined as "three grains of barley, dry and round, placed end to end, lengthwise."

"The pennyweight at this time was described as the weight of 32 (average) wheat corns (seeds). The pennyweight today is defined as 24 grains troy weight, equal to 1/20 ounce, or 1.555 grain. The average wheat seed in Plantagenet days probably weighed about 48.6 milligrams, hence 20,600 such seeds would weigh 1 kilogram. The inch has also been defined as the combined lengths of 12 poppyseeds, a barley seed being the average of four times as long as a poppyseed."

"A rule from England of 1566 declared that "four grains of barley make a finger; four fingers a hande; four handes a foote."

Discovery at Leisure

"Mendel's epoch-making discovery required little previous knowledge; what it needed was a life of elegant leisure spent in a garden".

Bertrand Russell.

Electron Microscope -

In dental research we tend to take for granted the use of the SEM and the contribution which it has made to our research. One hundred and eleven years ago in 1878 it was realized that there was a theoretical limit to the resolution of the optical microscope. In other words, no matter how lenses were improved there would always be some details too small to see. Ernst Abbe calculated that the smallest detail that could be resolved optically was about one thirty millionth of an inch.

In the 1850s German scientists, had been investigating the so-called "cathode rays". The exact nature of these rays was unknown, but scientists were soon making use of their properties, and about 80 years ago magnetic or electrostatic fields were being used to concentrate cathode ray beams. Since cathode rays - streams of electrons - have a much shorter wavelength than light, they can resolve much finer detail. In 1926 Hans Busch had discovered the analogy between the effect of a magnetic coil on an electron beam and a convex lens on a beam of light. Unfortunately, the significance of his discovery was not recognized. Two years

later in 1928, Max Knoll and Ernst Ruska investigated Busch's theory by experimenting with electron beams and focusing coils. Knoll and Ruska used a coil to form an image of a small aperture at a magnification of just over one. They then added a second stage of magnification to give a final image with a magnification of 17. This instrument is usually regarded as the first electron microscope, although it was build primarily for accurate measurement of magnification rather than for examining specimens. Knoll and Ruska's instrument was first demonstrated in 1931. By the end of 1933 Ruska had built a "super-microscope" which he achieved magnifications of up to 12,000 and surpassed the resolution of the optical microscope. In law, however, the inventor of the electron microscope is Gunther Reinhold Rudenberg who filed patent applications covering the combination electron lens for microscopy shortly before Knoll and Ruska's work was published in 1931.



World Emphasis on Dental Research

It is clear from the numbers of dental research papers presented in the last two years that an increased emphasis on research is emerging in all dental schools in both Europe and North America. A further 1,505 abstracts were presented by other national and regional Divisions of the IADR in meetings during 1989 which gives a total of 4,661 papers world wide for IADR and Divisional groups during 1989. It was encouraging to find that one of the areas of emphasis emerging from our curriculum planning process was that of increasing involvement with research in our dental programmes.

Identification

Microchips encased in glass about the size of a grain of rice, containing a 10 digit identification number are being implanted into the shoulder blades of dogs in San Francisco. The ID number which can be read by a scanner can be matched with name, address and phone number of the owner, the information which is kept on file can be updated. The system could be adopted for humans with the microchips being placed in

dental fillings. The procedure could be useful for identification of human remains following accidental death. The system may find use as a means of identification for suffers of Alzheimer's.

Call for Abstracts

Have you recovered from the AADR and IADR meetings in 1989?. If you have or even if you have not, you should remember that the abstracts for the 1990 IADR/AADR General Session meeting to be held in Cincinnati March 7-11th 1990 will be due next month in the IADR Central Office in Washington on or before September 29th 1989. If you were smart you would have written your abstract for the Cincinnati meeting on the flight home from the Dublin meeting.

Curiosity

"The disease of cancer will be banished from life by calm, unhurrying, persistent men and women, working, with every shiver of feeling controlled and suppressed, in hospitals and laboratories. And the motive that will conquer cancer will not be pity nor horror; it will be curiosity to know how and why" H.G.Wells.

Useful Source of Research Information

Many members of our faculty may think that patents are simply an insurance against imitation or forgery. They see a Patent Office as a huge vault in which inventors' descriptions and drawings are jealously guarded. However, the role played by the Canadian Patent Office is far more active. Clearly, one of its main responsibilities is, to protect the inventor, but it also has a much broader purpose which is to promote economic activity and technological development by making patented technical information available to the public. This includes our faculty members who may find that the Patent Office is a very useful source of research information. Faculty members need to keep abreast of technological development. As applied scientists, keeping up to date may avoid useless expenditures on a research topic which has already been undertaken. It is possible to find ready-made solutions to technical problems which may arise in our research.

Keeping informed is a way to avoid conducting research which someone else has already done or projects which may seem promising

but are based upon technology which is already outmoded or about to become so. To just review the regular published literature may not be sufficient for many research areas. It is impossible to keep abreast of technological innovations without using patent information. More than 70 percent of all patented information and data on new technologies throughout the industrial world is available only in patent literature. Dalhousie University library has quite a number of patents available, interlibrary loan can provide many that may not be available in Halifax. Failure to check the information available at the Patent Office has resulted in hundreds of thousands of dollars being spent on needless research whose methodology and results were already outlined and explained in considerable detail in office documents. Logically, no research project in any applied sciences should ever be undertaken or funded unless the initiators have first approached the Patent Office for a capsule survey of what is already known in the field.

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**Useful Source of
Research Information**
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The Canadian Patent Office has much more to offer, however. It provides access to millions of patents, including 1.2 million granted by the office itself and 4.4 million American patents. Canadian patents are classified into 35,000 different categories, allowing for rapid retrieval of information on any given technology. It is possible to check whether technology similar to one's own exists and how advanced it is.

The Patent Office has expertise in the full range of technological and scientific activities. As a result, the office is well able to assess new developments in Canadian technology. It can also assist researchers by directing them to the desired information and helping them interpret it.

Patent information can be very useful since the information is presented in a fairly uniform manner by most patent offices, and frequently has explanatory drawings. In describing the novelty of an invention, a patent normally discloses information on what was previously known, thus providing a capsule survey of the state of the art.

Disclosed information is normally more complete than other documentary sources of information, such as many research journals.

The practical application of the invention is very often disclosed in considerable detail. Other useful information often provided are the names and addresses of the patent owner and other principals, which may assist contact between researchers and others interested in exploiting the technology.

An important part of the work of the Patent Office is to promote and facilitate the transfer of technology to Canadian industries, universities and research centres. For this purpose, the office has vast quantities of scientific documentation, most of which cannot, for all practical purposes, be obtained elsewhere. It includes information on the millions of inventions patented by Canadians and others. These assets and the expertise it has acquired over the past 100 years make it a uniquely useful resource centre. The Patent Office provides access to about ten million patents catalogued in the Canadian, American and international systems; more

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**Useful Source of
Research Information
(cont from page 7)**

than two-thirds of these patents are not registered in Canada and can therefore be used freely by Canadians.

The Patent Office is a part of Consumer and Corporate Affairs Canada. You may write to it at the following address:

Canadian Government
Patent Office Consumer and
Corporate Affairs Canada, 50
Victoria Street Hull, Quebec
K1A 0C9

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**General Amendments to
the Patent Act**

The Government has proposed a set of amendments to Canada's Patent Act that will speed the transfer of technological information, thereby encouraging innovation, increasing productivity and strengthening the nation's competitive position; introduce a prompt and low-cost system whereby the public can request the reexamination of a patent by means of an administrative procedure at any time during the life of a patent; The reforms will harmonize Canada's patent system with most other nations, making it simpler for Canadians to acquire foreign patents.

The Canadian Patent Act has not been substantially

amended since 1935. A number of studies, including that of the Ilsley Royal Commission, have examined the Canadian patent system since 1950. These studies led to the preparation, in 1976, of a departmental working paper on a complete revision of the Patent Act, but these efforts have not, until now only, resulted in amendments to the Patent Act.

Canada's present Patent Act needs to be improved to make technological information more readily accessible to the Canadian business community and to bring the Act into closer harmony with other industrialized countries. The proposed amendments will simplify the patenting process in Canada while facilitating access to international patents.

The Canadian Patent Office is the largest repository of the latest technological information in Canada - a resource which has been under-used by industry, university researchers and government. More than 22,000 patents are granted each year by the Office.

Patent protection regards the inventor for his achievement by granting

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General Amendments to the Patent Act

him exclusive rights for a limited period of time to produce and market the invention. In exchange, the inventor discloses his invention to the public instead of keeping it secret. The patent then becomes an effective vehicle for promoting transfer of technology.

More emphasis will be placed on the dissemination of technological information contained in patents in order to better serve the needs of small and medium-sized Canadian businesses. Approximately 70 percent of all patented information on new technologies throughout the industrial world is available only in patent documents. It is impossible to keep abreast of technological innovations without using patent information. The proposed amendments will facilitate the exploitation and dissemination of this technological information, making the Canadian system more useful for Canadians. The many benefits of using the patent system are that it avoids duplication allows for the exploitation of foreign technology identifies new products improvements, industrial trends and alter-

native technology. The Patent Office can help the transfer of technology to Canadian industries, universities and research centres as a major part of its work. The Patent Office has vast quantities of scientific documentation, most of which cannot be obtained elsewhere. It includes information on the millions of inventions patented by Canadians and foreigners. Technology transfer has been recognized by the World Intellectual Property Organization (WIPO) as one of the main factors contributing to economic development. The Canadian Manufacturers' Association (CMA), the Economic Council and the Science Council have all recommended that Canada also move in this direction.

False Views

"False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for everyone takes a salutary pleasure in proving their falseness; and when this is done, one path toward error is closed and the road to truth is often at the same time opened"

Charles Darwin.

The Irish Experience

Amongst the interesting 1,266 papers at the IADR Meeting in Dublin was a paper (Abst #742) by Blankenau et al. which dealt with the use of argon laser polymerization of composite materials. The study indicated significant enhancement of the physical properties of the materials compared to the use of visible light. Measurements were made of compressive strength, diametral tensile strength, transverse strength and Young's modulus for a micro-filled and small particle sized resin restorative. Another interesting paper by Vanderstelt et al. (Abst #758) dealt with the use of computer aided quantification of angular periodontal bone defects. The study indicated that the computer aided lesion detection was a useful tool enabling a quantitative and reproducible radiographic assessment of periodontal bone lesions. The use of computer searching for key words has allowed the listing in the IADR programme for the first time of a selected index of topics which made the difficult job of deciding which papers to listen to much easier. A total of twenty papers were listed under biocompatibility, and a further 80 were identified as clinical trials, 22 were listed under endodontics and 15 were identified as educational research.

Top Honours for Mezei

Dr. Michael Mezei Professor in the College of Pharmacy and a principal investigator in our MRC Programme Grant "Synthesis, Evaluation, Application and Biological Testing of Biomaterials", will be the recipient of a top scientific award given by the Association of faculties of Pharmacy of Canada (AFPC). The award acknowledges Dr. Mezei's research involving the use of liposomes (artificial cells) as drug delivery systems.

Relationship

"A fundamental reversal in the relationship between human beings and materials is taking place. Its economic consequences are likely to be profound. Historically humans have adapted such natural materials as stone, wood, clay, vegetable fiber, and animal tissue to economic uses. The smelting of metals and the production of glass represented a refinement in this relationship. Yet it is only recently that advances in the theoretical understanding of the structure of physical and biological matter, in experimental technique, and in processing technology have made it possible to start with a need and then develop a material to meet it, atom by atom".

J.C. Clark & M.C. Flemings

Research Funding Obtained

The research funding obtained from federal agencies over the past thirty years by the Faculty of Dentistry at Dalhousie has steadily increased even when we take into account the level of inflation during this period.

Research Funding 1959-89

<u>Date</u>	<u>Agency</u>	<u>Amount</u>	<u>Discipline</u>
1959	NRC	\$2,350	Oral Surg
1960	NRC	Not Known	Perio
1969/71	MRC	\$14,000	Oral Biol
1972/74	MRC	\$15,000	Oral Biol
1976/78	MRC	\$60,000	Biomater
1979/80	NHRDP	\$28,218	Oral Biol
1979/81	MRC	\$55,042	Biomater
1982/84	MRC	\$108,433	Biomater
1985/88	MRC	\$170,802	Biomater
1986/89	MRC	\$125,102	Biomater
1988/91	MRC	\$712,591	Prog. Grt
1989	MRC	\$18,333	Prog. Grt
1989/90	NHRDP	\$141,872	Ped.Com
<u>TOTAL</u>		<u>\$1,469,093</u>	

It is interesting to note that close to 80% of this federal funding has been obtained in the past four years. However, research productivity should not be measured in terms of research dollars alone. Many types of research do not require vast amounts of funding. Indeed many research projects can be conducted without any funding at all. It is time not money which is the main cost for the development of productive scholarly and research activities. Block allocation of teaching time and research time are crucial. A research career cannot be

developed on isolated one day a week time allocations. However, as university scholars we should also realize that we do not work from 9:00 am to 5:00 pm. each day and take six weeks summer holiday each year. A solid commitment and investment of time is required in order to develop a meaningful research career.

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"Research Partnerships". NSERC's successful university-industry programmes are being expanded with the addition of a university-government programme component and a \$3.5 million budget increase. Under the expansion, the university-industry programmes and the newly ceated university-government programmes will be regrouped under the name "Research Partnerships". The total budget for the new programme for 1989-90 will be \$31.3 million. Individual projects will have a ceiling of \$150,000 per year in total support.

CHANCE

"...false hypotheses which together produce the truth by chance, do not, in the course of a demonstration in which they have been applied to many different matters, retain this habit of yielding the truth, but betray themselves".

Kepler.

Suspended

We tend to think that government funding the university finances have only become a problem for us in the past two or three years. However, a look back to 1976 shows us that for the year 1976/77 the grant for MRC summer student employment was suspended due to government cut-backs. In addition the MRC Discretionary funds were also reduced by one-third.

Commitment and New Knowledge

"In the early 1960s the United States decided to put someone on the moon by the end of the decade. To the non-scientists and engineers of the world, this was a remarkable goal. In hindsight, however, we can see that the basic knowledge needed to achieve it was available in 1960. The only thing lacking were the resources and commitment to make it happen. In contrast, researchers still have not found a cure for cancer despite huge financial expenditures over the last ten years. that's because progress in the war on cancer requires fundamental new knowledge." T.W. Eagar

SUCCESS STORY

"Science, apparently, is required to explain its own success"

Bas van Fraassen.

History of Support for Students.

We tend to think that we have only paid attention to the stimulation of students in terms of research in recent years. However, a recommendation by the Chairman of the Research Committee in 1974 put forward the name of a second year dental student Barry Pass to attend the IADR meeting in Atlanta, Georgia, from March 21st to 24th as the faculties student representative. In addition another second year student James Craft was selected to attend the ADA student Conference on Research in Birmingham, Alabama, on April 8th and 9th. The cost of sending Barry to the IADR meeting was supported to the extent of \$500 by Johnson & Johnson. The cost of sending James to the student Research Conference was supported by Proctor and Gamble to the extent of providing round trip plane fare and ground transportation. The research conference is still supported to this day and we have been lucky to have been able to send students over the last fifteen years. Unfortunately support for students to attend the IADR from industry was discontinued in about 1977. However, we have been able to support some student attendance at IADR meetings which is a valuable enrichment of their education.