Dalhousie University, Faculty of Dentistry JUNE -JULY 1988

Dental Research News

Research Development Office

(902)424-2545.

MAJOR GRANT FOR FACULTY. A three year MRC Programme Grant valued at $712,000, has been obtaind by a group of 6 researchers in the Faculty of Dentistry together with 2 colleagues in the School of Pharmacy and the Department of Chemistry. The programme deals with synthesis development and evaluation of biomaterials.

The Research Development Office is pleased to announce that a four project MRC Programme Grant "Synthesis, Evaluation, Application, and Biological Testing of Biomaterials" with a three year budget of $712,000:00 has just been awarded to the Faculty of dentistry.

The researchers involved are Choong Foong, Bruce Graham, Barbara Harsanyi, Robin Howell, Derek Jones, Jan Kwak (Chemistry), Michael Mezei (Pharmacy), and Elliott Sutow.

The four projects involved are #1 "Synthesis of Inorganic Biomaterials", #2 "Synthesis of Organic Biomaterials", #3 "Drug Release from Biomaterials", and #4 "Increased Corrosion Resistance for Base Metal Biomaterials by Electro-polishing". This grant application has been successful on it's second attempt, and provides a significant boost to research within our faculty. The success is a just reward for the team of faculty and staff who have worked so very hard towards this goal for the past two and a half years.

The work has involved the preparation of preliminary research data, submission and presentation of papers at research meetings, the putting together of the grant application, the preparation and participation in site visit's, and the painful waiting to hear the good news.

During the past two and a half years the group have published 14 papers, submitted 2 papers and presented 38 papers at international, national and provincial meetings all dealing with the subject matter of the grant application.

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SHOCKWAVES OF THE FUTURE

It has been calculated that the sum of all human knowledge acquired since the invention of the wheel will double within the next fifteen years. That is to say, in a few years we will aquire as much new knowledge as has been accumulated since the beginning of time.

Hon.Frank Oberle.

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BUGS REPLACE THE MOUSE?

Antibody fragments are now being produced in bacteria rather than using mouse cells, since human genes can then be inserted, reducing the chances of an immune reaction. Since the bacteria are relatively easy to grow and the antibody fragments easier to purify the process should be much less expensive.

Antibodies are large proteins produced in white blood cells to help fight off infection, tumor cells and foreign material. Each antibody recognizes and binds to a specific foreign cell or microbe and triggers other components of the blood to join in and destroy the foreign intruder. If an antibody that binds to a cancer cell is tagged with a radio-isotope before it is introduced into the body, the radioactive material will accumulate at the site of any tumor which is present thus allowing it to be easily detected. It has been estimated that the market for antibody-based cancer detection systems alone could reach $400 million a year in the U.S. by 1998. NeoRx Corp. of Seattle has finished testing such a "labeled antibody" system which is capable of detecting melanoma. The company are now awaiting the Food and Drug Administration approval to market the product.

Cancer drugs can also be attached to the antibodies. This will allow a concentration of the drug at the site of the tumor rather than the drug being spread throughout the body. This method will significantly reduce the side-effects of conventional chemotherapy.
Why should there be a larger market for cancer detection than for treatment? Well the truth is probably due to the fact that there are more who fear cancer than suffer from it.

DID YOU KNOW?

That a Compact Disc Read Only Memory (CD ROM) capable of storing 550 megabytes is now available. One megabyte represents approximately 295 pages of information, each page having about 500 words. Thus one CD ROM disc is capable of storing 162,250 pages of information, or over 81 million words.

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THE UNIVERSITY COMMITTEE ON LABORATORY ANIMALS (UCLA)

The UCLA is a presidential Committee which oversees all research projects involving the use of animals (vertebrate and invertebrate). All research involving animals needs to have an approved protocol. The approval of animal protocols follows closely the guidelines recommended by the Canadian Council on Animal Care. The primary areas of importance are:

1) that the animals do not suffer unnecessary or avoidable pain or stress and are handled with the best possible care;
2) that the experiments are of scientific merit or have had external review;
3) that alternatives to animal experiments have been considered.

The university has an excellent animal care facility with two veterinarians available who will assist researchers in animal handling and surgical procedures. Any researchers who may plan to use animals in their experiments can obtain the appropriate forms from the Research Development Office. Researchers are also advised to consult with our faculty representative on the UCLA, Dr. Wai-Choong Foong at an early stage in the planning, in order to avoid the possibility of unnecessary delays.

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A SIGNIFICANT FACT

Dr Paul Jones in an editorial in the Journal of Laboratory and Clinical Medicine in May 1988 quotes a survey of published articles conducted by Sterling (1970). The survey concluded that papers in which results significant at the 0.05 level were reported were more likely to be published than non-significant results. In addition the probability of a study being repeated became very small once a study had appeared in print, Sterling also concluded that many more studies were performed than appear on the pages of professional journals.

Paul Jones points out that the convention of the 0.05 level of significance is generally attributed to R.A.Fisher, who developed both the theory and practice of the analysis of variance. Fisher proposed in 1926 the following rational for calling a result "significant":

"If one in twenty does not seem high enough odds, we may, if we prefer it, draw the line at one in fifty (the 2 percent point), or one in a hundred (the 1 percent point). Personally, the writer prefers to set a low standard of significance at the 5 percent point, and ignore entirely all results which fail to reach this level. A scientific fact should be regarded as experimentally established only if a properly designed experiment rarely fails to give this level of significance. the high odds sometimes claimed for experimental results should usually be discounted, for inaccurate methods of estimating error have far more influence than has the particular standard of significance chosen."

It was pointed out by Dr Paul Jones that Fisher clearly recognized an arbitrary element in the 0.05 convention but he also recognized three essentials to good science:

1) the need for proper study design, including adequate sample size and power:

2) the need to replicate a study as often as necessary to validate initial conclusions: and

3)the need to select appropriate methods for estimating the error of the study.

Finally Paul Jones makes the very important observation that "Statistical tests of significance address only one question: If a study were repeated, to what extent would we expect the results to be close to those originally reported? Only if the concept of statistical significance is retained can we answer the more pressing question : How do we design studies that will produce valid estimates of study error."

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THE SPEED OF LIGHT

Researchers at Bell laboratories and Xerox are experimenting with integrated microchip circuits which use light from lasers and quantum wells as well as semi-conductors made from gallium arsenide in order to transmit information instead of electrical circuitry. The use of photonics and gallium arsenide to store and transmit signals may significantly increase the speed and performance of computers.

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RATS MAY TAKE OVER FROM THE MOUSE?

Some claim that biological computers may one day be produced using strands of genetic material such as DNA or even bacteria in place of the silicon microchips to store information. Some even suggest that microchips and neurons from the brain may one-day be bonded together implanted in humans to augment intelligence. If this sounds too far fetched Professor John Stevens of the Neuroscience Institute at the University of Toronto has in fact bonded a neuron from the BRAIN OF A RAT to a microchip in order to study and compare the biological and inorganic material.
Some believe that biological computers may hold hope for a new kind of computer which will work more rapidly and store more information. Theoretically a computer the size of a thimble could store the knowledge of the whole world according to Frank Ogden of the 21st Century Media Communications Inc Vancouver BC. However, before a biological computer could be developed a number of major problems will need to be addressed. In the first place how can the genetic material be incorporated into the computer? A further major problem will be how to keep the genetic material alive and protect it from disease excessive heat or electro magnetic damage. Skeptics say that the only advantage of using biological material in computers is that it can be packed to a relatively high density. Unfortunately biological material would generate heat when working at high speeds, which would destroy the genetic material (a sort of computer Alzhimers disease?). There are those, however, in the scientific community who feel that this line of research may not be fruitful so writes Debra Black in Air Canada's June 1988 edition of en-Route magazine.

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EXPRES

EXPRES = "Experimental Research in Electronic Submission" is a project at the Universities of Michigan and Carnegie Mellon which commenced in 1986 with funding of $6 million dollars over a period of three years. The goal of the project is to develop the ability to exchange compound computer documents among dissimilar hardware and software environments. Compound documents contain text, images, drawings, charts, graphs, animation, and even voice. Such exchanges are not possible with the available commercial technology.

Once perfected the technology would allow us to send our research grant applications to MRC direct from the computer. The MRC would be sending out grant proposals for review to researchers in the field by the same method. In ten years time we will be submitting our Abstracts to the IADR by the same method, these will be reviewed and evaluated by the same network system.

However, the main advantage of the EXPRES system may be that it will change the way that researchers communicate and collaborate. The members of our Canadian Centres of Excellence in a few years time will be using this type of network system routinely. The collaborative feature of the system allows a user to send not only a document or a graph over the network , but also the logic used to create it. This is a step ahead of the Fax machine which can only send a facsimile. It will be possible for the researcher receiving a graph to change the raw data and see the changes reflected on the graph. The future will see researchers in different parts of the world sitting at computers writing a paper together and conducting ongoing research projects as a routine procedure.

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ADVANCED MATERIALS CENTRE OF EXCELLENCE-NETWORK

An Ad Hoc committee with participation from Dalhousie, TUNS, AMEC, NRC-ARL, and NSRF have held a series of meetings over the past two months in order to put together an initiative for participation in an application for an Advanced Materials Research Centre. The outcome of these endeavors are that a group of 21 research scientists at Dalhousie and TUNS are aiming to participate in the setting up of a "Centre of Excellence in Advanced Materials Research " under the programme announced by the federal government. Meetings are being held with other universities across Canada to discuss the linking together of various nodes into a network system.

The announcement of the Advanced Materials Engineering Centre (AMEC) at TUNS with its $9 million funding, together with our MRC Programme grant support of $712,000, significantly strengthens the argument in favour of an Advanced Materials Centre of Excellence Network for Atlantic Canada.

The Hon. Robert de Cotret, Minister of Regional Industrial Expansion and Minister of State for Science and Technology, and the Hon. Frank Oberle, Minister of State (Science and Technology) announced on the 25th May details of the $1.3 billion in funding for science and technology. This includes $240 million for the establishment of national networks of centres of excellence, and a $200 million increase in the base budgets of the three university research Granting Councils. MRC will have its budget increased by $61 million over five years, with $103 million going to NSERC and $36 million going to SSHRC. The federal government currently provides more than half a billion dollars annually to the university research Granting Councils.

Mr. de Cotret said of the Centres of Excellence Programme "Our government has recognized the need in Canada's scientific community for the establishment of a structured and useful national programme that will permit the nation's best and brightest scientific minds to share their work with colleagues".

Mr.Frank Oberle said "Our future social and economic prosperity as a nation depends largely on the strength of our universities and the quality of research and training they provide for our youth".

The three federal granting councils will form an Inter-Council management committee to oversee the delivery of the programme for the Centres of Excellence Networks. There will be a single national competition open to all disciplines, with proposals initiated by the university or the industrial communities. The first stage of the process will be the submission of a a letter of intent. The guidelines and detailed requirements for the preparation of the letters of intent will be made known at the end of June.

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THE LAW OF ERRORS

"Everybody believes in it because mathematicians imagine that it is a fact of observation and observers that it is a theorem of mathematics" H.Poincare'.

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ACCURACY AND PRECISION
A PROBING QUESTION

Accuracy of measurement can be expressed as the rang of possible values which include the "true" value. On the other hand precision refers to the dispersion of values around the mean value, thus, an experiment with a small standard deviation would be considered precise. In experiments we have to consider the effect which both systematic and random errors may play in the accuracy and precision of replicate results from an experiment. Assuming we are measuring the pocket depth with a periodontal probe we are interested in both accuracy and precision.

If we have few random or systematic errors our results will be clustered around the "true" mean (ie. a small standard deviation). The presence of systematic errors increases the area under the frequency curve around the mean making our mean value less accurate. The presence of random errors increases the standard deviation around the true mean thus reducing the precision. When we unfortunately have both a large standard deviation and an increased area under the frequency curve around the mean then our measurements are neither precise nor accurate.

Winter(J.Perio 50:483, 1979) used a Boley gauge accurate to 0.1 mm to examine markings on periodontal probes and found that the new Williams probes made by Hu-Friedy were accurate and precise, 83% were 7.0 mm in length and the total range was only 6.8 to 7.3 mm. However, the Boley gauge only measured to the nearest tenth of a millimeter. An even more precise measurement using a micrometer would have measured to one hundredth of a millimeter (ie. to the nearest 10 um). Had the experimenter used a micrometer to make the measurements it would have been possible to measure the size of the probes to the nearest 0.01 mm. Using the Boley gauge the range (or accuracy) was given as 6.8 to 7.3 millimeter. The lowest limit may have been 6.76 to 6.84 and the upper limit 7.26 to 7.34 if the micrometer had been used. We have to realize that the error which is introduced by the rounding off of numbers, will be dependent upon the number of significant digits in the number. The smaller the number of significant digits the greater will be the range of error. If we make ten measurements with a Boley gauge accurate to 0.1 mm and find that the mean of the measurements is 7.87 we should report it as 7.9 since we only have two significant digits.

The required accuracy of an approximate number depends upon the type of experiment, the questions to be asked and the comparisons which have to be made. It would seem reasonable to accept a limit of 0.1 millimeters for the accuracy required for a periodontal probe.

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THE KEY TO RESEARCH SUCCESS

Two MIT scientists reported in the May 12th edition of Nature that they had deciphered the first word in a genetic code that has been known about for some time but scientists had previously failed to break the code. The scientists broke one "word" in the in the code by finding a chemical key on one of the transfer RNA's that gives it the ability to pair up with one of the amino acids. The Key turned out to be a "base pair", the most fundamental unit of which genetic chemicals are made. The discovery of the very small unit should make it easier to find the key on others. The discovery may also support the speculation that DNA was not the first genetic chemical but was preceded in evolution by other forms which later evolved into DNA.

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RADIATION DOSIMETRY USING TOOTH ENAMEL AND ESR

Dr's. Barry Pass and John Aldrich will be presenting papers at the Health Physics Society meeting in July in Boston and at the 14th L.H.Gray Conference on Low Dose Radiation - Biologic Bases of Risk Assessment, in Oxford England in September. Their research involves the development of a radiation dosimetry method for nuclear veterans using ESR and dental enamel.

The goal of the research programme is to develop an in vivo method of measuring absorbed radiation dose in the general population. It may then be possible to directly link low radiation exposure and cancer. The establishment of such a relationship would allow extrapolation to the risks associated with medical and dental radiographic procedures. At present the biological risk is only inferred from victims of large exposures such as that due to nuclear reactions.

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DENTISTRY AIDS DETECTION

One of the more than 2,000 papers presented at the IADR in Montreal last March was by Sandra Melnick. The researchers had examined nearly 600 homosexual men for a range of oral disorders such as: yeast infection; severe periodontal disease; cold canker sores; kaposi's sarcoma and hairy leukoplakia which is believed to be caused by a virus unique to those with AIDS.

Since the examination can be completed in 5 or 10 minutes with simple equipment the study indicates that oral examination of individuals with high risk of getting AIDS would be a very cost effective procedure. Among the 600 individuals screened the researchers found a man with Kaposi's sarcoma, the young man was unaware that he had AIDS.

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BIOTECHNOLOGY-BIOMATERIAL

Dr. Ernest Hayes a Professor of Chemistry at Acadia University reported at the 3rd Chemical Congress of North America in Toronto that a natural substance CHITIN one of the most abundant biological materials in nature could be one of the miracle substances of the future.

Chitin is found in mushrooms, yeasts, and in the outer shells of crabs and lobsters as well as in the hard shells of various insects. Professor Hayes together with colleagues at St. Mary's University has taken out a patent on a spray based on chitin for coating fruit and vegetables to prevent oxygen from spoiling them.

The other uses of chitin include: a biodegradable surgical suture material, as an oxygen -resistant burn healing spray, or as a matrix film to slowly release antibiotics, or hormones.

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Do you have any "RESEARCH NEWS ITEMS" which you would like to share with your colleagues?. If so, please forward such items to the Research Development Office, or call 2545.