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The Dental Research Institute at Wits 1954-1985

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A. HISTORY OF THE INSTITUTE

1954-1960

In 1954 the Council for Scientific and Industrial Research (CSIR) entered into an agreement with the University of the Witwatersrand. As a result, the Joint CSIR/University Dental Research Unit was formed with Professor James Irving appointed as Director. Professor Irving was a medical graduate of the University of Cape Town with an interest in mineral metabolism and calcification. This interest dominated the initial research programme of the research unit so that many publications during this period dealt with aspects of calcification.

Professor Irving attracted to his staff a chemistry graduate, Clive Solomons, who in due course obtained his PhD in the field of calcification. He subsequently moved to the United States where he has maintained his research interest in mineral metabolism and calcification.

A second important staff member was Dr. Jan Dreyer, Head of Orthodontics at the time. Dr. Dreyer already held a BSc degree and this plus his interest in biochemistry made him a natural foil to Professor Irving. Dr. Anthony Melcher, later to become head of the Canadian MRC Research Group in Periodontology, was another researcher who began his research career under Professor Irving.

In due course Professor Irving was attracted to the United States, in his case to Harvard University, to continue his research at the Forsyth Dental Infirmary. In the approximately 7 years that Professor Irving was at the helm some 36 publications appeared in the scientific press, and several higher degrees were begun.

1960-1970

In 1960, Dr Jan Dreyer was appointed Professor of Experimental Odontology and Director of the Dental Research Unit, and the next era commenced. Jan Dreyer's research interests were naturally directed by his orthodontic experience. The main direction was thus in the field of bone healing after orthodontic treatment, surgery and bone infection. In this he gained an international reputation. A particular contribution was his commitment to postgraduate dental education. He was one of the founders of the part-time Higher Diploma in Dentistry which was the basis on which much postgraduate dentistry in the RSA was built, and for many years he was responsible for the biochemistry component of the course.

Jan Dreyer's ability to attract researchers came to the fore when he recruited Drs. Hugo Retief and Peter Cleaton-Jones to his staff. Dr. Retief brought to the research unit his qualification in chemistry, his experience in the chemical industry and many years dental practice in Vanderbijlpark. Dr. Cleaton-Jones had other experience — in his case qualifications in dentistry and in medicine. Together the three complemented each other.

An activity during this period was fluoride analysis of water supplies and teeth. This, plus his chemical knowledge resulted in what some have regarded as Jan Dreyer's greatest contribution to dentistry in the RSA, his appointment as Member of the Governmental Commission of Enquiry into the Fluoridation of Public Water Supplies. The Commission systematically and scientifically examined evidence for and against fluoridation. In 1967, they unanimously recommended fluoridation and urged the RSA government to implement this. Regretfully, this has not occurred.

The dissemination of scientific knowledge continued and during his directorship approximately 67 papers were published. MDS degrees were completed by Alex Jacobson, Bernard Joffe, Tony Melcher and Mervyn Shear. In addition, two MSc degrees were awarded.

Overseas contact was increased when Dr. J.F.P. Dijkman, an orthodontist from the University of Nijmegen, The Netherlands, spent a sabbatical year in the Unit.

The next change that occurred, in 1969, was when the newly formed South African Medical Research Council (MRC) took over the responsibilities of the CSIR. The research unit was renamed the MRC/University of the Witwatersrand Dental Research Unit.

1970-1976

In due course Professor Dreyer was appointed Dean of the Dental Faculty and once again a new leader was required. This time Dr. Hugo Retief was appointed Professor of Experimental Odontology. The research emphasis in the unit veered towards adhesion. Hugo Retief was involved in the development of the direct bonding of orthodontic attachments to teeth, a field in which his international reputation grew. Coupled with this was research into fluoride, with particular reference to fluoride analytical techniques; and into the response of the dental pulp to various acids and filling materials.

John Austin, a veterinarian, was recruited during this

period. His specialized knowledge and innovative skills added much to the research programme.

Postgraduate activity increased in this period. Hugo Retief and Peter Cleaton-Jones completed their PhD degrees and two M Dent degrees were also awarded. Research publications also increased in number, some 112 being published in local and overseas journals.

In 1975, Professor Retief spent 6 months in the United States, during his sabbatical leave, and subsequently emigrated to the Institute of Dental Research at the University of Alabama at Birmingham, where he is at present.

1976 — present

Once Professor Retief had emigrated, Peter Cleaton-Jones was appointed to the Chair of Experimental Odontology. Initially this was of the Dental Research Unit but in 1978 the designation was changed to that of an Institute, which indicated its more permanent nature.

As was the case with previous directors, the direction of research changed somewhat. Epidemiology came to the fore, with emphasis on dental caries and its causation. In this research field close links were forged with the National Research Institute for Nutritional Diseases of the MRC, Epidemiology Section under Dr. B.D. Richardson, and with Dr. A.R.P. Walker of the MRC Human Biochemistry Research Unit at the South African Institute for Medical Research.

The tooth implantation/replantation research programme was also increased and another field that was expanded was research into nitrous oxide usage and pollution, in collaboration with Professor Don Moyes of the Department of Anaesthesia at Baragwanath Hospital.

International collaboration increased and the following distinguished researchers have been visiting professors or lecturers of the institute, several for more than one period:

Professor Gerry Winter	(London, U.K.)	(1981)
Professor Lars Granata	(Malmö, Sweden)	(1982 and 1984)
Professor Ingar Leidal	(Oslo, Norway)	(1984/1985)
Professor Tony Hargreaves	(Edmonton, Canada)	(1985)
Professor Miomir Cvek	(Stockholm, Sweden)	(1978-1985, various periods/year)
Professor Leo Sreebny	(Stony Brook, NY, U.S.A.)	(1983)
Dr. Graham Roberts	(London, U.K.)	(1985)
Professor Hans Peter Philipsen	(Arhus, Denmark)	(1978 and 1979)

In addition, Mr. Ruedi Schmid from the University of Zürich completed his MSc (Dent) degree in the institute. Postgraduate activity blossomed with the replacement of the higher diplomas in the faculty with Master's degrees. Since 1976 the following have been completed in the Institute: PhD 3; M Dent 14; MSc 1; MSc (Med) 2; MSc (Dent) 12.

Dr. Andrew Jodaikin, a "Wits" graduate, joined the Institute, completed his MSc (Dent) and then obtained a scholarship to the Weizmann Institute in Israel to undertake a PhD, a task with which he is busy at present. Another gain was Mrs. Elly Grossman who was transferred from an MRC unit that was closing. She brought with her specialist electron microscope knowledge and is presently completing an MSc (Dent).

An advance instituted over the past few years has been the introduction of a course in research methodology. This is compulsory for students for the MSc (Dent) degree by course work and is attended by students for other degrees within the faculty, from other faculties within the University and from other Universities and Technikons.

Research productivity has been aided by a stalwart band of honorary research fellows who, over the years, have themselves completed higher degrees in the institute. These include Dr. Freddie Barbakow (now at the University of Zürich); Dr. Alf Volchansky; Professor Kim Mizrahi; Dr. Les Fleisch; Dr. Pam McInnes (presently at the University of Louisiana Dental School), and Dr. Sean Williams. The combined activity of these researchers, the postgraduate students, and the many skilled technologists who have worked in the institute over the years, has resulted in the 32 higher degrees already mentioned and 177 full publications in local and overseas refereed journals. This productivity has increased the international reputation of the Institute and the Faculty of Dentistry.

B. PRESENT RESEARCH PROGRAMME

The present research programme is organised under five broad headings:

1. Bone and pulpal healing
2. Dental caries
3. Dental materials
4. Nitrous oxide
5. Oral mucosa

1. Bone and pulpal healing

How should the dental pulp be treated after accidental trauma has exposed it? Should the pulp be extirpated and filled? When teeth are replanted should root fillings be inserted immediately? later? or perhaps never? Should antibiotics be used routinely? only when infection is present? or perhaps topically? These are examples of the types of questions for which answers are being sought. Collaboration with Professor Miomir Cvek from Stockholm, an expert on the management of the traumatised tooth, has provided some of the answers, which are being prepared for publication.

Another aspect concerns bone healing after intentional trauma such as tooth extraction or orthognathic surgery. This type of research is well suited to those with a surgical background or interest. An asset in research on both pulp and bone healing is the availability, within the University, of non-human primates for projects, approved by the University's Animal Ethics Committee. Close collaboration with Professor John Lownie and his staff of the Division of Maxillo-Facial and Oral Surgery, ensures a strong link to clinical surgical practice.

2. Dental caries

The main thrust of dental caries research is in the epi-

demiology of the disease, a method which makes use of the striking variations within South African populations. Groups living side by side but with contrasting and similar lifestyles may be compared to each other. This natural laboratory has attracted collaborators from Scandinavia, Switzerland, Canada and the United States.

Descriptive epidemiology has been used to indicate trends in dental caries and analytical epidemiology is being used to investigate the causes of dental caries in RSA populations with particular reference to the interaction of the causative factors. In all, details of dental caries and related data for some 16 000 preschool children aged 1-6 years, are stored in a series of computer data sets. A direct link with the University's mainframe computer enables rapid manipulation of the data.

Laboratory studies have emerged from epidemiological observations and these have studied problems like fluorosis indices, the rôle of traditional black foodstuffs on rat caries; and proton-induced X-ray emission (PIXE) analysis of enamel and dentine of extracted teeth, to investigate trace elements in dental caries.

Future research will be geared towards investigating the rôle of confounders in the aetiology of dental caries in the RSA. This is especially necessary because of the varying patterns of caries development — a decrease in prevalence among white pre-school children and increases among other groups.

3. Dental materials

One of the main thrusts of materials research in the laboratory is concerned with the study of microleakage following tooth restoration, using fluorescent dye techniques. Thermal cycling is used to speed up stresses applied to restored human or monkey teeth.

Gradually the DRI has emerged as an international centre for the study of pulpal response to filling materials. This is because of the access that the DRI has to non-human primates and to the experience gained in some 12 years of this type of research. Results obtained in 1 000 teeth are stored in a computer data set for future reference and comparison. Also, sections from previous studies are available for re-examination and assessment. This expertise has resulted in several research contracts with overseas companies for certification of filling materials. It is expected that this will be a major avenue of expansion in the near future, because of the unique facilities and experience.

Biocompatibility testing of dental materials other than filling materials is also in progress and it is hoped that a post-doctoral student will soon be active in the synthesis of new polymer materials.

4. Nitrous oxide

It has been known for several years now that the inhalation of trace quantities of nitrous oxide by operating room and dental surgery personnel is harmful. This harm is usually an interference with reproduction manifested by an increased spontaneous abortion rate or lowered fertility. The dentist is at particular risk due to his or her close proximity to the mouth and nose.

In the DRI, research has confirmed that pollution exists in typical RSA dental surgeries and present research is aimed at reducing the hazard through the evaluation of scavenging devices and teratological experiments to determine threshold values for safe exposure. Professor Don Moyes and staff have brought their wealth of medical anaesthetic experience to the team which has also involved engineers and chemists. Collaboration with international experts is under way with regard to the determination of a threshold exposure level.

5. Oral mucosa

The structure and function of oral mucosa has been investigated using transmission and electron microscopy. Initially normal, unstressed oral mucosa was studied and subsequently mucosa against which pressure was applied. The latest stress to be applied is suction. Quantitative histometric analysis of the changes produced by pressure has shown that convolutions of the cell membrane appear to be for reserve to allow stretching rather than cellular attachment.

Temperature variation in the oral mucosa is also under study, as a possible aid in the early diagnosis of local disease including periodontal disease. Some baseline studies on variations in apparently clinically healthy mucosa have been completed and submitted for publication.

C. GENERAL PHILOSOPHY

The DRI was established to carry out dental research, to provide a training in dental research and to afford facilities for part-time dental research. All of these mandates set out in the original design of the Institute, are presently complied with.

Interdisciplinary co-operation is a key to modern research. Thus, in the DRI, close collaboration has been built up with statisticians, engineers, chemists, nuclear physicists, nutritionists, medical experts and so on, in other University departments and other institutions within and without the MRC.

Co-operation with colleagues abroad has gradually been built up through personal contact and this co-operation is increasing annually. The DRI is essentially a team, thus all staff members participate in all activities and authorship of articles. This has aided productivity which was recognized by the University of the Witwatersrand in 1983 when the DRI was presented with a merit award for research productivity.

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