DEAN’S WORD

Many of you will have seen and heard in the media last month that the University of Sydney has launched an ambitious fundraising campaign, INSPIRED, and may have wondered where the Faculty of Dentistry sits with this initiative. The short answer is that this is a University-wide activity that embraces all faculties.

This campaign will help us further our ground-breaking research and education, and raise awareness in the wider community of the importance of oral health to general wellbeing.

INSPIRED – the Campaign to support the University of Sydney is aligned to my vision – to establish a Dental Management and Research Centre in the faculty to provide the crucial link between education, clinical care and scientific research and improve oral health in the community.

The centre will focus on real-world solutions that support the dental practitioner, through developing and disseminating clinical guidelines based on solid research evidence. This will translate into better treatments and outcomes for patients and support healthy ageing.

Importantly, our research will help us to understand and treat, as well as prevent, both dental diseases and major disease conditions such as cardiac disease, diabetes and even cancer. This is not ‘pie in the sky’ – we are doing it already at Sydney. Currently, faculty researchers are working on ways to manage dental caries non-surgically, periodontal disease by disrupting the bacterial cells, trying to understand how cancer cells spread and how jaw muscle cells can be used to replace damaged heart cells in heart attack patients.

We are demonstrating the important links between dental and overall health, and applying our research in the community.

The new centre will assist us in continuing to provide evidence-based quality service to the most needy people in the community; in the hospital clinics where we teach; in Aboriginal communities located in Bourke and Dubbo; and increasingly with aged care service providers. I believe this vision is highly achievable and something we should all strive for.

The ‘enablers’ to deliver my vision are:

– a clinical cohort database and biobank to help track patients and their treatment (see page 2)
– digital dentistry to provide advanced education and clinical tools (see page 2)
– scholarships and stipends to support students and researchers (see page 5).

However, the reality is that if the faculty moves forward on its own, progress will be slow and the needs of the community unmet. The solution lies in us forging partnerships with individuals, organisations and philanthropic bodies.

We need your help to make this vision a reality. Your gift will make a difference now and can be an enormous source of personal satisfaction as you engage with us and see the impact of your support.

Professor Chris Peck
Dean, Faculty of Dentistry
ENBLER 1: FOSTERING NEW ORAL HEALTH DISCOVERIES

The first enabler for real-world solutions to dental health issues is a clinical cohort database and biobank, which will provide a platform for better targeted research.

Newly appointed Bela Schwartz Research Fellow, Dr Shanika Nanayakkara, will work with faculty researchers to establish a clinical cohort of patients at the faculty and the Westmead Centre for Oral Health. This cohort will serve as a resource for patient-based studies that address oral health outcomes of importance to our population. Dr Nanayakkara comes well prepared having recently completed a large clinical study on chronic kidney disease (CKD).

“Chronic kidney disease is an emerging global public health issue of which the pathophysiological and epidemiological knowledge is still incomplete,” Dr Nanayakkara says. “My interest, knowledge and experience in public health research, particularly on population surveys and cohort studies, will help me to establish an informative clinical cohort of patients to improve dental health.”

The ultimate objective of this work is to evaluate and improve oral health care services and key health outcomes for patients in need, Dr Nanayakkara adds.

The planned cohort will deliver a long-term resource for collaborative, multi-disciplinary research on oral diseases and their interaction with systemic diseases, such as cardiovascular diseases, diabetes and obesity, according to Dr Manish Arora who together with the faculty’s Research Committee has been developing the database concept.

Importantly, if we want to include regional and remote clinical sites in our databank, our roadmap needs to consider how to improve patient access to care. Patient consultations can already be undertaken via videoconferencing and could greatly improve with the rollout of the high-speed National Broadband Network. Here, the future could encompass tele-robotics, which includes tactile sensors that help enhance control of machines and examination and management of patients at distant sites. We are currently exploring such options with the Faculty of Engineering and Information Technologies.

Professor Neil Hunter, Associate Dean (Research), says the resource “will build research capacity by involving clinicians, laboratory scientists and postgraduate trainees in well-organised established projects that have ongoing ethics approval and archived bio-specimens for rapid research translation”.

Dr Arora adds that “clinicians interested in research training will be provided with structured supervision and the opportunity to harvest archived data, access study participants, and access samples stored in bio-specimen banks.”

A major outcome of the cohort will be research that directly informs clinical guidelines and policies on prevention that will contribute to healthy ageing.

ENBLER 2: EMBRACING THE DIGITAL AGE

The second enabler is creating a roadmap to make the best use of digital dentistry.

Under our blended learning strategy the faculty already offers online resources (e-books, movies, etc) supported by online quizzes, recorded lectures and face-to-face tutorials. Electronic submissions of assignments are assessed online by staff using plagiarism-detection software. Videoconferencing between Sydney and regional NSW already takes place with student groups and faculty committees.

Now we are going one step further by developing a digital roadmap that will consider how to integrate the multiple sources of learning information seamlessly. The roadmap will include virtual learning environments that incorporate robotic technology and virtual reality, to greatly enhance and accelerate clinical skills acquisition.

We will also build a clinical data and biological specimen bank that uses an electronic database to analyse disease trends. The bank will monitor patient clinical data and work towards improved clinical guidelines.

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On a different front, computer-aided design and manufacturing (CAD-CAM) in dentistry is rapidly advancing. While it is possible to have crowns and other restorations fabricated directly from digital ‘impressions’ of prepared teeth, our roadmap will explore linking this technology to advanced imaging and jaw tracking. One of our ultimate goals is to see this technology used for the manufacture of complex dental prostheses. Industry partners and our colleagues in the Faculty of Engineering and Information Technologies are essential collaborators in this venture.
There has been a recent breakthrough in our understanding of the mechanism of tooth decay (dental caries) and its management, led by our own Associate Professor Wendell Evans.

While it takes some time for early decay to progress to a hole in the tooth, the early signs of decay can be detected. Through a combination of home management, professional dental treatment and close monitoring, the decay can be stopped and the lost minerals (calcium and phosphate) naturally replaced from saliva.

This process is boosted by a combination of fluoride from drinking water and toothpaste, and professionally applied varnish. The challenge has been to translate this knowledge into practice.

The traditional approach to treating tooth decay is a visit to the dentist who will use the dental drill and restorative filling materials. While cavities – the result of the disease – can be restored successfully, this treatment alone is not sufficient to bring the disease under control.

Professor Evans’ caries management system focuses on a non-surgical approach which addresses individual risk factors and is tailored to each patient, based on their risk assessment for decay. The dentist and patient spend more time in communication, so that dentists can understand where their patient ‘is at’ in dental literacy terms, discuss effective caries management, deliver risk-specific non-surgical management protocols and monitor clinical and behavioural outcomes. The patient is invited to directly observe the early decay as seen, both in their teeth and in the dental radiographs.

In addition to professional care, it is important for patients to understand that the fundamental key to preventing and stopping decay is in their own hands, by treatment at home: twice-daily careful tooth-brushing with fluoride toothpaste and reducing sugar consumption. Thirdly, patients are coached on their brushing techniques.

Clear communication using motivational interviewing skills is essential to encourage and empower patients to manage their personal oral health.

We are teaching our future dentists these caries management techniques, which will carry through to their practice.

The emerging success of this program is once again thanks to donor support, which enables the faculty to continue pursuing this ground-breaking research.
GENERATING KNOWLEDGE ABOUT HEART DISEASE

We are researching the potential of a new stem cell source for heart repair after a heart attack – masticatory muscles. Dr Munira Xaymardan (pictured) explains.

Heart attack causes death of part of the heart muscle that is later replaced by scar tissue. This can compromise the heart’s function and lead to heart failure and death.

Currently, there is strong optimism that heart regeneration can be stimulated by delivering stem cells to the heart. Stem cells from various tissues including bone marrow and fat tissue as well as limb muscle have been investigated to determine the best cells for therapy. They all have produced some level of short-term improvement in the heart function. However, the long-term clinical outcomes have not been optimal. This is largely because the injected cells do not readily turn into cardiac cells and cannot integrate with the existing muscle cells.

One surprising stem cell source for heart repair may come from a previously unrecognised tissue: masticatory muscles. These jaw-related muscles are more similar to the heart than to the limbs.

Our data, together with recent reports from other groups, have shown that a common group of stem cells form both the masticatory and the cardiac muscles during embryonic development. Surprisingly, progenitor cells isolated from adult masticatory muscles can be induced to differentiate into heart-like cells that have the essential qualities of fatigue resistance and synchronous beating.

Masticatory muscle stem cells may be useful for replacing heart muscle cells lost after a heart attack. Currently, very little is known about the characteristics of these unique stem cells in adults or their suitability for heart repair. However, we hope to expand our knowledge base and thereby improve our understanding of heart disease.

CONTINUING EDUCATION: JUNE–NOVEMBER 2013 CALENDAR

JUNE
The microscope in everyday dentistry: Getting a closer view
Friday 7 June
Osseointegrated dental implants
Friday 14 to Sunday 16 June

JULY
Contemporary infection control: State of the art
Saturday 6 July
Periodontal disease
Friday 19 July

AUGUST
Sleep apnoea and snoring: What you need to know
Monday 5 August

SEPTEMBER
Implant prosthodontics workshop
Monday 16 and Tuesday 17 September
Rotary endodontics: A rotary refresher
Saturday 21 September
Extended fixed prosthodontics
Monday 30 to Friday 4 October

OCTOBER
Rotary endodontics: New concepts, new horizons
Saturday 19 October

NOVEMBER
Practical oral surgery – Melbourne
Friday 1 November
Advanced periodontal instrumentation
Saturday 16 November
Local anaesthesia and emergency medicine – Sydney
Wednesday 13 November
Local anaesthesia and emergency medicine – Melbourne
Tuesday 19 November

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ENABLER 3: MAKING A DIFFERENCE THROUGH FELLOWSHIPS AND SCHOLARSHIPS

The third important enabler is investment in fellowships and scholarships to support future education and innovation.

Our faculty is making ground-breaking advances in a number of important research areas which will lead to improvements in the community’s health. We have received global recognition for studies such as Drs Christine Austin and Manish Arora’s published research in *Nature* (see page 6), which demonstrates that the developing tooth is a great biomarker for chemical exposure during childhood.

The method developed by this team will help us understand better chemical exposure to humans around the world and can be linked to disease trends.

Dr Munira Xaymardan is investigating the use of jaw muscle stem cells to repair damaged cardiac muscle cells after a heart attack (see page 4). It looks like she is onto a good thing: there is increasing evidence revealing that the masticatory muscle shares a common developmental origin with the heart muscle.

The cells are fatigue resistant and possess markers that facilitate synchronous beating (as in the heart muscle). Ultimately Dr Xaymardan wants to develop successful treatments for heart disease.

These are two of many significant research projects in the faculty. Importantly, they demonstrate the key ingredients of the faculty’s research strategy: teamwork with other health researchers, the need for basic and clinical research collaboration, and an ultimate goal to improve the health of the population.

However, resource-intensive activities such as research are expensive and often need external support. We welcome partnerships and support from donors, enabling researcher fellowships and scholarships, purchase of equipment, materials and essentials.
GENERATING KNOWLEDGE ABOUT CANCER

Our researchers, led by Professor Hans Zoellner, are making discoveries that change our thinking about cancer progression, and could lead to new treatment approaches.

The essential nature of cancer is for genetically damaged cells to grow as clones and proliferate. Super-aggressive clones eventually overwhelm the patient. These damaged cells continue to mutate into sub-clones, thus increasing diversity among cancer cells. Although chemotherapy and other treatments often provide good early results there may be long-term failure as they cannot target the range of diverse cancer cells.

However, work by our researchers has demonstrated that tumour cell diversity can emerge without genetic changes. This surprising and exciting discovery significantly changes our concept of cancer progression, and raises possibilities for new approaches to the management of this devastating disease.

The research team includes researchers, Minh Huynh, Manu David, Elizabeth Kelly, and Hans Zoellner (pictured right), Head of the discipline of Oral Pathology and Oral Medicine at the University of Sydney.

We have discovered that cancer cells swap membrane and cytoplasm with normal surrounding cells by a process we have called ‘cellular sipping’. In this way, even within sub-clones of cancer cells, the process results in an almost infinite amount of cancer cell diversity. This helps account for both immune evasion and cancer therapy resistance, and raises hope for better treatment outcomes if cellular sipping could be blocked.

We are grateful for funding from the Australian Dental Research Fund and the Australian Dental Industry Association, with further support provided by the Faculty of Dentistry and the University of Sydney. This support has enabled Professor Zoellner to progress the project more quickly through a sabbatical year spent working in collaboration with the Memorial Sloan-Kettering Cancer Center in New York.

THE POWER OF COLLABORATIVE RESEARCH

The faculty has already helped make one major breakthrough that will deepen our understanding about important, real-world health issues. Dr Manish Arora was senior author on the ground-breaking paper in the prestigious journal, Nature.

Maternal milk is fundamental to the health of newborns. But how has this crucial feature of early childhood development evolved in primates? This question has perplexed researchers for decades – the problem lies in trying to estimate what long-extinct populations were doing thousands of years ago.

In a key breakthrough, the Faculty of Dentistry, Institute of Dental Research and other researchers from Australia and the United States developed a method that can be applied to ancient fossil samples, to uncover breastfeeding habits. Their research showed that consumption of maternal milk and then later transition to non-milk foods leaves an imprint in teeth. This imprint can be uncovered using sophisticated lasers and microscopes many years later.

The findings were published in scientific journal Nature and were part of a wide-ranging collaboration between Australian institutions (the University of Sydney and the universities of Technology Sydney, Melbourne and Southern Cross), and US institutions including Mount Sinai, Harvard and the University of California at Berkeley.

“It was the intersection of several disciplines, including analytical chemistry, dentistry and evolutionary biology that made this discovery possible,” says co-author Dr Christine Austin.
HONOURING OUR SUCCESS STORIES

We recognised the achievements of our students and staff at the faculty prize awards on 15 March 2013. Dean of the Faculty of Dentistry Professor Chris Peck paid tribute to our prize winners at the event.

As Dean, I am extremely proud of the accomplishments of our students. Those graduating in March this year joined the proud ranks of University of Sydney alumni. We expect to see them back at the University in one capacity or another, whether it be in the quest for life-long learning, to advance oral health through research, or to share expertise and experiences with future students.

Our staff are committed to the education of future clinicians and researchers. It is rewarding to see them recognised for innovation and excellence in their teaching activities with the Professor Roland Bryant Awards for Teaching Excellence.

I am extremely appreciative to our benefactors, including individuals, industry partners, alumni and those from professional organisations who have contributed generously to the faculty through donations to support our students and intellectual endeavours. Without this support, we simply could not offer the academic opportunities that we do.
An abundance of research shows that Aboriginal and Torres Strait Islander people have much poorer oral health than the general population. Their substantially higher levels of decay, periodontal disease and tooth loss are unacceptable.

For many communities, access to dental services is very difficult; not only because of cost but also because of the need to travel significant distances to a major centre. This used to be the situation in Bourke with the nearest dental service being in Dubbo – four hours away.

In 2008 a dental clinic was set up in Bourke by the Poche Centre, under the supervision of Dr Andrea Leonard. In 2011 our clinicians Dr Steven Naoum and Peter Salameh and final-year dentistry students provided a regular, much-needed service to the Aboriginal community in Bourke. In 2012 we expanded to Dubbo, in response to the local need.

The services have been comprehensive and well received. Faculty staff and students have provided dental treatment, oral health education in schools, a mouthguard program to protect kids’ teeth when playing sport, denture fabrication and repair and most recently hospital-based general anaesthetic dentistry for children. In 2013, by working with local Aboriginal Health Services, we expect to provide services to around 900 people.

In doing so, we are achieving our vision of serving our community, addressing the inequity of access to services in rural areas, and providing a range of valuable clinical experiences for our students.

The University’s strategy for improving Aboriginal and Torres Strait Islander engagement and participation in tertiary study, Winda Mura – Bunga Barrabugu, provides the context and commitment for our work. We are proud to partner with the University’s Poche Centre for Indigenous Health in the Faculty of Medicine to work in these communities. The three identified priorities which guide the centre’s work are Healthy Kids, Healthy Teeth and Healthy Hearts.