

UNIVERSITY OF OTAGO FACULTY OF DENTISTRY SIR JOHN WALSH RESEARCH INSTITUTE

TE POKAPŪ RAKAHAU O TĀ JOHN WALSH

Research Highlights

2013-2014

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Sir John Walsh Research Institute Highlights 2013-14

The Sir John Walsh Research Institute (SJWRI), a Research Centre of the University of Otago, advances research and increases knowledge for the improvement of oral health in New Zealand, and provides a national focus for dental research. The Institute's innovative, future-focused, interconnected research programmes cover the spectrum of oral health research, from the molecular, through biological systems to the health of populations. The SJWRI is integral to New Zealand's only Faculty of Dentistry, ranked in the top ten internationally, and its members have well-established productive collaborations across the University and with other institutions in New Zealand and worldwide. Our mission is to undertake research that underpins our teaching and clinical practice, and that translates discoveries into measurable health improvements for all New Zealanders. The Institute is named after Sir John Walsh, Dean of Dentistry from 1946 to 1971, a strong advocate for research in dentistry and oral health.

Mission

- Advance research and increase knowledge for the improvement of oral health
 in New Zealand
- Support and represent the oral health research community in New Zealand
- Facilitate the communication and application of our research findings for the benefit of oral and general health worldwide

Values

- Research for Public Benefit we are committed to carrying out research that leads to new methods for disease prevention, diagnosis, and treatment, in order to improve people's oral and general health
- Excellence we are committed to the pursuit of excellence in research for the development of dental care to enhance the oral health of the public
- Integrity we are committed to integrity, honesty and consistently high standards in research and in all our interactions, both internally and externally
- Accountability we believe that we are accountable for our actions and we are prepared to submit ourselves to appropriate scrutiny
- Equity we will ensure that our policies and practices do not discriminate unfairly or lead to other forms of unfair treatment

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We hope you enjoy *Research Highlights of the Sir John Walsh Research Institute*, a snapshot of our research activities and achievements for 2013-14. If you would like more information on our achievements, including news and events, activities and outputs, and profiles of our researchers and research programmes, please visit our website otago.ac.nz/sjwri. The full *Research Report of the Sir John Walsh Research Institute* for 2013-14, including research profiles for SJWRI staff and postgraduate students, and full listings of all SJWRI publications and research funding for the 2013-14 period, is available from otago.ac.nz/sjwri/research/.

Dr James Smith

Research Manager, Sir John Walsh Research Institute james.smith@otago.ac.nz

Compiled by James Smith

Many thanks to Professor Richard Cannon, Nicole Summerfield, Donnella Aitken-Ferguson, and the staff and students of the Sir John Walsh Research Institute

Dedicated to the memory of Professor Jules Kieser, 1950-2014

Introduction from the Dean



It is an absolute pleasure to write my first introduction to the Research Report of the Sir John Walsh Research Institute.

As colleagues will know, the Faculty of Dentistry at the University of Otago has just been ranked as the 8th best Dental School in the world, which is the first time that the QS rankings have included Dentistry as a stand-alone subject. I would hold the view that this is in no small part due to the excellent research that takes place within the Sir John Walsh Research Institute. Hard on the heels of this excellent news a new building has been announced by the University and in four to five years time we will be moving into a new clinical teaching and research facility which I am sure colleagues will agree is long overdue.

Against this backdrop we are preparing for the next Performance Based Research Funding (PBRF) round which is due to take place in 2018. The University is currently running an internal round in preparation that will allow us to focus our energies and resources on achieving the best possible outcome for the Faculty.

The Research Programmes within the SJWRI continue to be strong, the addition and further expansion of a practice based research network continues apace. This will reach out and engage practitioners throughout New Zealand, bridging the gap between academia and clinical practise, allowing for a variety of challenge-led research questions to be investigated. This development will complement the already existing research that takes place within the Institute.

I congratulate Professor Richard Cannon and all the team involved within the Institute for their accomplishments and wish them all the very best for the future.

Professor Paul Brunton

Dean, Faculty of Dentistry paul.brunton@otago.ac.nz

Report from the Director



The mission of the Sir John Walsh Research Institute (SJWRI) is to advance research and increase knowledge for the improvement of oral health in New Zealand. This Research Report sumarises our efforts over the period 2013 and 2014 to achieve this goal. There are many metrics that can be used to measure research output and performance. These include tangible, and easily quantified, outputs such as the number of publications, amount of contestable research funding awarded, and number of postgraduate degree completions. In addition, there are less tangible measures of research performance such as research collaborations, research prizes awarded, contributions to international conferences and public lectures. We have tried to capture and present these metrics in this report.

Other less tangible measures of research performance include the quality of our graduates and the reputation of our academics. This is why the result of the QS World University Rankings metric, referred to in the Dean's introduction, is so significant. In addition to measuring how many times research articles are cited by other scientists, the metric is based on academic reputation (by academics from other universities) and on how employers of graduates rate the university. This metric ranked the University of Otago Faculty of Dentistry as the eighth best Dental School in the world. This ranking reflects not only the quality of teaching within the Faculty, but also the quality of our graduates and our research.

Such research quality is not achieved within a two-year period and I would like to acknowledge the leadership and research activity within the SJWRI since its establishment in 2007. In particular, I would like to recognize the vision and enthusiasm of the inaugural SJWRI Director, Professor Jules Kieser, from whom I took over as Director in May 2014. Sadly Jules passed away in June 2014, and an obituary for Jules can be found in this Research Report.

The research required for the provision of optimal oral care is continually changing as new materials, processes and technologies become available. It is important, therefore, that the SJWRI continually adapts in order to provide the research to understand, develop, apply, and evaluate new technologies, and to underpin the training of dental students in the use of these technologies. It is noteworthy in this respect that a new SJWRI research programme was established in 2014. It is the *Craniofacial biology and clinical oral physiology* research programme led by Professor Mauro Farella. A description of this new programme is included in this report.

An important part of the mission of the SJWRI is to improve oral health in New Zealand. The Institute has recognized that this is best accomplished in partnership with oral health professionals. This is why a particular focus of the SJWRI over the last two years has been the establishment of a Practice-Based Research Network within the Clinical Research programme. We hope that a greater interaction between SJWRI researchers and the dental profession through undertaking practice-based research together will help resolve real issues for dentists and provide evidence for improved oral care.

In 2014 the SJWRI entered the world of social media under the capable moderation of SJWRI Manager James Smith. If you would like to keep up with our research news and developments please *like* the SJWRI on Facebook and *follow* @SJWRI on Twitter. The SJWRI is committed to meeting the needs of the users of dental research and we welcome feedback on our current research efforts and ideas of new ways to advance research and increase knowledge for the improvement of oral health in New Zealand.

Professor Richard Cannon

Director, Sir John Walsh Research Institute richard.cannon@otago.ac.nz

Sir John Walsh кве

Sir John Walsh made such a remarkable contribution to dentistry in New Zealand that Chapter 8 of Tom Brooking's A History of Dentistry in New Zealand is entitled the Walsh Era 1947-1972.' After graduating with a first class honours degree in dentistry (followed by a medical degree), and then serving as a medical officer in the Royal Australian Air Force, this self-described 'brash Australian' was appointed as the third Dean of the School of Dentistry at the University of Otago in 1946.

Walsh was a powerful advocate for research. Staff in the Faculty of Dentistry were encouraged to undertake PhD study. The School of Dentistry set out to grow its own researchers by introducing the highly successful MDS (Master of Dental Surgery) graduate programme. Some fifty years later this degree was replaced by the Doctorate in Clinical Dentistry (DClinDent) featuring a considerably expanded research component. This increased the research experience and clinical expertise of graduates in a world where biological knowledge, and its impact on clinical practice, are changing at an unprecedented rate. This initiative undoubtedly would have been endorsed by Walsh.

One of his most significant, but least well-known achievements, was developing a high-speed dental handpiece. Early electric drills were inefficient and caused considerable discomfort to patients. While testing the hearing of Australian airmen Walsh not only identified frequencies that caused pain but also those that did not. This led to the hypothesis that the vibrational frequencies from drills of sufficiently high speeds could minimise patient discomfort. With the assistance of H.F. Simmons from the University of Otago Department of Physics, an existing air-powered low-speed drill was modified to operate initially above the 42,000 rpm vibrational threshold, and then at 60,000 rpm. In 1947, Walsh persuaded the Ministry of Science and Industry to underwrite the development of the air turbine handpiece at the Dominion Physics Laboratory in Lower Hutt.

By 1949, a prototype was made, Walsh then obtained the results that contributed to his DDSc (Doctorate of Dental Science) from the University of Melbourne, and a New Zealand patent. Although the prototype overcame the pain problem, its high-pitched noise, excessive exhaust of air into the patient's mouth, and the too-frequent seizure of its primitive bearings (due to overheating) made it difficult to obtain further support from government or commercial sources. American and Swedish researchers had overcome the technical problems in the mid 1950s to produce the Borden Airotor.

Walsh expanded research activity within the Faculty by attracting research funding. He established the Biochemical Research Unit within the Dental School in 1960, now the Molecular Biosciences Laboratory, and supported an electron microscopy suite, now reflected in the Otago Centre for Electron Microscopy.

Walsh's appointment advanced dentistry at many levels. He served as a spokesperson for dentistry at the World Health Organisation. He led a campaign that overcame vociferous opposition to fluoridate water supplies. After 10 years of struggle he succeeded in building the iconic, heritage-listed glass curtain building that now houses the Faculty of Dentistry and bears his name.



Professor Jules Kieser, 1950-2014



Staff and students of the Faculty of Dentistry and Sir John Walsh Research Institute were saddened by the sudden and unexpected death of Professor Jules Kieser on 10 June 2014.

Jules was a dynamic academic who made outstanding contributions to teaching and research at the University of Otago and to forensic services in New Zealand and abroad.

He established and ran the popular forensic biology summer school paper FORB201. Several students were inspired by this course to pursue postgraduate forensic biology research under Jules' supervision.

Jules was the inaugural Director of the Sir John Walsh Research Institute, which encompasses all research undertaken within the Faculty of Dentistry. He moulded the Institute into the successful research centre that it is today. He had many research interests including oral biomechanics, anatomy, forensics, paleoanthropology and paleopathology. He was instrumental in the establishment of the annual Biomouth conference.

Jules was a valuable member of the Dunedin forensic odontology team. In addition to assisting local police with forensic investigations he received commendations for his contribution to disaster victim identification after the Boxing Day tsunami in 2004 and the Christchurch earthquake in 2011.

Jules is remembered by many for his humour, his wry smile, his passion for research and his genuine concern for his colleagues and students.

Biography

Professor Jules A Kieser BSc BDS PhD DSc FLS FDSRCS(Ed) FFSSoc FICD FFOMP(RCPA)

Born in Pretoria, South Africa, in December 1950, Jules obtained a BSc from the University of the Witwatersrand, and qualified as a dentist in 1975.

Having completed a compulsory Army year, he went into practice first in the outback of South Africa and subsequently in London and Johannesburg. While in practice, he received a PhD in 1989 and was appointed as Reader in Craniofacial Biology and also Honorary Professor of Anatomy at Witwatersand.

In 1996 Jules was appointed to the Chair in Oral Biology, and Head of the Department of Oral Sciences, University of Otago. Subsequently he obtained a DSc in 2001 and was awarded an ad hominem Fellowship in Dental Surgery from the Royal College of Surgeons, Edinburgh. In recent years he was elected as a professional Fellow of the Forensic Science Society (UK).

In 2009 he was appointed as the inaugural Director of the Sir John Walsh Research Institute.

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The Jules Kieser Memorial Trust

To honour Jules, the University of Otago Faculty of Dentistry and Sir John Walsh Research Institute established the Jules Kieser Memorial Trust.

The Trust will be used to provide an enduring tribute to his memory, by supporting PhD student research projects and providing for two undergraduate research prizes – one in oral biology and one in forensic biology.

To donate to the Professor Jules Kieser Memorial Trust, or to learn more about the Trust, please visit otago.ac.nz/jktrust.

With your help, this fund will provide a perpetual and growing tribute to a man who gave so much to dental education and research, forensic sciences and the dental profession.

Our Highlights

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FACULTY OF DENTISTIC

The Walsh Building, home of the Faculty of Dentistry since 1961.

Publications and Research Funding, 2013-14

Publications Summary, 2013-14

Note: To avoid double counting, unique publication counts are used when a publication has authorship from more than one department; e.g. for a publication with authors from more than one department, each department's contribution is allocated proportionally.

Clinical Services	2013	2014
Conference Contribution - Verbal presentation and other Conference outputs	0	0.33
Total	0	0.33
Office of the Dean (Dentistry)	2013	2014
Authored Book - Research	1	0
Journal - Research Article	13.14	7.45
Journal - Research Other	1	0.82
Conference Contribution - Published proceedings: Full paper	0.25	0
Conference Contribution - Published proceedings: Abstract	9.29	1.62
Conference Contribution - Poster Presentation (not in published proceedings)	0.25	0.33
Conference Contribution - Verbal presentation and other Conference outputs	0.92	3.58
Total	25.85	13.8
Oral Diagnostic & Surgical Sciences	2013	2014
Chapter in Book - Research	0.5	0
Journal - Research Article	8.63	7.88
Journal - Research Other	0.67	1.2
Journal - Professional & Other Non-Research Articles	2	0
Conference Contribution - Published proceedings: Full paper	0	1
Conference Contribution - Published proceedings: Abstract	10.22	7.17
Conference Contribution - Poster Presentation (not in published proceedings)	0	2.5
Conference Contribution - Verbal presentation and other Conference outputs	2.03	0.5
Film/Video/CD	4	0
Other Research Output	1.5	0
Total	29.55	20.25
Oral Rehabilitation	2013	2014
Chapter in Book - Research	1	1
Journal - Research Article	30.15	29.88
Journal - Research Other	3	4.33
Journal - Professional & Other Non-Research Articles	7	1
Conference Contribution - Published proceedings: Full paper	0	1.25
Conference Contribution - Published proceedings: Abstract	16.07	12.36
Conference Contribution - Poster Presentation (not in published proceedings)	1.08	5.95
Conference Contribution - Verbal presentation and other Conference outputs	2.17	1
Other Research Output	2	0
Total	62.47	56.77
Oral Sciences	2013	2014
Journal - Research Article	44.68	42.58
Journal - Research Other	5.33	7.78
Journal - Professional & Other Non-Research Articles	2	0
Conference Contribution - Published proceedings: Abstract	28.59	13.1
Conference Contribution - Poster Presentation (not in published proceedings)	3.77	6.58
Conference Contribution - Verbal presentation and other Conference outputs	4.1	3.75
Total	88.46	73.79

Total for Sir John Walsh Research Institute/Faculty of Dentistry	206.8	185.52
Total	0.47	20.57
Conference Contribution - Poster Presentation (not in published proceedings)	0.25	4.6
Conference Contribution - Published proceedings: Abstract	0.22	7.19
Journal - Professional & Other Non-Research Articles	0	0
Journal - Research Other	0	0.25
Journal - Research Article	0	8.53
Sir John Walsh Research Institute (PhD students and research-only staff)	2013	2014

Research Funding Summary, 2013-14

This table summates all external research funding awarded to Sir John Walsh Research Institute researchers in 2013-14, including competitive grants and commercial contracts.

Funding source	Amount
ANZAOMS Research & Education Foundation	\$11,380
Arthritis New Zealand National Research Fund	\$20,000
International agrichemical company	Over \$1.4M
Biomet 3i LLC	\$112,000
Cure Kids Research Fund	\$130,292
DENTSPLY Australia Pty Ltd Research Fund	\$543
Downie Stewart Solicitors (Fuller Scholarships in Dentistry)	\$29,966
Estadio de Sa University (Research subcontract)	\$5,000
FORENZAO Charitable Trust	\$22,943
Health Research Council of NZ (HRC)	\$1,340,416
Massey University (Research subcontract)	\$3,000
Maurice and Phyllis Paykel Trust	\$26,000
Ministry of Health Oral Research Fund (administered by the NZDA Research Foundation)	\$90,729
New Zealand Dental Association Central Districts Branch (NZDA-CD Postgraduate Scholarship)	\$5,996
New Zealand Dental Association Research Foundation	\$216,454
New Zealand Lottery Grants Board	\$228,875
Otago Medical Research Foundation	\$30,000
Resorba Medical GmbH	\$53,430
Royal Society of New Zealand Marsden Fund	\$773,913
Syngenta Limited	\$41,618
Universiti Malaya (Research subcontract)	\$9,000
University of Otago Research Committee (including University of Otago Research Grants)	\$408,774
Wishbone Trust	\$13,913
Total research funding, 2013-14	Over \$5M

News and Events

2013 SJWRI Research Day

On Wednesday July 31, 2013, the Sir John Walsh Research Institute held its seventh annual research day, held for the first time at the Dunedin Public Art Gallery. Students, practitioners, and academics from around the campus and around the world joined us for a day that celebrated the



research achievements of the staff, students and collaborators of the SJWRI. The day's proceedings were opened by Professor Jules Kieser (1950-2014), then Director of the SJWRI, followed by an opening address by Professor Richard Blaikie, Deputy Vice-Chancellor (Research and Enterprise) and an address by the Dean of the Faculty of Dentistry, Professor Gregory Seymour.

Our invited keynote speaker this year was Associate Professor Jan Harm Koolstra of the Department of Functional Anatomy, Academic Centre for Dentistry Amsterdam (ACTA), who presented his research on *Biomechanical analysis of fractures in the mandibular neck (collum mandibulae).* A common side-effect of nonsurgical treatments to heal fractures of the mandibular neck is the development of an open bite, even in cases where the jaw has been wired in place to heal. Jan's group have developed biomechanical models *in silico* to predict consequences of fractures and healing techniques on future masticatory function.

More on Associate Professor Koolstra's research: acta.nl/en/research/scientific-staff-alfabetical-order/ staff-member-i-l/koolstra-j-h/index.asp



Professor Jan Koolstra

Our second keynote speaker was the SJWRI's Professor Richard Cannon, 2011 winner of the supreme Sir John Walsh Research Award for sustained research excellence. Richard presented a summary of his group's work investigating resistance to antifungal drugs in the oral fungal pathogens *Candida albicans* and *Candida glabrata*. The objective of this work is to understand mechanisms of drug resistance mechanisms in *Candida*, and to discover ways of overcoming this resistance.

More on Prof Cannon's research: otago.ac.nz/healthsciences/expertise/profile/index. html?id=204

Our Student Guest Speaker was Carolina Loch Santos de Silva, whose PhD research was co-supervised by the late Prof Jules Kieser of the SJWRI and Prof Ewan Fordyce of the Department of Geology. Carolina's presentation was on her research into the morphology, structure and evolution of teeth in fossil and modern odontocetes (dolphins and related Cetacea.) Carolina used a multidisciplinary approach, with techniques ranging from morphological description and measurement, to scanning electron microscopy, nanoindentation, geochemical analyses and micro-CT scanning.

More on Carolina's research: sjwri.otago.ac.nz/students/craniofacial_ biomechanics/carolina_loch_silva.php

The award for Best Student Speaker was won by Ellie Knight, who was in her final year of a Doctorate of Clinical Dentistry in Periodontology for her presentation *Quantifying the diabetes-periodontitis association*. Ellie's DClinDent research, supervised by Prof Murray Thomson, Dr Jonathan Leichter and Dr Andrew Tawse-Smith, investigated the putative association between self-reported diabetes and periodontitis in the New Zealand adult population. Ellie is pictured being presented with her award by 3M ESPE Scientific Affairs Manager, Stephen Langdon.



Ellie Knight and Stephen Langdon

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The 2013 SJWRI Research Day also served as the launch for our 2011-2012 SJWRI Research Highlights, a magazine-style digest of our traditional bi-annual Research Report, released later in 2013. Copies of Research Highlights were available to all attendees.

As in previous years, the 2013 SJWRI Research Day was made possible by the generous support of 3M ESPE.

2013 Research Day Programme/abstract book: otago.ac.nz/sjwri/otago076770.pdf

2011-2012 SJWRI Research Highlights: otago.ac.nz/sjwri/otago076771.pdf

Celebrating research excellence: SJWRI Research Day 2014

On Thursday July 31, 2014, the Sir John Walsh Research Institute held its eighth annual research day, again at the Dunedin Public Art Gallery. Students, practitioners, and academics from around campus and around the world joined us for a day that celebrated the research achievements of the staff, students and collaborators of the SJWRI, and paid tribute to the legacy of the late Professor Jules Kieser (1950-2014), founding Director of the Institute.

The day's proceedings were opened by Acting Dean of the the Faculty of Dentistry, Professor Alison Rich, followed by a Māori welcome by Professor John Broughton and an opening address by Professor Richard Blaikie, Deputy Vice-Chancellor (Research and Enterprise).

Keynote research presentations were delivered by Dr Brian Monk (Oral Sciences), 2012 Sir John Walsh Research Award winner, on *Antifungal drug discovery* – *insights, highlights and reality*; Dr Don Schwass (Oral Rehabilitation) and Dr Carla Meledandri (Chemistry), on *Delivering the silver bullet: Development of a silver nanoparticle application for treating dental caries*; and Dr Jonathan Broadbent (Oral Rehabilitation), on *Fluoridation in Dunedin.*

In keeping with this year's theme of *Celebrating research* excellence, our postgraduate research students were invited to present their research. The award for Best Student Speaker was shared between Sophie Gray, who is in her final year of a Doctorate of Clinical Dentistry in Orthodontics, and forensic biology PhD student Anne-Christine (Anki) Lindström. Sophie's research, supervised by Professor Mauro Farella and the late Professor Jules Kieser, was on validation of the Cervical Vertebral Maturation method for predicting mandibular growth peak. Anki's research, also supervised by the late Prof Jules Kieser in collaboration with A/Prof Jurian Hoogewerff (Chemistry), Dr Zuzana Obertova (University of Auckland), Dr Josie Athens (Preventative and Social Medicine), A/Prof Warwick Duncan (Oral Sciences) and Dr Neil Waddell (Oral Rehabilitation), was on gunshot residue preservation in seawater





Sophie Gray and Anki Lindstrom

The 2014 Research Day also saw the introduction of a Poster Competition for staff, undergraduate and postgraduate students. Congratulations to the winners:

Award	Name	Title	Authors
Undergraduate	Catherine Edwards	Effectiveness of single-use BDS tips for dental air-water syringes	C Edwards, V Bennani, N Chandler, B Lowe
Postgraduate	Janine Tiu	Evaluating clinical molar preparations – Using the coordinate geometry method	J Tiu, B Al-Amleh, JN Waddell, WJ Duncan
Staff	Don Schwass	Enhanced antimicrobial activity and penetration of micelle-stabilised silver nanoparticles into dentine with iontophoresis	D Schwass, C Meledandri

As in previous years, the 2014 SJWRI Research Day was made possible by the generous support of 3M ESPE.

Please download the SJWRI Research Day 2014 Programme and Abstracts book for more information on our keynote and student research presentations: otago.ac.nz/sjwri/otago076766.pdf

Gallery of images from SJWRI Research Day 2014: otago.ac.nz/sjwri/news/otago078783.html

SJWRI Three Minute Thesis Competitions

Congratulations and thanks to all SJWRI PhD students who participated in our inaugural 3MT (Three Minute Thesis) Competitions in 2013 and 2014.

The SJWRI 3MT challenges participants to present their research in an engaging manner that can be understood by an intelligent audience with no background in the research area. This competition develops our PhD students' research communication skills, as well as giving them the chance to tell the Institute at large a little more about their project.

Entrants are required to present for no longer than three minutes, with the support of one slide, on the topic of their thesis. The presentation should describe the research, but should also communicate enthusiasm and the significance of the work. Presentations were judged on the following criteria:

1. Communication style

Was the thesis topic and its significance communicated in language appropriate to an intelligent but non-specialist audience?

2. Comprehension

Did the presentation help the audience understand the research?

3. Engagement

Did the oration make the audience want to know more?

In both years, PhD students presented on topics ranging right across the spectrum of SJWRI research, from the isolation of stem cells from gum tissue,

to the depictions of forensic science in the crime fiction of NZ writer Ngaio Marsh. All presentations were of an excellent standard and communicated their subject matter well.

The inaugural SJWRI 3MT Competition was held on Tuesday 10th September, 2013, and the winner was: Mohammad Alansary, PhD candidate, Oral Molecular and Immunopathology. His presentation was titled *Stem cells and*



the tooth fairy, and described his work isolating and characterising multipotent cells from primary human teeth pulp at different stages of tooth resorption. otago.ac.nz/sjwri/research/oral-molecularimmunopathology/otago081397.html

The 2014 SJWRI3MT Competition for PhD students, was held on Friday May 30, 2014. The winner of the \$500 first prize was Dara Shearer, of the Dental Epidemiology and Public Health programme, for her presentation *Trajectories of Glycated Haemoglobin and Periodontitis* – *a.k.a. "Gums and Glucose".* otago.ac.nz/sjwri/people/profile/otago082340.html

Sir John Walsh Research Institute Awards

Each year the Sir John Walsh Research Institute, on behalf of the Faculty of Dentistry, acknowledges and celebrates excellence in research by presenting a number of awards to staff and students.

Sir John Walsh Research Award

To acknowledge excellence in research over an extended period of time (more than 10 years) by a member of staff. The recipient receives \$3,000 towards professional development.

Basic Research Award

To acknowledge and promote basic research by a member of staff or postgraduate student. This award is to support a research development initiative that could make a contribution to the strategic direction of research within the Institute. The recipient receives \$5,000 towards their proposed research.

Clinical Research Award

To acknowledge and promote clinical research by a member of staff or postgraduate student. This award is to support a research development initiative that could make a contribution to the strategic direction of research within the Institute. The recipient receives \$5,000 towards their proposed research.

Research Publication Award

For the best paper published, or accepted for publication, in the previous calendar year. Its purpose is to recognise excellence in research by acknowledging the research calibre and effort required to produce a paper for the highest ranking journals in science or dentistry. The recipient receives \$1,000 towards professional development.

Postgraduate Research Publication Award

For the best paper published, or accepted for publication, in the previous calendar year by a Doctoral or Masters student. Its purpose is to encourage young researchers completing their masters or doctorate to publish an article in a professional refereed journal that will enhance their research portfolios. The recipient receives \$500.

Research Support Award

Tto recognise the excellent support provided by general staff to research groups, units and/or departments within the Faculty of Dentistry. The recipient receives up to \$2,000 for conference travel.

The Institute congratulates the following award recipients:

SJWRI Awards for 2012

Presented following the SJWRI 3MT Competition, September 10, 2013

Sir John Walsh Research Award: Dr (now Associate Professor) Monk, Molecular Microbiology otago.ac.nz/sjwri/people/profile/?id=617

Basic Research Award: Dr Basil Al-Amleh, Biomechanics and Oral Implantology otago.ac.nz/sjwri/research/clinical/otago061173.html

Clinical Research Award: Dr Vincent Bennani, Biomechanics and Oral Implantology otago.ac.nz/sjwri/people/profile/index.html?id=359

Research Publication Award: Prof Murray Thomson, Dental Epidemiology and Public Health otago.ac.nz/sjwri/people/profile/index.html?id=196

Postgraduate Research Publication Award: Darnell Kennedy, PhD candidate, Molecular Microbiology/ Forensic Biology (primary supervisor: Prof Jules Kieser) otago.ac.nz/sjwri/people/forensic-biology/ otago054508.html

SJWRI Awards for 2013 Presented at SJWRI Research Day, July 31, 2014

Basic Research Award: Dr Neil Waddell, Biomechanics and Oral Implantology otago.ac.nz/sjwri/people/profile/index.html?id=252

Clinical Research Award: Dr Lyndie Foster Page, Dental Epidemiology and Public Health otago.ac.nz/sjwri/people/profile/index.html?id=405

Research Support Award: Kate Wheeler, Dental Epidemiology and Public Health (research group of Dr Jonathan Broadbent) otago.ac.nz/sjwri/people/profile/index.html?id=362

2013 Postgraduate Publication Award: Kai Chun (KC) Li, PhD candidate, Biomechanics and Oral Implantology (primary supervisor: Assoc Prof Neil Waddell) otago.ac.nz/profiles/otago034889.html



Left to right: Dr Basil Al-Amleh (Winner, Basic Research Award), the late Professor Jules Kieser (Director, SJWRI) and Mohammed Alansary (Winner, SJWRI 3MT Competition).

SJWRI Clinical Research Symposiums

2013 SJWRI Clinical Research Symposium: *When practice meets research - a future full of possibilities*

The 2013 SJWRI Clinical Research Programme Symposium was held at the Dunedin Public Art Gallery on June 28, and provided an interesting and collegial day of CPD for those who attended.

The topics covered by our speakers were both informative and thought provoking, highlighting areas where our clinical decisions are more empirical than evidence-based, and forward-looking in providing glimpses of what technology can offer. Professor Mike Morgan of the University of Melbourne gave insight into eviDent, the Melbourne Dental Practice-Based Research Network, and Professor Janet Clarkson gave an entertaining podcast of the Scottish PBRN.

The feedback received has been very positive and a number of practitioners have expressed an interest in joining our Practice-Based Research Network. PBRNs foster relationships between practitioners and academics by investigating research questions of relevance to daily clinical practice. Benefits most often cited include collegiality, learning opportunities and improved patient care.

Our 2013 Symposium speakers included:

Suzanne Hanlin – Digital dentistry in Prosthodontics. From CADCAM to Webcam and everything in between

Basil Al-Amleh - Ceramic fractures and their origins

Andrew Tawse-Smith – Challenges of oral implant maintenance

Mike Morgan – Practice based research networks: eviDent

Jan Clarkson – Practice based research networks: The UK experience (Podcast)

Jonathan Broadbent - The animated dental chart

Bernadette Drummond – Management for molarincisor hypomineralisation with and without enamel breakdown

Lara Friedlander – The use of contemporary endodontic techniques to improve patient outcomes

For more information on our 2013 Clinical Research Symposium speakers, including biographies and outlines of their presentations, please visit otago.ac.nz/sjwri/research/clinical/otago061173.html

2014 SJWRI/ARCH Clinical Research Symposium: *Starting in research: Let's get it right!*

The SJWRI and ARCH Network Clinical Research Symposium was held at the University of Otago on 14 Feb 2014. The symposium was aimed at academic staff, postgraduate research students and dental practitioners interested in participating in clinical research in oral health and dentistry.

ARCH (Applied Research through Clinicians' Hands) is a new Dental Practice-Based Research Network (PBRN) which is being established through the SJWRI Clinical Research Programme. PBRNs foster relationships between practitioners and academics by investigating research questions of relevance to daily clinical practice.

Suzanne Hanlin, Director of the ARCH Network gave an introduction and welcome to the attendees, which was followed by a presentation by Neil Pickering (Senior Lecturer, Bioethics Centre) on *Key issues in research ethics*.

Gary Witte, Manager of Academic Committees for the University of Otago Ethics Committee, gave a presentation on *Human Participant Research Ethics: Frameworks and Practicalities*.

Following afternoon tea, Trish Leishman, Health Sciences Librarian gave a talk on *Getting your teeth into research: tools and skills for finding information*.

More on our Clinical Research programme: otago.ac.nz/sjwri/research/clinical/index.html

More on the ARCH Network: otago.ac.nz/arch/index.html

If you are a dental practitioner and are interested in joining our PBRN, or would like further information, please contact the ARCH Network by emailing arch.dentalpbrn@otago.ac.nz



Suzanne Hanlin presenting at the 2014 Clinical Research Symposium.

SJWRI hosts 9th NZ Biomouth Conference

The Sir John Walsh Research Institute hosted the 9th NZ Biomouth Conference at the Dunedin Public Art Gallery on the 9th October, 2013. The Biomouth Research Group is a collaborative collection of researchers from institutions across New Zealand, all of whom are interested in various aspects of human mastication, jaw mechanics, food development, dentistry, and other related areas of research. The accent of this year's conference was again on student participation, with a wonderful turnout (17 presentations) from all over New Zealand. The invited overseas keynote speaker for the 9th Biomouth Conference was Jianshe Chen, of the School of Food Science and Nutrition, University of Leeds, who spoke on *Oral capability of food handling and bolus swallowing.*





Jianshe Chen

The Biomouth Research Group was established in 2004, and includes researchers from across New Zealand unified by their interest in various aspects of human mastication. The group includes researchers from the University of Otago, the University of Canterbury, Massey University, the University of Auckland and the Plant and Food Research Crown Research Institute. The Biomouth Research Group aims to:

- Foster communication and collaboration between existing research groups within New Zealand that are involved or interested in mastication, jaw mechanics, food development, dentistry, and other related areas.
- Raise our profile and showcase our research locally and internationally.
- · Seek collaboration with overseas laboratories.
- Actively seek research funding for collaborative Biomouth research projects.

For more information, please visit the Biomouth website at biomouth.org

2013 HRC Funding Round success for Dr Brian Monk

Sir John Walsh Research Institute research is helping pave the way for novel antifungal drugs designed to overcome the world-wide problem of increasing resistance to current treatments.

In July 2013, Dr (now Associate Professor) Brian Monk of the SJWRI's Molecular Microbiology research programme was awarded a three-year Project grant worth \$1.19M in the 2013 HRC Funding Round, for his project *Structure-directed antifungal discovery*. Other named investigators from the SJWRI involved in this project are Professor Richard Cannon and Dr Mikhail Keniya, along with Dr (now Associate Professor) Joel Tyndall of the School of Pharmacy.



Associate Professor Brian Monk

Fungal infections by organisms such *Candida, Aspergillus* and *Cryptococcus* play an increasingly significant role in disease. Infections such as thrush

In July 2013, SJWRI Molecular Microbiology PhD student Madhu Shankar, jointly supervised by Dr (now Associate Professor) Monk of the SJWRI and Dr (now Associate Professor) Joel Tyndall of the National School of Pharmacy, published the crystal structure of the enzyme lumazine synthase from the fungal pathogen *Candida glabrata* in the highly regarded biological crystallography journal *Acta Crystallographa D*, which has an Impact Factor of 14.1. This is the first crystal structure of a protein published by researchers working in the SJWRI.

Candida glabrata has emerged as an important fungal pathogen with intrinsic resistance to azole drugs, and this is driving the need to identify new drug targets. Lumazine synthase is part of the riboflavin-

affect premature babies, the elderly, females of reproductive age, individuals with dry mouth and terminal cancer patients. They can be fatal; 1.4 million people die annually due to fungal infections made worse by co-infections with tuberculosis and AIDS or by medically-induced immune deficiency. To date, efforts to expand the array of antifungal treatments available have been hindered by the lack of molecularlevel understanding of potential drug targets and mechanisms causing drug resistance.

Dr Monk described the project as follows:

"There is an urgent need to augment the widely-used and well-tolerated but drug resistance-susceptible triazole drugs with broad-spectrum antifungals that target fungal lanosterol 14-alpha-demethylase (Erg11p) and not human CYP51. We have obtained highresolution X-ray crystal structures of yeast Erg11p with substrates and triazole inhibitors bound. We will apply our unique knowledge of cytochrome P450 structure and function and use a comprehensive set of screens to identify new antifungals. Our research will confirm key biochemical properties of the enzyme, identify a product egress pathway, and resolve the structures of the Erg11ps of several important fungal pathogens and human CYP51. Computer-aided drug design, yeast-based high throughput screens, secondary screens, counterscreens plus a combinatorial chemistry capacity will be used to identify efficiently optimal hits as Erg11p-specific drug candidates. The identification of new classes of antifungals will provide models for drug discovery and development that circumvent the ubiquitous activities of cytochrome P450 enzymes."

biosynthesis pathway, which is essential to fungi and bacteria and is a potential drug target for the development of broad-spectrum antifungal drugs.

The X-ray crystal structure of recombinant lumazine synthase from *C. glabrata* was obtained at 2.24 Angstrom resolution, and revealed a dimer of homopentamers, with one in five subunits containing a product molecule from the catalytic reaction.



X-ray crystal structure of recombinant enzyme lumazine synthase from C. glabrata, complexed with the product of catalysis. Image via Madhu Shankar, PhD student.

Otago discovery aids in fight against antifungal drug resistance

In February 2014, researchers led by Associate Professor Monk working with colleagues at the University of California San Francisco, published the complex structure of a full-length lanosterol 14α -demethylase, a key cell membrane protein involved in sterol metabolism and drug resistance, in the prestigious US journal Proceedings of the National Academy of Sciences (PNAS). Lanosterol 14α -demethylase is a membrane monospanning cytochrome P450 of the CYP51 family that catalyzes the first postcyclization step in ergosterol biosynthesis, and is inhibited by triazole drugs. Dr Monk says the research team's feat will provide new insights into mechanisms underlying fungal resistance to triazole drugs and aid in efforts to develop new broadspectrum drugs with minimal side-effects.

"Membrane proteins in general are important molecules in cells, and represent around 70 per cent of all drug targets. However, they are notoriously tricky for scientists to extract from cells and successfully study, so we are delighted that we have been able to do so."

The structure reveals new features likely to be held in common with many known membrane proteins, including closely related proteins that modify the action of commonly prescribed drugs. "They tell us how the fungal enzyme and its relatives interact with the membrane and provide important clues about relationships with substrates, inhibitors and products that have broad implications for biology, drug design and personalised medicine."

2014 was the United Nations-sanctioned International Year of Crystallography in honour of a century of multidisciplinary contributions. Yet, despite their biological significance, less than 0.5% of the protein structures so far determined worldwide are for membrane proteins, due to the difficulties with ordered crystallization of these proteins. Membrane proteins of the type investigated by Assoc Prof Monk and coworkers (bitopic membrane proteins with one transmembrane helix) were, prior to this publication, absent from Protein Data Bank repositories, which has limited understanding of how single-transmembrane helices orient enzymes and sensors at the membrane surface.

The next steps for Assoc Prof Monk and colleagues are further study of the membrane protein in several important fungal pathogens and use state-of-the-art screening technology to identify new broad-spectrum drugs that target this protein.

The research was supported by the US National Institutes of Health, the Marsden Fund of New Zealand, and the Otago Medical Research Foundation. The ongoing research, as noted above, is supported by the Health Research Council of New Zealand.

Assoc Prof Monk's international co-authors on the PNAS paper include Dr Thomas Tomasiak and Professor Robert Stroud of the University of California, San Francisco and Associate Professor Jeffrey McDonald of the University of Texas Southwestern Medical Center. Local co-authors include Professor Richard Cannon, Associate Professor Joel Tyndall, Dr Mikhail Keniya and PhD student Franziska Huschmann.

Publication Details: pnas.org/content/111/10/3865

More on Assoc Prof Monk's research: otago.ac.nz/healthsciences/expertise/profile/index. html?id=617

More on the Molecular Microbiology research programme: otago.ac.nz/research/sjwri/research/molecular_ microbiology.php

Marsden success for Professor Richard Cannon

The SJWRI congratulates Professor Richard Cannon, Dr Erwin Lamping and their group within the Molecular Microbiology research programme for their success in the 2013 Marsden Fund round, announced in late October. Professor Cannon and colleagues were awarded \$773,913 over three years, commencing 2014, for their proposal *Fungal drug resistance – not as simple as A-B-C'*.

Multi-drug-resistant fungal infections of humans have high mortality rates. This resistance is usually caused by the overexpression of pleiotropic drug resistance (PDR) ATP-binding cassette (ABC) membrane protein transporters that have a distinct topology compared to other well-studied classes of ABC protein. PDR pumps are predicted to contain large extracellular loops that are not present in other ABC proteins.

Professor Cannon's group has extensive preliminary evidence from the analysis of both site-directed and resistance-conferring mutations that existing models of PDR transporters are inaccurate. They have proposed that the extracellular loops form 'lids', and transmembrane segments form 'gates', essential for substrate selection/transport and inhibitor binding.

To test this hypothesis, they will employ molecular genetic, biochemical, and biophysical techniques in three complementary approaches to show that the lid and gate structures contribute to a novel ABC protein transport mechanism, and represent unique, specific, targets for clinically important PDR proteins.

Further information:

Professor Richard Cannon's research profile: otago.ac.nz/sjwri/people/profile/index.html?id=204

The SJWRI's Molecular Biosciences Laboratory, home of Professor Cannon's research group: otago.ac.nz/sjwri/research/molecular-microbiology/ otago054692.html

Marsden fund supports \$13 million worth of Otago research (University Media Release): otago.ac.nz/news/news/otago058112.html



Professor Richard Cannon

Joseph Antoun awarded Emerging Researcher First Grant by the Health Research Council



In May 2013, Joseph Antoun of the SJWRI and the Department of Oral Sciences was awarded a highly prestigious Health Research Council Emerging Researcher First Grant. The award, worth \$149,462 over three years, was made for his project *The genetics of dentofacial growth anomalies* with Professor Mauro Farella and Professor Murray Thomson of the SJWRI, and Associate Prof Tony Merriman of Biochemistry.

Having completed his Doctorate of Clinical Dentistry in 2013, Joseph is a senior lecturer in the Department of Oral Sciences, and a member of the Craniofacial Biology and Clinical Oral Physiology research programme,

Joseph Antoun

established in 2014 and led by Prof Farella. The objective of Joseph's research is to investigate the relationship between selected candidate genes and specific forms of the face (e.g. underdeveloped lower jaws) that often leads to functional and aesthetic problems requiring orthodontic or surgical treatment.

The research will recruit individuals with clinically important facial anomalies (i.e. typical orthodontic patients), as well as control participants. DNA samples will be used to analyse and compare genetic differences in candidate genes between the two groups.

His research will investigate the relationship between selected candidate genes and such specific forms of the face.

He aimed to establish a genetic data base and ultimately hoped "to substantially improve our understanding of the biological basis of facial growth".

The possible effects of an interaction between genetic and environmental factors, such as oral habits (e.g. thumb-sucking), will also be investigated. This project will establish a genetic database that can be followed up longitudinally and may substantially improve our understanding of the biological basis of facial growth.

More on Joseph's research: otago.ac.nz/sjwri/people/profile/index.html?id=1704

More on the Craniofacial Biology and Clinical Oral Physiology research programme: otago.ac.nz/sjwri/research/otago089660.html

Fluoridating water does not lower IQ: Otago research

University of Otago research out of the worldrenowned Dunedin Multidisciplinary Study, published in May 2014, does not support claims that fluoridating water adversely affects children's mental development and adult IQ.

The researchers were testing the contentious claim that exposure to levels of fluoride used in community water fluoridation is toxic to the developing brain and can cause IQ deficits. Their findings were published in the highly respected *American Journal of Public Health*.

The Dunedin Study has followed nearly all aspects of the health and development of around 1000 people born in Dunedin in 1972-1973 up to age 38.



Dr Jonathan Broadbent

Lead author Dr Jonathan Broadbent says the new research focused on Study members' fluoride exposure during the first five years of their lives, as this is a critical period in brain development, after which IQ is known to be relatively stable.

Dr Broadbent and colleagues compared IQs of Study members who grew up in Dunedin suburbs with and without fluoridated water. Use of fluoride toothpaste and tablets was also taken into account.

They examined average IQ scores between the ages of 7-13 years and at age 38, as well as subtest scores for verbal comprehension, perceptual reasoning, working memory and processing speed. Data on IQ were available for 992 and 942 study members in childhood and adulthood, respectively.

Dr Broadbent says the team controlled for childhood factors associated with IQ variation, such as socioeconomic status of parents, birth weight and breastfeeding, and secondary and tertiary educational achievement, which is associated with adult IQ.

"Our analysis showed no significant differences in IQ by fluoride exposure, even before controlling for the other factors that might influence scores. In line with other studies, we found breastfeeding was associated with higher child IQ, and this was regardless of whether children grew up in fluoridated or non-fluoridated areas."

Dr Broadbent says that studies that fluoridation opponents say show that fluoride in water can cause IQ deficits, and which they heavily relied on in city council submissions and hearings, have been reviewed and found to have used poor research methodology and have a high risk of bias.

"In comparison, the Dunedin Multidisciplinary Study is world-renowned for the quality of its data and rigour of its analysis," he says.

"Our findings will hopefully help to put another nail in the coffin of the complete canard that fluoridating water is somehow harmful to children's development. In reality, the total opposite is true, as it helps reduce the tooth decay blighting the childhood of far too many New Zealanders."

This work was supported by the New Zealand Ministry of Education, the New Zealand Department of Health, the New Zealand National Children's Health Research Foundation, US National Institute of Dental and Craniofacial Research Grant R01 DE-015260-01A1, UK Medical Research Council Grant MR/K00381X/1, US National Institute on Aging Grant AG032282, and a programme grant from the Health Research Council (HRC) of New Zealand. The Dunedin Multidisciplinary Health and Development Research Unit is supported by the HRC.

Publication details:

Community Water Fluoridation and Intelligence: Prospective Study in New Zealand

Jonathan M. Broadbent, PhD, W. Murray Thomson, BSc, PhD, Sandhya Ramrakha, PhD, Terrie E. Moffitt, PhD, Jiaxu Zeng, PhD, Lyndie A. Foster Page, BSc, PhD, and Richie Poulton, PhD

Am J Public Health. doi:10.2105/AJPH.2013.301857

Otago Dental Professor receives international distinguished scientist award

On 24 June 2014 the International Association for Dental Research (IADR) presented Professor Murray Thomson with the 2014 IADR Distinguished Scientist Award in Geriatric Oral Research during the Opening Ceremonies of the 92nd IADR General Session & Exhibition in Cape Town, South Africa. In doing so, Professor Thomson became the first New Zealander ever to win two prestigious awards from the IADR.

Murray Thomson is a professor of dental epidemiology and public health. He earned his BSc, BDS and Master of Community Dentistry degrees from the University of Otago, an MA from the University of Leeds,



Professor Murray Thomson

UK, and a PhD from the University of Adelaide on a longitudinal study of dry mouth and tooth decay in older people.

Professor Thomson entered academia in 1994 after five years in general dental practice in New Zealand and England, and seven years in this country's public dental sector. He has been at Otago in his academic and research role since 1996.

He has received numerous awards for his work, including the Alan Docking Award for Distinguished Research in Dentistry (2009), and the IADR H. Trendley Dean Distinguished Scientist Award in Epidemiology and Public Health (2010).

His epidemiological and clinical research covers a wide range of subjects and has been supported by grants from several funding bodies in the US and New Zealand. These include the US National Institutes of Health, Bethesda; the New Zealand Dental Association: the Health Research Council of New Zealand; and the New Zealand Ministry of Health. Currently, he is editor of the New Zealand Dental Journal and an associate editor for Gerodontology and for Special Care in Dentistry

The Geriatric Oral Research Award consists of a monetary prize of USD\$3,500 and plaque. The award is designed to stimulate, encourage, and recognize outstanding research accomplishments in the field of geriatric oral research, is one of the 16 IADR Distinguished Scientist Awards, and is one of the highest honours bestowed by IADR.

About the International Association for Dental Research

The International Association for Dental Research (IADR) is a nonprofit organization with nearly 11,500 individual members worldwide, dedicated to: (1) advancing research and increasing knowledge for the improvement of oral health worldwide; (2) supporting and representing the oral health research community, and (3) facilitating the communication and application of research findings.

For more information on the IADR, please visit iadr.org

Colgate NZ IADR Student Poster and Travel Awards

Each year, the SJWRI and the Faculty of Dentistry in conjunction with the IADR New Zealand Section holds a research poster competition to select students students to represent NZ at that year's IADR Australia/ New Zealand Annual Scientific Meeting. In both 2013 and 2014, two prizes of \$NZ2000 were kindly made available by Colgate New Zealand, with two further IADR ANZ Division Travel Grants, supported by the Faculty of Dentistry, also being awarded.

Congratulations to the winners of the 2013 Colgate NZ IADR Student Poster Competition and Travel Awards, held on Friday 19 April, with the awards made by the Dean on Tuesday 23 April:

Colgate Award, Undergraduate

Dhara Tilvawala, New Zealand Dental Therapists' knowledge and beliefs regarding child maltreatment. Supervisors: Dr Jonathan Broadbent, Colleen Murray.

Colgate Award, Postgraduate

Janine Tiu, *Objectively evaluating crown margins and core design* – a pilot study. Supervisors: Dr (now A/Prof) Neil Waddell, Prof Michael Swain.

IADR ANZ Division Travel Grant, Undergraduate

Deepa Mistry, *Molecular analysis of Candida albicans ABC transporter Cdr1p*. Supervisors: Dr Kyoko Niimi, Dr Masakazu Niimi, Prof Richard Cannon.

IADR ANZ Division Travel Grant, Postgraduate

Diogo Zanicotti, *Human adipose-derived stem cells on titanium surfaces*. Supervisors: Dr Dawn Coates, Prof Greg Seymour, A/Prof (now Prof) Warwick Duncan.

On Tuesday 20 May 2014, the 2014 Colgate IADR NZ Section Student Poster Competition winners were announced.

Colgate Award, Undergraduate

Catherine Edwards, *Effectiveness of single-use tips for dental air-water syringes*. Supervisors: Dr Vincent Bennani, A/Prof Nick Chandler, Dr Bronwyn Lowe (Applied Sciences)

Colgate Award, Postgraduate

Joanne Choi, *Continuous measurement of intraoral pH and temperature: development and validation of an appliance*. Supervisors: Dr (now A/Prof) Neil Waddell, Prof Michael Swain.

IADR ANZ Division Travel Grant, Undergraduate

Linda Hwang, Effect of air-polishing treatment on titanium surfaces: an in vitro study. Supervisors: Dr Vincent Bennani, Dr Andrew Tawse-Smith, Prof Richard Cannon, Dr Geoffrey Tompkins, Dr George Dias (Anatomy).

IADR ANZ Division Travel Grant, Postgraduate

Alia Sagatova, *Erg11p structure of triazole resistant and susceptible strains of yeast*. Supervisors: Dr (now A/Prof) Brian Monk, Dr (now A/Prof) Joel Tyndall, Dr Mikhail Keniya



Left to right: Colgate postgraduate award winner Joanne Choi, Colgate Scientific Affairs Manager Dr Rebecca Schipper, and Colgate undergraduate award winner Catherine Edwards.

Thanks to judges Dr Jonathan Broadbent, Associate Professor Nicholas Chandler and Dr Geoffrey Tompkins, and all who entered.

Student success at IADR ANZ Annual Scientific Meetings 2013 and 2014

BDS student Deepa Mistry won the IADR Australia/ NZ divisional student poster competition (junior category) at the IADR ANZ Division meeting in Bangkok, August 2013. Deepa's project was titled *Molecular analysis of Candida albicans ABC transporter Cdr1p*, and involved mutational analysis of Cdr1p for functional and structural analysis. She was a summer student in the Molecular Microbiology Programme in 2012-13 supervised by Dr Kyoko Niimi, Dr Masakazu Niimi and Professor Richard Cannon, and winner of an IADR ANZ Division Travel Grant in the 2013 Colgate IADR NZ Student Poster Competition. Following her success, Deepa presented her work at the international meeting of the IADR in Cape Town, South Africa in 2014.

BDS student Linda Hwang was the winner of the Junior Colgate Award for the best undergraduate research poster at the 54th Annual Scientific Meeting of the International Association for Dental Research Australia & NZ Division in Brisbane, in October 2014. The title of Linda's poster was *Effect of air-polishing on titanium surfaces, biofilm and biocompatibility*. As part of her prize, Linda was supported to present her work at the General Session of the IADR in Boston in 2015. Congratulations to Linda, and her supervisors Dr Vincent Bennani, Dr Andrew Tawse-Smith, Prof Richard Cannon, Dr Geoffrey Tompkins and Dr George Dias (Anatomy).

Also representing the SJWRI at IADR ANZ 2014 were PhD students Joanne Choi, Norhasnida Nordin and Alia Sagatova, DClinDent students Noor Othman and Wan Thani, BDS student Catherine Edwards, Professor John Broughton, Acting Dean Professor Alison Rich, and SJWRI Research Manager James Smith.



Linda Hwang

During the closing ceremony of the meeting, Dunedin was announced as host city for IADR ANZ 2015, the 55th Annual Scientific Meeting of the IADR ANZ Division, which will be held at the Dunedin Public Art Gallery from August 23-26 next year. Dental and oral health researchers from across Australasia are warmly invited to combine cutting-edge research with culture, adventure, and Southern hospitality at IADR ANZ 2015, the 55th Annual Scientific Meeting of the International Association for Dental Research Australia and New Zealand Division, which will take place in Dunedin this August at the Dunedin Public Art Gallery. For more information, please visit

otago.ac.nz/iadranz2015



Drill-free dentistry may cure kids of dental fears

An HRC-funded feasibility study led by Dr Lyndie Foster Page of the SJWRI has demonstrated that children significantly prefer a new way of treating tooth decay that doesn't involve needles or drills. Tooth decay is the most common chronic disease affecting children worldwide. Dr Foster Page and colleague Ms Dorothy Boyd, a specialist paediatric dentist, have been investigating the application of a promising new approach, the Hall technique, to arrest dental decay in primary teeth.

"Many children in New Zealand suffer from poor oral health. Tooth decay is the most common chronic disease affecting children worldwide," says Dr Foster Page.

Dr Foster Page and Ms Boyd trained 10 Hawkes Bay dental therapists to use the 'Hall technique', which involves placing a stainless steel crown over a baby molar tooth to seal the decay in, rather than the conventional method of removing the decay with a drill and then placing a filling. Starved of nutrients, the decay then stops or slows down. The crown remains in place until the tooth falls out naturally around age 10.

The Hall technique, which was developed by Scottish dentist Dr Norna Hall, involves placing a stainless steel crown over a baby molar tooth to seal the decay in, rather than the conventional method of removing the decay with a drill and then placing a filling. Starved of nutrients, the decay then stops or slows down. The crown stays in place until it falls out naturally with the tooth at about age 10.

Of the nearly 190 children between 5 and 8 years old who took part in the Hawke's Bay study, just over half were Māori. Nearly 100 children received treatment for their decayed teeth using the Hall technique, while the remainder were treated using conventional methods. Many of the children already had six or seven fillings in their mouth, and two-thirds came from low socioeconomic status areas.

Dr Foster Page said the study showed that children treated in the new way, which doesn't require anaesthetic, reported less dental anxiety than those who had received conventional care. Interestingly, almost all (90 per cent) of those treated with the Hall technique reported enjoying their clinic visit; among those conventionally treated, the figure was 52 per cent.

Dental phobias are generally thought to develop in childhood, and a traumatic experience may leave a person feeling anxious about visiting the dentist. "If children don't fear going to the dentist, we believe they'll be more inclined to go regularly for check-ups when they are adolescents and adults, but there is more work to do to understand exactly why the children said they preferred the new technique." As well as reducing the fear factor, the Hall technique was, on average, up to 20 minutes quicker than conventional treatment, and it had a much higher success rate.

"After six months, children who had conventional treatment had twice as many dental abscesses and nearly three times as many replacement fillings as those who were treated with the Hall technique," says Dr Foster Page.

"There's a strong shift in dentistry towards not removing all the decay in the tooth. We know that when we drill a tooth, the tooth doesn't like it; you get an inflammatory response. If the decay is close to the nerve then perhaps it's best to leave it."

The study is the first in the world where dental therapists have placed stainless steel crowns using the Hall technique. A five-year randomised control trial in Scotland (where dentists instead of dental therapists carried out the procedure) also showed that parents, children and dentists preferred this method of treatment.

"At first, some parents were concerned that people might judge children who had these crowns because of the way the crowns look. Many people today want white fillings. However, after the treatment, we found that the overall positive response of children to the treatment, and the fact that children didn't need an injection or to go back for replacement restoration work, seemed to far outweigh this concern."

Crowns cost more than conventional amalgam or white fillings, but Dr Foster Page says they could work out more economically in the long term.

"Replacing a filling two or more times during a tooth's life may actually cost more than a crown in the long term with labour costs included – and then there's the cost to children's well-being."

The success of the feasibility study has been reported widely in the national media, including in the New Zealand Herald and Otago Daily Times, as well as on national radio.

Dr Foster Page and Ms Boyd presented the findings of this feasibility study to the Hawke's Bay District Health Board and at the International Association for Dental Research in Seattle (USA). With the securing of further funding (see sidebar), they are now carrying out a randomised control trial of the Hall technique in New Zealand children.



Dr Lyndie Foster Page with fellow 2013 Early Career Award winners Dr Karen Brounéus (National Centre for Peace and Conflict Studies) and Dr Carla Meledandri (Chemistry).

Dr Lyndie Foster Page was one of five five upand-coming University of Otago academics whose outstanding research contributions were recognised through the 2013 Early Career Awards for Distinction in Research. Dr Foster Page, along with Dr Karen Brounéus (National Centre for Peace and Conflict Studies (Faculty of Dentistry), Dr Carla Meledandri (Chemistry), Dr Suetonia Palmer (Medicine, Christchurch), and Dr Virginia Toy (Geology) were selected based on their impressive research achievements at an early stage of their career. Announcing the awards, Deputy Vice-Chancellor (Research and Enterprise) Professor Richard Blaikie said that the five are shining examples of the depth and breadth of talent amongst the University's strong body of up-and-coming researchers.

"I warmly congratulate each on their notable contributions within their disciplines, work which is already creating new knowledge that underpins improvements in health, technology, social wellbeing and our understanding of environmental processes."

Professor Blaikie says that not only do these talented staff play an important role in the University's current research effort, they are also well-placed to be among Otago's future research leaders. The Early-Career Award for Distinction in Research includes a \$5000 grant for the recipient to use for research and scholarly development. Recipients also become members of the University's O-Zone Group of early-tomid-career researchers.

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In December 2013, the SJWRI's Dr Lyndie Foster Page, Dorothy Boyd, Professor Murray Thomson, Dr Jonathan Broadbent and Associate Professor Warwick Duncan were awarded a Cure Kids Research Grant for their proposal entitled "Transform a tooth with a 'transformer tooth.' A novel approach for child oral health." Dr Foster Page and team were awarded \$98,510 (plus GST) over three years, commencing 2014. The proposed project aims to evaluate the effectiveness of a new method to arrest dental caries in the primary teeth of children.

In their three-year Cure Kids proposal, Dr Foster Page and team intend to build on the results of their HRC feasibility study by performing a randomised clinical trial (RCT) to systematically assess the efficacy and performance of the Hall technique in the NZ dental care environment, compared with the existing approach. Up to 1,000 children between the ages of 3 and 7 will be recruited from the Whanganui District Health Board catchment. Half of those with cavities in their baby molars will be given fillings and the other half will have their teeth capped. An estimated 776 children are expected to be involved in the study. If this technique is found to be a suitable alternative to traditional care, it has the potential to revolutionise dental care for children, and will provide better health outcomes for children with caries.

2014 World Oral Health Day (March 20) saw further research funding success for Dr Lyndie Foster Page and her team within the Dental Epidemiology and Public Health Research Programme of the SJWRI, looking at prevalence of and new treatments for childhood caries. Following their award of nearly \$100,000 in funding from Cure Kids in late 2013, Dr Foster Page and team were announced as recipients of \$80,000 in Lottery Health Research funding for a related clinical research project investigating the potential of the Hall Technique in preventing caries in childhood populations.

In the 2014 round, University of Otago researchers gained just over \$1.9m in funding from the Lottery Grants Board to support studies aimed at improving the health status of New Zealanders. The grants support the purchase of scientific equipment, PhD scholarships, and the pursuit of translational research projects aimed to quickly translate into meaningful health outcomes and community benefit.

SJWRI and Faculty of Dentistry farewell retiring Dean and Clinical Research Director



Greg Seymour and Mary Cullinan

The Sir John Walsh Research Institute and the Faculty of Dentistry farewelled our Dean, Professor Gregory Seymour, and our foundation Clinical Research Director, Associate Professor Mary Cullinan, at the end of January 2014. After eight years at the University of Otago, Professor Seymour and Associate Professor Cullinan are retiring to Queensland to be closer to family.

Professor Seymour's achievements as Dean of the Faculty of Dentistry included overseeing the establishment of the Sir John Walsh Research Institute in 2007 under the Directorship of Professor Jules Kieser(1950-2014). The growth in research capability and productivity in the Faculty since the establishment of the Institute is demonstrated by the Faculty's strong performance in the most recent Performance Based Research Funding quality assessment.

As researchers, both Professor Seymour and Associate Professor Cullinan were highly productive and successful and made significant contributions to their research fields, to the Oral Molecular and Immunopathology research programme (which Professor Seymour co-directed), and to oral health research in New Zealand and internationally. Together with Professor Seymour, Associate Professor Cullinan was a driving force behind the establishment of the SJWRI's Clinical Research Programme, and of the practice-based research network ARCH (Applied Research through Clinicians' Hands).

Pro-Vice Chancellor of the Division of Health Sciences, Prof Peter Crampton said Prof Seymour had been an "agent for change" over the past eight years and contributed a "huge amount" to the school.

This included advocating for a replacement of the university's ageing dental school facility – now in the planning stages and scheduled to begin construction in late 2015. Other achievements included overseeing the establishment of the Sir John Walsh Research Institute and growing the faculty's research capability, which resulted in it performing "extraordinarily well" in the 2012 Performance Based Research Funding round.

He also oversaw the introduction of two new degrees, in particular the research-focused Doctorate of Clinical Dentistry degree for specialist dentist qualifications, replacing the traditional Master of Dental Surgery. He also helped build a relationship with the International Medical University in Malaysia, resulting in a large number international students coming to Otago.

"A really important achievement for Greg has been the establishment of relationships with Māori oral health providers up and down the country," Prof Crampton said.

His personal research contribution resulted in him in 2008 becoming only the second dentist to be elected as a fellow of the Royal Society of New Zealand – the first being Sir John Walsh who, among other achievements, invented the first high-speed drill.

Prof Seymour stepped down as Dean at the end of January 2014, with Prof Alison Rich serving as Acting Dean until the appointment of Prof Paul Brunton later in 2014.

> Portrait of Professor Greg Seymour, commissioned by the Faculty and the Division, and unveiled at his and Associate Professor Cullinan's official University farewell on 12 December 2013.



Professor Greg Seymour's research profile

Qualifications

BDS MDSc PhD FRCPath FFOP(RCPA) FRACDS FICD FADI

Position

Retired from Dean, Faculty of Dentistry, and Professor of Periodontology in December 2013

Research summary

Primary dentistry and oral health

Professor Seymour's research had two major themes:

- The relationship between oral disease and systemic conditions, primarily atherosclerosis
- The immunopathology of periodontal and oral mucosal diseases using immunological and molecular techniques

Investigations of the relationship between periodontal disease and atherosclerosis focused on molecular mimicry as the link. This work was central to a major collaboration with the University of Queensland, Australia, and the University of Niigata, Japan.

Investigations of the immunopathology of oral diseases focused on relating the nature of the inflammatory infiltrate together with the cytokine and gene expression profiles. An emerging theme in this research was the effect of environmental factors such as smoking and the use of bisphosphonates on gingival gene expression profiles.

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Associate Professor Mary Cullinan's research profile

Qualifications BDS MSc FADI

Position Retired from Research Associate Professor in December 2013

Research summary Periodontology and oral health

Associate Professor Cullinan's research was predominantly in periodontics, encompassing clinical, basic science and epidemiological studies.

A prominent theme was the inter-relationship between chronic periodontitis and systemic diseases such as cardiovascular disease, diabetes and ankylosing spondylitis, particularly in terms of the impact of oral infection and the immune response to oral organisms on systemic diseases. Other themes include the oral microbiota in health and disease (chronic periodontitis, peri-implantitis, dental caries) and the effect of bisphosphonates on gene expression in oral tissues. The long-term effects of triclosan on thyroid function and the oral microbiota in terms of the development of bacterial resistance have also been investigated.

Studies in collaboration with colleagues at the University of Queensland have demonstrated that in cardiovascular patients, periodontitis and the infection burden of *Porphyromonas gingivalis* and *Tannerella forsythia* were related to serum antibody levels to human heat shock protein 60 (HSP60). In patients at high risk of cardiovascular disease (6 risk factors), an improvement in periodontal health resulted in a reduction in anti-HSP60 (HSP60 and GroEL) antibody levels. Further collaboration with the Medical School, University of Queensland, investigated thyroid function and bacterial resistance after long-term use of triclosan in toothpaste and found no untoward effects.

In collaboration with Professor Lisa Heitz-Mayfield from the University of Western Australia, and Associate Professor Sheila Williams (Social and Preventive Medicine), data on the microbiota in patients with peri-implant disease was analysed and compared with two bacterial detection methods (qRT-PCR and Checkerboard DNA-DNA hybridization). The data originated from an international multicentre, randomised controlled trial.





A leading UK dental researcher and educator has been selected as the new Dean of the Faculty of Dentistry.

Professor Paul Brunton was appointed as Dean from his previous position of Director of Student Education at the University of Leeds' School of Dentistry, serving on its senior management team. He took up his position at Otago at the end of 2014.

Announcing the appointment, University Vice-Chancellor Professor Harlene Hayne says that Professor Brunton has an outstanding record as a researcher, teacher and senior administrator. He is a Professor of Restorative Dentistry whose research interests include operative dentistry, specifically tooth preparation and tooth whitening, and early diagnosis and treatment of tooth wear.

In his role of Director of Student Education he has provided strategic leadership to curricula development and innovation at the School at both undergraduate and postgraduate levels. He is also clinical project lead of e-Den, a national e-learning resource in dentistry that has more than 20,000 users.

Professor Brunton is currently President of the British Society for Restorative Dentistry and contributes to several UK national committees. These include the Research Committee of the Royal College of Surgeons of England, and he is also a board member of the Faculty of the Dental Surgery of that College. Additionally he advises and works with NHS England by chairing the Pathways Group, which is part of the implementation of the new dental contract in Primary Dental Care in England. After graduating from the Leeds School of Dentistry in 1984, Professor Brunton obtained his MSc in restorative dentistry in 1992 and his PhD in 1996 from the University of Manchester. He was granted his fellowship in dental surgery from The Royal College of Surgeons of Edinburgh in 1995.

He was subsequently awarded Fellowship ad eundem of the Faculty of General Dental Practice (UK) of the Royal College of Surgeons of England in 2005 and of the Faculty of Dental Surgery of the College in 2009.

Before taking up his appointment at Leeds in 2004, Professor Brunton was a clinical lecturer, and since 1997, a clinical senior lecturer, in restorative dentistry at the University of Manchester. His other earlier roles include Clinical Director of Dental Services for the Combined Healthcare NHS Trust in Stoke-on-Trent.

Professor Brunton is a regular speaker at national and international conferences and a referee for a number of national and international journals and grant-awarding bodies. He is on the editorial board of Journal of Dentistry and Operative Dentistry, both top-tier journals in their field. His strong research publication record includes more than 70 journal articles appearing in peer-reviewed journals, and he has written four textbooks, and edited another four, in restorative dentistry.

Otago Health Sciences Pro-Vice-Chancellor Professor Peter Crampton says he is delighted that Professor Brunton has accepted the role of Dean of the School. "Paul Brunton's wealth of experience as an innovative leader in dental education and research means he is very well-placed to build on Otago's existing strengths in these areas," Professor Crampton says.

Professor Brunton says he is greatly looking forward to further developing the Faculty of Dentistry and cementing its status as a centre of excellence for research, education and healthcare serving the needs of the population of New Zealand, but also extending its reach and influence within Australasia and beyond.

"Dentistry is changing very quickly and it's important we keep our research and education at the very cutting edge of the discipline, both by adopting new practices but also leading the way in developing novel technologies and materials that will be of benefit to our patients. A vital part of this is clinical and translational research, which is my background, and this is an area that I look forward to developing within the School."

"A faculty's environment is incredibly important in achieving success, and one of my first priorities will be to work closely with the University to realise the planned major upgrade of the Faculty of Dentistry's facilities.

"I look forward to working with my colleagues and our students both in the School and the wider University to realise our ambitions for the Faculty of Dentistry," Professor Brunton says.

While new, expanded facilities for the Faculty sit high on his wish-list, Professor Brunton is also keen to see it become a centre for oral health in New Zealand. "I want us to have much more of an external face and have more influence within New Zealand and beyond," Professor Brunton says. "We have many experts in this building who know a great deal about oral health for this country. So you'd expect Government to be seeking their advice and for us to have more of an influence on oral health and general health policies."

"We have many experts in this building who know a great deal about oral health for this country. So you'd expect Government to be seeking their advice..."

Alongside teaching, research has remained a key component of his work. He would like Otago to become more involved in translational research and can also see scope for collaboration with other departments.

"My own research at the moment is moving into the direction of oral health and general health and the interface between the two. So I want to work with colleagues in nutrition and general medicine - those that are dealing with diabetes and obesity particularly – and looking at the links between those and oral health."

The prospect of a new Dental School building is also exciting: "I believe environment is really important. If you're going to get people to flourish and really be world class they need a world class environment so a new school is high on my list and hopefully the University will be giving that final approval in the near future."

SJWRI PhD student Jenny McDowell wins AMP National Scholarship

The SJWRI is delighted that forensics PhD student Jenny McDowell was awarded a \$10,000 AMP Scholarship at a ceremony at the Auckland War Memorial Museum on December 4, 2014.



As a teenager, Jenny overcame the debilitating aftereffects of a shark attack which inspired her interest in anatomy and forensic anthropology, which led to beginning a PhD in the SJWRI under the mentorship of the late Professor Jules Kieser. Following in Jules' footsteps, Jenny's aim is become a world expert in marine forensics and disaster victim identification, and to be the first in New Zealand to obtain international accreditation in forensic anthropology.

After completing her undergraduate studies at the University of Otago, she finished a Masters of Physical Anthropology at the University of Pretoria, South Africa. During her study, she helped exhume the bodies of freedom fighters killed by police and buried in unmarked graves in apartheid-era South Africa.

She is now in her second year of study for a PhD in marine forensics at the SJWRI, looking at the chemical and morphological changes which happen in juvenile bone when exposed to a marine environment as a means of understanding marine decomposition of human body parts in a forensic context. However, to get accredited as forensic anthropologist, Jenny will need to do more field work abroad; with the scholarship money, she would attend a field school, possibly in Somaliland, East Africa.

"They are doing war-crime excavation and research – mass grave stuff."

Another option would be returning to South Africa to work at an anthropology research centre.

"It is one of the busiest forensic labs in the world and they get cases from police and do everything from homicides to missing persons to fire victims – it is a real smorgasbord." The work included constructing a biological profile of an unidentifiable person, providing estimates of age, sex and ancestry.

The aim of the AMP National Scholarship scheme is to support 'Kiwis who want to do their thing'. Each scholarship is worth up to \$10,000. Unlike researchrelated funding which SJWRI students typically pursue, there are no limits around what this scholarship can be awarded for. This year's recipients were from fields as diverse as cancer rehabilitation to fashion to BMX racing.

We are extremely proud of Jenny and thrilled that the AMP award, together with support from the SJWRI, will help her finish her PhD and achieve her dream of becoming an internationally accredited forensic anthropologist.

Professorial promotion for SJWRI Clinical Research Director Warwick Duncan

SJWRI Clinical Research Director Warwick Duncan was among a select group of fifteen leading University of Otago academics who were promoted to full professorships at the end of 2014, on the basis of their world-class research, teaching and service to the University and community.

Professor Duncan, who also serves as Associate Dean (Facilities and Clinical Services) in the Faculty of Dentistry, was the first Otago-qualified periodontist to be promoted to Professor at the University. His primary research interests are in periodontics (the treatment of gum diseases) and implantology (the replacement of missing teeth with dental implants). This work has extended from preliminary trials in animal disease models, to validation in human clinical trials, and have included the development of new bone replacement grafting materials, new metals and surfaces for osseointegration of oral implants, stemcell therapy for bone regeneration, novel approaches to the treatment of periodontal and peri-implant diseases, and new technologies for diagnostic imaging of gum and bone around teeth and implants. Through collaboration with the late Professor Jules Kieser, he developed research interests in forensic biology and victim identification.

A further 39 University of Otago academics were promoted to Associate Professor, including SJWRI researchers Brian Monk and Jonathan Leichter (Oral Sciences), and Neil Waddell (Oral Rehabilitation, Director of our Biomechanics and Oral Implantology research programme).

Professor Duncan's research profile: otago.ac.nz/sjwri/people/profile/index.html?id=198

More on the Clinical Research research programme: otago.ac.nz/sjwri/research/clinical/index.html

Student highlights

Hannah Jack, SJWRI DClinDent graduate, receives the John McDonald Medal from Royal College of Surgeons

July 2013

Following completion of her Doctorate of Clinical Dentistry in Orthodontics at the end of 2012, Hannah Jack was awarded the John McDonald Medal for having the highest overseas mark in the Membership in Orthodontics (MOrth) examination in July 2013. This examination is run by the Dental Council of the Royal College of Surgeons of Edinburgh, with those passing the exam being granted acceptance to the College. There are a number of sittings of these exams, one in Edinburgh, Adelaide (where Hannah sat), Hong Kong, Dubai and Cairo, and Hannah scored the best mark from these overseas exams. As part of the assessment procedure Hannah was expected to submit some of her own orthodontic cases as well as being examined on other orthodontic topics.

More on Hannah's DClinDent research: otago.ac.nz/sjwri/people/craniofacial-biomechanics/otago054459.html

Belinda Hsu wins 2013 ADA/Dentsply Student Clinician American Dental Association regional prize

The 35th Australian Dental Congress was held at the Melbourne Convention and Exhibition Centre on 4 April 2013 and included the Student Clinician Research Programme which is run by the ADA/Dentsply in 35 countries involving 17 student clinician programmes.

After her success in the NZ competition, Belinda Hsu was chosen to represent in Australia and went on to win the 2013 ADA/Dentsply Student Clinician American Dental Association (SCADA) regional prize (Australasia).

Belinda's research project *The Antimicrobial activity of Gingival Retraction Products* was conducted through a SJWRI Summer Studentship in conjunction with her supervisors Dr Donald Schwass and Dr Geoffrey Tompkins.

More on Belinda's research: dentistry.otago.ac.nz/news/gfx/BH_poster.pdf

SJWRI PhD graduate Sara Hanning profiled in the Otago Daily Times

The research of recent SJWRI PhD graduate Sara Hanning, whose doctoral project was supervised by the late Professor Jules Kieser in partnership with Associate Professor Natalie Medlicott of the University of Otago's National School of Pharmacy, was profiled in the Otago Daily Times in January 2014. Sara's research looked into ways to make the life of xerostomia patients more comfortable, through the development of more effective saliva substitutes.

odt.co.nz/news/dunedin/288860/dry-mouth-cure-hope

Xerostomia is a condition in which saliva production is drastically reduced, leading to a dry mouth. This can lead to difficulties with speech, eating and infection of the oral mucosa. Also, as the protective effect of the saliva on the enamel of the teeth is no longer present, the risk of developing cavities is considerably increased. Xerostomia is often found in cancer patients who have undergone radiotherapy of the neck and throat areas.

The aim of Sara's project was to investigate oily formulations for the treatment of dry mouth and its associated high risk of tooth caries. Oily formulations were investigated as water alone often quickly drains or evaporates away, resulting in persistence of the condition. Emulsions of oil and water were shown to be much more effective in reducing the effects of dry mouth.

Having completed her project and graduated from the University with a PhD, Sara is now heading to University College London to take up a postdoctoral research position. Her work is being built upon by a SJWRI Doctorate of Clinical Dentistry research student, Olivia Apperley, who is investigating clinical applications of Sara's saliva substitute in a small-scale clinical trial amongst xerostomia patients in Christchurch. This work is being conducted in collaboration with Dr Maggie-Lee Huckabee of the Van Der Veer Institute, University of Canterbury, as part of the Biomouth Research Group.

SJWRI success at Division of Health Sciences Research Forum

SJWRI staff and students joined University of Otago Health Science research colleagues from across the country for the 2014 Division of Health Sciences Research Forum, held on 16 September at the Dunedin Public Art Gallery. This year's Forum, 'Learning Different Research Languages', centred on themes of collaborative and multidisciplinary research.

SJWRI Clinical Research Programme Director, Associate Professor Warwick Duncan, was invited to present in the opening session of the conference, and gave an excellent and well-received presentation, reflecting on his experiences in translational dentistry and collaborative clinical research.

SJWRI students performed exceedingly well in the student poster competition, making up six of the 33 entrants across the Division, with Biomechanics and Oral Implantology PhD students Joanne Choi and Janine Tiu making it to the final round of the competition, a 'two minute thesis' style presentation of the research on their poster in front of the Forum attendees.

Janine's poster *Evaluating clinical molar preparations using the Coordinate Geometry Method* won our SJWRI Research Day postgraduate student poster award and finished second in the subsequent University of Otago Postgraduate Expo competition. Her research assesses the geometry of molar crown preparations generated in dental practice using a new measuring system developed by Janine and her supervisors, to investigate whether this may have consequences for the clinical longevity of dental crowns placed by dentists. Janine's poster finished equal third in the competition.

Joanne's poster, *Continuous and simultaneous measurement of intraoral pH and temperature*, presented her research on the development of a novel in-dwelling intraoral pH and temperature measuring device, in order to assess the impact of intraoral pH and temperature changes on the development of conditions such as dental erosion. Joanne's poster was awarded second place in the competition.

Our congratulations to Joanne and Janine, and our thanks to all six of our student competition entrants.

SJWRI students scoop OCEM awards

Congratulations to Jenny McDowell and Gemma Cotton, two PhD students carrying out research within the Sir John Walsh Research Institute, on being awarded Otago Centre for Electron Microscopy (OCEM) Student Research Awards in the September 2014 round.

Jenny McDowell is a forensic biology PhD student, whose award-winning research project *An evaluation of the chemical and morphological changes to juvenile bone when exposed to a marine environment* is supervised by SJWRI Director Prof Richard Cannon, Prof Abby Smith of the Department of Marine Science, and forensics expert Prof Sue Black of the University of Dundee. Jenny's research looks at how juvenile pig bones decompose when placed in marine environments, as a means of understanding marine decomposition of human body parts in a forensic context.

Gemma Cotton of the Department of Chemistry, whose PhD research is co-supervised by Dr Carla Meledandri of Chemistry and Dr Don Schwass of the SJWRI, also won an award for her project *Application* of antibacterial silver nanocomposite materials for treatment and prevention of dental caries and periodontal disease. This research looks at a novel way of using silver nanoparticles as a means of eliminating bacteria around dental fillings.

The OCEM Student Awards are presented biannually, and support novel student research projects in electron microscopy. The Awards cover up to 15 hours electron microscope usage and technical support time.

Our Programmes

Biomechanics and Oral Implantology

Programme Directors - Associate Professor Neil Waddell and Professor Warwick Duncan

Our work has two main themes, biomechanics and oral implantology. Within the area of biomechanics we conduct experimental and observational research in:

- Dental materials development of new dental restorative materials for dental CAD/CAM systems.
- Silver and gold nanomaterial technology group – developing nanoparticles for use in a range of therapeutic technologies and toughening of advanced ceramics.
- Cranio-facial biomechanics prosthodontic failure mechanisms and adhesion of dental restorations and materials.
- Sub-concussive brain injury research

 in vitro modelling of the effects of blunt force trauma to the head on accumulative damage to the brain.
- Dental hard tissues and evolutionary oral biology - using animal teeth to gather a wide range of information about the biology, evolution and interactions with the environment of fossil and recent species.
- Forensic biology *in vitro* modelling of blunt force trauma, forensic odontology, wounding and ballistic blood splatter analysis, development of simulant materials for forensic modelling.

Within the area of oral implantology our research focuses on:

- · Grafting and regenerative therapies.
- Surface treatments of implant fixtures for enhanced osseointegration.
- The effects of implant fixture corrosion products on periodontal structures.
- Developing ultrasonic diagnostic devices for dentistry.
- In vitro modelling of masticatory forces on implant overdentures, their supporting sub-structures and surrounding bone.



Image showing 4-point bend test measuring the energy of adhesion between a porcelainfused-to-metal (CoCr) bilayer.



Electron backscatter diffraction map showing the metallic phases in the CoCr alloy at the porcelain-fused-to-metal bilayer interface.

Key Personnel and Collaborations Staff

Professor J Kieser (deceased) Professor MV Swain Professor WJ Duncan Professor KM Lyons Associate Professor JN Waddell Associate Professor DC Tong Dr DR Schwass Dr B Al-Amleh Dr AA Tawse-Smith Dr S Ma Dr S Hanlin Dr C Loch Mr L Jansen van Vuuren Mrs W Jansen van Vuuren

Postgraduate Students

- Ajay Sharma Allauddin (Dini) Siddiqi Amanda George Andrea Coldea Andrew Quick Andrew Tawse-Smith Anne-Christine Lindstrom Carolina Loch Santos da Silva Darnell Kennedy Diogo Zanicotti Donald Schwass Erin Hutchinson
- Hamish Milmine Janine Tiu Joanne Choi Kai Chun Li Mohammed Alrashed Momen Atieh Patrick Wong Rami Farah Reham Osman Shuo Li Sunyoung Ma Therese De Castro

Our work involves a multi-disciplinary approach and we collaborate with a wide group of researchers within; the Faculty of Dentistry; the University of Otago (Department of Geology, Department of Chemistry, Department of Anatomy and Structural Biology, Department of Zoology, Department of Marine Sciences); nationally (Department of Mechanical Engineering, University of Canterbury, Van Der Veer Institute, University of Canterbury, Department of Engineering Sciences, Auckland University, Forensic Science Department of Environmental Science and Research, South Island Brain Injury Research Group (SIBIRG)) and internationally (Smithsonian Institution, New York Institute of Technology College of Osteopathic Medicine, Hampden-Sydney College, University of Adelaide School of Dentistry, South Australian Museum, Museo de Historia Natural de Santiago and Universidade Federal de Santa Catarina, Biomechanics and Mechanobiology Research Group at the University of Stuttgart, Centre for Advanced Tribology at Southampton (nCATS), Impact and Armour Group, Cranfield University / Defence Academy of the United Kingdom, Shrivenham, University of Kansai, Osaka, University of the Witwatersrand, Johannesburg, South African Nuclear Energy Corporation in Palindaba, Tokyo University of Agriculture and Technology, Tokyo).



SEM image showing particle distribution of pre-sintered CoCr alloy powder from a compacted powder metallurgy CAD/CAM milling block.



SEM image showing CoCr alloy surface after sintering of the compacted powder metallurgy particles.

Current Research

Activity 1. Dental Materials

Description: Evaluating specific issues associated with the range of dental materials from composite resin systems to advanced ceramics. One of the groups has a focus on mechanical properties of dental ceramics and their reasons for failure, with a particular interest in fractography and analysis of failure in brittle materials. A more recent novel area is the silver and gold nanomaterial technology group, which is developing nanoparticles for use in a range of therapeutic technologies and toughening of high strength ceramics.

Aim: Provide basic information about these materials that enables a better basis for understanding their usage in clinical settings and the development of new treatment technologies and materials.

Source(s) of funding: New Zealand Dental Association Research Foundation, Fuller Scholarship for Dentistry, Otago Innovation, University of Otago Research Grant, Sir John Walsh Research Institute and proprietary funding.

Activity 2. Sub-concussive Brain Injury

Description: Concussive and subconcussive injury is a global phenomenon, which has been likened to a silent epidemic due to the large numbers of young people who sustain head injuries in sports and military activities. The objective of this research is to quantify the impact forces transmitted through the various levels of scalp, skull and brain at values below what is predictive of concussion. Once these data are obtained, clinical evaluations of neurologic function using established methodology can be used to correlate the effects of these impact forces for further research, but the main objective for this research study is the quantification of these forces.

Aim: Can the impact forces involved with subconcussive head injury be quantified in order to determine a threshold or range of impact forces that may be predictive of sub-concussion?

Source(s) of funding: University of Otago Research Grant. University of Otago Health Sciences Division Sandpit Funding Grant. ANZAOMS Research and Education Trust.



Moulding process of the brain cavity in the development of a simulant skin/skull/brain anatomical model for sub-concussive brain injury force transfer research.

Activity 3. Soft and Hard Tissue Biomechanics and Forensic Biology

Description: Investigating the basic properties of skin, teeth and bone related to the craniofacial region and forensic issues.

Aims: Teeth and bone are special in that they preserve a record of their formation in the adult endproduct. Hence, an examination of adult morphology can be used to reveal some of the processes that were involved, as well as some of the perturbations of such processes. This knowledge can then be linked to clinical findings that will (hopefully) result in better therapeutic outcomes. Our research has mainly been focused on the structure and function of enamel in different species, the forces generated during swallowing, and the behaviour of skin and bones during events such as ballistic and blunt force trauma.

Sources of funding: New Zealand Dental Association Research Foundation, United States Department of Justice, ESR Capability Development Fund.

Activity 4. Oral Implantology and Associated Superstructures

Description: Our research teams have expertise with respect to conducting clinical (human) and preclinical (animal) trials and laboratory-based research relating to oral implants. Currently, funded research is being conducted into different oral implant systems, materials, surfaces, superstructures, and surgical and restorative protocols, as well as supporting biological and regenerative products. Our research encompasses immediate placement and/or loading of single implants and implant-supported over-dentures, fit of zirconia prostheses, implant analysis using micro-CT, and analysis of different implant systems and bone placement grafts in sheep femur and maxillary sinus models, in vitro modelling of strain distribution within implant overdentures and their supporting sub-structures and bone, in vivo analysis of implant fixture corrosion.

Aims: Evidence-based treatment that reduces the interval between oral implant placement and loading, by optimising the implant design and the surgical and prosthodontic protocols and materials.

Source(s) of funding: New Zealand Dental Association Research Foundation; JF Fuller Foundation; International Team for Oral Implantology ITI Switzerland; Straumann AG, Switzerland; NobelBiocare Australia; Southern Implants, South Africa; Korea Science and Engineering Foundation (KOSEF), Megagen Co Ltd., South Korea; Osstem Co. Ltd, South Korea; Neoss Australia Ltd; Keratec Ltd. New Zealand.



SEM image of the polymer chains with secondary crosslinking in an irreversible alginate impression material.



SEM image of diatomaceous earth filler diatoms in an irreversible alginate impression material.

Key Projects and Funding Successes

\$35,591. Tong DC, Waddell JN, Bennett AC: Quantification of impact forces in the prevention of sub-concussive head injury using a forensic head model. University of Otago Research Grant.

\$3,642. Tong DC: South Island Brain Injury Research Group - Strategic planning for research collaboration. University of Otago Health Sciences Division Sandpit Funding Grant.

\$11,380. Tong DC, Waddell JN, Winter T, Bennett AC: Quantification of impact forces to the head using a forensic model. ANZAOMS Research and Education Trust.

\$21,000. Schwass D, Meledandri CJ. Pre-seed funding support from Otago Innovation.

\$64,400. Schwass D, Meledandri CJ. Evaluating the efficacy of a topical antimicrobial gel formulation for treating peri-implantitis in a sheep model. University of Otago Research Grant.

\$3,000. Schwass D, Meledandri CJ.

Mechanical properties and Antibacterial Effects of a silver nanoparticle modified glass ionomer restorative material. Fuller Scholarship for Dentistry.

\$66,340. Duncan WJ and Schmidlin P, Resorba Medical GmbH, Germany.

\$10,000. Duncan WJ, Coates D, Ye Naung N, Zannicotti D, De Silva RK. Maurice and Phyllis Paykel Trust.

\$ 5,000 Duncan WJ, Waddell JN, Chandler N, Harris P, Petherick R, Wu D, Ultrasonic diagnostic devices for dentistry, University of Otago Health Sciences Division Sandpit Funding Grant.

\$40,000. Duncan WJ, Waddell JN, Chandler N, Harris P, Petherick R, Wu D, Ultrasonic diagnostic devices for dentistry, University of Otago Health Sciences Division Sandpit Funding Grant. (follow-on grant).

\$16,744. Duncan WJ, Sharma A, Effect of electrochemically modified Titanium-Zirconium (TiZr) alloy implant surface on osseointegration: an in vitro and in vivo study. NZ Orthopaedic Association Wishbone Trust.

\$23,800. Duncan WJ, Sharma A, Effect of electrochemically modified Titanium-Zirconium (TiZr) alloy implant surface on osseointegration: an in vitro and in vivo study. Lotteries Health.

\$5,000. Al-Amleh B, Establishing fracture toughness tests on dental ceramics using the surface crack in flexure method. University of Otago, Sir John Walsh Research Institute – 2013 Basic Research Award.

\$5,000. Waddell JN, Toughening of advanced ceramics. University of Otago, Sir John Walsh Research Institute – 2014 Basic Research Award.

\$82,757. Tong DC and Waddell JN. Otago Innovation Ltd., University of Otago, Temporary Inter-Maxillary Stabilisation (TIMS) Device – Research, Development and Commercialisation.



Image showing 4-point bending flexural strength testing of a fresh deer femur.

Dental Education

Research in dental education focuses on the study of factors that affect learning and teaching. Researchers in the Dental Education Research Programme typically examine educational experiences in the Faculty and other dental education environments, and look for evidence of what is working well, and what can be improved. We seek to use this information to identify strategies that can improve experiences and support for students and teachers, both within the Faculty and in other education environments.

A number of individuals have included research into aspects of education as part of their academic portfolios. These projects address several of the University's core values and strategic imperatives; in particular those of achieving excellence in research and teaching, and facilitating outstanding campus environments and student experiences.

In June 2014, a relaunch event was held for the Dental Education Research Programme. This event provided interested staff and postgraduate students in the Institute with an opportunity to get together and discuss what format and directions they would like the Dental Education research group to take. As well, it provided an opportunity to network with researchers involved in Higher Education from outside the Faculty.

The discussion, over a light lunch, was led by Dental Education Research programme leader Dr Janet Rountree, who took over the role from the retiring Professor Tom Kardos in 2013. Examples of current dental education research projects were discussed, with researchers talking about their ideas for collaboration. There was an excellent turnout to the event, and the potential for new projects and collaborations appears very strong. Attendees were surveyed on their keenness to participate in regular meetings to discuss dental education projects, which was well received. At the event, researchers shared their current projects and discussed ideas for collaboration, both with staff from within the Faculty, and with staff involved in Higher Education research outside of the Faculty. As a consequence of these conversations, new education research projects are beginning to be developed and executed.



Dental Education Research Programme relaunch, June 2014.

Dental Education Research Fellows

2013 Dr Janet Rountree2014 Dr Janet Rountree, Lee Adam

Publications

Anderson, V. (2014). 'World-travelling': A framework for re-thinking teaching and learning in internationalised higher education. *Higher Education 68*(5), 637-652. doi: 10.1007/s10734-014-9736-y

Anderson, V. R., McGrath, T., & Butcher, A. (2014). Asia-born New Zealand-educated business graduates' transition to work. *Asia Pacific Journal of Education 34*(1), 65-79. doi: 10.1080/02188791.2013.823378.

Anderson, V. (2013). 'Impure community: A framework for contact in internationalised higher education? *Journal of Intercultural Studies 34*(1), 34-54. doi: 10.1080/07256868.2013.751903

Foster Page, L. A., Kang, I., Anderson, V. R., Thomson, W. M., Meldrum, A. M., & Moffat, S. M. (2013). Changes in Bachelor of Oral Health students' perceptions of their dental education environment. *New Zealand Dental Journal, 109*(4), 134-140.

Gambetta-Tessini, K., Mariño, R., Morgan, M., Evans, W., & Anderson, V. (2013). Stress and health-promoting attributes in Australian, New Zealand, and Chilean dental students. *Journal of Dental Education*, 77(6), 801-809. Golding, C., & Adam, L. (2014). Evaluate to improve: Useful approaches to student evaluation. *Assessment* & *Evaluation in Higher Education*. Advance online publication. doi: 10.1080/02602938.2014.976810

Kang, I., Foster Page, L. A., Anderson, V. R., Thomson, W. M., & Broadbent, J. M. (2014). Changes in students' perceptions of their dental education environment. *European Journal of Dental Education*. Advance online publication. doi: 10.1111/eje.12112

Murray, C. M., & Chandler, N. P. (2014). Undergraduate endodontic teaching in New Zealand: Students' experience, perceptions and self-confidence levels. *Australian Endodontic Journal*, 40(3), 116-122. doi: 10.1111/aej.12084

Subramanian, J., Anderson, V. R., Morgaine, K. C., & Thomson, W. M. (2013). Effective and ineffective supervision in postgraduate dental education: a qualitative study. *European Journal of Dental Education*, 17(1), e142–e150. doi: 10.1111/j.1600-0579.2012774.x

Subramanian, J., Anderson, V. R., Morgaine, K. C. & Thomson, W. M. (2013). Improving the quality of educational strategies in postgraduate dental education using student and graduate feedback: findings from a qualitative study in New Zealand. *European Journal of Dental Education, 17*(1), e151-e158. doi: 10.1111/eje.12006

Subramanian, J., Anderson, V. R., Morgaine, K. C., & Thomson, W. M. (2013). The importance of 'student voice' in dental education. *European Journal of Dental Education*, *17*(1), e136–e141. doi: 10.1111/j.1600-0579.2012773.x

Tan, A. S., Anderson, V. R., & Foster Page, L. A. (2013). Second and third year oral health and dental student perceptions of future professional work. *European Journal of Dental Education*, 17(4), 241-250. doi: 10.1111/eje.12057

Research grants

Prof. A. Rich, , Dr J. Rountree, Prof. G. Seymour (University of Otago), Dr D. Lekkas, A/Prof. T. Winning and Prof. G. Townsend, (University of Adelaide).

Do multifaceted admission processes predict performance of students in two Australasian dental programmes?

UMAT Consortium Grant, \$100,000

Dr S. Gallagher, Dr J. Rountree, Prof. B. Drummond, Dr J. Millichamp, Dr M.Stubbe

Developing reflective practitioners through online videobased self-reflection

University of Otago Teaching Development Grant, \$20,035



Dr Lyndie Foster Page presenting a poster on research into first year students' perceptions of their educational environment

Dr L. Foster Page, Dr J. Rountree, Dr A. Tawse-Smith, Dr V. Anderson (University of Otago), Prof. L. Uden (Staffordshire University)

Aligning and improving Problem Based Learning in cariology teaching in undergraduate dentistry at IMU and Otago

University of Otago Internationalisation Grant, \$10,356

L. Adam, Dr J. Rountree, Ms A. Meldrum, Prof. A. Rich (University of Otago), Dr A. McLean (Simon Fraser University)

Guidelines for providing feedback in the clinical dental setting

University of Otago Teaching Development Grant, \$10, 075

Dental Education Researchers

Lee Adam Vivienne Anderson Jonathan Broadbent Mike Brosnan Richard Cannon Peter Cathro Nick Chandler Harsha De Silva Rohana Kumara De Silva Lyndie Foster-Page John Hamilton Suzanne Hanlin Wendy-Ann Jansen van Vuuren Karl Lyons Alison Meldrum Kate Morgaine Colleen Murray Kate Newsham-West Alison Rich Janet Rountree Don Schwass Jayaram Subramanian Andrew Tawse-Smith Murray Thomson



Dental Epidemiology and Public Health

Programme Director: Professor Murray Thomson

Overview

Our work has the two main strands of (1) dental epidemiological research and (2) dental health services research. In our dental epidemiological research, we study the occurrence, determinants and natural history of the common oral conditions. To do this, we employ a number of standard dental epidemiological approaches (most notably the prospective cohort study and the cross-sectional survey) and techniques. Our dental health services research (HSR) work is concerned with how the dental healthcare system works (including dental workforce research), and the extent to which users are benefitting from it. Key activities are measuring oral health outcomes and increasing understanding of how (and why) people use (or do not use) dental services. Our group also continues to play an important role in the development and epidemiological validation of self-report measures, working in collaboration with a number of overseas researchers. We are also one of only three WHO Collaborating Centres in oral health in our particular WHO region; the other two are in Niigata (Japan) and Beijing (China).

Key personnel and collaborations

Professor WM Thomson Professor JR Broughton Dr JM Broadbent Dr LA Foster Page Ms DM Shearer (funded by an HRC programme grant; working on oral-general health) Dr J Zeng (funded by an HRC programme grant; biostatistician; 2013-14) Dr KC Morgaine (left in mid-2014)

Our collaborations are very important to the work and impact of the group. Current collaborations include institutions in New Zealand (including Raukura O Hauora Tainui and the Waikato-Tainui College for Research and Development), Australia (the Universities of Adelaide and Melbourne), Canada (the University of Toronto, McGill University), Japan (Osaka University), Malaysia (Universiti Malaya), the USA (Duke University, the University of Michigan and the University of North Carolina), Britain (GKT Dental Institute, the University of London, Sheffield University, Dundee University), Chile (University of Chile) and Brazil (Federal University of Pelotas).

Current research projects and focus areas

Activity 1. Life-course research in oral health (the Dunedin Study)

Description: Prospective observational research into the natural history of oral health and disease in a representative birth cohort now in adulthood

Aim: Unprecedented information on the natural history of oral health and disease

Source(s) of funding: NZ HRC, US NIH, Otago Medical Research Foundation

Outcomes during 2013-14: Work in this area continues to attract international attention and to be published in the top international journals: 5 papers were published, and a number of conference presentations were made. We concentrated on working through the second 3 years of the 6-year programme grant. The funded aims of the dental research component for age 38 are: (1) to document the natural history of oral health and disease from childhood through to early midlife; (2) to determine the nature of the relationship of those conditions and associated SES inequalities with antecedent characteristics and exposures; (3) to investigate the relation between chronic periodontitis and cardiovascular risk; and (4) to identify gene-byenvironment associations in oral health and disease.



Activity 2. Other dental epidemiological and clinical research

Description: Dental epidemiological studies in NZ and overseas.

Aims: Various – enhancement of the knowledge base for dental epidemiology, dental public health, and clinical practice.

Source(s) of funding: Various – including NZ Ministry of Health, the International Collaborative Indigenous Health Research Partnership, NZDA Research Foundation, the Health Research Council of NZ, Dental Council of NZ.

Outcomes during 2013-14: 13 papers were published.

Activity 3. Dental health services research

Description: Dental health services research in NZ, including ongoing, systematic dental workforce research.

Aims: Enhancement of the knowledge base for dental public health and clinical practice.

Source(s) of funding: Various – including NZDA Research Foundation, the Health Research Council of NZ, Dental Council of NZ.

Work in this area uses both quantitative and qualitative approaches, and continues to be diverse and productive.

Outcomes during 2013-14: 15 papers were published (this total includes a number of dental educational research papers which are included here because they do not fit the other categories).

Activity 4. Development of new dental epidemiological, clinical and health services researchers and research capacity

Description: Training of new researchers for NZ and the Asia-Pacific region.

Aim: to build research capacity in our field.

Outcomes during 2013-14: successful postgraduate completions comprised one Doctor of Philosophy, five Doctors of Clinical Dentistry, and two Masters degrees. We also continue to informally mentor colleagues working in the wider health sector.

2013-14 highlights

Papers published and conference presentations made

In total, 41 papers were published in the peerreviewed international scientific literature during 2013-14. The total number of conference presentations made was 55 (including 6 keynote addresses).

Other publishing-related activity

Professor Thomson served as a member of the Expert Panel for the report *Health effects of water fluoridation: a review of the scientific evidence*. Wellington: Royal Society of New Zealand (2014).

Professor Thomson was Editor of the *New Zealand Journal* until retiring from that post in June 2014 because he was to take up the Editor-in-Chief position for *Community Dentistry and Oral Epidemiology* in January 2015. He was Associate Editor for Gerodontology until December 2014, and remains as Associate Editor for the *European Journal of Oral Sciences*.

Postgraduate student completions 2013-14

Doctor of Philosophy: David Healey

Doctor of Clinical Dentistry: Hadeel Ibrahim, Joanne Ngo, Joseph Antoun, Victoria Beck, Ellie Knight.

Master of Community Dentistry: Bethy Turton, Kathy Fuge.



DClinDent student Hadeel Ibrahim presenting at Research Day 2014.

External funding secured

2014. Ministry of Health Research Fund. *Supervised toothbrushing trial in Northland Intermediate Schools*. Dr LA Foster Page (PI), Professor WM Thomson, E Clarke and SS Ali (Northland DHB). \$NZ40,766.

2014. Lottery Health. *Transform a tooth with a "transformer tooth". A novel approach for child oral health.* Dr LA Foster Page (PI), Ms DH Boyd, Professor WM Thomson and Dr JM Broadbent. \$NZ80,000 (plus GST).

2013. Cure Kids. *Transform a tooth with a "transformer tooth". A novel approach for child oral health*. Dr LA Foster Page (PI), Ms DH Boyd, Professor WM Thomson, Dr JM Broadbent and Associate Professor WJ Duncan. \$NZ98,510 (plus GST).

2013. NZDA Research Foundation. *Does the Immunoscore Predict the Behavior of Oral Cancer*? Mr A Avadhani, Professor AM Rich, Dr VP Parachuru, Dr JM Broadbent, Professor GJ Seymour. \$NZ14,934.

Internal funding secured

2013. Internationalisation of the Curriculum Initiative Grants. *Aligning and improving Problem Based Learning in cariology teaching in undergraduate dentistry at Otago and IMU*. Dr LA Foster Page (PI), Dr J Rountree, Dr A Tawse–Smith, Dr VR Anderson, Professor TC Gait. \$NZ10,357.

2014. University of Otago Research Grant. *To drill or not to drill*. Dr JM Broadbent (PI), Dr LA Foster Page, Ms CM Murray, Dr D Schwass. \$NZ33,340.

Honours/awards

In 2014, **Dr Broadbent** received the *Building Bridges Award* from the Association for Psychological Science and the National Institute of Dental and Craniofacial Research (USA).

Dr Foster Page received a Fulbright Travel Award in 2014.

Dr Foster Page received the Sir John Walsh Research Institute Clinical Research Award in 2014.

Dr Foster Page received a University of Otago Early Career Research Award in 2013.

Professor Thomson was awarded a second IADR Distinguished Scientist Award (the 2014 Award in Geriatric Oral Research, for outstanding research accomplishments in the field of geriatric oral research) at the 2014 General Session of the International Association for Dental Research, Cape Town, June 2014. He is only the second New Zealander to have received two IADR Distinguished Scientist Awards; the other was Professor Basil Bibby (University of Rochester, NY).



Professor Murray Thomson giving a keynote address, Adelaide, April 2014.

Professor Thomson received the Sir John Walsh Research Institute 2013 Research Publication Award in September 2013 (for the paper Thomson WM, Mejia GC, Broadbent JM, Poulton R. Construct validity of Locker's global oral health item. *Journal of Dental Research* 91: 1038-1042, 2012).

On 19 August 2014, Professor Thomson was awarded the honour of Fellow of the New Zealand Dental Association for his contribution to the NZDA, primarily in his role as Editor of the *New Zealand Dental Journal* from July 2007 to June 2014.

Key publications

Dr JM Broadbent

Broadbent JM, Foster Page LA, Thomson WM, Poulton R. Permanent dentition caries through the first half of life. *British Dental Journal* 215: E12. doi:10.1038/ sj.bdj.2013.991 (2013).

McKay S, Farah R, Broadbent JM, Tayles N, Halcrow SE. Is it health or the burial environment: differentiating between hypomineralised and post-mortem stained enamel in an archaeological context. *PLoS ONE* 10.1371/journal.pone64573: (2013).

Thomson WM, Broadbent JM, Foster Page LA, Poulton R. Antecedents and associations of root surface caries experience among 38-year-olds. *Caries Research* 47: 128-134 (2013).

Tilvawala D, Murray C, Farah R, Broadbent JM. New Zealand dental therapists' beliefs regarding child maltreatment. *Australia New Zealand Journal of Public Health* 10.1111/1753-6405.12238 (2014).

Professor JR Broughton

Broughton JR, Person M, Maipi J TeH, Cooper-Te Koi R, Smith-Wilkinson A, Tiakiwai S, Kilgour J, Berryman K, Morgaine KC, Jamieson LM, Lawrence HP, Thomson WM. Ūkaipō niho: the place of nurturing for oral health. *New Zealand Dental Journal* 110: 18-23 (2014).

Ben J, Jamieson LM, Priest N, Parker EJ, Roberts-Thomson KF, Lawrence HP, Broughton JR, Paradies Y. Experience of racism and tooth brushing among pregnant Aboriginal Australians: exploring psychosocial mediators. *Community Dental Health* 31: 1–8 (2014). Broughton JR, Maipi JTeH, Person M, Thomson WM, Morgaine KC, Tiakiwai S-J, Kilgour J, Berryman K, Lawrence HP, Jamieson LM. Reducing disease burden and health inequalities arising from chronic disease among Indigenous children: an early childhood caries intervention in Aotearoa/New Zealand. *BMC Public Health* 13: 1177 (2013).



Professor John Broughton greeting a First Nations colleague, Toronto, March 2015.

McBride, D., Cox, B., Broughton, J., and Tong, D. "The mortality and cancer experience of New Zealand Vietnam war veterans: a cohort study." BMJ Open 3:e003379 (2013). doi:10.1136/bmjopen-2013-003379.

Dr LA Foster Page

Foster Page LA, Thomson WM, Marshman Z, Stevens K. The potential of the Child Health Utility 9D Index as an outcome measure for child dental health. *BMC Oral Health* 14:90 (2014). DOI: 10.1186/1472-6831-14-90.

Foster Page LA, Boyd DH, Davidson SE, McKay SK, Thomson WM, Innes NP. Acceptability of the Hall Technique to parents and children. *New Zealand Dental Journal* 110:12-18 (2013).

Foster Page LA, Thomson WM, Ukra A, Baker SR. Clinical status in adolescents: is its impact on oralhealth-related quality of life influenced by psychological characteristics? *European Journal of Oral Sciences* 121:182-187 (2013).

Foster Page LA, Boyd H, Thomson WM. Do we need more than one Child Perceptions Questionnaire for children and adolescents? *BMC Oral Health* 13:26 (2013).

Dr KC Morgaine

Henzell MR, Knight AM, Morgaine KC, Antoun JS, Farella M. A qualitative analysis of orthodontic-related posts on Twitter. *Angle Orthodontist* 84: 203-207 (2014).

McKelvey VA, Morgaine KC, Thomson WM. Adults with intellectual disability: a mixed-methods investigation of their experiences of dental treatment under general anaesthetic. *New Zealand Dental Journal* 110: 58-64 (2014).

Subramanian J, Anderson VR, Morgaine KC, Thomson WM. Effective and ineffective supervision in postgraduate dental education: a qualitative study. *European Journal of Dental Education* 17: e142-e151 (2013).

Subramanian J, Anderson VR, Morgaine KC, Thomson WM. The importance of 'student voice' in dental education. *European Journal of Dental Education* 17: e136-e141 (2013).

Ms DM Shearer

Zeng J, Williams SM, Fletcher DJ, Cameron CM, Broadbent JM, Shearer DM, Thomson WM. Reexamining the periodontal effects of smoking and periodontitis in the Dunedin study with an enhanced analytical approach. *Journal of Periodontology* 85: 1390-1397 (2014).

Thomson WM, Shearer DM, Broadbent JM, Foster Page LA, Poulton R. The natural history of periodontal attachment loss during the third and fourth decades of life. *Journal of Clinical Periodontology* 40: 672-680 (2013).

Professor WM Thomson

Thomson WM, Foster Page LA, Gaynor WN, Malden PE. Short-form versions of the Parental-Caregivers Perceptions Questionnaire (P-CPQ) and the Family Impact Scale (FIS). *Community Dentistry and Oral Epidemiology* 41: 441-450 (2013).

Thomson WM, Shearer DM, Broadbent JM, Foster Page LA, Poulton R. The natural history of periodontal attachment loss during the third and fourth decades of life. *Journal of Clinical Periodontology* 40: 672-680 (2013).

Thomson WM, JM Broadbent, LA Foster Page, R Poulton. Antecedents and associations of root surface caries experience among 38-year-olds. *Caries Research* 47: 128-134 (2013).

Thomson WM, Foster Page LA, Malden PM, Gaynor WN, Nordin N. Comparison of the ECOHIS and short-form P-CPQ and FIS scales. *Health and Quality of Life Outcomes* 12: 36 (2014). (doi: 10.1186/1477-7525-12-36)

Dr J Zeng

Zeng J, Williams SM, Fletcher DJ, Cameron CM, Broadbent JM, Shearer DM, Thomson WM. Reexamining the periodontal effects of smoking and periodontitis in the Dunedin study with an enhanced analytical approach. *Journal of Periodontology* 85: 1390-1397 (2014).

Molecular Microbiology

Programme Directors: Professor Richard Cannon (to June 2013) Dr Geoffrey Tompkins (2013-14)

Overview

Molecular Microbiology research within the SJWRI encompasses microbiological investigations applied to a variety of disciplines including endodontics, periodontics and implantology, cariology and treatment with antimicrobials, antifungal drug development, microbial genomics and forensics.

Major funding supporting research within the Theme during 2013-2014 (more than \$3 million) came from the Marsden Fund (Royal Society of New Zealand), University of Otago Research Committee, New Zealand Dental Research Foundation, Ministry of Health Oral Health Research Fund, New Zealand Health Research Council, Maurice and Phyllis Paykel Trust, the Fuller Scholarship, Dentsply, Syngenta and other commercial concerns.

Personnel

Staff

Professor Richard Cannon Associate Professor Nick Chandler Dr Nick Heng Dr Ann Holmes Dr Mikhail Keniya Dr Erwin Lamping Dr Hee Ji Lee Professor Robert Love Professor Karl Lyons Dr Li Mei Associate Professor Brian Monk Dr Kyoko Niimi Dr Masakazu Niimi Ms Manya Sabherwal Dr Don Schwass Dr Andrew Tawse-Smith Dr Geoffrey Tompkins Jenine Upritchard Dr Rajni Wilson Dr Matthew Woods

Postgraduate Students

Gemma Cotton (PhD) Sujan Gowda (PhD) Franziska Huschmann (PhD) Darnell Kennedy (PhD) Juhi Muthuplackal (MSc) Bikiran Pardesi (PhD) Ely Rodrigues (PhD) Alia Sagatova (PhD) Syarida Safii (PhD) Mohamad Al-Dujaili (DClinDent) Shreya Agarwhal (DClinDent) James Dawson (DClinDent) Arpana Devi (DClinDent) Siddhanta Dhrupad (DClinDent) Niveathanan Kamalendran (DClinDent) Nick Knight (DClinDent) Yeen Lim (DClinDent) Lydia Meredith (DClinDent) Katthryn Newsham-West (DClinDent) Wan Syasliza Mohamed Thani (DClinDent)



Yeast colonies cultured from the saliva of a denture wearer on CHROMagar Candida agar plate (Nick Knight, DClinDent student).

Visiting Scientists

Professor Alistair Brown, Aberdeen University, UK

Professor Susumu Kajiwara, Tokyo Institute of Technology, Tokyo, Japan

Extramural Collaborators

Dr Stewart Bisset, AgResearch, Palmerston North

Dr Ariya Chindamporn, Chulalongkorn University, Bangkok, Thailand

Dr Edmund Fleischer, MicroCombiChem, Weisbaden, Germany

Dr Anette Klinger, MicroCombiChem, Weisbaden, Germany

Associate Professor Lucio Gonçalves, Estácio de Sá University, Rio de Janeiro, Brazil

Dr Michael Gottesman, National Cancer Institute, NIH, Bethesda, USA

Professor Susumu Kajiwara, Tokyo Institute of Technology, Tokyo, Japan

Dr Kurt Lackovic, Walter and Eliza Hall Institute, Melbourne, Australia

Professor Amarila Malik, Universitas Indonesia, Jakarta, Indonesia

Associate Professor Alok Mitra, Auckland University, Auckland

Associate Professor Koshy Philip, Universiti Malaya, Kuala Lumpur, Malaysia

Professor Rajendra Prasad, Jawaharlal Nehru University, New Delhi, India

Dr Jan Schmid, Massey University, Palmerston North

Professor Larry Sklar, University of New Mexico, Albuquerque, USA

Professor Robert Stroud, UCSF, San Francisco, USA

Dr Thomas Tomasiak, UCSF, San Francisco, USA

Dr Silas Villas-Bôas University of Auckland, Auckland

Associate Professor Maggie-Lee Huckabee, University of Canterbury, Christchurch

Current research

Structure-directed antimicrobial discovery

PI Associate Professor Brian Monk

This group is focused on identifying drug targets in microorganisms, studying their structure and function and using these properties to obtain drugs that can circumvent the almost inevitable emergence of drug resistance. We use bioinformatics to identify potential drug targets. Bacterial and yeast expression systems are then used to screen for drugs and undertake physiological, biochemical and structural analysis. In recent years we have identified compounds that inhibit targets involved in yeast energy metabolism and multidrug efflux mediated by plasma membrane pumps. One of these compounds is being used in studies aimed at developing an endodontic dressing. Other molecular targets under development include bacterial DNA gyrase and we have also obtained the X-ray crystal structure of lumazine synthase from the pathogenic yeast Candida glabrata. Oral fungi can develop resistance to the widely used azole antifungal drugs. We have crystallized and obtained high resolution X-ray structures of the azole drug target Erg11p from the model yeast *Saccharomyces* cerevisiae. We are using this structure, the first fulllength structure for a eukaryotic plasma membranebound cytochrome P450 or a monospanning bitopic membrane protein, to guide the design of improved antifungal drugs for use in medicine and agriculture.



Dr Mikhail Keniya, Associate Professor Brian Monk and PhD student Alia Sagatova at Research Day 2014.

Candida adherence and drug-resistance

PI Professor Richard Cannon

Microbial biofilms are implicated in many diseases. An obvious example is dental plaque which can cause caries. Another important oral biofilm forms on the silicone voice prostheses used by patients who have received laryngectomies. These biofilms interfere with valve function necessitating their frequent replacement and associated morbidity. Interestingly, the predominant microbial species in the biofilms on voice prostheses is *Candida albicans*. We have shown that certain saliva proteins are selectively bound to silicone, including SPLUNC2, which acts as a receptor for *C. albicans* adherence. The early binding of *C. albicans* from saliva to new prostheses may explain the prevalence of *C. albicans* in these biofilms.

The main cause of high-level azole drug resistance in *C. albicans* clinical isolates is over-expression of ATP-binding cassette (ABC) membrane proteins that efflux the drugs from cells. We have used our patented *Saccharomyces cerevisiae* system for heterologously expressing membrane proteins to study *C. albicans* efflux pump Cdr1p. Alanine-scanning mutagenesis has been used to investigate the role of amino acids in pump function. We have also used the expression system to study human ABC proteins that contribute to the chemotherapy-resistance of melanomas.

Heme acquisition by periodontal bacteria PI Geoffrey Tompkins

Heme is thought to be an essentialgrowth factor for certain gram-negative bacteria implicated in the pathogenesis of periodontal disease. Establishing how these organsims acquire heme from their human host will aid in understanding how the disease develops, who may be susceptible and how we might intercede to prevent this widespread condition.

Microbial profiling and genome sequencing using next-generation DNA sequencing technology

PI Dr Nick Heng

The oral cavity of each human and animal harbours its own distinctive community of microbes, termed the "oral microbiota". The human oral microbiota is estimated to comprise over 700 species of microbes. Many species have been associated with disease such as *Streptococcus mutans* (dental caries) and *Porphyromonas gingivalis* (periodontal disease), are there any other species that may either contribute to disease progression or are associated with good oral health? Bacterial profiling of oral samples from



Cdr1p external loop 3 glutamate 704 mutated to alanine, glutamine or asparagine

Effect of amino acid substitutions on the localisation of Candida albicans efflux pump Cdr1p expressed in Saccharomyces cerevisiae (Dr Hee Ji Lee, Dr Kyoko Niimi and Dr Erwin Lamping).

healthy or diseased participants using high-yield next-generation DNA sequencing technology may help identify some of these species. This research group is also interested in revealing the genomic secrets of cultured species such as the antimicrobialproducing probiotic *Streptococcus salivarius* and a new streptococcal species isolated from the mouth of New Zealand brushtail possums.

Other research programmes undertaken within the Molecular Microbiology Theme are described in respective staff members' profiles in the 2013-14 SJWRI Research Report.

Highlights

Research Prizes

Belinda Hsu (BDS student) was awarded first place in the Australian Dental Association competition for undergraduate research (2013).

Deepa Mistry (BDS student) won an IADR NZ section IADR poster prize (2013), IADR ANZ Division Colgate Poster Prize (2013), Otago Medical Research Foundation Renshaw Prize (2014), and the New Zealand Dental Research Foundation Prize (2014).

Darnell Kennedy (PhD student) won the Sir John Walsh Research Institute Post-Graduate publishing prize (2013).

Associate Professor Brian Monk was awarded the Sir John Walsh Research prize (2013).

Alia Sagatova (PhD student) won an IADR NZ section IADR poster prize (2014).

Lynda Hwang (BDS student) was the winner of the Junior Colgate Award at the Australia-New Zealand meeting of the International Association for Dental Research (2014) and also won the New Zealand Dental Research Foundation Prize (2014).

Graduations

Sujan Gowda (PhD 2014) Madhu Shankar (PhD 2013) Darnell Kennedy (PhD 2013) Franziska Huschmann (PhD 2014) Ely Rodrigues (PhD 2013) Madhu Shankar (PhD 2013) Juhi Muthuplackal (MSc 2014) Kathryn Newsham-West (DClinDent 2013) Nick Knight (DClinDent 2014) Yeen Lim (DClinDent 2014)

Notable Publications

Monk, B.C, Tomasiak M.K., Keniya M.V., Huschmann, F.U., Tyndall J.D.A., O'Connell III, J.D, Cannon, R.D., McDonald, J.D., Rodriguez, A., Finer-Moore, J.S.,and Stroud, R.M. (2014) Architecture of a single membrane spanning cytochrome P450 suggests constraints that orient the catalytic domain relative to a bilayer. *Proc. Nat. Acad. Sci.* USA 111: 3865-3870.

Kennedy, D. M., J. A. Stanton, J. A. Garcia, C. Mason, C. J. Rand, J. A. Kieser, and G. R. Tompkins. Microbial analysis of bite marks by sequence comparison of streptococcal DNA. *PLoS One* 7:e51757 (2012).

Keniya, M.V., Holmes, A.R., Niimi, M., Lamping, E., Gillet, J.-P., Gottesman, M.M. and Cannon, R.D. (2014) Drug resistance is conferred on the model yeast *Saccharomyces cerevisiae* by expression of full length melanoma-associated human ABC transporter ABCB5. *Molecular Pharmaceutics* 11:3452-3462

Han, T.-L., Tumanov, S., Cannon, R.D. and Villas-Bôas, S.G. (2013) Metabolic response of *Candida albicans* to phenylethyl alcohol under hyphae-inducing conditions. *PLoS One* 8(8): e71364

Lamping, E., Niimi, M. and Cannon, R.D. (2013) Small, synthetic, GC-rich mRNA stem-loop modules 5' proximal to the AUG start-codon predictably tune gene expression in yeast. *Microbial Cell Factories* 12:74

Rawal, M.K., Khan, M.F., Kapoor, K., Goyal, N., Sen, S., Saxena, A.K., Lynn, A.M., Tyndall, J.D., Monk, B.C., Cannon, R.D., Komath, S.S. and Prasad, R. (2013) Insight into PDR ABC pump drug transport through mutagenesis of Cdr1p transmembrane domains. *Journal of Biological Chemistry* 288:24480-24493

Oral and Molecular Immunopathology

Programme Leaders: Professor Greg Seymour and Professor Alison Rich (2013) Professor Alison Rich (2014)

Current information about cellular and molecular mechanisms involved in the pathogenesis of chronic oral diseases and in development and healing allows advancement of diagnostic and treatment modalities. Our group uses a range of cellular, molecular, immunological and pathological tools including cell culture, genomic and focused micro-arrays, real time PCR, laser microdissection and immunohistochemistry to investigate a range of dental and oral mucosal conditions. Of major interest is regulation of the microenvironment in oral squamous cell carcinoma with respect to local and nodal immune regulation, influences on local invasion, angiogenesis and the reaction to endoplasmic stress and epigenetic effects. The interest in angiogenesis extends to pulpal tissues in terms of continued root development following pulp injury, as well as to the effect of bisphosphonates and the pathogenesis of bisphosphonate related osteonecrosis of the Jaw (BRONJ). Cell lines have been developed from pulp and periosteum to gather information on the presence of progenitor cells in these tissues.

Key Personnel and Collaborations Staff

Dawn Coates Mary Cullinan Bernadette Drummond Norman Firth Lara Friedlander Lynda Horne Sharla Kennedy Trudy Milne Praveen Parachuru Alison Rich Benedict Seo (also PhD student) Gregory Seymour Andrew Tawse-Smith (also PhD student)

PhD and DClinDent students

Muhammad Al-Ansary	Olive Allsobrook
Avadhoot Avadhani	Kullasit Chutipongpisit
Sarah Drake	Osea Gavidi
Simon Guan	Ramya Javvadi
Hina Narayan	Noel Ye Naung
Suraya Sinon	Muhammed Yakin
Sobia Zafar	Diogo Zanicotti

We have international collaborative studies with the Oral Cancer Research and Coordinating Centre, University of Malaya, Malaysia malaysiaoralcancer.org



Sarah Drake, DClinDent student.

Current Research Projects

Activity 1. Angiogenesis

- Angiogenesis and pulp biology
- Angiogenesis in inflammatory hyperplasias
- · Angiogenesis and oral squamous cell carcinoma
- Lymphangiogenesis and oral squamous cell carcinoma

Activity 2. Endoplasmic reticulum stress and the unfolded protein response

- · In an inflammatory model-periodontal diseases
- In a neoplastic model-oral squamous cell carcinoma
- In relation to signalling pathways-STAT3

Activity 3. Regulation of immune responses

- In periodontal diseases
- In oral squamous cell carcinoma-regulatory T cells
- In oral squamous cell carcinoma-IL17 and invasion
- In an immune-mediated lesion-oral lichen planus

Activity 4. Epigenetics

- In periodontal diseases
- In squamous cell carcinoma

Highlights 2013 and 2014

Funding successes

Does the immunoscore predict the behaviour of oral cancer? A Avadhani, AM Rich, VPB Parchuru, JM Broadbent, GJ Seymour. Funding: NZDRF 2013-2015 \$14,934.

BRONJ – The effects of zoledronic acid on the VEGF receptors and implications for osteoblast growth and maturation. DE Coates, K McLaughlin, M Cullinan, GJ Seymour Funding: NZDRF 2013-2015 \$14,073.

Primary tooth pulp as a source of progenitor cells for tooth regeneration. BK Drummond, M Alansary, DE Coates, GJ Seymour, LT Friedlander, DG Zanicotti. Funding: NZDRF 2013-2015 \$14,981.

Expression of Cyclin D1 in normal oral mucosa, oral dysplasia and oral squamous cell carcinoma. NA Firth, S Guan, R Love. Funding: NZDRF 2013-2015 \$4,624.

Endoplasmic Reticulum Stress proteins in the development of oral squamous cell carcinoma. BL Seo, DE Coates, AM Rich, GJ Seymour. Funding: NZDRF 2013-2015 \$15,000.

Lymphangiogenesis in the oral squamous cell carcinoma microenvironment. K Chutipongpisit, V Parachuru, AM Rich. Funding: NZDRF 2014-2016 \$9,285.

Primary tooth pulp as a source of progenitor cells for permanent tooth pulp-dentine regeneration. D Coates, M Alansary, BK Drummond, GJ Seymour, LT Friedlander, DG Zanicotti Funding: NZDRF 2014-2016 \$13,221.

MicroRNA expression profile in healthy and diseased gingival tissues. V Parachuru, R Katare, AM Rich, W Duncan, GJ Seymour. Funding: NZDRF 2014-2016 \$15,000.

Role of interleukin 17 in invasion of oral cancer. AM Rich, A Avadhani, T Milne, GJ Seymour. Funding: NZDRF 2014-2016 \$14,697.28

Effect of cigarette smoke on DNA methylation in human gingival fibroblasts in vitro. AM Rich, H Narayan, T Milne, GJ Seymour. Funding: MOHOHRF 2014-2016 \$14,179.

The use of periosteum-derived mesenchymal multipotent progenitor cells for bone regeneration on titanium surfaces. W Duncan, Y Naung, DE Coates, DG Zanicotti, R. De Silva. Funding: Arthritis New Zealand 2014-2016 \$20,000.

The use of periosteum-derived mesenchymal multipotent progenitor cells for bone regeneration on titanium surfaces. W Duncan, Y Naung, DE Coates, DG Zanicotti, R. De Silva. Funding: Wishbone Trust of New Zealand 2014-2016 \$16,000.

The use of periosteum-derived mesenchymal multipotent progenitor cells for bone regeneration on titanium surfaces. W Duncan, DE Coates, Y Naung, DG Zanicotti, R. De Silva, GJ Seymour. Funding: Maurice and Phyllis Paykel Trust 2014-2016 \$10,000.

Publications

In 2013 and 2014 members of the group published 14 papers in international peer reviewed journals. Eighteen conference presentations were made. Full details are available online.

Honours and Awards

2013: Diogo Zanicotti was the Postgraduate Award winner of the New Zealand Section of the International Association for Dental Research and won a trip to present his poster at the International Association for Dental Research, Bangkok.

2013: Maurice and Phyllis Paykel Trust - Travel Award for attendance at the International Association for Dental Research, Bangkok. D. Coates, S. Zafar, M. Cullinan, B. Drummond, G. Seymour. \$1000.

Postgraduate Student Completions

Praveen Parachuru (PhD, 2013) Lara Friedlander (PhD, 2014) Osea Gavidi (DClinDent Oral Pathology, 2013) Olive Allsobrook (DClinDent Oral Pathology, 2014) Ramya Javvadi (DClinDent Oral Pathology, 2014) Simon Guan (DClinDent Oral Medicine, 2014)



Masson's trichrome stain of the apical region of an immature permanent tooth root showing cell rich areas and the apical papilla tissue. This tissue has the potential to participate in apexogenesis and healing following pulp injury. (Lara Friedlander).

CD34 Alexa Fluor 594 D2-40 Alexa Fluor 488 D3-40 Alexa Fluor 488 D3-40 Alexa Fluor 488 Merged Merged

Case 1 - Lymphangioma

CD34 - blood vessel endothelial cell marker D2-40 (podoplanin) - lymphatic vessel endothelial cell marker

CD34/D2-40 double immunofluorescence staining assists in differentiating between blood and lymphatic vessel endothelial cells. This photomicrograph is of a lymphangioma, a benign tumour of lymphatic vessels. The top left image image shows the expression of CD34, a marker for blood vessel endothelial cells (red). Top right image shows the expression of D2-40 (green), a marker for lymphatic vessel endothelial cells. Bottom left image shows the DAPI counterstain. Bottom right image is a merge of all the other images in the panel and allows the distinction of blood and lymphatic vessels. (Kullasit Chutipongpisit, DClinDent Oral Pathology student, and Praveen Parachuru).

IL17 soluble receptors



Graph demonstrating that soluble IL17 receptors were detected in all OSCC cell lines tested and that their expression increased in a time dependent manner. (Avadhoot Avadhani, PhD student, and Trudy Milne).

Emerging research programmes

CLINICAL RESEARCH

Programme Directors: Associate Professor Mary Cullinan (2013) Professor Warwick Duncan (2014)

The Clinical Research Programme (CRP) was established in 2013 following the awarding of University of Otago Research Centre status to the SJWRI. Clinical research aims to improve patient care and to achieve better outcomes for patients. A major ongoing initiative of the CRP is the development of a dental practice-based research network, Applied Research through Clinicians' Hands (ARCH).

Practice Based Research Networks (PBRNs) foster relationships between practitioners and academics by investigating research questions of relevance to daily clinical practise. The types of studies that may be undertaken range from retrospective studies using dental records, observational studies of routine care, case-control studies, through to clinical trials.

PBRNs have been operating successfully in a number of countries in recent years. For example, the US has the National Dental Practice-Based Research Network with a mission To improve oral health by conducting dental practice-based research and by serving dental professionals and their patients through education and collegiality. Research carried out through PBRNs in the US has examined a range of topics including: outcomes of cracked teeth and of single tooth endodontic and restorative treatment, repair or replacement of defective restorations, remineralisation of white spot lesions following removal of orthodontic brackets, and medications and dry mouth.

In 2011, the Victorian Branch of the Australian Dental Association, in conjunction with the Oral Health Cooperative Research Centre of the University of Melbourne, set up a PBRN named eviDent. Some of the projects undertaken by eviDent members include a retrospective study of implant complications in private practice, general practice prescribing and xerostomia, molar/incisor hypomineralisation, and periodontal diagnosis, treatment and maintenance in general practice.

PBRN practitioners in the US and Australia feel the experience offers them benefits in terms of improving patient care, providing collegiality and learning opportunities, and that they can give something back to the profession. Many are enthusiastic about the research and find it empowering. They also find that patients are willing to participate in something that will improve treatments and outcomes.

The last two years have seen considerable progress with the establishment of the practice-based research network ARCH (otago.ac.nz/arch), within the Clinical

Research programme. This has been achieved with the support of the University of Otago through SJWRI Research Centre funding. Collaborative links have been developed with the University of Otago Bioethics Centre to develop a blended learning module in ethics for practitioners undertaking clinical research. Collaboration is being undertaken with HEDC to develop an on-line platform for information sharing and clinical research. The SJWRI has worked closely with the NZDA and the Melbourne-based eviDent Foundation to put in place the training and support structures needed to involve dental practitioners in dental research. ARCH provides an exciting opportunity to address clinically relevant research needs identified by dental practitioners. As the PBRN develops and matures, there is increased scope for research-informed practice and practice-informed research projects and the potential to access new external funding opportunities from government and industry. The types of studies that have initially been undertaken include retrospective studies using dental records, and it is anticipated that the second phase of the PBRN will undertake observational studies of routine care, case-control studies, clinical trials and other issues of relevance to dentists here in New Zealand. The group is also offering scholarships to support postgraduate clinical research.



Key Personnel

Assoc Prof Mary Cullinan (to end 2013) Professor W Duncan Dr B Al-Amleh Mr M Brosnan Professor P Brunton Mr H De Silva Professor B Drummond Professor M Farella Dr L Friedlander Ms D Hanlin Ms S Ma Ms C Murray

Research projects and themes established:

- Direct pulp capping practices in New Zealand A PBRN study
- · Vital pulp therapy (VPT) in general practice.
- The understanding of undergraduate dental students and clinical tutors around VPT.
- Research ethics for practitioners undertaking clinical research.
- A retrospective assay of implant outcomes in New Zealand Dental Practice.

Awards

Otago Medical Research Award

2013 – Kate McElroy (supervisors Dr Lara Friedlander, Suzanne Hanlin, Dr Ben Daniel, Assoc Prof Mary Cullinan

Summer Research Project – Direct pulp capping practices in New Zealand – A PBRN study

NZDRF Grant

2014 – Friedlander L, Hanlin S, Daniel B

Direct pulp capping in New Zealand general dental practice – A Practice Based Research Network (PBRN) study

New Zealand Dental Research Foundation and Continuing Dental Education Research Award

\$14,970

Collaborative links

With eviDent Foundation, HEDC and the Bioethics centre to develop a blended learning module in ethics for practitioners undertaking clinical research.

Collaboration with HEDC to develop an on-line platform for information sharing and clinical research.

2013 activities

The 2013 SJWRI Clinical Research Symposium: When practice meets research - a future full of possibilities was held at the Dunedin Public Art Gallery on June 28, providing an interesting and collegial day of CPD for those who attended. The topics covered by our speakers were both informative and thought provoking, highlighting areas where our clinical decisions are more empirical than evidence based, and forward-looking in providing glimpses of what technology can offer. Professor Mike Morgan of the University of Melbourne gave insight into eviDent, the Melbourne Dental Practice Based Research Network, and Professor Janet Clarkson gave an entertaining podcast of the Scottish PBRN. The feedback received has been very positive and a number of practitioners have expressed an interest in joining our Practice Based Research Network ARCH. Benefits most often cited from involvement in a PBRN; include collegiality, learning opportunities and improved patient care.

Our Symposium speakers included:

Suzanne Hanlin – Digital dentistry in Prosthodontics. From CADCAM to Webcam and everything in between

Basil Al-Amleh – Ceramic fractures and their origins

Andrew Tawse-Smith – Challenges of oral implant maintenance

Mike Morgan – Practice based research networks: eviDent

Jan Clarkson – Practice based research networks: The UK experience (Podcast)

Jonathan Broadbent - The animated dental chart

Bernadette Drummond – Management for molarincisor hypomineralisation with and without enamel breakdown

Lara Friedlander – The use of contemporary endodontic techniques to improve patient outcomes

For more information on our 2013 Clinical Research Symposium speakers, including biographies and outlines of their presentations, please visit otago.ac.nz/sjwri/research/clinical/otago061173.html

In September 2013, Assoc Prof Mary Cullinan, Suzanne Hanlin and SJWRI Research Manager James Smith travelled to Melbourne to visit eviDent. The significant achievement of this trip was the establishment of a collaboration with eviDent for information sharing regarding PBRN establishment, structure and governance, recruitment of practitioners, research project management and collaborative projects (eg development of new training resources for participating practitioners in terms of research ethics and practice).

2014 activities

The SJWRI and ARCH-PBRN held a Clinical Research Symposium *Starting in research? – Let's get it right!* at the University of Otago on 14 Feb 2014. The symposium was aimed at academic staff, postgraduate research students and dental practitioners interested in participating in clinical research in oral health and attracted dental practitioners from Otago and Southland.

Suzanne Hanlin, Director of the ARCH Network gave an introduction and welcome to the attendees, which was followed by a presentation by Neil Pickering (Senior Lecturer, Bioethics Centre) on *Key issues in research ethics*. Gary Witte, Manager of Academic Committees for the University of Otago Ethics Committee, presented on *Human Participant Research Ethics: Frameworks and Practicalities*.

Following afternoon tea, Trish Leishman, Health Sciences Librarian spoke on *Getting your teeth into research: tools and skills for finding information*.

A PBRN governance symposium for key stakeholders was held in Dunedin in May 2014 at the HD Skinner

Annex, Otago Museum and included representation from the New Zealand Dental Association (NZDA), Ministry of Health (MoH), Southern District Health Board (SDHB), Accident Compensation Corporation (ACC), and South Island dental professionals. This event was designed to get buy-in from representatives of oral health in New Zealand and assist in establishing a validated governance model. Dr Denise Bailey (eviDent; Melbourne) chaired the meeting and outlined the development of evident highlighting the potential and pitfalls involved in developing and then supporting an active PBRN.

Topics covered included:

- Development of a research network- the Australian experience.
- Broad overview of the projects that have been completed.
- The role of a research advisory panel.
- Support for clinical research in New Zealand
- An open forum discussed engagement and potential roles of stakeholders in PBRN



HD Skinner Annex, Otago Museum, venue for the 2014 SJWRI/ARCH Clinical Research Symposium.

Engagement with stakeholders around the ARCH concept

Dr Lara Friedlander and Ms Suzanne Hanlin met with NZDA Executive (Wellington) on behalf of the ARCH-PBRN in October to present the case for a collaborative partnership. A highly productive discussions indicated NZDA support for the PBRN initiative and discussions regarding ongoing levels of support are ongoing.

Also in October, SJWRI Research Manager James Smith represented ARCH at the eviDent AGM in Melbourne, to discuss collaborative projects and governance with eviDent researchers.

In the highly contested 2014 NZDA Research Foundation grant round, Dr Lara Friedlander and colleagues secured funding to expand the dental pulp capping PBRN study to a second phase. This project involved a focus group with dental practitioners from across NZ and was planned for March 2015. These focus groups will be followed by site visits to dental practices to more fully understand the engagement and support that is required to undertake productive practice based clinical research. These visits are planned for July 2015.

Student projects 2014

ARCH currently has an BDS5 honours student Jeffrey Ong who is supervised by Dr Lara Friedlander, Ms Suzanne Hanlin and Dr Ben Daniel (HEDC) and is undertaking a practice based research project related to *Philosophies and practices of vital pulp therapy in general practice*.

SJWRI Grant Round

In 2014 seeding funds were made available through SJWRI/ARCH-PBRN to support a practice based research project at the Faculty of Dentistry (applications close early 2015). A larger round to support student projects in clinical research will be conducted in mid 2015.

Establishing a tissue bank to support clinical research

Infrastructure was put in place to establish a tissue bank to support clinical research within the SJWRI: an ultra low temperature freezer (-80°C) and racks to house the Tissue Bank has been purchased, and liquid nitrogen storage and computer resources are in place. The establishment of the Tissue Bank was put on hold while the Division of Health Sciences reviewed Tissue Banks across the Division through 2013-14, with the possible outcome that they may be centralised. This process having run its course, the Tissue Bank will be established within the Institute from 2015 using best practice identified by the Division of Health Sciences in its review.

More on our Clinical Research programme: otago.ac.nz/sjwri/research/clinical/index.html

More on the ARCH Network: otago.ac.nz/arch/index.html

If you are a dental practitioner and are interested in joining our PBRN, or would like further information, please contact the ARCH Network Director, Suzanne Hanlin by emailing arch.dentalpbrn@otago.ac.nz



PBRN research team: Dr Ben Daniel (Higher Education Development Centre), Ms Suzanne Hanlin, Dr Lara Friedlander.

CRANIOFACIAL BIOLOGY AND CLINICAL ORAL PHYSIOLOGY

Established in late 2014, The Craniofacial Biology and Clinical Oral Physiology research programme encompasses a diverse range of exciting fields, including the basic and molecular sciences relevant to craniofacial growth, the impact of malocclusions on jaw function and psychological wellbeing, and the understanding of the peripheral and central mechanisms of orofacial pain with their clinical correlates.

Several research approaches are used to study topics relevant to craniofacial biology, including cell response to mechanical loading, animal models, and clinical genetics. The latter focuses on identifying genetic markers for some dentofacial anomalies which could potentially provide us with a clinically important window of opportunity to predict abnormal growth patterns at an early age and, possibly, to provide personalized orthodontic treatments.

An additional area of active research is focusing on the development of novel treatment strategies for clinical problems such as craniofacial syndromes, jaw discrepancies and misaligned teeth. Furthermore, the impacts of craniofacial anomalies and smile problems are quantitatively and qualitatively assessed at population and individual level using survey methods including social media. Social media enables us to gather opinions from the public about the importance of smiles for individuals themselves and also the perspective of their peers.

Research in the field of clinical oral physiology examines mastication and jaw kinematics, bruxism and non-functional oral behaviours, sleep disordered breathing including snoring and sleep apnea, intra-oral tongue pressure changes, dysphagia, tooth wear and novel food products. We are currently using wired and wireless sensors to monitor intraoral pH and jaw activity for the purpose of identifying and evaluating ways of overcoming orofacial pain, jaw dysfunction, jaw clicking sounds, and dental wear. We also use monitoring equipment to improve the quality of sleep in New Zealand children and adults.



Developing intraoral sensors to monitor pH, temperature and jaw activity.



Heat map of pressure in the skull associated with jaw movement

The programme is led by Professor Mauro Farella, and includes the following Key Personnel:

Dr Joseph Antoun Prof Richard Cannon A/Prof Rohana De Silva Prof Warwick Duncan Dr Sophie Grey Dr Nick Heng Dr Li Mei Dr Trudy Milne Dr Benedict Seo Prof Murray Thomson

Florence Bennani A/Prof Nick Chandler Dr Harsha De Silva Professor Mauro Farella Winifred Harding Dr Hannah Jack Prof Karl Lyons Dr Christopher Robertson Suzan Stacknik A/Prof Neil Waddell

Other University of Otago Researchers Dr Azam Ali (Department of Applied Sciences)

Dr Claire Cameron (Department of Preventive & Social Medicine)

A/Prof George Dias (Department of Anatomy)

Julia Horsfield (Department of Pathology)

A/Prof Barbara Galland (Department of Women's and Children's Health)



EMG (Electromyogram) of bruxism episode in the time-frequency domain.



Three-dimensional image of mandibular growth in a rabbit.

A/Prof Michael Paulin (Department of Zoology)
A/Prof Igor Meglinski (Department of Physics)
A/Prof Tony Merriman (Department of Biochemistry)
A/Prof Sylvia Sander (Department of Chemistry)
Prof. Steven Robertson (Department of Women's and Children's Health)

Dr Bernard Venn (Department of Human Nutrition)

Visiting scientists and students Prof Luigi Gallo (University of Zurich)

A/Prof Vyacheslav Kalchenko (Weizmann Institute of Science, Israel)

Prof Murray Meikle (NZAO Visiting Professor)

Emeritus Prof Sandro Palla (University of Zurich)

Dr Roberto Rongo (University of Naples Federico II)

Postgraduate students

Azza Al-Ani (DClinDent) Mohamad Al-Dujaili (DClinDent) Joseph Antoun ((DclinDent, PhD) Victoria Beck (DClinDent) Gareth Benic (DClinDent) Catherine Carleton (DClinDent) Joanne Choi (PhD) Sophie Gray (DClinDent) Erin Hutchinson (PhD) Ghassan Idris (PhD) Yana Itskovich (DClinDent) Austin Kang (MHealSc) Shaz Khayami (DClinDent) Jennifer Lee (DClinDent) Andrew Parton (DClinDent) Coreen Loke (DClinDent) Lydia Meredith (DClinDent) Andrew Quick (PhD)

Research collaborations

The research group actively collaborates with other renowned scientific groups within the University of Otago such as:

- Center for Bioengineering and Nanomedicine
- Department of Anatomy
- Department of Chemistry
- Department of Computer Science
- Department of Human Nutrition
- Department of Physics
- Department of Zoology
- Genetics Otago
- Neuroscience Programme
- Otago Zebrafish Facility

The programme also collaborates with the New Zealand Biomouth Research Group, and internationally works closely with the Department of Neuroscience at the University of Naples Federico II (Italy) and the Laboratory for Jaw Biomechanics at the University of Zurich (Switzerland).



Research Projects

- A new approach to engineering 3-dimensional constructs of human bone matrix in a mechanically-active environment
- The genetics of dentofacial growth anomalies
- Finding the missing link of hypodontia
- A novel model for exploring the causes and treatments of craniofacial birth defects
- Growth factor expression in the rat condyle: implications for craniofacial development
- Efficacy of oral probiotics for the management of dental plaque and oral malodor during orthodontic treatment
- Intra-oral monitoring of oral pH and bruxism
- Mandibular growth in 3D: CBCT analysis in a rabbit model.
- Intraoral pressure changes upon varying the vertical facial dimension.
- Merging anatomical and fluorescence molecular imaging to investigate craniofacial growth
- Predictive factors of orthodontic pain
- Can we really grow mandibles? An appraisal of the validity of historical controls used in contemporary clinical trials
- Morphometric analysis of cervical vertebrae in relation to mandibular growth

2013-2014 Highlights and External Funding Secured

In total 26 articles were published in the peer-reviewed scientific literature. For details, please refer to the Publications data in the 'Our Achievements' section of the 2013-14 SJWRI Research Report.

Total research funding (external) obtained in 2013-2014 amounted to \$427,650.

ERDG/FORENZAO Charitable Trust Intraoral pressure changes upon varying the vertical dimension (Shaz Khayami, Mauro Farella, Jules Kieser) \$4,130

ERDG/FORENZAO Charitable Trust Mandibular growth in 3D: CBCT analysis in a rabbit model (Andrew Parton, Mauro Farella, Warwick Duncand, Jules Kieser) \$7,170

ERDG/FORENZAO Charitable Trust Short-Term Efficacy of the Twin-Block Appliance on Obstructive Sleep Apnea and Snoring In Children: A Cross-Over Randomized Clinical Trial \$10,100

ERDG/FORENZAO Charitable Trust The influence of enamel surface roughness on bacterial adhesion (Li Mei, Richard Cannon, Lydia Meredith, Mauro Farella) \$1,540 *Health Research Council* Genetics of dentofacial anomalies (Joseph Antoun, Mauro Farella, Tony Merriman, Murray Thomson) \$149,462

Maurice Phyllis Paykel Trust Genetics of dentofacial anomalies, equipment grant (Joseph Antoun, Mauro Farella, Tony Merriman, Murray Thomson) \$3,000

Ministry of Oral Health Research Fund Efficacy of a Mandibular Advancement Appliance on Sleep Disordered Breathing in Children (Mauro Farella, Ghassan Idris, Barbara Galland, Christopher Robertson) \$24,374

Ministry of Oral Health Research Fund Efficacy of the oral probiotic Streptococcus salivarius in managing biofilm formation in patients wearing fixed orthodontic appliances (Li Mei, Gareth Benic, Mauro Farella, Nick Heng) \$11,410

New Zealand Dental Association Research Foundation A novel model for exploring the causes and treatments of craniofacial birth defects (Julia Horsfield, Jospeh Antoun, Mauro Farella, Catherine Carleton) \$10,400

New Zealand Dental Association Research Foundation A new approach to engineering 3D constructs of human bone matrix in a mechanically active environment (Murray Meikle, Trudy Milne, Yana Itskovich, Mauro Farella, Richard Cannon) \$11,862 New Zealand Dental Association Research Foundation Growth factor expression in the rat condyle: Implications for craniofacial development (Trudy Milne, Mauro Farella, Li Mei, Richard Cannon, Mohamad Al-Dujaili) \$14,042

New Zealand Dental Research Foundation Wireless monitoring of oral pH and bruxism. (Mauro Farella, Sylvia Sander, Jules Kieser and Michael Paulin) \$15,000

New Zealand Lottery Grants Board Wireless monitoring of oral pH and bruxism. (Mauro Farella, Jules Kieser and Michael Paulin) \$49,500

Otago Medical Research Foundation A novel model for exploring the causes and treatments of craniofacial birth defects (Julia Horsfield, Joseph Antoun, Mark Hampton) \$30,000

University of Otago Research Grant Merging anatomical and molecular imaging to investigate craniofacial growth in 3D (Mauro Farella, Warwick Duncan, Igor Meglinski, Jules Kieser) \$35,000

University of Otago Research Grant The influence of enamel surface roughness on bacterial adhesion. (Li Mei, Richard Cannon, Lydia Meredith, Mauro Farella) \$10,660

University of Otago Research Grant Wireless monitoring of oral pH and bruxism (Mauro Farella, Jules Kieser and Michael Paulin) \$40,000







UNIVERSITY OF OTAGO FACULTY OF DENTISTRY SIR JOHN WALSH RESEARCH INSTITUTE TE POKAPŪ RAKAHAU OTĀ JOHN WALSH