



SJWRI Research Report 2019-2020

Sir John Walsh Research Institute

Te Pokapū Rakahau o Tā John Walsh

Faculty of Dentistry



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otago.ac.nz/sjwri



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The Sir John Walsh Research Institute (SJWRI) advances research and increases knowledge for the improvement of oral health in New Zealand, and provides a national focus for dental research.

As the research arm of the University of Otago Faculty of Dentistry, New Zealand's National Centre for Dentistry, our innovative research programmes cover the spectrum of oral health research, from the molecular, through biological systems to the health of populations.

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.

Our mission

- To advance research and increase knowledge for the improvement of oral health in New Zealand
- To support and represent the oral health research community in New Zealand
- To facilitate the communication and application of our research findings for the benefit of oral and general health worldwide

Our 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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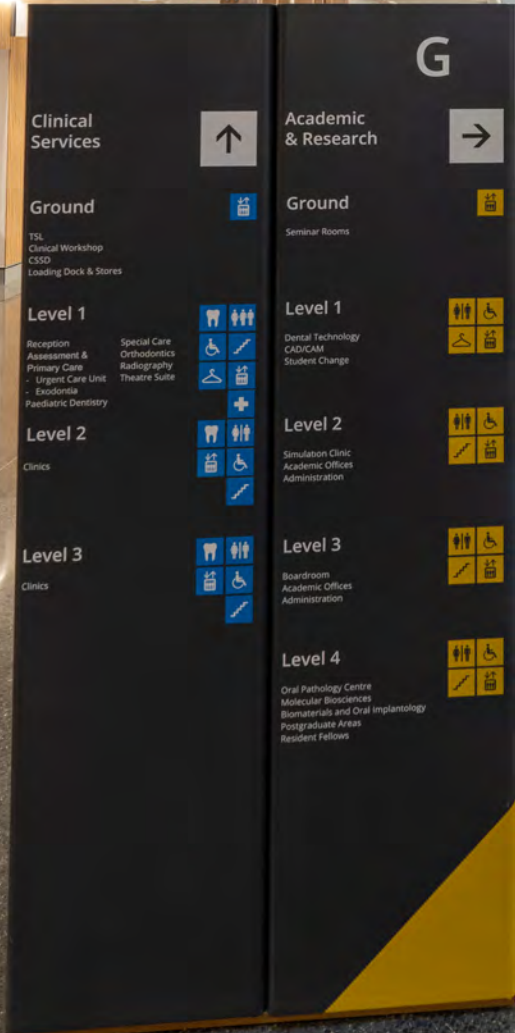
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Appendix: Our achievements

Available to download from the SJWRI website, including a full listing of research publications, research grants and contracts, doctoral research thesis abstracts and postgraduate degree completions for 2019-2020. Download link: www.otago.ac.nz/sjwri/otago835407.pdf



We hope you enjoy this Research Report of the Sir John Walsh Research Institute, a snapshot of our research activities and achievements for 2019-2020. If you would like more information, further details on our research programmes, activities and achievements, our latest news and events, and profiles of researchers are available from the SJWRI website: www.otago.ac.nz/sjwri.

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This Research Report of the Sir John Walsh Research Institute 2019-2020 was compiled by Dr James Smith, with thanks to the staff and students of the Sir John Walsh Research Institute and Faculty of Dentistry, University of Otago.

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Welcome from our Dean

Professor Michael Morgan

It is an absolute pleasure to write this introduction to the 2019-2020 Research Report of the Sir John Walsh Research Institute. As a graduate of Otago's Faculty of Dentistry it was an honour to return to the Faculty in the position of Dean from January 2020. I am grateful for the strong leadership of Professors Alison Rich and Karl Lyons as Acting Deans through to the end of 2019 for their impact within the Faculty and their ongoing support.

The Faculty and its people have shown remarkable fortitude to endure and thrive through tremendously difficult circumstances, through the continued disruption of our research and clinical activities during the final stages of the building project, the establishment of a clinical and teaching facility on a 'greenfield' site in South Auckland, and then the gathering storm clouds of the global Covid-19 pandemic and ongoing lockdowns from March 2020 onwards. While the pandemic persists as I write these words, the Faculty has now moved into our new, completed Faculty of Dentistry precinct, with the research laboratories of the SJWRI proudly occupying the top floor of the redeveloped Walsh Building. Sir John Walsh, long an advocate for research during his decades as Dean of our Faculty, would certainly be proud.

Through these challenges, the Faculty of Dentistry at the University of Otago has maintained a ranking among the best Dental Schools in the world, which is in no small part due to the excellent research that takes place within the Faculty under the aegis of the Sir John Walsh Research Institute. The Research Programmes within the SJWRI continue to be strong, the addition and further expansion of clinical and translational research being key. This development will complement the already existing research that takes place within the Institute, now reunited with our clinical activities under a single roof (or certainly two rooves linked by a glorious sunlit atrium!)

In early 2021, Professor Richard Cannon completed his term as Director of the Institute and Associate Dean Research of the Faculty. I would like to take this opportunity to commend Richard and his team for all of their accomplishments, not only in the period covered by this Report, but in the years since he took on these roles in 2014. With the appointment of Professor Warwick Duncan to these positions, the SJWRI and the research direction of the Faculty are in very safe hands.

I am in no doubt that the SJWRI and the research accomplishments of our Faculty are the envy of those in our region, and will continue to lead in research and teaching for the benefit of our students and the community. I sincerely thank you all again and look forward to our ongoing success.



Introduction from our Director Professor Warwick Duncan

The past two years have been a period of change for the Sir John Walsh Research Institute (SJWRI). We farewelled our long-serving Director, moved into our brand-new research facilities, celebrated our researchers' achievements and found ourselves negotiating the restrictions imposed by COVID-19.

In early 2021, Professor Richard Cannon stepped down after eight years, having been appointed as the second Director SJWRI following the untimely loss of our inaugural Director, Professor Jules Kieser. Richard's leadership has been critical during a tumultuous period in our School's history, coordinating the design and fit-out of our new laboratories whilst encouraging continuity of research despite our staff and students being decanted into eight different locations around campus. I am honoured to have been appointed as the Institute's third Director, and relish the opportunity to build on the fine work of two such august predecessors.

The opening of the revitalised heritage Walsh Building in March signalled the completion of the National Centre for Dentistry's five-year expansion project, along with the official opening of our Auckland clinical facility in February. In early 2021 our research staff moved into the new laboratory spaces that now take up the entire fourth floor of the Walsh Building, replacing the main undergraduate clinics where many readers will recall receiving their clinical education in the past. The new facilities include three laboratories dedicated to Oral Pathology, Molecular Biosciences, and Biomaterials, Biomechanics and Craniofacial Research, as well as new accommodation for our postgraduate students and postdoctoral fellows. Visitors to the school have commented on our spacious and state-of-the-art research facilities, which we think will serve the Dental profession well in the years ahead. If you are visiting Dunedin, please ask for a tour!

Our academic staff and postgraduate students have continued the hard work of attracting grants to support research that is relevant to the dental profession in New Zealand. Across 2019-20, our researchers secured funding from agencies including the Health Research Council of NZ, the Royal Society Te Apārangi, the New Zealand Dental Research Foundation and Ministry of Health Oral Health Research Fund, Cure Kids, the Lottery Grants Board, and industry partners including Colgate-Palmolive New Zealand. We are very grateful for the continued support of our research by these agencies; highlights of these awards are presented on pages 15-20, with a full listing of our research grants, publications and postgraduate completions available for your perusal in the Appendix to this Report.

The ongoing challenges of the COVID-19 pandemic through 2020-21 have obliged us to remain flexible in the way we work and collaborate, not least of which being the restriction on mass gatherings which resulted in our



annual SJWRI Research Day, usually a large conference-style meeting in the Dunedin Public Art Gallery, being run as a series of evening webinars, in combination with the Faculty's Clinical Excellence Day. Our staff and postgraduate students, not to mention lead organiser Dr James Smith, demonstrated remarkable fortitude when faced with lockdown and adroitly pivoted from a physical conference to a virtual format which was livestreamed as a Zoom webinar. This was a huge success; participants from around the country and the world watched live and contributed questions for the presenters. We thank 3M Oral Care New Zealand whose continued generous support made these events possible.

Our future plans include the establishment of a new research programme in Dental Engineering and Tissue Regeneration, led by Associate Professor Dawn Coates, which aims to recognise and enhance cutting edge bioengineering and tissue regeneration research within the SJWRI and provide a platform to attract high calibre students, enhance intramural and extramural collaboration, and secure external funding. As part of the SJWRI strategic development plan, we are also moving to establish a new research programme in Māori and Pasifika Oral Health Research. Currently this remains mostly aspirational, however a number of our new and emerging researchers are active in this area: watch this space for developments.

The current pandemic continues to provide us with challenges in the research environment: dwindling numbers of international doctoral students in our PhD and DClintDent programs; limitations on academic staff presenting their research at international conferences; inability to host our international collaborators in our new labs; the ongoing nightmare of supply chain issues. Despite this, the prevailing mood in the Sir John Walsh Research Institute is one of quiet optimism and a determination to continue producing the world-class research exemplified by the pioneering dental researcher for whom our Institute is named. *Ake ake!*

Sir John Walsh KBE (1911-2003) 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, at just 34 years of age.

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 Master of Dental Surgery graduate programme. Some fifty years later this degree was replaced by the Doctorate in Clinical Dentistry 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 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 Airtor.

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. He was knighted in 1960 and awarded honorary life membership of the New Zealand Dental Association in 1971. After 10 years of struggle he succeeded in building the iconic, heritage-listed glass curtain building that houses the Faculty of Dentistry and bears his name.

Fittingly, the redeveloped Walsh Building has been retained as the centrepiece of the new University of Otago Faculty of Dentistry precinct, opened in 2021.

Associate Professor Brian Monk



Sir John Walsh at his desk in the Otago Dental School, 1940s. Hocken Collections, *Uare Taoka o Hākena*, University of Otago.

Our highlights

Publications

Category	2019	2020	Total
Chapter in Book - Research	1	0	1
Journal - Research Article	109	151	260
Journal - Research Other	35	56	91
Journal - Professional & Other Non-Research Articles	2	1	3
Conference Contribution - Published proceedings: Abstract	86	15	101
Conference Contribution - Poster Presentation (not in published proceedings)	1	0	1
Conference Contribution - Verbal presentation and other Conference outputs	12	5	17
Commissioned Report for External Body	0	1	1
Working Paper; Discussion Paper; Technical Report	2	1	3
Other Research Output	2	0	2
Awarded Doctoral Degree (Staff)	4	12	16
Total for Sir John Walsh Research Institute, Faculty of Dentistry	254	242	496

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. Data courtesy Molly McCormick, Publications Office, University of Otago.

Research funding

Funder/Contracting body	2019		2020		Total	
	# contracts	NZD value	# contracts	NZD value	# contracts	NZD value
3M (NZ)			1	\$2,087	1	\$2,087
BLIS Technologies Limited			2	\$18,500	2	\$18,500
Colgate Palmolive Limited (NZ)	3	\$38,737	1	\$40,000	4	\$78,737
Cure Kids	1	\$49,458	1	\$14,215	2	\$63,673
Downie Stewart (Fuller Scholarships)	5	\$19,809	4	\$19,900	9	\$39,709
Foundation for Orthodontic Research & Education, NZAO			1	\$3,863	1	\$3,863
Foundation Trust University of Otago (Sidey Trust)			1	\$12,000	1	\$12,000
Health Research Council of NZ	2	\$1,204,968	1	\$206,046	3	\$1,411,014
In Vitro Technologies			1	\$150,000	1	\$150,000
International College of Prosthodontists			1	\$7,692	1	\$7,692
Leverhulme Trust (University of Kent subcontract)	1	\$97,858			1	\$97,858
Maurice and Phyllis Paykel Trust	3	\$28,000	1	\$10,000	4	\$38,000
MedTech CoRE (University of Auckland)			1	\$41,376	1	\$41,376
Ministry of Education Malaysia (Higher Education)			1	\$10,000	1	\$10,000
Ministry of Health NZ Oral Health Research Fund	3	\$61,059	2	\$47,402	5	\$108,461
New Zealand Dental Research Foundation	11	\$142,212	15	\$158,206	26	\$300,418
New Zealand Lottery Grants Board			3	\$296,370	3	\$296,370
ANZ Head & Neck Cancer Society - NZ Research Foundation			1	\$15,000	1	\$15,000
Otago Innovation Limited			1	\$44,000	1	\$44,000
Sun Pharma Global FZE	1	\$192,138			1	\$192,138
University of Otago Research Grants	7	\$196,589	3	\$96,281	10	\$292,870
Grand Total	37	\$2,030,828	42	\$1,192,938	79	\$3,223,766

Figures represent all research funding contracts commencing between 1 Jan 2019 and 31 Dec 2020, led by Principal or First Named Investigators from the Sir John Walsh Research Institute and Faculty of Dentistry. This does not reflect contracts beginning in earlier years which ran through the 2019-20 period, or contracts led by PIs outside the Faculty of Dentistry on which SJWRI researchers were Named Investigators. For multi-year awards, funding is counted against the primary year of award. Data courtesy Dr John Milnes and Lorraine Harris, Research and Enterprise Office, University of Otago.

SJWRI researchers were Named Investigators on a further seven research contracts awarded to Principal Investigators from outside the Faculty of Dentistry across 2019-2020, worth a total of \$2,070,986.

Comprehensive listings of all our research publications, research contracts and postgraduate degree completions for the 2019-2020 period are provided in the Appendix to this Research Report, available at www.otago.ac.nz/sjwri/otago835407.pdf.

New building opened at National Centre for Dentistry

11 July 2019

One of the “highest tech” dental facilities in the world was officially opened this morning – the hospital-level patient-treatment building for New Zealand’s National Centre for Dentistry, at the University of Otago.

Division of Health Sciences Pro-Vice-Chancellor Professor Paul Brunton told the packed event that he believes it is possibly the largest building of its kind in the southern hemisphere and he felt overwhelmed by the amazing occasion.

He says the impressive Faculty of Dentistry already provides world-class education and research so the challenge now is to take that to next level – and that “is a challenge I have no doubt you are up to”.

He also challenged the faculty to work with the government “to do all we can to improve the oral health of New Zealanders ... you all know there’s much work to do”.

Speakers at today’s launch used a lectern that was also used during the opening of the faculty’s neighbouring Walsh Building, which started being used for patient treatments in 1961 and will now be gutted then refurbished as the next stage of this project.

Vice-Chancellor Professor Harlene Hayne told the audience this is the single largest and most complex project the University has attempted in its 150 year history so involved a lot of risk but the University had gone ahead because of the faculty’s incredible dedication to teaching, research and clinical practice.

The event included the unveiling and then laying of a stone to mark the occasion by Chancellor Dr Royden Somerville QC.

Attending the event was Dunedin’s Dame Elizabeth Hannan, the daughter of Sir John Walsh who was Faculty of Dentistry Dean for 25 years from 1946 and had the faculty’s existing Walsh Building named in his honour.

Dame Elizabeth says the occasion was emotional and she “absolutely feels his vision is continuing”.

Faculty of Dentistry acting Dean Professor Karl Lyons says his is thrilled with the opening.

Images at right, top to bottom:

Vice-Chancellor Professor Harlene Hayne speaks at the launch.

Pro-Vice-Chancellor (Health Sciences) Professor Paul Brunton speaks at the opening.

Dame Elizabeth Hannan with Professor Harlene Hayne and Professor Paul Brunton at the opening.

University Chancellor Royden Somerville unveils the stone plaque.

Faculty of Dentistry Associate Dean for Clinical Services Dr Peter Cathro takes a look at TV One reporter John McKenzie’s teeth.

Photos: Sharron Bennett.



“To see the building and what we have got, and what we can do in the future, is just fantastic.”

The faculty is also constructing a new building in South Auckland to help meet high health needs while providing students with wide-ranging learning opportunities in a diverse community that will increase their understanding of people from a range of backgrounds.

Jamie Cargill is the project director for construction of both the Auckland and Dunedin building, which has been a once in a lifetime opportunity to work on a dental hospital because not many are built around the world – now he is thrilled staff, students and the public are using it.

“This project is also a great investment in Dunedin. The national centre for dentistry has been here for over 100 years and this will mean it’s here for at least another 50-plus – and that’s exciting.”

He has been working on the project for more than five years – from design to build – and will be moving on to the next phase soon, gutting and rebuilding the interior of the Walsh Building, which is in front of the new building in Great King Street.



New technology

Professor Brunton says moving into the new building also involves adopting new ways, including the 214 new patient chairs – 61 more than previously - have integrated computers so:

- Patients’ records can be seen on a screen on the chair
- The results of x-rays and scans can be seen on the screen, by the student, supervisor and patient
- Images from a digital camera that takes photos inside patients’ mouths can be seen on the screen
- A computerised self-cleaning system ensures infection prevention standards are stringent
- Software (Vionex) monitors each chair’s functioning so any maintenance needs are immediately obvious and can be dealt with

In addition, student tutorial spaces are linked to patient treatment areas, which integrates technology to enrich the learning experience, and with the use of digital technology, staff are no longer using potentially hazardous chemicals to produce x-rays.

Another major change is using electronic patient records instead of paper files, Professor Brunton says.

Previously, only patients’ names, contact details and financial records were kept electronically, everything else was in paper files taken from one place to another as patients were assessed and treated – during about 76,000 treatments annually for the public.

In the new building, the electronic patient management system Titanium has been broadened to cover more tasks so all new files will be completely electronic. As in any health environment, staff and students will be allowed access to relevant patients’ files only and have to sign a confidentiality agreement, he says.

With the new system:

- Every time a patient is assessed or treated, students and supervisors can simply call up the patient’s electronic record
- Students can immediately enter details of the treatment they are providing
- Instead of administration staff using details in the paper patient files to monitor waiting lists, academic staff can easily compare electronic records to add patients to waiting lists and adjust the list as needed
- Collaboration about patients’ care among the various dentistry disciplines is much easier because they can all instantly see what assessments, prevention measures, restoration and rehabilitation work other disciplines have done or are planning
- The various disciplines can view a patient’s file simultaneously rather than waiting for a paper file to arrive, and can discuss the patient from different locations while looking at the same electronic file

- Academic staff have an easy electronic way to monitor the types of patients each student has been treating, to select appropriate patients to fill any gaps in each student's learning.

Using the upgraded Titanium system also helps prepare students for the workplace because most district health boards around New Zealand use Titanium – the software is one of the most commonly used in the health sector in Australasia. Many private practices also use a similar version of Titanium software, Professor Brunton says.

Having an electronic system will help solve one of the most common complaints patients make to the Faculty of Dentistry as well, that they did not know what their treatment was going to cost.

Staff and students can print out a treatment estimate to discuss with patients before treatment starts.

Despite all the changes, this University service continues to aim to provide patients with quality treatment at an attractive cost, recognising patients play a vital role in helping to train the students, Professor Brunton says.

The new systems were introduced first at Orthodontics in the Faculty of Dentistry and the Te Kaika health, social and education clinic in Caversham in Dunedin – which provided opportunities to smooth out any complications with both the upgraded electronic systems and new processes.

All existing processes were documented by a business analyst from the moment a potential patient contacts the Faculty of Dentistry until the patient leaves its care, including investigations into patients' possible eligibility for funding.

That formed the basis for new processes and about 80 per cent of them were introduced before staff and students started using the new building, in preparation for the move.

Occupation of the new building

The public began being treated in the new building early this month, when the urgent care clinic started taking a few patients.

Staff and students have had a building orientation and received more training on new equipment and systems in the build-up to the official opening, Professor Brunton says.



Technical Services Manager Steve Swindells (right) explains the value of the Clinical Service Building's new Technical Services Laboratory to Education Minister Chris Hipkins during the Minister's visit last week.

Dentistry building gets Ministerial stamp of approval

16 July 2019

Education Minister Chris Hipkins declared Kiwis' teeth to be in good hands at Otago's Faculty of Dentistry, following a tour of the new Clinical Services Building.

Mr Hipkins visited the new building on Friday, following a meeting with University representatives including Deputy Vice-Chancellor (Research and Enterprise) and Acting Vice-Chancellor Professor Richard Blaikie, Pro-Vice-Chancellor (Health Sciences) Professor Paul Brunton, and President of Otago University Students' Association (OUSA) James Heath.

The tour of the Clinical Services Building was hosted by dental students Ming Yap, Rereahu Jefferies and Jesse Lewis, and University Chancellor Dr Roydon Somerville. It included explanations of many aspects of the new building and new equipment – and the vast improvements in research, treatment and teaching those investments will allow.

Minister Hipkins said the “really good visit” was “a welcome opportunity to hear first-hand the latest developments at Otago University”.

“The new dental school is very impressive. It is cutting edge technology and a great space for dental training and dental services, and just a couple of steps away from the dental researchers. Kiwis' teeth are in good hands.”

Professor Blaikie says having Mr Hipkins tour the new building was a good chance to show a senior Government minister what an asset the country has in the Clinical Services Building.

“Having Mr Hipkins here was an honour. We're proud of the Clinical Services Building that combines a modern and fully functional dental hospital with state-of-the-art teaching facilities; it's a great space to work, teach and research in, and it was good to be able to communicate that to the Minister.

New Auckland dental base on target

Thursday 4 April 2019

Construction of the University's dental teaching facility and patient treatment clinic in South Auckland is proceeding well, with structural steel now being ordered, Campus Development Division Director David Perry says.

Building began on the \$28.31 million, two-storey, 32-chair building in mid-December 2018 on land owned by the Counties Manukau District Health Board, beside its Manukau SuperClinic on Great South Road.

Tasks completed

The first task was to build a new car park to replace a SuperClinic car park that is being used to access the site and this car park will eventually become the dental facility's carpark. This car park was completed a week ahead of programme and is now being used by the SuperClinic.

Piling for the clinic was also finished five days ahead of schedule – the work started in mid-December and finished at the end of January.

Now the project is out of the ground, concrete is now being poured for ground beams for the foundation slab and the structural steel is being ordered, Mr Perry says, while crediting Project Director Jamie Cargill and main contractor Savory Construction for the efficient work.

The project is on target for completion before the start of the academic year in 2020, all going to plan.

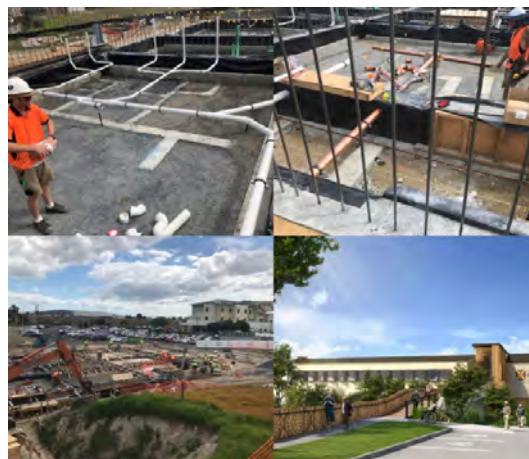
Purpose

The new dental clinic aims to help meet high health needs, while providing students with wide-ranging learning opportunities in a diverse community that will increase their understanding of people from a range of backgrounds, Pro-Vice-Chancellor of the Division of Health Sciences Professor Paul Brunton says.

The Counties Manukau Health Board provides services to 11 per cent of New Zealand's population, including 12 per cent of New Zealand's Māori, 37 per cent of New Zealand's Pacific people, and 21 per cent of New Zealand's Asian people.

The project will strengthen relationships and partnerships with Māori and Pacific communities based on mutually beneficial goals incorporating patient care, research and education.

Not only will the Faculty of Dentistry regularly consult the community to find out what it needs from the clinics then work to deliver that, the Faculty will also provide a wide range of outreach activities.



South Auckland dental facility building progress, April 2019 (clockwise from bottom left):

The site for the new dental teaching facility and patient treatment clinic from the east with cars in the new car park and the project in the background

Drain pipes under the concrete slab floors

Reinforcing steel and pipes for other services that will also be beneath the slab floors

Architects' rendering showing how the completed building will look

The clinic will follow the long-standing social contract model operated successfully in Dunedin, where patients receive treatment provided by students under supervision at a highly accessible cost, he says.

Education

At any one time, 48 final-year Bachelor of Dental Surgery students will be assigned to the Counties Manukau facility.

The facility is designated as a general dental practice. It has 32 treatment chairs and another chair dedicated to teledentistry.

The facility's Simulation Clinic – with artificial heads for practising dentistry – has 16 fully-equipped stations which also include screens for students and dentists to watch others work, lectures, or patients being treated (teledentistry).

The facility's seminar room's capacity is up to 50 people.

Having an Auckland base in an area home to a large number of oral healthcare professionals will also make it easier for them to access continuing education opportunities.

The facility could help meet international demand for upskilling dentists as well, because Auckland is so accessible, Professor Brunton says.

South Auckland dental's benefits already flowing at official opening

Thursday 4 February 2021

About half the students who graduated from the University of Otago's new dental facility in South Auckland last year now work in high-needs communities as dentists, and facility patients are grateful for accessible dental treatment for their long-term problems, University of Otago Vice-Chancellor Professor Harlene Hayne says.

The University of Otago, Auckland Dental Facility – which Professor Hayne officially opened on 4 February after a soft launch last year – had 11 students in 2020 and is progressing with 29 this year then to full capacity with almost 50 in 2022, which will be half the Faculty of Dentistry's final-year students and the facility's limit, Professor Hayne says.

“This provides them with an amazing opportunity, not just to learn, but to make a real contribution and become part of the community. We have already seen this happening in the time we have been open. Similarly, we offer oral health practitioners opportunities to continue their dental education.”

Facility Clinical Director Dr David Roessler believes one of its most lasting impacts could be the numbers of graduates who decide to work in high needs areas.

Another lasting impact will be the students promoting oral health awareness and educating people about oral health.

Already praise has been flowing from the facility's broad range of patients, most of whom have conditions that have gone untreated for years.

“We've had a lot more impact than we expected, we



haven't even had to advertise for patients. This is a big deal in Auckland.”

The facility, which provides treatment by appointment only, follows the model operated successfully by the Faculty of Dentistry in Dunedin where the University service provides patients with quality treatment at an attractive cost, recognising that patients play a role in helping to educate the students.

Dr Roessler says the Auckland students “are in a world class facility situated in a highly multicultural area with an extremely diverse range of oral health needs.

“This provides them with an amazing opportunity, not just to learn, but to make a real contribution and become part of the community. We have already seen this happening in the time we have been open. Similarly, we offer oral health practitioners opportunities to continue their dental education.”

Dr Roessler says the facility staff and students have been “like a big family, which is really, really nice”.

University of Otago Faculty of Dentistry Dean Professor Mike Morgan says the \$28.2 million, two-storey, 32-chair building was built on Counties Manukau District Health Board (DHB) land neighbouring the Manukau Super Clinic on Great South Road.

The University partnered with the DHB on the project which increases access to subsidised oral health care in South Auckland and fulfils the University's objectives of education, research and serving the community.



“This is an exciting day for the Faculty of Dentistry. The standard of the clinic matches our world- class dental teaching facilities in Dunedin and its position in the community will allow us to make a real difference in improving health outcomes,” he says.

The University of Otago, Auckland Dental Facility was made possible by a \$10 million donation from businessman Graeme Hart and his wife Robyn.

Professor Morgan says the broad range of learning opportunities will support the education of first-class dental graduates.

“They will leave their education and training experiences with a greater appreciation of the complex needs of our increasingly diverse population.”

Division of Health Sciences Pro-Vice-Chancellor Professor Paul Brunton says the facility provides an additional educational opportunity for students across all dental programmes: “This is particularly the case with respect to developing cultural competencies while providing dental care to a high- needs population in South Auckland.

“The facility’s continuing education and training post-graduation also helps dental teams across New Zealand maintain their skills to the benefit of all New Zealanders.”

The facility will strengthen relationships and partnerships with Māori and Pacific communities based on mutually beneficial goals incorporating patient care, research, and education.

The Faculty of Dentistry will regularly consult the community to find out what it needs from the clinics and will also provide outreach activities.

Construction of the facility – which incorporates state of the art dental and audio-visual equipment – was completed ahead of time and under budget. The design accommodates the requirements of clinical services, education, and community accessibility.

Based on current world best-practice, the dental chairs have more space around them for family. While most chairs are in bays, some are in rooms for extra privacy.

Through a partnership with the Te Ākitai iwi, a cultural narrative has been woven into the facility under the guidance of notable artist Johnson Witehira.



Familiarity and forward-thinking for new Faculty of Dentistry Dean

Monday 5 August 2019

It will be both a homecoming and a new adventure when the University of Otago Faculty of Dentistry's new Dean arrives next year.

Professor Mike Morgan, who will begin in the role by February 2020, graduated from Dunedin as a dentist in 1979. The intervening decades have mostly been spent in Australian academia – as well as a three-year spell in Hong Kong.

During those years Professor Morgan has undertaken significant research and filled many leadership positions – including his current role as Head of the Melbourne Dental School, Faculty of Medicine, Dentistry and Health Sciences, at the University of Melbourne.

Otago Vice-Chancellor Professor Harlene Hayne said the appointment of such a well-respected, highly qualified and vastly experienced person was worthy of celebration.

“Professor Morgan will bring considerable experience and talent to what is an important role for the Faculty and for the wider University. I am looking forward to his arrival; we know he will drive the Faculty of Dentistry forward over the coming years.

“We also know the Faculty’s facilities, research, reputation and its calibre of staff and students make it a sought-

after place to work. An appointment of someone as well regarded as Professor Morgan is proof of that.”

“I look forward to working with the outstanding staff and students to see the Faculty reach its full potential in the coming years.”

Professor Morgan said the opportunity to return to Dunedin’s Faculty of Dentistry, with its long history, brand-new world-class facilities, and its ranking as one of the world’s top dental schools, was an honour.

“The Dental Faculty at Otago has been gifted an extraordinary generational opportunity to build on its already outstanding reputation, and to set a future course for providing the best oral health care and research knowledge in the New Zealand community and internationally.

“I am absolutely honoured to join the University of Otago at this exciting time in the Faculty of Dentistry’s remarkable evolution.

“And I am thrilled to return to the University which provided me with a career in dentistry and academia. I look forward to working with the outstanding staff and students to see the Faculty reach its full potential in the coming years.”

University of Otago Division of Health Sciences Pro-Vice-Chancellor Professor Paul Brunton said Professor Morgan was an excellent researcher, teacher and senior administrator.

“I am delighted that he will now be in a position to provide his outstanding leadership to the whole of the Faculty of Dentistry. I look forward to working with Professor Morgan and staff of the Faculty into the future.”



\$1.2M Health Research Council project grant awarded to Associate Professor Brian Monk of the SJWRI

Monday 1 July 2019

Congratulations to Associate Professor Brian Monk of the SJWRI's Molecular Microbiology research programme on the award of a three-year Project Grant worth \$1,199,967 in the 2019 Health Research Council of New Zealand annual funding round, for his project 'Structure-directed discovery of next-generation antifungals'.

This continues a long-standing programme of Marsden Fund and HRC-supported research into antifungal drug development in the Monk laboratory. Associate Professor Monk says, "The research will use our structure-based understanding of how existing antifungals work in order to create new broad-spectrum drugs that are more effective and inexpensive."

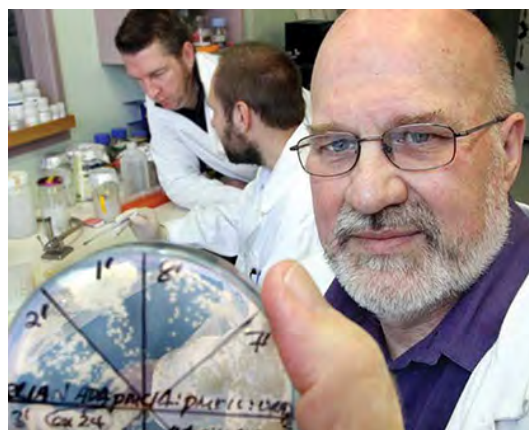
The project

Opportunistic invasive fungal infections (IFIs) carry high morbidity and mortality for those with co-morbidities, especially the immunocompromised, such as transplant and AIDS patients. Despite treatment with the best available antifungal drugs, approximately 50% of the patients with IFIs die. The need for new, potent and inexpensive fungicides is urgent due to innate and acquired resistance to antifungal agents. This project will meet this need. It will use high-resolution structures of the antifungal target lanosterol 14 α -demethylase (LDM) from a range of fungal species and humans, together with yeast-based assays, clinical isolates of fungal pathogens, and animal trials, to elucidate key features conferring antifungal specificity and that optimize broad-spectrum antifungal candidates in readiness for drug development by the pharmaceutical industry. Drug resistance will be addressed using in-house technology to identify LDM-directed fungicides and mixtures that improve potency and avoid the emergence of drug target- and drug efflux-mediated antifungal resistance.

The team

Otago-based members of the project team include Dr Mikhail Keniya and Dr Rajni Wilson of the SJWRI, along with Associate Professor Joel Tyndall of the School of Pharmacy. Each were key investigators on Associate Professor Monk's previous HRC-funded work on this project. Two PhD students will work on elements of the project. Yasmeen Ruma and Parham Hosseini will use a yeast expression system to obtain crystal structures that will increase understanding of LDMs from particular species of fungal pathogens.

Team members from overseas include long-term collaborators Dr Anette Klinger and Dr Edmund



Associate Professor Brian Monk (foreground), with Associate Professor Joel Tyndall and Dr Mikhail Keniya.



PhD students Yasmeen Ruma and Parham Hosseini discuss recombinant yeast phenotypes with visiting professor Associate Professor Michaela Lackner.

Fleischer of German company MicroCombiChem, Associate Professor Michaela Lackner of the Medical University of Innsbruck in Austria, and Professor David Perlin, founding Chief Scientific Officer of the new Hackensack Meridian Health Center for Discovery and Innovation in New Jersey, USA.

Associate Professor Lackner is an early-career researcher who visited the Monk laboratory as part of a Catalyst Seeding Fund activity aimed at creating a smart science platform between NZ and Austria with the goal of broad-spectrum antifungal discovery. She was recently awarded an Austrian FWF grant, on which Associate Professor Monk was listed as a collaborator, on the characterization of intrinsic azole resistance in mucormycetes, a group of fungal pathogens for which some existing azole drug treatments are ineffective.

Professor Perlin's expertise lies in drug discovery, mechanisms of antifungal drug resistance and diagnosis of drug-resistant pathogens. He was recently awarded \$33.3M USD over five years from the National Institutes of Health to develop new antibiotics to overcome bacteria that have become resistant to current hospital treatments.

SJWRI research supported by New Zealand Dental Research Foundation and Ministry of Health oral health funding

The New Zealand Dental Association and Ministry of Health (MoH) are key supporters of our cutting-edge dental and oral health research, through the NZ Dental Research Foundation (NZDRF) and MoH Oral Health Research funding rounds. Funding from these grants supports the research of our academic and research staff, as well as training of our postgraduate students.

In the 2019 NZDRF funding round, a total of \$142,212 in funding was awarded for research projects led by our staff, PhD and DCLinDent students. SJWRI researchers were also principal investigators on projects awarded \$61,059 in targeted Ministry of Health Oral Health Research funding.

In the 2020 NZDRF funding round, a total of \$158,296 in funding was awarded for research projects led by our staff and postgraduate students. SJWRI researchers are also lead investigators on projects awarded \$47,402 in MoH Oral Health Research funding, with a further \$44,000 awarded to projects led by our collaborators at University of Otago Wellington on which our researchers are named.

As always, we thank the NZ Dental Research Foundation and the Ministry of Health for their continued support.

New Zealand Dental Research Foundation

Established in 1964, the NZ Dental Research Foundation awards grants for research projects related to dentistry. Its overall purpose is to "promote, foster and extend the study and practice of the art and science of dentistry in New Zealand".

Since its inception, the Foundation has provided financial support for decades of dental and oral health research projects within the Dental School and the SJWRI, to help extend the boundaries of dental knowledge and to promote the fostering and extension of the study and practice of the art and science of dentistry in New Zealand.

The Research Foundation is funded by donations from dental practitioners, the dental supply industry and other businesses, as well as profits from the annual NZDA Conference and other fundraising activities.

The SJWRI and the Faculty are hugely grateful for the role and contribution of the NZDRF in supporting our research over the past five decades, in the process helping many of our Masters, PhD and specialising dental postgraduate students complete their studies.

In the 2019 NZ Dental Research Foundation grant round, projects led by SJWRI researchers were awarded a total of \$142,212 in funding, including \$5,000 from the International College of Dentists, and \$12,355 from the Continuing Dental Education Trust of Auckland.

Lead investigator	Other named investigators	Project title	Awarded
<i>Zeina Al Naasan</i>	A/Prof Jonathan Broadbent, Dr Moira Smith (Public Health, UOW), Prof Warwick Duncan	Community based oral health promotion among adult Syrian former refugees resettled in Dunedin, New Zealand	\$15,000
<i>Mohammad Arshad Aziz</i>	Dr Benedict Seo, Dr Haizal Hussaini, A/Prof Merylyn Hibma (UO Pathology), Prof Alison Rich	Investigating biomarkers for oral squamous cell carcinoma in exosomes derived from serum and saliva of patients with oral squamous cell carcinoma and their potential in developing an oral cancer diagnostic test using saliva	\$15,000
<i>Abdulrahman Badarneh</i>	A/Prof Neil Waddell, Dr Kai Chun Li, Dr Joanne Choi, Prof Karl Lyons	Wear of glazed vs. non-glazed translucent monolithic zirconia against bovine enamel	\$6,664
A/Prof Dawn Coates	Prof Karl Lyons, Prof Alison Rich, William Early (Otago Polytech), Prof Mauro Farella	A 3D bioprinter for tissue engineering research in dentistry	\$15,000
A/Prof Manikandan Ekambaram	Dr Kai Chun Li, Dr Li Mei, <i>Suneil Nath</i>	Biomimetic Remineralization: A comparative evaluation of novel peptide-based agents for enamel regeneration	\$15,000
<i>Anthony Yu-Chieh Kao</i>	A/Prof Andrew Tawse-Smith, Dr Momen Atieh, Prof Warwick Duncan	The effect of mechanical decontamination procedures on moderately roughened titanium surfaces: quantity and size of the titanium particulate released by mechanical instrumentation	\$14,455 (\$5,000 ICD)
<i>Chitra Shankar Krishnan</i>	Prof Richard Cannon, A/Prof Geoffrey Tompkins, Prof Karl Lyons	Evaluation of Electrolysed Oxidising Water (EOW) as a multipurpose, non-toxic and cost-effective disinfectant in dental healthcare	\$14,805

Lead investigator	Other named investigators	Project title	Awarded
Dr Susan Moffat		New Zealand's School Dental Service 1921 – 2021	\$5,475*
<i>Marguerite Paterson</i>	Dr Fiona Firth, Prof Mauro Farella, Dr Trudy Milne	Modulation of osteoblasts and periodontal ligament cells by IL-17 and IL-6	\$15,000
<i>Michael Skilbeck</i>	A/Prof Li (Peter) Mei, Prof Mauro Farella, Prof Richard Cannon	Surface modification of orthodontic elastomers to overcome biofilm formation	\$13,478
<i>David Yong</i>	Dr Peter Cathro, Dr Jithendra Ratnayake, Prof George Dias (Anatomy), Prof Paul Cooper, Dr Joanne Choi	Development and characterization of a novel Hydroxyapatite-Silicate cement for use in dental pulp capping	\$12,335 (CDET)

In the 2020 NZ Dental Research Foundation grant round, projects led by SJWRI researchers were awarded a total of \$158,296 in funding, including \$4,360 from the Dental Industry Group Research Award and \$10,000 from the Continuing Dental Education Trust of Auckland.

Lead investigator	Other named investigators	Project title	Awarded
Dr Joanne Choi	A/Prof Sunyoung Ma, Prof Neil Waddell, <i>Anastasiia Grymak</i>	Evaluation of mechanical properties, wear behaviour and polishability for occlusal splints fabricated using various manufacturing methods	\$10,860
Dr Harsha De Silva	<i>Jesslyn Praganta</i> , Prof Murray Thomson, A/Prof Rohana K De Silva, Prof Darryl Tong	Does the intra-operative use of advanced platelet-rich fibrin (A-PRF) improve post-operative outcomes in third molar surgery?	\$7,350 (\$4,360 DIGRA)
Prof Warwick Duncan	<i>Asrar Elahi</i> , A/Prof Dawn Coates, Prof Neil Waddell, Dr Kai Chun Li	Development and optimisation using supercritical fluid CO ₂ extraction of bovine bone for oral block grafting	\$15,000
Prof Mauro Farella	<i>Nicholas Pittar</i> , Dr Fiona Firth	Effect of passive clear aligners on masticatory muscle activity in adults with and without oral parafunction	\$10,000
Dr Fiona Firth	<i>Sherry Lee</i> , Prof Mauro Farella, A/Prof Li (Peter) Mei, A/Prof Ben Daniel (Higher Education Development Centre, UO)	Patients' experiences with orthodontic treatment through traditional fixed appliances, clear aligners and direct-to-consumer clear aligners: a qualitative study	\$10,000 (CDET)
A/Prof Haizal Mohd Hussaini	<i>Shelly Arora</i> , A/Prof Lara Friedlander, Prof Paul Cooper, Dr Benedict Seo, Dr Shakila Rizwan (Pharmacy, UO), Prof Alison Rich	Can immunotherapy be used in inflamed dental pulp tissue to preserve tooth vitality?	\$15,000
A/Prof Haizal Mohd Hussaini	<i>Nurul Aida Ngah</i> , Prof George Dias (Anatomy, UO), Prof Darryl Tong, Dr Jithendra Ratnayake	Osteoinductive potential of bioactive glass, collagen and lyophilized platelet-rich fibrin scaffold for alveolar cleft osteoplasty	\$14,980
A/Prof Sunyoung Ma	<i>Majd Khashashneh**</i> , Dr Joanne Choi, Prof Sergio Salis	An <i>in vitro</i> study of accuracy of partial denture frameworks fabricated using traditional and digital workflows	\$14,990
Dr Lei (May) Mei	A/Prof Li (Peter) Mei, A/Prof Mani Ekambaram, Prof Chun Hung Chu (Hong Kong U), Prof Richard Cannon	The development of a novel dual-action antimicrobial peptide to prevent root caries	\$15,000
Dr Li (Peter) Mei	<i>Khac Thuong Nguyen</i> , Prof Mauro Farella	Three-dimensional stereophotogrammetry analysis of lip response to changes of incisor position and occlusal vertical dimension	\$1,500
Dr Trudy Milne	Dr Erwin Lamping, Prof Richard Cannon	MiniG*1600 – Automated Tissue Bead Mill Homogeniser and Cell Lyser	\$15,000
Dr Jithendra Ratnayake	Dr Lei (May) Mei, Prof Paul Cooper, A/Prof Geoffrey Tompkins	Bringing waste cow bone to toothpaste: Development and testing of a novel silver-substituted bovine derived nanohydroxyapatite toothpaste for caries management	\$8,919
Dr Don Schwass	Prof Paul Brunton, A/Prof Geoffrey Tompkins, A/Prof Carla Meledandri (Chemistry, UO), <i>Minati Choudhury</i>	Gold nanoparticles: A novel treatment strategy for oral mucositis	\$10,330
Dr Graeme Ting	Dr Moira Smith (Public Health, UOW), Dr Ariyapala Samaranyaka (DSM Biostatistics, UO), <i>Beatrice Ng</i>	Feasibility of teledentistry among residents and primary care providers at aged residential care facilities in the Otago region of New Zealand	\$5,000
Dr Graeme Ting	Prof Murray Thomson, <i>Farah Zainuddin</i>	Measuring dry mouth in older people in residential care in Dunedin	\$4,367

Ministry of Health Oral Health Research Grants

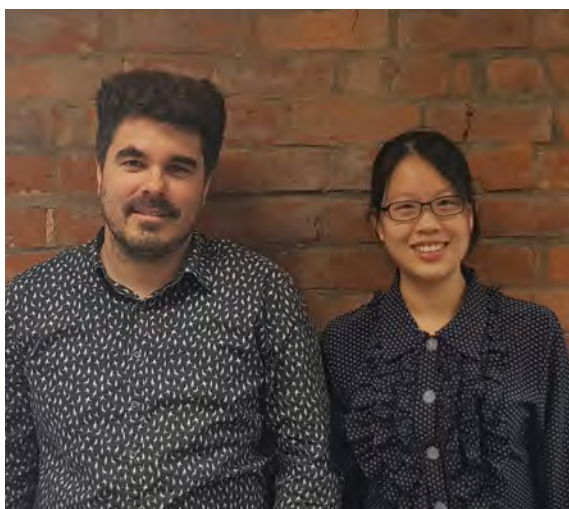
In 2007, the NZ Ministry of Health established a funding programme for oral health research, managed by the NZDA and its Research Foundation, to fund research targeted towards the oral health priorities of the Ministry. Priority is given to oral health research that targets children and adolescents; people of all ages with physical, intellectual, behavioural, or cognitive disabilities, or who are medically compromised; people experiencing inequalities of outcome (e.g. Maori, Pacific and low-income populations); maternal oral health; older adults; and research focusing on promoting oral health, building links with primary care and building the oral health workforce.

In the 2019 MoH Oral Health Research round, SJWRI researchers were principal investigators on awards totalling \$61,059.

Lead investigator	Other named investigators	Project title	Awarded
<i>Ceridwen Benn</i>	Dr Graeme Ting, Billie Bradford (Victoria Uni of Wgtn)	An exploratory study of the education needs of practicing lead maternity carer (LMC) midwives: enablers and barriers to providing evidence based oral health advice and oral health promotion to their clients during pregnancy	\$4,580
A/Prof Jonathan Broadbent	Dr Martin Lee (Canterbury DHB), Dr William Leung (Public Health, UOW), Dr Trudy Sullivan (Preventive & Social Medicine)	The affordability of dental care in New Zealand	\$53,556
<i>Emma Johnson</i>	Prof Murray Thomson, Dr Graeme Ting, Dr Juliet Gray (Canterbury DHB)	Oral health status and Oral-Health-Related Quality of Life of a group of young adults using mental health services in Christchurch	\$2,923

In the 2020 MoH Oral Health Research round, projects led by SJWRI researchers were awarded a total of \$47,402 in funding. Our collaborators at University of Otago Wellington, led by SJWRI Associate Investigator Dr Moira Smith (Department of Public Health, UOW), secured a further \$88,000 in MoH funding across two projects, one of which Faculty of Dentistry researchers are directly involved in.

Lead investigator	Other named investigators	Project title	Awarded
A/Prof Jonathan Broadbent	Chuen Lin Hong, Prof Murray Thomson	Towards understanding inequality in oral health-related quality of life	\$39,152
Dr Moira Smith (Public Health, UOW)	Dr Anna Ferguson (Public Health, UOW), Dr Graeme Ting	Promoting and protecting the oral health of dependent older New Zealanders 'ageing in place'	\$44,000
Dr Moira Smith (Public Health, UOW)	Prof Murray Thomson, Dr Graeme Ting, Dr Juliet Gray (Canterbury DHB)	Embedding oral health in primary medical care practice: determining feasible and acceptable approaches	\$44,000
Prof Murray Thomson	<i>Tania Stuart</i> , A/Prof Jonathan Broadbent, Dr Lee Adam	Oral health care experiences of patients undergoing treatment for head and neck cancer	\$8,250



Associate Professor Jonathan Broadbent and Chuen Lin Hong

All named investigators are from the SJWRI, Faculty of Dentistry unless otherwise noted.

Honorifics of investigators (Dr, A/Prof etc) are listed at time of press (mid-2021) rather than at year of award.

Italicised names indicate postgraduate students.

CDET Continuing Dental Education Trust of Auckland

DIGRA Dental Industry Group Research Award

ICD International College of Dentists

UO University of Otago (Dunedin)

UOW University of Otago Wellington

* Grant was declined post-award by Principal Investigator

** Postgraduate student *M Khashashneh* left this project in late 2020, replaced by *A Badarneh*

Highlights of research funding awarded in 2019-2020

Colgate SJWRI Research Grants

In 2019, Colgate-Palmolive and the SJWRI established a competitive funding round to support fundamental research by SJWRI investigators. The following projects were awarded funding in 2019-2020:

2019 recipients

Cattle Bone Toothpaste?

Peter Cathro, Simon Guan, Li Mei, Jithendra Ratnayake
\$14,357

Changes in mineral density and nanomechanical properties of enamel white spot lesions

Mani Ekambaram, Carolina Loch, Alison Meldrum
\$15,000

Sugar in your diet: kino te pai!, An evaluation of oral health outreach results and community impact

Carolina Loch, Deanna Beckett, Richard Cannon
\$9,380

You can read more about 'Sugar in your diet: kino te pai!' at <https://www.otago.ac.nz/news/otago667944.html>.

2020 recipients

What's in a smile? Impact of oral health on smiling features

Mauro Farella, Hamza Bennani
\$40,000

Cure Kids

In 2017, Dr Joanne Choi (*below*) was supported by Cure Kids' Innovation Seed Fund for her project 'Development of white crowns to treat dental caries in children.' Further funding for this project was awarded in 2020:

Development of white crowns to treat dental caries in children - Phase 2

Joanne Choi
\$14,215

This project aims to develop a novel white shell crown for drill-free treatment of New Zealand's most common chronic childhood disease – dental cavities.



You can read more about Joanne's Cure Kids-funded research at <https://curekids.org.nz/research/development-of-novel-tooth-coloured-shell-crowns-to-treat-dental-caries-in-children/>.

In 2021, Joanne went on to secure Health Research Council of NZ Feasibility Study funding for this project of approximately \$250,000. Read more about this award at <https://www.otago.ac.nz/news/news/otago829517.html>.



Division of Health Sciences Career Development Postdoctoral Fellowships

SJWRI PhD graduate Sabarinath Prasad (*above right*) was awarded a two-year Health Sciences Career Development Postdoctoral Fellowship in the November 2020 round, under the mentorship of Professor Mauro Farella (*left*).

Read more about Sabarinath's award and his research at <https://www.otago.ac.nz/sjwri/news/otago826351.html>.

Health Research Council of New Zealand

In 2019, Associate Professor Brian Monk was awarded \$1.2M over 36 months for his project 'Structure-directed discovery of next-generation antifungals', which you can read more about on page 15 of this Report.

In 2020, Associate Professor Haizal Hussaini was awarded \$206,246 over 36 months in the HRC's Emerging Researcher First Grant round. This project aims to understand the role of controlling inflammation through the use of novel immunotherapeutic molecules in order to promote regeneration and healing of dental pulp after infection.

Read more: <https://hrc.govt.nz/resources/research-repository/interrogating-immunotherapy-dental-pulp-therapy-and-management>

Interrogating immunotherapy for dental pulp therapy and management

Haizal Hussaini, Benedict Seo, Shakila Rizwan (Pharmacy), Lara Friedlander, Chuen Yen Hong
\$206,046

Lottery Health Research

2019 recipients

A 3D bioprinter for tissue engineering research in Dentistry
Dawn Coates, Kai Chun Li, Warwick Duncan
\$52,500 (Shared Equipment grant)

Although 3D printing has been used generically for a number of years, 3D bioprinting of cells in biocompatible scaffolds for clinical application is a relatively new field, and is driving the development of new therapeutic options in tissue repair and regeneration. The ability to create complex therapeutic and regenerative materials

by means of bioprinted scaffolds has applications in periodontics, endodontics, oral surgery, and biomaterials as well as providing a valuable translational research tool.

This funding was awarded by Lottery Health Research towards the purchase of a CELLINK BIO X 3D bioprinter, with a primary focus on dental pulp stem cells for tooth regeneration and human mesenchymal stem cells for bone regeneration. The bioprinter was subsequently purchased in 2020, with supplemental funding from the NZ Dental Research Foundation (see page 16) and the Maurice & Phyllis Paykel Trust.

A topical ultrasound contrast agent for oral cancer screening

Warwick Duncan, Carla Meledandri (Chemistry),
Tanmoy Bhattacharjee, Paul Harris (Callaghan)
\$119,749 (Translational Research Project grant)

This project is a new initiative that developed from the 'UltraD3' collaboration between the SJWRI, the Department of Chemistry and Callaghan Innovation, which was originally awarded \$1.2M in MBIE Targeted Research funding in 2015 to develop instrumentation for the early diagnosis of gum diseases using ultrasound.

Read more about UltraD3: <https://callaghaninnovation.wordpress.com/2015/09/23/meet-the-ultras/>

2020 recipients

Zygo ZeGage Pro 3D Optical Surface Profiler

Fiona Firth, Mauro Farella, Li Mei
\$124,121 (Shared Equipment grant)

This optical profiler is a non-contact tool allowing quantitative measurements of 3D form and roughness on a variety of surfaces. The profiler allows efficient and accurate measurements to be collected without disturbing the surface. Surface roughness is an important factor in the formation of biofilms on medical and dental implants, with greater roughness encouraging greater biofilm growth and the risk of biofilm-mediated infections in medical devices. The research team, who are key members of our Craniofacial Research programme and of the Orthodontics discipline, will use the profiler to investigate the surface topography analysis of commercially available clear aligners, orthodontic brackets and wires.

Sir Thomas Sidey Postdoctoral Fellowship

Our Sir Thomas Kay Sidey Postdoctoral Fellowship for 2019-2020 was awarded to Dr Ian Towle. Ian (*top right*) has been working under the mentorship of Dr Carolina Loch on a research project titled 'An evolutionary perspective on dental properties, disease and wear'.

In this two-year Postdoctoral Fellowship project, Ian and Carolina will examine tooth wear and dental disease in a range of primate species and archaeological human samples to better understand the evolution of the human dentition, by assessing the influence of dental properties such as morphology, size and mechanical properties on the development of these conditions.



The Sir Thomas Kay Sidey Postdoctoral Fellowship is intended to support outstanding doctoral research graduates to further their careers by undertaking a postdoctoral fellowship within the SJWRI.

Read more about Ian's research and his Fellowship award: <https://www.otago.ac.nz/sjwri/news/otago716063.html>

University of Otago Research Grants

2019 recipients (2020 UORG round)

Regeneration of dental pulp tissue using a novel hybrid biomaterial

Azam Ali (Food Science 2019-2020; Dentistry 2021-),
Lara Friedlander, Karl Lyons
\$43,930

Cattle bone in Root Canal therapy? Development of a novel root canal medicament from New Zealand-sourced waste bovine bone

Jithendra Ratnayake, Peter Cathro, Joanne Choi, George Dias (Anatomy)
\$36,486

2020 recipients (2021 UORG round)

Aerosol generation level by different dental high-speed handpieces

Joanne Choi, Jane Choi, Susan Moffat, Neil Waddell
\$29,488

Development of a novel bioactive ovine-teeth derived dental putty for clinical applications

Jithendra Ratnayake, Samuel Carrington, Paul Cooper, George Dias (Anatomy)
\$30,307

A full listing of all active research funding contracts held by SJWRI investigators in 2019-2020 is provided as an Appendix to this Research Report.

Young Otago dentistry lecturers net international awards

Friday 14 February 2020

Two young University of Otago Dentistry lecturers have won prestigious international Emerging Leaders awards. The winners, Dr Carolina Loch and Dr May Mei, are both Senior Lecturers in the University's Faculty of Dentistry.

The International Association for Dental Research (IADR) announced the awards in celebration of its 2020 centennial. While winners were picked from around the globe, Dr Loch and Dr Mei were two of only four winners selected from across the Asia/Pacific region.

The IADR Board of Directors launched the IADR Centennial Emerging Leaders Award to recognise young investigators "who will lead the research field into the next century".

The winners demonstrated scientific accomplishment in the field of dental, oral and craniofacial research and had "shown outstanding promise for continuing service and leadership within the IADR and the scientific community".

"These accomplished young investigators are poised to lead the IADR into the next century of ground-breaking research and discovery."

Dr Loch, who specialises in evolutionary oral biology and comparative dental morphology, said she felt "extremely honoured and humbled" to be recognised with this award among so many talented early career dental researchers worldwide.

"The IADR is the most important dental research association in the world, and receiving this recognition shows that we are also doing great things here in our Faculty at the bottom of the globe."



Dr Loch (*above right, with Dr Mei and Prof Mike Morgan*) said she was grateful for the Faculty's support and encouragement, to her late mentor Professor Jules Kieser who "opened up the doors of oral biology research to me", and to the late Professor Grant Townsend from the University of Adelaide who was one of her nominators.

Dr Mei (*left*), who specialises in cariology (the study of tooth decay and its development), was recognised for the work she undertook at The University of Hong Kong before joining Otago last August.

Dr Mei said she was grateful to the IADR committee for their recognition.

"I would also like to thank my co-workers from Hong Kong for their continued support over the years. While this award is a recognition of past works I am looking forward to the future, collaborating with my new colleagues in Otago."

More on the IADR Centennial Emerging Leaders awards: <https://www.iadr.org/IADR/About-Us/News/ArtMID/132983/ArticleID/805/IADR-Announces-the-IADR-Centennial-Emerging-Leaders-Award-Winners>

IADR video of Dr May Mei talking about her research: <https://www.youtube.com/watch?v=d-9-aZPeZik>

Three awards for Health Sciences PVC

Wednesday 11 September 2019



Three fellowships from three major international dentistry organisations have been awarded to the University's Pro-Vice-Chancellor (Health Sciences), and former Dean of the Faculty of Dentistry (2015-2018), Professor Paul Brunton in the past year.

The International College of Dentists (ICD) extended its invitation to Professor Brunton (*left*) last year. The Pierre Fauchard Academy inducted Professor Brunton as a fellow in May this year at an event in Australia, while earlier this month Professor Brunton was welcomed as a Fellow of the American College of Dentists at an event in California for "contributions to dentistry and the community".

Professor Brunton says the awards were a chance to both reflect on his time in dentistry to date, and to reflect on the people he has worked with, especially at Otago. "I'm very humbled by these awards, but I'm also very aware they aren't just a reflection on any one person. An environment like we have here at Otago encourages and supports good work, and I've been lucky to be in such good environments, surrounded by very good people, for a long time."

Read more: <https://www.otago.ac.nz/news/otago717840.html>

Sir John Walsh Research Institute Awards for 2019-2020

Our Institute Awards celebrate the research achievements of academic staff and postgraduate students, as well as commending the contribution of general staff to the research successes of the SJWRI and Faculty of Dentistry.

Strategic Research Prize

This award is to acknowledge and promote new research within the Faculty of Dentistry, by supporting a research development initiative by a member of staff or postgraduate student that could make a contribution to the strategic direction of research within the Institute.

2019 recipient: Dr Joanne Choi

Dr Choi's award-winning project, 'Development of a pulp blood flow and intraoral humidity simulating system', supported the development of a novel laboratory model to investigate the effects on dental pulp of heat created by dental procedures.

Research Supervisor Awards

Introduced in 2016, this award is to celebrate outstanding research supervisors of postgraduate and undergraduate students within the Faculty of Dentistry. Nominations are made via a survey process, whereby students are asked to anonymously nominate outstanding supervisors, providing reasons such as being supportive, available, interested and enthusiastic, knowledgeable and an expert in their field, a good communicator, and taking prompt, decisive action to resolve issues were listed as being important for excellent supervision.

In recent years, the award has been split into undergraduate and postgraduate research supervisor categories to reflect strong fields of nominees and the differing challenges of each supervisory role.

Postgraduate Research Supervisor Awards

2019 recipient: Professor Karl Lyons

Professor Karl Lyons (*opposite on left, receiving his award from SJWRI Director Professor Richard Cannon*) is Professor of Restorative Dentistry in the Department of Oral Rehabilitation and Acting Dean of the Faculty of Dentistry. His research interests are in clinical and in vitro research in dental tooth whitening, dental implants, microbial adhesion to dental obturator prostheses as well as ceramics and other dental materials, including CAD/CAM and 3D printing. He is currently supervising five DCLinDent projects and one PhD project.

2020 recipient: Professor Warwick Duncan

Professor Duncan is director of the Clinical and Translational Research programme within the SJWRI, as well as leading Implantology research within the

Biomechanics, Biomaterials and Oral Implantology research programme. Within the Faculty of Dentistry he is Head of Discipline of Periodontology, and was chosen as the third Director of the Sir John Walsh Research Institute in May 2021.

Professor Duncan's primary research interests are in periodontics and implantology. He has supervised more than fifty PhD, DCLinDent and Masters research theses, the majority as primary supervisor.

Undergraduate Research Supervisor Awards

2019 recipient: Dr Lee Adam

Dr Lee Adam is Lecturer, Education and Research in the Department of Oral Sciences. Her research concentrates on teaching and learning in higher education; specifically, how students' learning experiences and outcomes can be enhanced. She researches students' experiences in higher education, in order to gain insights into how policy and practices might be structured to encourage students' retention and success. Other research involves examining how we can improve teaching practices in higher education. She also coordinates the DENT552 final year undergraduate student elective programme.

2020 recipient: Dr Joanne Choi

Dr Joanne Choi is a Senior Lecturer in the Department of Oral Rehabilitation, where she teaches about dental technology and dental materials. Her current research interests include qualitative and quantitative analysis of the mechanical properties and failure mechanisms of restorative dental systems, observational research in the oral environment using portable measurement systems, studies to develop simulation systems to investigate pressure distribution in the oral environment and head injury, and the development and application of new materials and devices to dental care.

Research Publication Awards

This award is to recognise excellence in research by acknowledging the research calibre and effort required to publish in high impact journals in science and dentistry. To be eligible, the manuscript must have been accepted for publication in the previous calendar year.



2019 recipient: Christina Gee

Christina (opposite, on left, receiving her award from SJWRI Director Professor Richard Cannon) is currently a PhD candidate in the SJWRI, supervised by Professor Warwick Duncan and Associate Professor Dawn Coates in collaboration with UO Christchurch's CReaTE Group. Her award-winning article "Influence of ageing on glass and resin bonding of dental glass-ceramic veneer adhesion to zirconia: A fracture mechanics analysis and interpretation", published in *Acta Biomaterialia*, was based on research carried out as an Assistant Research Fellow prior to beginning her PhD.

MV Swain, C Gee, KC Li (2018) Influence of ageing on glass and resin bonding of dental glass-ceramic veneer adhesion to zirconia: A fracture mechanics analysis and interpretation. Acta Biomaterialia 74, 454-463.
<https://doi.org/10.1016/j.actbio.2018.04.049>

2020 recipient: Dr Joanne Choi

Dr Choi is the first and the corresponding author for this paper, which was published in the *Journal of the Mechanical Behavior of Biomedical Materials*. In the process of developing a new coating material for teeth and dental restorations, Dr Choi and co-authors evaluated the surface properties of currently available denture coating and glaze materials and look into the effect of aging over time, using a variety of mechanical testing and analytical methods. The findings will help with the development of new wear- and corrosion-resistant coatings inform practice by enabling dental practitioners to select the most effective polishing and coating material for dentures.

Choi JJE, Uy CE, Ramani RS & Waddell JN (2020). Evaluation of surface roughness, hardness and elastic modulus of nanoparticle containing light-polymerized denture glaze materials. Journal of the Mechanical Behavior of Biomedical Materials, 103:103601.
<https://doi.org/10.1016/j.jmbbm.2019.103601>

Postgraduate Research Publication Awards

This award is to recognise excellence in postgraduate student research by acknowledging the research calibre and effort required to publish in high impact journals in science and dentistry. The publication must have been accepted for publication in the previous calendar year, and have been written by a Masters or Doctoral research student.

2019 recipient: Dr Ghassan Idris

Ghassan is currently carrying out a DClinDent in the Faculty of Dentistry under the supervision of Professor Mauro Farella, having previously completed a PhD with the same research group. His article titled "Mandibular advancement appliances for sleep-disordered breathing in children: A randomized crossover clinical trial" reported the main findings of his PhD research, and was published in the *Journal of Dentistry* in January 2018.

G Idris, B Galland, CJ Robertson, A Gray, M Farella (2018) Mandibular advancement appliances for sleep-disordered breathing in children: A randomized crossover clinical trial. Journal of Dentistry 71, 9-17.
<https://doi.org/10.1016/j.actbio.2018.04.049>



2020 recipient: Dr Zhen Dong

Dr Dong recently completed a PhD in the SJWRI under the lead supervision of Associate Professor Dawn Coates, exploring potential biomarkers for mammalian stem cells, as well as the key proteins, biological processes and pathways involved in stem cell maintenance, development and activation during deer antler generation and regeneration. Deer antler is the only known mammalian structure that can annually regenerate to produce a complex tissue. Dr Dong's award-winning publication, 'Quantitative proteomic analysis of antler stem cells as a model of mammalian organ regeneration', was published in the *Journal of Proteomics*.

Dong Z, Coates D, Liu Q, Sun H & Li C. (2019). Quantitative proteomic analysis of deer antler stem cells as a model of mammalian organ regeneration. Journal of Proteomics, 195, 98-113.
<https://doi.org/10.1016/j.jprot.2019.01.004>

Research Support Award

This award is to recognise excellent support provided by general, professional and technical staff to research groups, units and/or departments within the SJWRI and Faculty of Dentistry.

2019 recipient, SJWRI Research Manager Dr James Smith, was nominated by Director Professor Richard Cannon:

"Dr Smith has provided outstanding support for a range of research staff and students across the SJWRI Research Programmes for the last six years. This support has included helping people with grant writing, managing contracts and keeping people informed of grant expenditure. He has shown particular support for the establishment and continuation of the Practice Based Research Network ARCH. He has produced very high quality Research Reports for the SJWRI and has gone above and beyond the call of duty in organising and staffing booths for NZDA and IADR conferences."

Read more about our 2019-2020 SJWRI Award recipients:

2019 Institute Awards:
<https://www.otago.ac.nz/sjwri/news/otago718244.html>

2020 Research Supervisor Awards:
<https://www.otago.ac.nz/sjwri/news/otago806446.html>

2020 Research Publication Awards:
<https://www.otago.ac.nz/sjwri/news/otago799646.html>

Professor Jules Kieser Memorial Trust Award celebrates top student

Wednesday 25 November 2020

Looking past her biases and focusing on the science helped Liberty Ockwell to become the first Jules Kieser Memorial Trust Award recipient, for being top student in Otago's Forensic Biology Summer School paper, FORB201.

This year the inaugural award was given to Liberty (*above right*), a Bachelor of Laws (Honours) student and Bachelor of Science (Biochemistry) graduand. She received \$500 for being the top student in the class.

FORB201 presents students with a mock crime scene, usually following a New Year's poker game, and six weeks to gather and analyse evidence, listen to guest lecturers, self-reflect, think critically and hopefully figure out whodunnit.

In the course students hear from an array of guest lecturers from forensic scientists to police officers. They also get to run a variety of tests in the lab and at the scene including maggots, DNA evidence, lifting fingerprints, bite mark analysis, forensic chemistry (drug analysis) and document analysis.

Course Co-ordinator Dr Angela Clark says the course gives students the opportunity to expand their critical thinking and understand their own preconceptions and judgements.

"It's an opportunity for real personal growth and gain which they might not do in other degrees and papers, in addition to doing something really interesting and fun over the summer."

For Liberty the opportunity to try and solve a murder is right up her alley, having developed an interest in forensics from an early age.

She found the paper bridged a gap between her two degrees. Her favourite part of the paper was the essay, in which she took on the role of a coroner following a fictitious natural disaster.

"I really liked how it just gave you the opportunity to focus on one part of the course that might not have been covered as extensively and you could follow up on it on your own."

As Liberty prepares to finish her time at Otago she won't be forgetting FORB201 any time soon.

Her long-term goal is to work in medical and coronial law, something the course cemented her interest in. But for now, she's just hoping to practice law in the context of science.

The Jules Kieser Memorial Trust Award will be again awarded to the top student in the 2021 class.



Professor Jules Kieser, 1950-2014.

Professorial promotions

Neil Waddell (Department of Oral Rehabilitation) was one of thirty University of Otago academics promoted to the position of Professor in 2019.

Making the announcement, Vice-Chancellor Professor Harlene Hayne said the promotion to Professor recognised the hard work, skill and dedication of a wide range of Otago academics.

Otago's promotion process involves thorough evaluation of each individual's record of contributions to research, teaching, and service to the University and community. It also involves input from international experts in evaluating the candidates' research contributions.

The following members of staff were promoted to Associate Professor in 2019-2020:

2019

Lara Friedlander, Oral Rehabilitation
Sunyoung Ma, Oral Rehabilitation

2020

Manikandan Ekambaram, Oral Sciences
Li Mei, Oral Sciences
Haizal Hussaini, Oral Diagnostic & Surgical Sciences

Editorship in the Sir John Walsh Research Institute

Professor W. Murray Thomson

As well as publishing their own research findings and scholarship, a number of Faculty staff contribute to the publication of research as Editors-in-Chief or Associate Editors of scientific and clinical journals.

This vitally important work is often overlooked in comparison to other research 'outputs' (publications, research funding, student supervision and so forth), yet the existing scientific publishing model would not work without the work of such staff. Without Editors, there would be no scientific literature, and so papers would not get published.

Editors of academic journals play a vital but largely overlooked role in academic publishing, initiating and managing the peer-review process and ultimately accepting (or indeed rejecting) manuscripts of the type that become researchers' prized research outputs.

In our Faculty, at least 14 academic staff members currently serve as Editors-in-Chief or Associate Editors. The journals involved range from relatively low-throughput society journals to major international titles handling many hundreds of manuscripts each year. The editors' collective expertise and editorial activities contribute to the University's reputation, functioning and Performance Based Research Fund (PBRF) performance in a number of direct and indirect ways.

An overview of Faculty staff involvement in such work is presented in the Table below. In addition to this, faculty members also serve as guest editors, Editorial Advisory Board members and as peer reviewers for manuscripts.

Staff member	Current roles	Past editorial roles
Deanna Beckett	Associate Editor, <i>Aust NZ J Dent Oral Health Ther</i>	
A/Prof Jonathan Broadbent	Scientific Editor, <i>NZ Dent J</i> Associate Editor, <i>J NZ Royal Soc</i>	Topic Editor, <i>J NZ Royal Soc</i>
Prof Richard Cannon	Associate Editor, <i>Gerodontol</i>	
Prof Nicholas Chandler	Editor-in-Chief, <i>NZ Dent J</i>	
Prof Paul Cooper	Specialty Editor, <i>Frontiers Dent Med</i> Section Editor, <i>J Clin Med</i>	
Prof Mauro Farella	Associate Editor, <i>Orthod Craniofac Res</i>	
Dr Nick Heng	Associate Editor, <i>Oral</i>	
Dr Kai Chun Li	Topic Editor, <i>Nanomaterials</i> Topic Editor, <i>Frontiers Oral Health</i>	
Dr Carolina Loch	Associate Editor, <i>J NZ Royal Soc</i>	Topic Editor, <i>J NZ Royal Soc</i>
A/Prof Sunyoung Ma	Associate Editor, <i>Int J Dent</i>	
A/Prof Li (Peter) Mei	Associate Editor, <i>Oral Infect Microbiol</i>	
Prof Brian Monk	Associate Editor, <i>J Fungi</i>	
Prof W Murray Thomson	Editor-in-Chief, <i>Gerodontol</i> Associate Editor, <i>Eur J Oral Sci</i>	Editor-in-Chief, <i>Community Dent Oral Epidemiol</i> (2015-21) Editor, <i>NZ Dent J</i> (2007-14) Associate Editor, <i>Gerodontol</i> (2012-14) Associate Editor, <i>Spec Care Dent</i> (2007-12)

Journal abbreviations and links:

<i>Aust NZ J Dent Oral Health Ther</i>	Austr & NZ Journal of Dental and Oral Health Therapy	https://www.adohta.net.au/ANZIDOHT
<i>Community Dent Oral Epidemiol</i>	Community Dentistry and Oral Epidemiology	https://onlinelibrary.wiley.com/journal/16000528
<i>Eur J Oral Sci</i>	European Journal of Oral Sciences	https://onlinelibrary.wiley.com/journal/16000722
<i>Frontiers Dent Med</i>	Frontiers in Dental Medicine	https://www.frontiersin.org/journals/dental-medicine
<i>Frontiers Oral Health</i>	Frontiers in Oral Health	https://www.frontiersin.org/journals/oral-health
<i>Gerodontol</i>	Gerodontology	https://www.tandfonline.com/toc/tnzr20/current
<i>Int J Dent</i>	International Dental Journal	https://onlinelibrary.wiley.com/journal/1875595x
<i>J Clin Med</i>	Journal of Clinical Medicine	https://www.mdpi.com/journal/jcm
<i>J NZ Royal Soc</i>	Journal of the Royal Society of New Zealand	https://www.tandfonline.com/toc/tnzr20/current
<i>Nanomaterials</i>	Nanomaterials	https://www.mdpi.com/journal/nanomaterials
<i>NZ Dent J</i>	New Zealand Dental Journal	https://www.nzda.org.nz/nzdj
<i>Oral</i>	Oral	https://www.mdpi.com/journal/oral
<i>Orthod Craniofac Res</i>	Orthodontics and Craniofacial Research	https://onlinelibrary.wiley.com/journal/16016343
<i>Spec Care Dent</i>	Special Care in Dentistry	https://onlinelibrary.wiley.com/journal/17544505

Research Day 2019: celebrating our research excellence

Wednesday 11 September 2019

SJWRI Research Day 2019, highlighting the research achievements of the University of Otago's Sir John Walsh Research Institute and Faculty of Dentistry, was held on Wednesday 11 September at the Dunedin Public Art Gallery.

In its thirteenth year, the Institute's annual celebration of research excellence featured our staff and students presenting their work to peers, fellow researchers from across the University, industry professionals and dental practitioners.

As in previous years, the opening session of Research Day spotlighted one of our areas of research strength as our featured research programme; this year our featured programme was Biomaterials, Biomechanics and Oral Implantology, led by Associate Professor Neil Waddell.

Our opening keynote was given by invited speaker Professor Patrick Schmidlin (*opposite*), the head of the Division of Periodontology at the Center of Dental Medicine, University of Zurich, Switzerland. Professor Schmidlin's presentation, titled 'Posterior composite restorations – friend or foe?' compared the use of amalgam versus composite resin materials for restorations of posterior teeth.

The programme for the day also featured a presentation from Dr Young-Chul Kwon, Asia-Pacific Scientific Affairs & Education Manager for our long-term supporters 3M Oral Care, on Revisiting caries and the development of preventive treatments.

SJWRI Research Day 2019 schedule:
<https://www.otago.ac.nz/sjwri/otago716892.pdf>

Presentation awards were made to the best student oral presentations across the day, as well as the best poster competition entries.

Congratulations to the following Research Day presentation award winners:

Student oral presentation awards

Postgraduate winner

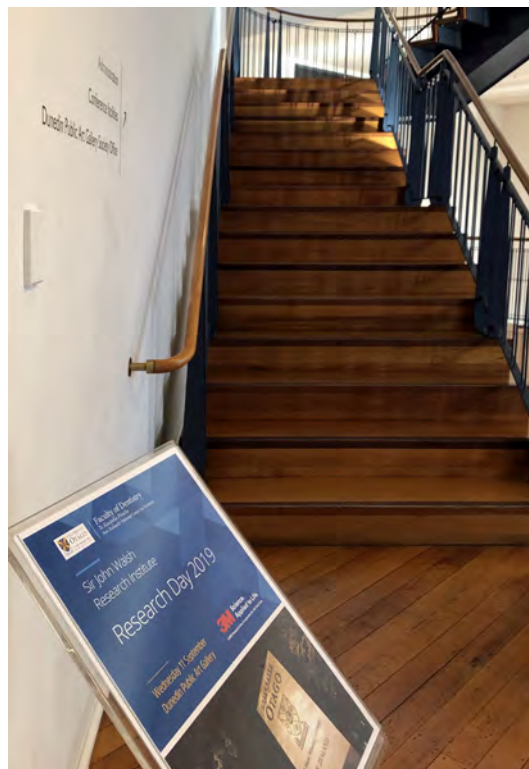
Emma Morelli, DCLinDent candidate (Periodontics)
Is parity associated with periodontal attachment loss and other oral conditions?

Postgraduate runner-up

Yasmeen Ruma, PhD candidate
Characterization of *Cryptococcus neoformans* lanosterol 14 α -demethylase

Undergraduate winner

Helene Chua, BDS 3rd year
Cooling efficiency of different coolant port designs on high-speed handpieces



Poster presentation awards

Winner

Dina Abdelmoneim, PhD candidate
Hydrogels as a 3D cell culture model to evaluate the cytotoxicity of metallic nanoparticles

Runner-up

Golnoush Madani, PhD candidate
Expression, purification, and negative staining of *Candida albicans* plasma membrane protein Cdr1

The SJWRI Awards for 2019 (see pages 22-23) were also presented as part of the closing session.

Webinar series shares our research and clinical excellence with the world

Thursday 17 December 2020



This September, the Faculty of Dentistry held a month-long webinar series in place of our traditional Clinical Excellence Day and SJWRI Research Day events. These events are an opportunity for our final-year doctoral postgraduates to share their research and clinical achievements with the Faculty and the local profession.

This year, with the support of our long-term event sponsors 3M Oral Care, these events were combined and run as an evening series of webinars through the month of September, called the Clinical and Research Excellence (CaRE) Spring Webinar Series.

The online format enabled interested members of the dental profession throughout New Zealand and overseas to take part in the event, by watching along and asking questions in real time, in a way that wasn't possible with our traditional meeting formats.

Staff and students adapted admirably to the new challenge of webinar presentation, and a survey of attendees returned very positive feedback on the new format.

Thanks to the presenters and attendees, the eConferencing team at Otago, and our sponsors 3M Oral Care for helping to make the 2020 CaRE Series a resounding first-time success.



Programme and speakers for the 2020 CaRE Series: <http://www.otago.ac.nz/sjwri-rs/programme-and-speakers/index.html>



At the Faculty of Dentistry Prize-Giving for students on Saturday 12 December, awards were presented for the best clinical and research presentations given by postgraduate students within the CaRE Series, as determined by an expert panel of judges.

The following students were awarded prizes for their excellent presentations:

Postgraduate Clinical Presentation Awards

1st prize

Saeideh Nobakht (*above*), DClinDent candidate (Periodontics)

Decision-making in the management of residual periodontal pockets

2nd prize

Payman Hamadani, DClinDent candidate (Endodontics)

Dental trauma and its sequelae

3rd prize

Jessica YJ Lee, DClinDent candidate (Oral Surgery)

Pleomorphic adenoma of the palate

Postgraduate Research Presentation Awards

1st prize

Danielle Hodgkinson (*left*), DClinDent candidate (Orthodontics)

Do orthodontic extractions affect faces?

2nd prize

Tatiana Tkatchenko DClinDent candidate (Periodontics)

Histomorphometric and radiographic evaluation of ovine forestomach matrix collagen membrane combined with Bio-Oss® bone graft in a sheep tooth extraction model

3rd prize

Rachel Farrar, DClinDent candidate (Orthodontics)

Development of an ovine model to investigate the effects of orthodontic tooth movement

Our programmes

A photograph of a modern, multi-story building with a facade of light-colored panels and large windows. The building is the University of Otago Faculty of Dentistry. The text 'UNIVERSITY OF OTAGO' and 'Te Whare Wānanga o Ōtago NEW ZEALAND' is visible on the upper part of the facade. The text 'Faculty of Dentistry Te Kaupeka Pūmāhono' is visible on the lower part of the facade. There are also two small black plaques on the wall.

UNIVERSITY OF OTAGO
Te Whare Wānanga o Ōtago
NEW ZEALAND

Faculty of Dentistry
Te Kaupeka Pūmāhono

Biomaterials, biomechanics and oral implantology

Programme leaders: Dr Carolina Loch (Biomaterials and Biomechanics) and Professor Warwick Duncan (Oral Implantology).

In biomechanics and biomaterials, we conduct experimental and observational research in themes such as:

- Dental materials - development of new dental restorative materials for dental CAD/CAM systems.
- The use of 3D printing in the fabrication of dental appliances and prostheses.
- Craniofacial biomechanics - prosthodontic failure mechanisms, adhesion of dental restorative materials, bite forces and stress on teeth and dental restorations, failure prediction in synthetic and biological materials.
- Structure of dental hard tissues and evolutionary oral biology research – characterisation of animal teeth and other biological materials to elucidate the biology, evolution and interactions with the environment of fossil and recent species.
- Remineralisation of early caries lesions and development of bioactive materials for caries management.
- Forensic biology - forensic odontology, in vitro modelling of blunt force trauma, wounding and ballistic blood splatter analysis, development of simulant materials for forensic modelling.

In oral implantology, our research focuses on:

- Grafting and regenerative therapies.
- Surface treatments of implants for enhanced osseointegration.
- The effects of implant fixtures corrosion products on periodontal structures.
- Developing ultrasonic diagnostic devices for dentistry.
- Silver and gold nanomaterial technology: developing nanoparticles for use in therapeutic technologies.
- *In vitro* modelling of masticatory forces on implant overdentures, their supporting sub-structures and surrounding bone.

Current research projects

Development of novel white shell crowns for dental caries treatment in deciduous teeth

Dental caries is the most common chronic childhood disease in New Zealand. Traditional treatment involves surgical removal of the infected dental tissues and restoration using a filling material. The Hall Technique (HT) is known as a ‘no-drill, no pain’ restorative procedure using metal preformed crowns (PFCs). Although effective clinically, this technique has an aesthetic limitation—the crown is silver rather than tooth-coloured. The metal PFCs also have other disadvantages: cost to healthcare providers is high

Key personnel

Staff

Dr Carolina Loch
 Prof Warwick Duncan
 Prof Paul Brunton
 Prof Mauro Farella
 Prof Karl Lyons
 Prof Darryl Tong
 Prof Neil Waddell
 A/Prof Vincent Bennani
 A/Prof Jonathan Broadbent
 A/Prof Dawn Coates
 A/Prof Mani Ekambaram
 A/Prof Sunyoung Ma
 A/Prof Andrew Tawse-Smith
 Dr Tanmoy Bhattacharjee
 Dr Peter Cathro
 Dr Joanne Choi
 Dr Angela Clark
 Dr Gemma Cotton
 Dr Kai Chun Li
 Dr May Lei Mei
 Dr Jithendra Ratnayake
 Dr Ian Towle
 John Aarts
 Ludwig Jansen van Vuuren
 Wendy Jansen van Vuuren

Postgraduate Students

PhD
 Dina Abdelmoneim
 Deanna Beckett
 Ambre Coste (Geology)
 Asrar Elahi
 Christina Gee
 Ludwig Jansen van Vuuren

DClinDent

Shafiq Abdul Aziz
 Abdelrahman Badarneh
 Huda Mohammed
 Yu-Lynn Lee
 Suneil Nath
 Raj Singh
 Sunethra Tennekoon

MDentTech

Vidya Mudliar



How hard can you bite? Bite force analysis (L Jansen van Vuuren)

and placement can be difficult. Our research team has successfully developed a novel white shell crown system for the Hall Technique, improving both aesthetics and crown placement, while reducing treatment costs.

Aim: To develop novel white shell crowns for dental caries treatment in children using the Hall Technique.

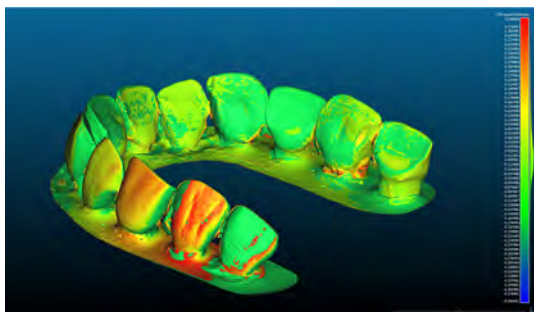
Source(s) of funding: Cure Kids Innovation Seed Funding, University of Otago Research Grant.

Mucosa sensor development for edentulous patients

Complete tooth loss (edentulism) results in difficulty in eating, speaking and socialising. Removable complete dentures, however, are associated with a high failure rate and appreciable pain, leading to tissue damage (denture stomatitis and traumatic ulcers) and bone resorption. Thus, patients often need to have their dentures relined or remade, which could be time-consuming and expensive. The real-time measurement of pressure distribution underneath dentures has always been a challenge within both clinical and lab set-ups. An accurate measurement of the contact pressure induced by the denture insertion could significantly influence optimization of prosthetic design. This could also lead to development of patient-specific solutions targeted at minimizing the occurrence of residual ridge resorption and traumatic oral lesions. The impact of different denture designs on the load distribution across oral soft tissues has been studied in a few cases. However, when it comes to researching the human stomatognathic system, simulation models need to be constructed in order to improve our understanding of the biomechanics.

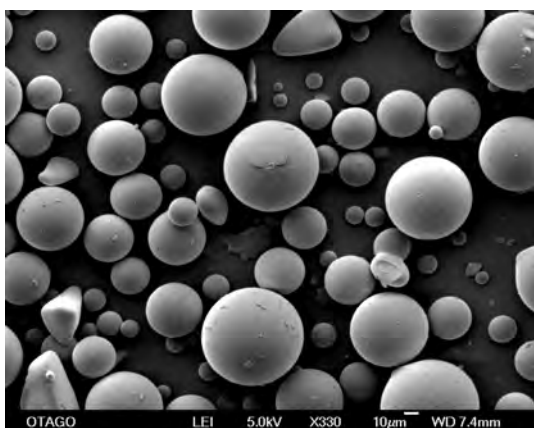
Aims: To measure real-time pressure distribution on the oral mucosa, induced by complete dentures using a novel wireless pressure sensor, an anatomically accurate chewing robot and a jaw simulation model, which will be validated against clinical data, also obtained from this project.

Source(s) of funding: Maurice and Phyllis Paykel Trust, University of Otago Research Grant.



Above: Comparison of mesh distance between different intra-oral scanning conditions (KC Li).

Below: SEM image showing the size range and spherical morphology of glass beads used to polish material in a sand-blasting process (JN Waddell)



Collaborations

Within the University of Otago

Department of Geology, Department of Chemistry, Department of Anatomy, Department of Zoology, Department of Marine Sciences

National

Department of Mechanical Engineering, University of Canterbury; Van Der Veer Institute, University of Canterbury; Department of Engineering Sciences and Department of Mechanical Engineering, Auckland University; Forensic Science Department of Environmental Science and Research; South Island Brain Injury Research Group

International

University of Hong Kong; The University of Western Australia; University of Adelaide School of Dentistry; Impact and Armour Group, Cranfield University /Defence Academy of the United Kingdom; University of the Witwatersrand, South Africa; South African Nuclear Energy Corporation in Palindaba; Tokyo University of Agriculture and Technology; Facharzt für Rechtsmedizin, Institut für Rechtsmedizin, Germany; University of Kent Canterbury, UK; Université Bordeaux, France; Hampden-Sydney College, USA; South Australian Museum Adelaide; Centro Nacional Patagonico, Argentina; Universidade Federal de Santa Catarina, Brazil

We also have **commercial research relationships** with HiTem Korea Ltd, EPD Korea, PackIt Ltd (Dunedin), Kamahi Electronics (Dunedin).

Dental materials

This activity aims to evaluate specific issues associated with a range of dental materials, from composite resin systems to advanced ceramics. Focus on mechanical properties of dental ceramics and their reasons for failure, with an 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.

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

Source(s) of funding: Neurological Foundation Research Grant, Maurice and Phyllis Paykel Trust, ANZAOMS Research and Education Trust, New Zealand Dental Research Foundation, Otago Innovation, University of Otago Research Grant, SJWRI and proprietary funding.

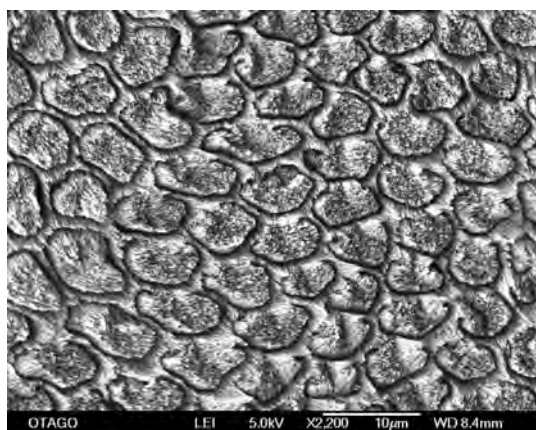
Soft and hard tissue biology, biomechanics and forensic biology

Teeth and bone are special tissues as they preserve a record of their formation in the adult structures. The examination of adult morphology can be used to reveal some of the developmental processes involved, and perturbations of such processes. By studying teeth and other biological materials, we aim to understand the biology, life history, evolution and interactions with the environment of fossil and recent species. Comparative dental morphology and ultrastructure are key elements of this activity. This knowledge can then be linked to clinical findings that can result in better therapeutic outcomes.

Our research has mainly been focused on the structure and function of enamel and dentine in different species, the forces generated during swallowing, and the behaviour of skin and bones during events such as ballistic and blunt force trauma.

Aims: To investigate the basic properties of skin, bones and teeth, to elucidate broad aspects of evolutionary oral biology, comparative dental morphology related to the craniofacial region and forensic issues.

Sources of funding: New Zealand Dental Research Foundation, Leverhulme Fund (UK), Lottery Health Research, University of Otago Research Grant, Otago Medical Foundation Laurensen Award.



Prismatic enamel in the polar bear (C Loch)

Oral implantology and associated superstructures

Our research teams have conducted clinical (human) and preclinical (animal) trials and laboratory-based research related 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 overdentures, fit of zirconia prostheses, implant analysis using Micro-CT, and analysis of different implant systems and bone placement grafts in sheep jaw, femur and maxillary sinus models, in vitro modelling of strain distribution within implant overdentures and their supporting substructures and bone, in vivo analysis of implant fixture corrosion.

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

Source(s) of funding: New Zealand Dental 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 NZ.

Key funding successes

2019

\$97,858. Biorhythm of Childhood Growth. Leverhulme Fund (UK). (PI: C Loch)

\$57,000. University of Otago Research Grant. Development of 3D-printed crowns to enable non-invasive treatment of dental caries in primary teeth. (PI: KC Li, G Cotton)

\$52,500. Lottery Health Research Equipment Grant. A 3D Bioprinter for Tissue Engineering Research in Dentistry. (PI – Coates D, CI – Li KC, Duncan W, Waddell JN, Cannon R, Lyons K, Rich A, Early W, Farella M).

\$44,900. University of Otago Research Grant. Investigation of pressure distribution in edentulous patients: Development and validation of simulation systems. (PI: J Choi, CI: S Ma, N Waddell, P Xu)

\$25,931. University of Otago Research Grant. Dolphin teeth as a biomonitoring tool of heavy metal exposure. (PI: C Loch, CI: C Kemper (South Australian Museum), J Palin (Geology), K Stockin (Massey University), M Taylor (Macquarie University))

\$15,000. New Zealand Dental Research Foundation. A 3D bioprinter for tissue engineering research in dentistry. (PI – Coates D, CI – Li KC, Duncan W, Waddell JN, Cannon R, Lyons K, Rich A, Early W and Farella M)

\$15,000. Colgate Palmolive Limited (NZ). Changes in mineral density and nanomechanical properties of enamel white spot lesions. (PI: M Ekambaram, C Loch, A Meldrum).

\$15,000. New Zealand Dental Research Foundation. Biomimetic Remineralization: A comparative evaluation of novel peptide-based agents for enamel regeneration. (PI: M Ekambaram, CI: KC Li).

\$14,455. New Zealand Dental Research Foundation. The effect of mechanical decontamination procedures on moderately roughened titanium surfaces: quantity and size of the titanium particulate released by mechanical instrumentation. (PI: A Tawse-Smith, CI: W Duncan, A Yu-Chieh Kao, S Ma).

\$12,335. New Zealand Dental Research Foundation. Development and characterization of a novel Hydroxyapatite-Silicate cement for use in dental pulp capping. (PI: P Cathro, CI: J Ratnayake, D Yong)

2020

\$100,000. MedTech Core. Overcoming dental anxiety with needle-free tooth anaesthesia. (PI: A Taberner (UoA), CI: B Ruddy (UoA), J McKeage (UoA), P Brunton, C Loch, D White (AUT))

\$29,488. University of Otago Research Grant (Early Career). Aerosol generation level by different dental high-speed handpieces (PI - Choi J, CI: Waddell JN, Choi J Moffat S)

\$15,000. New Zealand Dental Research Foundation. Development and optimisation using supercritical fluid CO₂ extraction of bovine bone for oral block grafting. (PI – Duncan W, CI – Waddell JN, Elahi E, Li KC, Coates D).

\$14,900. New Zealand Dental Research Foundation. An in vitro study of accuracy of partial denture frameworks fabricated using traditional and digital workflows (PI – S Ma, CI: J Choi, S Salis)

\$14,215. Cure Kids Discretionary Project Grant. Development of white crowns to treat dental caries in children, Phase 2. (PI – Choi J, CI – Waddell JN, Foster-Page L, Duncan WJ).

\$10,860. New Zealand Dental Research Foundation. Evaluation of mechanical properties, wear behaviour and polishability for occlusal splints fabricated using various manufacturing methods. (PI – Choi J, CI – Waddell JN, Ma S, Grymak A).

Awards

International Association of Dental Research, Joan Chong Award in Dental Materials (ANZ Division) 2019 – Dr J Choi

University of Otago Early Career Award for Distinction in Research 2019 – Dr C Loch

International Association of Dental Research, Oral Biology Award (ANZ Division) 2020 - Dr M Mei

International Association for Dental Research, Centennial Emerging Research Leaders Award 2020 – Dr C Loch and Dr M Mei

Clinical and translational research

Programme leader: Professor Warwick Duncan

Te Kaupeka Pūniho, New Zealand's National Centre for Dentistry, is the centre of excellence in New Zealand for clinical and translational research in dentistry and oral health.

The Clinical and Translational Research programme groups together researchers and projects whose objective is to enhance care and achieve better outcomes for our patients. There is considerable overlap with other research programmes, particularly with respect to the translation from benchtop, *in vitro* and preclinical animal research into development of commercially-viable products or improvements in clinical practice.

Current projects range from clinical trials conducted within the school and out in the community, of new products or modified treatment protocols, to development of new therapeutic agents and devices from benchtop through initial *in vitro* and preclinical animal trials with the objective of phase 1 clinical trials, to surveys conducted within the school or in the community regarding the techniques employed in clinical dental practice and their outcomes. Funding for this work ranges across contestable research grants, commercial sponsorship and contract research, and includes both researcher-initiated investigations and research driven by manufacturers of dental products.

Key personnel

Staff

Professor Warwick Duncan
Professor Mauro Farella
Professor Paul Brunton
Professor Darryl Tong
A/Prof Mo'men Atieh
A/Prof Nick Chandler
A/Prof Neil Waddell
A/Prof Vincent Bennani
A/Prof Andrew Tawse-Smith
A/Prof Lyndie Foster-Page
A/Prof Dawn Coates
Dr Sunyoung Ma
Dr Trudy Milne
Dr Carolina Loch
Dr Joanne Choi
Dr Gemma Cotton
Dr Tanmoy Bhattacharjee
Dr Jithendra Ratnayake
Dorothy Boyd

ARCH dental practice-based research network

Dr Lara Friedlander
Suzanne Hanlin

Postgraduate students

Tatiana Tkatchenko
Anumala Ram
Saeideh Nobakht
Siddharth Kothari
Rachel Farrar (Walters)
Christina Gee
Dina Abdelmoneim
Asrar Elahi

The major part of Clinical and Translational Research involves diverse projects undertaken by the staff, postgraduate and undergraduate students of the School. Additionally, work has continued on the development of our dental practice-based research network, Applied Research through Clinicians' Hands (ARCH), with a view towards fostering research conducted outside the School by and for New Zealand dental practitioners, with the support of Dental faculty staff.



Clinical facilities within the new Clinical Services Building.

Current research projects

'Silverbone' project

Professor Warwick Duncan (right) is working on two significant advances in dental technology that could cut the cost of treatments, improve general health and involve New Zealand's agricultural sector with a new high-value product.

“As a periodontist I treat gum disease, take teeth out and graft bone to be able to implant new teeth as necessary. But as mouths are relatively filthy places, infections can occur and if grafts don't work you can actually lose bone. To a certain extent we can manage that with antibiotics, but we're trying to reduce their use.”

The drive for improvement sees Professor Duncan heading an international and interdisciplinary team including Chemistry's Dr Carla Meledandri and Dr Nina Molteno from Molteno Ophthalmic Ltd, a Dunedin manufacturer specialising in bone graft materials.

His team has come up with a new bone-based grafting material, Silverbone, that is robust enough for dental work and contains silver with anti-bacterial properties.

“It would be nice not to have animal testing phases, but we have to show it is safe and promotes new, healthy bone growth. So now we are working in the laboratory to create something that will be superior and save money and be sold and used in dental procedures every day.”

'UltraD3' project

Professor Duncan is also working on developing UltraD3 – a miniaturised ultrasound device to help with dental diagnosis – with Callaghan Innovation engineer Paul Harris and a world-leading team with capabilities in dental research, ultrasonics, electronics and materials science.

“We're trying to make a new tool to assist diagnosis of gum disease around teeth and dental implants. When Paul first asked how I diagnose gum disease I told him I poked it with a stick. It's actually called a periodontal probe, but it's much the same thing. We're aiming to do better than that.”

The diagnostic technique hasn't changed for a century, so it's high time for an improvement, says Duncan.

Gum disease affects one in three adult New Zealanders and is the world's sixth most prevalent condition, with strong links to diseases with high morbidity and mortality. Early intervention should reduce both discomfort and late stage treatments, save money and improve health.

Ultrasound is used for many conditions, such as in breast cancer diagnostics, where it measures changes in tissue stiffness.

“The challenge is to make the device small enough to fit comfortably in the mouth and accurate enough dealing with very small amounts of tissue. We're now on version three and we're getting close. It should be a very useful diagnostic device and almost certainly will be able to be used in other ways in the future.



Collaborations

Within the University of Otago

Department of Applied Sciences, Clothing & Textile Sciences
Department of Geology
Department of Preventive
& Social Medicine, Dunedin
School of Medicine
Department of Physics Department of Chemistry School of
Pharmacy

Other Universities

Department of Mechanical Engineering, University of Auckland
MedTech CoRE (Centre for Research Excellence), New Zealand
University of Zürich, Switzerland

Companies and other entities

Aroa Biosurgery Ltd
Callaghan Innovation
Geistlich Pharma (Switzerland)
Ivoclar International (Liechtenstein)
Molteno Ophthalmic Ltd
Resorba Medical GmbH (Germany)
Southern Implants Ltd (South Africa)
Zimmer Biomet 3i (United States of America)

Key funding successes

\$41,376. University of Auckland - MedTech CoRE. Needle free injections (Paul Brunton, Carolina Loch Santos da Silva)

\$36,486. University of Otago Research Grant. Cattle bone in Root Canal therapy? Development of a novel root canal medicament from New Zealand-sourced waste bovine bone (Jithendra Ratnayake, Peter Cathro, Joanne Choi, George Dias)

\$43,930. University of Otago Research Grant. Regeneration of dental pulp tissue using a novel hybrid biomaterial (Azam Ali, Lara Friedlander, Karl Lyons)

\$44,000. Otago Innovation Limited. Initial formulation of manuka oil for delivery on collagen sheet devices (Warwick Duncan, Gemma Cotton)

\$119,749. New Zealand Lottery Grants Board. Ultrasound cancer screening device and contrast agent project (Warwick Duncan, Tanmoy Bhattacharjee)

\$29,488. University of Otago Research Grant. Aerosol generation level by different dental high-speed handpieces (Joanne Choi, Jane Choi, Susan Moffat, Neil Waddell)

Developing white shell crowns for Hall technique use

Dental decay is the most common chronic childhood disease in New Zealand. Treatment is often delayed, for many reasons – including fear and cost – which only serves to exacerbate the severity of the problem; consequently, increasing the cost and fear associated.

Decay also has a greater impact on certain subsets of society, such as a Maori and Pasifika, as well as children from lower socioeconomic environments. The impact is further compounded by the significant impact restorative dental care has on the public health system.

Dr Joanne Choi (right) and colleagues from the SJWRI's Clinical and Translational Research programme are looking to improve upon a novel technique that could reduce some of the anxiety associated with going to the dentist. Known as the Hall Technique, this method allows for children to avoid the 'drill and fill' of conventional dental care. Instead of the usual invasive measures, a stainless-steel cap is placed on the decaying tooth without any need for anaesthetic or drilling. The crown seals off the decaying tooth, preventing further tooth decay.

One downside to the Hall Technique is the crown's aesthetically unpleasant look. The appearance of the crown represents a very real obstacle to its use. Dr Choi and her team are developing an alternative crown to stainless steel; one that is tooth coloured and hence less visible as different from the surrounding teeth.

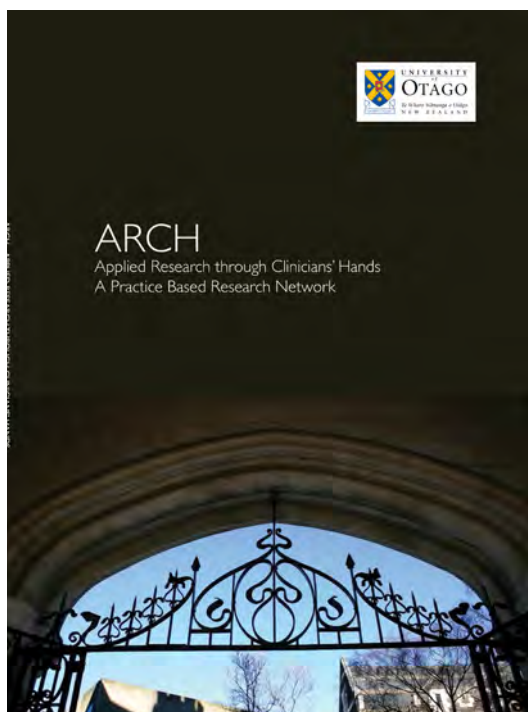
Producing a tooth-coloured cap is not as easy as it sounds; several attempts have been made, only to come up against similar issues around the malleability and plasticity required for the Hall Technique. Using a variety of materials, representing different required functionalities, Dr Choi and her team hope to create a strong crown that lasts.

The team plan to translate their lab-based research into a clinical trial and, ultimately, to make the tooth-coloured crowns available for use in all dental practices.

Other clinical and translational research projects

Novel therapeutic agents

- Silver nanoparticles (Silverbone project, details on previous page) – *in vitro* and preclinical animal trial
- Optimisation of MoaBone® natural hydroxyapatite xenograft (with Molteno® Ophthalmic Ltd.) (*in vitro* and preclinical)
- Manuka honey as an antibacterial agent (*in vitro* and clinical trial)
- Manuka oil as an antibacterial agent (*in vitro*)
- Regenerative membrane for alveolar ridge preservation (with Aroa Biosurgery Ltd.) – preclinical trial
- Gel-loaded lactoferrin for oral bone grafting (with Auckland University and CReaTE Research Group) – *in vitro* and preclinical animal trial
- Novel grafting materials for sinus lift therapy (preclinical animal trial)
- Healing mechanisms in stem-cell driven regeneration of deer antler



Novel therapeutic approaches

- Hall technique for childhood caries – clinical trial
- Development of white crowns for Hall technique (details above) – *in vitro*
- Vital tooth bleaching - clinical trial
- Orthodontic tipping and bodily movement of premolars in a sheep model – preclinical trial

Implant therapy

- Titanium-zirconium narrow dental implants for replacing single posterior missing teeth - clinical trial
- Dental implant abutment-interface and marginal bone loss - preclinical animal trial

Diagnostics

- Ultrasonic devices for early diagnosis of periodontal diseases (UltraD3 project, details on previous page) – benchtop, preclinical animal trial, clinical trial

Craniofacial research

Programme Leader: Professor Mauro Farella

Deputy Programme Leader: Associate Professor Peter Li Mei

The Craniofacial Research programme encompasses a diverse range of exciting fields, including the basic and molecular sciences relevant to craniofacial growth, the impact of malocclusions on oral health, jaw function, self-esteem, psychological wellbeing, and the understanding of the peripheral and central mechanisms of orofacial pain and jaw dysfunction with their clinical correlates.

Several research approaches are used to study topics relevant to craniofacial research, 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.

Craniofacial research examines mastication and jaw kinematics, bruxism and non-functional oral behaviours, sleep disordered breathing including snoring and sleep

Key personnel

Staff

Professor Mauro Farella
A/Prof Li Mei
Dr Joseph Antoun
Florence Bennani
Prof Richard Cannon
A/Prof Rohana De Silva
Professor Mauro Farella
Dr Fiona Firth
Dr Winifred Harding
Dr Hannah Jack
Dr Austin Kang
Dr Carolina Loch
Dr Trudy Milne
Dr Christopher Robertson
Dr Suzan Stacknik
Prof Murray Thomson
A/Prof Geoffrey Tompkins
A/Prof Jonathan Broadbent
A/Prof Nick Chandler
Prof Warwick Duncan
A/Prof Mani Ekambaram
A/Prof Lyndie Foster Page
A/Prof Nick Heng
Dr Benedict Seo
Dr Ajith Polonowita
Dr Simon Guan

Postgraduate students

PhD
Hisham Yasser
Sabarinath Prasad
Joseph Antoun

DClinDent
Nick Pittar
Sherry Lee
Teddy Nguyen
Julia Smith
Reginald Kumar
Michael Skilbeck
Margie Paterson
Gracie Nichols
Rachel Farrar
James Millar
Danielle Hodgkinson
Ghassan Idris
Simon Olliver
Wei Lin
Ana Low
Caleb Lawrence
Divya Ramanan

apnea, intra-oral tongue pressure, dysphagia, tooth wear, eating behaviour, and novel food products. We are currently using wired and wireless sensors to monitor intraoral pH, temperature, and jaw activity for the purpose of identifying and evaluating ways of overcoming orofacial pain, dental wear, jaw dysfunction, jaw clicking sounds, snoring, and obstructive sleep apnea. We also use monitoring equipment to improve the quality of sleep in New Zealand children and adults.



A/Prof Li Mei, Prof Mauro Farella, Danielle Hodgkinson and Dr Austin Kang.

Current research projects

Relationship between chewing features and body mass index in young adolescents

Ghassan Idris, Claire Smith, Barbara Galland, Rachel Taylor, Chris Robertson, Hamza Bennani, Mauro Farella

Behavioural aspects of chewing may influence food intake, nutritional status and in turn body weight. This study aimed to study chewing features in adolescents as they naturally occur in home-based settings, and to test for a possible association with weight status. Our findings suggested that adolescents who are overweight eat at a slower pace for a shorter period of time than their counterparts who are a healthy weight. This unexpected finding based on objective data appears to conflict with existing questionnaire findings but provides impetus for further work testing the effectiveness of changing eating behaviour as a weight-management intervention in youth.

Ecological momentary assessment of pain in adolescents undergoing orthodontic treatment using a smartphone app

Will Sew Hoy, Joseph Antoun, Wei Lin, Nick Chandler, Tony Merriman, Mauro Farella

The purpose of this study was to determine the feasibility of a smartphone application (app) to assess pain levels in real life, and to test their association with gender, age, time in orthodontic treatment, and type of orthodontic adjustment. Eighty-two participants undergoing orthodontic treatment were recruited. A newly developed app was used to assess pain scores at regular intervals in the three days after adjustment of braces. Resting and chewing pain were assessed using sliding digital visual analogue scales. The mean age of the sample was 15.2 ± 1.6 years, the mean time in treatment was 12 ± 8.4 months, and the majority (56.1%) were females. Resting pain and chewing pain at the teeth rose steadily from baseline, peaked at approximately 20 hours, then decreased gradually over the next two days. Details of the orthodontic adjustments were associated with the total pain experienced at the teeth, with new bond-ups resulting in significantly more pain than routine orthodontic adjustments. Pain levels were not significantly associated with age, gender, or time in treatment. This smartphone app shows promise in measuring orthodontic pain in the real world, and will aid future research projects which investigate various factors that could influence pain severity.

Smart-phone assisted monitoring of jaw muscle activity in freely moving individuals with and without myogenous temporomandibular pain

Sabarinath Prasad, Divya Ramanan, Michael Paulin, Richard Cannon, Mauro Farella

This study aimed to collect objective data on masticatory muscle activity during wake-time in the natural environment using a smart-phone assisted wireless electromyographic (EMG) device; and to compare the features of masticatory muscle activity between females with myogenous temporomandibular disorder (TMD) and age-matched pain-free controls.



A young adolescent wearing our electromyographic device and the wearable camera (indicated by arrows) as used in the study.



Smart-phone assisted EMG device developed at the University of Otago for continuous monitoring of jaw muscle contractions. The device provides a comprehensive analytical tool to estimate when, how often, how long, and how strongly the jaw muscles contract.

EMG activity was detected unilaterally using a minimally invasive wireless EMG device attached to the skin overlying the masseter muscle and connected to a smart-phone serving as data logger (above). Study participants performed a series of standardised tasks in a laboratory setting, wearing both the wireless device and reference standard EMG equipment, and then wore the wireless device for at least eight hours while performing their normal routine activities. For our second aim, EMG activity was collected in females with myogenous TMD and in age-matched pain-free controls while performing

their normal routine activity over two consecutive days. The wireless device reliably detected masseter muscle contraction episodes under both laboratory and natural environment conditions, with most masseter contraction episodes during normal routine being of low amplitude and short duration. A significant difference in total jaw contraction time was found, with longer contractions in the TMD pain group. No significant association was found between self-reported parafunction and masticatory muscle activity. Smart-phone assisted monitoring of the jaw muscles represents a promising tool to investigate oral behaviour patterns in orthodontic patients.

Is posterior crossbite a risk factor for temporomandibular joint clicking?

Simon Olliver, Jonathan Broadbent, Murray Thomson, Mauro Farella

The relationship between dental malocclusion and temporomandibular disorders (TMDs) remains controversial. We aimed to investigate whether there is an association between posterior cross-bite in adolescence and self-reported temporomandibular joint (TMJ) clicking later in life, by analysing data from the Dunedin Multidisciplinary Health and Development Study. This is a longitudinal study of a birth cohort of 1037 children born in Dunedin, New Zealand between April 1972 and March 1973. Posterior cross-bite was clinically assessed when study members were aged 15 years, and self-reported TMJ clicking (at least occasionally) was assessed at age 38. Cross-tabulations and logistic regression modelling were used to assess whether an association existed between posterior cross-bite and subsequent TMJ clicking. A total of 726 Study members (70% of the original cohort) were both dentally examined at age 15 and participated at age 38 years. One in three had received orthodontic treatment by the age of 26 years. 94 Study members (13%) had a unilateral or bilateral posterior cross-bite at age 15 years. Among those who had no posterior cross-bite at 15, 33% reported TMJ clicking at least occasionally by age 38 years, while it was 34% among those with a cross-bite at age 15. No association between cross-bite and TMJ clicking was observed, and this held after controlling for their history of orthodontic treatment. We conclude that posterior cross-bite in adolescence is not a risk factor for TMJ clicking by late thirties.

Three-dimensional analysis of lip changes in response to simulated maxillary incisor advancement

Joanne Au, Li Mei, Florence Bennani, Austin Kang, Mauro Farella

In order to investigate three-dimensional (3D) lip changes in response to advancement of maxillary incisors, incremental maxillary incisor advancement was simulated by placing wax of increasing thickness (+2mm, +4mm, +6mm) on the incisors of 20 participants, and the induced lip changes were recorded using 3D stereo-photogrammetry. The induced displacement of lip landmarks was quantified using 3D image analysis software. A large inter-individual variation in lip response to simulated incisor advancement was observed. A significant overall effect on 3D lip changes was found

Collaborations

Collaborators within the University of Otago

A/Prof Azam Ali (Department of Applied Sciences)
Dr Hamza Bennani (Department of Computer Science)
Dr Claire Cameron (Department of Preventive & Social Medicine)
A/Prof George Dias (Department of Anatomy)
Julia Horsfield (Department of Pathology)
Prof Barbara Galland (Department of Women's and Children's Health)
Dr Louise Mainvil (Department of Human Nutrition)
A/Prof Tony Merriman (Department of Biochemistry)
A/Prof Michael Paulin (Department of Zoology)
Prof. Steven Robertson (Department of Women's and Children's Health)
Prof Rachel Taylor (Department of Medicine)
Dr Louise Mainvil (Department of Human Nutrition)

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 Medicine
- Department of Psychology
- Department of Zoology
- Genetics Otago
- Neuroscience Programme
- Otago Zebrafish Facility

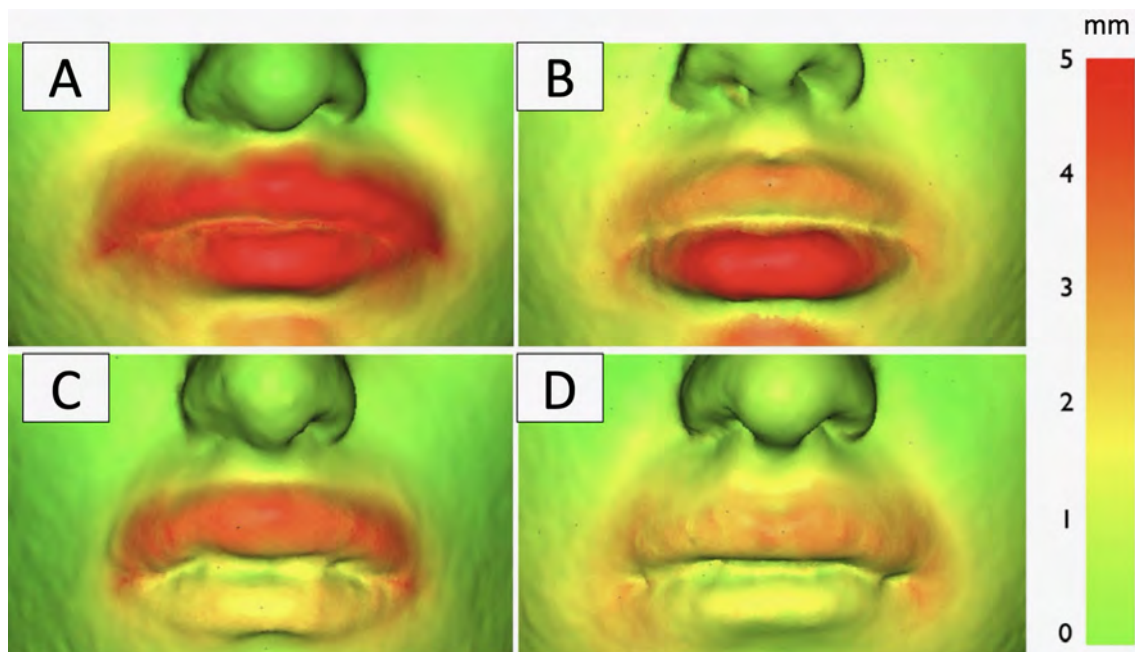
Collaborators at other institutions

A/Prof Mithran Goonewardene (University of Western Australia)
A/Prof Paul Schneider (University of Melbourne)
Professor Craig Dreyer (University of Adelaide)
Professor Ali Darendeliler (University of Nanjing)
Professor Kenji Fushima (University of Kanagawa)
Professor Noriaki Yoshida (University of Nagasaki)
Professor Huang Li, Dr Jialing Li, Dr Mary Ma (University of Nanjing)
Prof Alan Brook (University of Adelaide)
Dr Iacopo Cioffi (University of Toronto)
Jie Fang (Sichuan University)
Prof Luigi Gallo (University of Zurich)
A/Prof David Healey (University of Brisbane)
Jialing Li (Nanjing Medical University, China)
Prof Ambra Michelotti (University of Naples, Federico II)
Prof Sandro Palla (University of Zurich)

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).

Key funding successes

Lottery Health. Equipment Grant. Zygo ZeGage Pro 3D Optical Surface Profilometer. (Firth F and others) \$ 124,121
New Zealand Dental Research Foundation. Effect of passive clear aligners on masticatory muscle activity in adults with and without oral parafunction. (Farella M and others) \$ 10,000
New Zealand Dental Research Foundation. Patients' experiences with orthodontic treatment through traditional fixed appliances, clear aligners and direct-to-consumer clear aligners: a qualitative study. (Firth F and others) \$ 10,000
Colgate Grant. What's in a smile? Impact of oral health on smiling features. (Farella M and others) \$ 40,000
CureKids Innovation Seed A novel approach for monitoring eating behavior in children" (Farella M and others) \$49,458



for increasing values of simulated incisor advancement, as well as significant differences between anatomical landmarks of the lip. Maxillary incisor advancement significantly affects upper lip change in three planes of space; particularly, the anteroposterior plane, in which the response to simulated advancement appears to be non-linear.

Examples of colour-coded scalar fields from four different female participants (A,B,C,D) with + 6 mm of incisor advancement. Green areas correspond to areas of little to no change (-0.5 mm to 0.5 mm); yellow and red correspond to increasingly positive values of displacement. Note the large interindividual difference in soft tissue response.

Other craniofacial research projects

- What's in a smile? Impact of oral health on smiling features
- Effect of passive clear aligners on masticatory muscle activity in adults with and without oral parafunction
- Patients' experiences with orthodontic treatment through traditional fixed appliances, clear aligners and direct-to-consumer clear aligners: a qualitative study
- Effect of orthodontic extractions on face profile
- Modulation of bone related mediators in osteoblasts and periodontal ligament cells
- Can aligners move roots? Let's torque about it
- The psychological effect of malocclusion over the life course
- Development of an ovine model to investigate orthodontic tooth movement
- Impact of psychological and genetic factors on orthodontic pain
- Management of biofilm formation with Air-Flow in patients with fixed orthodontic appliances
- A novel approach for monitoring eating behavior in children
- Relationship between sugar sweetened drinks, tooth wear and dental caries in Māori
- Jaw muscle overload as a possible cause of orofacial pain
- Assessing three-dimensional tooth movements during orthodontic activations using an E-typodont
- The effect of mechanical strain on the unfolded protein response of periodontal ligament cells in a three-dimensional culture
- Predictive factors of orthodontic pain
- Efficacy of a mandibular advancement appliance on sleep disordered breathing in children
- A new approach to engineering 3-dimensional constructs of human bone matrix in a mechanically-active environment
- Genetic and environmental factors associated with hypodontia
- Biofilm management with oral probiotics in orthodontic patients: a triple-blind randomised placebo-controlled trial
- Genetics aspects of the long face

Dental education research

Programme Leader: Dr Lee Adam

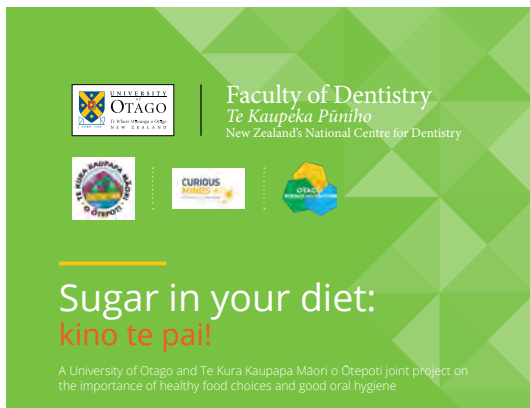
Deputy Programme Leader: Dr Susan Moffat

Key personnel

Dr Lee Adam	Mr Sam Carrington
Dr Susan Moffat	Dr Andrew Tawse-Smith
Mrs Alison Meldrum	Mrs Dorothy Boyd
Prof Alison Rich	Mrs Deanna Beckett
Dr Arthi Senthilkumar	AProf Sunyoung Ma
Dr Carolina Loch	Prof Paul Cooper
A/Prof Jonathan Broadbent	Dr Jo Oranje
Prof Paul Brunton	Dr Abdullah Barazanchi
Mrs Hanna Olson	



Dr Lee Adam.



Dental education research focuses on enhancing theoretical and evidence-based policies and practices in teaching and learning. Researchers in the Dental Education Research Programme engage in examining educational experiences at the Faculty and other dental education environments in order to foster a positive impact on education, both in the clinical and traditional teaching and learning environments.

The research currently being undertaken will identify strategies and practices that can improve experiences and support for students and educators, both within the Faculty of Dentistry, and in other clinical and traditional education environments.

Current research projects

Sugar in your diet: kino te pail, An evaluation of oral health outreach results and community impact

Carolina Loch Santos da Silva, Deanna Beckett, Richard Cannon

This study evaluated the impact and effectiveness of a combined science outreach, oral health education and tooth brushing initiative introduced into a New Zealand Māori immersion primary school. Participants completed questionnaires on dental anxiety, oral health practices and dental knowledge before and after the intervention. Pre- and post-intervention responses were compared to determine if knowledge and outcomes had improved. Semi-structured interviews were conducted with six students 18 months later to determine long term retention of information and subsequent oral health practices. Improvements in good oral hygiene habits and diet were observed in several areas. Interview participants comments showed that although students may be aware of recommended oral health practices, they will not necessarily implement them. A decline in the amount of sugary drinks consumed daily was observed, alongside a significant increase in participants' understanding of the effect of fluoride on teeth. Not all dental terminology and scientific knowledge was retained long term as a result of this initiative; however, improvements were observed when reinforcement of messages was delivered regularly throughout the duration of the study. Scientific outreach and dental initiatives need to be ongoing to ensure long term retention of information provided, and to encourage regular oral health practices.

Investigating the adequacy of oral health care knowledge content for geriatric patients in undergraduate nursing programmes in New Zealand

Paul Brunton, Karl Lyons, Arthi Senthilkumar

A recent report indicated that one in six of the adult population will be aged 65 and above in 2050, up from one in 11 in 2019. A recent national survey suggested higher treatment needs among older adults, however 64% of residential homes do not have an oral health protocol. This study aimed to investigate the educational content relevant to elderly oral health care in nursing curriculum, oral health knowledge of undergraduates, barriers to incorporate oral health care content and students' attitude

on providing oral health care for older adults, through conducting a survey among nursing educators and nursing students in New Zealand.

Of 18 nursing institutes in New Zealand, 14 participated in the educator survey, while 145 students participated in the student survey (15% of 2020 graduates). The survey among nursing educators suggested that risk factors associated with dental caries and periodontal health are not taught in almost 40% of schools. The four themes identified in qualitative analyses were “no barrier”, “lack of expertise”, “no space for more content” and oral health content “already included”. The student survey results suggested that nursing graduates have good basic oral health knowledge, however their knowledge of oral systemic disease connection and oral examination were poor. Graduates thought oral health care education is overlooked and indicated they received very minimal oral health education. Even though educators reported that oral health care content is already incorporated in the nursing curriculum, student survey report suggested that the current content is not enough for students to provide oral health care for their future patients.

[An exploratory study of the education needs of practising lead maternity carer midwives: enablers and barriers to providing evidence based oral health advice and oral health promotion to their clients during pregnancy](#)

Graeme Ting, Ceridwen Benn

This research aims to explore the education needs, facilitators, and barriers of practising lead maternity carer (LMC) midwives with respect to the provision of evidence-based oral health advice and promotion. LMC midwives in New Zealand were invited to participate in a mixed-methods study comprising a web-based survey and semi-structured interviews.

Around 3/4 of respondents provided oral health advice and promotion to their clients despite over 4/5 of those having had no educational exposure regarding oral health in pregnancy. 99% of respondents believed it was safe to access oral health care during pregnancy, and almost two thirds believed maintaining good oral health was very important for pregnancy wellbeing. The most prevalent barriers to providing oral health advice and promotion were: High cost of dental care; a lack of resources to provide to clients; and a lack of education regarding oral health in pregnancy. Specific barriers identified by interviewees included overloading of midwives, and wider barriers to accessing dental care in New Zealand. The belief that good oral health was a very important part of pregnancy wellbeing was associated with a significantly increased likelihood of LMC midwives providing oral health advice and promotion.

LMC midwives recognise the importance of oral health as part of overall pregnancy wellbeing, are receptive to further oral health education, and to providing oral health advice and promotion as part of maternity care. Until the wider barriers to dental care services access in New Zealand are addressed, it is unreasonable to expect the midwifery workforce to pick up the gauntlet of contributing to the improvement of oral health, and oral healthcare services access of New Zealand women during pregnancy.

Key funding successes

Sugar in your diet: kino te pai!, An evaluation of oral health outreach results and community impact. Carolina Loch Santos da Silva (Lead), Deanna Beckett, Richard Cannon. Colgate Palmolive Limited (NZ), \$9,318

Investigating the adequacy of oral health care knowledge content for geriatric patients in undergraduate nursing programmes in New Zealand. Paul Brunton (lead), Karl Lyons, Arthi Senthilkumar. Downie Stewart (Fuller Trust), \$2,027

An exploratory study of the education needs of practising lead maternity carer (LMC) midwives: enablers and barriers to providing evidence based oral health advice and oral health promotion to their clients during pregnancy. Graeme Ting (lead), Ceridwen Benn. New Zealand Dental Association Research Foundation, \$4,580

Perceived confidence in performing peripheral venipuncture among dental practitioners in New Zealand and Malaysia. Graeme Ting (Lead), Darryl Tong, Mohd Hakimin Mohamed Ashri. Downie Stewart (Fuller Trust), \$3,000

[Perceived confidence in performing peripheral venipuncture among dental practitioners in New Zealand and Malaysia](#)

Graeme Ting, Darryl Tong, Mohd Hakimin Mohamed Ashri

This research aims to determine the perceived confidence in performing peripheral venipuncture among dental practitioners in New Zealand and Malaysia and determine the preferred mode of training in venipuncture from the dental practitioners' perspective. Venipuncture is an underrated but very common and essentially performed medical procedure. A competent level of skill in performing venipuncture is a valuable asset for dental practitioners.

This study was carried out through online questionnaires. The study population in New Zealand was a convenience sample of dental practitioners registered with the Dental Council of New Zealand. In Malaysia, the study population was a convenience sample of Malaysian dental practitioners registered with the Malaysian Dental Council. Sample rates of New Zealand and Malaysian dental practitioners were 6.7% (87) and 4% (510) based on respective overall registered and actively practising dental practitioners in both countries. In New Zealand, 44% of dental practitioners surveyed had undergraduate exposure to venipuncture, while in Malaysia, it was 46%. 47% of New Zealand dental practitioners had confidence in performing venipuncture during non-medical emergencies and 29% during medical emergencies, while in Malaysia these figures were 21% and 9% respectively. In New Zealand, 65% perceived venipuncture training as essential, while in Malaysia, 81%. Both New Zealand and Malaysian dental practitioners would prefer to receive venipuncture training through clinical activity, workshops, simulated practice with mannequin arm and inclusion in both undergraduate and postgraduate curriculum.

The results of this study will inform training programmes in venipuncture for dental practitioners. It is hoped that these educational resources can be deployed to maintain competence, improve skills and boost confidence in this area of patient care.

An interprofessional education initiative for dentistry, oral health, and medical laboratory science teachers and students

Hanna Olson, Catherine Ronayne, Megan Anakin, Alison Meldrum, Alison Rich

In the health professional education literature, there is a need for information about the teaching and learning of medical laboratory sciences for clinical practice. The goal of this reflection-on-practice is to describe how an orofacial pathology interprofessional education (IPE) initiative was designed and implemented. The designers of this initiative were teachers from dentistry, oral health, and medical laboratory science.

The designers used six interprofessional competencies (patient-centred care, role clarification, team functioning, collaborative leadership, communication, and cultural practice) to guide their construction of teaching and learning resources. The initiative required students to work collaboratively with a given patient case to develop a differential diagnosis, prepare a treatment plan, present their case to classmates and staff members, and describe how they worked together to address the orofacial pathology in their case. The designers collected and considered evaluation information including the learning resources used, logistical arrangements for the initiative, and evaluation data from students via an anonymous 10-item questionnaire.

Students rated statements that addressed the six interprofessional competencies and provided written comments about the initiative. In general, the students agreed strongly with all statements except for cultural practice. Written comments about the initiative were positive and indicated that students appreciated learning about their own discipline and that of other professionals in the context of providing oral healthcare involving orofacial pathology.

Given the acceptability of this initiative to the designers, facilitators, and students, the next step is to consider the feasibility of scaling-up this small voluntary IPE initiative into a permanent component of the dentistry, oral health, and medical laboratory science programmes. Aspects to consider include staffing, scheduling, assessment, and cultural perspectives.

Using the flipped classroom concept in post-COVID postgraduate dental education

Darryl Tong

This project is investigating the potential of using a flipped classroom concept in postgraduate dentistry teaching in a post-COVID world. It examines integrating current teaching modalities that are more concurrent than intergrated, but by using online teaching methods.

Developing biofidelic models for dental education

Paul Cooper, Richard Arm (Nottingham Trent University), Michael Milward (University of Birmingham)

This research uses synthetic gums and fibers to model realistic gums and tongues, and bone-simulating resins to model teeth and jaw bones, all which behave “like the real thing.” Dental students will be able to work on the models as they learn how to examine the mouth. The models are designed to mimic real tissue, and look and feel like a human mouth, providing students with a realistic experience as they develop their clinical skills.

End-users' perspectives of a state-of-the-art dental education facility

Lee Adam, Alison Meldrum

Across 2016-2021, the University of Otago Faculty of Dentistry has been undertaking demolition and construction work as part of a major building redevelopment. A new clinical building has been erected adjacent to the existing building, which has undergone extensive refurbishment. The two buildings are connected by a large atrium. The redevelopment work required re-location of staff offices and the simulation suite into temporary off-site locations. In June 2019, the Faculty's new Clinical Services Building opened, and students began undertaking their clinical work in this brand-new space with state-of-the-art equipment and technology. The refurbishment of the Walsh building was completed before the start of the 2021 academic year, housing staff offices, laboratory spaces, and the simulation suite. This mainly qualitative investigation explores the staff, students' and other stakeholders' views and experiences of their new facilities.



Clinical Services Building under construction, November 2017.

Dental epidemiology and public health

Programme Leader: Professor Murray Thomson

Deputy Programme Leader: Associate Professor Jonathan Broadbent

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 techniques and approaches, most notably the prospective cohort study and the cross-sectional survey.

Our dental health services research work is concerned with how the dental healthcare system works, and the extent to which users are benefitting from it. Key activities are measuring oral health outcomes, dental workforce research and enhancing understanding of how and why people use, or do not use, dental services.

Our group also plays an important role in the development and epidemiological validation of self-report measures, working in collaboration with a number of overseas researchers.

Current research projects

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

Prospective observational research into the natural history of oral health and disease in a representative birth cohort now in adulthood, aimed at uncovering unprecedented information on the natural history of oral health and disease.

The Dunedin Study is now the world's most important and influential source of information on the natural history of oral conditions through adulthood. Our influential life-course work in that study is "it" as far as understanding what happens to oral health throughout the lifecourse. There is no comparable archive of longitudinal oral health data anywhere else.

For example, consider dental caries (tooth decay), the most important cause of tooth loss and oral pain in humans. Our Dunedin Study work has made the following important contributions to knowledge of dental caries: unprecedented information on its natural history from childhood to midlife; the unexpected finding that the average caries increment is constant through life; tooth loss due to caries begins in late adolescence; early childhood caries is a risk factor for ongoing adult dentition caries; and characterisation of the widening of social inequalities in caries experience as we pass through adulthood.

We are also making seminal contributions to knowledge of the natural history of tooth loss and periodontal

Key personnel

Staff

Prof Murray Thomson
A/Prof Jonathan Broadbent
Ms Chuen Lin Hong
Dr Susan Moffat
Dr Lee Smith (to 2019)
Mr Graeme Ting
Prof John Broughton (retired June 2020)

Postgraduate students Completions 2019-2020

DClinDent
Adelyn Lau
Jessica Lee
Hamid Mohammed
Emma Morelli
Gracie Nichols
Simon Olliver
Master of Oral Health
Naseem Asadi
Keri Carruthers
Master of Community Dentistry
Kate Naysmith
Helen Lloyd
Alexander Holden
Philip Goh
Hayley Dixon

Postgraduate students

Current enrolments

PhD
Nazahiah Bakri
Deanna Beckett
Angela Benn
Dorothy Boyd
Begoña Ruiz Conrads

DClinDent

Zeina Al Nassan
Ceridwen Benn
Emma Jefferies (Johnson)
Hakimin Mohamed Ashri
Beatrice Ng
Lenoka Rupasinghe
Farah Zainuddin

Master of Oral Health

Jane Choi
Hayley James

Master of Community Dentistry

Rebecca Chapman
Sarah Lobb
Manisha Narsinh
David Rumble
Tania Stuart
Dhara Tilwawala

attachment loss. Such findings have influenced clinical oral health care provision, dental research and dental public health policy around the world.

In 2019-2020, we completed the age-45 assessments, supported by funding from a HRC project grant. The aims of the dental research component of the age 45 assessments were to: produce unprecedented information on the natural history of oral health and disease; test hypotheses for genetic and environmental risk factors for chronic dental diseases; identify treatable early-life antecedents of high-rate dental caries and periodontitis in adulthood; quantify ageing of the teeth and dentition, and relate this to early life exposures to environmental factors, along with genetic factors; and quantify the public health significance and financial burden of the cost of treating acute and chronic dental conditions through life.

Work in this area continues to attract international attention and to be published in the top international journals: 11 papers were published, and a number of conference presentations were made.

Other dental epidemiological and clinical research

Beyond our work with the dental component of the Dunedin Study, our group carries out a broad range of dental epidemiological and other studies in NZ and overseas. This is aimed at enhancement of the knowledge base for dental epidemiology, dental public health, and clinical practice. A key component of this work is our gerodontology research, which is growing in importance and scope as the dentate older population increases in size. Dr Moira Smith (UOW) and Prof Ngaire Kerse (University of Auckland) are key collaborators.



A/Prof Jonathan Broadbent and Chuen Lin Hong.



Graeme Ting, Farah Zainuddin and Prof Murray Thomson.

Funding for these projects has been forthcoming from a variety of sources, including the NZ Ministry of Health, NZ Dental Research Foundation, and the Health Research Council of NZ. Across 2019-20, 21 papers were published, and a number of conference presentations were made.

Dental health services research

Our work in this area encompasses dental health services research in New Zealand, including ongoing, systematic dental workforce research, work on social accountability, barriers to oral health for Pacific adolescents, and access to orthodontic treatment for disadvantaged adolescents. The aims of this work are in enhancement of the knowledge base for dental public health and clinical practice. Work in this area uses both quantitative and qualitative approaches, and continues to be diverse and productive. Support for this work across 2019-20 has come from a variety of sources, including the NZ Dental Research Foundation and the Health Research Council of NZ. Across this period, 23 papers were published.

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

This objective is centred around the training of new researchers for NZ and the Asia-Pacific region, in order to build research capacity in our field. Across 2019-20, our successful postgraduate completions included seven Doctors of Clinical Dentistry and seven Masters degrees. We are currently supervising a further seven Doctor of Philosophy, nine Doctor of Clinical Dentistry, and five Masters degree candidates. We also continue to informally mentor colleagues working in the wider health sector, both internationally and in New Zealand.

Collaborations

National

Department of Public Health, University of Otago Wellington
 Canterbury District Health Board
 Massey University
 University of Auckland
 University of Canterbury
 Auckland University of Technology

Australia

University of Adelaide
 University of Queensland
 University of Melbourne

International

University of Toronto, Canada
 McGill University, Canada
 Osaka University, Japan
 Universiti Malaya
 Duke University, USA
 University of Michigan, USA
 University of North Carolina, USA
 GKT Dental Institute, UK
 University of London, UK
 Sheffield University, UK
 Dundee University, UK
 University of Chile
 Federal University of Pelotas, Brazil
 University of Rio Grande do Sul, Brazil

Key funding successes

Projects led by investigators from the Faculty of Dentistry

\$53,556. The affordability of dental care in New Zealand. Ministry of Health Oral Health Research Fund, 2019 (Jonathan Broadbent, William Leung (Public Health, UOW), Trudy Sullivan (Preventive & Social Medicine))

\$15,000. Community based oral health promotion among adult Syrian former refugees resettled in Dunedin, New Zealand. New Zealand Dental Research Foundation, 2019 (Jonathan Broadbent, Warwick Duncan, Moira Smith (Public Health, UOW), Zeina Al Naasan)

\$44,208. Oral health knowledge and attitudes of carers of home-based dependent older people. University of Otago Research Grant, 2019 (Graeme Ting, Moira Smith (Public Health, UOW))

\$39,152. Towards understanding inequality in oral health-related quality of life. Ministry of Health Oral Health Research Fund, 2020 (Jonathan Broadbent, Chuen Lin Hong, Murray Thomson)

Projects led by investigators outside the Faculty of Dentistry

\$619,189. NSC Ageing Well: through Eating, Sleeping, Socialising and Mobility (AWESSOM), 2019. (Moira Smith (Public Health, UOW), Rebecca Abey-Nesbit (Medicine, UOC), Ulrich Bergler (Medicine, UOC), Catherine Ferguson (Public Health, UOW), John Pickering (Medicine, UOC), Murray Thomson)

\$1,185,360. Novel methods of infant feeding in New Zealand - cause for concern or optimism? Health Research Council of NZ, 2019 (Anne-Louise Heath (Human Nutrition), Jillian Haszard (Human Nutrition), Lisa Houghton (Human Nutrition), Alison Meldrum, Rachael Taylor (Medicine, OMS))

\$38,506. Oral health inequity among patients diagnosed with cancer: exploring the impacts on quality-of-life and survivorship. University of Otago Research Grant, 2020 (Moira Smith (Public Health, UOW), Cheryl Davies (Public Health, UOW), Catherine Ferguson (Public Health, UOW), Virginia Signal (Public Health, UOW), Ramona Tiatia (Public Health, UOW), Graeme Ting)

\$44,000. Promoting and protecting the oral health of dependent older New Zealanders 'ageing in place'. Ministry of Health Oral Health Research Fund, 2020 (Moira Smith (Public Health, UOW), Anna Ferguson (Public Health, UOW), Graeme Ting)

Molecular microbiology

Programme Leader: Associate Professor Brian Monk

Molecular Microbiology research within the SJWRI encompasses microbiological investigations applied to a variety of disciplines relevant to Dentistry. These include endodontics, periodontics, implantology, cariology and treatment with antimicrobials, antifungal and antibacterial drug development, drug resistance, structural biology and microbial genomics.

Research is primarily conducted in the Molecular Biosciences Laboratory, which relocated in October 2018 to a temporary facility in the ground floor of the Department of Biochemistry during the redevelopment of the Walsh Building.

Current research projects

Structure-directed discovery of next-generation antifungals

Brian Monk, Mikhail Keniya, Rajni Wilson

The emerging problem of antifungal resistance, together with a lack of structural information on existing antifungal drug targets, is a significant issue in both medicine and agriculture. We are investigating the structure and function of a number of antifungal drug targets, including the azole target lanosterol 14 α -demethylase, the terbinafine target squalene monooxygenase, the echinocandin target glucan synthase and drug efflux pumps from the ATP binding cassette and major facilitator superfamilies. Overexpressing these proteins in yeast provides proteins for purification and structural resolution by X-ray crystallography, as well as enabling targeted physiological screens for antifungals and valuable tests of antifungal efficacy. This information is being used to design potent chimeric antifungals that combine the best attributes of existing antifungals, and has enabled computer-based screens of large compound libraries in efforts to discover novel antifungals.

Since 2014, our group has deposited in the Protein Data Bank over 30 crystal structures of wild type and mutant lanosterol 14 α -demethylase from *Saccharomyces cerevisiae* in complex with a range of azole drugs and agrochemicals, plus the first crystal structures of full-length lanosterol 14 α -demethylase from the fungal pathogens *Candida glabrata* and *Candida albicans*. We have also investigated lanosterol 14 α -demethylase in other important and emerging fungal pathogens including the human pathogens *Aspergillus fumigatus*, *Cryptococcus neoformans* and *Candida parapsilosis* and the plant pathogens *Zymoseptoria tritici* and *Phakopsora pachyrhizi*. This research is providing phenotypic and structure-based insight into the intrinsic azole resistance associated with the ancient mucormycete family of fungal pathogens.

The group published 4 papers in this area in 2019-20. Our primary funding was a Health Research Council of NZ grant (2016-2019) entitled "Structure-directed discovery of next-generation antifungals" and a subsequent HRC grant (2019-2022) "Readying next-generation antifungals

Key personnel

Staff	Postgraduate students
Professor Richard Cannon	<i>PhD</i>
Associate Professor Vincent Bennani	Dina Abdelmoneim
Dr Peter Cathro	Minati Choudhury
Associate Professor Dawn Coates	Zhen Dong
Dr Gemma Cotton	Asrar Elahi
Dr Nick Heng	Christina Gee
Dr Mikhail Keniya	Parham Hosseini
Dr Erwin Lamping	Chitra Krishnan
Professor Karl Lyons	Golnoush Madani
Dr Li Mei	Yasmeen Ruma
Dr Trudy Milne	Amira Salem
Associate Professor Brian Monk	Shaikha Al Samahi
Dr Don Schwass	<i>DClinDent</i>
Associate Professor Geoffrey Tompkins	Deepak Chellappa
Dr Rajni Wilson	James Millar
	Nurul Thiyahuddin
	Marguerite Paterson
	Anumala Ram
	Michael Skilbeck

for drug development". These grants built on previous Marsden (2010-2015) and HRC (2013-2016) funding. The award of a Catalyst Fund grant in 2018 supported a collaboration and researcher exchange in 2019-20 with Associate Professor Michaela Lackner of the Medical University of Innsbruck.



A/Prof Michaela Lackner (right) with PhD students Yasmeen Ruma (left) and Parham Hosseini (centre).

Fungal colonisation and drug resistance

Richard Cannon, Erwin Lamping

The increased incidence of infections caused by drug resistant microorganisms is a major global health concern. While the multidrug resistance of bacteria is most prominent, drug resistance of fungi is also of great concern. The main cause of high-level azole drug resistance in the most common oral fungal pathogens, *Candida albicans* and other non-*albicans Candida species*, is the over-expression of ATP-binding cassette (ABC) transporters that protect cells from azole antifungals.



Professor Brian Monk.

We have used our patented, and further optimised, *Saccharomyces cerevisiae* system for heterologously overexpressed membrane proteins to study efflux pumps from a number of important fungal pathogens including the major efflux pumps contributing to antifungal drug resistance of *C. albicans* (Cdr1), *Candida auris* (Cdr1) and *Fusarium keratoplasticum* (Abc1).

In a project supported by the Marsden Fund, site-directed mutagenesis has been used to investigate the role of amino acids, particularly cysteines, in pump function. We have also used the expression system to study antifungal drug resistance mechanisms of the more recently emerging human fungal pathogens *Candida auris* and *Fusarium keratoplasticum*. Other projects have ii) created a new set of plasmids for the functional characterization of membrane proteins with various N- and C-terminal fluorescent (double)-tags; and ii) studied the possible homo-dimerization of Cdr1 in live yeast cells.

Before organisms can cause oral infections, they must first colonise the oral cavity. Little is known about the range of fungal species and diversity of *C. albicans* strains that colonise people's mouths. We have used rDNA sequencing and multilocus sequence typing (MLST) to identify and investigate fungi colonising people with dentures, oral cancer and older people. Surface roughness of oral surfaces can facilitate oral colonization. We have investigated how interproximal reduction of teeth affects surface roughness and microbial adherence. With our colleagues in the Tokyo Institute of Technology we have developed a novel assay to measure *C. albicans* adhesion to hydroxyapatite (the main component of enamel).

Our group published 7 papers and 1 book chapter in 2019-2020.

Microbial profiling and monitoring, and genome characterisation using molecular tools

Nick Heng, Trudy Milne

The oral cavity of each human and animal harbours its own distinctive community of microbes, termed the "oral microbiota". The human oral microbiota alone is estimated to comprise over 700 species of microbes. Many

Key collaborators

Structure-directed discovery of next-generation antifungals

A/Prof Michaela Lackner (Medical University of Innsbruck, Austria)
A/Prof Joel Tyndall (University of Otago School of Pharmacy)
Prof Robert Stroud (University of California San Francisco, USA)
Prof Gabriele Cruciani and PhD student Lucia Cesarini (Università Degli Studi Di Perugia, Italy)
MicroCombiChem (Wiesbaden, Germany)

Fungal colonisation and drug resistance

A/Prof Alok Mitra (University of Auckland)
Prof Lutz Schmitt and Holger Gohlke (Heinrich Heine University Düsseldorf, Germany)
A/Prof Jacinta Santhanam (Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia)
Prof Stefan Rauner (Max Planck Institute for Molecular Physiology, Dortmund, Germany)
A/Prof Morgan Han (Chongqing Medical University Stomatological Hospital, Chongqing, China)
Dr Masakazu Niimi, Dr Kyoko Niimi and Prof Susumu Kajiwara, (Tokyo Institute of Technology, Tokyo, Japan)

Microbial profiling, monitoring and genomics

Professor Amarila Malik (Universitas Indonesia, Depok, Indonesia)
Professor Lucio Gonçalves (University Estácio de Sá, Rio de Janeiro, Brazil)
Professor Julian Crane (University of Otago Wellington)
Dr Xochitl Morgan (University of Otago)
BLIS Technologies (Dunedin, NZ)

Key funding successes

\$1,199,968. Structure-directed discovery of next-generation antifungals. Health Research Council of NZ, 2019 (Brian Monk, Mikhail Keniya, Joel Tyndall (Pharmacy), Rajni Wilson)

\$14,805. Evaluation of Electrolysed Oxidising Water as a multipurpose, non-toxic and cost-effective disinfectant in dental healthcare. New Zealand Dental Research Foundation, 2019 (Richard Cannon, Karl Lyons, Geoff Tompkins, Chitra Krishnan)

\$13,478. Surface modification of orthodontic elastomers to overcome biofilm formation. New Zealand Dental Research Foundation, 2019 (Li Mei, Richard Cannon, Michael Skilbeck)

\$10,000. Drug resistance in the emerging fungal pathogen *Candida auris*. Maurice and Phyllis Paykel Trust, 2019 (Richard Cannon, Erwin Lamping)

\$8,000. Efficacy of electrolysed oxidising water as a cost-effective dental disinfectant. Maurice and Phyllis Paykel Trust, 2019 (Geoffrey Tompkins, Richard Cannon)

\$15,000. MiniG*1600 - Automated Tissue Bead Mill Homogeniser and Cell Lyser. New Zealand Dental Research Foundation, 2020 (Trudy Milne, Erwin Lamping, Richard Cannon)

\$14,000. Genome analysis of bacterial strains. BLIS Technologies Limited, 2020 (Nicholas Heng)

Major funding supporting research within the Programme during 2019-2020 came from: New Zealand Dental Research Foundation, Health Research Council of NZ, Ministry of Business Innovation and Employment, Marsden Fund of the Royal Society of NZ, Sir Thomas Kay Sidey Postgraduate Visiting Fellowship of the University of Otago Faculty of Dentistry, Ministry of Higher Education Malaysia Fundamental Research Grant Scheme, Catalyst Fund of the Royal Society of NZ, Maurice and Phyllis Paykel Trust, SJWRI Colgate Research Grant, Fuller Scholarship, Return on Science/Otago Innovation Ltd, KiwiNet/Otago Innovation Ltd, Lottery Grants Board.

species have long been associated with disease such as *Streptococcus mutans* (dental caries) and *Porphyromonas gingivalis* (periodontal disease). Bacterial profiling of oral samples from healthy or diseased participants using next-generation DNA sequencing technology have helped identify some species that may either contribute to disease

progression or are associated with good oral health. Some bacterial species, e.g. *Streptococcus salivarius*, are potential probiotic species, i.e. they are believed to confer beneficial effects when colonising their human (or animal) hosts. This research group is not only interested in revealing the genomic secrets of cultured species such as antimicrobial-producing *S. salivarius* strains and new oral streptococcal species isolated from other animals, but also developing real-time PCR probe sets to specifically detect and monitor particular probiotic species.

In 2019-2020, our group published 5 journal articles.

Oral bacteriology

Geoffrey Tompkins, Peter Cathro

Bacteria are involved in various diseases affecting the teeth and gingival tissues. Current projects in this group include: (i) development of new antimicrobials directed at the extremely alkaline-tolerant bacteria that cause root canal treatments to fail; (ii) evaluation of lasers to remove biofilms from dental implants; (iii) the effect of various antimicrobials, including chlorhexidine, and silver-based antimicrobials on oral microbial ecology.



Developing novel antimicrobial agents for oral applications

Dawn Coates, Gemma Cotton

Antibiotic resistance has become an increasing problem in clinical medicine. This team undertakes research on the development of novel antimicrobials for oral applications and as an adjunct to bone grafting materials. Research includes both chemically synthesised compounds and those derived from New Zealand native plants. Antimicrobial action, formulation, release profiles, molecular mechanisms of action, along with in vitro and in vivo trials on efficacy and compatibility are all conducted.

Microbial biofilms

Vincent Bennani, Li Mei

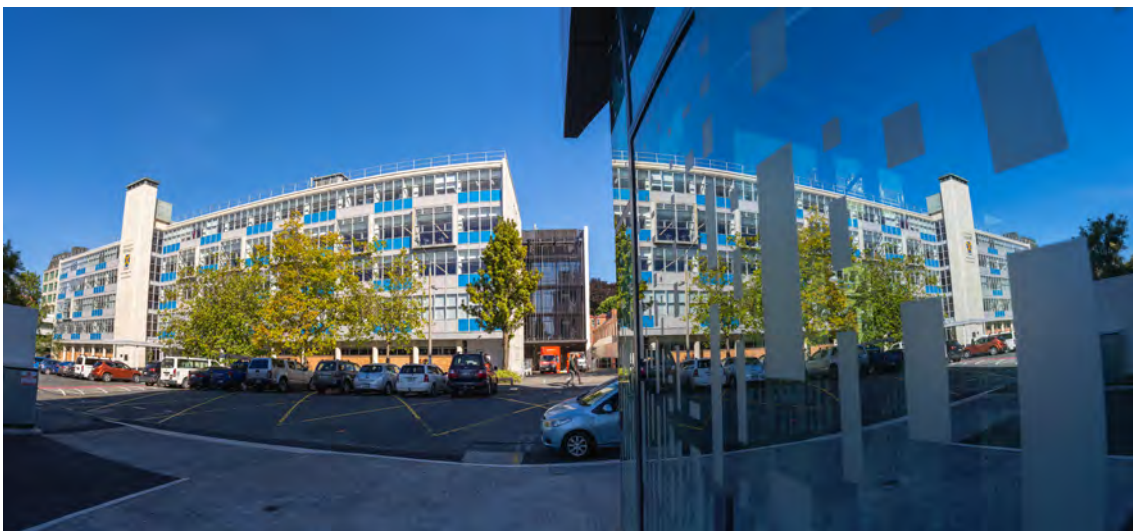
Most microorganisms live within biofilms and in the mouth these biofilms can cause diseases such as dental caries, periodontitis and peri-implantitis. We are interested in how biofilms form on oral surfaces including denture acrylic, implant titanium, and orthodontic appliances – and measuring how effective methods are for removing these biofilms. We have also investigated the use of *Streptococcal salivarius* strains as probiotics to inhibit the growth of oral pathogens and improve oral health in orthodontic patients.

Oral immunology

Trudy Milne

Understanding the role the immune system plays in response to smoking and Type 2 diabetes and the effect on dental pulp vitality and healing will enable clinicians to offer personalised patient management strategies. The role cellular signaling between osteoblasts and periodontal ligament cells and the inflammatory response during orthodontic tooth movement is also under investigation.

Left (L-R): Prof Richard Cannon, Dr Trudy Milne and Dr Erwin Lamping with the MiniG[®]1600 Automated Tissue Bead Mill Homogeniser and Cell Lyser, funded by a grant from the NZDRF.



Oral molecular and immunopathology

Programme Leader: Professor Alison Rich

Deputy Programme Leader: Associate Professor Haizal Hussaini

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 (OSCC) with respect to local and nodal immune regulation, influences on local invasion, angiogenesis and the reaction to endoplasmic stress. Exosomes, membrane bound nanovesicles released by cells into their extracellular environment, contain potential biomarkers of OSCC.

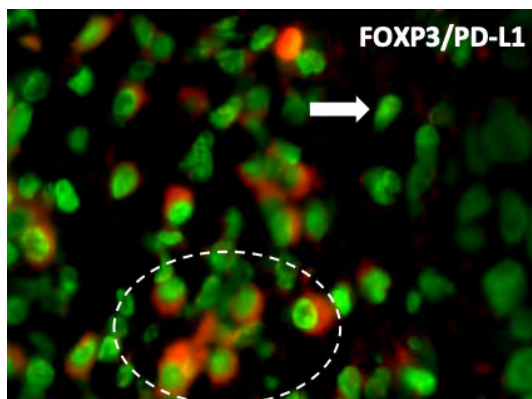
Salivary exosomes are easily accessible and we are investigating their extraction and identification. Our interest in the immune response extends to preclinical assessments of immune modulation in oral lichen planus and in the normal and inflamed pulp and associated with bone grafting materials. Pulpal responses to injury in healthy patients are being compared to responses in people with diabetes using a range of histochemical and immunohistochemical staining, tissue culture and PCR.

Current research projects

Regulation of immune responses

In oral squamous cell carcinoma-regulatory T cells and various cytokines

Oral squamous cell carcinoma develops in an immune cell-rich environment, where inflammatory cells in the tumour microenvironment establish an anti-tumour response by secreting pro-inflammatory cytokines.



Key personnel

Staff

Prof Alison Rich
A/Prof Haizal Hussaini
Prof Paul Cooper
A/Prof Harsha de Silva
Dr Fiona Firth
A/Prof Lara Friedlander
Dr Finn Gilroy
Dr Simon Guan
Lynda Horne
Dr Trudy Milne
Dr Benedict Seo
Qing Sun

Postgraduate students

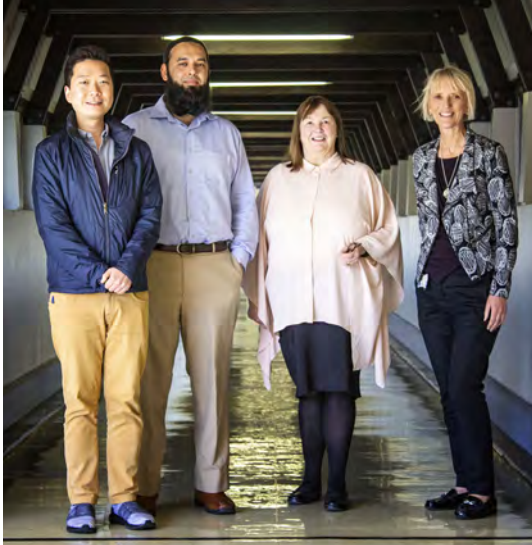
PhD
Shelly Arora
Shaikha Alsamahi
Mohammad Aziz
Aida Ngah
DClinDent
Elizabeth Williams
Nurul Zainuddin
PGDipClinDent (Oral Path)
Kate McElroy

At the same time the cancer cells may induce various mechanisms suppressing the anti-tumour response such as regulating a network of suppressive cytokines and the recruitment of suppressive regulatory T Cells (Tregs). These escape mechanisms are seen at the local tumour site and similar mechanisms may also occur in regional lymph nodes. Gene analysis studies demonstrated active regulation of T cell anergy and tolerance genes in primary OSCC and in metastatic lymph nodes. Regulatory T cells and the transmembrane protein programmed cell death ligand (PD-L)-1 have been implicated in cancer development and progression. Tregs and PD-L1 have been detected in oral squamous cell carcinoma (OSCC) and oral epithelial dysplasia. We have found an increased proportion of PD-L1-expressing Tregs, in addition to a higher proportion of Tregs, in OSCC and potentially malignant oral disorders suggesting that this specific and targeted expression may be an important mechanism in the development of OSCC.

In oral lichen planus

Regulatory T-cells and Th17 cells, which express interleukin (IL)-17, are two Th subsets that may be important in the pathogenesis of oral lichen planus (OLP). Lichen planus is a relatively common chronic dermatologic disease that often affects the oral mucosa. We have previously found that the balance between Tregs and IL-17+ cells is altered in OLP with more FoxP3+ Tregs present in OLP lesions and fewer IL-17+ than non-specific inflammatory (NSI) control cases. In light of the development of IL-17 and IL-23 inhibitors, eg tildrakizumab, and their success in the management of psoriasis, our current project is investigating the role of IL-23 in OLP and measuring the effects of its inhibition.

Left: Photomicrograph showing cells with green single stained nuclei (white arrow) which are FoxP3+ cells. In the white circle are cells double-stained with green (FoxP3+) and red programmed cell death ligand (PD-L)-1. This is from the BDS (Hons) project undertaken by Bomi Aum (2020, 1st class) who found more double-stained FoxP3+PD-L1+ cells in oral squamous cell carcinoma than in non-specifically inflamed tissue.



(L-R) Dr Benedict Seo, Mohammad Aziz, Prof Alison Rich and Prof Merylyn Hibma, of the 'Exosomes in oral cancer' project.

Collaborations

We have international collaborative studies with:

- Oral Cancer Research and Coordinating Centre (OCRCC), University of Malaya and MAHSA University (www.malaysiaoralcancer.org) Malaysia (immune modulation in oral cancer, exosomes in oral cancer)
- Kyungpook National University, Korea, Dr J-K Jung and colleagues (lymphangiogenesis in oral lichen planus)
- University of Sri Jayewardenepura, Sri Lanka, Dr M Weerasekera and colleagues (Joint projects investigating the role of Candida in oral carcinogenesis and vascular endothelial growth factor (VEGF) in oral cancer)
- School of Dentistry, University of Birmingham, UK – with Prof Mike Milward & colleagues investigating the role of phototherapies in the treatment of oral & dental diseases.

Key funding successes

\$192,138. *In vitro* inhibition in oral lichen planus. Sun Pharma Global FZE, 2019. (Alison Rich, Haizal Hussaini, Benedict Seo, Qing Sun)

\$15,000. Investigating biomarkers in exosomes derived from serum and saliva of patients with oral squamous cell carcinoma. New Zealand Dental Research Foundation, 2019. (Alison Rich, Mohammad Aziz, Merylyn Hibma (Pathology, OMS), Haizal Hussaini, Benedict Seo)

\$206,046. Interrogating immunotherapy for dental pulp therapy and management. Health Research Council of NZ, 2020. (Haizal Hussaini, Lara Friedlander, Chuen Yen Hong, Benedict Seo, Qing Sun)

\$15,000. Can immunotherapy be used in inflamed dental pulp tissue to preserve tooth vitality? New Zealand Dental Research Foundation, 2020. (Haizal Hussaini, Shelly Arora, Paul Cooper, Lara Friedlander, Alison Rich, Shakila Rizwan (Pharmacy), Benedict Seo)

\$15,000. Exosomal biomarkers in blood plasma and saliva of oral cancer patients. New Zealand Research Foundation of the Australia & NZ Head and Neck Cancer Society, 2020. (Benedict Seo, Merylyn Hibma (Pathology, OMS), Haizal Hussaini, Benedict Seo, Alison Rich)

\$14,980. Osteoinductive potential of bioactive glass, collagen and lyophilized platelet-rich fibrin scaffold for alveolar cleft osteoplasty. New Zealand Dental Research Foundation, 2020. (Haizal Hussaini Aida Ngah, George Subasinghe Dias (Anatomy), Darryl Tong, Jithendra Ratnayake)

In the dental pulp

Inflamed pulp produces cytokines including interleukins to defend against infection. However, if ILs are produced in excess and for a longer time, this can impede pulp healing leading to death of the tissue. Our particular interest is in the role of IL-23 as its inhibitors have been used successfully to treat chronic inflammatory diseases such as rheumatoid arthritis and psoriasis. We propose that by blocking the IL-23 pathway, inflammation in the pulp can be controlled and tissue healing may be facilitated. This is the subject of our current study, which uses *in vitro* cell culture models.

Exosomes in oral cancer

In the first part of this study we developed methodology to extract and identify exosomes from oral cancer and normal oral keratinocyte cell lines. To extract exosomes from OSCC cells grown in culture ultracentrifugation and an exosome isolation kit (Exoquick TC plus) were used. The extracted vesicles were characterised with a Zetasizer which uses dynamic light scattering to determine the size of particles for the size range 0.6 nm to 6 µm, in addition to using Transmission electron microscopy. Having extracted an adequate number of vesicles and confirmed they were exosomes, we were then able to extract RNA from them.

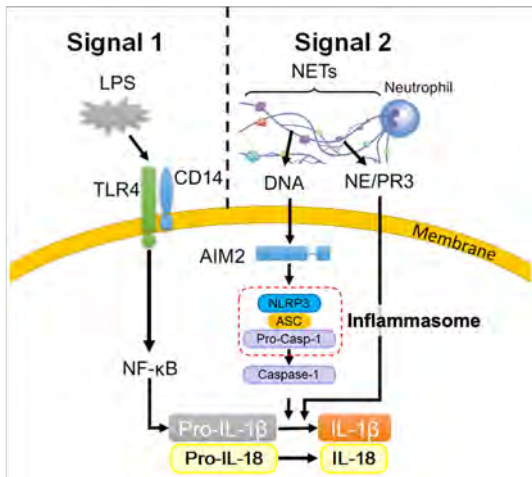
Having completed this baseline cell culture work and refined the techniques to be used going forward, we then moved on to study exosomes in saliva and blood samples from patients with OSCC and healthy controls using samples sourced from ORCCC. The mean expression level of HSPA1A was higher in both OSCC plasma and saliva exosomes compared with controls. Enzyme linked immunosorbent assay (ELISA) results showed a higher expression of FOXM1, DNMT1 and CCNB1 in OSCC plasma exosomes than matched controls.

While more precise exosome isolation methods are still being developed it was shown that saliva exosomes are very important for future research and potential clinical application as they carry genes and proteins in greater quantities when compared with plasma exosomes.

Pulpal response to insult

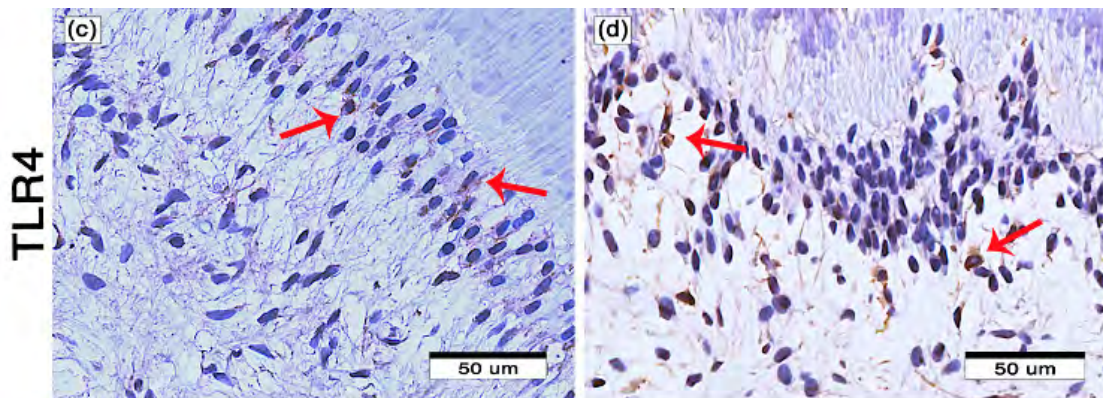
Effects of diabetes on the dental pulp

Histological changes were observed in normal dental pulp of participants with Type 2 diabetes (T2D) compared with healthy controls. T2D resulted in a dental pulp that was less cellular, less vascular, demonstrated thickened blood vessel walls, increased pulp calcification, increased collagen and decreased elastin deposition. More cells/unit area in T2D dental pulps were CD68+ and CD83+, while fewer were FOXP3+ compared with non-T2D samples. The cytokines IL1β, IL6, IL17 and TNF-α were more highly expressed in T2D dental pulps as was the glycation process as evidenced by increased IHC expression of AGE and RAGE.



Above: Dysregulated inflammasome signalling underpins a range of chronic inflammatory diseases. Recent studies from Paul Cooper and colleagues have indicated that this pathway is active in several dental and oral diseases. Signal 1 involves a proinflammatory stimuli such as a bacterial component, e.g. lipopolysaccharide (LPS), and signal 2 is derived from a damage associated molecular pattern (DAMP), e.g. DNA/histones present in neutrophil extracellular traps (NETs). The activated intracellular signalling leads to production of proinflammatory master regulatory cytokines [i.e. interleukins (ILs)] which are processed by caspases from their inactive (pro-) to active state prior to their cellular release.

Below: Photomicrograph showing immunohistochemistry results with anti-toll-like receptor (TLR)-4 in the pulp of normal pulps from patients without diabetes (non-T2D) and with well-controlled Type 2 diabetes. This work was part of the PhD project of Shaikha Alsamahi who found numerous differences in the histology and distribution of immune cells and cytokines in diabetic patients with ostensibly normal healthy pulps, compared to a control group of patients without diabetes.



Endoplasmic reticulum stress and the unfolded protein response

In a neoplastic model-oral squamous cell carcinoma

In this study we are investigating cellular stress pathways known as the unfolded protein response (UPR). These pathways are activated when the endoplasmic reticulum (ER), the protein-producing factory within the cell, is stressed. ER stress modulates UPR pathways, thus partially determining the cellular response to disease.

To investigate UPR in OSCC cell lines derived from normal, dysplastic and malignant oral keratinocytes were subjected to tunicamycin-induced ER stress of varying intensity and chronicity. OSCC cells maintained viability in the presence of ER stress at a significantly greater level compared with normal oral keratinocytes. Furthermore, caspase-3/7 activity and DNA fragmentation, hallmarks of cell death, were suppressed in OSCC.

It was discovered that UPR-induced apoptosis-related factors, most notably DDIT3, were significantly up-regulated in OSCC. Also, the master regulator of lipid metabolism, SREBP1, and CREB3L3, an ER-resident transcription factor closely related to ATF6, which plays an important role in linking ER stress with immune-inflammatory responses, were significantly up-regulated in OSCC.

The identified factors should be further studied and validated *ex vivo* and, eventually, *in vivo*, in view of their potential diagnostic and prognostic role in improving the diagnosis, treatment and management of oral cancer.

Our people

John M. Aarts

**BEd (WeiTec) BHealSc
DipDentTech DipTertTchg (CIT)
MHealSc PGDipCDTech (Otago)**

Senior Lecturer, Department
of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=269>

John Aarts has a strong research platform based in removable prosthodontics, with a focus on biomechanical and patient outcomes. His research is focused on innovative developments in dentistry, and the relationship of the biological, mechanical, functional, and aesthetic elements. This research combines a number of different research disciplines from various areas including; clinical dentistry, biomaterials, physics, and biomimetics in dentistry.

Mr Aarts is a founding member of the Biomimetics Research Group, which investigates the materials and techniques used to mimic life. The Biomimetic Research Group has a strong history of publishing and it is currently involved in several collaborative projects with other researchers from within the University of Otago, international universities, and dental profession. Some of the research he has published has been in the areas of dental materials and clinical treatment techniques. His research relating to pressure generated during dental impression techniques is based on a modelling system that he was instrumental in developing. His research interests fit well with his research supervisor role for the Master of Dentistry (with endorsed in aesthetic dentistry) which has seen him supervise a number students through to completion of their Masters research projects during 2019-20.

Key publications 2019-2020

Aarts, J. M., Choi, J. J. E., Metcalfe, S., & Bennani, V. (2020). Influence of build angulation on the mechanical properties of a direct-metal laser-sintered cobalt-chromium used for removable partial denture frameworks. *Journal of Prosthetic Dentistry*. Advance online publication. doi: 10.1016/j.prosdent.2020.06.014

Chai, S. Y., Bennani, V., Aarts, J. M., Lyons, K., & Das, R. (2020). Stress distribution within the ceramic veneer-tooth system with butt joint and feathered edge incisal preparation designs. *Journal of Esthetic & Restorative Dentistry*. Advance online publication. doi: 10.1111/jerd.12655

Chai, S. Y., Bennani, V., Aarts, J. M., Lyons, K., & Lowe, B. (2020). Effect of incisal preparation design on load-to-failure of ceramic veneers. *Journal of Esthetic & Restorative Dentistry*, 32, 424-432. doi: 10.1111/jerd.12584

Chew, D., Bennani, V., Aarts, J. M., Chandler, N., Gray, A., & Lowe, B. (2019). Bonding strengths to porcelain: An in vitro study of ultrasonic and conventional tooth preparation and etching. *Journal of Conservative Dentistry*, 22(1), 76-81. doi: 10.4103/JCD.JCD_302_18

Full publication listings for each staff member are available via their individual profile on the SJWRI website, linked above.

Lee A. Adam

BEd PhD PGDipArts (Otago)

Dental Education Support
Officer, Faculty of Dentistry
Programme Leader, Dental
Education Research



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2027>

Dr Lee Adam's research concentrates on teaching and learning in higher education. Currently much of her research centres on how Dental Students' learning experiences and outcomes can be enhanced. Dr Adam researches students' experiences in higher education in order to inform how policy and practices can be structured to encourage students' retention and success. Dr Adam also researches how teachers teach in order to identify what works and how. This information can be used to inform best teaching practices in higher education.

Dr Adam is currently working on two social anthropological projects, one investigating the use of physical spaces in education, and the other examining academic integrity; how it is understood and enacted. Other research is in the area of Public Health, investigating health professionals' and patients' experiences of treatments.

Dr Adam supervises research students at both undergraduate and postgraduate level. In 2019 she was awarded the Undergraduate Research Supervisor Award by the Sir John Walsh Research Institute. Current supervision projects include research in Public Health, Oral Health, and social anthropology in healthcare. Her research expertise is as a social anthropologist using qualitative research methods.

Dr Adam is the Director of the Education Research Programme of the Sir John Walsh Research Institute. She has international collaborations with other researchers in higher education and clinical education.

Key publications 2019-2020

Adam, L., Oranje, J., Rich, A.M., & Meldrum, A. (2019). Advancing dental education: feedback processes in the clinical learning environment. *Journal of the Royal Society of New Zealand*, i-first. doi: 10.1080/03036758.2019.1656650

Youhanna, K. M. M., Adam, L., Monk, B., & Loch, C. (2020). Dentistry students' experiences, engagement and perception of biochemistry within the dental curriculum and beyond. *European Journal of Dental Education*. Advance online publication. doi: 10.1111/eje.12607

Holden, A. C. L., Adam, L., & Thomson, W. M. (2020). The relationship between professional and commercial obligations in dentistry: A scoping review. *British Dental Journal*, 228(2), 117-122. doi: 10.1038/s41415-020-1195-5

Boyd, D., Zhang, Y., Smith, L., Adam, L., Foster Page, L., & Thomson, W.M. (2020). Caregivers' understanding of informed consent in a randomized control trial. *Journal of Bioethical Inquiry*, i-first. doi: 10.1007/s11673-020-10085-w

M. Azam Ali

MSc(Jahang) PhD(Sci U
Malaysia)

Associate Professor,
Department of Oral
Rehabilitation (from 2021)



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=3407>

Research into biomaterials involves the precise engineering of novel materials including molecularly engineered biomaterials (i.e. engineered therapeutics), fabrication of biomaterials into medical devices, and technology for biomedical applications (human and animal). In addition to having specific physical, mechanical, and biological properties, biomaterials must be biocompatible with healing and tissue regeneration abilities. The research, therefore, encompasses elements of medicine, material science and tissue engineering.

Innovative materials can drive the creation of new products (e.g. medical devices and technology) in many life-science sectors. This makes it a crucial pillar for engineered therapeutics. Thus, the biomaterials and bioengineering team have sound expertise and experiences in multifaceted applied and pure research and commercial sector partnership. Located within the Centre for Bioengineering and Nanomedicine (Dunedin hub), Faculty of Dentistry, Division of Health Sciences, University of Otago, this research focuses on materials / biomaterials (including dental biomaterials), regenerative medicine, stem cells and their relationships with humans.

Research includes:

- Skin and dermal tissue regeneration
- Bone substitutes and bone ceramics
- Dental biomaterials and bone grafts
- Intervertebral Disc (IVD) replacement
- Heart valve leaflet
- Medical gels
- Drug-eluting medical sutures
- Neural tissue regeneration

Key publications 2019-2020

Ali, A., Gould, M., & Lyons, K. (2020). Development of an organic-inorganic nanostructured hybrid dental biocomposite. *Journal of Nanoscience & Nanotechnology*, 20(8), 5252-5259. doi: 10.1166/jnn.2020.18527

Ali, M. A., Rajabi, M., & Sali, S. S. (2020). Additive manufacturing potential for medical devices and technology. *Current Opinion in Chemical Engineering*, 28, 127-133. doi: 10.1016/j.coche.2020.05.001

Ali, A., & Gould, M. (2020). Untapped potentials of hazardous nanoarchitectural biopolymers. *Journal of Hazardous Materials*. Advance online publication. doi: 10.1016/j.jhazmat.2020.124740

Hewitt, E., Mros, S., McConnell, M., Cabral, J. D., & Ali, A. (2019). Melt-electrowriting with novel milk protein/PCL biomaterials for skin regeneration. *Biomedical Materials*, 14, 055013. doi: 10.1088/1748-605X/ab3344

Abdullah Barazanchi

BDS DClinDent (Otago) MRACDS

Lecturer, Department of Oral
Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2600>

Dr Abdullah Barazanchi's research interests primarily revolve around CAD/CAM, dental materials and their behaviour in the oral cavity. His background as a specialist prosthodontist helps relate research outcomes to clinical aspects of dentistry. He completed his doctoral research in 2018 on the topic of milling and 3D printing of cobalt chromium, presenting on the topic nationally and internationally.

Beyond the dental biomaterials and prosthodontics space, Dr Barazanchi has collaborated with other researchers exploring public health aspects of dentistry and the challenges facing disadvantaged communities.

As a newly appointed lecturer in the Faculty of Dentistry he has enjoyed the opportunity to explore his developing interest in research into dental teaching, including a project evaluating inter-professional experience between pharmacy and dental students, as well as the efficacy of various teaching methods.

Key publications 2019-2020

Barazanchi, A., Smith, S. W., Han, J., Reid, T., & Lyons, K. (2020). Uptake and experience of visual magnification and illumination aids by Otago University Bachelor of Dental Surgery students'. *New Zealand Dental Journal*, 116(4), 129-139.

Barazanchi, A., Li, K. C., Al-Amleh, B., Lyons, K., & Waddell, J. N. (2020). Mechanical properties of laser-sintered 3D-printed cobalt chromium and soft-milled cobalt chromium. *Prosthesis*, 2, 313-320. doi: 10.3390/prosthesis2040028

Barazanchi, A., Li, K. C., Al-Amleh, B., Lyons, K., & Waddell, J. N. (2020). Adhesion of porcelain to three-dimensionally printed and soft milled cobalt chromium. *Journal of Prosthodontic Research*, 64, 120-127. doi: 10.1016/j.jpjor.2019.05.007

Hansrani, V. K., Barazanchi, A., Laverty, D., & Brunton, P. (2019). The use of direct resin composite restorations in the management of localized anterior tooth wear: A clinical update part 1. *Dental Update*, 46(8), 708-720. doi: 10.12968/denu.2019.46.8.708

Deanna Beckett

MPH DPH(Otago)
DipDentTher(Wgtn)

Lecturer, Department of Oral
Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=3024>

Deanna Beckett's principal research interests are in the fields of dental public health, dental health promotion, dental enamel defects and vitamin D deficiency, and dental therapy/oral health therapy education.

Ms Beckett is currently involved with a team investigating the dental consequences of vitamin D deficiency during pregnancy and infancy. In 2017 she completed her Master of Public Health degree investigating economic evaluation and oral health related quality of life measures for children. She won the Otago 'Three Minute Thesis' competition at both Divisional and University levels, going on to win the 'people's choice award' at the national competition in Wellington.

Ms Beckett commenced her PhD in July 2018, and is investigating several aspects of intergenerational oral health using data from the Family Health History study, Dunedin Multidisciplinary Health and Disability Study, and the Next Generation Study.

Key publications 2019-2020

Bērziņš, K., Sutton, J. J., Loch, C., Beckett, D., Wheeler, B. J., Drummond, B. K., Fraser-Miller, S. J., & Gordon, K. C. (2019). Application of low-wavenumber Raman spectroscopy to the analysis of human teeth. *Journal of Raman Spectroscopy*, 50, 1375-1387. doi: 10.1002/jrs.5648

Olson, H., Beckett, D. M., Adam, L. A., Tawse-Smith, A., & Moffat, S. M. (2019). Self-perceived stressors of Bachelor of Oral Health students and implications for student support. *Focus on Health Professional Education*, 20(1), 36-49. doi: 10.11157/fohpe.v20i1.313

Vincent Bennani

Quals DDS(Reims) Docteur de
l'Université de Nice Sophia
Antipolis CertAdvPros(Tufts)
CertAdvImpl(Bordeaux)

Associate Professor,
Department of Oral
Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=359>

Associate Professor Bennani has two research themes linking his clinical interests and his biomaterials expertise. His research interests are focused on innovative techniques in dentistry, on new processing techniques such as 3D printing and Biomimetic in dentistry. "Biomimetic" in dentistry means to copy what is life-like. When restoring teeth, the goal is to return the tooth to its original form and function. This research group, co-founded by Associate Professor Bennani, investigates the biomaterials and techniques used to achieve that goal.

In 2019-2020, the team carried out several research projects within the Faculty, including a clinical research, project producing 6 high-quality publications which advanced knowledge within the profession. During this period Associate Professor Bennani further developed his interdisciplinary research with the Departments of Geology, Chemistry, Human Nutrition and Anatomy at the University of Otago, and internationally with the University of Aristotle, University of Thessaloniki (Greece), Tufts University in Boston (USA), Bordeaux University (France) and with the Department of Aerospace and Aviation, Faculty of Engineering, RMIT University, Melbourne, Australia.

Launched in 2017, the Master of Dentistry with endorsement in aesthetic dentistry (MDent) coordinated by Associate Professor Bennani has published multiple research papers in high impact factor international journals. This work highlights the very best clinical, review and research papers in the field of aesthetic dentistry, the most prestigious publication being selected to be published in the newly established "Advances in Aesthetic Dentistry" special issue of the *Journal of Aesthetic and Restorative Dentistry*.

Key publications 2019-2020

Ramani RS, Bennani V, Aarts JM, Choi JJE, Brunton PA. Patient satisfaction with esthetics, phonetics, and function following implant-supported fixed restorative treatment in the esthetic zone: A systematic review. *J Esthet Restor Dent*. 2020; 1- 11. <https://doi.org/10.1111/jerd.12625>

Aarts JM, Choi JJE, Metcalfe S, Bennani V. Influence of build angulation on the mechanical properties of a direct metal-laser sintered Cobalt-Chrome for partial denture frameworks. *J Prosthet Dent*. 2020 Sep 3; S0022- 3913(20)30423-6. doi: 10.1016/j.prosdent.2020.06.014

Bennani V, Aarts JM, Brunton PA. A randomized controlled clinical trial comparing the use of displacement cords and aluminum chloride paste. *J Esthet Restor Dent*. 2020; 32: 410-415. <https://doi.org/10.1111/jerd.12581>

Chai SY, Bennani V, Aarts JM, Lyons K, Lowe B. Effect of incisal preparation design on load-to-failure of ceramic veneers. *J Esthet Restor Dent*. 2020 Jun;32(4):424-432. doi: 10.1111/jerd.12584

Tanmoy Bhattacharjee

BSc MSc (Mumbai) PhD (HBNI)

Postdoctoral Fellow, Sir John
Walsh Research Institute



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2983>

Dr. Bhattacharjee is a postdoctoral fellow on the Topical Ultrasound Contrast Agent for oral cancer screening project led by Professor Warwick Duncan and supported by funding from Lottery Health research grant. He is also part of the team developing the UltraD3 (Ultrasonic Disease Diagnostic Device) for commercial use and is currently conducting clinical trials with the device. His primary interest is in the application of techniques from physics and chemistry fields to biological problems. He has a keen interest in disease screening and diagnosis using spectroscopy and ultrasound, specifically relating to dental disease and cancer diagnostics.

Dr Bhattacharjee has previously worked on spectroscopy-based delineation of protein dynamics, pathogen detection, and evaluation of photodynamic therapy. He also has an interest in developing software and has written MATLAB and R-based scripts for the analysis of large data sets. He is also interested in adapting ultrasound and spectroscopic tools for forensic applications.

Key publications 2019-2020

Sakane KK, Bhattacharjee T, Fagundes J, et al. Biochemical changes in *Leishmania braziliensis* after photodynamic therapy with methylene blue assessed by the Fourier transform infrared spectroscopy. *Lasers in Medical Science*. 2021 Jun;36(4):821-827. doi: 10.1007/s10103-020-03110-2

Paschotto DR, Pupin B, Bhattacharjee TT, Soares LES. Saliva Preparation Method Exploration for ATR-FTIR Spectroscopy: Towards Bio-fluid Based Disease Diagnosis. *Anal Sci*. 2020 Sep 10;36(9):1059-1064. doi: 10.2116/analsci.20P029

Gomes RNS, Bhattacharjee TT, Carvalho LFCS, Soares LES. Adverse effects of respiratory disease medicaments and tooth brushing on teeth: A scanning electron microscopy, X-ray fluorescence and infrared spectroscopy study. *Microsc Res Tech*. 2019 Sep;82(9):1489-1499. doi: 10.1002/jemt.23314

Monteiro da Silva, R., Pupin, B., Bhattacharjee, T. T., Kulcsar, M. A. V., Uno, M., Chammas, R., & de Azevedo Canevari, R. (2020). ATR-FTIR spectroscopy and CDKN1C gene expression in the prediction of lymph nodes metastases in papillary thyroid carcinoma. *Spectrochimica Acta Part A*, 228, 117693. doi: 10.1016/j.saa.2019.117693

Jonathan M. Broadbent

**BDS PhD
PGDipComDent(Otago)**

Associate Professor,
Department of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=362>

Associate Professor Broadbent conducts research in dental epidemiology and dental public health. His work over the years has had considerable impact in socio-dental epidemiology, health services research and the oral health of older people. His work in the renowned Dunedin Study has contributed to new knowledge on oral conditions, and he successfully completed data collection for the age 45 dental assessments in 2019. His published output includes 89 papers in the peer-reviewed international scientific literature (with 3311 citations), and his Scopus h index is 31. During the 2019-2020 period, he published 16 papers in the peer-reviewed international literature, along with several editorials.

Associate Professor Broadbent is active in supervision of research, and is currently supervising one DCLinDent student (Zeina al Naasan), five PhD students (Angela Benn, Deanna Beckett, Ludwig Jansen van Vuuren, Begoña Ruiz Conrads, Nazahiah Bakri) and two MComDent students (Manisha Narsinh and Tania Stuart).

Since January 2017, he has been the scientific editor of the *New Zealand Dental Journal*, and is now an associate editor for the *Journal of the Royal Society* (since 2019) and *BMC oral health* (since 2020), remains a member of the editorial advisory board for *Community Dentistry and Oral Epidemiology* (since October 2018). He successfully led a special issue of the *Journal of the Royal Society on dental research* (published 2020) and in 2020 he commenced work on a new special issue dedicated to longitudinal research. He is the president of the New Zealand Section of the International Association for Dental Research.

Key publications 2019-2020

Reuben, A., Elliott, M. L., Abraham, W. C., Broadbent, J., Houts, R. M., Ireland, D., Knodt, A. R., Poulton, R., Ramrakha, S., ... Caspi, A., & Moffitt, T. E. (2020). Association of childhood lead exposure with MRI measurements of structural brain integrity in midlife. *JAMA*, 324(19), 1970-1979. doi: 10.1001/jama.2020.19998

Olliver SJ, Broadbent JM, Thomson WM, Farella M. Occlusal Features and TMJ Clicking: A 30-Year Evaluation from a Cohort Study. *Journal of Dental Research*. <https://doi.org/10.1177/0022034520936235> (2020).

Broadbent JM, Murray CM, Schwass DR, Brosnan M, Brunton PA, Lyons KS, Thomson WM. The Dental Amalgam Phasedown in New Zealand: A 20-year Trend. *Operative Dentistry*. doi: 10.2341/19-024-C (2020).

Hong CL, Broadbent JM, Thomson WM, Poulton R. The Dunedin Multidisciplinary Health and Development Study: Oral health findings and their implications. *Journal of the Royal Society of New Zealand*. DOI: 10.1080/03036758.2020.1716816 (2020)

Paul A. Brunton

BChD(Leeds) MSc PhD(Manc)
FDSRCEd FDSRCS FFGDP(UK)

Pro-Vice-Chancellor, Division
of Health Sciences



<https://www.otago.ac.nz/sjwri/people/Profile/?id=1711>

Professor Brunton's research interests are primarily clinical and centred around primary dental care, clinical trials and translational research. Recent projects include modification of restorative filling materials to improve their therapeutic properties and multidisciplinary research with colleagues in diabetes centred around obesity and in needle free local anaesthesia. He has a track record in clinical and translational research having been involved in several multicentre international trials of new technologies, restorative materials and whitening systems primarily working with general dental practitioners. Other ongoing research projects have also included craniofacial research, notably around opening jaw forces and concussive brain injury, and surveys in Oceania focusing on the repair versus replacement of restorations, and dental education in the COVID 19 era.

Professor Brunton collaborates with academics, both in New Zealand, the USA, Europe and the UK. Current collaborations include the Auckland Bioengineering Institute at the University of Auckland in New Zealand, the University of Leeds, Birmingham, University College Cork, Kings College London in the UK, the National University of Athens in Greece and the University of Michigan in the United States of America. He continues to actively collaborate with the Academy of Operative Dentistry and the Faculty of Dental Surgery of the Royal College of Surgeons of England.

In July 2018 Professor Brunton was appointed Pro-Vice-Chancellor of the Division of Health Sciences. He is delighted and honoured to lead the Division which is New Zealand's leading provider of education and research in health and the biomedical sciences.

Key publications 2019-2020

Jum'ah, A. A., Brunton, P. A., Li, K. C., & Waddell, J. N. (2020). Simulated clinical adjustment and intra-oral polishing of two translucent, monolithic zirconia dental ceramics: An in vitro investigation of surface roughness. *Journal of Dentistry*. Advance online publication. doi: 10.1016/j.jdent.2020.103447

Ratnayake, J., Guan, G., Polonowita, A., Li, K. C., Gray, A., Waddell, J. N., Loch, C., & Brunton, P. A. (2020). Can the measurement of jaw-opening forces assist in the diagnosis of temporomandibular disorders? *Journal of Oral & Facial Pain & Headache*, 34(3), 199-205. doi: 10.11607/ofph.2587

Kothari, S., Jum'ah, A. A., Gray, A. R., Lyons, K. M., Yap, M., & Brunton, P. A. (2020). A randomized clinical trial investigating three vital tooth bleaching protocols and associated efficacy, effectiveness and participants' satisfaction. *Journal of Dentistry*, 95, 103322. doi: 10.1016/j.jdent.2020.103322

Kothari, S., Gray, A. R., Lyons, K., Tan, X. W., & Brunton, P. A. (2019). Vital bleaching and oral-health-related quality of life in adults: A systematic review and meta-analysis. *Journal of Dentistry*, 84, 22-29. doi: 10.1016/j.jdent.2019.03.007

Richard D. Cannon

BA PhD(Camb)

Professor, Department of Oral
Sciences

Associate Dean (Research) and
Director SJWRI (to March 2021)



<https://www.otago.ac.nz/sjwri/people/profile/?id=204>

Professor Cannon is a molecular microbiologist who is primarily interested in how microorganisms cause oral diseases and how treatments for patients with these diseases can be improved. His research covers a number of themes, from oral microbial colonization and biofilm formation to the molecular mechanism of drug efflux pumps. A major focus of his research is the drug resistance of human fungal pathogens. He has found that clinically significant fungal drug resistance is due to energy-dependent drug efflux from the cell. His group has developed a versatile protein expression system to study these efflux pumps in *Saccharomyces cerevisiae*. He has extended this study to investigate the anthelmintic resistance of parasitic nematodes that infect livestock. Other research is using on-body wireless probes to monitor facial muscle contractions, investigating the genetic basis of malocclusion, and studying the formation, and removal, of oral biofilms.

Professor Cannon collaborates with several national and international groups to investigate efflux-mediated fungal drug resistance. He is working with Associate Professor Alok Mitra (University of Auckland) on a project to obtain structural insights into *Candida albicans* efflux pump Cdr1. He is also collaborating with Professor Susumu Kajiwara (Tokyo Institute of Technology), Dr Ariya Chindamporn (Chulalongkorn University, Bangkok) and Associate Professor Jacinta Santhanam (National University of Malaysia) to study drug efflux pumps from the important fungi *C. utilis*, *Penicillium marneffei*, and *Fusarium solani* species complex. Professor Cannon has developed a collaboration with several researchers at the Chongqing Medical University Stomatological Hospital, and has been made an Honorary Professor at that institution. His DClinDent candidate Nurul Thiyahuddin graduated in 2019, and his PhD candidate Golnoush Madani in 2020.

Key publications 2019-2020

James, J. E., Lamping, E., Santhanam, J., Milne, T. J., Razak, M. F. A., Zakaria, L., & Cannon, R. D. (2020). A 23 bp cyp51A promoter deletion associated with voriconazole resistance in clinical and environmental isolates of *Neocosmospora keratoplastica*. *Frontiers in Microbiology*, 11, 272. doi: 10.3389/fmicb.2020.00272

Jiang, Q., Mei, L., Zou, Y., Ding, Q., Cannon, R. D., Chen, H., & Li, H. (2019). Genetic polymorphisms in FGFR2 underlie skeletal malocclusion. *Journal of Dental Research*, 98(12), 1340-1347. doi: 10.1177/0022034519872951

Han, T.-L., Cannon, R. D., Gallo, S. M., & Villas-Bôas, S. G. (2019). A metabolomic study of the effect of *Candida albicans* glutamate dehydrogenase deletion on growth and morphogenesis. *npj Biofilms & Microbiomes*, 5, 13. doi: 10.1038/s41522-019-0086-5

Mohd Thiyahuddin, N., Lamping, E., Rich, A. M., & Cannon, R. D. (2019). Yeast species in the oral cavities of older people: A comparison between people living in their own homes and those in rest homes. *Journal of Fungi*, 5(2), 30. doi: 10.3390/jof5020030

Peter R. Cathro

MDS PGCertTertT(Otago)
PhD(Adel)

Senior Lecturer and Head of
Department, Department of
Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2216>

Dr Cathro's research underpins both endodontic (root canal) practice and clinical teaching. His PhD thesis was entitled Proteomic analysis of *Enterococcus faecalis* cell membrane proteins under high alkaline stress conditions. A seminal finding has been the identification of up and down-regulated proteins which now forms the basis of on-going investigations as a PhD project.

A current trend in Endodontics is the use of a more biological approach for the management of roots that have not fully developed due to infection, termed revitalisation. In order to facilitate research in this field, a suitable animal model is required. Dr Cathro proposed the use of sheep as a suitable model and this has formed the basis of a PhD which he co-supervised with three resulting publications.

The bleaching of stained teeth requires the use of toxic materials. Dr Cathro has been a supervisor in two DCLinDent projects investigating the efficacy and safety of bleaching protocols.

Key publications 2019-2020

Ratnayake, J. T., Ross, E. D., Dias, G. J., Shanafelt, K. M., Taylor, S. S., Gould, M. L., Guan, G., & Cathro, P. R. (2020). Preparation, characterisation and in-vitro biocompatibility study of a bone graft developed from waste bovine teeth for bone regeneration. *Materials Today Communications*, 22, 100732. doi: 10.1016/j.mtcomm.2019.100732

Scott, N., Thomson, W. M., & Cathro, P. R. (2020). Traumatic dental injuries among New Zealanders: Findings from a national oral health survey. *Dental Traumatology*, 36, 25-32. doi: 10.1111/edt.12505

Smith, A., Scott, I., Ratnayake, J., Newsham-West, K., & Cathro, P. (2019). An intervention study: Does a cognitive reappraisal technique reduce the perceived stress in fourth-year dental students in New Zealand? *International Journal of Dentistry*, 2019, 5864591. doi: 10.1155/2019/5864591

Loch, C., Ratnayake, J., Veerasamy, A., Cathro, P., Lee, R., & Brunton, P. A. (2019). Direct restorations, endodontics, and bleaching: Materials and techniques used by general dentists of New Zealand. *International Journal of Dentistry*, 2019, 6327171. doi: 10.1155/2019/6327171

Jung Eun (Joanne) Choi

BDentTech(Hons) PhD(Otago)

Senior Lecturer, Department
of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2302>

Dr Choi carries out qualitative and quantitative analysis of the mechanical properties and failure mechanisms of various restorative dental materials (dental resins, metals and ceramics, and CAD-CAM and 3D printed dental materials). She also conducts research into developing new dental restorative materials to improve oral care and real-time measuring systems to evaluate physiologic changes (e.g. intraoral pH and temperature, temperature changes in restorative materials) or biomechanics of the materials in the oral cavity (e.g. pressure from dentures and other oral appliances). For her PhD, Dr Choi developed and validated a wired sensor system to monitor intraoral pH and temperature for long-term periods, the results of which can be used in identifying and evaluating causal factors involved with dental wear. She is part of the Biomechanics and Oral Implantology and Craniofacial Research programmes of the Sir John Walsh Research Institute.

In 2019-2020 Dr Choi was awarded \$79,975 in competitive research funding as Principal Investigator from funding bodies including the NZ Dental Research Foundation, Cure Kids, the Maurice and Phyllis Paykel Trust and the University of Otago. She was awarded the 2019 Joan Chong Award in Dental Materials from the International Association of Dental Research (ANZ Division), the 2019 SJWRI Strategic Research Prize, and the 2020 SJWRI Publication Award and Undergraduate Research Supervisor Award. Her BDentTech(Honours) student Ana Grymak won the IADR Colgate NZ Poster Competition Junior category in 2020, for the study "Polishability of Occlusal Splint Material by Various Manufacturing Methods". She was 3rd placegetter in the Australia/New Zealand Divisional poster competition.

Key publications 2019-2020

Aarts J, Choi JJE, Bennani V, Metcalfe C (2020). The influence of build angulation on the mechanical properties of a direct-metal laser-sintered cobalt-chrome used for removable partial denture frameworks. *Journal of Prosthetic Dentistry*. 20:30423-6. doi: 10.1016/j.prosdent.2020.06.014.

Choi JJE, Uy CE, Ramani RS, Waddell JN (2020). Evaluation of surface roughness, hardness and elastic modulus of nanoparticle containing light-polymerized denture glaze materials. *Journal of the Mechanical Behaviour of Biomedical Materials*. 103:103601

Tykhonova LY, Dias M, Zhou LD, Richardson C, Waddell JN, Choi JJE (2020). The efficacy of a novel temporary crown system marginal seal and structural durability in terms of cyclic loading – a pilot study. *Dental Oral Biology and Craniofacial Research*. 10.31487.

Choi JJE, Uy CE, Plaksina P, Ramani RS, Ganjigatti R, Waddell JN (2019). Bond strength of denture teeth to heat-cured, CAD/CAM and 3D printed denture acrylics. *Journal of Prosthodontics*.

Angela Clark

**BSc(Hons)(C Lancs) MSc(Brad)
PhD(Otago)**

Lecturer, Sir John Walsh
Research Institute



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2348>

Dr Angela Clark was appointed within the SJWRI as a 0.6 FTE confirmation path Lecturer in mid-2019. As an expert forensic anthropologist, Angela's research integrates a bioarchaeological approach to forensic science acknowledging that human beings are both sociocultural and biological beings – te tapu o te Tangata. Her area of research interests are reading the signs of trauma, disease, and stress on the bones and teeth, figuring out how those markers relate to understanding the circumstances around an individuals' death, and how these may also assist formal identification procedures through uncovering who they were during life.

Dr Clark is striving to pursue research excellence within the underdeveloped field of forensic science at the University of Otago, and building strong research collaborations with Crown Forensic Science Provider, ESR. Dr Clark advises pathologists, New Zealand Police, and lawyers when human remains are found, writes expert reports, and provides evidence to courts in New Zealand. In 2019, Angela had the honour to work with Te Runanga o Kaikōura and North Canterbury Transport Infrastructure Recovery (NCTIR), Kaikōura on the repatriation of kōiwi tangata during the rebuilding of SH1. Her professional experience fuels important real-world research questions, including potential biological, psychological, legal, sociocultural and ethical considerations of the presentation of 3D model replicas and digitisations of human skeletal remains (kōiwi tangata) in a criminal courtroom.

In 2020, Dr Clark supervised a dental elective student who examined the History of Forensic Odontology in Aotearoa New Zealand from a mātauranga Māori perspective. This research found that except for some forensic anthropological casework, formal methods for forensic human identification often did not consider tikanga Māori and initiate the process from a kaupapa Māori approach.

Key publications 2019-2020

Clark A.L, Stantist, C, Buckley H.R, and Tayles, N. (2020) Oral health of the prehistoric Rima Rau cave burials, Atiu, Cook Islands. *Journal of the Royal Society of New Zealand*, 50:1, 158-177

Dawn E. Coates

BSc PhD(Otago)

Research Associate Professor,
Sir John Walsh Research
Institute



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=529>

Dr Coates undertakes research into the cellular and molecular mechanisms involved in tissue growth and remodeling in relation to health and disease with a strong focus on regeneration within the oral cavity. She has particular expertise in the processes of osteogenesis and angiogenesis. Stem cell research continues to be a major focus with projects investigating adipose, periosteum and dental pulp stem cells for tissue regeneration. She also conducts research using proteomics to elucidate the key pathways and mechanisms involved in deer antler renewal, as the only model of stem cells driven mammalian organ regeneration. Dr Coates is currently developing her stem cell research platform to encompass the field of 3D bioprinting. Other areas of research include: ER stress and the unfolded protein response, oral squamous cell carcinoma, and development of bone graft materials.

During the period 2019-2020, Dr Coates published 8 papers in peer-reviewed journals and 17 abstracts. She received 5 new grants with \$136k of funding. Postgraduate students received notable awards including the Sir John Walsh Postgraduate Research Publication award, poster/presentation awards, travel awards, and a scholarship to undertake collaborative research in Switzerland. Dr Coates has judged research competitions, served on an expert panel, reviewed theses and leads multiple projects. She also has oversight of the dental tissue culture facility. In 2019 Dr Coates won an EVOS microscope for her research, was an invited speaker at the Queenstown Research week, and delivered talks and seminars within the Dental Faculty. She supervised 2 PhD and 4 DCLinDent completions, and has 4 current PhD students. Key collaborations include: Key State Lab in Changchun, China; University of Malaya; CReaTE research group, University of Otago; University of Queensland Dental Faculty; Prof Cornish, University of Auckland; Prof Bostanci, Karolinska Institutet, Sweden.

Key publications 2019-2020

Dong, Z., Li, C., & Coates, D. (2020). PTN-PTPRZ signalling is involved in deer antler stem cell regulation during tissue regeneration. *Journal of Cellular Physiology*. Advance online publication. doi: 10.1002/jcp.30115.

Dong, Z., Haines, S., & Coates, D. (2020). Proteomic profiling of stem cell tissues during regeneration of deer antler: A model of mammalian organ regeneration. *Journal of Proteome Research*, 19, 1760-1775. doi: 10.1021/acs.jproteome.0c00026.

Cotton, G. C., Gee, C., Jude, A., Duncan, W. J., Abdelmoneim, D., & Coates, D. (2019). Efficacy and safety of alpha lipoic acid-capped silver nanoparticles for oral applications. *RSC Advances*, 9(12), 6973-6985. doi: 10.1039/c9ra00613c.

Dong, Z., Coates, D., Liu, Q., Sun, H., & Li, C. (2019). Quantitative proteomic analysis of deer antler stem cells as a model of mammalian organ regeneration. *Journal of Proteomics*, 195, 98-113. doi: 10.1016/j.jprot.2019.01.004.

Paul R. Cooper

BSc(Hons)(Leeds) PhD
PGCILTHE (Birm) MRSNZ

Professor, Department of
Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/?id=3228>

Professor Cooper's research is broad ranging within the field of oral and dental tissue inflammation and repair. He has over 20 years experience in oral and dental research, he has over 160 full publications and has an h-index of 53. In 2019-2020 his outputs were 20 full publications and one book chapter. He has multiple research collaborations around the world including with colleagues at Universities in Japan, US, Italy, Ireland and the UK. Over 2019-2020 he served as the vice-president, president and past-president of the Pulp Biology and Regeneration Group of the IADR. He is on the Editorial Board of several leading dental journals including Journal of Dental Research, Journal of Periodontal Research, Journal of Endodontics, Journal of Dentistry, Dentistry Journal, Frontiers in Dental Medicine (Section Editor - Endodontics). His particular research interests include:

- *Dentine-pulp complex biology* – study of the molecular changes which occur in the dentine-pulp complex as a result of dental disease & injury, stem cell responses & tissue regeneration, and in responses to dental materials.
- *Oral epithelial and neutrophil responses* – studies in oral inflammatory diseases, including caries and periodontal diseases, in response to oral pathogens, and the potential role of Neutrophil Extracellular Traps and epithelial-mesenchymal transition in disease pathogenesis.
- *Low Level Light/Laser Therapy, photobiomodulation/phototherapy* - exploring the utility of phototherapies in promoting oral and dental tissue health as well as for disinfection.
- *Tribology of tooth cleaning* - industry funded studies have utilised profilometry, gloss analyses, stain models and SEM to investigate mechanistic actions of toothpaste for oral hygiene.

Key publications 2019-2020

Aral, K., Milward, M. R., & Cooper, P. R. (2020). Dysregulation of inflammasomes in human dental pulp cells exposed to *Porphyromonas gingivalis* and *Fusobacterium nucleatum*. *Journal of Endodontics*, 46(9), 1265-1272. doi: 10.1016/j.joen.2020.06.008

Arruda-Vasconcelos, R., Louzada, L. M., Feres, M., Tomson, P. L., Cooper, P. R., & Gomes, B. P. F. A. (2020). Investigation of microbial profile, levels of endotoxin and lipoteichoic acid in teeth with symptomatic irreversible pulpitis: a clinical study. *International Endodontic Journal*. Advance online publication. doi: 10.1111/iej.13402

Holder, M. J., Wright, H. J., Couve, E., Milward, M. R., & Cooper, P. R. (2019). Neutrophil extracellular traps exert potential cytotoxic and proinflammatory effects in the dental pulp. *Journal of Endodontics*, 45(5), 513-520.e3. doi: 10.1016/j.joen.2019.02.014

Koutroulis, A., Kuehne, S. A., Cooper, P. R., & Camilleri, J. (2019). The role of calcium ion release on biocompatibility and antimicrobial properties of hydraulic cements. *Scientific Reports*, 9, 19019. doi: 10.1038/s41598-019-55288-3

Harsha L. De Silva

BDS(S Lanka) MS(Colombo)
DClinDent(Otago) FDSRCS
FFDRCS

Senior Lecturer, Department
of Oral Diagnostic and
Surgical Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=621>

Harsha De Silva's research interests include the clinicopathological behaviour of oral potentially malignant disorders, post-operative outcomes of third molar surgery and contemporary surgical practice trends in general dental practice. Ongoing research collaborations with the University of Sri Jayewardenepura, Sri Lanka focuses on molecular markers in oral carcinogenesis. Progress has been hampered by the disturbances due to the Covid-19 pandemic and will hopefully gather momentum shortly.

His second area of research interest focuses on trends in general dental practice to investigate how general dental practitioners perceive and apply current evidence in the surgical management of dental patients with complex medical needs. This has been further developed to formulate clinical trials to facilitate graduate research for Clinical Doctorate students in the discipline of oral surgery on "improvements of third molar surgery outcomes". This developing research platform has received support from the New Zealand Dental Association Research Foundation.

Key publications 2019-2020

Won J, De Silva HL, De Silva RK, & Colambage S. (2020) An unusual lingual lesion: Actinomycosis of the tongue. *Oral Surgery*, 13(1), 33-36. doi:10.1111/ors.12437

Won J, De Silva HL, & De Silva RK. (2020). A diagnostic dilemma: An unusually large osteochondroma of the mandibular condyle and temporomandibular dysfunction. *Oral Surgery*, 13, 164-167. doi: 10.1111/ors.12471

Edirisinghe, S., Yasewardene, S., Weerasekera, M., Rich, A., De Silva, H., Milne, T., Hussaini, H., ... Gunasinghe, R. (2020). Association of smoking and level of expression of vascular endothelial growth factor (VEGF) gene with oral squamous cell carcinoma. *Journal of Anatomy*, 236(Suppl. 1), P1-CM12. doi: 10.1111/joa.13163

Lamb AW, Hong CL, De Silva HL, Thomson WM, & Broadbent J M. (2019). New Zealand oral health practitioners' cross-infection control practices. *New Zealand Dental Journal*, 115(1), 5-10

Rohana K. De Silva

BDS(S Lanka) FDSRCP(S Glas)
FFDRCSI FDSRCS

Associate Professor,
Department of Oral Diagnostic
and Surgical Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=213>

Associate Professor Rohana Kumara De Silva performs research to identify methods to improve the quality of life in patients with dental and oral health related problems, in particular minimising complications and providing effective pain management following oral surgery procedures. He has also continued a collaboration with collaborators in Sri Lanka which began in 2015 in oral squamous cell carcinoma (OSCC), in order to help surgeons identify the best surgical procedure for the patients of oral squamous cell carcinoma with clinically negative neck nodes, and minimise unnecessary surgical procedures. His group is planning to further investigate by incorporating the data from 2016 to 2020 in Sri Lanka, as well as incorporating data from Malaysia. He recently published a review article in a high impact journal on "Oral epithelial dysplasia: causes, quantification, prognosis and management challenges" which, since oral epithelial dysplasia is a potentially malignant condition, will educate clinicians in the management of these lesions more effectively.

He was principal supervisor for the DClintDent research project of Adelyn Lau, who won the senior category of the 2019 Colgate New Zealand IADR poster competition, and finished first runner-up in the 2019 Australia/New Zealand Divisional competition at the IADR APR meeting in Brisbane, November 2019. This earned her an opportunity and a travel grant to present at the IADR General Session in Washington DC in 2020 (unfortunately cancelled due to COVID). He also co-supervised recent DClintDent graduates Oripa Waqa (completed 2019), Jessica Lee (completed 2020), and current DClintDent in Oral Surgery candidates Jesslyn Praganta and Nigel Tan.

Key publications 2019-2020

Won, J., De Silva, H. L., & De Silva, R. K. (2020). A diagnostic dilemma: An unusually large osteochondroma of the mandibular condyle and temporomandibular dysfunction. *Oral Surgery*, 13, 164-167. doi: 10.1111/ors.12471

Won, J., De Silva, H. L., De Silva, R. K., & Colabage, S. (2020). An unusual lingual lesion: Actinomycosis of the tongue. *Oral Surgery*, 13(1), 33-36. doi: 10.1111/ors.12437

Naung, N. Y., Duncan, W., De Silva, R., & Coates, D. (2019). Localization and characterization of human palatal periosteum stem cells in serum-free, xeno-free medium for clinical use. *European Journal of Oral Sciences*, 127, 99-111. doi: 10.1111/eos.12603

Tilakarathne, W. M., Jayasooriya, P. R., Jayasuriya, N. S., & De Silva, R. K. (2019). Oral epithelial dysplasia: Causes, quantification, prognosis, and management challenges. *Periodontology 2000*, 80(1), 126-147. doi: 10.1111/prd.12259

Warwick J. Duncan

ED MDS PhD(Otago) FRACDS FICD
MRSNZ

Professor, Department of Oral
Sciences
Programme Leader, Clinical
and Translational Research
Director SJWRI (March 2021-)



<https://www.otago.ac.nz/sjwri/people/profile/?id=198>

Professor Duncan's primary research involves Periodontology and Dental Implantology. He conducts clinical testing of dental implants and periodontal treatment approaches in human clinical trials, and is active in preclinical testing using animal models. Professor Duncan's personal expertise includes clinical periodontics, implant surgery, hard-tissue histomorphometry, and leading multi-disciplinary research teams. He leads the regional team for forensic dental victim identification and is active in forensic research. He is also Regimental Colonel of the Royal New Zealand Dental Corps and has published research in military medicine. He has active collaborations with researchers in Switzerland, Malaysia and Korea, and in New Zealand with Callaghan Innovation and the Department of Medicine in the University of Auckland. He has conducted commercial research for many international dental implant companies and producers of maxillofacial grafting products and has active collaborations with several NZ biotech firms. At Otago, Professor Duncan collaborates with the Departments of Anatomy and Chemistry, Christchurch Regenerative Medicine and Tissue Engineering (CReaTE) research group and with his colleagues in the SJWRI. Current research includes:

- Regeneration of bone to support titanium implants with different modified surfaces
- Novel bone grafting materials - biomechanical, *in vitro* and *in vivo* analyses
- Ultrasound diagnosis of periodontal and peri-implant diseases
- Adjunctive chemotherapeutics for treatment of periodontitis and peri-implantitis

Key publications 2019-2020

Jansen van Vuuren, L., Jansen van Vuuren, W. A., Broadbent, J. M., Duncan, W. J., & Waddell, J. N. (2020). Development of a bite force transducer for measuring maximum voluntary bite forces between individual opposing tooth surfaces. *Journal of the Mechanical Behavior of Biomedical Materials*, 109, 103846. doi: 10.1016/j.jmbbm.2020.103846

Sheftel, Y., Ruddiman, F., Schmidlin, P., & Duncan, W. (2020). Biphasic calcium phosphate and polymer-coated bovine bone matrix for sinus grafting in an animal model. *Journal of Biomedical Materials Research Part B*, 108B, 750-759. doi: 10.1002/jbm.b.34429

Cotton, G. C., Gee, C., Jude, A., Duncan, W. J., Abdelmoneim, D., & Coates, D. (2019). Efficacy and safety of alpha lipoic acid-capped silver nanoparticles for oral applications. *RSC Advances*, 9(12), 6973-6985. doi: 10.1039/c9ra00613c

Ma, S., Tawse-Smith, A., Brown, S. D. K., & Duncan, W. (2019). Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 5-year results from a prospective single-arm clinical trial. *Clinical Implant Dentistry & Related Research*, 21, 344-351. doi: 10.1111/cid.12733

Manikandan Ekambaram

**BDS(Dr MGR) MDS PhD(HK)
FDSRCEd MPaedDent(RSCEd)
MRACDS**

Associate Professor,
Department of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/?id=2873>

Associate Professor Ekambaram's research focuses on strategies to manage early enamel caries lesions, enhancement of enamel and dentine adhesion with focus on adhesion to developmentally hypomineralised enamel. He also has a special interest in paediatric oral health which aligns well with his clinical specialty.

Through his research, he has established a niche in experimental strategies for enhancing dentine bond durability, enhancing bonding to developmentally hypomineralised enamel, studying the remineralisation potential of various contemporary remineralisation agents on early enamel carious lesions. Additionally, his ongoing research projects are aiming at other novel experimental strategies to remineralise such lesions.

Since his appointment at the University of Otago Faculty of Dentistry in 2018, Associate Professor Ekambaram has published 28 research articles in peer review journals, and received research funding as either principal or co-investigator of a total value of \$473,868 NZD. He has supervised six postgraduate research theses to completion. His key collaborators include colleagues from Faculty of Dentistry, The University of Hong Kong and the UWA Dental School, The University of Western Australia.

Key publications 2019-2020

Bijle, M. N., Ekambaram, M., Lo, E. C. M., & Yiu, C. K. Y. (2020). Antibacterial and mechanical properties of arginine-containing glass ionomer cements. *Dental Materials*, 36, 1226-1240. doi: 10.1016/j.dental.2020.05.012

Bijle, M. N., Ekambaram, M., Lo, E. C. M., & Yiu, C. K. Y. (2020). The enamel remineralization potential of fluoride varnishes containing arginine. *Journal of Dentistry*, 99, 103411. doi: 10.1016/j.jdent.2020.103411

Uy, E., Ekambaram, M., Lee, G. H. M., & Yiu, C. K. Y. (2019). Remineralization potential of calcium and phosphate-based agents and their effects on bonding of orthodontic brackets. *Journal of Adhesive Dentistry*, 21(3), 219-228. doi: 10.3290/j.jad.a42305

Lam PPY, Sardana D, Ekambaram M, Lee GHM, Yiu CKY. Effectiveness of Pit and Fissure Sealants for Preventing and Arresting Occlusal Caries in Primary Molars: A Systematic Review and Meta-Analysis. *J Evid Based Dent Pract*. 2020 Jun;20(2):101404. doi: 10.1016/j.jebdp.2020.101404

Mauro Farella

**DDS (Naples) Dottore di
Ricerca (Reggio Calabria)
SpecOrthodontics (Naples)
SpecMedStat (Milan)**

Professor, Department of Oral
Sciences

Programme Leader,
Craniofacial Research



<https://www.otago.ac.nz/sjwri/people/profile/?id=530>

Professor Farella's research interests include clinical trials in orthodontics, biomechanics of tooth movements, normal and abnormal craniofacial growth, and translational craniofacial research using animal models. He is a widely recognized expert in jaw function, pathophysiology of orofacial muscles, bruxism, and long-term monitoring of masticatory muscle activity.

In 2018-20, Professor Farella has published 18 full-length articles, and obtained 8 grants from various funding bodies, including Cure Kids, NZDA, Colgate, and NZAO. He has been acting as main supervisor or co-supervisor of two PhD projects, eighteen DCLinDent projects, and one Honours projects.

He is Associated Editor of the Journal Orthodontics and Craniofacial Research and on the Editorial Board of the Journal of Oral Rehabilitation. Professor Farella has served the Management Committee of the New Zealand Consortium for Medical Devices Technologies (MedTech Core). He is also member of the Centre for Bioengineering, of the Neuroscience Programme, of Pain@Otago, and of Genetics Otago.

Key publications 2019-2020

Al-Ani, A. H., Antoun, J. S., Thomson, W. M., Merriman, T. R., & Farella, M. (2020). Common variants of EDA are associated with non-syndromic hypodontia. *Orthodontics & Craniofacial Research*. Advance online publication. doi: 10.1111/ocr.12419

Idris, G., Smith, C., Galland, B., Taylor, R., Robertson, C. J., Bennani, H., & Farella, M. (2020). Relationship between chewing features and body mass index in young adolescents. *Pediatric Obesity*. Advance online publication. doi: 10.1111/jipo.12743

Olliver, S. J., Broadbent, J. M., Thomson, W. M., & Farella, M. (2020). Occlusal features and TMJ clicking: A 30-Year evaluation from a cohort study. *Journal of Dental Research*, 99(11), 1245-1251. doi: 10.1177/0022034520936235

Prasad, S., Paulin, M., Cannon, R. D., Palla, S., & Farella, M. (2019). Smartphone-assisted monitoring of masticatory muscle activity in freely moving individuals. *Clinical Oral Investigations*, 23, 3601-3611. doi: 10.1007/s00784-018-2785-3

Fiona A. Firth

**BDS DCLinDent(Otago) FRACDS
MOrth RCSEd MRACDS(Orth)**

Senior Lecturer, Department
of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/expertise/profile/?id=3250>

Dr Firth's research activities interests lie in the biology of tooth movement and craniofacial biology. She has a particular interest in the use of tissue culture models to investigate orthodontic movement.

Dr Firth was heavily involved with the development of a mechanical strain model for the assessment of periodontal ligament cell endoplasmic reticulum stress in three-dimensional culture. Her ongoing research is continuing to develop and expand tissue culture models for orthodontic tooth movement research.

Dr Firth is interested in a wide variety of other research areas, including clinical research, craniofacial growth and development and clinical genetics. Fiona is overseeing the ongoing collection of genetic samples from orthodontic patients with specific phenotypes such as hypodontia or oligodontia. She was a co-recipient of NZDRF grants in both 2019 and 2020. She was also Principal Investigator on a successful Lottery Health Research equipment grant application in 2020, which awarded \$124,121 towards the purchase of an optical profiler that will allow quantitative measurements of 3D form and surface roughness.

Key publications 2019-2020

Firth, F. A., Milne, T. J., Seo, B., & Farella, M. (2020). An in-vitro mechanical strain three-dimensional culture model: Periodontal ligament cell viability, apoptosis, and endoplasmic reticulum stress response. *European Journal of Oral Sciences*, 128, 120-127. doi: 10.1111/eos.12681

Firth, F. A., Farrar, R., & Farella, M. (2020). Investigating orthodontic tooth movement: Challenges and future directions. *Journal of the Royal Society of New Zealand*, 50(1), 67-79. doi: 10.1080/03036758.2019.1684957

Lee, S., Firth, F. A., Bennani, F., Harding, W., Farella, M., & Antoun, J. S. (2019). Evaluation of objective and subjective treatment outcomes in orthodontic cases treated with extraction of a mandibular incisor. *Angle Orthodontist*, 89(6), 862-867. doi: 10.2319/011018-25.1

Hodgkinson, D., Firth, F. A., & Farella, M. (2019). Effect of incisor retraction on facial aesthetics. *Journal of Orthodontics*, 46(1, Suppl.), 49-53. doi: 10.1177/1465312519840031

Lara T. Friedlander

MDS PhD(Otago) FRACDS

Associate Dean
(Undergraduate Studies)
(from Feb 2021)

Associate Professor,
Department of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/?id=442>

Associate Professor Friedlander is a researcher within the Oral Molecular & Immunopathology, Clinical, and Dental Education Research Groups. Her predominant area of interest is in endodontics encompassing pulpal biology, bioengineering and regeneration, clinical translational research and curriculum development. Associate Professor Friedlander is an active researcher in ARCH (Applied Research through Clinicians Hands), NZ's first dental practice-based research network (PBRN). PBRNs answer clinical questions and deliver research-led findings which are relevant NZ healthcare. She has been a co-investigator of substantial external HRC, UORG and NZDRF Grant funding to advance research in bioengineering and dental pulp regeneration. Dr Friedlander supervises PhD, Clinical Doctorate and BDS students and collaborates with programme leads from international universities to expand these research platforms.

Local collaborators in 2019-20 have included Professor Alison Rich, Dr Trudy Milne, Associate Professor Haizal Hussaini, Dr Shaikhah AlSamahi, Professor Nick Chandler, Ms Lucy Prendergast, Ms Gabrielle Hunt, Dr Finn Gilroy, Dr Payman Hamadani, Ms Shelly Arora, Dr Ben Seo, and Dr Shakila Rizwan (Pharmacy), Associate Professor Ben Daniel (HEDC). Dr Friedlander has numerous international collaborations in pulp biology and education which have resulted in publications. Clinical collaborations have occurred around practice based research with the ARCH network and national collaborations have been made with interested general practitioners who have engaged with New Zealand's first dental PBRN.

Key publications 2019-2020

Rossi-Fedele, G., Damiani, F., Love, R. M., George, R., Parashos, P., Wu, M. C.-Y., Friedlander, L., ... Abbott, P. V. (2020). Revised guidelines for educational requirements for specialisation in endodontics in Australia and New Zealand (July 2020). *Australian Endodontic Journal*. Advance online publication. doi: 10.1111/aej.12431

Coates, D. E., Alansary, M., Friedlander, L., Zanocotti, D. G., & Duncan, W. J. (2020). Dental pulp stem cells in serum-free medium for regenerative medicine. *Journal of the Royal Society of New Zealand*, 50(1), 80-90. doi: 10.1080/03036758.2019.1673447

Friedlander, L. T., Meldrum, A. M., & Lyons, K. (2019). Curriculum development in final year dentistry to enhance competency and professionalism for contemporary general dental practice. *European Journal of Dental Education*, 23, 489-506. doi: 10.1111/eje.12458

Al-Hassiny, A., Hussaini, H., Milne, T., Seo, B., Rich, A. M., & Friedlander, L. T. (2019). Vascularity and angiogenic signaling in the dentine-pulp complex of immature and mature permanent teeth. *European Endodontic Journal*, 4(2), 80-85. doi: 10.14744/ej.2019.26349

Guangzhao (Simon) Guan

BDS MB ChB DClinDent(Otago)

Senior Lecturer, Department
of Oral Diagnostic and
Surgical Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2872>

Dr Simon Guan is currently a senior lecturer and specialist consultant in Oral Medicine at the Faculty of Dentistry, University of Otago, New Zealand. As an oral medicine specialist, he has a special interest in orofacial pain and oromucosal diseases. His primary research interest is in oral cancer, particularly developing prognostic or predictive molecular markers that can be used for assessment of the severity of the disease, prognosis, and therapy. He also has experience in a wide range of temporomandibular joint, oral mucosal diseases and oral medicine education research projects.

Traditional oral cancer diagnosis methods based on scalpel biopsy and histological investigation are invasive, subjective, and time consuming. Cellular mechanical properties have been shown to be novel biomarkers which can discriminate certain cancer cells from their normal counterparts. Atomic force microscopy (AFM) has been used for the non-invasive imaging and mechanical analysis of living cells and, importantly, it requires very few cells for an accurate diagnosis. Dr Guan has commenced a PhD research project to investigate whether AFM could be used to improve early oral cancer diagnosis with a new non-invasive technique.

In the past two years (2019-20), Dr Guan has published 15 research articles in peer review journals and 9 articles in non-peer review journals. He has received three grants from NZDRE, SJWRI DClinDent Research Grant and Health Research Council of New Zealand.

Key publications 2019-2020

Guan, G., Mei, L., Polonowita, A., Hussaini, H., Seo, B., & Rich, A. M. (2020). Malignant transformation in oral lichen planus and lichenoid lesions: A 14-year longitudinal cohort study of 829 patients in New Zealand. *Oral Surgery, Oral Medicine, Oral Pathology & Oral Radiology*. Advance online publication. doi: 10.1016/j.oooo.2020.07.002

Guan, G., Lau, J., Yew, V., J-Y., Qu, W-W., Lam, J., Polonowita, A., & Mei, L. (2020). Referrals by general dental practitioners and medical practitioners to oral medicine specialists in New Zealand: A study to develop protocol guidelines. *Oral Surgery, Oral Medicine, Oral Pathology & Oral Radiology*, 130(1), 43-51. e5. doi: 10.1016/j.oooo.2020.03.050

Mei, L., Lai, Y., Lee, P., Ng, A., Tan, K., Zafar, S., & Guan, G. (2020). Final year dental students' career plans, work patterns, work-life balance and domestic life in New Zealand and Australia. *European Journal of Dental Education*. Advance online publication. doi: 10.1111/eje.12556

Ly, N., Sun, M., Polonowita, A., Mei, L., & Guan, G. (2020). Management of oral medicine emergencies during COVID-19: A study to develop practice guidelines. *Journal of Dental Sciences*. Advance online publication. doi: 10.1016/j.jds.2020.07.016

Nicholas C. K. Heng

BSc(Hons) PhD(Otago)

Senior Lecturer, Department
of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=444>

Dr Nick Heng's research expertise is in the field of molecular microbiology, specialising in the following areas:

- i. Genomics of micro-organisms involving state-of-the-art DNA sequencing technologies and bioinformatics.
- ii. The use of next-generation DNA sequencing technology to investigate changes in the oral microbiota (oral microbial populations) in relation to oral health and disease.
- iii. Characterisation of antimicrobial proteins (bacteriocins) produced by oral bacteria.

The scope of research conducted by Dr Heng's group during 2019-2020 included:

- i. Whole-genome sequencing (and bioinformatics) of bacterial species from marine mammals using the PGM (Ion Torrent) DNA sequencing platform,
- ii. Genomic characterisation of *Streptococcus mitis* in relation to bacteriocin resistance; and
- iii. The analysis of Illumina short-read DNA sequence data to profile bacteriocin-producing oral bacteria.

Within the Faculty of Dentistry, Dr Heng currently has ongoing collaborations with Associate Professor Geoffrey Tompkins (Discipline of Molecular Microbiology), and Dr Carolina Loch (Oral Biology) in relation to the molecular microbiology of dental caries and marine mammal microbiomes. In addition, he has ongoing research collaborations with (i) Professor Amarila Malik (Universitas Indonesia, Indonesia – bacterial genomics), and (ii) Professor John Tagg and Dr John Hale (Blis Technologies – bacteriocins).

Key publications 2019-2020

Reid, P., Heng, N.C.K., Hale, J.D., Krishnan, D., Crane, J., Tagg, J.R., & Milne, T.J. (2020). A TaqMan™-based quantitative PCR screening assay for the probiotic *Streptococcus salivarius* K12 based on the specific detection of its megaplasmid-associated salivaricin B locus. *Journal of Microbiological Methods* 170, 105837. <https://doi.org/10.1016/j.mimet.2020.105837>.

Heng, N.C.K., & Stanton, J.L. (2020). Next-generation DNA sequencing of oral microbes at the Sir John Walsh Research Institute: technologies, tools and achievements. *Journal of the Royal Society of New Zealand* 50, 91-107.

Gonçalves, L.S., de Carvalho, Ferreira, D., Heng, N.C.K., Vidal, F., Dos Santos, H.F., Zanocotti, D.G., Vasconcelos, M., Stambovsky, M., Lawley, B., de Paula Motta Rubini, N., Regina Netto Dos Santos, K., & Seymour G.J. (2019). Oral bacteriome of HIV-1-infected children from Rio de Janeiro - Brazil: Next-generation DNA sequencing analysis. *Journal of Clinical Periodontology* 46, 1192-1204.

Sartono, G., Rizqiyah, I., Asmarinah, A., Heng, N.C.K., & Malik, A. (2019). Three bacteriocin peptides from a lactic acid bacterium *Weissella confusa* MBF8-1 with spermicidal activity. *Current Pharmaceutical Biotechnology* 20, 766-771.

Haizal Mohd Hussaini

BDS MDentSc(Leeds)
PhD(Otago) FDSRCSEd

Associate Professor,
Department of Oral Diagnostic
and Surgical Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2090>

Dr Hussaini is an oral pathologist with research interests in oral cancer. His research focus is in investigating immune responses in the tumour microenvironment of oral squamous cell carcinoma, particularly in the modulation of the immune system by cancer cells in the process of metastasis. This research interest began in 2007 with subsequent completion of his PhD thesis in 2013. Within the Oral Molecular and Immunopathology Research programme, he has expanded his research area to look into immune tolerance in metastatic lymph nodes and early failure of immune cells, angiogenesis in metastatic lymph nodes and myofibroblast in oral cancer progression, and many other oral cancer related research. He has also been involved in translational research work, currently leading an inter-faculty research team (Faculty of Dentistry and School of Pharmacy, University of Otago) undertaking translational research relating to the development of immunotherapy for endodontic practice, a much needed, yet inactive area of research in New Zealand. This project is funded by a 2020 Emerging Researcher Grant from the Health Research Council of New Zealand, worth \$206,000. This research collaboration will be the first in the world investigating the use of immunotherapy for dental therapeutic use.

Over 2019-2020, Dr Hussaini was primary supervisor of one DClinDent student, two full-time PhD students, and a co-supervisor of three others. At international level, Dr Hussaini is the current regional councillor for Australasia for the International Association of Oral Pathologists, which assists international members in various diagnostic and research work. Dr Hussaini has an international research collaboration with the Oral Cancer Research Coordinating Centre, Malaysia, a key research institute and oral cancer tissue bank in South East Asia, and with the University of Trisakti and University of Airlangga, Indonesia.

Key publications 2019-2020

Rich, A. M., Hussaini, H. M., Seo, B., & Zain, R. B. (2020). Understanding the complex microenvironment in oral cancer: The contribution of the Faculty of Dentistry, University of Otago over the last 100 years. *Journal of the Royal Society of New Zealand*, 50(1), 15-34. doi: 10.1080/03036758.2020.1736586

Yakin, M., Seo, B., Hussaini, H., Rich, A., & Hunter, K. (2019). Human papillomavirus and oral and oropharyngeal carcinoma: The essentials. *Australian Dental Journal*, 64, 11-18. doi: 10.1111/adj.12652

Yu, Z., Seo, B., Hussaini, H. M., Meldrum, A. M., & Rich, A. M. (2020). The relative frequency of paediatric oral and maxillofacial pathology in New Zealand: A 10-year review of a national specialist centre. *International Journal of Paediatric Dentistry*, 30, 209-215. doi: 10.1111/ipd.12590

Ludwig Jansen van Vuuren

BTechDent NatDipDentTech
(Technicon Pretoria)
MTechDent(Tshwane UT)

Senior Lecturer, Department
of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=532>

Ludwig Jansen van Vuuren is a Dental Technologist with research experience in micromechanical testing of biomaterials and dental hard tissue, which includes analysis of microstructure, mechanical properties and composition of teeth. He also has experience with a wide range of preparation and analytical techniques for dental studies.

During this period, Mr Jansen van Vuuren's research activities have been focused on his PhD thesis research, titled 'Dental Occlusal Stress', supervised by Professor Neil Waddell, Professor Warwick Duncan and Associate Professor Jonathan Broadbent. This research aims to develop a measurement model to evaluate the stress teeth may experience, to inform best practise in design and material selection for all-ceramic restorations. The testing model development is following a four phase approach;

1. Develop a bite force transducer
2. Record and measure maximum voluntary bite force and average occlusal contact area in healthy human volunteers
3. Develop a device and method to record periodontal ligament compression
4. Establish compression of the periodontal ligament of a sample of healthy human volunteers

The findings of this work will provide dental clinicians and technicians with better advice on the design and reliability of all-ceramic crowns. Further to this, he is testing new dental material properties as well as investigating the structure, microstructure and chemical composition of human and animal teeth, and relating the arrangement of these structures to their mechanical properties.

Key publications 2019-2020

Jansen van Vuuren, L., Broadbent, J. M., Duncan, W. J., & Waddell, J. N. (2020). Maximum voluntary bite force, occlusal contact points and associated stresses on posterior teeth. *Journal of the Royal Society of New Zealand*, 50(1), 132-143. doi: 10.1080/03036758.2019.1691612

Jansen van Vuuren, L., Jansen van Vuuren, W. A., Broadbent, J. M., Duncan, W. J., & Waddell, J. N. (2020). Development of a bite force transducer for measuring maximum voluntary bite forces between individual opposing tooth surfaces. *Journal of the Mechanical Behavior of Biomedical Materials*, 109, 103846. doi: 10.1016/j.jmbm.2020.103846

Prasad, S., Farella, M., Paulin, M., Yao, S., Zhu, Y., & Jansen van Vuuren, L. (2020). Effect of electrode characteristics on electromyographic activity of the masseter muscle. *Journal of Electromyography & Kinesiology*, 102492. Advance online publication. doi: 10.1016/j.jelekin.2020.102492

Jansen van Vuuren, W., Jansen van Vuuren, L., Aarts, J., Hanlin, S., & Waddell, J. N. (2020). Mechanical properties of denture base resin materials: CAD/CAM versus traditional heat-cure. *New Zealand Dental Journal*, 116(3), 81-89.

Wendy-Ann Jansen van Vuuren

**BTechDent NatDipDentTech
(Technicon Pretoria)
MTechDent(Otago)**

Senior Lecturer, Department
of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2039>

Mrs Jansen van Vuuren's research interests are in the field of mechanical properties and strength testing of dental bio-materials, with a focus on dental ceramics and indirect restorative materials. She conducts experimental and observational research investigating the structure and mechanical properties of bio-materials under different functional conditions. She is also interested in the field of Digital Dentistry and the impact thereof on the quality of Dental education. Wendy works with her colleagues in the Bio-materials research group within the Sir John Walsh Research Institute and has been the main event organiser for the Dental Technology Research Conference, held every year in Dunedin.

Key publications 2019-2020

Jansen van Vuuren, W., Jansen van Vuuren, L., Aarts, J., Hanlin, S., & Waddell, J. N. (2020). Mechanical properties of denture base resin materials: CAD/CAM versus traditional heat-cure. *New Zealand Dental Journal*, 116(3), 81-89.

Jansen van Vuuren, L., Jansen van Vuuren, W. A., Broadbent, J. M., Duncan, W. J., & Waddell, J. N. (2020). Development of a bite force transducer for measuring maximum voluntary bite forces between individual opposing tooth surfaces. *Journal of the Mechanical Behavior of Biomedical Materials*, 109, 103846. doi: 10.1016/j.jmbbm.2020.103846

Jansen van Vuuren, W.-A., Al-Amleh, B., Alkharusi, A., Dohan, Z., & Waddell, J. N. (2019). Surface Crack in Flexure versus the Vickers indentation method for calculating fracture toughness in two veneering porcelain. *New Zealand Dental Journal*, 115(4), 151-156.

Gowans, L. J. J., Cameron-Christie, S., Slayton, R. L., Busch, T., Romero-Bustillos, M., Eliason, S., ... Drummond, B. K., Markie, D. M., Jansen van Vuuren, W., Jansen Van Vuuren, L., ... van Staden, I., ... Robertson, S. P., & Butali, A. (2019). Missense pathogenic variants in KIF4A affect dental morphogenesis resulting in X-linked taurodontism, microdontia and dens-invaginatatus. *Frontiers in Genetics*, 10, 800. doi: 10.3389/fgene.2019.00800

Mikhail V. Keniya

**Specialist(Hons) Kandidat
Nauk(Rostov State)**

Senior Research Fellow,
Department of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=533>

Dr Keniya has investigated mechanisms of drug resistance in fungi and the structural biology of Cytochrome P450, based on his expertise in microbiology, protein chemistry, enzymology and molecular genetics.

He is a full-time associate investigator in the project *Readying next-generation antifungals for drug development* (HRC of New Zealand 2019-2021, PI BC Monk) In part, this investigation is based on the discoveries made within the projects "Structure-directed discovery of next-generation antifungals" (HRC of New Zealand, 2016-2019, PI BC Monk) and "Multifunctional azoles: A triple whammy designed to defeat drug resistance" (Marsden Fund, 2011-2015, PI BC Monk). The research involves molecular biological, biochemical studies and structural with emphasis in creating yeast producer and tester strains that express functional drug targets from pathogenic fungi and screening scaffolds for novel azole inhibitors of lanosterol 14 α -demethylase.

Work on co-expressing of drug targets (LDM and CPR) from pathogen *Rhizopus arrhizus* was done in a research collaboration with Assoc. Prof. Michaela Lackner (Medical University of Innsbruck). The other collaborators are MicroCombiChem e.K, Germany and Professor DS Perlin (Rutgers University, USA). This collaboration was funded by a Catalyst Fund Seeding grant: ("Tools for drug discovery from an ancient fungal family" awarded to Assoc. Prof. BC Monk).

Dr Keniya co-supervised two PhD candidates: Yasmeen Nazim Ruma (Project: Development of *Cryptococcus neoformans* and *Candida parapsilosis* CYP51s as drug targets) and Parham Hosseini (Project: Development of *Aspergillus fumigatus* CYP51 isoforms as drug targets). In 2019-2020 he co-authored 2 articles, and 1 conference presentation.

Key publications 2019-2020

Monk, B. C., Sagatova, A. A., Hosseini, P., Ruma, Y. N., Wilson, R. K., & Keniya, M. V. (2020). Fungal lanosterol 14 α -demethylase: A target for next-generation antifungal design [Invited review]. *Biochimica et Biophysica Acta: Proteins & Proteomics*, 1868, 140206. doi: 10.1016/j.bbapap.2019.02.008

Keniya, M. V., & Monk, B. C. (2019). Attenuated apoptotic BAX expression as a xenobiotic reporter in *Saccharomyces cerevisiae*. *FEMS Yeast Research*, 19(5), foz048. doi: 10.1093/femsyr/foz048

Erwin Lamping

DiplIng Dr rer nat(TU Graz)

Senior Research Fellow, Sir John Walsh Research Institute



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2006>

Dr Lamping has expertise in biochemistry, genetics and molecular biology, and is particularly interested in studying the structure and function of eukaryotic membrane proteins associated with multidrug resistance of oral fungal pathogens and human cancer cells. A significant part of his research is dedicated to creating efficient tools for the study of integral membrane proteins and synthetic biology in the eukaryotic model organism, *Saccharomyces cerevisiae*. His interests also include studies of the fungal mycobiome of the oral cavity and how it affects the health and well-being of the elderly and other vulnerable population groups.

Dr Lamping created a suite of plasmids and yeast strains for increased cloning efficiency of membrane protein genes and the detailed characterization of membrane proteins associated with antifungal drug resistance of the major human fungal pathogen, *Candida albicans*, and the recently emerging pathogens *C. auris* and *Fusarium keratoplasticum*. He discovered how efflux pumps become resistant to inhibition by the immunosuppressor, FK506. He discovered three conserved extracellular disulphide bonds critical for folding and trafficking of *C. albicans* Cdr1, a cyp51A promoter deletion associated with voriconazole resistance in clinical *F. keratoplasticum* isolates, and characterized five *C. auris* efflux pumps, with Cdr1 being the major efflux pump responsible for the innate *C. auris* drug resistance phenotype.

During 2019-20, Dr Lamping published three research articles supported by grants from the Marsden Fund and NZDRF. He supervised two PhDs, one DClinDent and a summer student, and was an invited speaker at two international conferences. Collaborators include Professors Lutz Schmitt and Holger Gohlke (Düsseldorf, Germany), Associate Professors Alok Mitra (Auckland, NZ) and Jacinta Santhanam (Kuala Lumpur, Malaysia) and Drs Mihnea Bostina (Otago, NZ), Ariya Chindamporn (Bangkok, Thailand) and Masakazu Niimi (Tokyo, Japan).

Key publications 2019-2020

James, J. E., Lamping, E., Santhanam, J., Milne, T. J., Razak, M. F. A., Zakaria, L., & Cannon, R. D. (2020). A 23 bp cyp51A promoter deletion associated with voriconazole resistance in clinical and environmental isolates of *Neocosmospora keratoplastica*. *Frontiers in Microbiology*, 11, 272. doi: 10.3389/fmicb.2020.00272

Mohd Thiyahuddin, N., Lamping, E., Rich, A. M., & Cannon, R. D. (2019). Yeast species in the oral cavities of older people: A comparison between people living in their own homes and those in rest homes. *Journal of Fungi*, 5(2), 30. doi: 10.3390/jof5020030

Tanabe, K., Bonus, M., Tomiyama, S., Miyoshi, K., Nagi, M., Niimi, K., ... Cannon, R. D., Niimi, M., & Lamping, E. (2019). FK506 resistance of *Saccharomyces cerevisiae* Pdr5 and *Candida albicans* Cdr1 involves mutations in the transmembrane domains and extracellular loops. *Antimicrobial Agents & Chemotherapy*, 63(1), e01146-18. doi: 10.1128/aac.01146-18

Kai Chun Li

BDentTech(Hons) PhD(Otago)

Senior Lecturer, Department of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2374>

Dr Li's research expertise is in the structural and failure analysis of amorphous and crystalline materials. His main research focus has been developing micro-scale mechanical properties test to understand and predict failure in a wide range of synthetic and biological materials. Dr Li is also adept in applying 3D printing, engineering and programming to create new research tools. These skills have allowed experimental and analytical work to be conducted with enhanced reliability and standardisation by minimising operator and experimental errors. Through his research interest, Dr Li has developed ongoing collaborations with researchers within the Sir John Walsh Research Institute, Faculty of Dentistry, researchers within the University of Otago, and the Faculty of Science at the University of Auckland.

During 2019-2020, Dr Li has published 11 full-length journal articles and is a part of two successful external grants from NZDRF and Foundation Nakao. He has been acting as the main or co-supervisor for 1 PhD and Master's project, 6 DClinDent projects and 1 Honours project. He was appointed the topic and review editor for *Frontiers in Oral Health* in 2020 and is an active reviewer for international journals.

In 2020, in collaboration with the Department of Anatomy, he helped develop a standardised tensile test for soft tissue using a 3D printed clamping system and the methodology has been published in *HardwareX* where all resources have been made freely available for other researchers to use. Currently, Dr Li is working with Dr Johann Zwirner to develop a clamp-free tensile testing system designed for measuring the properties of very soft tissues.

Key publications 2019-2020

Porter, G. C., Tompkins, G. R., Schwass, D. R., Li, K. C., Waddell, J. N., & Meledandri, C. J. (2020). Anti-biofilm activity of silver nanoparticle-containing glass ionomer cements. *Dental Materials*, 36, 1096-1107. doi: 10.1016/j.dental.2020.05.001

Zwirner, J., Safavi, S., Scholze, M., Li, K. C., Waddell, J. N., Ondruschka, B., Hammer, N. (2020). Topographical mapping of the mechanical characteristics of the human neurocranium. *Scientific Reports*. doi: 10.1038/s41598-020-80548-y

Scholze, M., Safavi, S., Li, K. C., Ondruschka, B., Werner, M., Zwirner, J., Hammer, N. (2020). Standardized tensile testing of soft tissue using a 3D printed clamping system. *HardwareX*. doi: 10.1016/j.ohx.2020.e00159

Brimble, M. A., Dissanayake, S. S. M., Ekambaram, M., Li, K. C., Harris, P. W. R. (2020). Identification of Key Functional Motifs of Native Amelogenin Protein for Dental Enamel Remineralisation. *Molecules*. doi: 10.3390/molecules25184214

Carolina Loch Santos Da Silva

BSc(FU Santa Catarina) MSc(FU Paraná) PhD(Otago)

Senior Lecturer, Department of Oral Sciences

Programme leader,
Biomaterials, Biomechanics and Oral Implantology



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=2033>

Dr Loch's research focuses on evolutionary oral biology and comparative dental morphology, mainly using animal teeth to gather a wide range of information about the biology, evolution and interactions with the environment of fossil and recent species. Comparative dental anatomy and ultrastructure are some of the key components of her research. She is also interested in clinically applied biomaterials research, dental education development and health services research.

During 2019-2020, Dr Loch published 18 peer-reviewed papers in international journals, and was involved in research grants including two Colgate SJWRI Research Grants (one as PI and one as AI) and one MedTech CoRE grant as AI, totalling \$125K. She has co-supervised one PhD student to completion and attracted one postdoctoral fellow to her research programme. She has ongoing multidisciplinary collaborations with researchers at Otago (Departments of Geology, Chemistry, Anatomy, Zoology, Marine Sciences), other NZ Universities (Massey University, University of Auckland, Auckland University of Technology) and overseas institutions (USA: Smithsonian Institution USA, Hampden-Sydney College; UK: University of Kent, University of Leicester; Australia: University of Adelaide, South Australian Museum; Chile: Museo de Historia Natural de Santiago; Argentina: Centro Nacional Patagonico; Brazil: Universidade Federal de Santa Catarina). Dr Loch received a University of Otago Early Career Award for Distinction in Research in 2019, and a International Association of Dental Research Centennial Emerging Researcher Award in 2020.

Key publications 2019-2020

Loch, C., Vaz Viegas, S., Waddell, J. N., Kemper, C., Cook, R. B., & Werth, A. J. (2020). Structure and properties of baleen in the Southern right (*Eubalaena australis*) and Pygmy right whales (*Caperea marginata*). *Journal of the Mechanical Behavior of Biomedical Materials*, 110, 103939. doi: 10.1016/j.jmbbm.2020.103939

Loch, C., Kuan, I. B. J., Elsalem, L., Schwass, D., Brunton, P. A., & Jum'ah, A. A. (2020). COVID-19 and dental clinical practice: Students and clinical staff perceptions of health risks and educational impact. *Journal of Dental Education*. Advance online publication. doi: 10.1002/jdd.12402

Werth, A. J., Loch, C., & Fordyce, R. E. (2020). Enamel microstructure in Cetacea: A case study in evolutionary loss of complexity. *Journal of Mammalian Evolution*, 27, 789-805. doi: 10.1007/s10914-019-09484-7

Loch, C., Buono, M. R., Kaithoff, D. C., Mörs, T., & Fernández, M. S. (2019). Enamel microstructure in Eocene cetaceans from Antarctica (Archaeoceti and Mysticeti). *Journal of Mammalian Evolution*, 27, 289-298. doi: 10.1007/s10914-018-09456-3

Karl M. Lyons

**MDS PhD(Otago)
CertMaxillofacialPros(UCLA)
FRACDS**

Acting Dean (Apr 2019 - Jan 2020), Associate Dean (Clinical) and Director of Clinical Education, Faculty of Dentistry

Professor, Department of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=200>

Professor Lyons has carried out clinical and in vitro research in dental tooth whitening, dental implants, microbial adhesion to dental obturator prostheses as well as ceramics and other dental materials, including CAD/CAM and 3D printing. His research has included collaborative research with postgraduate students including DClintDent and PhD students.

Professor Lyons is undertaking collaborative work with Associate Professor Azam Ali from the Centre for Bioengineering and Nanomedicine, Department of Oral Rehabilitation, that has included the award of an HRC Explorer Grant for a project titled "No Drill No Fill" and a University of Otago Research Grant. He is also carrying out work on dental tourism with Professor Brent Lovelock from the Department of Tourism on a project that received support from a University of Otago Research Grant and which resulted in a publication in *Tourism Management*, with Professor John Beumer from UCLA that includes co-authoring a number of book chapters for a second edition oral implant textbook and an upcoming third edition of the same textbook, that is also including contributions from a number of colleagues in the Faculty of Dentistry.

Professor Lyons has co-supervised two DClintDent completions in 2019-20 and is currently supervising four DClintDent projects and one PhD project. He is also currently President of the Australia and New Zealand Division of the International Association for Dental Research, and is also a member of Council for IADR.

Key publications 2019-2020

Kothari, S.P., Jum'ah, A.A., Gray, A. R., Lyons, K.M., Yap, M., and Brunton, P.A. (2020). A randomized clinical trial investigating three vital tooth bleaching protocols and associated efficacy, effectiveness and participants' satisfaction. *Journal of Dentistry*. doi: <https://doi.org/10.1016/j.jdent.2020.103322>

Barazanchi, A., Li, K.C., Waddell, J.N., Al-Amleh, B., and Lyons, K.M. (2020). Adhesion of porcelain to three-dimensionally printed and soft milled cobalt chromium. *Journal of Prosthodontic Research*. 64(2): 120-127

Ali, A., Gould, M., and Lyons, K. (2020). Development of an organic-inorganic nanostructured hybrid dental biocomposite. *Journal of Nanoscience and Nanotechnology*. 20(8): 5252-5259. doi: <https://doi.org/10.1166/jnn.2020.18527>

Chen, M., Lyons, K., Tawse-Smith, A., Ma, S. (2019). Resonance frequency analysis in assessing implant stability: a retrospective analysis. *International Journal of Prosthodontics*. 32(4):317-326. doi: 10.11607/ijp.6057

Sunyoung Ma

**BDS DClinDent PhD (Otago)
FPFA**

Associate Dean (Postgraduate
Studies)

Associate Professor,
Department of Oral
Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=596>

Dr Ma's research interests include conducting clinical trials using different treatment modalities involving dental implants for patients, particularly of older age, that need to replace their missing teeth. This work has looked at both the biological success of the treatment as well as any long-term clinical maintenance issues and complications for both clinicians and patients including any treatment impact on oral health related quality of life for these patients. Dr Ma is also primary investigator on research evaluating the clinical stability of zirconia abutments in association with low-temperature degradation and wear at the titanium-zirconia implant-abutment interfaces.

With ongoing national and international collaborations in addition to previous and ongoing research funding support, Dr Ma continues to produce research outputs in the areas of oral implantology and gerodontology. Across 2019-20, Dr Ma published 6 articles in peer-reviewed international journals and gave 5 conference abstracts/presentations at national/international research meetings). Dr Ma has had multiple international invitations to present her research in these areas and is currently working on several projects related to different technologies used to rehabilitate patients with missing teeth. She has supervised multiple undergraduate and postgraduate research projects and is actively involved as a reviewer for multiple international peer reviewed journals and grant applications.

Key publications 2019-2020

Cheah C, Lim C, Ma S (2020). The dentist will scan you now: the next generation of digital-savvy graduates. *European Journal of Dental Education*. doi:10.1111/eje.12596.

Choi JJE, Zwirner J, Ramani RS, Ma S, Hussaini HM, Waddell JN, Hammer N. Mechanical properties of human oral mucosa tissues are site dependent: a combined biomechanical, histological and ultrastructural approach. *Clinical and Experimental Dental Research*. doi:10.1002/cre2.305.

Al Lawati I, Al Maskari H, Ma S (2019). I am a lefty in a right-handed world: qualitative analysis of clinical learning experience of left-handed undergraduate dental students. *European Journal of Dental Education*. doi:10.1111/eje.12432.

Ma S, Tawse-Smith A, Brown SDK, Duncan W (2019). Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 5-year results from a prospective single-arm clinical trial. *Clinical Implant Dentistry and Related Research*. 21:344-351.

May Lei Mei

MDS(Nanjing) PhD(HK)

Senior Lecturer, Department
of Oral Rehabilitation



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=3192>

Dr May Mei's research focuses on two themes, the use of silver diamine fluoride in caries management and developing bioactive materials for caries management.

In the past two years (2019-20), Dr May has published 19 research articles in peer review journals. Across this period, she received one external grants from NZDRF as principal investigator, and three external grants as co-investigator, with a total amount of approximately 408,000 NZD. She supervised two PhD students to successful and timely completion during this period. My key collaborators are colleagues from Faculty of Dentistry, the University of Hong Kong.

In 2020, Dr Mei was a recipient of the International Association for Dental Research Centennial Emerging Leaders Award, which was to be presented at the 98th IADR General Meeting, Washington DC, USA, 2020 (unfortunately the meeting was cancelled due to COVID-19 Pandemic outbreak). Dr Mei was also awarded the 2019 Basil G. Bibby Young Investigator Award from the IADR Cariology research group at the 97th IADR General Meeting, Vancouver, Canada, and the Oral Biology Award of the Australia/New Zealand Division of the IADR in 2020.

Key publications 2019-2020

Mei ML, Yan Z, Duangthip D, Niu JY, Yu OY, You M, Lo ECM, Chu CH. Effect of silver diamine fluoride on plaque microbiome in children. *J Dent*. 2020 Nov;102:103479. doi: 10.1016/j.jdent.2020.103479

Yin, I X., Zhang, J., Zhao, I. S., Mei, M. L., Li, Q., & Chu, C. H. (2020). The antibacterial mechanism of silver nanoparticles and its application in dentistry. *International Journal of Nanomedicine*, 15, 2555-2562. doi: 10.2147/IJN.S246764

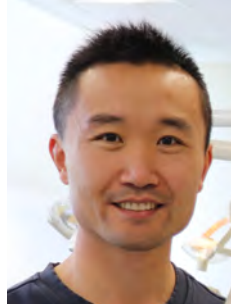
Yin IX, Yu OY, Zhao IS, Mei ML, Li QL, Tang J, Chu CH. Developing biocompatible silver nanoparticles using epigallocatechin gallate for dental use. *Arch Oral Biol*. 2019 Jun;102:106-112. doi: 10.1016/j.archoralbio.2019.03.022

Dai, L. L., Mei, M. L., Chu, C. H., & Lo, E. C. M. (2019). Mechanisms of bioactive glass on caries management: A review. *Materials*, 12(24), 4183. doi: 10.3390/ma12244183

Peter Li Mei

BDS MDS DDS(Sichuan)
PhD(Groningen)

Associate Professor,
Department of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=1262>

Associate Professor Mei's research expertise is in biofilms, microbiomics, antimicrobial strategies, craniofacial biology, orthodontics, caries, and halitosis. His recent research activities are mainly focused on the mechanism and prevention of bacterial adhesion and biofilm formation on dental materials.

He has measured the adhesion forces between living bacteria and orthodontic materials using atomic force microscopy at a nano-level, and decoupled the bacterial adhesion forces into specific and non-specific forces. In addition, he has investigated measures for preventing biofilm formation using quaternary ammonium compounds. He developed a novel contact-killing surface by incorporating quaternary ammonium compounds into composite resin and studied its efficacy of killing the adhered bacteria and its bio-safety for human cells. He has investigated clinical methods for enhancing oral hygiene in patients wearing fixed orthodontic appliances.

His other interests include randomized controlled trials (RCT), evidence-based dentistry, systematic reviews and meta-analysis, dental education, and the 'business' of dentistry.

Key publications 2019-2020

Guan, G., Won, J., Mei, L., & Polonowita, A. (2020). Extensive adipose replacement of the parotid glands: An unusual presentation of sialadenosis: A case report and literature review. *Oral Surgery*, 13, 41-47. doi: 10.1111/ors.12442

Jiang, Y., Tang, T., Mei, L., & Li, H. (2020). COVID-19 affected patients' utilization of dental care service [Short communication]. *Oral Diseases*. Advance online publication. doi: 10.1111/odi.13568

Ly, N., Sun, M., Polonowita, A., Mei, L., & Guan, G. (2020). Management of oral medicine emergencies during COVID-19: A study to develop practice guidelines. *Journal of Dental Sciences*. Advance online publication. doi: 10.1016/j.jds.2020.07.016

Jiang, Q., Yang, R., Li, M., Ma, Q., Wu, T., & Li, H. (2019). A novel approach of torque control for maxillary displaced incisors. *American Journal of Orthodontics & Dentofacial Orthopedics*, 155(6), 860-870. doi: 10.1016/j.ajodo.2017.11.045

Trudy J. Milne

PhD(Qld UT) NZCS

Senior Research Fellow, Sir
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Dr Milne's research continues in a number of oral health areas including endodontics, periodontology and orthodontics. Investigation of periodontopathogens and their association with angiogenic and inflammatory gene expression in dental pulp continues with the hope of improved dental treatment outcomes for smokers and patients with Type 2 diabetes. A study of a grafting material in a bone-healing sheep model and the genes associated with osteogenesis aims to advance the development of implant options for dental patients. Dr Milne is also investigating the role osteoblasts and periodontal ligament cells play in the immune response and bone remodelling during orthodontic tooth movement.

During 2019-2020 Dr Milne co-supervised six students on a number of collaborative projects, including DCLinDent (Orthodontics) candidate Marguerite Paterson looking at the effect of IL-17 and IL-6 on osteoblasts and periodontal ligament cells, with Dr Fiona Firth and Professor Mauro Farella of the Craniofacial Research programme; Shaikha Alsamahi (PhD) with Professor Alison Rich, Dr Lara Friedlander and Dr Haizal Hussaini of the Oral Molecular and Immunopathology programme; and Zhen Dong (PhD) and DCLinDent (Periodontology) graduates Anumala Ram, Tatiana Tkatchenko and Saeideh Nobakht, whose research was co-supervised with Clinical and Translational Research programme members Professor Warwick Duncan and Associate Professor Dawn Coates.

Dr Milne has been supported with grants from the New Zealand Dental Research Fund. Following a number of successful collaborations Dr Milne has published six co-authored peer-reviewed articles in 2019-2020.

Key publications 2019-2020

Reid, P., Heng, N. C. K., Hale, J. D., Krishnan, D., Crane, J., Tagg, J. R., & Milne, T. J. (2020). A TaqMan™-based quantitative PCR screening assay for the probiotic *Streptococcus salivarius* K12 based on the specific detection of its megaplasmid-associated salivaricin B locus. *Journal of Microbiological Methods*, 170, 105837.

Perry, S. E., Huckabee, M.-L., Tompkins, G., & Milne, T. J. (2020). The association between oral bacteria, the cough reflex and pneumonia in patients with acute stroke and suspected dysphagia. *Journal of Oral Rehabilitation*, 47, 386-394. doi: 10.1111/joor.12903

Firth, F. A., Milne, T. J., Seo, B., & Farella, M. (2020). An in-vitro mechanical strain three-dimensional culture model: Periodontal ligament cell viability, apoptosis, and endoplasmic reticulum stress response. *European Journal of Oral Sciences*, 128, 120-127. doi: 10.1111/eos.12681

James, J. E., Lamping, E., Santhanam, J., Milne, T. J., Razak, M. F. A., Zakaria, L., & Cannon, R. D. (2020). A 23 bp cyp51A promoter deletion associated with voriconazole resistance in clinical and environmental isolates of *Neocosmospora keratoplastica*. *Frontiers in Microbiology*, 11, 272. doi: 10.3389/fmicb.2020.00272

Susan M. Moffat

BA PhD DPH(Otago)
CertDentTherp(Wgtn)

Senior Lecturer, Department
of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=262>

Susan Moffat's principal research interests are in the fields of dental public health, dental therapy history, and dental therapy/oral health therapy education and workforce.

Susan has been one of the pioneers in dental/oral health therapy research, and her work has laid some of the groundwork for an ongoing research foundation for both the dental therapy and oral health therapy disciplines.

Susan has collaborated with other Faculty staff on dental public health, dental workforce/education, and clinical research projects, and has collaborated internationally with researchers in Australia, the United States, and other countries, particularly on projects requiring knowledge of dental therapy or oral health therapy practice in New Zealand.

Susan's PhD research combined both workforce and dental public health research, centering on the development of the SDS within New Zealand's social, economic and political history.

In 2019, Susan was awarded The New Zealand Dental and Oral Health Therapists Association/the New Zealand Dental Hygienists' Association's Hon. Dame Annette King Award for Leadership and Excellence in Oral Health.

Key publications 2019-2020

Moffat, S. M. (2020). 'A bold experiment': The New Zealand School Dental Service and the Colombo Plan. *Journal of the Royal Society of New Zealand*, 50(1), 47-66. doi: 10.1080/03036758.2020.1713182

Carrington, S. D., Treharne, G. J., & Moffat, S. M. (2020). Job satisfaction and career prospects of Oral Health Therapists in Aotearoa/New Zealand: A research update and call for further research in light of the COVID-19 pandemic. *The Australian & New Zealand Journal of Dental & Oral Health Therapy*, 8(2), 8-13.

Olson, H., Beckett, D. M., Adam, L. A., Tawse-Smith, A., & Moffat, S. M. (2019). Self-perceived stressors of Bachelor of Oral Health students and implications for student support. *Focus on Health Professional Education*, 20(1), 36-49. doi: 10.11157/fohpe.v20i1.313

Moffat, S., Meldrum, A., Aitken, W., & Coates, D. (2019). 'Smile for the nurse': Oral health advice at infant immunisation. *Journal of Dental Research*, 98(Spec Iss A), 0932

Brian C. Monk

BSc(Hons)(Well) PhD(Monash)

Associate Professor,
Department of Oral Sciences
Programme Leader, Molecular
Microbiology Research
Director, Molecular Biosciences
Laboratory



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Associate Professor Monk's primary research interests are in drug discovery and drug resistance. With support from ongoing Health Research Council of NZ (HRC) funding, he has developed a unique yeast-based protein expression platform that provides basic knowledge and tools to combat infectious disease through phenotype-based and structure-directed drug discovery, especially where drug resistance poses an important threat. Most of the targets he has prototyped for antimicrobial discovery are membrane proteins, including drug efflux pumps, fungal P-type ATPases and cytochrome P450 enzymes, expressed in yeast. Soluble targets expressed in bacteria have included lumazine synthase from *Candida glabrata* and DNA gyrase from *Thermus thermophilus*. Initially supported by a grant from the Marsden Fund and a collaboration with the NIH (USA) Roadmap Membrane Protein Expression Center, he obtained high resolution X-ray crystal structures for yeast lanosterol 14 α -demethylase +/- substrates and azole drugs. These first structures for a full-length membrane spanning cytochrome P450 have led to libraries of target-ligand complexes (>30 structures), with major impact on antifungal discovery, and on drug discovery and development in general. This has attracted funding of three 3-year project grants from 2013-2022 totalling \$3.5 million. The yeast expression system Monk patented is a key component of his research platform and is employed widely to express membrane proteins from sources including pathogenic fungi, plants, nematodes and humans. Monk's research also included defining and/or mitigating echinocandin (a new antifungal class) resistance, expressing fungal, human and parasite drug targets for drug screening and combating dental pathologies. Monk's research group provides an environment and network for undergraduate and graduate researchers to gain experience with membrane proteins, including drug targets.

Key publications 2019-2020

Monk, B. C., Sagatova, A. A., Hosseini, P., Ruma, Y. N., Wilson, R. K., & Keniya, M. V. (2020). Fungal lanosterol 14 α -demethylase: A target for next-generation antifungal design [Invited review]. *Biochimica et Biophysica Acta: Proteins & Proteomics*, 1868, 140206. doi: 10.1016/j.bbapap.2019.02.008

Youhanna, K. M. M., Adam, L., Monk, B., & Loch, C. (2020). Dentistry students' experiences, engagement and perception of biochemistry within the dental curriculum and beyond. *European Journal of Dental Education*. Advance online publication. doi: 10.1111/eje.12607

Monk, B. C., Keniya, M. V., Sabherwal, M., Wilson, R. K., Graham, D. O., Hassan, H. F., Chen, D., & Tyndall, J. D. A. (2019). Azole resistance reduces susceptibility to the tetrazole antifungal VT-1161. *Antimicrobial Agents & Chemotherapy*, 63(1), e02114-18. doi: 10.1128/AAC.02114-18

Keniya, M. V., & Monk, B. C. (2019). Attenuated apoptotic BAX expression as a xenobiotic reporter in *Saccharomyces cerevisiae*. *FEMS Yeast Research*, 19(5), foz048. doi: 10.1093/femsyr/foz048

Hanna Olson

Tandhygienistexamen
(Gothenburg) MHSK(Kristianstad)

Lecturer, Department of Oral
Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=1768>

Hanna Olson is a Lecturer, Deputy Convenor of the BOH Programme and Programme Interprofessional (IPE) Convenor within the Faculty of Dentistry. She contributes to the advancement of teaching and learning activities in particular for the group of oral health students. Her research highlights a learner-centred approach including facilitation of IPE activities across health professional educational programmes within the University as well as coordination of health promotion projects in the community.

Key publications 2019-2020

Abdullah, R., Olson, H., Todd, G., & Tong, D. (2020). Oral health perceptions, attitudes and knowledge among intensive care nursing staff in a tertiary hospital. *Australian & New Zealand Journal of Dental & Oral Health Therapy*, 8(1), 15-18.

Olson, H., Ronayne, C., Anakin, M., Meldrum, A., & Rich, A. (2020). Working together in clinical pathology: An interprofessional education initiative for dentistry, oral health, and medical laboratory science teachers and students [Version 2]. *MedEdPublish*. Advance online publication. doi: 10.15694/mep.2020.000009.2

Olson, H., Meldrum, A., & Smith, L. (2019). New Zealand and Swedish dental hygienists' perceptions of their work and job satisfaction. *Australian & New Zealand Journal of Dental & Oral Health Therapy*, 7(3), 24-28.

Olson, H., Beckett, D. M., Adam, L. A., Tawse-Smith, A., & Moffat, S. M. (2019). Self-perceived stressors of Bachelor of Oral Health students and implications for student support. *Focus on Health Professional Education*, 20(1), 36-49. doi: 10.11157/fohpe.v20i1.313

Jithendra T. B. Ratnayake

BE(Hons)(Sheff) PhD(Otago)

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Dr Ratnayake's main research interest is on developing novel biomaterials from waste materials, in particular in adding value to waste products from New Zealand's annual \$NZ6 billion red meat export industry. He has significant expertise in characterizing biomaterials using various analytical techniques and evaluating the biocompatibility using *in vitro* and *in vivo* techniques. He is also interested in developing medical devices, dental materials, management of temporomandibular disorders, endodontic applications and treatments, restorative dentistry and dental education. His current research is focused on developing novel bone grafts from bovine and ovine bone for bone regeneration applications; developing bio-composite materials for biomedical applications (e.g. wound dressing, cleft lip palate repair, orthopaedics); development and testing of a bovine-derived nanohydroxyapatite toothpaste for caries management; development of a novel hydroxyapatite-based vital pulp therapy material synthesized from waste bovine bone; and a novel approach for the diagnosis and monitoring of temporomandibular disorders.

Dr Ratnayake has collaborations with Colgate Palmolive Ltd, ANZCO Foods and Intuitive 8 Healthcare LLC (India), and with universities in the UK, Australia, Saudi Arabia, China, Sri Lanka and the USA. Locally, collaborators include Professor Paul Brunton (PVC Health Sciences), Professor George Dias (Department of Anatomy) and Professor Paul Cooper of the SJWRI. His PhD "Developing a novel bone graft from NZ sourced bovine bone", for which a provisional patent was filed, was completed in 2017. His current postgraduate supervision includes Jeffrey Huang, Minati Chaudhury, Zohaib Khurshid, Aida Nghah (all PhD) and David Yong (DClinDent).

Key publications 2019-2020

Ramesh, N., Ratnayake, J. T. B., Moratti, S. C., & Dias, G. J. (2020). Effect of chitosan infiltration on hydroxyapatite scaffolds derived from New Zealand bovine cancellous bones for bone regeneration. *International Journal of Biological Macromolecules*, 160, 1009-1020. doi: 10.1016/j.ijbiomac.2020.05.269

Ratnayake, J. T., Ross, E. D., Dias, G. J., Shanafelt, K. M., Taylor, S. S., Gould, M. L., Guan, G., & Cathro, P. R. (2020). Preparation, characterisation and in-vitro biocompatibility study of a bone graft developed from waste bovine teeth for bone regeneration. *Materials Today Communications*, 22, 100732. doi: 10.1016/j.mtcomm.2019.100732

Huang, J., Ratnayake, J., Ramesh, N., & Dias, G. J. (2020). Development and characterization of a biocomposite material from chitosan and New Zealand-sourced bovine-derived hydroxyapatite for bone regeneration. *ACS Omega*, 5, 16537-16546. doi: 10.1021/acsomega.0c01168

Ratnayake, J., Guan, G., Polonowita, A., Li, K. C., Gray, A., Waddell, J. N., Loch, C., & Brunton, P. A. (2020). Can the measurement of jaw-opening forces assist in the diagnosis of temporomandibular disorders? *Journal of Oral & Facial Pain & Headache*, 34(3), 199-205. doi: 10.11607/ofph.2587

Alison Rich

**BDS (Otago) MDSc PhD (Melb)
FRACDS FFOP (RCPA) FRCPath**

Professor, Department of
Oral Diagnostic and Surgical
Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=215>

Professor Rich's research in the broad field of oral pathology is focused on the immunopathogenesis of various oral diseases. This research informs her work as a specialist diagnostic oral pathologist and Head of the Oral Pathology Centre, the national oral pathology diagnostic service. She leads the Oral Molecular and Immunopathology Research Group of the Sir John Walsh Research Institute. The interests of the group are the regulation of the microenvironment in oral squamous cell carcinoma with respect to local and nodal immune control and interaction with vascular and lymphatic systems. Factors relating to the immune response and angiogenesis and lymphangogenesis in immune-mediated oral mucosal diseases and in pulpal disease are also being investigated.

Research achievements in 2019-20 included the enrolment and progression of excellent PhD and DClintDent students under her supervision and our success in attracting significant grant funding from the New Zealand Dental Research Foundation and the Ministry of Health Oral Health Research Fund. Professor Rich's research collaboration with the Oral Cancer Research and Co-ordinating Centre of Malaysia has resulted in a number of on-going projects.

Key publications 2019-2020

Lu EM, Ratnayake J, Rich AM, Assessment of proliferating cell nuclear antigen (PCNA) expression at the invading front of oral squamous cell carcinoma. *BMC Oral Health* 19:233 doi: 10.1186/s12903-019-0928-9

Rich, A. M., Hussaini, H. M., Seo, B., & Zain, R. B. (2020). Understanding the complex microenvironment in oral cancer: The contribution of the Faculty of Dentistry, University of Otago over the last 100 years. *Journal of the Royal Society of New Zealand*. 50: 15-34

Yakin M, Seo B, Rich AM. Tunicamycin-induced endoplasmic reticulum stress up-regulated tumour-promoting cytokines in oral squamous cell carcinoma. *Cytokine* 120 130-143 2019

Yakin M, Seo B, Hussaini H, Rich A, Hunter K. Human papillomavirus and oral and oropharyngeal carcinoma: the essentials. *Australian Dental Journal* 2019 64: 11-18 doi: 10.1111/adj.12652.

Benedict Seo

BDS DClintDent PhD(Otago) FICD

Senior Lecturer, Department
of Oral Diagnostic and
Surgical Sciences



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Dr Benedict Seo is a specialist oral pathologist. He is a Senior Lecturer in Oral Pathology and a Consultant Oral Pathologist at the Oral Pathology Centre. He is an active member of the Oral Immunopathology Research Programme, Sir John Walsh Research Institute, and is involved in its various projects concerning oral squamous cell carcinoma (OSCC) pathobiology, with a special emphasis on cellular/metabolic stress and responses to those stimuli. His investigations include in vitro and ex vivo as well as blood and saliva models, and encompasses various techniques that examine gene, protein and cellular responses. He is also interested in the epidemiology of oral and maxillofacial pathology in New Zealand and abroad. Dr Seo investigates the pathogenesis of oral cancer, odontogenic lesions and immune-mediated oral diseases, with a particular focus on unfolded protein response (UPR) and endoplasmic reticulum (ER) stress. Techniques such as qRT2-PCR, IHC, histochemistry, western blot, cell culture and in vitro assays (viability, caspase-based, TUNEL) are employed in his research. He has an active research partnership with the University of Malaysia, Oral Cancer Research and Coordination Centre and the National University of Malaysia, as well as with Dunedin Public Hospital. Dr Seo is also a reviewer for the *Journal of Periodontal Research*, *Pathology* and *BMC Oral Health*. He has previously received the Oral Presentation Award from the International Association of Oral Pathologists (IAOP), Elman Poole Fellowship, IADR-Colgate Postgraduate Award and Sir Thomas Hunter Scholarship, amongst others.

Key publications 2019-2020

Firth, F. A., Milne, T. J., Seo, B., & Farella, M. (2020). An in-vitro mechanical strain three-dimensional culture model: Periodontal ligament cell viability, apoptosis, and endoplasmic reticulum stress response. *European Journal of Oral Sciences*, 128, 120-127. doi: 10.1111/eos.12681

Guan, G., Mei, L., Polonowita, A., Hussaini, H., Seo, B., & Rich, A. M. (2020). Malignant transformation in oral lichen planus and lichenoid lesions: A 14-year longitudinal cohort study of 829 patients in New Zealand. *Oral Surgery, Oral Medicine, Oral Pathology & Oral Radiology*, 130(4), 411-418. doi: 10.1016/j.oooo.2020.07.002

Al-Hassiny, A., Hussaini, H., Milne, T., Seo, B., Rich, A. M., & Friedlander, L. T. (2019). Vascularity and angiogenic signaling in the dentine-pulp complex of immature and mature permanent teeth. *European Endodontic Journal*, 4(2), 80-85. doi: 10.14744/ej.2019.26349

Yakin, M., Seo, B., & Rich, A. (2019). Tunicamycin-induced endoplasmic reticulum stress up-regulates tumour-promoting cytokines in oral squamous cell carcinoma. *Cytokine*, 120, 130-143. doi: 10.1016/j.cyt.2019.04.013

Andrew A. Tawse-Smith

DDS(Colombian Sch of Dent)
PhD(Otago)
CertPeriodontology (Göteborg)

Associate Professor,
Department of Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/?id=536>

Dr Tawse-Smith's research interests involve the fields of oral implantology, and periodontology. His main research focus in oral implantology comprises a long-term clinical evaluation of patients who have been rehabilitated with various implant prostheses. He is currently investigating tribocorrosion of the implant surface and the association of titanium particle leakage and its impact on peri-implant health. He has also developed novel in-vitro methodologies to complement his ongoing clinical studies to investigate the efficacy of different implant surface decontamination protocols. He has also carried out systematic review-based research in dental implantology and periodontology. He has been involved in the prospective evaluation of patients rehabilitated with oral implants. Selected peri-implant parameters have been measured to evaluate implant success, survival rates, health of peri-implant tissues and patient satisfaction.

Dr Tawse-Smith completed his PhD "Presence and origin of titanium particles in peri-implant tissues" in 2018 and is working in collaboration with the Centre for Trace Element Analysis, Department of Chemistry and the Otago Micro and Nanoscale Imaging Unit of the University of Otago. He has international collaborations with universities and implant companies in South America, South Africa, Sweden and Australia. As a part of the University of Otago-International Medical University (IMU) BDS partnership agreement, he has evaluated the transition of IMU students into the University of Otago dental curriculum.

Key publications 2019-2020

Atieh, M. A., Pang, J. K., Lian, K., Wong, S., Tawse-Smith, A., Ma, S., & Duncan, W. J. (2019). Predicting peri-implant disease: Chi-squared automatic interaction detection (CHAID) decision tree analysis of risk indicators. *Journal of Periodontology*, 90, 834-846. doi: 10.1002/jper.17-0501

Chen, M. H.-M., Lyons, K., Tawse-Smith, A., & Ma, S. (2019). Resonance frequency analysis in assessing implant stability: A retrospective analysis. *International Journal of Prosthodontics*, 32(4), 317-326. doi: 10.11607/ijp.6057

Ma, S., Tawse-Smith, A., Brown, S. D. K., & Duncan, W. (2019). Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 5-year results from a prospective single-arm clinical trial. *Clinical Implant Dentistry & Related Research*, 21, 344-351. doi: 10.1111/cid.12733

Olson, H., Beckett, D. M., Adam, L. A., Tawse-Smith, A., & Moffat, S. M. (2019). Self-perceived stressors of Bachelor of Oral Health students and implications for student support. *Focus on Health Professional Education*, 20(1), 36-49. doi: 10.11157/fohpe.v20i1.313

W. Murray Thomson

MA(Leeds) BSc BDS MComDent
(Otago) PhD(Adel) FICD FADI

Professor, Department of Oral
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Programme Leader, Dental
Epidemiology and Public Health Research



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Professor Thomson conducts research in the broad fields of dental epidemiology, dental public health and dental health services research. His work over the years has had considerable impact in the fields of socio-dental epidemiology, health services research and the oral health of older people. His influential life-course work in the renowned Dunedin Study has been complemented by his pivotal role in the development and testing of a number of important self-report measures now in wide use in oral health care. In a published bibliometric analysis, he was identified as one of the top contributors to dental public health research of the last half century, and his work also features in a 2021 overview of the 100 most cited papers in dental public health journals. His output includes 408 papers in peer-reviewed international scientific journals (>23,700 citations), and his Scopus h index is 55. Across 2019-20, he published 46 peer-reviewed papers, along with a major report, two commentary articles and one editorial. He was author or co-author of 9 conference presentations, including 7 keynote addresses, and gave 2 talks on his research to community groups. During this period he supervised 4 DCLinDent (Lee, Lau, Mohammad, Morelli) and 5 MComDent theses (Dixon, Goh, Holden, Lloyd, Naysmith), for a career total of 81 doctoral and Masters thesis completions. He currently supervises 7 DCLinDent (Johnson, Rupasinghe, Zainuddin, Tan, Praganta, Lintern, Oliver), 5 PhD (Antoun, Boyd, Benn, Bakri, Conrads), 1 MDent (Sese) and 2 MComDent theses (Narsinh, Stuart). From Jan 2015 to Jun 2021 he was the Editor-in-Chief of *Community Dentistry and Oral Epidemiology*. He has also served as Editor-in-Chief for *Gerodontology* since Apr 2021, and Associate Editor for the *European Journal of Oral Sciences* since Nov 2012. Among his many collaborations, his most fruitful international ones have been with the University of Adelaide, University of Sheffield, Duke University, Harvard University, New York University, University of Michigan, McGill University, University of Pelotas, Manipal University, Charité-Universitätsmedizin Berlin and Chongqing Medical University.

Key publications 2019-2020

Thomson WM. Subjective oral health measures for use with children: New Zealand's contribution to a burgeoning field. *Journal of the Royal Society of New Zealand* 50: 4-14 (2020).

Ferguson CA, Thomson WM, Kerse NM, Peri K, Gribben B. Medication taking in a national sample of dependent older people. *Research in Social and Administrative Pharmacy* 16: 299-307 (2020).

Thomson WM, Elani HW, He S. Self-report oral health and disease experience among adults in China and NZ. *Clinical Oral Investigations* 23: 2123-2128 (2019).

Thomson WM, Broadbent JM, Caspi A, Moffitt TE, Poulton R. Childhood IQ predicts age-38 oral disease experience and service-use. *Community Dentistry and Oral Epidemiology* 47: 252-258 (2019)

Graeme S. Ting

MSc MDS (Otago) FRACDS

Senior Lecturer, Department
of Oral Diagnostic and Surgical
Sciences



<https://www.otago.ac.nz/sjwri/people/profile/?id=2982>

Graeme Ting's specialist experience in clinical Special Needs Dentistry and Hospital Dentistry extends more than two decades. This experience includes provision of clinical dental services to people with medical problems, people with learning disabilities, mental health problems, physical disabilities and older people with dementia whose care is best provided from a hospital-based setting.

Mr Ting's research expertise is in the field of 'translational research' and the application of best practice protocols in the clinical setting. Examples include treatment of, and treatment guidelines for patients taking bisphosphonates and patients taking anticoagulant medications who require oral surgery and patients with inherited bleeding disorders.

He is interested in the oral health of people with special needs, with a particular focus on the oral health of older people with complex medical problems. He has researched the oral health of older people with dementia living in nursing homes in Auckland. Graeme has been involved at national level with the New Zealand Dental Association having helped to author a guidebook that teaches caregivers working in nursing homes, how to assist residents with oral health care. His interest in caring for people with special needs extends to those with hereditary bleeding disorders and he is current Chair of the Dental Committee for the World Federation of Haemophilia.

Geoffrey R. Tompkins

BSc PhD PGDipSci (Otago)

Associate Professor and Head
of Department, Department of
Oral Sciences



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=205>

Associate Professor Geoffrey Tompkins' principal research pursuit is in determining how the bacteria involved in periodontal disease acquire iron, an essential nutrient for all living cells. Additional interests involve collaborations with members of the Faculty of Dentistry from diverse disciplines including orthodontics, endodontics, periodontics, cariology, material sciences and respiratory infection. As a microbiologist employed in the Faculty of Dentistry, Associate Professor Tompkins' research is focused on dental microbiology. Much of his research involves providing microbiological support in collaborative studies with clinicians undertaking applied research, because most of our postgraduate students are involved in clinical (or translational) research (and do not have the background and training for more fundamental microbiology research). As such, Associate Professor Tompkins' research platform is highly varied, having been involved in dental forensics, endodontic, implant, restorative and proprietary (AgResearch) research. His work on bite mark analysis (forensics) is recognised internationally to the point that he has twice been invited to contribute to what is currently regarded as the definitive publication in the field; the significance of his bite mark research was acknowledged in *The Lancet* (2006). A more recent publication describing a convenient and rapid method to quantify bacterial survival in dentinal tubules following endodontic treatment promises a significant technical advance in the field.

Key publications 2019-2020

Perry, S. E., Huckabee, M.-L., Tompkins, G., & Milne, T. (2020). The association between oral bacteria, the cough reflex and pneumonia in patients with acute stroke and suspected dysphagia. *Journal of Oral Rehabilitation*, 47, 386-394. doi: 10.1111/joor.12903

Porter, G. C., Schwass, D. R., Tompkins, G. R., Bobbala, S. K. R., Medlicott, N. J., & Meledandri, C. J. (2020). AgNP/Alginate Nanocomposite hydrogel for antimicrobial and antibiofilm applications. *Carbohydrate Polymers*, 251, 117017. doi: 10.1016/j.carbpol.2020.117017

Porter, G. C., Tompkins, G. R., Schwass, D. R., Li, K. C., Waddell, J. N., & Meledandri, C. J. (2020). Anti-biofilm activity of silver nanoparticle-containing glass ionomer cements. *Dental Materials*, 36, 1096-1107. doi: 10.1016/j.dental.2020.05.001

Darryl C. Tong

ED BDS MB ChB PhD (Otago)
MSD (Wash) FFDRCSI FDSRCS
FFACOMS ACS

Professor and Head of
Department, Department of
Oral Diagnostic and Surgical
Sciences



<https://www.otago.ac.nz/sjwri/people/profile/?id=620>

Professor Darryl Tong's main research interests include military and civilian trauma with a particular focus on ballistic injuries to the head, face and neck, sports-related concussion, subconcussive impact force research and the development of an anatomical simulant head for forensic trauma investigations and surgical teaching. Clinical and systematic review-based research in oral and maxillofacial surgery including dentoalveolar surgery, pathology, trauma, dental implantology, and other clinical aspects of the specialty. Of particular interest however is maxillofacial trauma and ballistic injury especially in theatres of conflict. Professor Tong's PhD involved looking at war injuries of the face and jaws from an integrated historical and surgical viewpoint. Other research interests include forensic biology, subconcussive injury using a forensic head model system and veterans' health research topics.

Key publications 2019-2020

Kenny, C., Oldfield, L., Broadbent, J. M., & Tong, D. (2020). Common medications among dental outpatients: An update. *New Zealand Dental Journal*, 116(4), 121-126.

Abdullah, R., Olson, H., Todd, G., & Tong, D. (2020). Oral health perceptions, attitudes and knowledge among intensive care nursing staff in a tertiary hospital. *Australian & New Zealand Journal of Dental & Oral Health Therapy*, 8(1), 15-18.

Chapman, L., & Tong, D. (2019). Optimal follow-up time following lower third molar coronectomy: A clinical audit and literature review. *New Zealand Dental Journal*, 115(3), 89-95.

Ondruschka, B., Lee, J. H. C., Scholze, M., Zwirner, J., Tong, D., Waddell, J. N., & Hammer, N. (2019). A biomechanical comparison between human calvarial bone and a skull simulant considering the role of attached periosteum and dura mater. *International Journal of Legal Medicine*, 133, 1603-1610. doi: 10.1007/s00414-019-02102-4

Ian Towle

BSc(Hons)(Cardiff)
MSc(Bournemouth) PhD
(LJMU)

Sir Thomas Sidey Postdoctoral
Fellow (2019-21), Sir John
Walsh Research Institute



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=3149>

Dr Ian Towle's research interests are in using dental remains to understand how diet and behaviour has changed through primate, and especially human, evolution. He joined the SJWRI as the 2019 recipient of the Sir Thomas Sidey Postdoctoral Fellowship, awarded over two years. He completed his Fellowship in July 2021.

Dr Towle's previous research explored how dental wear differs among hominin species, and found that enamel properties heavily influence the formation of wear and fractures on the teeth surface. His postdoctoral fellowship project, working with Dr Carolina Loch, was titled 'An evolutionary perspective on dental properties, disease and wear'. Drs Towle and Loch have had several key articles published on dental tissue loss in fossil and living primates, and have recently submitted follow-up articles exploring how tooth mechanical and structural properties influence these patterns. By combining these methods, their research allows new insight into the evolution of the human dentition, but also through direct comparisons with living primates can provide ecological information on our fossil ancestors and relatives.

One of Towle and Loch's recent articles (2021) focused on chipping patterns across primate dentitions and highlighted that fossil humans have extremely high rates of tooth fracture, comparable with hard object eating living primates. In contrast, the pair's research has shown another group in our family, *Paranthropus*, has extremely low levels of fracture, suggesting a diet eating lots of tough vegetation is more likely the cause of them evolving very large back teeth. In two other articles Drs Towle and Loch showed that enamel properties vary across tooth crowns, and this links well with chipping patterns in primates. For example, the side of the tooth with most fractures is the side with the hardest enamel. Therefore, this shows that looking at mechanical and structural differences across tooth crowns may offer new insight into dental evolution but also help optimise dental implants.

Key publications 2019-2020

Towle, I., & Irish, J. D. (2020). Recording and interpreting enamel hypoplasia in samples from archaeological and palaeoanthropological contexts. *Journal of Archaeological Science*, 114, 105077. doi: 10.1016/j.jas.2020.105077

Towle, I. (2019). Tertiary dentine frequencies in extant great apes and fossil hominins. *Open Quaternary*, 5(2), 1-7. doi: 10.5334/oq.48

Towle, I., & Irish, J. D. (2019). A probable genetic origin for pitting enamel hypoplasia on the molars of *Paranthropus robustus*. *Journal of Human Evolution*, 129, 54-61. doi: 10.1016/j.jhevol.2019.01.002

Towle, I., Dove, E. R., Irish, J. D., & De Groote, I. (2017). Severe plane-form enamel hypoplasia in a dentition from Roman Britain. *Dental Anthropology*, 30(1), 16-24. doi: 10.26575/daj.v30i1

J. Neil Waddell

**MDipTech(Dent Tech)(TN) PhD
PGDipCDTech(Otago) HDE(UN)**

Professor, Department of Oral
Rehabilitation

Director, Biomaterials
Laboratory (from 2021)



<https://www.otago.ac.nz/sjwri/people/profile/index.html?id=252>

Professor Neil Waddell conducts experimental and observational research in dental materials, toughening of advanced ceramics, prosthodontic failure mechanisms and adhesion of dental restorations and materials, and intra-oral pressure dynamics, craniofacial biomechanics, subconcussive brain injury research, *in vitro* modelling of the effects of blunt force trauma to the head and accumulative damage to the brain, forensic biology and odontology, wounding and ballistic blood splatter analysis, and development of simulant materials for forensic modelling. Across 2019-20, he was lead or co-investigator on \$203,347 in new grants from funders including the NZDRF, Cure Kids, Lottery Health Research and the University of Otago, and was an author on 25 peer-reviewed publications. He supervised two postgraduate research students to completion, Huda Mohammed (DClinDent, 2019) and Vidya Mudliar (MDentTech, 2019). Key collaborations which underpin his current research are with the Department of Mechanical Engineering (University of Canterbury) investigating aerosol generation by different dental high-speed handpieces and ultrasonic scalers in terms of Covid-19 dental hazards; with the Faculty of Mechanical Engineering (Auckland) to develop real-time measurement of the denture mucosa pressure distribution in edentulous patients; with Callaghan Innovation on a MBIE-funded initiative led by Professor Warwick Duncan to develop an ultrasonic dental diagnostic device to improve the early diagnosis of gum disease around teeth and titanium dental implants; and with the Department of Anatomy (Otago), Department of Mechanical Engineering (Canterbury) and the Facharzt für Rechtsmedizin, Institut für Rechtsmedizin, Leipzig, Germany to investigate biomechanical properties of human skin/skull/brain system for the purpose of developing simulant materials and mathematical modelling systems.

Key publications 2019-2020

Jansen van Vuuren WA, Al-Amlah B, Alkharusi A, Dohan Z, Waddell JN, 2019. Surface Crack in Flexure versus the Vickers Indentation Method for calculating Fracture Toughness in two veneering porcelains. *NZ Dental Journal* Vol. 115 Issue 4, p151-156.

Jansen van Vuuren L, Broadbent JM, Duncan WJ, Waddell JN. 2019. Maximum voluntary bite force, occlusal contact points and associated stresses on posterior teeth. *Journal of the Royal Society of New Zealand*. 2019:1-12. DOI 10.1080/03036758.2019.1691612

Waddell JN, Deckhart I, Welge M, Ichim I, Swain MV. 2019. The influence of flame and furnace soldering method on the stress corrosion, fatigue resistance and fracture toughness of soldered bar attachment systems for implant overdentures. *Journal of the Royal Society of NZ*. 2019:1-17. DOI:10.1080/03036758.2019.1681478.

Lee JHC, Ondruschka B, Falland-Cheung L, Scholze M, Hammer N, Tong DC and Waddell JN. 2019. An investigation on the correlation between the mechanical properties of human skull bone, its geometry, microarchitectural properties, and water content., *J Health Eng.*, Vol 2019, Article ID 6515797, 8 pages. <https://doi.org/10.1155/2019/6515797>



Sir John Walsh Research Institute

Research Report 2019-2020

Appendix: Our achievements

SJWRI Research Report 2019-2020 Appendix: Our achievements

is now available for download from the
SJWRI website.

The 'Our Achievements' Appendix
document includes full listings of our:

Research publications

Research grants and contracts

PhD completions and thesis abstracts

*DClinDent completions and thesis
abstracts*

*Other postgraduate degree
completions*

for the 2019-2020 period.

To view or download a copy of the
SJWRI Research Report 2019-2020
Appendix, please visit our website
www.otago.ac.nz/sjwri.

Direct download link for the Appendix:
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Emeritus title humbling for Broughton

Friday 21 August 2020

It is impossible for Emeritus Professor John Broughton to select his proudest achievement from his time at Otago; 47 years simply cannot be condensed to one moment.

An Otago graduate himself – he graduated with a Bachelor of Dental Surgery in 1977 – Professor Broughton went on to establish himself as an authority on Māori health.

He was a dental health surgeon from 1978, and a part-time clinical supervisor and guest lecturer in the medical school and dental school for 10 years until 1989, when he became a full staff academic staff member.

He retired on 30 June and has been awarded the title of Emeritus Professor.

His list of highlights includes establishing the Ngāi Tahu Māori Health Research Unit in the Department of Preventative and Social Medicine in 1996, which “allowed the team to undertake Māori health research projects”. He is particularly proud of three publications that came out of the unit; UKAIPO - the stories of four generations of Māori women and childbirth, Puffing Up A Storm, and Injury to Māori, does it really have to be like this?, which was launched in the Great Hall of Parliament by three Ministers of the Crown.

He recalls the “incredible community support” he received for his role in introducing the Hauoroa Māori modules in the undergraduate medical curriculum, especially from “four very prominent Māori women, Christine Rimene, Connie Hassan, Christine Maxwell and Wendi Raumatī”.

“I simply could not have done it without them, and I am to this day forever grateful.”

In 1990, Emeritus Professor Broughton was the driving force behind the establishment of the whānau dental clinic, Te Whare Kaitiaki, which he ran for more than 25 years.

“I am grateful to Professor Ferguson who gave me the clinical facilities and allowed me to run it utilising a kaupapa Māori approach.

“In the end we had people coming by the van load each week from Invercargill.”

The “ever increasing” number of Māori health students admitted to the health science courses, especially those in the Dental School, and the strength of Ngā Mokai O Ngā Whetu, the New Zealand Māori Dental Students Association, is high on his highlight list.

Emeritus Professor Broughton’s impact can also be seen outside the Dental School; he is responsible for the University banner which is front and centre of every graduation ceremony.

“I am very proud of the fact that we got 90 per cent of the tamariki (children) from Te Kura Kaupapa Māori o Ōtepoti - the Māori immersion school - who chose to access our dental service, through to their secondary dentition without a filling in their mouths. And the



majority were like that when they were 16 or 17 years of age.”

“It came about because at one procession many years ago OUSA had made a banner from an old dirty, stained bed sheet and had written on it with spray paint – it looked absolutely terrible. So, I thought we could do better than that.

“It just so happened that at that time the NZ Embroiders Association was having a national conference here in Dunedin, so I contacted Jan Wilson and asked her to make a beautiful embroidery University banner; which she did.”

And the Otago University Student Association Anzac services, established by former OUSA president Logan Edgar, also got off the ground with Emeritus Professor Broughton’s support. He hasn’t missed one ceremony since, including this year when the country was in COVID-19 lockdown.

“It was very important to acknowledge the 500 University students and 17 staff members who served in WWI and in particular the 97 who did not return,” he says of the services.

But, in his mind, his numerous awards, publications and achievements pale in significance to his students, and their achievements and it them he will miss the most, he says.

“It is definitely the students I will miss the most, especially Ngā Mokai O Ngā Whetu and the final year dental students for whom I run the paper ... which is concerned with the five-week community service learning placement programme with Māori and Pacific oral health providers throughout the country and Tonga, Samoa and Fiji.”

While retirement will mean a different life, it will not necessarily be a quieter one; his days are well and truly filled with his role as secretary of the Otago University Rugby Club and the Otago Officers’ Club, he is still helping out with the DENT 553 paper, and will have plenty of duties to attend to at the Puketeraki and Araiteuru marae.

“And I’ll have more time to attend to the garden and sit in the sun and read my book.”

This 47-year connection will not end with retirement.

“It is a great honour to be awarded the title of Emeritus and I’m humbled by it. I will still be here to support the University in any way I can as required – especially at our graduation ceremonies.”