22 YEARS MEMORIAL

CELEBRATING 'MRUFD' and the 'POWER OF GIVING'

MELBOURNE RESEARCH UNIT FOR FACIAL DISORDERS

2003 - 2025

'Helping Children Smile'

THE UNIVERSITY OF MELBOURNE

The Royal Children's Hospital Melbourne

Murdoch Childrens Research Institute

THE 'MRUFD' STORY 2003 - 2014

2014 Website Archive

THE 'MRUFD' STORY
2003 - 2014

2014 Website Archive

Foreword to the MRUFD Story

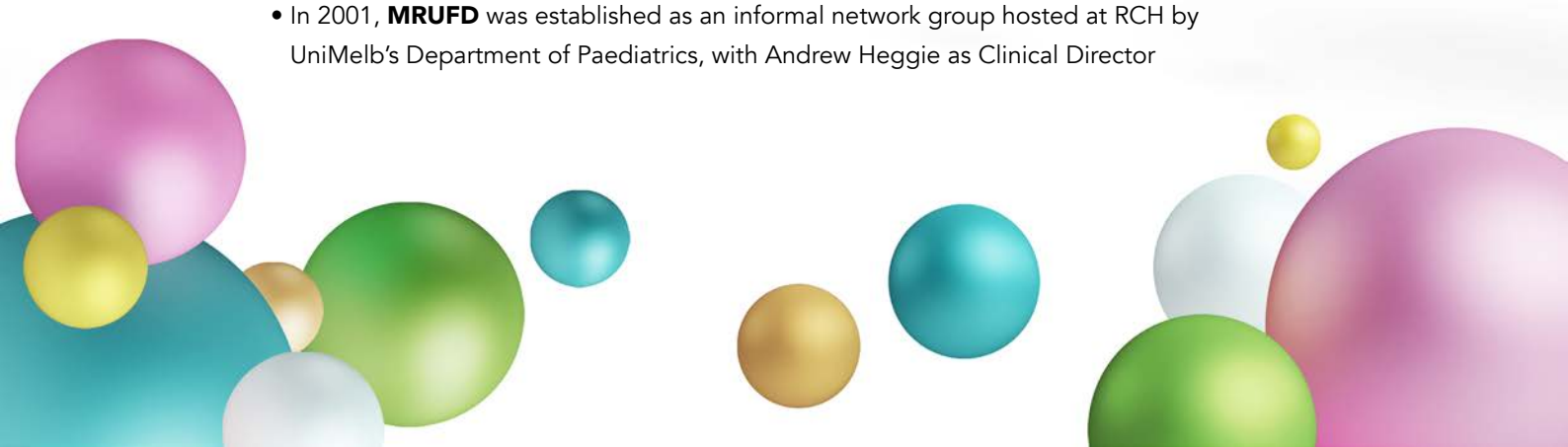
"MRUFD in a nutshell"

- Founded with a generous benefaction to the University of Melbourne (2001-13) by philanthropists **Allan Myers** (AC, KC) & **Maria Myers** (AC), the Melbourne Research Unit for Facial Disorders ('MRUFD') became a pioneering force at translating science into social good
- MRUFD's novel mission to 'Help Children Smile' – through harnessing a unique combination of expertise in basic science, paediatric medicine and dentistry – was rewarded with multiple achievements as outined below
- These successes reflect the "Power of Giving", having drawn on diverse charitable contributions (time, resources, funds) during and after the founding benefaction
- MRUFD is being memorialised with a webpage* hosted by its spiritual successor, 'The D3 Group' (D3G), and an archive of the 2014 MRUFD website as follows

**thed3group.org/mrufd-memorial*

How did MRUFD start?

- MRUFD had serendipitous origins at the beginning of this century, and soon became an unprecedented translational research venture amalgamating four key elements – children's orofacial health, dentistry, medicine and basic science
- The adventure started when **Allan and Maria Myers** told their friend **Paul Schneider** (an orthodontist) of their interest in supporting oral health research in children
- Paul teamed up with his colleague **Andrew Heggie** (an oral and maxillofacial surgeon at the Royal Children's Hospital; RCH) to develop the case for a "bench to bedside" research unit servicing widespread interests at RCH, the Melbourne Dental School, and beyond
- This visionary plan (today called "science translation") was refined with senior leaders at the University of Melbourne (UniMelb), Murdoch Childrens Research Institute (at RCH), and RCH
- In 2001, **MRUFD** was established as an informal network group hosted at RCH by UniMelb's Department of Paediatrics, with Andrew Heggie as Clinical Director



THE 'MRUFD' STORY
2003 - 2014

2014 Website Archive

- **Mike Hubbard**, a biomedical scientist with dental qualifications, was recruited from New Zealand and started as Research Director in 2003
- The Myers' benefaction supported key people (Mike Hubbard and lab manager **Jon Mangum**), and seeded numerous research projects, over the following decade
- Key outcomes of these 10 years, and their underpinning translational philosophies, are outlined in the website archive below
- By the end of 2013, lasting impacts had been secured through four major advances – namely two crosssector network groups (D3G, Proteomics & Metabolomics Victoria), a significant research discovery (chalky enamel composition) and an ensuing patent (BlueCheck diagnostic)

What happened after 2013?

- As the website archive shows, MRUFD had established several advances before the Myers' benefaction finished in 2013
- Decisions were made to streamline operations, tighten belts, and focus on D3G and its Chalky Teeth Campaign
- In 2017, with commercialisation of BlueCheck well underway, Mike Hubbard turned to internationalise D3G as a "science to social good" venture focussed on prevention of "chalky molars" (aka "molar hypomineralisation", a major risk factor for tooth decay in children)
- By 2022, D3G had members in over 50 countries, two educational websites that had attracted over 10 million hits, numerous networked projects and partners, and a 100-year research breakthrough relating to medical prevention of chalky molars
- Allied success of D3G's world-first international symposia series, hosted in Canada by the University of Toronto, cemented plans to spin out D3G as a non-profit venture (social enterprise)
- Accordingly, in 2025, MRUFD was wound down, its assets incorporated into D3G, and various reflections collated as herein
- This memorial is dedicated to our colleague **Glenn Bowes**, the Professor of Paediatrics who hand-held MRUFD's leadership from 2003 through to his untimely death in January 2025

THE 'MRUFD' STORY
2003 - 2014

2014 Website Archive

Instigators' reflections

Allan & Maria (MRUFD benefactors, 2003-13)

Maria and I are very fortunate to have had the opportunity to provide assistance to the many dedicated friends who have made MRUFD a force for good in the world.

Paul Schneider (Co-founder)

A simple question to me by the Myers about how they could help support research and development in my area of interest, orthodontics and children's dentistry, has grown to the global community working to understand molar hypomineralisation and other conditions. The vision, determination, hard work and generosity shown by Maria and Allan Myers, along with the recruited scientists Mike Hubbard, Jon Mangum and others, with leadership of Andrew Heggie have led to real benefits for those affected by these conditions and their families due to improved detection, treatment and hope for prevention in the future. I am personally very grateful to Maria and Allan for this substantial act of philanthropy which is just one example of what they do for the community and how they live their lives.

Andrew Heggie (Co-founder, Clinical Director)

Having received the opportunity to establish a relatively small research Unit was both a privilege and a challenge as the plan was to straddle paediatric dentistry, medicine and paediatrics. With the appointment of Mike Hubbard, we were able to combine clinical interests at the Royal Children's Hospital of Melbourne with a basic science laboratory that fostered an enthusiastic collaboration.

Mike Hubbard (Research Director, Lead scientist)

Amazingly, MRUFD has comprised half of my career (and still counting with D3G). The Myers and MRUFD transformed me from an introverted "mad scientist" to a worldly "social entrepreneur". I'm so grateful to have had such a rewarding opportunity, as challenging as it was. Forever thankful to all those involved.

Mark Hargreaves (Dean, Faculty of Medicine, Dentistry & Health Sciences, 2015-2016)

During my time as Dean I worked closely with Glenn Bowes (Deputy Dean). We provided MRUFD a small resource for additional work and connection with the University Business Development team to advance some of the potential commercial opportunities. This built on the support provided by Glenn during his time as Head of Paediatrics and his moral support continued in the years after and upon his retirement from formal University roles.

Other reflections from MRUFD's people

Vidal Perez – MRUFD PhD graduate

My years at MRUFD (2011–2015), as a PhD student in Mike Hubbard's laboratory, were truly life-changing. Studying the molecular pathogenesis of Molar Hypomineralisation provided me not only with invaluable scientific training but also with lasting friendships that continue to this day. That experience transformed my academic career in Chile, where I now serve at the University of Talca, helping to position a regional university in Latin America on the global stage. The spirit of innovation and collaboration fostered at MRUFD continues to inspire my work and remains a cornerstone of my professional life".

A showcase for giving

The Myers' benefaction was made with the stated intent of seeding bold new beginnings that would attract ongoing support. Indeed over the years, their financial gift – and accompanying moral support – inspired much other giving (financial, in kind, pro bono leadership), and positioned MRUFD to win various research grants and awards. Notably this support came from diverse sources across the sector (academia, professions, industry, government, public), in keeping with the translational nature of MRUFD.

Archive of MRUFD's 2014 Website

The MRUFD website was hosted by RCH and had its last major revision in 2012.
The following reproduction is pretty much unaltered from 2014 except that external website links were removed to avoid redundancy.

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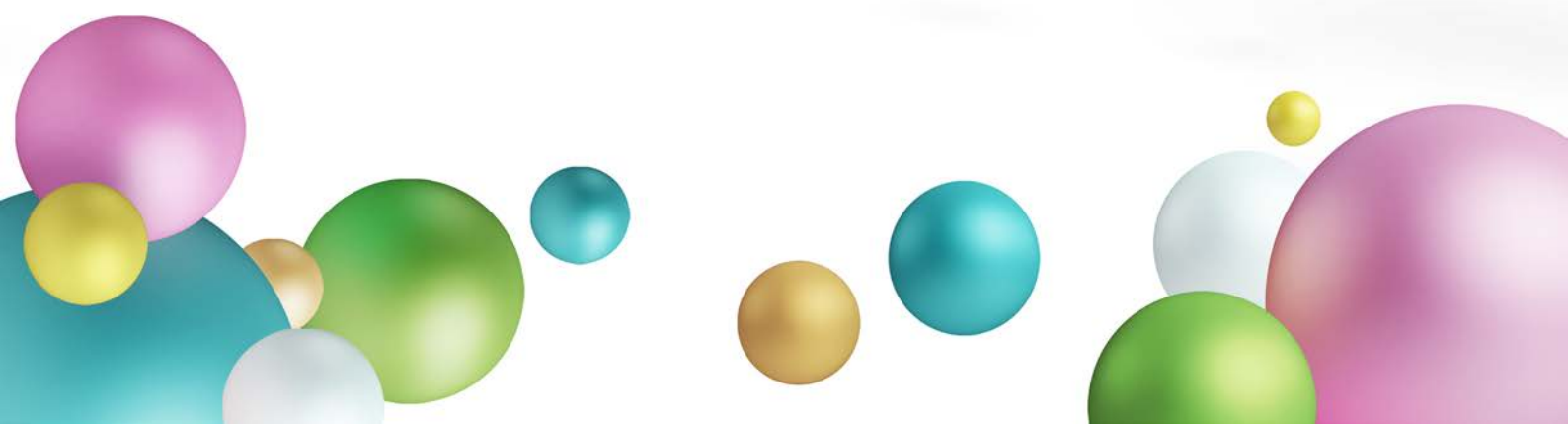
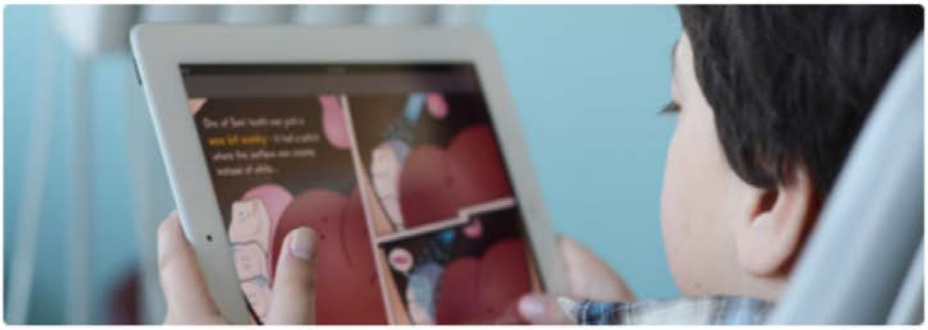
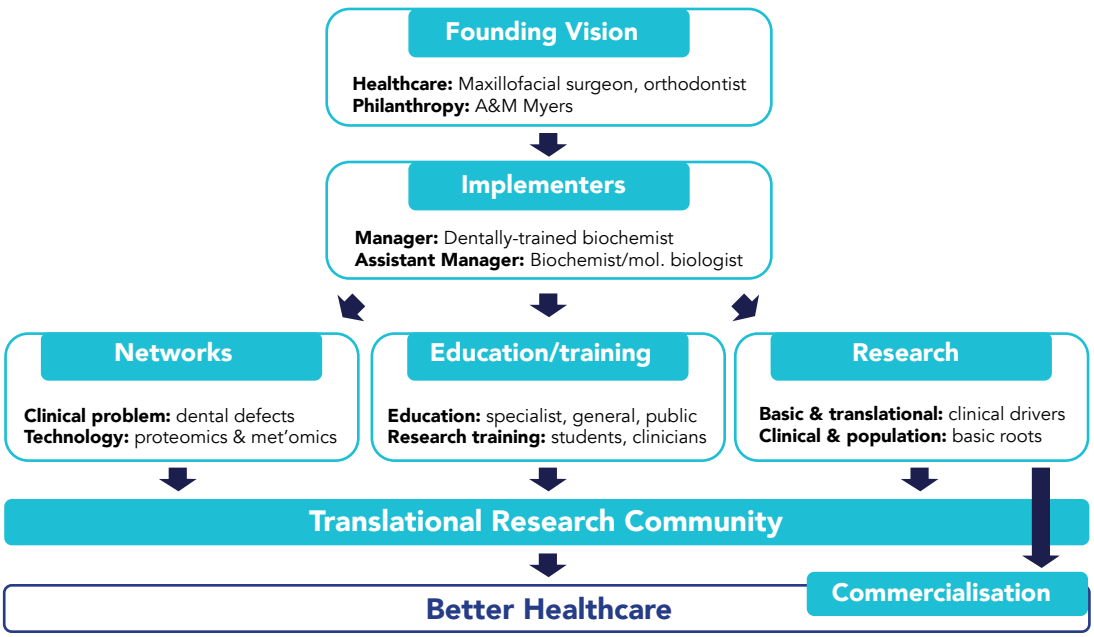




Melbourne Research Unit for Facial Disorders

Our Unit and its Translational Research Mission

Founded in 2000, we comprise a group of **orofacial clinicians and researchers** with a common vision that translational research holds much promise for our field of healthcare. Our primary aim is to improve the health and well-being of children who are afflicted with facial disorders (i.e. oral, dental and craniofacial problems). As elsewhere, Melbourne faced the problem of scientists working in isolation from the "clinical coalface" and from each other. And our clinicians were too busy fixing people to become deeply engaged in research. The founding goal therefore was to foster an integrated approach to research translation, with clinicians and scientists of various disciplines working together. In this way, important problems would be defined by clinicians and then basic scientists would pursue exciting discoveries in these areas. Subsequently, translational researchers, clinicians and public health workers would extend the benefits of this new knowledge to patients and the general population. Improved education was seen to be a critical part of this goal, for specialists and the public alike. Based at the Royal Children's Hospital, the Melbourne Research Unit for Facial Disorders (MRUFD) is hosted by the University of Melbourne's **Department of Paediatrics** (administrative base) and **Department of Pharmacology (Hubbard lab)**.



Visionary foundation

The vision for MRUFD as a translational research vehicle came from four colleagues with shared beliefs in the power of teamwork and community. Two were clinicians who, as specialists in facial surgery and orthodontics, encountered bone and tooth problems on a daily basis. Both academically inclined, they foresaw that healthcare benefits would arise from improved research attention, particularly if clinical obstacles were better targeted with basic science. The other two were philanthropists who admired the Royal Children's Hospital and University of Melbourne for their collective healthcare services, education skills and research endeavours. Accepting that the then-fragmented orofacial field lacked "funding pull", they agreed to support the initiation of a "bench to bedside" project that would draw on Melbourne's strengths in research, clinical care and education. The mutually agreed priority was to improve communication between clinicians and career researchers, and to better harness the efforts of existing research pillars – in other words, to develop a translational research community in the orofacial field. Such a challenging task merited the dedicated attention of a senior academic manager, and so two major donations were made to create and later extend a Professorial Fellowship based at the Royal Children's Hospital precinct. Philosophically, this visionary plan was a pioneering example of research translation, hatched as it was during 1999-2000.

Implementation

To develop a research community spanning from basic science through clinical care to population health, it was desirable to engage an academic manager experienced in both biomedical science and clinical practice. Recruited from New Zealand, Mike Hubbard brought early experience as a dentist followed by a fulltime career in biomedical research. He was joined by his NZ-lab manager, Jon Mangum, had over 3-years experience working in areas relevant to orofacial science (calcium biology, enamel cell biology, proteomics technology). Their efforts were largely turned to: (1) design and implementation of collectives to assist research translation; (2) initiating and supporting translational research projects; and (3) education and research training. Key design philosophies were to build critical mass and linkages over islands of existing expertise, to be as inclusive of small players as of big, to preserve autonomy when assembling collectives, and to educate appropriately at multiple levels. Strategically, prime focus was placed on a burgeoning dental problem that drew in many local contributors including Hubbard's group, and on molecular technologies (proteomics, metabolomics) whose power had yet to be tapped by the orofacial field. Metaphorically, Melbourne had many exciting musicians available in both these spheres – they just needed assembling into orchestras.

Translational outcomes

Good progress towards development of a translational research community has been made through all three of our new endeavours. Two cross-sector networks have been established, bringing multiple gains to the dental defect and proteomics/metabolomics fields regionally

(i.e. Australia-NZ and State of Victoria, respectively). Through their unprecedented reaches, both these networks have strong impact potential extending from basic science through to healthcare as elaborated elsewhere (see links below). A multidisciplinary dental-research program has been advanced substantially, growing from clinical conception to mechanistic discovery and now heading into a pre-commercialisation track, thereby exposing a raft of exciting opportunities throughout. And a second showcase program, which interfaces proteomics/metabolomics technology with a mix of clinical problems from the bone/tooth arena, has been conceived and pilot studies started. Importantly this will provide a united venture for the bone and tooth themes of MRUFD. Education has proceeded across multiple levels and formats, holding importance for our networks and our research programs. Research advice has been given to many, and an increasing demand for research training (particularly for clinical trainees) is being met to the extent that resourcing allows. MRUFD has attracted a multitude of in-kind contributions, both facilitating and endorsing its strong progress. Additional funding has been received from several sources (competitive grants, trade/industry, Victorian Government, donations), directed mostly at our research and network endeavours. Although still skeletal in places, these translational initiatives are benefitting many people in the orofacial field and beyond, with network membership now numbering in the hundreds and education/website audiences larger still. Developed over 9 years by a small team, this seminal framework is now ripe for further exploitation and investment. By attracting broader input, great opportunity exists not only to advance the current initiatives but also to address other topics of orofacial importance.

Our Achievements

Over the past decade, MRUFD has successfully developed a translational research network with unparalleled scope in the orofacial arena. Building on existing strengths, most attention has been directed at problems associated with children's facial bones and teeth. Our bone-focussed team, led by maxillofacial surgeon **A/Prof Andrew Heggie**, has continued to pioneer revolutionary advances in the treatment of craniofacial disorders. Their strong progress has come both from a variety of clinical trials and through translation of laboratory-based investigations. In 2003, we engaged **Prof Mike Hubbard**, a dentally-trained biochemist, to develop our research-translation plan further. Harnessing contributions from many others (researchers, academics, practitioners, public health, trade, industry, government), Mike and colleague **Jon Mangum** have since implemented a variety of initiatives that are proving to have broad value for the orofacial field and beyond.

1. Translational Research Networks

To build community, the MRUFD has initiated and nurtured two cross-sector network groups, one addressing a clinical problem and the other technological. Besides their individual value, these complementary initiatives hold great potential for productive interaction.

Proteomics & Metabolomics Victoria –
Developed with support from the Victorian Government, the PMV network comprises over 200 members representing academia, trade and industry. This initiative continues to strengthen the sector through key improvements in unity, access, communication, education, strategy and advocacy.

The D3 Group for Developmental Dental Defects –
With over 100 members from across Australia and New Zealand, The D3 Group comprises a rapidly-expanding community of researchers, clinicians, public health workers, trade and affected families. The primary focus is on improving understanding and care of people with Molar Hypomineralisation, a "dental birth defect" characterised by soft enamel.

2. Research and Clinical Successes

To build momentum, the MRUFD has successfully seeded and supported a variety of orofacial research projects leading to more than 39 peer-reviewed publications in the scientific and clinical literature. One main theme has been to establish better methods for manipulating the generation and shape of facial bone, thus addressing a major challenge in the treatment of craniofacial disorders. And as a showcase for the power of translational research, MRUFD has marshalled a broad-based effort against Molar Hypomineralisation. Already, this pioneering initiative appears on track to produce public health benefits within the foreseeable future.

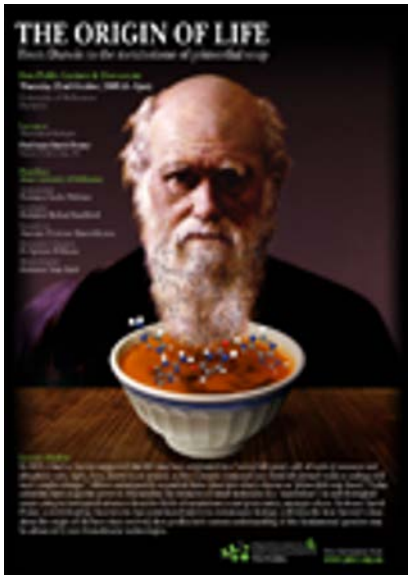
Clinical advances in manipulating the generation and shape of facial bone –
Treatment of facial and cranial (skull) disorders is frequently compromised by the difficulties that surgeons have in reshaping or replacing bone. MRUFD maintains a strong interest in developing better treatment options through its work in three main areas. First, a "bone-stretching" technique (i.e. distraction osteogenesis) has been successfully adapted to rebuild small faces affected by developmental syndromes including cleft lip and palate. And through miniaturisation of devices, the same process is being used to lengthen the jaws of infants whose orofacial development has occurred improperly, such as the girl with facial clefting pictured above. The revolutionary benefits include vastly improved abilities to breathe and eat along with improved appearance. Second, important improvements have been made to the "fixation" methods used for stabilising bone segments after they have been repositioned (i.e. osteotomy). This is a particularly challenging problem in small faces and jaws. Third, addressing problems where insufficient bone is available from elsewhere in the patient (e.g. for repair of skull defects), MRUFD has successfully explored use of bone substitutes in experimental model systems.

Translational project on Molar Hypomineralisation – Early canvassing by MRUFD identified this developmental disorder as a major concern to many dentists and academics. "Molar Hypomin" affects about 15% of otherwise healthy kids, putting them at risk of pain, tooth decay and life-long treatment needs. Following the "bench-to-bedside" maxim, MRUFD has built multi-disciplinary research teams, obtained competitive funding, and published novel research exploiting proteomics technology. Excitingly, some of the findings have provided new clues about the underlying disease mechanism, raising hopes that Molar Hypomin may become preventable someday (**read more**). Other findings have spurred thoughts about new diagnostic and treatment aids, heading MRUFD into the pre-commercialisation arena (patent pending, start-up company under construction).

Two dentists and two scientists in the lab

3. Education and Training Initiatives

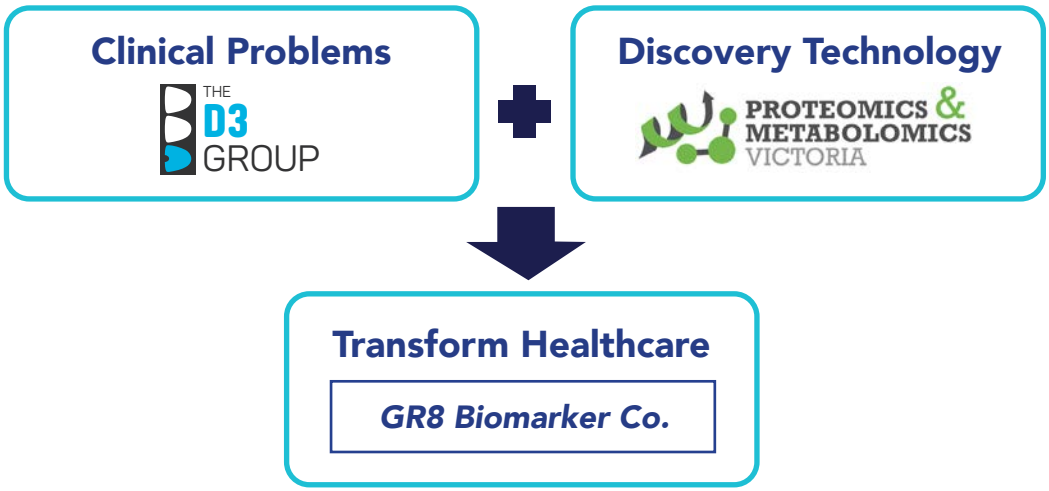
Multi-level education is a core theme across all MRUFD initiatives. Strong educational focus is built into the portal websites of **PMV** and **D3G**, and MRUFD staff are regularly invited to speak to diverse audiences (professional, academic, student). In 2009, MRUFD hosted a public lecture commemorating Charles Darwin and attracted over 360 registrants from secondary schools, academia and the general public. MRUFD is increasingly involved in research training, providing "bite-sized" projects and simplified technical options for clinical visitors. To capture premium clinical knowhow, a key advance was inclusion of late-career clinicians as hands-on contributors in basic research teams.



Public lecture on Darwin and metabolomics

Our Prospects

Great potential now exists to bring the discovery power of proteomics and metabolomics technologies to the orofacial field. One exciting prospect is a cross-field effort to develop robust biomarkers for monitoring hard-tissue dynamics on a day-to-day basis. Compromising healthcare today, many clinical situations exist where bone and tooth alterations can only be assessed on long timescales, typically using X-rays. With this in mind, MRUFD has started investigating the feasibility of using body-fluid diagnostics to expedite treatments at the orthodontist. The same concept can be applied to many other bone and tooth problem areas (e.g. bone stretching & orthopaedics, developmental dental defects, osteoporosis).



Continuing Support

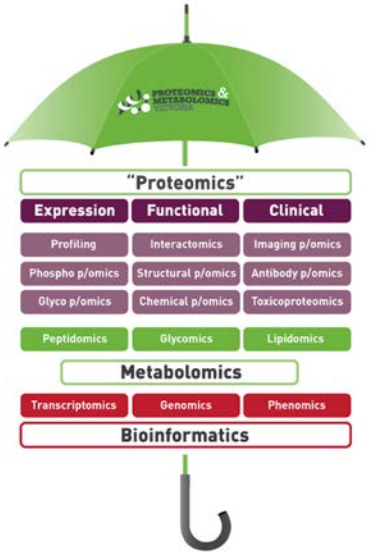
Initiated and sustained with two major donations from **Allan and Maria Myers**, the MRUFD receives financial support from a variety of sources including patients' families, practitioners, professional societies and industry. We welcome the opportunity to discuss MRUFD activities directly with other potential benefactors and donors.

Allan & Maria Myers, mother & child, Hubbard & Heggie

Proteomics & Metabolomics Victoria

Proteomics is a modern technological field aimed at enriching our understanding about proteins by studying them collectively rather than individually (i.e. a holistic approach). Likewise, metabolomics is used to investigate many small molecules, or "metabolites", at once (learn more at **PMV**). When the ideas that led to PMV were being conceived, the proteomics discipline was little more than a decade old and expanding rapidly. While attracting great excitement, the field was also suffering growth pains which were only aggravated when metabolomics subsequently rose to prominence.

Vision



The overall vision was for PMV to be an umbrella network that brought unity and identity to this nascent technological sector, thereby enhancing its strength and recognition. Follow-on advances would lead to better efficiencies and increased investment in this and neighbouring sectors. Before PMV, problems arose from fragmentation and lack of block identity, leading to missed opportunities as a whole. Applying holistic philosophy shared by the "-omics" fields (i.e. that enriched learning comes from addressing many things together), it seemed sensible to unite mainstream proteomics and metabolomics, plus their conceptual offshoots, under a common banner.
A second problem concerned accessibility, with interest in these enticing new technologies outstripping the available resources and guidance. Improved communication, both within the sector and externally, was clearly needed to address these and additional problem areas. A bold and distinctive vision was to span the full user-base (academia, research, trade, industry) through to government, thereby developing a mandated community in which research translation could thrive. It followed that academic and commercial interests might then work together to "grow the pie", rather than compete between existing "slices". Finally, it was envisioned that such a collective would provide a sizeable building block that could interact effectively alongside other sectors and networks (e.g. other "-omics technologies", healthcare, biotechnology, education), in Victoria and elsewhere.

Implementation

To get the "cross-sector" vision rolling, a small group of proponents was assembled from academia and trade. After obtaining support and financial backing from the Victorian government, broader buy-in was secured from academia, trade and industry (i.e. 18 founding organisations & companies contributed financially). PMV was then formalised as

an incorporated association and management structures put in place. Foundation initiatives (website portal, network functions) were designed and implemented, engaging broadly across the sector and region. A design focus here was to include small players as well as big, recognising that such diversity brought strength when solving individual scientific and technological problems (particularly challenges at the "front end"). Once broad membership was secured around the core areas, attention turned to fulfilling the umbrella vision by including peripheral players (e.g. protein structure/function) and interfacing with other network initiatives. From the outset, a particular challenge was to overcome the classical "us and them" barrier that existed between academia and trade, as necessitated by the vision for collaborative pie-growing. To address this challenge alongside other important matters, the idea of a regular "pub meeting" event was born (i.e. "public meeting" of the PMV Working Party, followed by a networking function at a nearby "public house").

Translational outcomes

Good progress has been made towards fulfilling the founding vision, to the extent that PMV has received governmental praise as a role model and since been emulated by others.

Unified identity: As a world-first of its type, the PMV network has successfully delineated a technology sector that draws on widespread academic input and translates through to opportunity for diverse applications in healthcare, agriculture and industry. Thus, for outsiders and government, PMV provides a graspable identity that covers a large amount of science and expenditure in the region. For insiders (>200 members), PMV brings flexible benefits associated with exposure and critical mass whilst preserving autonomy at organisational and individual levels. Effectiveness of the umbrella concept is evidenced by extensive online cross-referencing of PMV in Victoria and elsewhere, growing membership (including two more paid-up organisations), and the recent inclusion of the Melbourne Protein Group as an affiliate.

Access to technology: Seeking better access for outsiders, PMV developed a comprehensive online database of "who does what" across Victoria. Based on high use of this website section ("**Get Help**") and member reports, it is clear that the vastly improved information flow between potential participants (clients/providers/collaborators) saves time for all. Additionally, many items of major equipment are being utilised more heavily than before, anecdotally at least.

Better communication: PMV's first communication initiative was to develop a portal website that benefitted insiders (intercommunication, purchasing) and outsiders (education, access) alike, while also showcasing regional strength of the sector. Based on remarkably high use (consistently > 1200 unique visits per month since launch), this website is clearly fulfilling its design functions well. Secondly, the "pub meeting" initiative has proved successful, attracting a full spectrum of attendees from across the sector (i.e. students

through to company executives). This quarterly event has evolved to include tours/talks by the host organisation (revolving through academia, trade and industry), so provoking an unprecedented level of local awareness and fellowship. One pleasing outcome has been new connections between industry and academia, as evidenced by linkage funding and co-supervision of postgraduates.

Strategic planning and advocacy: PMV has opened a new door for planning and advocacy at community/sector level, driven in large part by its regular gatherings and other communication improvements that together provide an unprecedented melting pot. In its founding plan with Government, PMV was to turn its focus to education and training issues that thwarted sustainability (including further provision of infrastructural support). Initiatives are underway in both these areas (below) accompanied by community-centric discussion about major equipping needs. Additionally, cooperative arrangements have been established with other network groups including the **Victorian Platform Technology Network** (cf. transecting interest in core facilities) and PMV's new affiliate, the **Melbourne Protein Group** (cf. student focus). In an advocacy role, PMV participates by invitation in technology-infrastructure planning at state and national level (**NCRIS**), aiming to complement the inputs from Metabolomics Australia, Proteomics Australia and other member organisations.

Education and training: Having amalgamated many interest areas and talents from across the sector, PMV is proving to be a strong educational vehicle. Through its portal design, the PMV website offers many educational opportunities for outsiders besides its highly-accessed Learn section. With a view to improving visibility at secondary education level in particular, PMV co-hosted a public lecture linking metabolomics with Charles Darwin and the origin of life. Ensuing links (**GTAC**, Victorian Department of Education, Science Teachers Association) have led to plans for PMV to coordinate a student-focussed e-learning resource about proteomics and metabolomics ("bench to bedside to industry"). Hoping that these education initiatives will bring more people to the field, PMV has also designed a technician-training scheme involving flexible apprenticeships hosted collaboratively by academia/trade/industry.

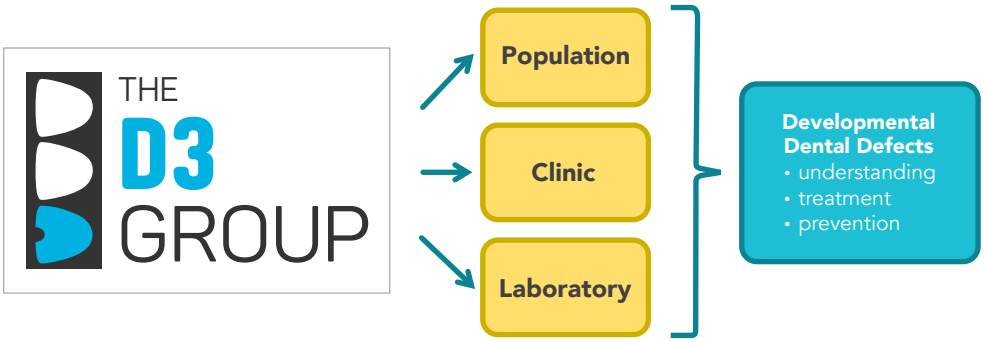
Support and investment: Adding to ongoing contributions from MRUFD, PMV has attracted broad in-kind support from its management and members – hence its ongoing operation and outcomes have been achieved at low cost. To meet these costs, 21 entities representing academia, trade, industry and government have made financial contributions, strongly endorsing the cross-sector vision of PMV.

It is apparent from these outcomes that PMV has made strong translational advances, both by coming to fruition and through initiatives it has developed since. With its exciting plans for further growth and development (e.g. e-learning resource, training schemes, educational tradeshows, scientific/educational liaison officers), PMV is ripe for further development

alongside other network ventures in Victoria and elsewhere.

THE D3 GROUP

In essence, Developmental Dental Defects (DDDs = D3s) are dental birth defects. They comprise a wide variety of disorders that manifest as malformed (e.g. discoloured, soft, pitted) or missing teeth. Whilst common and often problematic to the extent that many consider them a public-health burden, these disorders traditionally have received little attention at multiple levels (research, practitioner, population health, public awareness). However, the past decade has brought increased concern, particularly amongst clinical specialists dealing with children, prompting formation of The D3 Group.



Vision

The D3 Group was founded as a regional network that would draw together existing interests from across the sector, leading to a collective assault on the under-recognition problem that chokes the field worldwide. It was envisioned that such amalgamation of available strengths and concerns would also provide an unprecedented kernel for translational research, whose nourishment could benefit public health and economies globally. Of foremost concern, there was remarkable ignorance over the gravity of these dental defects (D3s), even within the oral healthcare professions. Such a general lack of awareness, together with paucity of data about morbidity and economic impacts, had left the field seriously neglected from a research perspective. A cross-sector approach seemed essential to address these problems and trumpet the field as a research priority (i.e. aiming to convert from "researcher push", to " health-provider pull"). Secondly, the field in general faced several problems relating to smallness, fragmentation and lack of focus (e.g. narrow thinking, gaps and duplications, subthreshold mass, misplaced competition). Although a pleasing number of workforce strengths existed in our region, these were of boutique scale, largely independent, and scattered geographically. It was clear that diverse benefits would arise through consolidation and unity at network level, particularly if there was collective effort to identify key problems and maximise outcomes through talent pooling.

With regard to research translation, there was need to not only link existing islands of expertise but also to fill several gaps as needed for an effective translational continuum. Crucially, such workforce advances would provide a globally attractive target for research funding, thus complementing the network's effort to get D3s recognised as a research priority. A third problem area was inadequate education, which unsurprisingly caused many of the difficulties mentioned above. From a translational viewpoint, particular concerns were primitive aetiological understanding (which sullied attitudes towards prevention) and inconsistencies surrounding terminology, diagnosis and treatment. Clearly, these pivotal issues would be better tackled by a collective, aiming to provide a common language and understanding for broader dissemination. Finally, a key translational issue was the missed opportunity to engage clinicians and clinical students in basic research, and conversely with exposing basic scientists to clinical reality (i.e. cross training and clinical awareness, respectively). Similar problems existed in interfacing with public health as the next tier up. Development of a network approach, together with appropriate support structures, seemed attractive in these regards.

Implementation

Building on early input from concerned clinicians who identified Molar Hypomineralisation ("Molar Hypomin") as the principal D3 problem in our region, broader consultation was undertaken with opinion leaders from clinical, research and public health arenas. Research leaders were then assembled to identify strengths and gaps, and to subdivide future efforts. A translational focus group (comprising representatives from academia, hospital and specialist practice) was established to plan research strategy and foundation initiatives. Terminology and branding were developed, aiming to make the field more accessible internally and externally. A clinical co-director was co-opted and The D3 Group (D3G) was launched in 2007 via a scientific/network meeting and website. D3G public meetings were held periodically thereafter, making efforts to engage across Australia and NZ (e.g. guest speakers, funded by MRUFD). The oral healthcare industry was also engaged through hosting of D3G meetings and research support. New research projects were started, strategically covering basic, population and translational aspects. Existing educational efforts were enhanced to emphasise translational aspects and to reach more broadly across society. Finally, new training opportunities were instituted, catering to late-career clinicians and clinical students in particular.

Translational outcomes

Good progress has been made bridging the chasm that classically separates busy clinicians and scientists, to the extent that several fruits of D3G's labour are starting to receive broad recognition and uptake.

Unified identity: D3G has united the field regionally by engaging comprehensively across the research, clinical and population health arenas, so providing a "one-stop-shop"

for those interested in D3. Furthermore, the whole sector has been embraced through outreach to industry and affected families, making D3G a world-first network of this type. Replacing a forgettable tongue-twister, the new "D3" appellation has given the sector a catchy label – this rebadging has met with rapid adoption, being accessible to professionals and the public alike. Through its composition and mission, D3G has also made a defining statement about translational research (which had been an unfamiliar concept for much of the membership). Already, the sector's newfound visibility as a substantive cohort extending across Australia and NZ (membership >100, growing rapidly) is improving awareness of the D3 problem and regional strengths available to attack it.

Clarification of the main problem and its research worthiness: Responding to tractional needs for sharper focus, D3G has prioritised Molar Hypomin as its primary concern – this choice recognised high impact at population level, potential preventability, and research tractability. For some this necessitated shifting away from the classical focus on two other D3s that, under the same criteria, rank as less problematic in our region (i.e. amelogenesis imperfecta, dental fluorosis). Conversely, by expanding the focus on Molar Hypomin to include downstream impacts (e.g. caries susceptibility, need for specialist treatments such as orthodontics), research marketability has been improved markedly. Research worthiness has been further emphasised by refining terminology to highlight the most problematic aspects (cf. caries risk) and the potential for prevention. Addressing the uncertainties about health burden, D3G's translational focus group has undertaken a cost modelling study to assess incidence and economic costs. Strikingly, the results put Molar Hypomin on par with major cancers in terms of treatment costs at population level, again highlighting the desirability for research into prevention and cost-effective treatments (publication in preparation).

Strengthened research effort: Since formation of D3G, communications have improved between researchers from across the region, particularly through regular opportunity to share thoughts and findings informally at D3G's scientific/network meetings. By bringing together researchers, clinicians and public health workers, these meetings have also provided an unprecedented environment for research translation. In the Melbourne hub, planning by the research leaders group has led to establishment of several new research initiatives and teams, drawing in part on new "translational research talent" contributed by late-career clinicians. For example, targeting mechanistic understanding, an NHMRC-funded project explores animal models of D3. At the other end of the spectrum, another project investigates downstream risks and economic impacts of Molar Hypomin at population level, and a clinical subproject investigates its impacts on orthodontics – both these projects draw heavily on clinicians' inputs, complementing those from career researchers. And of further translational importance, a new clinical research avenue exploiting proteomics and metabolomics has been started (funded by MRUFD). The first **publication**, involving researchers from 3 areas (dental academics, hospital dentist, basic scientists), provided intriguing insights to the molecular characteristics and pathogenesis of Molar Hypomin – thus opening the door not only to important new questions of

preventive significance, but also to ideas for new products as follows.

Translation from "Bench to Chairside": Cognisant of issues raised by clinicians repeatedly, the above proteomics study led basic scientists to think of practical aspects that might be exploited clinically (i.e. diagnostic and treatment aids). With their follow-up work proving supportive (patent pending), initial steps towards product development are now being taken. Attractively, this advance will represent a full translational cycle from clinical problem to clinical benefit via basic science, should it come to fruition.

Better visibility and recognition: Visibility and recognition of the D3 field have improved markedly since formation of D3G. For example, the founding D3G website has elicited multiple contacts from outside the network (e.g. interested practitioners, affected families), and articles on D3G have appeared in practitioner magazines. Moreover, D3G leaders have been invited to give numerous talks about Molar Hypomin (science, clinical and public audiences) leading to broad exposure of D3G and its translational activities.

Education and training: D3G is attacking the education and training problem on multiple fronts, to good effect. For example, through repeat invitations, D3G members have regularly combined to give "translational" lectures via a tag-team approach, and a multi-level online learning resource (catering for affected families, public health sector, practitioners and researchers) is at an advanced stage of development. Through their informality, the D3G scientific/network meetings are proving a popular vehicle for cross-disciplinary exchange, including presentations from less-experienced contributors (students, clinicians). And through collaborative training efforts directed largely at late-career clinicians and clinical postgraduate students, the translational research workforce is being strengthened vastly.

Funding and advocacy: Whilst most effort has been directed at establishment of the network and pilot projects (both sponsored largely by MRUFD), attention is increasingly turning to funding of D3G's enhanced capability to undertake translational research. Rewardingly, D3G teams have secured competitive grants from public and industry sources (NHMRC, Dentsply), and two high-profile dental companies (Dentsply, Colgate) have provided financial support for D3G meetings. These and other visible indicators of traction have put D3G in a strong position for advocacy, which has commenced both locally (public health providers) and nationally (policy regarding caries monitoring and treatment).

These outcomes suggest that D3G has made a strong start at turning a poorly recognised dental problem into a public health issue with community ownership. Given that such endeavours are needed worldwide, D3G occupies a pioneering position that with appropriate development could impact oral healthcare globally.

RESEARCH INTERESTS & PUBLICATIONS

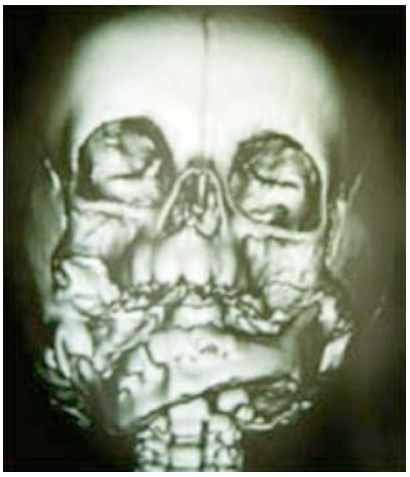
Current research

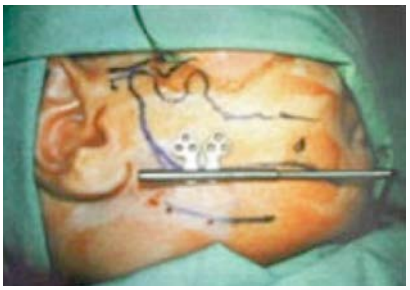
Currently the MRUFD has two main research themes that relate to bone and teeth respectively. A third theme on biomarkers, which pertains to both bone and teeth, is at an early stage of development. Being complementary at both the biological and clinical levels, these companion topics hold broad relevance across the orofacial spectrum. As such, current efforts are providing a strong foundation for future expansion into a variety of clinical areas.

1. Surgical and biological manipulation of bone generation and shape

The MRUFD maintains a strong interest in the biological behaviour of bone at several levels, ranging from the remodelling of facial bones following repositioning to the generation of new bone using distraction techniques in craniofacial syndromes.

Distraction osteogenesis – In the 1950's, the Russian surgeon, Illizarov, successfully lengthened shortened lower limbs using his novel technique of distraction osteogenesis. This technique was adapted to advance the bones of the facial skeleton in the early 1990s following several animal studies. Initially this involved lower jaw (mandibular) lengthening in patients with diminutive jaws (micrognathia). This application broadened to include advancement of the mid-face in cases of cleft lip and palate and the syndromic craniosynostoses. Many internal and external devices have since been trialled for regular clinical use. Protocols have been developed for the use of these techniques, leading to publications on this topic.





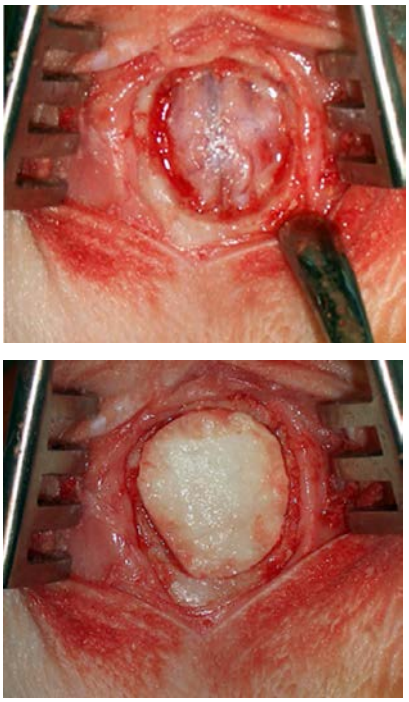
*See **story** in The Age*

Upper airway obstruction is an increasingly recognised condition in paediatric patients with craniofacial anomalies. The application of mini-internal devices to lengthen the mandible in neonates and infants with Robin Sequence and other micrognathic conditions was commenced early this century in conjunction with the Departments of Neonatology and Respiratory Medicine and our team was one of the first in the world to conduct a prospective series for investigation. Similarly, internal and external devices have been applied to young patients with obstructed airways due to hypoplastia of the

mid-facial structures. Distraction osteogenesis in many of these patients has revolutionized their management by eliminating the need for tracheostomies, by removing the need for noctural supplemental oxygen and has led to earlier discharge from hospital and the more rapid establishment of feeding. Studies are continuing in these areas and further publications are being prepared.

Protocols of management – Repositioning components of the facial skeleton by performing traditional osteotomies has been well established for several decades but the advent of distraction osteogenesis has provided another tool for use in the management of cleft and craniofacial patients. Uncertainties remain about the response and stability of certain movements of the jaws in three dimensions using these techniques. Optimised protocols are evolving and are the subject of continuing investigation by A/Prof Heggie's team in the Department of Plastic and Maxillofacial Surgery.

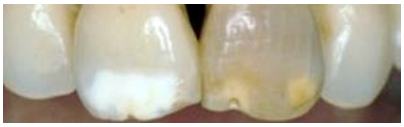
Bone regeneration – Major skeletal defects often require more bone for replacement than is available from the patient. The ability to grow ("culture") bone outside the body or at the site of the defect for repair of craniomaxillofacial defects is an aspiration for scientists worldwide. The new field of tissue regeneration challenges the hugely successful era of hard and soft tissue reconstruction based on flaps and free vascularised transfer. Enormous interest surrounds the use of stem cell technology to replace damaged tissues, ranging from bone and cartilage to cardiac muscle.

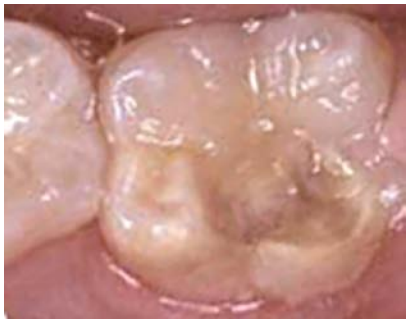


Skull repair using regenerated bone

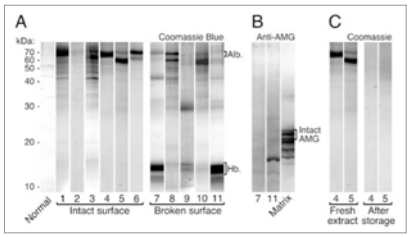
Cranial defects resulting from various conditions have proved to be a challenge to the surgeon as the availability of sufficient bone to use for repair is not always possible. With the development of bone substitutes, stem cell research and agents that promote bone healing, investigation of ways to effectively avoid the use of patient donor sites has been undertaken by MRUFD. The successful use of fresh frozen irradiated allografted bone using the rabbit critical size cranial defect was published, and a similar outcome involving a resorbable polymer was reported by Dr. Peter Farlie and his team. The use of a decellularized connective tissue matrix was also investigated in the same model.

2. Cause and prevention of Developmental Dental Defects





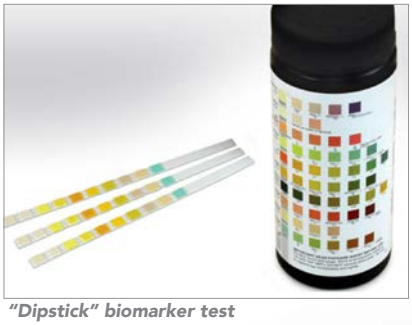
Hypomineralisation defects in incisors and a "6-year-old" molar



Diagnostic profiling of Molar Hypomineralisation lesions

Capitalising on Prof. Hubbard's experience in the biology of enamel-forming cells and calcium regulation, a major research thrust of the MRUFD is to improve understanding of Developmental Dental Defects (DDDs = D3s). We hope to not only help improve treatment options but ultimately to achieve prevention of D3s in many cases, through understanding their causes. D3s have a disturbingly high prevalence, affecting about 20% of children worldwide. Consequently D3s bring high costs to patients and society, particularly through increased risk of dental decay and pain. The most common types of D3 are acquired during infancy, apparently as a result of injury to the tooth-forming cells. It remains unclear what causes such cellular injuries, although suspicions centre on environmental toxins and several factors associated with childhood illness. To tackle the D3 problem effectively through a translational approach, the MRUFD has initiated and spear-headed development of a cross-sector network. Focussing on what is considered the most pervasive problem, Molar Hypomineralisation (pictured), MRUFD has assembled new research teams comprising career scientists and clinicians working alongside each other. With seed funding from MRUFD, one such multidisciplinary team has undertaken a pioneering analysis of the molecular makeup of hypomineralised enamel. Their findings have given useful insights to the underlying disease mechanism, and provided protein profile information that could be useful for guiding diagnosis and treatment (**read more**). Other teams are applying a variety of biochemical, biophysical and structural approaches to clinical specimens and experimental models of D3 (read more at **The D3 Group**).

3. Biomonitoring of tooth and bone dynamics



"Dipstick" biomarker test

Seeking better options for orofacial healthcare, MRUFD is well positioned to engage the biomarker arena having spear-headed the establishment of Proteomics & Metabolomics Victoria. Medical applications of biomarkers are well established and receive widespread use (e.g. monitoring of proteins released from damaged cardiac muscle after a heart attack, PSA test for prostate cancer). However, many of these tests are prone to error as they rely on single biomarkers. Proteomics/metabolomics technology can reveal groups of useful biomarkers, opening the door to more powerful "multiplex" tests.

Two biomarker projects of interest to MRUFD involve "real-time" monitoring of tooth and bone movement (as in orthodontics and distraction osteogenesis of jaws) and of dental development. Orthodontists usually move teeth slowly to minimise risks of damaging the tooth roots. This problem of root resorption can lead to loss of teeth and is only detectable at advanced stages using X rays. Several studies have explored using a biomarker to give early warning about root resorption and, in its absence, to move teeth more rapidly. Promising results have been obtained, but we believe multiplex tests will be required for clinical robustness. Maxillofacial surgeons often need to reshape the facial skeleton using a bone-stretching process called distraction osteogenesis, as outlined above. Currently the stretching is done at an empirical "rule of thumb" rate and surgeons receive little feedback on how individual treatments are progressing. An attractive prospect is to use biomarkers to monitor this process so that stretching rates can be optimised for each individual. Given that D3s (developmental dental defects) are a widespread and costly problem, an attractive prospect is to monitor immature teeth as they develop in infants. Ultimately this approach might enable interventions that avoid D3s and maximise enamel strength. The current lack of such tests means that D3s are usually discovered several years later when the tooth erupts into the mouth, which is too late for preventive measures.

In both problem areas, there is a fundamental need to discover informative patterns of biomarkers. A second requirement is to develop clinical tests for monitoring these biomarker sets. Biomarkers generally comprise proteins or their fragments (peptides), or natural small molecules (metabolites) that can be revealed in large numbers by proteomics and metabolomics technologies, respectively. Computer analysis is then used to select informative biomarker sets that in turn are validated rigorously in the clinical context. PMV provides access to technology experts, major equipment and the education sector, and provides links with industry and government that could benefit subsequent commercialisation. A substantial market is likely to exist for multiplex biomarker tests that foster individualised healthcare strategies in the orofacial sector.

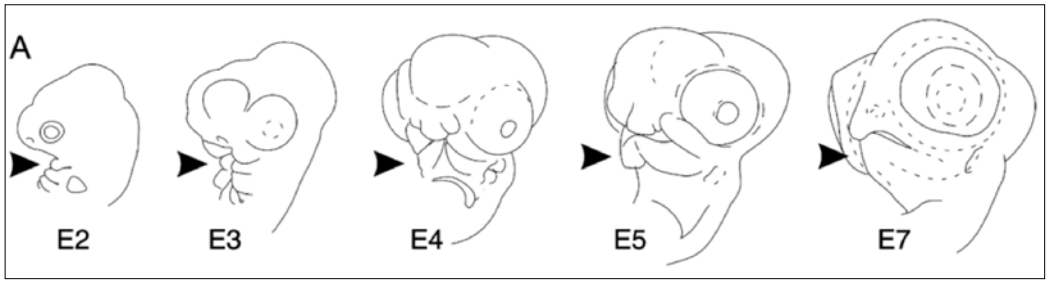
Other Research Interests

A variety of other research avenues of interest to the MRUFD will be pursued as appropriate funding and resources become available, including:

- Using the new discipline of 'phenomics' (a type of reverse genetics) to investigate the genetic foundation of common craniofacial disorders
- Interpretation and management of cleft palate speech disorders
- Identification of cellular populations in neural crest tissue
- Molecular foundations of facial anomalies (see below)

Molecular foundations of facial development and abnormality

Prof. Hubbard teamed up with **Dr Peter Farlie** (Murdoch Childrens Research Institute and Deputy Director, Research, Department of Plastic and Maxillofacial Surgery) to initiate a ground-breaking project investigating the molecular foundation of facial development. This research provides a new method of investigating the pathogenesis of abnormalities in facial development that lead to birth defects such as clefting disorders, cranial shape abnormalities (craniosynostoses) and absent teeth. By combining Dr. Farlie's experience in craniofacial embryology with Prof. Hubbard's skills in 'proteomics' (a cutting-edge technology involving the analysis of many proteins simultaneously), a new way of learning about the cells that form the lower face (including jaw and teeth) became possible. With seed funding from the MRUFD, this study progressed well and the early findings were published in a widely read multidisciplinary journal. **Dr Firas Alsoleihat** (a dental graduate from Jordan) joined this project and his extension of the proteomics studies and development of other new research avenues led to successful completion of a PhD in 2008. Many intriguing avenues exist for expanding these investigations.



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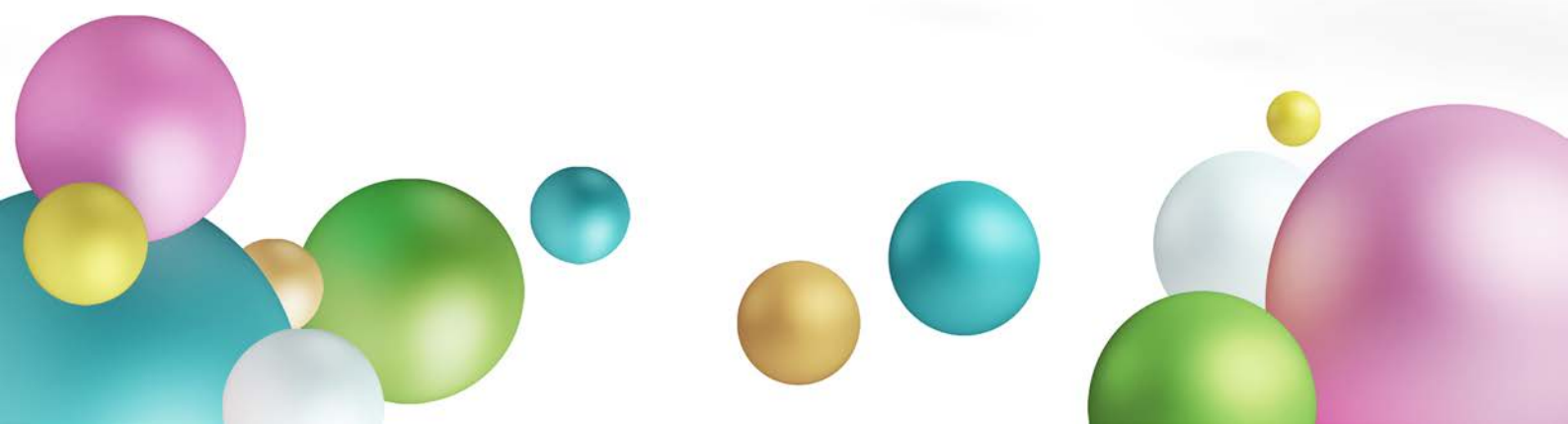

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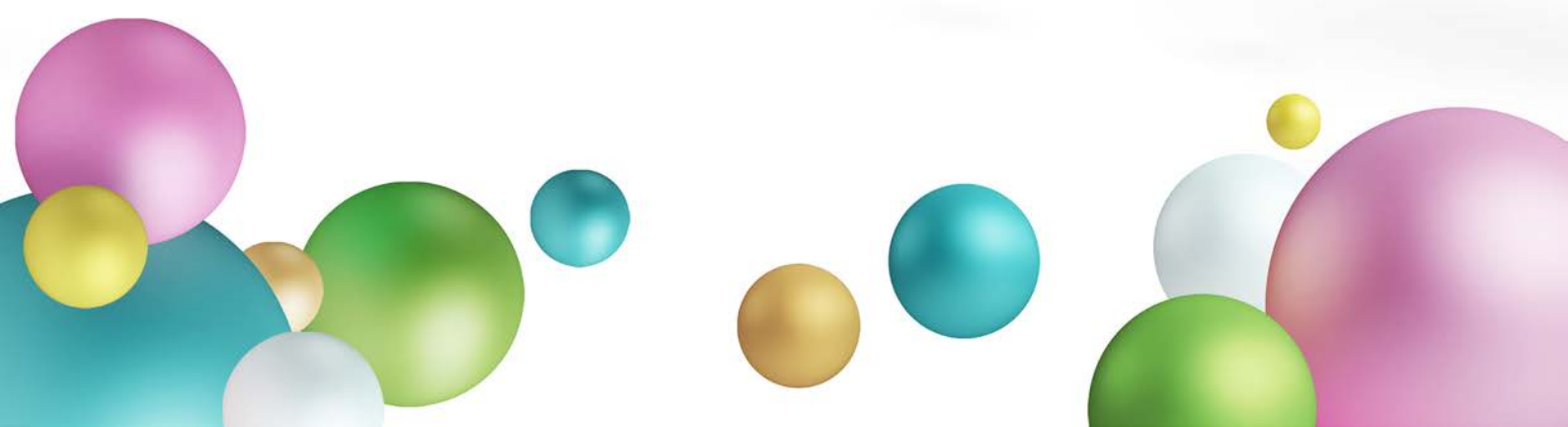


MRUFD'S PEOPLE

Management of MRUFD

Associate Professor Andrew Heggie
Director of MRUFD (Clinical)

Andrew is an oral and maxillofacial surgeon who heads the Oral & Maxillofacial Surgery section within the **Department of Plastic & Maxillofacial Surgery** at the Royal Children's Hospital, and also practices privately. He founded the MRUFD together with orthodontist colleague, Paul Schneider, in 1999. Andrew is primarily responsible for the bone research theme of MRUFD, and maintains an active interest in paediatric maxillofacial surgery, clinically related research and teaching.

Professor Mike Hubbard
Director of MRUFD (Research)

Mike is a biochemist who originally trained as a dentist. He has held the first MRUFD Professorial Fellowship in Oral and Facial Sciences since 2003, hosted by the University of Melbourne's **Department of Paediatrics**. Besides overseeing translation of basic research, he maintains primary responsibility for the dental research theme of MRUFD, co-directs **The D3 Group**, spear-heads ongoing development of **Proteomics & Metabolomics Victoria** and heads a research lab.

Dr Jocelyn Shand
Deputy Director of MRUFD (Clinical)

Jocelyn is a consultant oral and maxillofacial surgeon at the Royal Children's Hospital with strong clinical and research interests in paediatric maxillofacial surgery, particularly involving the correction of upper airway obstruction in infants with diminutive jaws. She also practices privately and contributes to several professional bodies at executive level, currently focussing on professional training and specialist registration issues.

Jon Mangum
Deputy Director of MRUFD (Research)

Jon is a biochemist/molecular biologist who has held the first MRUFD Research Fellowship since 2003. Hosted by the University of Melbourne's **Department of Pharmacology**, Jon manages the **Hubbard lab**, plays a lead role developing MRUFD collaborative investigations, assists MRUFD colleagues with their experiments, and undertakes research at basic, translational and clinically applied levels. He is also in the throes of completing a PhD.

Dr Garry Nervo
MRUFD Development Manager

Garry is a specialist endodontist who practiced privately in central Melbourne until recently. For several years, Garry worked part time in the Hubbard lab, helping with D3-related projects (co-authorships forthcoming) and as a foundation member of **The D3 Group**. Garry is now sharing this valuable experience in translational research by helping MRUFD in a liaison and advocacy role.

MRUFD-associated Investigators

Dr Peter Farlie
Group Leader, Murdoch Childrens Research Institute

Peter is a developmental biologist with degrees in biochemistry and neurobiology. His research aims to clarify the causes of craniofacial birth defects, particularly through improved understanding of skeletal development. He also oversees a variety of bone-related research projects in his role as Deputy Research Director, **Department of Plastic & Maxillofacial Surgery** at the Royal Children's Hospital.

Associate Professor Paul Schneider
Head of Orthodontics, Melbourne Dental School

Paul is an orthodontist with additional training in paediatric dentistry. He operates a **private orthodontics practice** and, having helped train orthodontists at **Melbourne Dental School** for many years, was ideally placed to take over as Head of Orthodontics in 2011. Since co-founding the MRUFD in 1999, Paul has helped establish our dental defect (D3) and biomarker research projects, which now are becoming increasingly embedded within postgraduate training.

Professor David Manton
Head of Child Dental Health, Melbourne Dental School

David is a paediatric dentist with broad experience in dental research (PhD), academia and private practice. His education and research responsibilities at **Melbourne Dental School** span paediatric dentistry, orthodontics and special-needs dentistry. David has been a key supporter of MRUFD's dental defect theme and helped establish **The D3 Group**, which he co-directs.

Professor Mike Morgan
Head of Population Oral Health, Melbourne Dental School

Mike is a paediatric dentist with additional training in epidemiology and public health (PhD). Besides his numerous responsibilities at **Melbourne Dental School** (Deputy Head, research, education), Mike serves as an advisor on several professional and governmental groups. Mike has been a key supporter of **The D3 Group**, helping guide development of the population health tier.

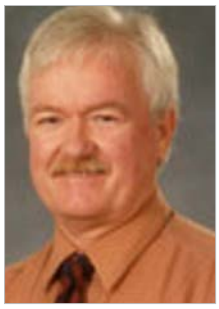
Associate Professor Joseph Palamara
Head of Biophysics, Melbourne Dental School

Joseph is a physicist with vast experience in dental research. At **Melbourne Dental School** he orchestrates many projects investigating the physical properties of teeth, bone and dental materials. As such, Joseph helps several D3G/MRUFD teams and is a foundation contributor to **The D3 Group**.

Associate Professor Roger Hall
Honorary Researcher, Hubbard Lab, University of Melbourne

Roger is a retired paediatric dentist who is well known as the first Head of Dentistry at The Royal Children's Hospital Melbourne and as principal author of a leading textbook on paediatric dentistry. Building on his past clinical interests and research experience in dental defects, Roger is actively involved in D3-related investigations in the Hubbard lab (co-authorships forthcoming) as well as helping **The D3 Group** with its educational mission.

Associate Professor Kerrod Hallett
Head of Dentistry, The Royal Children's Hospital Melbourne



Kerrod is a paediatric hospital dentist with additional training in public health. His research interests include childhood caries and clinical trials of dental products. Kerrod is helping MRUFD develop its caries and biomarker research, and supporting **The D3 Group** with cases and specimens.

Emeritus Professor Louise Brearley Messer, AM
Past Head of Child Dental Health, Melbourne Dental School

Louise is a paediatric dentist with additional training in nutritional biochemistry (PhD). Her illustrious career in academia has led to numerous paediatric dentists receiving highest quality training in both the clinical and research aspects of their profession. In 2012 she received Federal recognition for her service to the dental profession (Medal in the Order of Australia). Louise is a foundation member of **The D3 Group** and continues to be actively engaged in several D3 research projects and promotion of the Molar Hypomin problem.

Dr Felicity Crombie
Lecturer, Melbourne Dental School

Felicity is a general dentist whom, having completed a PhD in 2011 (studying Molar Hypomin), now graces the hallowed halls of academia as lecturer and researcher. With an impressive string of publications and invited lectures behind her, Felicity remains actively involved in several D3 projects. She has contributed to **The D3 Group** since its inception and still finds a little time for private dental practice.

MRUFD-associated Practitioners

Dr Ed Lobaza
Specialist in Periodontics, Central Melbourne

Ed is a periodontist who spends most of the working week at his specialist private practice in central Melbourne. On his half-day off, Ed helps out at the Hubbard and Palamara labs, working on a D3 project (co-authorship forthcoming). "Why play golf when you can get to use your brain in the lab?" asks Ed. Indeed, and the lab workers love hearing Ed's stories about life at the clinical coalface.

Dr Loch Ramalingam

Consultant Paediatric Dentist, The Royal Children's Hospital Melbourne

Loch is a paediatric hospital dentist who both treats children and helps train the next generation of "kids dentists". Loch's strong awareness of the Molar Hypomin problem has led her to support **The D3 Group** with cases and specimens. Of late she has taken on a co-supervisory role with D3 research based at the Royal Children's Hospital.

Dr Margarita Silva

Specialist Paediatric Dentist, Eastern Melbourne

Margarita is a paediatric dentist with a particular passion for the Molar Hypomin problem. In addition to private practice, she is also actively involved in training dental students and paediatric dentists, and teaches at Community Dental Health centres in the country. Margarita has actively supported a variety of D3 research projects with cases and specimens, leading to co-authorship of two papers about Molar Hypomin (and more on the way). Unsurprisingly she is also a foundation
member of **The D3 Group**.

Dr Karen Kan

Specialist Paediatric Dentist, Eastern Melbourne

Karen is another paediatric dentist in private practice with a strong desire to help those with Molar Hypomin. Karen is a foundation member of **The D3 Group** and continues to support several D3 projects with specimens and clinical data (co-authorships forthcoming). Through her lectures and teaching, Karen also plays an important role in publicising the Molar Hypomin problem to the profession

and beyond.

MRUFD-associated Public Health Managers

Adjunct Professor Hanny Calache

Director of Clinical Leadership, Education and Research, Dental Health Services Victoria

Hanny is a paediatric dentist with additional training in public health (doctorate) and health administration. He has broad experience in private and public practice, education and training. In 2010 and 2011 he received awards for his numerous contributions at **Dental Health Services Victoria**. Hanny has been a key supporter of **The D3 Group**, helping promote better awareness of D3 problems at government and community levels.

Associate Professor Chris Olsen

Head of Specialist Paediatric Dentistry, Dental Health Services Victoria

Chris is a paediatric dentist responsible for specialist care delivery to children at the **Royal Dental Hospital of Melbourne**. He has helped train paediatric dentists for over 20 years. Through his experience in private and hospital settings, Chris is well versed in how broadly the Molar Hypomin problem impacts communities. Having supported the **The D3 Group** since its early days, Chris is now increasingly involved in D3 research projects.

APPENDIX 1:

MRUFD's Research Students and 'Dad's Army' lab volunteers

A. STUDENTS

1. Hubbard lab (primary supervision)

PhD and early career track

- **Jon Mangum**

a. PhD, graduated 2014 (Colgate-IADR Travel Award, to Fiji)

b. Grad Cert Commercialisation, graduated 2013 (Dean's award)

c. NHMRC Doherty Early Career Fellowship, awarded 2014

***Jon** (PhD 2014), **Vidal** (PhD 2015), **Mike** (PhD 1983)*

PhD

- **Vidal Perez**, graduated 2015 (Colgate-ANZSPD research award, Chancellor's prize nomination)

Doctor of Clinical Dentistry (research component)

- **Rebecca Williams**, Paediatric Dentistry, graduated 2012
- **Paul Dever**, Orthodontics, graduated 2012
- **Amanda Leen**, Orthodontics, graduated 2013
- **Cary Chien**, Orthodontics, graduated 2014
- **Edwin Tan**, Orthodontics, graduated 2014

***Paul Dever** (Orthodontist 2012-)*

B Med Sci

- **Su Ang**, graduated 2008
- **Jeremy Clark**, graduated 2013

2. Dental School (co-supervisory role)

PhD

- **Felicity Crombie**, graduated 2011

Doctor of Clinical Dentistry (research component)

- **Debra Knox (Elsby)**, Paediatric Dentistry, graduated 2014

3. Murdoch Childrens Research Institute (co-supervisory role)

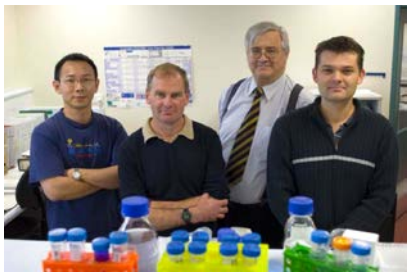
PhD

- **Firas Alsoleihat**, graduated 2008

4. Biochemistry/Bio21 (co-supervisory role)

PhD

- **Dhana Gorasia**, graduated 2012



***Kon, Mike, Garry, Jon** (2007)*

B. 'DAD'S ARMY' VOLUNTEER ASSISTANTS IN HUBBARD LAB

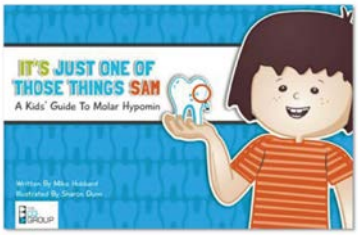
- **Garry Nervo**, endodontist, 2005-14
- **Roger Hall**, paediatric/hospital dentist, 2007-13
- **Ed Lobaza**, periodontist, 2007-13

APPENDIX 2:

MRUFD's "translational publications"

1. Children's storybook

- "Sam's Story", 32-page reader (over 15,000 copies distributed [sponsored or sold])
- First edition (2013), *A kid's guide to Molar Hypomin*
- Second edition (2018), *A kid's guide to Chalky Molars*



2. The D3 Group online learning resource

- thed3group.org, launched August 2013

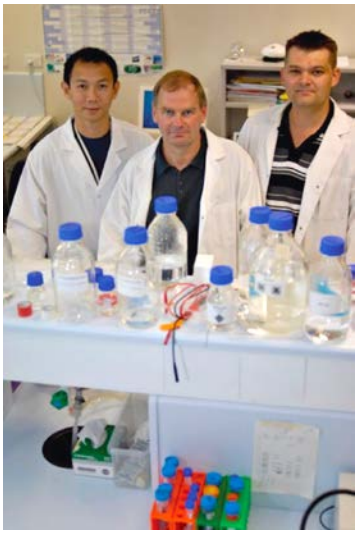
(over 17 million hits at August 2025)

3. The Chalky Teeth Campaign website

- chalkyteeth.org, launched November 2015

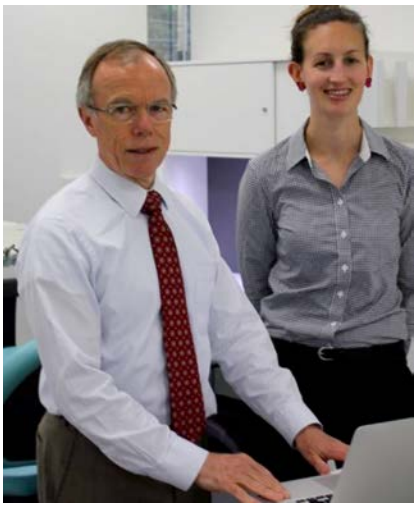
(over 1 million hits at August 2025)

APPENDIX 3:










GROUP



THE D3 GROUP
for
Developmental Dental Defects
THE CHALKY TEETH CAMPAIGN
thed3group.org
chalkyteeth.org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- Everyone who made MRUFD possible, productive and fun

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