

Research at the School of Dental Sciences





2	Contents
3	Welcome from Head of School
4	Message from Director of Research
6	Collaborators
8	Translational Oral Bioscience
10	Case Study to follow
12	Applied Oral Health Research
14	Case Study
16	Dental Education
18	Case Study
20	Postgraduate Research
22	Postgraduate Research Case Studies
24	Other research opportunities
26	Our facilities

Welcome

At Newcastle we are proud of our research for its innovation, high quality and impact on dental practice and policy. Our work ranges across Translational Oral Bioscience, Applied Oral Health research and Dental Education research and we work with partners across different disciplines and across the globe to ensure what we do is cutting edge and translational.

Our school community and culture are key to achieving the best research possible and we continue to build a diverse community across the school and to work to ensure our positive culture is highly supportive. We particularly value our engagement with the wider dental community, patients, the public, industry, other stakeholders and policy-makers to ensure the relevance of our work. We also benefit from state of the art facilities both within the school and through access to university-wide infrastructure.

I am especially proud of our work in developing the next generation of researchers. We have put in place schemes to encourage research at undergraduate level and have a strong international postgraduate research community, with PhD students working across our areas of expertise. We have a strong track record in mentoring and supervising early career researchers through their career pathways with particular success in attracting funding for fellowships. Our opportunities include vacation (summer) projects for undergraduates, a Master of Research in Oral and Dental Health, scholarship or fellowship funded PhDs and international exchanges for academic staff.

If you are interested in our work or working with us, we are always open to new conversations and opportunities, so please do get in touch. I hope you enjoy sampling a little of what we do through this booklet.



Professor Chris Vernazza, Head of School
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Introduction

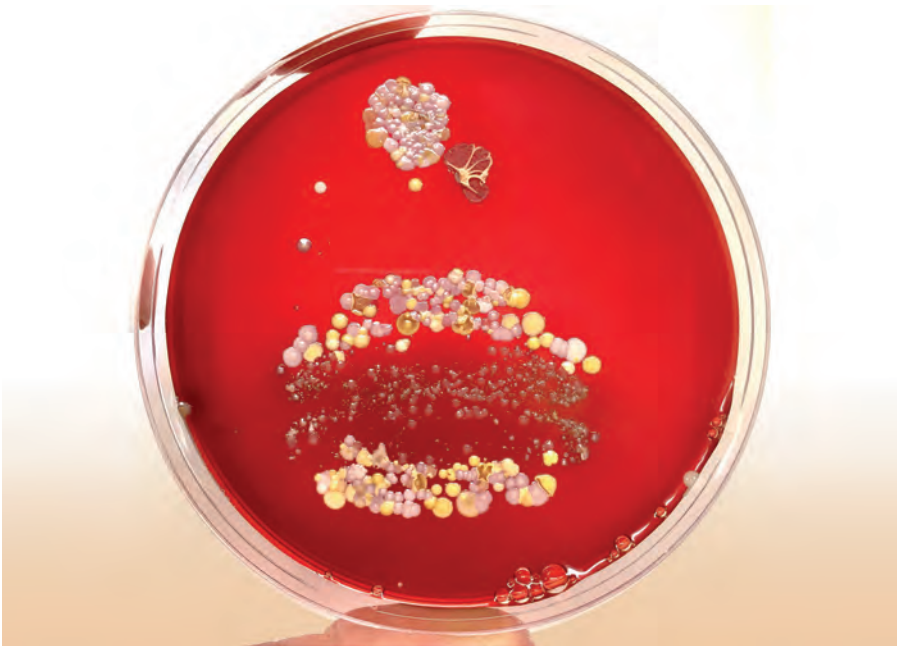
This booklet gives you an introduction to the research we conduct at Newcastle University School of Dental Sciences. Our mission is to conduct world class multi-disciplinary research that improves oral health through academic excellence, policy impact and commercial innovation.

Our research is organised into three core strands: Translational Oral Biosciences, Applied Oral Health, and Dental Education. A brief description of each of these strands, together with case-studies of typical research we conduct, is provided in the following pages. We have a diverse and vibrant community of postgraduate students, clinical academic trainees, full time researchers, professional support staff and academic staff, and later in this booklet we provide brief information about opportunities to join us and details of the world class facilities we have here. I hope this booklet is useful and we look forward hearing from you if you would like to know more about any of our research or to discuss our opportunities.



Dr Matt German, Director of Research
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We work with leading scientists across the globe in some of the most important aspects of oral health research.

The map highlights many of our current international collaborations.



Translational Oral Biosciences



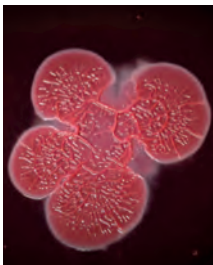
Lead

Professor Nick Jakubovics

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What we work on

In oral microbiology we investigate novel approaches to control oral biofilms, how bacteria respond to external environments and how cellular ageing affects the ability of pathogenic yeast to cause disease. Oral immunology explores cholinergic regulation of immune responses and the potential immune functions of stem cells in the dental pulp. Research into oral cancer investigates molecular markers for early disease characterisation. Our orofacial pain research establishes new models for acute dental pain and the relationship between neuronal hyperexcitability and pain symptoms. In dental materials research we develop new bioactive anti-microbial polymer composites. We study the roles of microRNAs and genetic polymorphisms in oral mucosal inflammatory disorders such as oral lichen planus.



Who we collaborate with

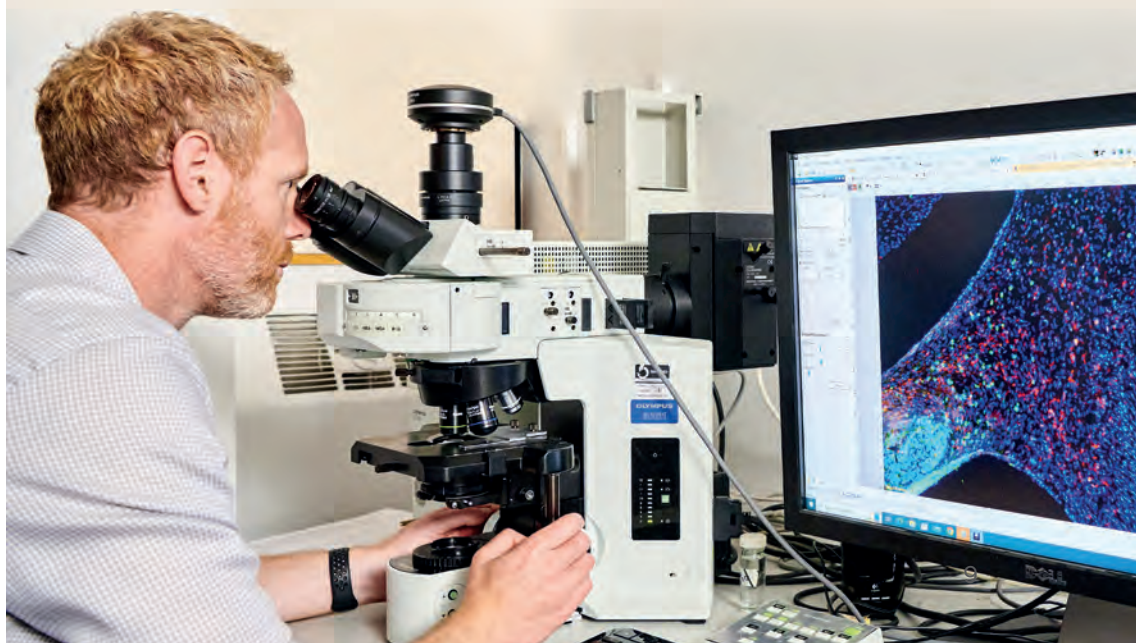
We work with engineers, computer scientists, mathematicians, bioinformaticians, pharmacists, parasitologists and colleagues from a wide range of other disciplines at Newcastle University. We have a global network of collaborations from the US to Germany, Japan, Brazil, China, Malaysia, Singapore and many others.

Some recent projects

- Identification of molecular mechanisms driving antifungal drug resistance in aged *Candida* spp. Populations funded by the Royal Society, lead Dr Alessandra da Silva Dantas
- A probiotic approach to control periodontitis funded by the Dunhill Medical Trust, lead Professor Nick Jakubovics
- Predicting the clinical outcome of oral potentially malignant disorders using transcriptomic-based molecular pathology, published in *British Journal of Cancer* 125, 413–421 (2021), lead Dr Ralf Kist
- Constructing a bacterial biosensor to signal kynurenine imbalance in pulpitis funded by the Rosetrees Trust, lead Dr Chien-Yi Chang

What impact we have had

We have developed novel enzymes and agents for biofilms control that are progressing through the translational pipeline. Our biomarker research has identified novel biomarker signatures associated with periodontitis and the development of oral cancer that are the subject of patent applications. Our group has a strong track record in successfully training PhD students, including many international students from around the world.



Case study

Understanding and controlling bioaerosols in dentistry



Funder

Wellcome Trust; Faculty of Dental Surgery (Royal College of Surgeons of England)

Lead

Mr James Allison

What was the project about?

The COVID-19 pandemic caused massive disruption to dental services across the world. Many dental clinics had to close due to uncertainty over the risks posed by the dispersion of viruses in aerosols (bioaerosols) produced by dental procedures. The aim of our research was to understand how much risk is posed by these bioaerosols, and how they can be controlled in dental clinics, to inform dentists how to safely provide care.



What did you do?

We developed a simulation model to study dental bioaerosols, first using fluorescent dyes, and then non-harmful viruses (bacteriophages) as tracers to understand where human pathogens may be dispersed to during dental procedures. We measured both the amount of infectious virus and viral nucleic acids dispersed during simulated dental procedures, and the effect of bioaerosol control measures commonly used in dental clinics.

What did you find?

We found that infectious virus is dispersed during dental procedures using our simulation model, and that this can travel several meters from a dental procedure, with bioaerosols persisting for some time after the procedure, depending on the ventilation rate in the treatment room. Reassuringly, we showed that simple bioaerosol control measures, such as dental suction, local exhaust ventilation, dental waterline disinfectants, and rubber dam, are highly effective in reducing the dispersion of potentially infectious dental bioaerosols.

What difference will this make?

Our findings informed guidelines for dental care during and following the COVID-19 pandemic and contributed to the safe reopening of dental clinics and recommencement of clinical dental education in the UK and elsewhere in the world. As a result of this work, dentists will be better prepared in any future outbreak, and the need to close dental clinics due to uncertainty over bioaerosols should be reduced. With a better understanding of dental bioaerosols, dental professionals are now better prepared to safely treat patients with either endemic or emerging respiratory infections who require urgent or emergency dental care.

Applied Oral Health Care



Lead
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What we work on

Our globally recognised multidisciplinary research ranges from multicentre clinical trials, to the design and conduct of national epidemiological surveys of oral health. Our skills in conducting mixed methods research across the whole life course, enables us to answer key research questions and priorities. Together with our growing expertise in oral health economics and health services research, we are making a substantial contribution to the evidence-base that underpins evolving health policy, making a meaningful improvement to the health and wellbeing of patients and populations. Our research in periodontal disease, temporomandibular disorders and bioaerosols builds upon the basic sciences through clinical research and interventions for improved patient outcomes.



Who we collaborate with

We work with health economists, pharmacists, epidemiologists, general medical and dental practitioners, psychologists, sociologists and clinical trialists within Newcastle University, and across the region. We have active collaborations with colleagues in other universities both across the United Kingdom and internationally, as well as commercial, policy and patient partners.

Some recent projects

- Smoking cessation interventions in primary dental care (ENHANCE-D trial). Funded by NIHR, lead Dr Richard Holliday
- Identifying undiagnosed atrial fibrillation in older adults attending dental clinics (DETECT AF study). Funded by Daiichi Sankyo UK Ltd, lead Dr Susan Bissett
- Dental care preference elicitation: an application to National Health Service dental contract reform. Funded by NIHR, lead Ms Katherine Carr
- Controlling infectious bioaerosols in dentistry. Funded by The Wellcome Trust and the Royal College of Surgeons of England Faculty of Dental Surgery, lead Dr James Allison
- Dental extraction versus filling of adult teeth in children: a cost-effectiveness analysis (DECIDE study). Funded by NIHR, lead Dr Greig Taylor
- Managing chronic Myalgia Temporomandibular Disorder: a pragmatic randomised controlled trial of Botulinum toxin type A, lidocaine, and amitriptyline/gabapentin. Funded by NIHR, lead Professor Justin Durham
- Perceptions of community pharmacists and patients on opportunities for early identification and referral of patients with suspected head and neck cancer. Funded by NIHR, lead Dr Susan Bissett

What impact we have had

Our health economics and health services research studies have been acknowledged nationally by commissioning, policy and professional organisations, including NHS England, Public Health England and the British Dental Association. Our bioaerosols research has played a key role in informing oral healthcare service delivery globally during the pandemic, the recovery phase and beyond. Our clinical research continues to inform policy and guideline development, making a meaningful improvement to patient care and outcomes.

Case study

Investigating problem-orientated patient pathways, Toothache to treatment: ImPacT Study



Funder

National Institute for Health Research

Lead

Dr Charlotte Currie

What was the project about?

Almost one-third of adults only seek professional dental care when suffering with acute dental pain rather than engaging in routine dental care, so called problem-orientated dental attenders. These individuals can wait a long time before seeking care resulting in: greater impacts on everyday activities, and greater potential for serious adverse events. They can present to a range of services including emergency dental services, medical emergency departments, and general medical practitioners (GMPs). The aim of this project was to build an understanding of problem-orientated attendance and associated care pathways to subsequently develop an intervention to encourage regular dental attendance.

What did you do?

This research had four components. The first was a retrospective observational study examining dental attendances at Welsh GMPs. The second and third were qualitative studies exploring: (1) problem-orientated attenders' perspectives and experiences of seeking repeated emergency dental care (2) adolescents' experiences of dental care and their future plans for dental attendance. The final component co-designed an intervention to prevent problem-orientated dental attendance.

Dental attendance rates at GMPs varied over the period studied and appeared to relate to key policy change dates. Overall, dental attendance rates appeared to be decreasing, however just over 10% of patients were repeat attenders. Predictors of

repeat attendance included living in an urban and deprived area, or rural area, as well as being prescribed an antibiotic or no referral as an appointment outcome.

The reasons for starting and maintaining problem-orientated attendance were complex and multifactorial. They also linked to patient choice of attendance location and associated care pathways. The transition from adolescence into independence was a key period for this behaviour change to become a problem-orientated attender. Some barriers and facilitators which contributed to decision-making around problem-orientated attendance spanned both adolescence and adulthood. These key, overarching themes included: lack of knowledge or misunderstanding; dentist characteristics; dental anxiety; dental charges and affordability of care. These themes interacted and could compound one another, creating a complex network of barriers and facilitators explaining the transition to, and maintenance of, problem-orientated dental attendance. Finally, an intervention was developed targeted at adolescents and young adults to encourage continued regular dental attendance as they transitioned to independence, hence preventing problem-orientated attendance.



Dental Education



Lead

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What we work on

The research conducted in dental education aims to inform the development, enhancement and delivery of high quality education for dental health care professionals. We have members researching a wide range of aspects associated with dental education and a number of areas of specific interest.

The key areas that we work on include:

- The individual learner and teacher: learner wellbeing, peer learning and team working, improving and assessing professional qualities and educational transitions
- Development of the curriculum: including integration, theory, development, delivery and assessment
- Wider views: Internationalisation, patient involvement in assessment, feedback and selection.



Who we collaborate with

Within Newcastle University we have strong links with other Schools in the Faculty of Medical Sciences and also with Schools in the wider University. We also work with colleagues at other Dental Schools throughout the United Kingdom.

Some recent projects

- 'Obtaining patient feedback for quality assurance of undergraduate dental teaching', Mrs Zoë Freeman
- 'Understanding the background to the GDC learning outcomes for undergraduate dental programmes', Mrs Helen Mather
- 'Developing public engagement in the quality assurance of teaching programmes', Professor Janice Ellis
- 'Educating Dental Educators to do Education Research', Dr Luisa Wakeling and Professor Janice Ellis
- 'Oral Health in People with Learning Disabilities: Development of e-training to raise awareness and improve communication skills in dental undergraduates', Dr Susan Bissett

What impact we have had

The key outcome for our research is better education of dental health care professionals. What we do feeds back into teaching and curriculum development at Newcastle University and beyond.

Our members are actively involved in the British Alliance for Researchers in Dental Education and Scholarship (BARDES), and at the most recent annual conference we contributed to a number of different sessions. Through BARDES we are extending our collaborations and activities.

Education research at the School of Dental Sciences has informed our contributions to the UK Regulator's development of undergraduate dental education learning outcomes.

Our members have had publications in both dental and dental education journals and presentations at local meetings, national and international conferences.

Case study

What are the attributes needed of a dental graduate?



Funder

Faculty Educational Research Development and Practice Grant (Newcastle University)

Lead

Mrs Helen Mather

What was the project about?

Exploring the concept of the newly qualified dentist as viewed through the lens of the stakeholders within dental education, with a view to developing consensus on, and defining the attributes required of a newly qualified dentist

What did you do?

Firstly, it was important to better understand how the attributes of a dentist are currently defined by the learning outcomes for dentists in the General Dental Council (GDC) curriculum document Preparing for Practice, along with the impetus for the development and implementation of these learning outcomes. This was achieved through curriculum mapping and a series of interviews with key stakeholders, supported by documentary analysis of archival materials.

Secondly, we aim to develop consensus amongst stakeholders of dental education on the attributes of a newly qualified dentist, at the point of graduation. Attributes alongside statements regarding the purpose of a dentistry degree in the UK will be put forward to a range of stakeholders.

What did you find?

Mapping of the learning outcomes for dentists from two iterations of GDC curriculum documents highlighted a number of changes that are likely to have impacted on how schools approached clinical and professional skills teaching. A number of themes derived from the data collected from stakeholder interviews and document analysis, triangulated with the mapping outcomes, led us to conclude that whilst the GDC are responsible for changes to the learning outcomes, they are influenced by changes in context, contemporaneous events and other stakeholder influence. There is a divergence of opinion on the outcome of undergraduate dental training and what a graduate is, or should be, prepared for, alongside a felt need to define the purpose of undergraduate dental education and training.

What do you plan to do next?

Having gathered the opinions of the required attributes of a newly qualified dentist from a wide range of groups involved in the education and training of dentists, these are to be assimilated into a series of questionnaires, using consensus methodology, to develop agreement on the attributes of a newly qualified dentist.



Postgraduate research study opportunities



Lead
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Opportunities for study

With our international reputation and excellent research facilities, we are well placed to offer postgraduate research opportunities of the highest standard. As a postgraduate research student studying for a Dental Sciences MPhil or PhD, you will be based within a Research Institute in the Faculty of Medical Sciences. The programme is delivered in the School of Dental Sciences where you will work within research teams led by experts in their field in a friendly and supportive environment. We offer research projects in three key areas: Translational Oral Biosciences, Applied Oral Health Research and Dental Education. Further details on the research in each of the areas can be found earlier in this booklet.



The research student community

We are proud of our rich and diverse research community, including UK, EU and international students engaged in a wide range of research projects. This is reflected by our varied research seminar programme to which invited external speakers, School- and faculty-based researchers and all postgraduate students contribute.

Training environment

Our postgraduate students benefit from a comprehensive research skills training programme including hands-on training in laboratory techniques and a range of workshops on health and safety, research methods and ethics, IT skills, and academic presentations/writing. English language support, academic mentoring and career advice are also available.



Funding

Our dedicated postgraduate funding website lists all funding sources in one place.

We support applications to University scholarship schemes as well as applications to external funding bodies such as the NIHR or international organisations.



How to apply

Further information on Dentistry and Dental Sciences MPhil/PhD and how to apply





Muath Alrashed

PGR Case study

What are you studying?

My PhD project is to develop a preference-based child-centred measure specific for malocclusion using adolescent involvement throughout, through deriving a classification system and validating the classification. A malocclusion-specific measure would enable future economic evaluation of interventions to improve adolescent's oral health.

Why did you choose Newcastle?

Because it has an excellent reputation and is one of the best dental schools, I was excited to finish my postgraduate studies at the Newcastle School of Dental Sciences. I thought that contributing to this school's scientific innovation and academic leadership would enable me to achieve my goals.

What is it like studying at Newcastle?

Studying at Newcastle University offers a top-tier academic experience with supportive faculty, modern facilities, and a diverse student community. I am particularly grateful to my supervisors for their outstanding support. In addition, the school offers a variety of workshops to help enhance my research skills.

What do you hope to do after your PhD?

My objective is to contribute to the education of future dentists at PSAU, Saudi Arabia. I would also like to regularly engage in ongoing research as part of my job to benefit the scientific community.



Emma Beecroft

PGR Case study

What are you studying?

I am an academic oral surgery trainee, which means I am training to be an oral surgeon in addition to completing a PhD in orofacial pain as a staff member at Newcastle University. My clinical practice revolves around pharmacological and surgical management for acute and persistent pain conditions affecting the head, face and oral cavity. Being supported to complete my PhD as a staff member provides me with an opportunity to develop a laboratory-based pain model which we can use to work out what causes persistent orofacial pain and, in the future, develop better medications to manage the pain, which could directly benefit patients under my care.

Why did you choose Newcastle?

The opportunity to learn from internationally renowned pain academics, using world leading research facilities in a beautiful city are just a few of the many reasons why Newcastle was the right place for me. Additionally, Newcastle University's success in supporting early career researchers to meet their career aspirations, demonstrated it was an institution which would care about my future.

What is it like studying at Newcastle?

The culture of cross faculty networking at Newcastle University means I have been able to access advice and training across many fields, strengthening my project. The open, collaborative academic environment has ensured breadth to my research training, provided collaborative opportunities and nurtured new friendships.

What do you hope to do after your PhD?

After my PhD I will firstly complete my surgical training, with a long term aim of working as a clinical academic. I hope that my current and future work means that more effective orofacial pain management options become available for those who need them in the future.

Other opportunities for research

Research for taught students

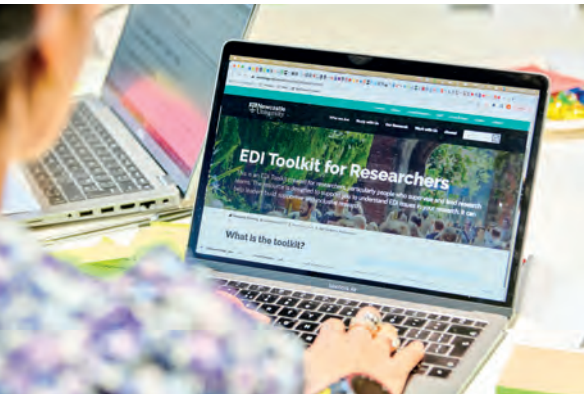
We are passionate at Newcastle University about giving opportunities and promoting research careers. Many of our undergraduate students become involved in research with opportunities ranging from informal projects to intercalated degrees. We run a Wellcome Trust funded INSPIRE scheme offering a number of activities to encourage dental students with research. We also welcome enquiries from students interested in undertaking research related placements and electives as part of their studies.

We run a popular MRes programme which includes a number of taught modules but also a major research project element and we host several MRes students each year undertaking dentally related projects.

Our postgraduate taught programmes within the dental school include a suite of MClinDent programmes in restorative dentistry all of which include a research project.

Clinical Academic Careers

We advertise a number of posts each year for dentists interested in pursuing clinical academic careers. These posts are funded by NIHR and include both clinical training and protected time to develop research projects. Applicants must be eligible for UK GDC registration and, where appropriate, specialist training in the UK.





Research posts and fellowships

We occasionally advertise positions for researchers to contribute to funded projects on an ad-hoc basis. In addition the university has a prestigious and highly competitive post-doctoral fellowship scheme, the NuACT scheme, which includes a five-year paid position, research costs and PhD studentship

The university is committed to equality and diversity in all aspects of its work including recruitment of researchers and holds a silver Athena SWAN award in recognition of this. We are fully committed to the development of researchers and are a signatory of the UK Concordat to Support the Career Development of Researchers.



For information on any of these opportunities, contact:

Dr Matt German, Director of Research
matthew.german@newcastle.ac.uk

Our facilities

We enjoy world class facilities in the School of Dental Sciences and across the university to enable us to undertake our world leading research. These facilities include our Dental Science Laboratories and our dedicated Dental Clinical Research Facility.



Dental Sciences Laboratories

The Translational Oral Biosciences laboratories are fully equipped for molecular biology, electrophysiology, cell and tissue culture, microbiology and biofilm modelling, and include a large Class II containment facility. The Dental Materials laboratories contain polymer synthesis facilities and standard mechanical and physical characterisation techniques such as mechanical testers, ion-

selective electrodes and infrared spectroscopy. Within the School there is also a confocal fluorescence microscope and an atomic force microscope.

Dental Clinical Research Facility

The Dental Clinical Research Facility (DCRF) is a dedicated clinical research environment for conducting high quality clinical dental research within the Newcastle School of Dental Sciences and Dental Hospital. It is comprised of four dental surgeries and is supported by the Dental School's three research laboratories. The facilities in the DCRF mean a full range of clinical dental research can be undertaken, including restorative dentistry, endodontics, periodontics, implant research, dental materials research, paediatric dentistry, local anaesthetic studies, fluoride therapy, nutritional research, and surgical procedures. In addition, two of the surgeries are equipped with operating microscopes for advanced surgical and restorative procedures.

University infrastructure

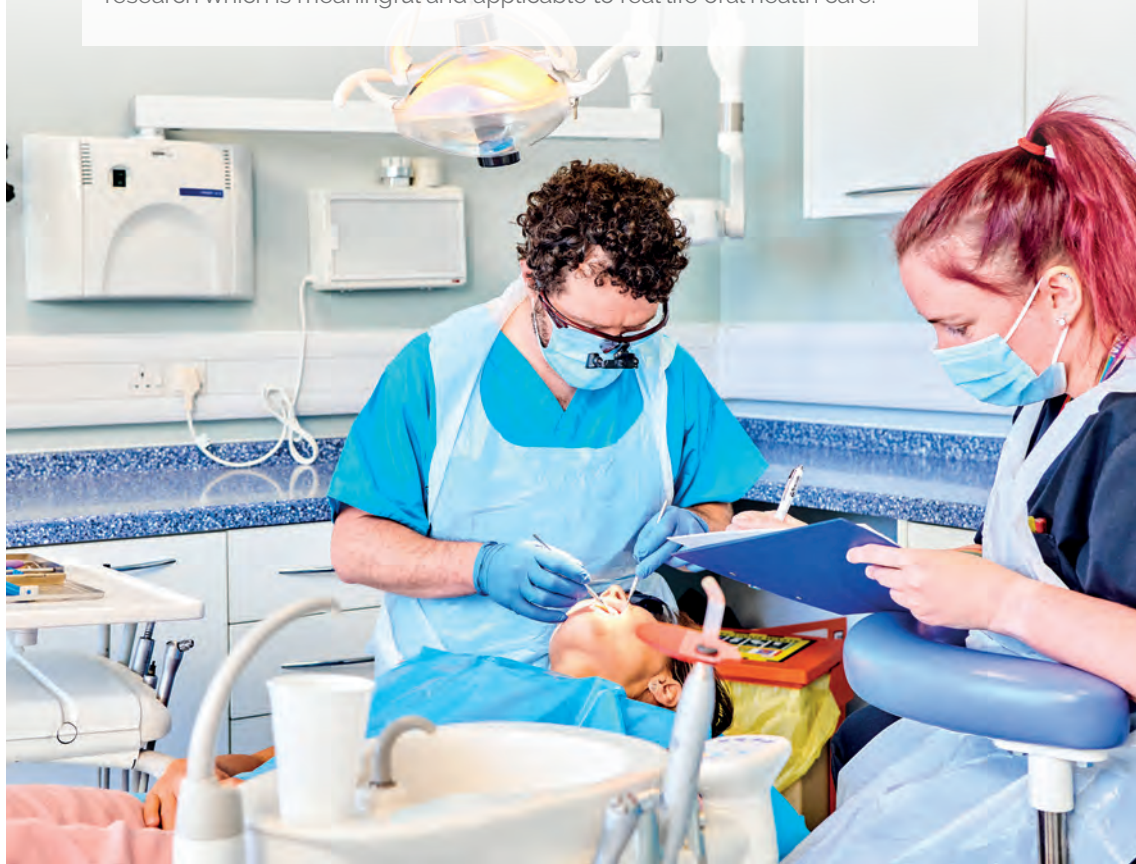
In addition to our in house facilities, we have easy access to state-of-the-art instruments and expertise through the Newcastle University Core Facilities Service. These platforms include flow cytometry, bioimaging, electron microscopy, microbiome sequencing and bioinformatics.

Northern Dental Practice Based Research Network



We have a network of research ready and engaged dental practices across the North East of England. Many of the practices are actively participating in ongoing national clinical trials such as ENHANCE-D and CALM.

This network of practices is a key component of our ability to undertake research which is meaningful and applicable to real life oral health care.



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