Major investment in the development of researchers and the academic infrastructure in the University of Leeds makes for exciting times for research and academic endeavour in the School of Dentistry.

The recruitment of new, world class academics to work alongside our current cohort of outstanding staff is further strengthening our research base. These staff will contribute to the research themes presented in this guide as well as developing new areas of research in collaboration with our colleagues in this and other universities as well as in industry.

Researchers and postgraduate students at Leeds produce world class research which impacts health and health inequalities at international, national and local levels. The School of Dentistry occupies a key position in the heart of the University campus which facilitates translation research across diverse scientific areas. Reflecting the truly multi-disciplinary nature of our academic base and of our philosophy of ‘bench to patient to population and back again’, the diverse partnerships presented in the guide are the foundation for many of our collaborations with academia, industry and the National Health Service (NHS).

This guide provides only a taste of who we are and what we do; please visit our website for further details of the depth and breadth of research and innovation expertise that can be accessed at the School of Dentistry, University of Leeds.
SCHOOL OF DENTISTRY

In the last UK Research Excellence Framework 91% of our research was rated as world leading or internationally excellent.

Our outstanding strength in basic sciences and holistic approach to world-class research are central to our ability to offer a seamless continuum from the laboratory to the clinic and to our aim of providing an exceptional experience for our postgraduates. The School’s flagship Wellcome Trust funded Dental Translational and Clinical Research Unit provides an excellent environment to accelerate research innovation for patient benefit.

We offer access to an interdisciplinary team of clinical and basic science researchers with international reputations in their respective fields and are supported by excellent facilities. We work in close partnership with Leeds Teaching Hospitals NHS Trust. Its dental hospital, Leeds Dental Institute, enables our students to deliver patient treatment as part of their undergraduate and postgraduate training. This close relationship also allows our researchers easy access to the Institute’s clinicians and network.

We have the capacity and expertise to respond rapidly and effectively to the needs of our partners and stakeholders, and pride ourselves on understanding their drivers, goals and delivering to their needs.

Working together with our partners and students we have never been better placed to address clinical innovation challenges and deliver our vision of underpinning excellence in clinical research with outstanding basic science.
UNIVERSITY OF LEEDS

The University of Leeds is a major economic and cultural contributor to Leeds and the surrounding region. Leeds is focused on original, creative and innovative research to address the economic, environmental and societal challenges facing the world.

Leeds is one of the UK’s top research universities with more than 80% of our research rated as ‘world leading’ or ‘internationally excellent’, securing the University 9th place for research power in the most recent Research Excellence Framework (REF).

We actively encourage and support an enterprising spirit. We are ranked 2nd nationally in terms of number of university spinouts created, with over 100 companies since 1995, and it also has the largest number of listed spinout companies (6).

Supported by over £6m of investment, our research and innovation sector hubs provide a focused and strategic gateway for potential industry and sector partners to access the industry-leading experts and world-class academics in the University for multidisciplinary projects. By working together we can develop practical solutions to real needs based on world-class research. This approach:

– marries external market demand with our recognised research and innovation strengths
– is challenge driven, applying research excellence to issues of national and international importance
– makes our research relevant to industry and external partners.

36% of our academics are involved in applied research or as consultants to industry with an estimated value of £58m

1st

Ranked 1st out of 16 participating Russell Group universities for overall international student satisfaction*

*International Student Barometer survey (autumn 2012)

www.dentistry.leeds.ac.uk | 05
DENTAL TRANSLATIONAL AND CLINICAL RESEARCH UNIT (DenTCRU)

Funded via a prestigious £1.7m capital award from the Wellcome Trust/University of Leeds, DenTCRU is a state-of-the-art research clinic dedicated to the delivery of world-class translational and clinical research in dentistry.

DenTCRU provides our researchers with an environment:

– to expedite the roll-out of our research in interdisciplinary dental sciences for patient benefit ‘from bench to patient and back again’
– to train the next generation of clinical academics in high-quality clinical research
– to forge multi-disciplinary research partnerships between clinicians, academics, industry and patients
– to support development of methodologically robust projects tailored to NHS priorities and with Patient Public Involvement (PPI)
– to deliver the evidence base for dental treatment and treatment to maximise patient benefit and NHS impact.

Equipped to an exceptionally high standard, DenTCRU has six high specification dental units and supporting laboratory infrastructure, providing researchers with access to non-invasive intra-oral diagnostics, high throughput microbiological molecular screening and stem cell-based therapies and devices in regenerative skeletal medicine. Working closely with the renowned University of Leeds Clinical Trials Research Unit ensures that our clinical research is performed to the highest standards of clinical governance and rigour.

Benefits

DenTCRU is a dedicated facility through which we achieve our vision of delivering research excellence with impact for our staff, students, partners and collaborators. It supports our work in sustained partnerships with a wide range of partners and stakeholders from major international companies to our local community.
SKELETAL TISSUES RESEARCH BANK

The School of Dentistry successfully renewed its Research Tissue Bank status in July 2013. The Bank facilitates the work of our staff, students and collaborators in the priority areas of skeletal tissue engineering, regenerative medicine and stem cell biology whilst ensuring the strictest adherence to the Human Tissue Act governing the use of human tissue in research.

Working with clinicians across the School and the Leeds Teaching Hospitals NHS Trust, the bank provides samples including teeth, bone and stem cells. Access to samples is provided for our staff, students and collaborators (both academic and industrial) across the globe for use:

- to improve our understanding of skeletogenesis/odontogenesis
- to understand the mechanisms of tooth decay, erosion and wear
- to develop new ways of repairing teeth and restoring their function, including development of new materials for fillings
- using dental pulp and bone marrow to provide a source of adult stem cells for tissue regeneration and repair.

Benefits
The Skeletal Tissues Research Bank is an excellent research resource for our staff, students and collaborators whilst guaranteeing the highest standards of clinical governance and protection for patient donors.

MEDICAL TECHNOLOGIES INNOVATION AND KNOWLEDGE CENTRE (IKC)
FUNDED BY THE EPSRC†, BBSRC* AND INNOVATE UK#

The Medical Technologies Innovation and Knowledge Centre is unique in bringing together businesses with world-class experts to accelerate the commercial development of new medical technology products and services. Through investment in proof of concept projects, the Centre aims to reduce risk and uncertainty for companies, allowing them to invest with greater certainty to progress a technology beyond the validation stage all the way through to launch and subsequent commercial viability.

Translation of the School of Dentistry’s research in biomaterials, biomineralisation and stem cell therapies for skeletal tissue regeneration and repair is both facilitated and expedited by the School’s membership of the Medical Technologies IKC. Under the leadership of Professor John Fisher, the IKC focuses on six innovation themes including scaffolds, stem cells, medical devices, diagnostics, medical imaging and enabling technologies. School staff have roles as Technology Leaders and Investigators in the IKC.

Impact and benefits
The Medical Technologies IKC has had a significant positive impact on our ability to deliver new therapies and devices in clinical dentistry. This is demonstrated by the recent collaboration between the School of Chemistry, The WELMEC Centre of Excellence in Medical Engineering and the School of Dentistry which brought together expertise in artificial scaffolds based around self-assembling peptides (SAPs) and in biomineralisation which led to the development of a novel treatment for early dental caries. This technology has now been licensed to a Swiss company, credentis ag, who is marketing the product.

Clinical governance and protection for patient donors of tissues and cells

Accelerating medical technology development

†Engineering and Physical Sciences Research Council
*Biotechnology and Biological Sciences Research Council
#Innovate UK
STRATEGIC PARTNERSHIPS

Responding to the recognition that global health problems in oral and musculoskeletal diseases require global solutions, we are committed to working with key strategic partner institutions to bring together expertise and skills to address these significant disease burdens.

Building on shared expertise and knowledge amongst our partners, we aim to work together to improve oral health outcomes in our own communities and across the globe.

Some of our strategic partnerships include formal memoranda of understanding with the Universities of Michigan (USA) and Osaka (Japan) as well as the establishment of a Joint Centre for Oral Health Sciences with the University of Nanjing (China).

We are founder members of the World Universities Network (WUN) for Oral Health Sciences, a network of 16 research intensive universities from five continents around the world.

Current themes include:
- reducing inequalities in oral health
- challenging future dental care: stem cell therapy for dental tissue engineering
- translational research in dentistry
- contemporary perspective on Chinese traditional medicine in oral care.

Impact and benefits
The development of our strategic partnerships has led to joint research through staff/student exchange resulting in publications, grant income and enhanced opportunities for dissemination of research advances to a global audience.

INNOVATION IN DIGITAL IMAGING

Digital workflows in dentistry are likely to have a profound effect on the profession in terms of the way dentists diagnose disease, restore function & appearance and communicate with patients and other dental professionals. Digital imaging lies at the heart of this emerging discipline.

Concept
The NHS Business Services Authority has changed clinical monitoring in orthodontics by indicating that any records must now be submitted with 3D digital study models produced by scanning impressions, cast models or by intra-oral scanning.

University owned IP, developed by Dr Andrew Keeling, in digital imaging has been licensed to Arkive Dental Ltd, a company which specialises in the secure scanning, archiving and storage of digitized orthodontic casts.

Impact and benefits
Orthodontists and general dentists are able to digitally archive their study models and access them from anywhere in the world at the touch of a button. This reduces the need for physical storage space and prevents deterioration of the models over time.

Further work in digital dentistry at Leeds has involved liaising with 3D printer manufacturers to tailor machines specifically for printing high quality dental models. This means the archived digital dental models can be transformed back into physical models, printed at resolutions of 10 microns.

The license fees generated by this partnership are being put back into furthering this, and many other avenues of research in digital dentistry at Leeds. The focus is on enhancing clinical practice and dental education.
INTERNATIONAL CARIES DETECTION AND ASSESSMENT SYSTEM (ICDAS)

The ICDAS Foundation’s purpose is to progress the study and management of caries in a unified way. It involves caries experts worldwide who work along with representatives of international associations including the World Dental Federation, European Organisation for Caries Research and International Association for Dental Research. These experts come from various backgrounds including clinical practice, clinical research and dental public health.

This collaboration is a non-profit organisation which includes researchers from universities in the UK, Denmark, the USA and Columbia. The School of Dentistry is represented on the Board of Directors by Professor Gail Douglas.

Concept
ICDAS employs an evidence-based approach to classifying stages of the caries process and has developed an internationally accepted clinical scoring system for use in dental education, research and public health. It is designed to lead to better quality information to inform decisions about appropriate diagnosis, prognosis, and clinical management at both the individual and public health levels. The approach provides a framework to support and enable personalised total caries management for improved long term health outcomes through preventively orientated management of caries.

Impact and benefits
Importantly, both groups have a focus on translating this underpinning knowledge into products for clinical use. In addition to gaining funding to carry out fundamental research, funding has been obtained to take material/cell constructs as far as pre-clinical testing.

Equally importantly, this collaboration has facilitated the training of several PhD students/Postdoctoral Research Assistants in a multidisciplinary way of working.

SKELETAL TISSUE REPAIR AND REGENERATION

The School of Dentistry at the University of Leeds and the Department of Biology at the University of York have a long-standing academic collaboration between materials scientists and biologists with a common interest in the repair/regeneration of hard tissues. We aim ultimately to apply the knowledge gained by working together to the development of therapies for patient benefit.

Concept
A focus of the School’s Biomaterials and Tissue Engineering Research Group, led by Professor David Wood, is the development of acellular scaffolds for the repair of bone and/or cartilage. At York, our collaborators in the Biomedical Tissue Research Group have been working on cell and molecular biology of skeletal tissues, including the characterisation of mesenchymal stem cells (MSCs) with a focus on osteogenesis. By bringing together these different but complementary skill-sets we aim to understand the nature of the interactions between model materials and mesenchymal stem cells at a genetic and molecular level.

Impact and benefits
Importantly, both groups have a focus on translating this underpinning knowledge into products for clinical use. In addition to gaining funding to carry out fundamental research, funding has been obtained to take material/cell constructs as far as pre-clinical testing.

Equally importantly, this collaboration has facilitated the training of several PhD students/Postdoctoral Research Assistants in a multidisciplinary way of working.
Filling Children’s Teeth: Indicated or Not (FiCTION) Funded by NIHR HTA*

The FiCTION research partnership includes co-applicants and collaborators from the majority of dental schools in the UK. The research project, led by Professor Gail Douglas in Leeds, Professor Janet Clarkson and Dr Nicola Innes in Dundee and Dr Anne Maguire in Newcastle, is a randomised controlled study of caries management strategies for the primary teeth.

Concept
Concepts of how best to manage caries in the primary dentition vary widely between dentists and educational establishments, which is a feature of the lack of robust evidence.

This £2.9m multi-centre study in 50 general dental practices around the UK aims to establish whether one method is better than another in preventing toothache and infection in young children with caries. The three strategies being tested are:

- conventional management (fillings with the use of local anaesthetic and caries removal)
- biological management (sealing of decay from the oral environment with partial or no caries removal and usually no local anaesthetic)
- prevention only.

Impact and benefits
This partnership between UK dental schools is an important example of specialists and researchers uniting to answer an important clinical question. It is anticipated to have direct impact on guidelines for the way dental caries in the primary dentition is managed worldwide.

Being a NIHR funded study it is likely to also impact on UK policy.

Answering clinical questions with evidence-based research

EFFECT OF SELF-ASSEMBLING PEPTIDES (SAPs)
IN THE TREATMENT OF WHITE SPOT CARIES LESIONS AND DENTINAL SENSITIVITY

In 2010 credentis ag was founded to commercialise the University of Leeds’ intellectual property in the field of SAPs for dental applications. The University holds significant equity share in the company. Successful ‘first in man’ trials were carried out in the School’s DenTCRU, and a CE mark approving clinical use of the product ‘Curodont Repair™’ was awarded in January 2012.

Concept
The aim of the collaboration is to further develop the University’s innovative SAPs technology through to clinical delivery with credentis ag. This is being achieved at Leeds through jointly increasing capacity to develop the technology, expanding and improving the product range and assessing the products for clinical application.

The ultimate goal is to establish the technology globally, benefiting patients and generating revenue and jobs in the UK.

Impact and benefits
Led by Professor Jennifer Kirkham, ‘Filling without Drilling’ peptide technology was co-invented and taken through to commercial partnership at the School of Dentistry, working in collaboration with Dr Amalia Aggeli in the Department of Chemistry and WELMEC.

Further funding was recently received through the University’s EPSRC-funded IKC in Medical Technologies, matched by support from credentis ag to provide screening capability based at the School for further product development. Curodont Repair (for Filling without Drilling) and Curodont Protect (for protection against acid attack) are now available for use by dentists in the UK. The project exemplifies the School’s strategy in translational research with basic research in biomineralisation being used to inform therapeutic design for patient benefit.

Filling without drilling – translating basic sciences into new clinical therapy

*National Institute for Health Research Health Technology Assessment

www.credentis.com/en/home
IN SITU STUDIES WITH FLUORIDATED MILK
FUNDED BY THE BORROW FOUNDATION

The Borrow Foundation is committed to a programme for caries prevention through supporting milk fluoridation programmes for schools globally.

Many schools have a programme of making milk available to children. Addition of fluoride to milk is a novel way of delivering fluoride for prevention of dental caries especially in children who are considered 'high caries risk'.

The Foundation has funded studies at the School of Dentistry to research the impact of milk fluoridation. Led by Professor Jack Toumba, these studies aim to further understand the role of fluoride delivered in milk and to investigate which concentrations of fluoride in milk demonstrate optimum beneficial effect for implementation in school milk fluoridation programmes.

Concept
A population-based study to research this question would be prohibitively difficult and expensive. Initially in vitro models were used to study varying concentrations of fluoride in milk. This was then translated to in situ models using enamel slabs taken from extracted human teeth to study the preventive effects of various concentrations in human volunteers using a randomised controlled study design.

Impact and benefits
This series of studies is an example of successful translation from in vitro to in situ studies in human volunteers. We are establishing optimum and safe levels of fluoride with maximum caries preventive effects in school children in collaboration with The Borrow Foundation. This will subsequently inform the Foundation's global programme supporting milk fluoridation for schools.

ADVANCING THE GENETICS OF ENAMEL DEVELOPMENTAL ABNORMALITIES (AGEnDA)
FUNDED BY THE WELLCOME TRUST

AGEnDA brings together researchers from the University of Leeds and clinicians from the Leeds Teaching Hospitals NHS Trust to work with an associated network of researchers and clinicians around the world.

This partnership aims to improve insight into the basis of developmental enamel abnormalities. This will lead to an improved understanding of biomineralisation and translation of this new knowledge to clinical care in different ways.

Concept
The partnership involves the full cycle of ascertainment and recruitment of families, gene discovery and feedback to those affected through dissemination of findings. Families with Mendelian-inherited enamel developmental abnormalities including Amelogenesis Imperfecta are investigated via cutting-edge genetics approaches in the Leeds Institute of Biomedical and Clinical Science (LIBACS) at the University. Preliminary functional data related to gene discovery is obtained in multidisciplinary partnerships.

Impact and benefits
In a short period of time the partnership gained novel insights into gene function critical to biomineralisation and in selected families, associated retinal degeneration, immunological function, muscle formation or renal impairment. These discoveries translate with global relevance to the care of those affected. They also open up new areas of biomineralisation research that inform the development of new therapies with the potential to promote biomineralisation not only in teeth but also in other settings.
The Centre for Doctoral Training (CDT) in Tissue Engineering and Regenerative Medicine

Regenerative medicine has been identified by the government as one of 'eight great technologies' vital to driving UK economic growth and EPSRC funding for the new Centre for Doctoral Training confirms Leeds’ place as a leader in the discipline.

Concept
A new £3.2m training centre aimed at keeping the UK at the cutting edge of regenerative medicine research has been based at the University of Leeds since 2014.

Impact and Benefits
The CDT is expected to bring 50 PhD studentships over five years to the University, allowing researchers to explore new treatments addressing, for example, cardiovascular and musculoskeletal diseases. Aligning fully with the School’s research strategy, academics from the School of Dentistry will be providing research projects in the areas of biomaterials, tissue engineering and biomineralisation.

The doctoral trainees will enter a bespoke four-year programme that will, based on their previous experience and parent disciplines, first train them in the field and then guide them through their PhD research. The ultimate aim of the CDT is to bring together the brightest young researchers from a wide range of disciplines in a structured programme to train the specialists in regenerative medicine the UK needs.
POSTGRADUATE RESEARCH DEGREES

The School of Dentistry’s internationally renowned scholars and state-of-the-art facilities provide an ideal research environment in which to undertake postgraduate studies.

Student support and personal and professional development are key elements in our postgraduate programmes. The University of Leeds is committed to providing a setting in which our postgraduate students can acquire research skills and knowledge; develop a wide range of attributes; prepare for academic or industrial careers and also realise personal/professional ambitions.

Research programmes at the School cover a wide range of clinical and basic science disciplines with seamless multidisciplinary integration across all areas. We offer research degrees at PhD, MPhil and MSc levels.

Postgraduates have the choice of studying for their PhD by following the classic route by research alone. Alternatively, there are the innovative Integrated PhD and Professional Doctorate programmes – research degrees with taught components. These programmes are most suitable for clinicians as they offer advanced clinical training and education combined with high level research activity.

Whichever career path you choose, a research degree from the University of Leeds is the ideal springboard to realise your aspirations.

For more information on postgraduate research degrees, contact:
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