Annual Review 2018

Medical Technologies

INNOVATION AND KNOWLEDGE CENTRE

Regener8

Contents

To find out more about our research please visit:
medical-technologies.co.uk

IKC and Regener8 in numbers

2511

Papers published

£122.7m

Public research and innovation funding secured

£148m

Private sector investment in tech development

National excellence and regional strength

Since our launch in 2009, the IKC has adapted its strategic approach to respond to external changes, but our core principles remain the same: bringing together different disciplines and different technologies to take research closer to commercialisation.

By specifically focusing on the translation pathway, we add value to high quality research across many disciplines. From our base in Leeds, we now support activity across the UK, with a distinctive focus on certain specialisms within medical technologies. Our wider network of universities has enabled us to address new healthcare areas, applying the same approach and processes we first developed to advance technologies in musculoskeletal (MSK) regeneration.

The following pages showcase our expertise in the clinical application of technologies in orthopaedics, joint replacement, MSK and dentistry, with growing interest in other areas of excellence, namely cardiovascular, soft tissue repair and ophthalmology.

But as well as a national centre of excellence, we are part of a strong regional medical technologies sector, as evidenced by our Science Innovation Audit for the Leeds City Region, sponsored by the Department for Business, Energy and Industrial Strategy.

Our collaborations with the region's universities, healthcare providers and medtech companies creates a broad regional footprint covering a wide range of medical technologies.

The global medical technology market is expected to see a 50 per cent increase by 2022. This provides an economic opportunity, but it also foreshadows a major change in how healthcare will be delivered. Yet technology alone cannot make improvements. Technologies need to be innovatively applied to create cost-effective advances in healthcare.

Our rigorous process, which identifies clinical application and market potential at an early stage, enables technologies to be robustly assessed before moving on to commercialisation. This approach has proven its value, with many technologies we have supported through proof of concept now in clinical trials or already on the market, as highlighted in this report.

Nine years on, we are happy to let our results speak for themselves.

Professor John Fisher CBE
Academic Director,
Medical Technologies IKC

IKC and Regener8 in numbers

Extending our influence

Among the IKC's most energising achievements has been its success in extending successful innovation practice across academic research translation programmes both regionally and nationally.

Our distinctive contribution is driven by our technology innovation managers (TIMs). Because they all have extensive experience of developing commercial products in or with the private sector, they fully appreciate the pressures involved in technology development for industry.

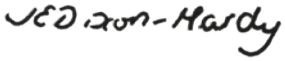
At the same time, they also understand the objectives underpinning academic work. The ability to offer project management in a way that draws academic and industry imperatives together and delivers impact and outcomes for all parties really sets the IKC apart.

Another aspect of our approach that makes the IKC distinctive is the variety and depth of our engagement with industry.

Our core mission is to develop commercial products and deliver economic benefits. To do that effectively, we need to build partnerships across a broad stakeholder community. That's why our programme includes industry-led funding calls and includes industry members on our advisory board. Our engagement with the sector, through initiatives such as the Science Innovation Audit, has also helped us understand emerging trends, for example the increasing growth opportunities offered through technology convergence projects.

The value of our approach can be seen throughout our project portfolio as technologies progress towards commercialisation. But it's just as exciting to see the IKC's influence and good practice extending into other initiatives such as the HEFCE (now Office for Students)-funded Translate programme, and the nationally focused MeDe Innovation.

Most recently, we've secured funding for Grow MedTech, which brings together six universities in the Leeds and Sheffield city regions to tackle commercialisation challenges. One of 14 projects nationwide funded by Research England, Grow MedTech is a £9.5m programme which will extend our approach into partner institutions by embedding a technology innovation manager in each one. These TIMs will work as a team, working to find the best partnerships across the programme to promote industry engagement, to increase academic opportunity and, ultimately deliver new benefits to patients.



Dr Josephine Dixon-Hardy
Director of Medical Technologies Innovation, Medical Technologies IKC

190
Collaborative partners

45
Patents and IP registered

506
People participating in our innovation development programmes

Our innovation portfolio

The ageing population and the associated predicted growth in the global medical technologies market present significant opportunities for the UK medtech sector. However, the innovation 'valley of death' which exists between fundamental research and commercialisation presents considerable challenges to companies. The IKC bridges this gap with sector-specialist innovation expertise and targeted proof of concept and co-development funding, ensuring technologies are fit for purpose and providing the evidence required for companies to invest with confidence in their development.

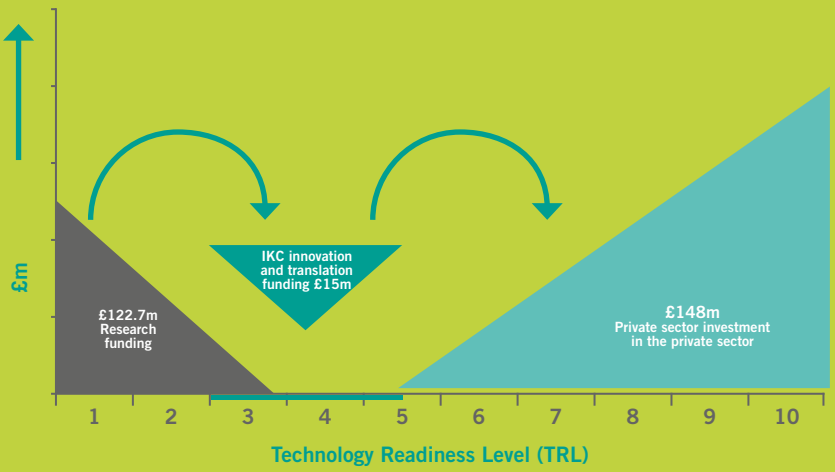
More than 40 UK universities and 50 companies have collaborated in 236 projects through the lifetime of the IKC. The IKC has contributed almost £7m to these projects, with contributions from industry partners totalling a further £21.5m. Mature projects, many originating in the first phase of the IKC, are now achieving significant impact, producing 2500 peer-reviewed publications, 45 patents, six spin-out companies, and leveraging more than £148m private sector investment into the private sector to date. Exciting achievements in 2018 include the development and publication of a new international standard for medical device testing and the launch of a new commercial product in the UK.

The case studies presented showcase the diversity of projects in the IKC portfolio, from our earliest to our most recent. They illustrate the spectrum of themes which has evolved from an original focus on musculoskeletal regeneration to include growing areas in cardiovascular, wound-care and ophthalmology, reflecting the health challenges facing the ageing population and the IKC's engagement with an increasing number of UK universities and companies who bring exciting development opportunities.

These case studies illustrate the essential role the IKC continues to play in working with partners to generate the evidence required to progress technologies through the regulatory pathway, to support clinical cases for the use of medical devices and to scale-up for commercial processes.

Moving forward, the IKC's sustainability strategy includes leveraging new sources of innovation and translation funding. Our partnership with the charity Arthritis Research UK is continuing for a third year (almost £1m contribution to translation projects to date). The Translate project (£2.5m HEFCE Catalyst 2015-18) has extended and sustained academic translational capability development and will be sustained by the five university partners going forward. Most recently, £5m of Research England Connecting Capability Funding will enable our new Grow MedTech programme (2018-21) to expand our innovation management infrastructure across the Leeds City Region, supported by a £2m translational project fund.

The medtech innovation landscape



84

Projects completed and progressing to market

236

Total projects in our portfolio

6

Spin-outs

Clinical application areas:

Orthopaedics and joint replacement

– Biomimetic scaffold for large joint repairs
– SAFER implant testing for knee repair
– ‘Hearing’ hip dysplasia in infants
– 3D printed alloys can match stiffness of bone

“

Total hip and knee replacement surgery is considered hugely successful, with around 160,000 procedures carried out in England & Wales each year. The challenge is to develop devices that meet the expectation of younger, more active patients, who are demanding better options for injury and at an earlier stage of disease. We are supporting a significant number of technology developments to address the needs of patients.

”

Dr Jenny Spear
Technology Innovation Manager

Our portfolio of orthopaedic and joint replacement projects includes:

Development of finite element simulation tools to capture patient variation for the analysis of orthopaedic devices across a patient cohort
University of Leeds

Electro mechanical hip simulator method SOP and training
University of Leeds

Development, validation and international standardisation of pre clinical tests for tissue repair scaffolds in the knee
University of Leeds

Novel metal suppression MRI biomarkers for joint prosthesis
University of Leeds

Computational models to predict PE wear in the knee - a SAFER approach
University of Leeds

A parametrised model of the natural knee, for SAFER surgical interventions
University of Leeds

Spine IP extension study
University of Leeds

Measure the efficacy of a functionally biomimetic osteochondral scaffold
UCL

Pre clinical simulation of tissue repair interventions for the patella
University of Leeds

SHINE: Screening the Hips In NEwborns - The use of an acoustic device to identify developmental hip dysplasia in babies
University of Liverpool

Development and evaluation of a functional prototype for the automated identification of osteoporotic vertebral fractures: VERDIC
University of Sheffield

In vivo proof of concept for a new bio inspired resorbable non delaminating construct for osteochondral repair using a large animal model of joint damage
University of Nottingham

ToKa®: A high precision patient specific high tibial osteotomy procedure
University of Bath

Additive manufacture of magnesium alloy resorbable tibial osteotomy implant
Imperial College London

Pre clinical functional performance assessment of a new bio inspired non delaminating osteochondral construct using a physiological knee implantation model
University of Nottingham

Dr Chaozong Liu

Biomimetic scaffold for large joint repairs

A UCL team working to design an osteochondral scaffold that can repair large joint defects has been awarded an Innovate UK grant to develop ways of manufacturing the device.

The early development of the biomimetic scaffold was supported through the IKC's partnership with Arthritis Research UK, which enabled it to be tested in sheep and in human donor tissue from joint replacement operations.

The scaffold is made from a titanium matrix that has been combined with biopolymers and collagen to encourage bone and cartilage regrowth. It is designed to repair large defects caused by injury or conditions such as osteoarthritis.

Currently, the only treatment for these conditions is joint replacement surgery, a major operation which often will not give back full mobility to the patient.

The team, led by Dr Chaozong Liu, was awarded a £2m Innovate UK-MoST grant, under the UK-China Research and Innovation Bridges Competition. They are now working with industry partners to design manufacturing protocols for the device that conform to GMP – the good manufacturing practice required by regulatory bodies.

All the materials used in the device are already cleared for clinical use, but the scaffolds used in trials to date have been produced in the laboratory. These laboratory protocols must now be translated into a process that can be scaled up for commercial production.

Partners include Chinese company, Shenzhen Lando Biomaterials Co. Ltd, which is setting up a GMP facility in China, and Oxford MeStar Ltd, which specialises in translational and regenerative medicine.

"If left untreated, these defects can lead to problems such as osteoarthritis, so there is a real unmet clinical need for new treatments," says Dr Liu. "The scaffold we have developed looks extremely promising – it has the strength needed for load-bearing, but also the surface materials provide the right environment for new cartilage and bone to grow."

The team is also due to start a longer-term animal study, to test the performance of the device over a six month period, and they are seeking funding for a first-in-human clinical trial later this year.

£2m

Awarded a £2m Innovate UK-MoST grant

SAFER implant testing for knee repair

A major focus of the Medical Technologies IKC is on delivering the right treatment to the right patient at the right time – an approach also known as stratified medicine.

Researchers at the University of Leeds Institute of Medical and Biological Engineering are using an approach they call SAFER - Stratified Approaches for Enhanced Reliability. The IKC's strategy for implementing this approach is to develop technology to robustly model and rigorously test new implantable devices. With SAFER, new devices developed within the IKC and its partners are subject to thorough testing to discover the potential effects of patient and surgical variability on a device's performance, and how these might affect failure rates and patient satisfaction.

The IKC is supporting Leeds researchers who are continually investigating new ways to improve testing methods so that patient stratification can be built into the design of new devices. This not only benefits patients, but reduces risk for commercial partners. Nowhere is this approach more apparent than in the joint simulation facility at the University of Leeds.

The facility, set up by the University in partnership with Simulation Solutions, is the largest independent simulation laboratory in the world for the pre-clinical testing of artificial implants.

Proof of concept funding from the IKC is allowing collaboration with industry to develop and test replacement knee implants designed to treat osteoarthritis patients.

A research team led by Dr Louise Jennings is using natural knee simulators to test decellularised animal cartilage. The team has developed machines that can simulate walking, applying a range of loads and motions that knees endure in the real world. This enables them to investigate plugs of bone and cartilage tissue known as osteochondral grafts that could be used to repair damage and degeneration and understand how they might perform in different patient groups.

Beyond osteochondral grafts, Dr Jennings hopes the simulators can be used to test other treatments too: "Most of the current interventions for conditions such as osteoarthritis lack evidence of pre-clinical performance and have variable patient outcomes. We desperately need new techniques, devices and procedures, that have been functionally tested biomechanically and tribologically. We are involved in the writing of international standards for device testing and our hope is that these standardised methods will be adopted internationally, so all devices will be properly and routinely tested before they go into patients."

Dr Louise Jennings

To plan successful treatment for individual patients, it may well be necessary to also understand the specifics of their individual knee function. Computer modelling techniques developed by IKC researchers – also within Leeds' Institute of Medical and Biological Engineering – allow for a change of parameters and variants based on a patient's anatomy and biomechanics. Understanding how particular implants might be affected by surrounding cartilage, for example, can help plan repair treatment. In some patients, the potential damage to surrounding tissue could mean certain treatments are not advisable.

Professor Ruth Wilcox and colleagues have already developed computer models of the natural knee and are now working on methods to represent variations between individual knees in the models. The knee is an incredibly complex joint and there are broad variations in function. So that the right treatment can be matched to the right patient, this variation must be considered.

In line with the SAFER approach, the computer models will enable different therapies, or different variants of a device, to be matched to different patient groups.

Both teams' pre-clinical tests reduce risk in developing a technology or device. If it is shown to work in vitro, then companies have more confidence to invest resources before animal or human trials begin.

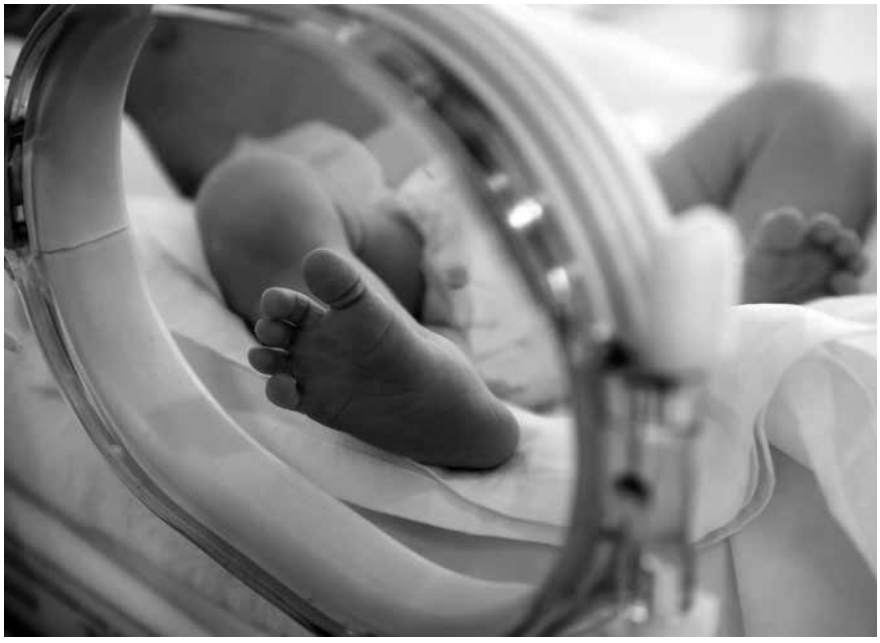
And, as Professor Wilcox also explains, a direct benefit to patients is testing of devices already available: "Our computer and experimental models can also be used to help predict who could benefit from which treatments. It is precisely our ability to define specifics about an individual that will help us know what will and won't work."

2018

Published international standard for testing wear of total hip-joint prostheses under edge loading conditions (ISO 14242-4:2018)

If it is shown to work in vitro then companies have more confidence to invest resources before animal or human trials begin.

‘Hearing’ hip dysplasia in infants



An electronic acoustic sensor that can detect hip dysplasia in newborn babies could better equip doctors to identify the condition – and reduce the need for children to have corrective surgery after late diagnosis.

Daniel Perry, a consultant surgeon at Liverpool’s Alder Hey Children’s Hospital is leading the project, called SHINE - Screening the Hips In NEwborns. Researchers at Liverpool John Moores University are contributing technical expertise required to develop the prototype device and the IKC is supporting the project’s commercial development. The work is funded by Arthritis Research UK as part of its commitment to preventing the onset of osteoarthritis.

“The tools that clinicians currently have for detecting hip dysplasia are pretty poor and even if the baby’s family has spotted that something is amiss, it can be hard to get a diagnosis,” explains Mr Perry. “The tool that we’re developing is relatively straightforward and inexpensive to implement and could completely transform the way babies are tested for this condition.”

Hip dysplasia affects between one and three babies out of every thousand born in the UK each year. If caught early, it can usually be treated with a simple harness to correct the displacement, which can be removed after a few weeks.

Doctors assess newborns for the condition as part of a routine clinical examination. An ultrasound screening will follow if any abnormality is detected.

Despite these tests, around two thirds of cases are not detected at this early stage.

Babies who aren’t diagnosed within the first few months commonly need surgery to reset the ball of the femur back into the hip socket. Procedures can be complex and require the patient to spend several months in spica casts – also called plaster trousers. Late treatment of hip dysplasia can also lead to osteoarthritis later in life.

The development of new technology could not only save huge disruption and distress to families, but it could also represent a significant saving to the NHS.

Hip dysplasia affects between one and three babies out of every thousand born in the UK each year.

Ti

3D printed alloys can match stiffness of bone

Orthopaedic surgeons are accustomed to carrying out joint repairs using devices made from titanium – but although it has many of the properties needed for success, titanium is many times stiffer than bone, and can cause deterioration in surrounding tissue.

Researchers at Imperial College London are working with additive manufacturing experts, Renishaw, to design implants made from titanium alloys in a lattice design. They have succeeded in developing a material that matches the natural stiffness and anisotropy of bone that can be used to repair joints or to correct their alignment.

Using the 3D printing process, the team has even succeeded in incorporating a Velcro-style fixing system to the design that means the device can be implanted without the need for screws.

“Bone changes depending on the strain it experiences,” explains Dr Jonathan Jeffers, of Imperial College, who is leading the research. “If you use an implant that’s much stiffer, it reduces the strain on surrounding bone, so it will remodel itself to become less dense and weaker. We need implants that work alongside existing bone but also enable it to retain its strength.

“Titanium is already widely used in orthopaedics, so the new properties that we’re introducing will be more easily adopted into the clinic.”

Dr Jeffers is also taking advantage of other materials already in clinical use to take the device into a new area of innovation – resorbable implants.

A magnesium alloy, used in stents by cardiac surgeons to repair arteries, is now being tested as an orthopaedic device using the same design and manufacturing process as the titanium alloy implants. Using IKC proof of concept funding, researchers are developing the material prior to testing in animal models. The aim is to use it to treat younger patients who have a greater ability to regenerate bone.

“The IKC has been able to guide the development of this research, but it’s also been useful to access its network of industry and academic partners,” says Dr Jeffers. “Providing opportunities for potential partners to talk to one another is a valuable part of the innovation process.”

Researchers are developing the material prior to testing in animal models.

To find out more about
our research please visit:
medical-technologies.co.uk

Clinical application areas:

Soft tissue repair

– Collagen dressing approaches first-in-human trial
– Wound-healing regenerative gel
– Anti-bacterial scaffold for wound healing

“

Wound healing problems cost the NHS over £5 billion per year. Our projects tackle the barriers of infection and excess production of damaging exudate while promoting repair - and also remind us that wounds do not just affect the skin.

”

Dr Mike Raxworthy
Operations Director, Regener8
and RAEng Visiting Professor in
Medical Technology Innovation
and Translation

Our portfolio of soft tissue repair projects includes:

Urinary tract application for a bladder derived natural acellular matrix
University of York

Collagen wound dressing
University of Leeds

In vivo diagnosis of over active bladder (OAB) through dynamic morphology measurement
University of Leeds

Intra Abdominal Platform (IAP) development
University of Leeds

Small bowel replacement and regeneration
Northwick Park Institute for Medical Research

Decellularised biomaterials for homologous use in urinary bladder auto augumentation
University of York

Adipose derived regenerative cells (ADRCs) to prevent anastomotic leak following gastrointestinal surgery
University of Leeds

Evaluation of the novel PhotoTherix scaffold system for treating infected wounds
University of Bradford

Omental derived regenerative cells (ODRCs) to prevent anastomotic leak following gastrointestinal surgery
University of Leeds

Collagen dressing approaches first-in-human trial

A wound dressing impregnated with collagen fibres is to undergo preliminary testing in patients, following successful in vivo trials.

The dressing is more absorbent than currently available products and can accelerate healing in chronic wounds.

An IKC proof of concept grant enabled researchers to prove the safety, reproducibility and long-lasting stability of the material in vitro before testing it in diabetic mice. Their results showed wounds treated with the collagen dressing healed completely after 20 days, while untreated wounds were only 40 per cent healed.

The team, based at the University of Leeds, also confirmed that the collagen can absorb enzymes released as part of the body's first response to wound healing. These enzymes can aggravate chronic wounds and prolong the healing process.

Dr Giuseppe Tronci, lecturer in healthcare materials at Leeds School of Design, says:

"The NHS treats more than two million wounds each year, many of which require multiple visits to the clinic. A solution that can heal wounds faster has clear benefits for patients and healthcare services."

A first-in-human trial is planned in Leeds, to investigate the safety and acceptability of the materials in patients with ulcers on their fingers, ahead of a full clinical trial.

The team has also confirmed the GMP-compliant manufacture of medical grade prototypes with an industrial partner and has secured an MRC CiC award to explore using the technology in guided bone regeneration in dentistry.

First-in-human trial planned in Leeds, ahead of a full clinical trial.

Wound-healing regenerative gel

A gel that combines with regenerative cells from the omentum, the fatty layer inside the abdomen, is being developed to support wound healing following colorectal surgery.

The project, a collaboration between regenerative cell therapy company, Cytori Therapeutics Inc. and the NIHR Surgical MedTech Co-operative, is being supported through an IKC proof of concept grant. The team, led by Surgical MIC clinical director, Professor David Jayne, have been testing the gel in the laboratory on wound healing models, with encouraging results.

"All the components of the gel are working well together, and the gel is able to support the growth and vitality of the regenerative cells," said Professor Jayne. "We aim to begin the first pre-clinical tests during the summer, and if those are successful, to apply for further funding for larger scale tests and to support preparatory work for first-in-human trials."

The aim is to use the gel initially to reduce the risk of anastomotic leaks following bowel cancer surgery, where re-joined sections of bowel fail to heal properly, with potentially fatal consequences.

> **"We aim to begin the first pre-clinical tests during the summer."**

Anti-bacterial scaffold for wound healing

University of Bradford researchers are working with a York medtech company to refine its novel resorbable scaffold, created to promote healing in chronic wounds.

The scaffold was developed by spin-out company, Neotherix, and is made by electrospinning a bioresorbable polymer into a mesh structure. Once implanted into a wound it is designed to encourage new skin cells to grow into it, promoting healing.

The PhotoTherix™ scaffold will dissolve once enough time has passed for new cells to grow into the area. It is also impregnated with a dye that will release molecules called reactive oxygen species (ROS). When activated by a particular type of light, the ROS can kill bacteria in the wound.

Researchers led by Professor Des Tobin at the University of Bradford's Centre for Skin Sciences are now working on an IKC-funded project to investigate what type of light is most effective in activating the release of the ROS, and so most effective at killing bacteria.

"The NHS is facing two major challenges in the area of woundcare – an increasingly ageing population and rising levels of diabetes," explains Professor Tobin. "Both of these mean more resources than ever are needed to treat chronic wounds such as ulcers, which can remain unhealed for a year or even longer. They're expensive to treat in terms of monitoring and changing dressings, as well as being painful and inconvenient for patients, who have to arrange hospital or home visits for treatment."

Working with microbiology specialist Dr Anna Snelling, also based at the University of Bradford, the team will introduce different types of bacteria commonly found in chronic wounds into the scaffold in the lab, along with healthy skin cells. The samples will then be irradiated with different wavelengths of light. The aim is to verify that the ROS will selectively kill bacteria without harming any of the healthy skin cells.

The project was also supported by the NIHR WoundTec Healthcare Technology Co-operative, who helped identify the scale of the unmet clinical need for the technology.

Clinical application areas:

Musculoskeletal regeneration

– Cartilage repair device starts trial
– Innovative technology for human joint repair
– Microspheres deliver stem cells for bone repair
– Shining light on cartilage

“

Leeds’ decellularised scaffold platform has huge potential and has led to the spin-out of Tissue Regenix, which is now seeing excellent results with their dermis product. Decellularisation technology is an area that we continue to support, particularly since it represents a great opportunity to develop tissue replacements that are engineered specifically for the needs of individual patients and applications.

”

Dr Graeme Howling
Senior Technology Innovation Manager

Our portfolio of musculoskeletal regenerative projects includes:

The development of novel devices for the rapid enrichment of large quantities of mesenchymal stem cells for 'one step' orthopaedic and regenerative medicine applications
University of Leeds

In vivo testing of decellularised bone to determine osseointegration and biocompatibility
University of Leeds

Development of a medical device for intra operative stimulation of synovial mesenchymal stem cells for improved joint repair
University of Leeds

Bioactive cements and pre set porous scaffolds to promote bone tissue regeneration
University of Sheffield

Manufacturing bone tissue using resorbable porous calcium phosphate microspheres loaded with autologous stem cells
University of Nottingham

In vivo evaluation of decellularised porcine superflexor tendon for ACL reconstruction
University of Leeds

Decellularised human bone patella tendon bone tendon for ACL
University of Leeds

Development of a label free cell separator for autologous stem cell enrichment for skeletal tissue repair
University of Leeds

Systemic upregulation of bone marrow MSC by platelet transfusion
- University of Leeds

Smart fixation devices for soft tissue fixation
University of Bradford

The use of de mineralised bone and cellularised de mineralised bone in rotator cuff repair
UCL

A parametrised model of the natural knee, for SAFER surgical interventions
University of Leeds

Development, validation and international standardisation of pre clinical tests for tissue repair scaffolds in the knee
University of Leeds

The application of Raman arthrospectroscopy for intra operative mapping of early articular cartilage degeneration
Royal Veterinary College

Pre clinical trial of a novel patient specific biphasic synthetic scaffold for the treatment of osteochondral defects
University of Cambridge

A novel process for the sterilisation of acellular allografts
University of Leeds

Pre clinical simulation of tissue repair interventions for the patella
University of Leeds

Dual action injectable bone graft substitutes for unmet clinical needs in orthopaedic and dental surgery
University of Sheffield

Surgical nanoformulations of injectable PolyNIPAM for effective regeneration of intervertebral disc (IVD)
Sheffield Hallam University

Nano hydroxyapatite pastes with enhanced osteogenic and anti bacterial properties
University of Sheffield

Decellularised osteochondral scaffolds for cartilage repair
University of Leeds

Manufacturing porous microspheres from FDA approved bioglass materials
University of Nottingham

Dr Thomas Baboolal (right)

Cartilage repair device starts trial

A clinical trial of an arthroscopic brush that may enhance cartilage repair is underway in Leeds, to provide the evidence needed for full commercialisation of the device.

The brush device was developed by Dr Thomas Baboolal from the University of Leeds, with proof of concept funding from the IKC. The trial is looking at its use during keyhole microfracture knee surgery, where tiny holes are drilled into the bone near the cartilage injury to release bone marrow stem cells into the damaged area.

The device provides additional healing capability by mobilising stem cells from the synovium – which has a higher concentration of stem cells than bone marrow – allowing them access to the injury site.

The trial at Chapel Allerton Hospital in Leeds, supported by the NIHR Leeds Biomedical Research Centre, is recruiting patients with a full thickness cartilage defect, an injury severe enough to impact on joint movement. This is to ensure that any clinical benefit from the device will be clearly seen, although as the full extent of cartilage damage is often only diagnosed during surgery, it can make recruitment to the trial more difficult.

Dr Baboolal said: “This type of cartilage injury is clearly defined in previous research, which gives us other studies to compare our trial against. This means that we can get more robust results to support a clinical case for use of the device, so it can be taken forward for manufacture and marketing.”

Nearly half of the trial cohort has been recruited to date, of which two met the criteria during surgery. The trial is set to run for a further six months, with an extension likely to ensure full recruitment.

A licensing agreement has already been signed with Leeds-based medical device company, Xiros, who aim to apply for the device to be CE marked once the clinical evidence is completed.

The researchers are also considering the device’s potential for use with other surgical devices, including scaffold implants, or with other procedures such as the new technique of joint distraction, where the knee joint is held apart to enable recovery from more severe cartilage damage.

Medical device company, Xiros, aims to apply for CE marking once clinical evidence is completed.

Innovative technology for human joint repair


Dr Hazel Fermor

A key element of the IKC's work focuses on supporting research to improve the successful integration of implants in the body. A particular emphasis is on composite tissues – a combination of soft tissue such as tendons and the bone to which it is attached.

Underpinning these projects is a novel technique, developed at the University of Leeds, to 'decellularise' donated tissue – removing cellular and DNA material to reduce the chances of rejection and allow the implant to support the growth of new tissue using the patient's own cells.

The technology was developed by Professor Eileen Ingham's team in the Institute for Medical & Biological Engineering and commercialised through the spin-out company, Tissue Regenix, as dCELL®. Originally designed to repair heart valve tissue, the technique has been modified for different tissue types to help patients with a range of conditions and needs.

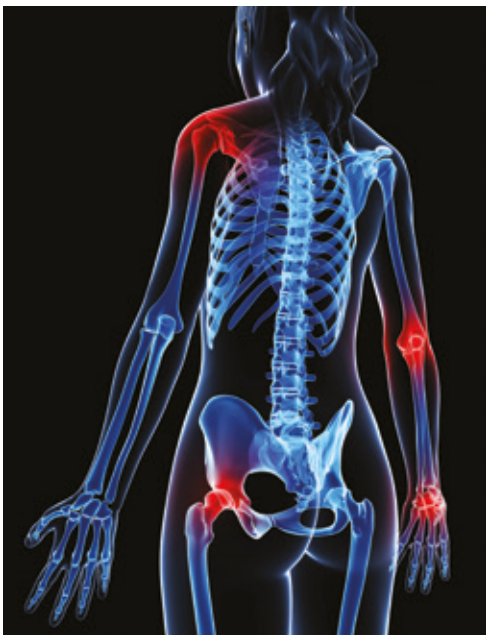
The IKC has supported research, in collaboration with NHS Blood and Transplant Tissue and Eye Services (NHSBT TES), into a human bone-patellar tendon-bone implant to repair anterior cruciate ligament damage, which has been tested successfully in sheep. Alongside this, Professor Ingham has been testing a process developed by NHSBT TES for reducing the risk of infection by sterilising the implant materials, also supported by the IKC.

Interdisciplinary expertise

The team's interdisciplinary knowledge is the secret to its success. There are few groups in the field of regenerative medicine that combine physics and engineering with biology and immunology - and the ability to test both the biomechanical properties and biological compatibility of the tissues has produced rich results.

Since the original decellularisation patent in 2001, further patents have been granted for meniscus, bladder and artery tissue, which require additional steps in the process.

Professor Ingham explains: "Heart valve tissue is relatively thin and we've found our method works well on thin tissues like pericardium and amnion but it's harder to decellularise thick tissue. The bladder when relaxed is very thick and muscular, so we needed to add in an additional trick. The secret is to stretch it like a balloon before the decellularisation process."



That process of stretching and decellularising bladder tissue, which was developed in collaboration with Professor Jenny Southgate at the University of York, also shows huge promise for developing patches that can increase bladder capacity for patients who have bladder disease or dysfunction. Current solutions use a patient's own intestinal tissue which carries risks of infection and bladder stone formation in addition to unknown cellular effects over time. Ramnath Subramaniam, a consultant paediatric urologist at the University of Leeds, is keen to find alternative ways of enlarging the bladder.

Mr Subramaniam is collaborating on a project led by Professor Southgate working with porcine acellular bladder matrix (PACM) and investigating how well the material integrates with the mucosa of the bladder inner lining. Although only working with small patches at the moment, the results are positive.

"We are seeing the acellular matrices become cellularised and integrated and in our tests we aren't finding the complications reported in previous clinical work in the field. The method is amazingly promising and we want to move forward with a human bladder matrix equivalent and to test the human aspect of this," he says.

2018

Eileen Ingham and John Fisher shortlisted for European Inventor of the Year award

Early career opportunities

Dr Hazel Fermor is working alongside Professor Ingham on a related IKC-funded project to develop a decellularised osteochondral scaffold as an early intervention therapy for damaged cartilage.

Dr Fermor took part in research translation training through the IKC's PGCert in Professional Innovation Management, and also won the national Chemistry Young Entrepreneurs Scheme, aimed at raising awareness of technology commercialisation.

> **"My focus is now much more on developing products, than just 'doing research', and I'm much more aware that we need to look at efficacy and safety, and work with companies and clinicians."**

"I've been really fortunate in learning from Eileen and being supported by the IKC," says Dr Fermor. "My focus is now much more on developing products, than just 'doing research', and I'm much more aware that we need to look at efficacy and safety, and work with companies and clinicians."

Also working with Professor Ingham is Dr Tony Herbert, an independent researcher who was awarded IKC funding to investigate the structural properties of different types of decellularised allogeneic bone.

"It's very difficult to get significant grants without a tenured academic post, but the IKC assessed my application purely on its merit," says Dr Herbert. "That's given me the opportunity to work with NHS Blood and Transplant Tissue and Eye Services to investigate how bone properties might be matched to particular load-bearing needs."

Microspheres deliver stem cells for bone repair

£1.2m

additional funding from NIHR i4i

Dr Ifty Ahmed

Microspheres that deliver stem cells to accelerate bone repair and regeneration are being developed through a collaboration between the University of Nottingham and Johnson Matthey.

Supported by an IKC Industrial Partnership Award, the research will explore whether silicate-based bioglass microspheres, can be manufactured into highly porous microspheres.

These would be injected via small needles directly into sites at high risk of fracture, providing millions of stem cells to regenerate bone tissue. The proposed prophylactic treatment could improve the quality and the density of bone in patients with osteoporosis.

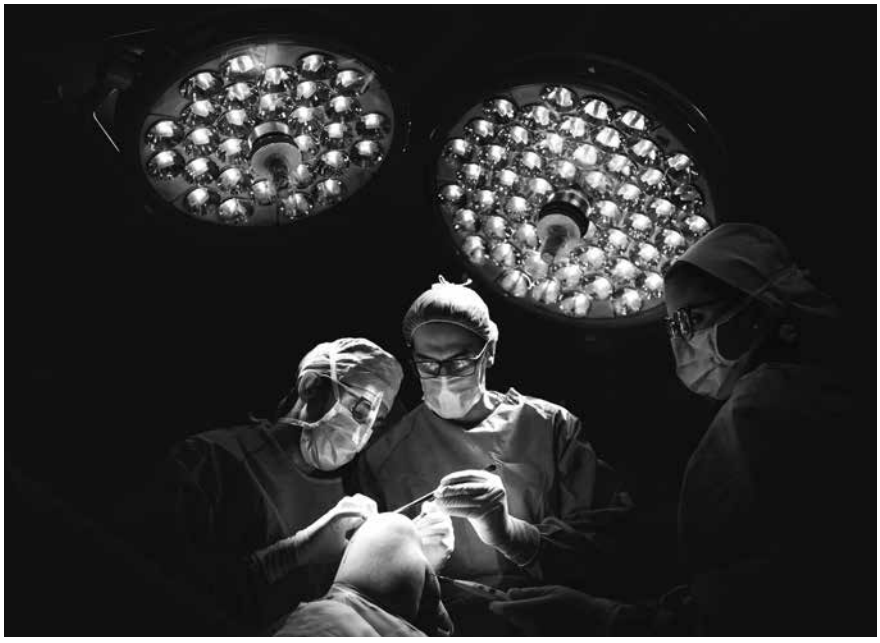
Researchers at the University of Nottingham originally developed the single stage manufacturing method for producing highly porous microspheres with support from an IKC proof of concept grant.

The microspheres initially developed were made from a calcium phosphate glass material which is also under investigation for regenerating bone tissue. However, this material is not yet cleared for clinical use, so the researchers are also exploring alternative materials with Johnson Matthey and investigating a potentially faster route to market. They hope to be able to achieve similar results to those produced using phosphate-based glasses.

The initial IKC funding enabled the team to apply for a £1.2m grant from the National Institute for Health Research i4i programme to optimise the manufacture of calcium phosphate microspheres and design and test a delivery device. Through a patient survey, they also showed how receptive patients would be to the use of stem cells as a prophylactic treatment option for damaged bone.

“This technology offers a potential early-stage intervention for patients with osteoporosis, giving us the opportunity to strengthen compromised bone and reduce the risk of fragility fractures,” explains Dr Ifty Ahmed, who is leading the research. “Although our current focus is on osteoporosis, we can already see potential for treating other diseases, such as bone cancer.”

He added: “The key advantage of our porous microspheres is that we could also use them as a delivery vehicle for other biologics, for example, proteins, drugs or growth factors – there’s a lot of potential for this technology.”



Shining light on cartilage

A joint Arthritis Research UK and IKC proof of concept award has enabled a diagnostic tool for early stage cartilage disease to move closer to commercialisation.

The tool is based on a technology called Raman spectroscopy, which uses lasers to identify the composition of materials. Combined with an optical probe, the technique can be used during keyhole surgery to provide an objective assessment of the state of cartilage within a joint and so enable clinicians to decide what intervention will be needed.

Dr Jayesh Dudhia of the Royal Veterinary College and Professor Paul McMillan of UCL have identified specific features of scattered light that reveals early stage cartilage disease – when it cannot be picked up by MRI or X-ray imaging. However, they needed to build sufficient data across other areas of the spectrum so the tool could be validated.

Dr Dudhia said: "With the additional data, we're now able to reliably assess the changes that occur with age, as the composition of cartilage in a 20-year-old can be markedly different to that of a 50-year-old. By having this wider range of data, we can take natural changes into account, to ensure the tool only responds when disease is present."

The researchers hope to team up with an optics company to improve the sensitivity and practicality of the tool and ensure it meets the needs of clinicians. They have also been awarded a grant by UCL Enterprise to develop its commercial potential.

The aim is to build a probe that will beam a laser onto the cartilage and give the surgeon a 'traffic light' tool to guide the boundaries between diseased and healthy or borderline cartilage.

"We're now adding to our data to build the algorithm that will enable this simple output, so the machine does all the hard work and the surgeon can focus on the operation," said Dr Dudhia. "At present, some prostheses fail because surgeons can't see the extent of the underlying problem – this is where we believe our tool can help. But it can also be applied to cartilage regenerative medicine and engineering fields."

The aim is to build a probe that will beam a laser onto the cartilage and give the surgeon a 'traffic light' tool to guide the boundaries between diseased and healthy or borderline cartilage.

“

The material that we have developed is very similar to natural enamel and, our device enables us to apply it to teeth and harden it off with a cold pulsed laser, all within a couple of minutes.

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To find out more about
our research please visit:
medical technologies.co.uk

Clinical application areas:

Dentistry and oral

– A hard and fast approach to repairing tooth enamel
– New applications for dental peptides

“

The self-assembling peptide technology platform developed in Leeds is very exciting - especially now that products containing Curolox will be hitting shelves of UK supermarkets soon. The IKC supported this technology through a number of proof of concept and co-development projects with Credentis. The high quality science, coupled with the commitment of the academic team and the close collaboration with Credentis has led to the success of this technology.

”

Dr Graeme Howling
Senior Technology Innovation Manager

Our portfolio of dentistry, oral and maxillofacial projects includes:

Restoration of lost enamel using engineered acid resistant and photosensitive minerals and eye safe pulsed lasers
University of Leeds

Polymeric scaffolds functionalised for periodontal repair
University of Manchester

Self assembling peptides for maxillofacial bone repair
University of Leeds

Investigation into the production and application of shape memory gutta percha in dental root canal fillings
University of Leeds

Periodontal restoration using femtosecond pulsed lasers (PRUF)
University of Leeds

A biomimetic anti microbial hydrogel for periodontal regeneration in periodontal disease
University of Leeds

Exogenous mineralisation of acid eroded enamel using ultrafast lasers - in situ appliance trials
University of Leeds

A hard and fast approach to repairing tooth enamel

A prototype device that can repair damaged tooth enamel – developed thanks to IKC proof of concept funding – is ready to be trialled in human volunteers.

The device, which lead researcher Professor Animesh Jha describes as looking 'a bit like a water pistol', delivers a synthetic calcium phosphate material directly to the tooth where it is hardened using pulsed laser technology.

Professor Jha, an expert in Materials Science at the University of Leeds, first developed the technique in an early IKC proof of concept project using bench top lasers and novel bio-mineral coatings. This research was supported via a co-development of 'cold' pulsed laser by Professor Tom Brown's group in the School of Physics and Astronomy at the University of St Andrews in a collaborative RCUK-funded programme.

The work led to an international research partnership and two further projects: the first, funded by the Engineering and Physical Sciences Research Council, enabled the coating materials and advanced cold pulsed laser to be optimised for dental enamel restoration. The second, an EU-funded Marie-Curie IAPP project, focused on developing the integrated materials and laser device for clinical use.

The water pistol inspired design was suggested by Professor Monty Duggal at Leeds' School of Dentistry. Professor Jha's team worked with an Italian company, ICMEA, on the device design, and materials were engineered together with Glass Technology Services Ltd in Sheffield,with laser technology from Glasgow-based company MSquared.

"Enamel is acellular, so the body can't regenerate it when it becomes damaged," explains Professor Jha. "The material that we've developed is very similar to natural enamel and our device enables us to apply it to teeth and harden it off with a cold pulsed laser, all within a couple of minutes."

A new IKC project, launched in 2017, will see the device tested in an in-situ mouth appliance trial in collaboration with the School of Dentistry at Leeds. For the first time, the technology, which has already been tested successfully on bovine and donor human teeth, will be trialled in human volunteers. If successful, a full clinical trial can be planned.

In a related project, Dr Antonios Anastasiou, a post-doctoral researcher in Professor Jha's team, is using the technology to develop a technique for restoring gums damaged through conditions such as peridontitis. An IKC feasibility grant is enabling Dr Anastasiou to explore ways to use lasers to help re-join damaged gum tissue to the tooth's hard enamel surface. The periodontal project was funded by Marie-Curie EU Fellowship.

For the first time, the technology will be trialled in human volunteers.

New applications for dental peptides

When Professor Jennifer Kirkham and Dr Amalia Aggeli began looking at self-assembling peptides for use in dentistry, their idea was to create a mouthwash that would infiltrate the peptides into decay lesions in the teeth, where they could start to repair the damage.

2018 will see such a mouthwash launched in the UK, just one of many products on the market that contain the self-assembling peptides – today termed Curolox® Technology – from gels for use in the clinic to toothpastes and dental chews.

Professor Kirkham said: "It's come such a long way from that early research at the University of Leeds, which developed and characterised the self-assembling peptide, ensuring it would behave as expected on the tooth and in early clinical trials. All the products now on the market are rooted in that initial work."

The self-assembling peptide P11-4 is the central component of Curolox Technology. It creates a 3D biomatrix that supports the regeneration of tooth enamel, enabling a natural repair to caries lesions, without the need for more invasive procedures. Developed with support from the IKC, the technology is licensed to the Swiss company, Credentis AG, who have formulated and developed it for diverse dental applications and brought it to an international market.

The technology can also reduce tooth sensitivity by blocking pores in the root dentine, filling them with mineral crystals, or create a protective layer over the teeth, to prevent further damage to the enamel.

Credentis has pioneered all of these uses in its Curolox Technology products, Curodont Repair, Curodont D'Senz and Curodont Protect, with the former due to be launched in the UK this year.

2018

will see a mouthwash launched in the UK, one of many products on the market that contain the self-assembling peptides

Already one of the IKC's major successes, the story doesn't end there. The IKC has supported further work to identify other self-assembling peptides with similar regenerative potential. The IKC is also co-funding research, with Credentis, to look at the use of self-assembling peptides in repairing the damage caused by gum disease.

"It's a natural progression for the technology," said Credentis CEO and founder, Dr Dominik Lysek. "From a scientific perspective, the peptide has been shown to work on bone and tooth, and both are involved in gum disease. And from the business side, there is only one competitor product on the market and Curolox Technology has the advantage of being fully synthetic."

The area around the tooth where it emerges through the gumline and into the mouth creates a natural 'pocket' (the gingival crevice) that can accumulate bacteria leading to chronic inflammation and eventual tissue destruction.

The new research aims to combine the 3D biomatrix with a slow-release anti-microbial agent, which can help to combat the early stages of inflammation, enabling repair of the tooth-supporting structures and preventing further damage. The self-assembling peptide, in gel form, would be injected into the gingival crevice enabling infection to be treated locally rather than systemically.

Dr Phil Davies and Professor Deirdre Devine from the University of Leeds are investigating the release kinetics of the anti-microbial agent with different self-assembling peptides, to see which combination works best. This will then be tested in the lab against a microbial biofilm, similar to that forming in the mouth, including the key pathogens present in periodontal disease.

Dr Davies said: "We know from early tests that the peptides can help repair periodontal tissue, but these were done in the absence of infection. We now need to fine tune the combination with the anti-microbial, to enable the minimum concentration to be used."

The ethos of the strapline for the original research – filling without drilling – holds true for this latest project as well, whose aim is to create an effective, but minimally invasive and painless treatment.

The IKC has supported further work to identify other self-assembling peptides with similar regenerative potential.

The IKC is also co-funding research, with Credentis, to look at the use of self-assembling peptides in repairing the damage caused by gum disease.

To find out more about
our research please visit:
medical technologies.co.uk

Clinical application areas:

Cardiovascular

– Award-winning scanner secures FDA clearance
– Decellularisation for pulmonary valve replacement

“

Cardiovascular has been a developing area for the IKC since we helped to progress VitalScan – spin-out company Creavo’s flagship device – which has now raised more than £20 million in investment. This is a hugely exciting project, and its success shows the potential opportunities and outcomes from proof of concept projects.

”

Dr Andrew Aldridge
Technology Innovation and
IP Development Manager

Our portfolio of cardiovascular projects includes:

Medical magnetic imaging
University of Leeds

In vivo evaluation of decellularised porcine pulmonary roots
University of Leeds

CamRegen scaffolds for cardiac repair
University of Cambridge

Cardiovascular implants, simulation methods and SOPs
University of Leeds

Award-winning scanner secures FDA clearance

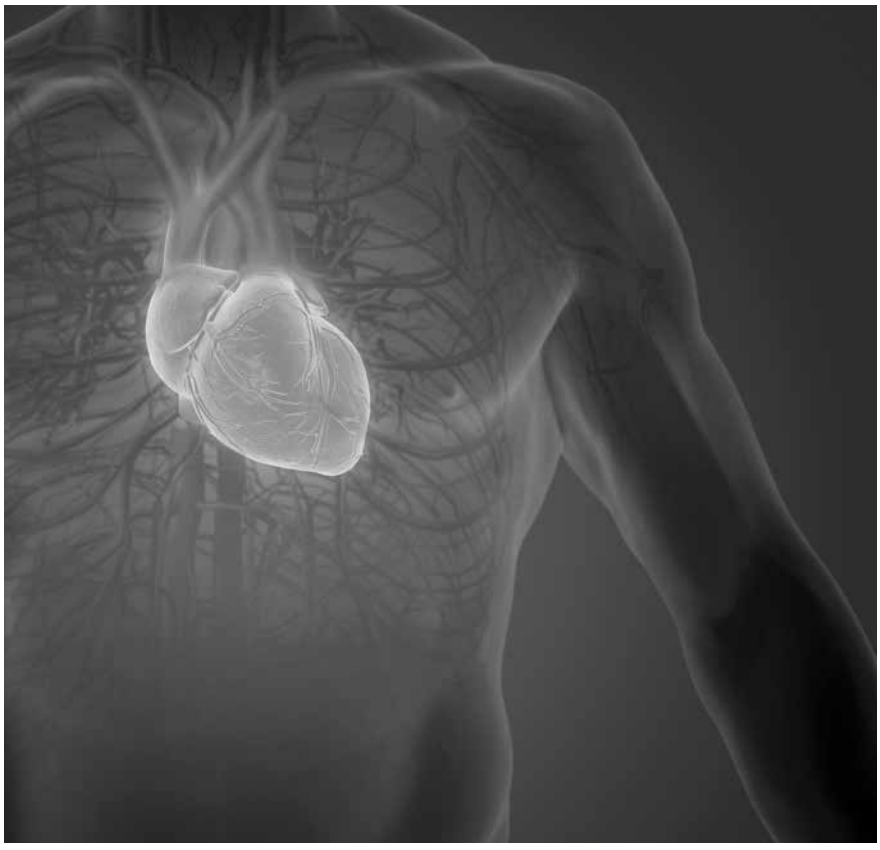
VitalScan, a portable scanner that can help clinicians quickly rule out serious heart disease in patients, has been awarded medical device clearance from the Food and Drug Administration (FDA), opening up distribution in the USA.

The device, based on research by Professor Ben Varcoe of the University of Leeds, was supported by the IKC at proof of concept stage and is already CE marked. It uses the heart's electromagnetic signals to carry out a rapid assessment of cardiac health, enabling healthy patients to be sent home without further costly tests or referrals.

Spin-out company Creavo Medical Technologies successfully raised £13.4m investment in 2017 to commercialise the device and make it ready for market. Creavo also won two Institute of Engineering and Technology awards – for best healthcare technology and best overall emerging technology design. A UK-wide clinical trial of VitalScan is nearing end of recruitment. Creavo already has distribution agreements signed in several countries, with more in the pipeline and some distributors looking at running further trials.

£13.4m

Raised by Creavo Medical Technologies in 2017 to commercialise the device and make it ready for market



The team is working with NHS Blood and Transplant to apply the technology to human valves.

Decellularisation for pulmonary valve replacement

A process designed to reduce the risk of rejection in heart surgery patients receiving donated aortic valves is now also being applied to pulmonary valves.

The decellularisation process, in which cellular material is removed from tissue before a patient's own cells repopulate the remaining matrix, was developed by Professor Eileen Ingham and colleagues at the University of Leeds. It was first designed for the aortic valve, which pumps blood around the body. Physiologically the aortic valve works hardest and is more likely to need replacing in patients.

Often a surgeon will take the pulmonary valve, which supplies blood to the lungs, and switch it over to the aortic side, using a donor valve to replace the pulmonary one. Donor valves wear out over time, but this happens more slowly on the pulmonary side and is usually caught through monitoring symptoms.

In conversations with a Brazilian heart surgeon and collaborator, the question arose as to whether the decellularisation process could also work on the pulmonary valve. The IKC has supported early testing of decellularised porcine pulmonary valves in a sheep model, with largely positive results.

The community is rightly cautious about using decellularised porcine valves because of earlier failures in this area by a US company. While any new approach will take time to be accepted, the team is working with long-term partner NHS Blood and Transplant to apply the technology to human valves.

Clinical application areas:

Opthalmology

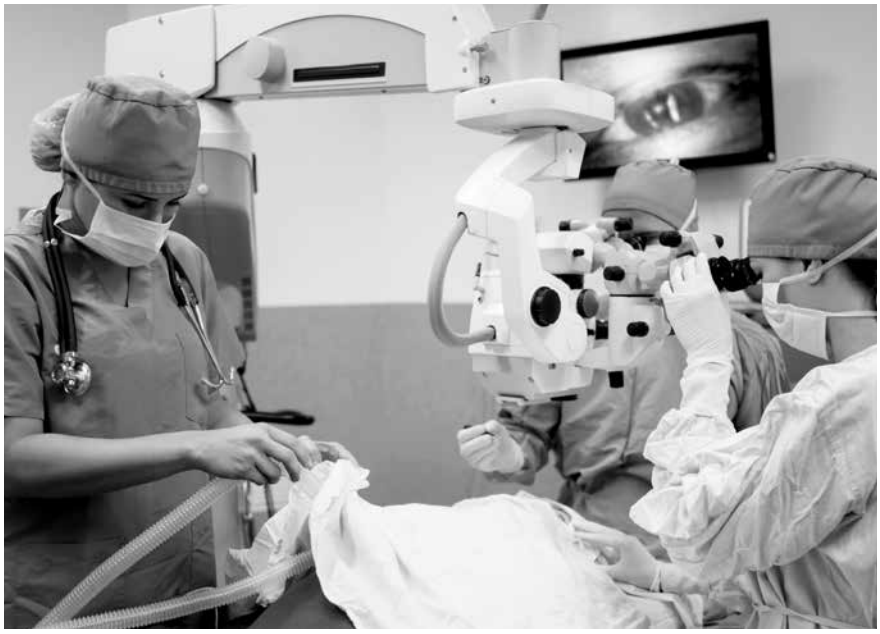
– Taking a new look at corneas

“Ophthalmology is a new focus for the IKC, and the Theagen product shows great potential to help alleviate the global shortage of donor corneas. IKC support is helping the project progress from the laboratory into a commercial environment, and will demonstrate the use of Theagen in a pre-clinical model.”

Dr Andrew Aldridge
Technology Innovation and
IP Development Manager

Our portfolio of opthalmology projects includes:

Development and pre clinical feasibility testing of Theagen™: A regenerative sight saving therapy for corneal transplantation
University of Nottingham



Taking a new look at corneas

Off-the-shelf, sterile replacement corneas that can be produced and shipped on demand are being developed thanks to IKC support.

The product, known as Theagen™, is the result of a collaboration between the University of Nottingham and spin-out company NuVision. Theagen is manufactured using a drying technique first developed at the University and licensed to the company for drying amniotic membrane. Using this technique with corneas creates a corneal repair therapy which is stable at room temperature.

Dr Laura Sidney of the University of Nottingham said: "There's a global shortage of corneas, but given issues of storage and transport, those donated in one part of the world can't be used in another. Drying the tissue so it just needs to be rehydrated when needed for surgery would overcome this problem and enable corneal repair therapies to be easily held in stock for emergency use as needed."

Through IKC funding, production of Theagen is now being transferred from the University to the clean room manufacturing facilities at NuVision. The team is also investigating whether using gamma irradiation as a final sterilisation step – needed for regulatory approval – will impact the properties of the product. Once this step is finalised, they will move on to test the corneas in animal models.

Although initially devised as a product for the developing world, there is increasing interest in Theagen from UK clinicians.

Dr Andy Hopkinson, CEO of NuVision, said: "Our aim is to create affordable, accessible therapies for those who wouldn't otherwise be able to access them and we didn't think the UK would be a significant opportunity for Theagen. But early feedback from clinicians is that Theagen has several potential uses, widening the market to developed healthcare systems."

The company aims to work in collaboration with national eye banks around the world, processing corneas that are close to their expiry date or have been donated outside the window for use as live tissue.

"Simply proving we can extend the collection window from 24 to 48 hours, we could double the pool of donated corneas in the UK," explains Dr Hopkinson. "We see Theagen as a service as much as a product, providing both commercial benefit and answering a clinical need."

Production of Theagen is now being transferred from University to the clean room manufacturing facilities at NuVision.

Doing their BEST for medtech

Embedding skills and knowledge in medical technology innovation and entrepreneurship is the aim of a programme run at the University of Leeds by the IKC and supported by the Royal Academy of Engineering (RAEng).

Now in its second year, MedTech BEST is an extra-curricular, modular course that sees students work in teams to identify a clinical need to address, a hypothetical product that fills that gap and then create a company concept and business plan to take their ideas forward.

The students meet every month to hear speakers from a range of backgrounds across medtech and work on their ideas. Teams that make it to the final – held this year in May – pitch their ideas to a Dragons' Den-style panel, with the winner being the company that offered the most convincing investment proposition.

Course director and RAEng Visiting Professor, Mike Raxworthy, said: "We aim to show students the full complexity of medtech innovation and translation, bringing in experts in venture capital, new business formation and product development. MedTech BEST allows them to try out entrepreneurship in a safe environment, so they can see if it's a road they'd like to follow."

The 2018 final saw two teams go head to head to impress a panel that included Sarah Gummer, Programme Manager in the Royal Academy of Engineering Enterprise Hub, Marcus Orton, CEO of SwabTech Ltd, Giles Proffitt, Associate at Ortheia and JRI Orthopaedics Ltd, Ruth Wilcox, Director of Leeds' Institute of Medical and Biological Engineering and former CEO of GETECH Group plc, Raymond Wolfson.

The teams each pitched a diagnostic technology, one for detecting early-stage kidney disease and the other for analysing anti-microbial resistance. The kidney disease detection device, developed by a mostly undergraduate team, won the day, as the judges deemed it a stronger investment opportunity.

Dr Raxworthy said: "The teams put in a huge amount of commitment and time – in addition to their studies – to develop their hypothetical but scientifically plausible technologies, their 'company' and business plan. This energy and passion always shines through in the final pitch."

> "We aim to show students the full complexity of medtech innovation and translation, bringing in experts in venture capital, new business formation and product development."

To find out more about our research please visit: **medical-technologies.co.uk**

Strengthening partnerships through good practice

Forging strong working partnerships with different types of organisations is fundamental to the IKC's success. It supports our core aim of translating new medtech innovation and allows us to learn and share good practice.

The medtech programme, now running since 2014, enables the charity to deliver more commercially-focused research alongside its fundamental research programmes.

Our partnership with Arthritis Research UK on their medical technologies proof of concept programme is a great example.

The IKC helps to assess funding applications and advises researchers on how to develop and 'de-risk' projects. Arthritis Research UK has particular strengths in ensuring projects are designed in consultation with patients, which is key to this process.

The medtech programme, now running since 2014, enables the charity to deliver more commercially-focused research alongside its fundamental research programmes, attracting researchers who might not otherwise have approached the charity.

Orlando Arnold is Arthritis Research UK's Income Transformational Lead. He says: "We support millions of people who are suffering from arthritis – and while our core focus remains on scientific research and direct services, we recognise that the benefits from that work might not be realised for some time. It's therefore important that we also pursue innovative and novel projects where we can deliver impact more quickly, and that's where our partnership with the IKC has been really beneficial."

IKC-Regener8 Conference 2017

The 2017 conference themes – widening markets, extending reach and growing capability – gave us a great opportunity to reflect on the growing impact of medical technology on health and how that will develop in the near future.

We were able to showcase a number of projects that the IKC has supported in dental health, addressing areas such as bone and soft tissue repair and enamel replacement. These are new fields for the IKC and serve to illustrate how we have broadened our focus from orthopaedic devices into other areas.

Our approach to research translation is steadily being adopted by partners also working in the medtech field, including research charity, Arthritis Research UK. Two projects funded by Arthritis Research UK and managed by IKC-Regener8 were highlighted at the conference, showing this successful translation process in action.

In terms of growing capability, our conference programme also focused on the IKC projects that we have supported from a very early stage which are now getting very close to the clinic.

A closing session, led by experts from NICE and Smith & Nephew, underlined the importance of developing a robust evidence base and adoption strategy. Even after a product has been launched, the process of gathering evidence and exploring new applications never really ends!

Two projects funded by Arthritis Research UK and managed by IKC-Regener8 were highlighted at the conference, showing this successful translation process in action.

Meet the team

Our people, working with our partners, provide the foundations for our success.

Our technology innovation and programme support team bring specialist skills and know-how to progress technologies and develop innovation capability across our portfolio of programmes.

Photo L-R

Dr Graeme Howling
Senior Technology Innovation Manager

Kelly Broadbent
Project Administrator

Dr Mike Raxworthy
Operations Director, Regener8 and RAEng Visiting Professor in Medical Technology Innovation and Translation

Dr Andrew Aldridge
Technology Innovation and IP Development Manager

Rowan Grant
Communications and Engagement Manager

Dr Josephine Dixon-Hardy
Director of Medical Technologies Innovation

Nick Chester
Reporting Officer

Dr Jenny Spear
Technology Innovation Manager

Dr Sean Clarkson
Technology Innovation Manager

Dr Danielle Miles
Technology Innovation Manager

Beverley Croft
Team Secretary

To find out more about our research please visit:
medical-technologies.co.uk

Our work would not be possible without our External Advisory Board of global leaders in medical technology innovation.

The EAB provides us with academic, industrial, clinical, investment and regulatory perspectives, and their insights shape and steer the strategic direction of our programmes.

Ben Rendall
UKRI, EPSRC

Cassie Doherty
IP Group

Eileen Ingham
University of Leeds

Helen Gillan
NHS Blood and Tissue Services

Iain Larmour
UKRI, EPSRC

Ian Revie
Invibio

Lisa Brown
Markham Brown IP

Mark Richardson
University of Southampton

Mike Raxworthy
Neotherix

Peter Hamer
Tissue Regenix

Phil Evans
Techceram

Rebecca Bryan
Simpleware

Ruth Wilcox
University of Leeds

Stephen Simpson
Arthritis Research UK

Sue Dunkerton
The Knowledge Transfer Network

To find out more about
our research please visit:
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EPSRC
Engineering and Physical Sciences Research Council

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