



# ANNUAL REPORT 2023



Dear healthcare engineering community,

It is my great pleasure and pride to welcome you to our 2023 annual report, reflecting on the accomplishments and milestones of the past year.

Last year saw the Institute of Healthcare Engineering (IHE) build upon its successes. Our IHE Impact Fellowship welcomed its fourth cohort of researchers, bringing our total number of Impact Fellows past and present to over 70. It is fantastic to see the long-term influence of the Impact Fellowship on research and engagement culture as Fellows go out into the world and take their learnings with them – from stand-up shows to teaching science to school children in Spain.

Our dedication to fostering emerging talent was demonstrated by the continued success of the IHE Summer Studentship scheme, which provides hands-on clinical experience to engineering undergraduates. Last year, we expanded the scheme into Moorfields Eye Hospital, allowing students to work on an even broader range of clinical applications and bringing the number of students we've supported with our Summer Studentship to 46. You can read about their experiences in the 'Education' chapter.

In line with our commitment to diversity and inclusion, 2023 also saw us participate in HDR UK's Black Internship initiative, which aims to help talented Black data scientists thrive in STEM. We worked with Dr Aghogho Onojuvbebo, a medical doctor who is currently studying for a master's degree in Healthcare Analytics and Artificial Intelligence. Following her placement with Professor James Cole (UCL Centre for Medical Image Computing), Aghogho has co-authored a paper and now has plans to continue in academia.

Across the globe, there is no denying that last year was the 'year of AI' - from Chat GPT's meteoric soar in popularity, to the UK Government's announcement that £13 million will be invested to accelerate AI innovation in healthcare (UCL was awarded more than £2.2 million in this allocation). In our research highlights chapter, you can read about the many ways UCL researchers are harnessing the capabilities of AI.

Currently doing the rounds on social media are what's 'in and out' for 2024. If we had to make predictions for the year ahead, we think AI will continue to dominate the discussion, but quantum computing will also come into the fore. Our team recently worked with the UK Government to inform their national quantum strategy mission that 'by 2030, every NHS Trust will benefit from quantum sensing-enabled solutions, helping those with chronic illness live healthier, longer lives through early diagnosis and treatment'. Keep your eyes peeled!

We hope you enjoy reading this report.

Best wishes,

Professor Rebecca Shipley

Director, UCL Institute of Healthcare Engineering

# 1 INTRODUCTION

About us	5
The year in numbers	6-7

# 2 RESEARCH

Artificial intelligence	10-13
Research highlights	14-21
Science Museum	22-23

# 3 CAREERS & EDUCATION

Education	26-34
HDRUK Black Internship	35-37

# 4 ENGAGEMENT

Future Forums Policy Workshop	40
IHE Engagement Awards	41-43
IHE Impact Fellowship	44-48
In Theatre installation	49
Royal Society Summer Science exhibition	50-51
Science of Surgery	52
Podcast	53

# 5 GLOBAL

GDI Hub and IIT-D	56-57
Visit to India	58-59
Infectious disease partnership	60
Integrated health services in Africa	61

# 6 TRANSLATION & INDUSTRY

Centre for Digital Innovation	64-65
Healthy Ageing Challenge Awards	66-67
Revolutionising healthcare workshop	68-69
Innovation projects and enterprises	70-72
Notable visits	73-75

# 7 PEOPLE & OUR COMMUNITY

IHE members	77-78
Community highlights	79-82

# 8 AFTERWORD

Thank you	83
Contact	83

# ABOUT US

## TRANSFORMING LIVES THROUGH DIGITAL AND MEDICAL TECHNOLOGIES

**Healthcare engineering is the field of applying maths and science to solve healthcare problems. This covers an incredibly broad range of activities – from developing 3D-printing prosthetic limbs through to using artificial intelligence to predict cancer therapy responses, to monitoring health and well-being from phone Apps. Our mission is to develop digital and medical technologies that transform lives across the globe.**

For us, it's all about overcoming the big challenges – the ones that matter most. They drive our research and, quite frankly, get us to work every morning. We want to help patients with spinal injuries walk again. We want people to avoid stroke and paralysis. We want to hold back the visual deterioration that comes with age. We want to help cure cancer.

We support healthcare engineering research at UCL through activities like:

- Identifying priorities and supporting strategic funded research opportunities
- Creating networking opportunities and connecting researchers from across the university and our partner hospitals
- Facilitating meaningful knowledge exchange between academics, healthcare professionals, industry, patients and members of the public
- Providing training and development opportunities for students and early-career researchers
- Pump-priming projects
- Hosting events that develop interdisciplinary skills and knowledge
- Guiding researchers through UCL's research development pipeline, from foundational research to clinical practice

We have strong links to our affiliated hospitals and biomedical research centres, which help ensure our research focus is always on identifying and solving real clinical problems.

# 2023 IN NUMBERS

#1

Biomedical  
Engineering &  
Medical Technology<sup>1</sup>

Research power  
in medicine, medicine,  
health and life sciences<sup>1</sup>



4

Healthcare engineering-related  
Centres for Doctoral Training

Partner hospitals

8



£23  
million

EPSRC healthcare  
technologies portfolio



3

Biomedical  
research centres

#1

#3

Computer Science &  
Engineering<sup>2</sup>

## INSTITUTE OF HEALTHCARE ENGINEERING



1

Director



2

Deputy directors



3

Core members



5

Delivery groups  
with members  
from across UCL

# UCL

46



IHE Summer  
Studentship  
placements  
since 2021

70



IHE Impact Fellows  
trained since 2021

2

RESEARCH



# ARTIFICIAL INTELLIGENCE



## AI MODEL AIMS TO PREDICT HOW MEDICINES TASTE

**A team from the UCL Global Business School for Health (GBSH) and the UCL School of Pharmacy are using data collected from an “electric tongue” to create an AI model for predicting the bitterness of drugs.**

Taste is key to making sure people regularly take their medications and is an important part of drug development. For example, taste has been identified as the biggest barrier in compliance for children taking medicine, but taste is also an issue for adults, especially adults taking long-term medication, such as for HIV.

A research team led by former IHE Impact Fellow, Dr Hend Abdelhakim (UCL Global Business School for Health) used an e-tongue (a device made of sensors responding to taste) to assign bitterness scores to medicines, and in turn estimate the aversiveness expected from the clinical dose planned.

The e-tongue measures how much the bitter molecules stick on a plastic sensor that acts like the human tongue, and then compares it with a clear sample. The difference between the two measurements represents a theoretical bitterness level of a medicine.

Using an e-tongue means drugs can be tested more quickly and effectively compared to the alternative option of conducting a human trial, but now the team are collaborating with machine learning experts including Dr David Shorthouse (UCL School of Pharmacy) to speed up drug development further using an AI model.

Using data from the e-tongue, the AI model breaks down a drug into a series of molecular descriptors (e.g., number of atoms, total surface area of the molecule) that determine taste in order to predict levels of bitterness.

The model being developed will be an open access tool, meaning that pharmaceutical development around the world can benefit from the data on palatability of medicines.

## AI MODEL TO BOOST GLOBAL RESEARCH INTO REDUCING BLINDNESS

Researchers at UCL and Moorfields Eye Hospital have developed an AI system that has the potential not only to identify sight-threatening eye diseases but also to predict or identify other health conditions, including heart attacks, stroke, and Parkinson’s disease.



**RETFound, one of the first AI foundation models in healthcare, and the first in ophthalmology, was developed using millions of eye scans from the NHS.**

The research team are making the system open-source and freely available to use by any institution worldwide, to act as a cornerstone for global efforts to detect and treat blindness using AI. This work has been published in Nature.

A foundation model describes a very large, complex AI system, trained on huge amounts of data, which can be fine-tuned for a diverse range of subsequent tasks. RETFound consistently outperforms existing state-of-the-art AI systems across a range of complex clinical tasks, and even more importantly, it addresses a significant shortcoming of many current AI systems by working well in diverse populations, and in patients with rare disease.

The work, supported by three Biomedical Research Centres, was led by Moorfields Eye Hospital and UCL Institute of Ophthalmology (IoO). Prof Daniel Alexander, Healthcare Engineering & Imaging Theme Director at the UCLH BRC, was a co-author on the research.

**Prof Pearse Keane, senior author on the paper, said:**

***This is another big step towards using AI to reinvent the eye examination for the 21st century, both in the UK and globally. We show several exemplar conditions where RETFound can be used, but it has the potential to be developed further for hundreds of other sight-threatening eye diseases that we haven’t yet explored.***

***If the UK can combine high quality clinical data from the NHS, with top computer science expertise from its universities, it has the true potential to be a world leader in AI-enabled healthcare. We believe that our work provides a template for how this can be done.***

AI foundation models have come under the spotlight with the launch of foundation models such as ChatGPT, trained using vast quantities of text data to develop a versatile language tool. Taking a comparable approach with eye images, RETFound has been trained on millions of retinal scans to create a model that can be adapted for potentially limitless uses.

One of the key challenges when developing AI models is the need for data to be meticulously labelled and annotated, often expensive or time-consuming. RETFound can match the performance of other AI systems whilst using as little as 10 percent of human labels in its dataset.

In addition, RETFound has shown that it is equally effective in detecting disease across diverse populations. RETFound could help improve diagnosis of some of the most debilitating eye diseases, including diabetic retinopathy and glaucoma, and predict systemic diseases such as Parkinson’s, stroke and heart failure.

The research team, led by Yukun Zhou and Pearse Keane of Moorfields and UCL IoO, have made the model freely available for use on GitHub. Researchers worldwide, such as Singapore and China, have been using RETFound in their novel investigation into eye diseases.

This article was originally published by the UCL/UCLH NIHR Biomedical Research Centre.

## ARTIFICIAL INTELLIGENCE HELPS TO SIMPLIFY LUNG CANCER RISK PREDICTION

Machine learning models to identify the simplest way to screen for lung cancer have been developed by researchers from UCL and the University of Cambridge, bringing personalised screening one step closer.

In the study, researchers used data from the UK Biobank and US National Lung Screening Trial to develop models to simplify the prediction of a person getting lung cancer within the next five years.

The model was found to be as good or better at predicting an individual's risk of getting lung cancer within five years compared to the best risk models available and was able to do so using just a quarter of the information needed. The findings are published in PLOS Medicine.

Dr Tom Callender (UCL Medicine), first author of the study, said:

*Screening for cancer and other diseases saves lives and we are increasingly able to personalise this process.*

*But such personalised screening and disease prevention programmes present important logistical challenges at scale.*

*Our study shows that artificial intelligence can be used to accurately predict lung cancer risk using just three pieces of information that would be easy to gather during routine GP appointments, online or via apps. This approach has the potential to greatly simplify population level screening for lung cancer and help to make it a reality.*

This work was supported by Wellcome, the National Science Foundation, the Medical Research Council and Cancer Research UK.

## SCIENCE MINISTER PLEDGES £13M FOR AI RESEARCH IN HEALTHCARE DURING VISIT TO UCL

UCL's world leading expertise in artificial intelligence was chosen as the setting, when in August the UK Government announced £13 million will be invested to accelerate AI innovation in healthcare.

In the funding allocation, UCL was awarded more than £2.2m for four AI driven research projects, that are all designed to find more efficient and effective solutions to current health challenges.

As part of the visit to talk with UCL scientists, Michelle Donelan, Secretary of State for Science, Innovation and Technology, was given a tour of the cutting-edge facilities at UCL's Wellcome / EPSRC Centre for Interventional and Surgical Sciences (WEISS).

UCL recipients of the Artificial Intelligence (AI) innovation to accelerate health innovation award:

- ◆ Dr Sophia Bano (UCL Computer Science & WEISS): AID-PitSurg: AI-enabled decision support in pituitary surgery.
- ◆ Dr Charles-Antoine Collins-Fekete (UCL Medical Physics & Biomedical Engineering): AI-based diagnosis for improving classification of bone and soft tissue tumours across the UK.
- ◆ Dr Anoop Shah (UCL Institute of Health Informatics): Optimisation of natural language processing for real-time structured clinical data capture in electronic health records.
- ◆ Professor Pearse Keane (UCL Institute of Ophthalmology): From 2 million to 20 million: scaling and validating a foundation model for ophthalmology, including the detection of eye and other diseases.

# RESEARCH HIGHLIGHTS



## UCL RESEARCHERS DEVELOPING GENE THERAPIES AGAINST EBOLA, HIV-AIDS AND MALARIA

**In collaboration with High Value Manufacturing Catapult's CPI and the Innovation Launchpad Network, two University College London academics could help millions with their research project.**

Two academics from UCL are set to cause a stir in the healthcare research space with a new cell and gene research project which could help millions of people suffering from Ebola, HIV-AIDS and Malaria.

In collaboration with CPI and the Innovation Launchpad Network+, Beatrice Melinek and Salome Alexandra De Sa Magalhaes (UCL Biochemical Engineering) will be gathering vital information during their Researcher in Residence placement with the aim of creating and commercialising a compact, standalone automated device for reliable, predictable and robust production of DNA.

The production of Plasmid DNA (pDNA) forms the base of DNA vaccines and gene therapies against many infectious and genetic diseases such as Ebola, HIV-AIDS and Malaria. Current manufacturing techniques use cells grown in bioreactors, but Beatrice and Salome are proposing a next-generation method which bypasses this step. Their novel cell-free production platform could be substantially faster, more productive, and more robust.

Working alongside CPI, Beatrice and Salome's project will benefit from the centre's expert knowledge and their state-of-the-art facilities for the development of a flexible purification method. CPI will provide its knowledge and expertise in high-throughput and small-scale development of purification methods including training and access to CPI's equipment and facilities.



## MRI SCANS IMPROVE PROSTATE CANCER DIAGNOSIS IN SCREENING TRIAL

**Using MRI as a screening test alongside PSA density allowed detection of cancers that would have been missed by the blood test alone, according to new research from UCL, UCLH and King's College London.**

The REIMAGINE study, published in BMJ Oncology, is the first study to use MRI scans with prostate specific antigen (PSA) density to assess the need for further standard NHS tests. Of the 29 participants found to have serious prostate cancer, 15 had a 'low' PSA score that would have meant they were not referred for further investigation under the current system.

Currently, men over 50 in the UK can ask for a PSA test if they are experiencing symptoms or are concerned about prostate cancer. Previous screening studies have used a PSA level of 3ng/ml or above as the benchmark for performing additional tests to look for prostate cancer, such as a biopsy.

Though previous research found that the combination of a PSA test and/or digital rectal examination, followed by a biopsy if disease is suspected, helped to reduce prostate cancer mortality by 20% after 16 years, this approach has also been linked to overdiagnosis and overtreatment of lower risk cancers.

In recent years, the introduction of MRI as a first step in investigating men at higher risk of prostate cancer has spared one in four men from an unnecessary biopsy, which is invasive and can lead to complications.

It is hoped that using MRI as a screening tool that is offered to men without them needing to ask for it could further reduce prostate cancer mortality and overtreatment.

**Professor Mark Emberton (UCL Surgical & Interventional Science and consultant urologist at UCLH), senior author of the study, said:**

*The UK prostate cancer mortality rate is twice as high as in countries like the US or Spain because our levels of testing are much lower than other countries. Given how treatable prostate cancer is when caught early, I'm confident that a national screening programme will reduce the UK's prostate cancer mortality rate significantly.*

*There is a lot of work to be done to get us to that point, but I believe this will be possible within the next five to ten years.*

This research was supported by the National Institute for Health and Care Research UCLH Biomedical Research Centre, the Medical Research Council (MRC) and Cancer Research UK (CRUK).





## TWISTED MAGNETS MAKE BRAIN-INSPIRED COMPUTING MORE ADAPTABLE

**A form of brain-inspired computing that exploits the intrinsic physical properties of a material to dramatically reduce energy use is now a step closer to reality, thanks to a new study led by UCL and Imperial College London researchers.**

Such an approach, known as physical reservoir computing, has until now been limited due to its lack of reconfigurability. This is because a material's physical properties may allow it to excel at a certain subset of computing tasks but not others.

In the new study, published in the journal *Nature Materials*, an international team of researchers used chiral (twisted) magnets as their computational medium and found that, by applying an external magnetic field and changing temperature, the physical properties of these materials could be adapted to suit different machine-learning tasks.

Dr Oscar Lee (London Centre for Nanotechnology at UCL and UCL Department of Electronic & Electrical Engineering), the lead author of the paper, said:

*This work brings us a step closer to realising the full potential of physical reservoirs to create computers that not only require significantly less energy, but also adapt their computational properties to perform optimally across various tasks, just like our brains.*

*The next step is to identify materials and device architectures that are commercially viable and scalable.*

The work also involved researchers at the University of Tokyo and Technische Universität München and was supported by the Leverhulme Trust, Engineering and Physical Sciences Research Council (EPSRC), Imperial College London President's Excellence Fund for Frontier Research, Royal Academy of Engineering, the Japan Science and Technology Agency, Katsu Research Encouragement Award, Asahi Glass Foundation, and the DFG (German Research Foundation).

## UCL RESEARCHERS WIN AWARD AT THE ROYAL PHOTOGRAPHIC SOCIETY AWARDS 2023

**An interdisciplinary team from UCL has been recognised with a prestigious photography prize for their work developing new techniques to view the internal workings of human organs.**

Professor David Long, Dr Daniyal Jafree (UCL Great Ormond Street Institute of Child Health) and Dr Claire Walsh (UCL Mechanical Engineering) collected the Combined Royal Colleges Medal for their advances in imaging to better understand kidney disease.

Using a revolutionary technology called Hierarchical Phase-Contrast Tomography (HiP-CT) and through the Human Organ Atlas project, the interdisciplinary team of engineers, biologists and clinicians made it possible to view the entire human kidney in three dimensions.

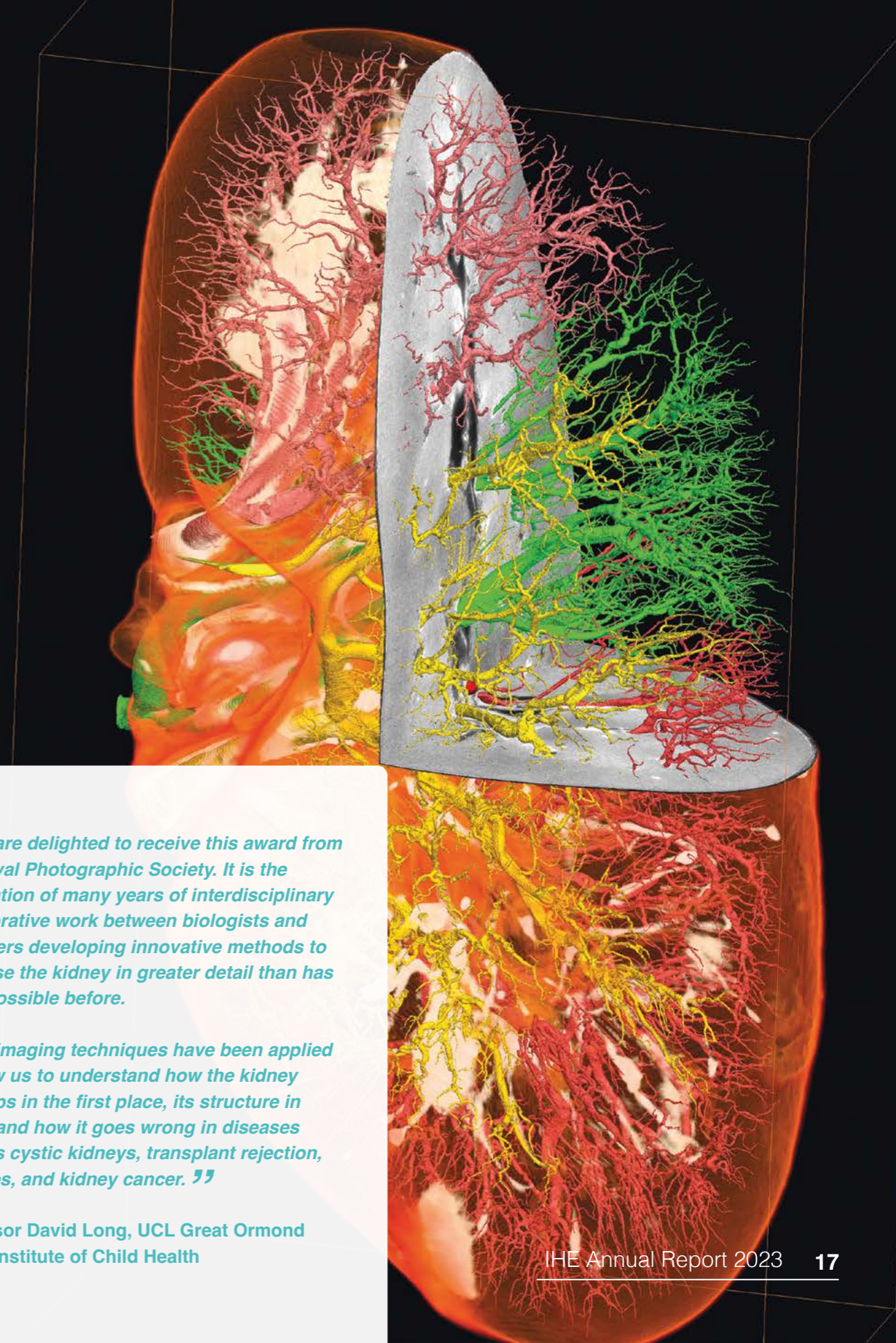
This allowed them to zoom down to the level of individual kidney filters and vessels. This new technique will now be applied to kidney disease to provide an overall picture of how the structure of the whole kidney is altered in these conditions.

“

*We are delighted to receive this award from the Royal Photographic Society. It is the cumulation of many years of interdisciplinary collaborative work between biologists and engineers developing innovative methods to visualise the kidney in greater detail than has been possible before.*

*These imaging techniques have been applied to allow us to understand how the kidney develops in the first place, its structure in health and how it goes wrong in diseases such as cystic kidneys, transplant rejection, diabetes, and kidney cancer.”*

Professor David Long, UCL Great Ormond Street Institute of Child Health



## NEW £4M DIGITAL HUB TO TACKLE ANTIMICROBIAL RESISTANCE

**A new digital health hub, led by UCL researchers, will bring together an interdisciplinary team to better deploy digital technologies in the fight against antimicrobial resistance across humans, animals and the environment.**

Antimicrobial resistance cuts across many sectors, as resistant pathogens can be transmitted between animals, humans and food, but this interconnectedness is poorly understood and data remains in silos.

The new Digital Health Hub for Anti-microbial Resistance, awarded £4 million from the Engineering and Physical Sciences Research Council (EPSRC), aims to increase knowledge and skills sharing among diverse groups, from researchers and healthcare workers to those working in animal health and environmental agencies, to policymakers, charities, industry and the public. It seeks to transform surveillance of and action against antimicrobial resistance by harnessing digital technologies that played such a key role during the pandemic.

A three-year hub programme will encompass a number of projects, for instance the research foundations of a trusted-research environment for one-health antimicrobial surveillance data; a machine learning tool that can identify hospitalised patients who need a change in antibiotic therapy in real time; a dashboard for clinicians that can visualise data on resistant pathogens obtained from wastewater in Wales; nanodiamond sensors that can detect resistant pathogens at incredible sensitivity; and a project exploring if online search data can predict antibiotic use.

The hub will also focus on upskilling and capacity building of large numbers of researchers, with a flexible funding programme aiming to encourage new collaborations. It will bring together researchers working across computer science, data visualisation, biomedical engineering, behavioural science, environmental science, clinical and public health research.

The hub is one of five new digital healthcare hubs in England that aim to drive the development of innovative digital technologies for healthcare, created with £16.5 million funding from EPSRC.

The UCL co-investigators are based across various disciplines including Professor Laura Shallcross (UCL Institute of Health Informatics), Professor Ingemar Cox (UCL Computer Science), Professor James Hetherington (UCL Centre for Advanced Research Computing), Dr Fabiana Lorencatto (UCL Psychology & Language Sciences), Associate Professor Vasileios Lampos (UCL Computer Science), Dr Jo Gibbs (UCL Institute for Global Health), Associate Professor Steven Gray (Bartlett Centre for Advanced Spatial Analysis at UCL), and Professor Eleni Nastouli (UCL GOS Institute of Child Health; UCL Hospital).



## NEW RESEARCH HUBS WILL IMPROVE VACCINE ACCESS IN LOW- AND MIDDLE-INCOME COUNTRIES

**A new vaccine hub that will address the challenges of vaccine manufacturing and delivery in developing countries will be led by experts at UCL and the University of Oxford.**

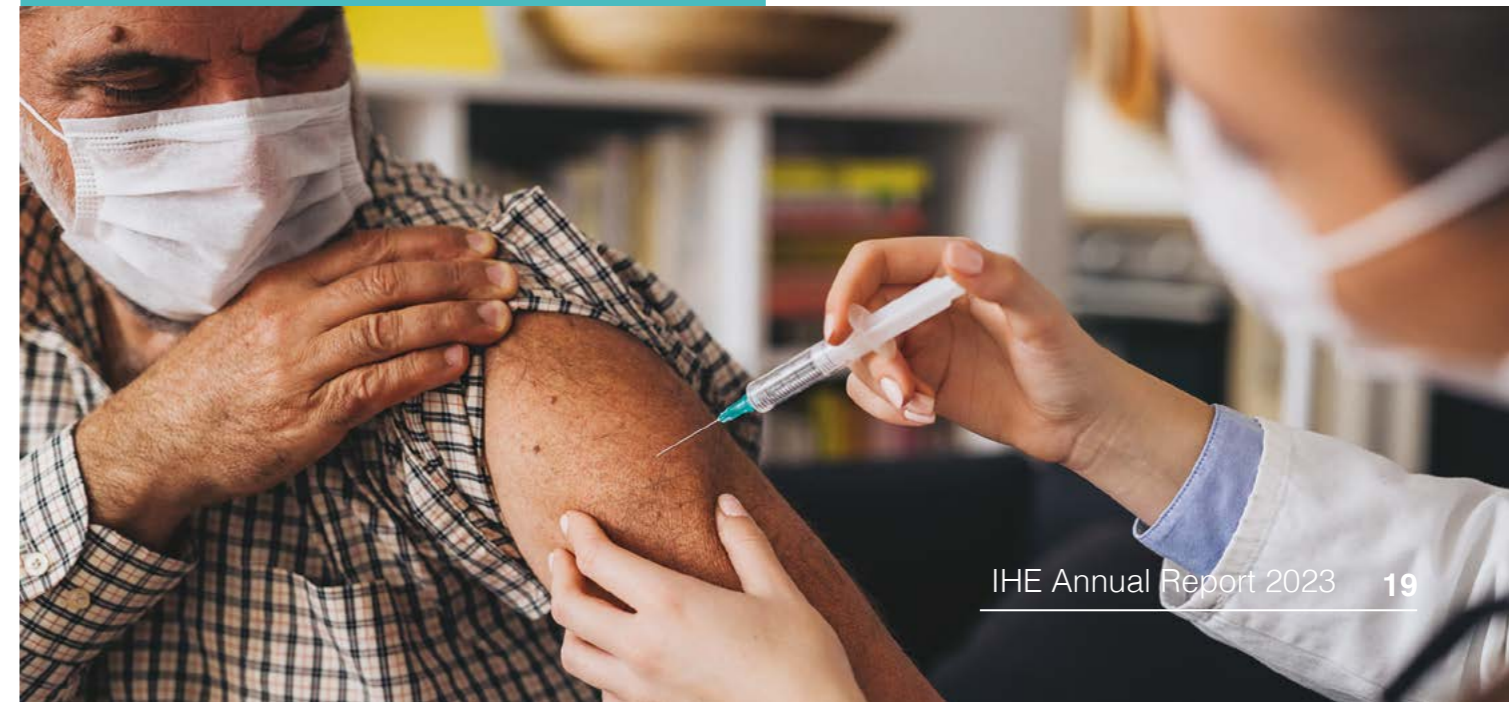
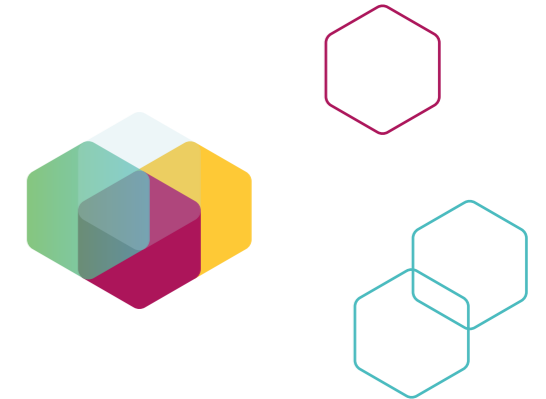
**The Vaccines Manufacturing Hub for LMIC (Vax-Hub Global) is one of four new hubs that will be led by UCL, the University of Oxford, Imperial College London and the University of Sheffield, working with experts from across Africa, Asia, and Latin America.**

**The hubs will use the lessons from the global rollout of Covid vaccines to improve the processes of manufacture and distribution in low and middle-income countries (LMICs).**

**Communicable disease epidemics are still a major threat to public health globally. They are responsible for half of all deaths in low- and middle-income countries and it is estimated that 25 million children are under or unvaccinated, despite vaccines being available for more than 20 life threatening diseases**

Vax-Hub Global was awarded £10 million in funding over four and a half years. It will be led by Professor Martina Micheletti (UCL Biochemical Engineering) and Dr Catherine Green from the University of Oxford.

The vision of the Hub is to deliver flexible, easily transferable multi-product platforms and simplified engineering solutions that enable development of low cost, effective and globally deployable vaccines to LMICs. The hub will work on existing and new vaccine platform technologies, such as adenoviral-based, virus-like particles, mRNA and bioconjugates, which can be used in vaccine development for diseases such as polio, dengue fever and pneumococcal disease.



## PROTEIN FOUND IN MILK SPEEDS UP WOUND HEALING

**Bandages infused with casein, a protein that occurs naturally in cow's milk, significantly improved wound healing in rats compared to those in control groups, according to a new study by UCL researchers.**

The study, published in July in the journal Royal Society Interface, and is the first to test casein's reputed healing benefits on an animal model. The promising results suggest that casein, which is cheap, abundant and has antimicrobial properties, has potential to replace expensive materials such as silver in wound dressings.

Casein is a protein found in the milk of mammals and is most abundant in cow's milk, where it makes up to 80% of the proteins in cow's milk.

In the last decade, interest has grown in casein's antimicrobial, antioxidant and anti-inflammatory properties, as well as its utility as a high-protein dietary supplement.

**Dr Jubair Ahmed (UCL Mechanical Engineering), first author of the study, said:**

*Natural materials contain some wonderful properties, many of which are unknown. We knew that casein was reputed to have healing benefits and our results suggest there is a lot of potential to use it in medical applications like wound dressings.*

*More work is needed to ensure that casein dressings are safe and effective in humans, but these initial findings are promising.*

This work was funded by the EPSRC.



## SIMPLE WOMB CANCER TEST COULD REDUCE NEED FOR INVASIVE DIAGNOSTIC PROCEDURES

**A new test to detect womb cancer could prevent 87% of women who do not have cancer from needing invasive diagnostic procedures, finds a new study led by researchers at UCL and the University of Innsbruck.**

Womb cancer is the fourth most common cancer in women in the UK. However, it can be difficult to detect, as the main symptom – abnormal vaginal bleeding – can also be caused by multiple non-cancerous conditions that are difficult to distinguish from cancer with imaging alone.

The test, called WID-qEC, could simplify and speed up the pathway to a diagnosis of womb cancer or ruling the condition out as a cause of symptoms.

The research, published in The Lancet Oncology and funded by gynae cancer research charity The Eve Appeal, The European Research Council and Land Tirol, shows that the WID-qEC test outperforms imaging at ruling out womb cancer and could save nearly 90% of peri- and post-menopausal women from needing invasive surgical biopsies when getting abnormal vaginal bleeding symptoms checked.

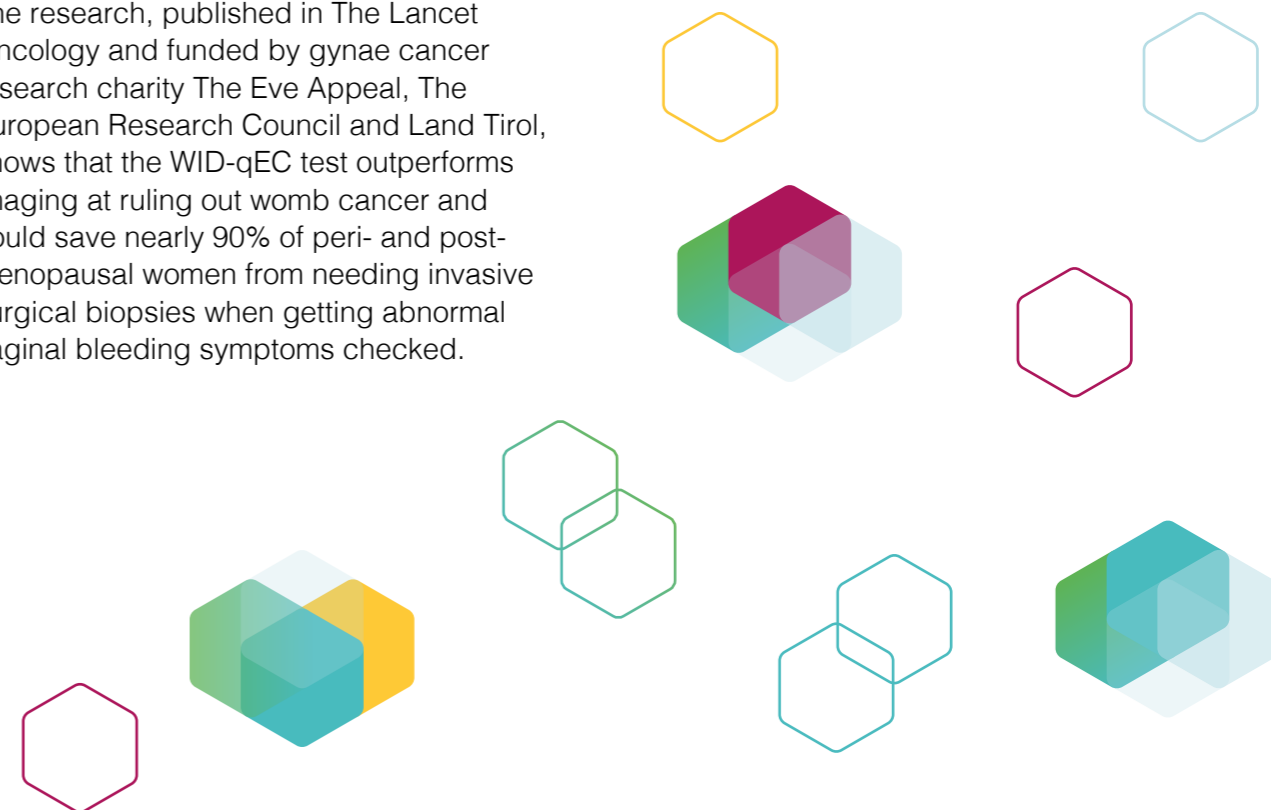
This could save thousands of women each year from potentially painful surgical biopsies and increased anxiety while waiting for answers.

**Professor Martin Widschwendter (UCL EGA Institute for Women's Health and University of Innsbruck), said:**

*One of the most important principles of modern preventative medicine is 'less is more'.*

*The WID-qEC test is an ideal example of this. It significantly reduces the complexity of the pathway which women, presenting with abnormal bleeding, currently have to undergo.*

*We're excited that the test will be commercially available in Austria and Switzerland from early 2024 and are actively working towards commercialisation in other countries including the UK in the coming months.*



# SCIENCE MUSEUM

## NEW 'ENGINEERING' GALLERY OPENS AT THE SCIENCE MUSEUM AND FEATURES UCL ENGINEERS

In June 2023, a new gallery was unveiled at the Science Museum, highlighting world-changing engineering innovations and the diverse and fascinating range of people behind them – including Professor Rebecca Shipley and Professor Ilias Tachtsidis.



Among the items on display is a Ventura CPAP (Continuous Positive Airway Pressure) device, a breathing aid that can help keep Covid-19 patients out of intensive care.

The device was rapidly developed in just 100 hours by a team from UCL and their collaborators in the first weeks of the pandemic, in which Professor Shipley played a leading role.



Also on display is another UCL engineering innovation, the 'Metabolight', developed by a team led by Professor Ilias Tachtsidis (UCL Medical Physics and Biomedical Engineering).

The device uses invisible, harmless near-infrared light to detect signs of brain injury in newborn babies.

“

*It is important to show the links between technology, engineering developments and people. The gallery manages in a very interactive way to build the story of engineering innovations, how these have impacted our everyday life and the people behind these innovations. Like in my case, how we use technologies such as LED and digital cameras to develop devices that can image the brain of infants and provide clinical information to help doctors and patients.”*

**Professor Tachtsidis,**  
Professor in Biomedical Engineering

The Engineers gallery is open now at the Science Museum, London. Entry is free with a pre-booked ticket.



### CREATING

Engineers are creative people. They create new things that work and make old ones work better. They make knowledge from scientists useful, and give technicians plans to pursue. They think in particular ways, defining and solving problems, adapting and improving, visualising outcomes, thinking about systems, and learning from failures. Anyone can be creative by thinking like an engineer. How will you change the world?

CREATING  
CONNECTIONS



# 3 CAREERS & EDUCATION

# EDUCATION

## MEDICAL IMAGE COMPUTING SUMMER SCHOOL 2023

The 9th UCL Medical Image Computing Summer School (MedICSS) took place between 3-7th July 2023. The event was organised by Dr Catarina Veiga and Dr Evangelos Mazomenos and supported by the Centre for Medical Image Computing (CMIC) and WEISS.

MedICSS is an annual summer school open to early-career researchers interested in cutting-edge technologies and the latest innovations in medical image computing and computer-assisted medical applications. The summer school included a series of lectures from world-leading experts from academia, industry, and healthcare, complimented with hands-on computational projects that the delegates undertook in small groups.

The 2023 MedICSS edition marked its first time in a hybrid format, making MedICSS truly an international event. It was with great enthusiasm that we welcomed over 40 in-person delegates from a variety of institutions, backgrounds, and career stages –undergraduate to PhD level students, clinical and early-career scientists. In parallel, lectures were streamed to over 100 delegates worldwide, expanding MedICSS's reach to a diverse global audience.



## INTRODUCTION TO UCL INDUSTRY EXCHANGE NETWORK

The UCL Industry Exchange Network (IXN) gives UCL Computer Science students hands-on experience with industry as part of their degree.

Through UCL IXN, hundreds of students have worked on technologies that address real-world problems. The UCL Computer Science department is uniquely allied with over 300 organisations that provide work experience to students throughout every year of their course.

Their partners are tech corporations, including Microsoft, IBM, NTT DATA, Intel, Google, Facebook and Amazon, international banks, cutting-edge small businesses and gaming companies. UCL IXN projects have also driven digital innovation in the NHS and global charities.



## IXN CASE STUDY: NHS ENGLAND VISITS UCL COMPUTER SCIENCE FOR STUDENTS' PRESENTATIONS

UCL students worked on proofs of concept addressing healthcare challenges for their MSc Computer Science courses. They then demoed these ideas to Directors of NHS England in a showcase in August.

Dr Tim Ferris, National Director of Transformation and Dr Melanie Iles, Interim Chief Clinical Information Officer at NHS England visited UCL. Steve Hailes, Head of Department, gave a welcome speech and eight teams of students presented their prototypes. These prototypes were responses to problem scenarios provided by NHS staff.

Two teams showed how the Microsoft Power Apps Platform could automate processes and connect systems, saving time and increasing efficiency. The Microsoft Power Apps Platform enables clinical teams to build applications quickly using their own data.

Other teams focused on tools to aid data visualisation and make collaboration easier between clinicians. Students demonstrated how UCL's Open-IllumiRoom V2 could present datasets from across a hospital together in one place. The innovative projection software means there's no need for several monitors or screens, and valuable insights can be seen at a glance.



A new iteration of UCL HoloRepository, software which renders CT and MRI scans as holograms, allows clinical staff to discuss and annotate these 3D models over Microsoft Teams.

Some concepts sought to directly improve patients' lives by increasing accessibility for those with limiting conditions. There was a new version of UCL MotionInput, UCL's touchless computing software, which had been enhanced to recognise facial movements, eye gaze and speech.

Another demo used UCL and University of Illinois Dysarthric Speech, supported by IBM. This application showed how people with unclear and slurred speech could be understood more easily.

NHS England enthused about the projects and were keen to develop the ideas beyond the proof-of-concept stage, to take them onto the healthcare frontline.

“ Seeing what students were capable of with access to the right mentorship, industry and NHS partners gave me hope for the future. ”

Dr Tim Ferris, National Director of Transformation

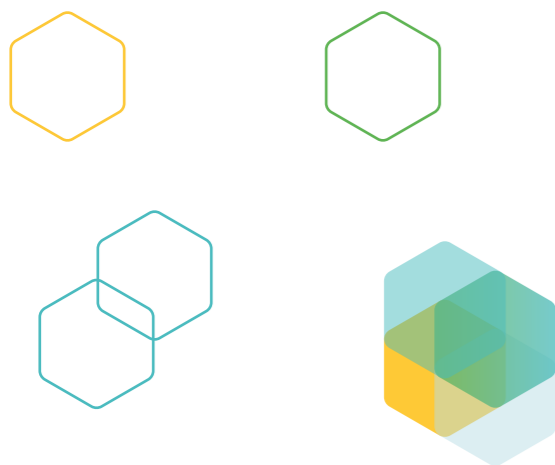
## IXN CASE STUDY: UCL COMPUTER SCIENCE STUDENT SHOWCASE AT IBM

15 teams of UCL master's students presented leading-edge proofs of concept to senior managers at the Innovation Studio at IBM's London offices. These ideas showed the many ways that computer systems are a boon for people and the planet.

Collaboration was a theme common to several projects, whether that was enabling medical staff or corporate employees to work better together. Many concepts were advancing assistive technology. Others were educational tools, an explainer for quantum computing, for example.

Fun was a focus, creating games within workspace apps to boost social interactions and, consequently, the mental health of people working remotely.

One environmental approach used AI to help robots identify weeds within fields of crops, enabling farmers to use fewer pesticides. Another empowered people to monitor their computer's energy usage, encouraging them to reduce their carbon footprint.



Alyssa Quenney

# IHE SUMMER STUDENTSHIPS



Launched in 2021, the IHE Summer Studentship scheme gives undergraduate students an exciting opportunity to shadow clinicians and take part in a related research project at the Royal National Orthopaedic Hospital (RNOH), the UCL/UCLH Biomedical Research Centre, and Moorfields Biomedical Research Centre.

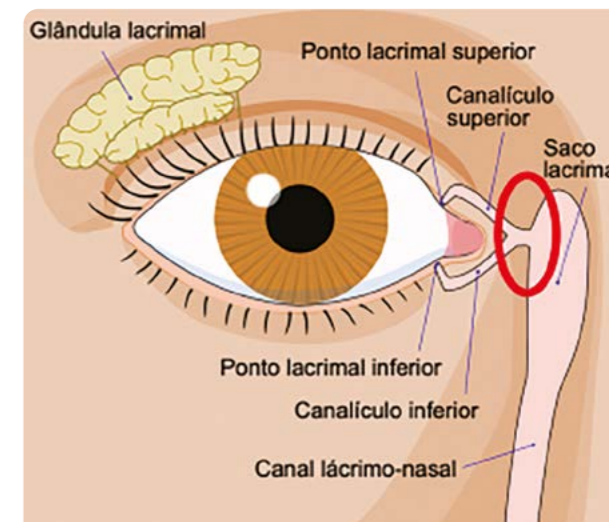
The studentships run for 8 weeks and provide students with an insight into research work in a busy hospital environment.

## ALYSSA QUENNEY'S BLOG

*This summer, I was privileged to have the opportunity to undertake an IHE studentship at Moorfield's Eye Hospital.*

*My project was titled 'Design of a Biomedical Device to Enhance Safety and Efficacy of Ophthalmic Topical Medications' and my supervisor was Professor Paul Foster. The project was to help patients suffering from glaucoma, a severe eye condition where the optic nerve is damaged, leading to loss of vision and eventually, blindness.*

*Eyedrops are the most preferred forms of treatment, however, some eyedrops (beta blockers and adrenergic agonists) can potentially cause respiratory and cardiovascular side effects such as shortness of breath and*



The area of the eye that Alyssa Quenney's device targets.

*wheezing if they drain into the nose through the nasolacrimal duct and inhaled into the lungs. This would be particularly dangerous for elderly patients with asthma, chronic bronchitis or other pre-existing respiratory disorders.*

*To prevent this from happening and to enhance the efficacy of the medication, the aim was to design a device to help patients apply pressure to the inner corners of the eyes and nose to block the drainage of the medication into the lacrimal sac when applying the eye drops.*



*I spent 8 weeks observing glaucoma and adnexal clinics and surgery in theatres, meeting and gathering information from patients and clinicians/surgeons alike, to familiarise myself with the clinical background of this project and inspire initial design ideas. Simultaneously, I was designing my device using 3D CAD modelling, whilst considering the design criteria and challenges including gender and racial facial anatomical differences.*

*I was fortunate to be granted access to 3D printers to manufacture and assemble my prototypes in both PLA and clear resin. The clinicians at Moorfield's were more than generous in allowing me to test my prototypes on them along the way.*

*At the conclusion of my project, after refining and testing many prototypes, I delivered a fully functional prototype to my supervisor. We decided that this current design could be further improved in specific design aspects as well as in conducting a material analysis. There is currently no such device on the market so further development of this would ultimately increase the efficacy of glaucoma eye drops to benefit patients.*

*Vision impairment is one of the commonest disabilities in the UK and the world causing significant personal and economic impact. This project therefore appealed to me as ophthalmological applications of biomedical engineering in my course have not been explored in depth and I was very interested in the prospect of creating a device to assist visually impaired patients and gain more experience in my field. This also gave me the opportunity to apply skills I have learnt in my course to date in a real-world scenario.*

*Moorfields Eye Hospital is at the forefront of ophthalmological care and research in the world so I was very excited to be able to meet and work alongside clinicians and researchers who are experts in their field.*



Alyssa and her supervisor  
Prof Paul Foster



### COMMITTEE SUPPORTS IHE RESEARCH PLACEMENT FOR FEMALE ENGINEER

**The UCL Medical Physics and Biomedical Engineering Athena SWAN committee funded Danae Morell Cheng's placement at the Royal National Orthopaedic Hospital (RNOH).**

In 2023, the IHE arranged 19 studentships, one of which was generously funded by the UCL Medical Physics and Biomedical Engineering (MPBE) Athena SWAN committee for the second year running.

The MPBE Athena SWAN committee is a group of 30 staff and students, representing a range of career stages, whose work focuses on improving gender equality within the department.

In July, we spoke to the student, Danae Morell Cheng, and Drs Charlotte Hagen and Reem Ahmad from the committee about the award and what it means to them.



### DANAE MORELL CHENG – THIRD-YEAR MEng STUDENT IN BIOMEDICAL/ MEDICAL ENGINEERING

Can you tell me about the Athena SWAN committee in UCL Medical Physics and Biomedical Engineering?

*I found out about the IHE summer student-ship programme through my personal tutor Lynsey Duffell. What immediately appealed to me about the studentship programme was the focus on prosthetics and biomechanics within some of the projects. As someone very interested in mechanical design and medical devices, this was an area that aligned with my career aspirations.*

*Moreover, the opportunity of being immersed in a setting where I could work closely with clinicians and surgeons really appealed to me.*





*I am working on a screw project. In orthopaedics, screws are an important device used to join bones. Companies keep developing different variations of screw designs aimed to achieve optimal compression in the bone. The project I am working on is aimed at investigating and comparing the compression of a new design model to other traditional screws designs from various companies to test its efficiency. To do so, we purposefully designed and built an apparatus with sensors that measures compression force.*

*I am enjoying this experience at the RNOH, and it has been incredibly beneficial for my personal and professional growth.*

*This opportunity has provided me with hands-on learning experiences beyond the confines of traditional class lectures. Working in the lab has developed my biomechanics and designing skills by learning to use the machinery there and has exposed me to a lot of professionals with whom I learn from every day.*

*One particular highlight was the chance to observe an ankle operation in the theater of a patient case that we learned from on the first day. It was an enriching experience that allowed me to see the applications of biomedical engineering and the use of orthopaedic screws in real life.*

## DR CHARLOTTE HAGEN

*Currently, we have much fewer women than men in research and academic roles, particularly in the more senior ranks, and the MPBE Athena SWAN committee thinks about what can be done to change that. I have been the committee chair for almost three years but will move into a new role come September.*

*The placements provide hands-on experience and, I would think, can be a decisive factor in choosing engineering as a future career. They also strengthen a student's CV and provide valuable contacts.*

*I cannot emphasise enough that we need more women in engineering. Sponsoring a place for a female student is a very good use of our funds, and I am excited that we have made this happen for a second year running.*



## DR REEM AHMAD

*I have been working with the MPBE Athena SWAN committee as the deputy chair for the past three years.*

*I think these placements give our students a unique experience where they can get a real idea of what a career in engineering will be like. I know from my own experience in a similar kind of placement that the insight gained from a placement is invaluable and helps build a network within the field.*

*We had many discussions within the committee about how best to use our funds and with this placement it was a unanimous decision. We know that we need more women in engineering, and all agreed that this may help inspire a future engineer.*



## RONIT SARNA'S BLOG

*Over the summer of 2023, I interned at the Royal National Orthopaedic Hospital (RNOH) in Stanmore under the Institute of Healthcare Engineering (IHE) Summer Studentship scheme. I was afforded the privilege of participating in the "Artificial Intelligence for Optimising the Design and Placement of Patient Specific Posterior Pedicle Screws in Scoliosis Surgery" project.*

*From the get-go, this project was immediately engaging to me because of its blending of AI within healthcare, particularly in the analysis of medical imaging. I already had a strong interest in this field and had tailored most of my 4th year modules to correlate with computer science in medical imaging. Securing this internship was a very helpful step in further developing my understanding and appreciation of different uses and methods of machine learning architecture in the biomedical engineering field.*

*During the duration of the project, I worked under several doctors at RNOH and researchers at UCL who were immensely obliging in teaching me about the realities of clinical research. Alongside a fellow student, we were both tasked with parsing through cadaveric CT scans of scoliotic patients and segmenting these images to produce intricate mask data of each vertebrae. This mask data would importantly be used for later training and testing in machine learning models.*

*Pertinently, these masks were used for ancillary projects, such as in the 3D printed prototypes that were used by orthopaedic surgeons for testing pedicle surgery guides. As part of my internship, I was allowed to view the process of screw fixation onto a cadaveric spine, using a 3D printed guide.*

Dr Charlotte Hagen,  
Danae Morell, and  
Dr Reem Ahmad



*It was both interesting and enriching to see how the work I could produce would be used in practical surgical settings.*

*Initially, understanding the layout of the CT scans was rather difficult, and using unfamiliar programmes to perform the segmentation posed a new challenge for me. However, I found myself increasingly fulfilled as the project progressed as my skills in reading CT and in segmenting the spines both improved. My supervisors graciously offered their time to accommodate me and guided me with pragmatic advice which bettered my workflow immediately. The novel experience of being in a clinical research setting was what I enjoyed the most, as it helped me solidify many of the concepts I had read and learnt about in my previous 3 years of study in Biomedical Engineering.*

*I have truly benefited from this internship and am very grateful to the IHE for the opportunity, as well as my supervisors for all the guidance they provided me throughout the 8 weeks. Understanding the practical challenges of medical imaging analysis has enlightened me on my future options and has only invigorated my passion for the field. As I enter 4th year, this experience will significantly inform and shape how I comprehend my medical imaging modules. Although I was unfortunately only on the project for 2 months, I hope I will be able to witness the fruition of the research efforts in due course.*



Ronit Sarna



# HDR UK BLACK INTERNSHIP



## ADDRESSING THE LACK OF BLACK SCIENTISTS IN HEALTHCARE ENGINEERING

**We've got a problem in healthcare: we don't have many healthcare engineers from a minority background, especially from a Black ethnic background. We want to help change that.**

When you look around, what do your colleagues look like? This isn't a situation limited to UCL, it's nationwide. In the Government's inquiry into this, carried out by the Careers Research and Advisory Centre, they found that only 8% of undergraduates were Black with this number falling as students went up the academic ladder.

Only 2.2% of Black students pursued a PhD whilst 1.4% chose to become Postdoc's and so while Black students are well-represented at UG level, this declines higher up the ladder. What was shocking was only a handful of Black students pursued Physics. A handful! One or two! (Diversity and inclusion in STEM report by the UK Parliament Science and Technology Committee, 2023). These are alarming numbers so is it any wonder we don't see many Black people in academia?



And it's not just a case of Black people not being interested in the sciences. If we start with 8% and then dwindle to 0.4% when it comes to professorship, clearly the problem lies in the pipeline. Black people don't see a future in academia, or it as something that's open to them. Most don't even know that PhDs are an option, or even further study outside of an undergraduate degree.

This is why we took part in HDR UK's Black Internship Programme. The programme is a way for Black students to become familiar with an academic setting and gain experience in a field that isn't very open to Black students. Over an 8-week period, we helped host Aghogho Onojuvbevbo with Professor James Cole and his team at the Centre for Medical Imaging Computing (CMIC). Aghogho spent her time analysing existing/current neuroimaging data for biases and ethnic inequalities. James and his team were amazing in supporting Aghogho and trying to do their bit in tackling the systemic issues we're seeing at UCL and in the wider academic community.

One thing that stuck out was that after the programme, when we spoke to Aghogho, she told us that she'd changed her mind about academia. She initially wanted to apply for more 'corporate' jobs but after speaking to James and his team, she'd started considering a career in academia and was asking about fellowships and Research Assistant roles.

This was just with one person – imagine the impact with a whole cohort of Black interns... but we're getting ahead of ourselves here.

We know this issue seems larger than life, but we all need to do our bit in making small ripples in a big pond. We plan on taking part in HDR UK's Black Internship Programme again and we hope you will join us in doing our bit in bringing more Black academics to UCL.

Here's our interview with Aghogho, and what she got out of her internship this summer.

### AGHOGHO ONOJUVBEVBO

Why did you take part in the programme?

*I took part in HDR UK's Black Internship Programme because I wanted practical experience in the health data science sector. I saw this as an opportunity to expand my knowledge, gain practical skills and advance my career in health data. I also liked that the programme aims to include more Black people in this field, promoting fairness and diversity.*

How did you find working with James and his team?

*Working with James and his team at the neuroimaging lab was a fantastic experience. James was incredibly helpful, dedicated and supportive throughout my time there. His commitment to guiding and mentoring me significantly contributed to my learning and growth. The team members were equally dedicated and collaborative, which made for a positive and productive work environment. I truly enjoyed working with them and their expertise and teamwork enhanced the overall quality of my internship.*

How did you find the whole process?

*The entire experience, including working with the IHE team, was truly enriching. Your accessibility, support, and genuine interest in my professional growth were consistent throughout my internship, making me feel valued and motivated. The proactive efforts to organise beneficial activities and facilitate connections with other UCL staff members beyond my primary assignment were particularly valuable. Moreover, the continuous support in exploring opportunities beyond the internship and the regular check-ins to discuss my interests and goals showed a remarkable level of care and dedication, which I deeply appreciate. Working with the team was a rewarding experience that significantly impacted both my internship and personal development.*

What's something you've learned through this?

*During this internship, I had the opportunity to apply theoretical knowledge to practical tasks which significantly enhanced my technical skills.*

*I acquired valuable hands-on experience in programming. Moreover, managing the demands of both work and school taught me effective time management. Juggling these responsibilities required careful planning, prioritisation, and multitasking, skills that I believe will be invaluable in my future career endeavours.*

What did you find really challenging?

*While gaining hands-on experience was really rewarding, adapting to complex concepts in certain technical areas initially posed a challenge.*

*Additionally, balancing the demands of the internship alongside my academic commitments required a high level of time management and flexibility. Overcoming these challenges was a valuable part of my internship experience and contributed to my personal and professional development.*

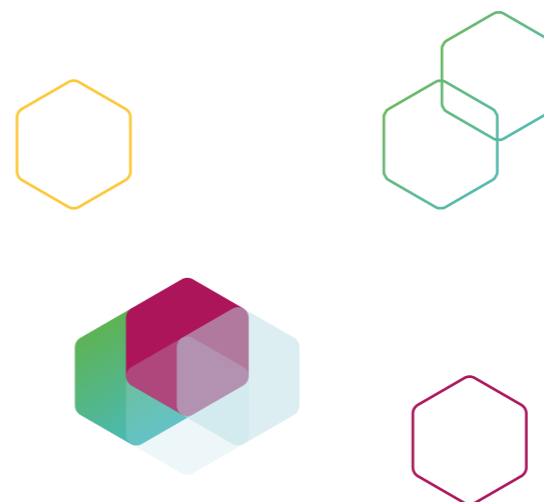
Has your career path changed? What was it before and what do you want to do now?

*The exposure to real-world applications of programming and data science in the context of healthcare has sparked more interest in this field. This internship has inspired me to leverage my newfound skills and knowledge to pursue a career that integrates both my healthcare background with my programming expertise.*

Do you recommend this programme to others?

*Yes, I would highly recommend this program to others. My experience in this program has been incredibly valuable, providing me with hands-on experience, opportunities for personal and professional growth.*

*The supportive environment, dedicated staff and the focus on addressing under-representation makes this programme highly commendable for anyone aspiring to enter the health data science sector.*



Aghogho Onojuvbevbo

the HEALTH  
CHANGERS



# 4 ENGAGEMENT



# FUTURE FORUMS POLICY WORKSHOP



## A POLICY WORKSHOP ON HEALTHCARE INEQUALITIES

**On 12 September, the Policy Impact Unit ran its first Futures Forum in collaboration with the IHE, on the topic of health inequalities.**

The session presented an opportunity for researchers across UCL to discuss with policymakers ways in which their work is relevant for the future of health inequalities.

Conversely, it enabled policymakers to dedicate some time thinking about potential evidence gaps to address health inequalities in years to come. Attendees discussed the opportunities, as well as limitations, of new technology in addressing health inequalities.

Individuals from a range of institutions attended the event, including the NHS, local authorities, learned societies and think tanks (such as the Physiological Society, British Heart Foundation, Health Foundation and Ada Lovelace Foundation), as well as researchers from the IHE and across UCL.



# IHE ENGAGEMENT AWARDS



## CELEBRATING OUR FIRST IHE ENGAGEMENT AWARDS

On Monday 11 September, we celebrated our inaugural IHE Engagement Awards – recognising excellence in public engagement within our healthcare engineering and digital health community.

In June 2023, we announced the launch of the IHE Engagement Awards and put out a call for submissions.

Developing a culture where public engagement is embedded into practice and valued by staff requires support, encouragement and recognition of effort and achievement. We know there are teams and individuals from across UCL who are delivering phenomenal and innovative public engagement activities in our field.

Our vision is that the IHE Engagement Awards will provide researchers with the formal recognition they deserve, alongside a powerful boost to their morale (and their CV!).

The awards were judged by:

- ◆ Prof Clare Elwell, Professor of Medical Physics in the Department of Medical Physics and Biomedical Engineering, and Vice Dean for Impact for Faculty
- ◆ Dr Rupy Kaur Matharu, Research Fellow, UCL Civil, Environmental and Geomatic Engineering
- ◆ Dr Rebecca Baker, Research Fellow, UCL Institute of Cardiovascular Science
- ◆ Alice Hardy, Communications and Impact Manager, UCL Institute of Healthcare Engineering

Thank you to everyone who submitted an application; we were incredibly impressed by the breadth and quality of applications.



**We are delighted to announce the following winners:**

### PHD AND EARLY-CAREER RESEARCHERS

**Category winner: MERS Repair Café**

**The Mechanical Engineering Researchers Society is a UCL Mechanical Engineering society for PhD students and ECRs. In 2022, they teamed up with the UCL Institute of Making, UCL Engagement and the Restart Project to support an Electronics Segment at a Repair Café.**

In this interactive workshop, members of the public could bring their broken devices along for a consultation with a repair expert, and tips on how to fix the object themselves. They had more than 220 visitors, nearly all of whom left the Repair Café with their device either full repaired or in better condition than when they arrived.

Through their evaluation, they learned that as well as gaining new skills and confidence, visitors left the workshop with renewed hope, new connections and friendships.

### CO-PRODUCTION

**Category winner: Oh Pod!**

**Oh Pod is a mental health podcast series co-produced by UCL academics and members of minority communities.**

The aim of the project is to host honest discussions between researchers and marginalised communities in East London, that lead to developed trust.

The podcast focused on mental health, neurodiversity and illnesses that are often taboo in BAME communities.

The UCL team worked with Future Formed (a Borough of Waltham Forest initiative) that offers residents exposure to creative industries. The format of the podcast helped ground conversations in reality and allowed people with lived experience to lead the conversation. The skills and experience gained by the community members led to improved confidence and will allow them to continue their work in podcasting and the creative field.



### COMMUNITY ENGAGEMENT AND PATIENT AND PUBLIC INVOLVEMENT (PPI)

**Category winner: VaxHub**

**Based in UCL Biochemical Engineering, VaxHub is engaging with the public to improve understanding of vaccines and their role against resistant pathogens and future epidemics.**

Since July 2022, the team have been collaborating with Langdon Park School in East London, and North Hertfordshire College in Stevenage to co-create an impactful, interactive outreach programme to engage with teachers and pupils, and raise awareness of vaccine design, development and manufacture.

The project leads worked closely with teachers to develop the programme and tailor it to their needs. They offered CPD training to teachers in modern vaccine development, held workshops in schools, hosted lab sessions at UCL, and arranged group research projects for school groups.

One teacher said, “VaxHub never stops to amaze our students by not only bringing cutting-edge science, but also bringing them to their unique labs to manufacture a vaccine to the dengue virus”.

### COMMUNICATING OUR RESEARCH

**Category winner: Sing, Say, Spray**

**Sing, Say, Spray is a creative interactive exhibition that showcases research taking place in the Healthy Infrastructure Research Group.**

Following the COVID pandemic, the exhibit was designed and built specifically for experimental knowledge transfer between children and UCL researchers on the movement on bioaerosols. Children learned about respiratory droplets and aerosols and the activities that generate their spread – like breathing, shouting, coughing and sneezing.

Some of the activities included blow painting, giant microbe stuffed toys, and counting particles through an old-fashioned megaphone.

The group shared their work at a range of high-profile engagement festivals, including Bloomsbury Festival and Cally Fest, and attracted over 600 visitors. Their work was featured in a Bloomsbury Festival YouTube video, and they are developing and refining their ideas for next year.

**Drs Stephen Morris and Salomé Magalhães from Vax-Hub**



**Congratulations to everyone, and keep your eyes peeled for next year!**

# IHE IMPACT FELLOWSHIPS



## IHE IMPACT FELLOWSHIP WELCOMES ITS FOURTH COHORT

**The IHE Impact Fellowship Scheme helps UCL healthcare engineers make an impact and engage with people beyond the university.**

We're delighted to welcome 18 new Impact Fellows on board to the scheme for 2023/24.

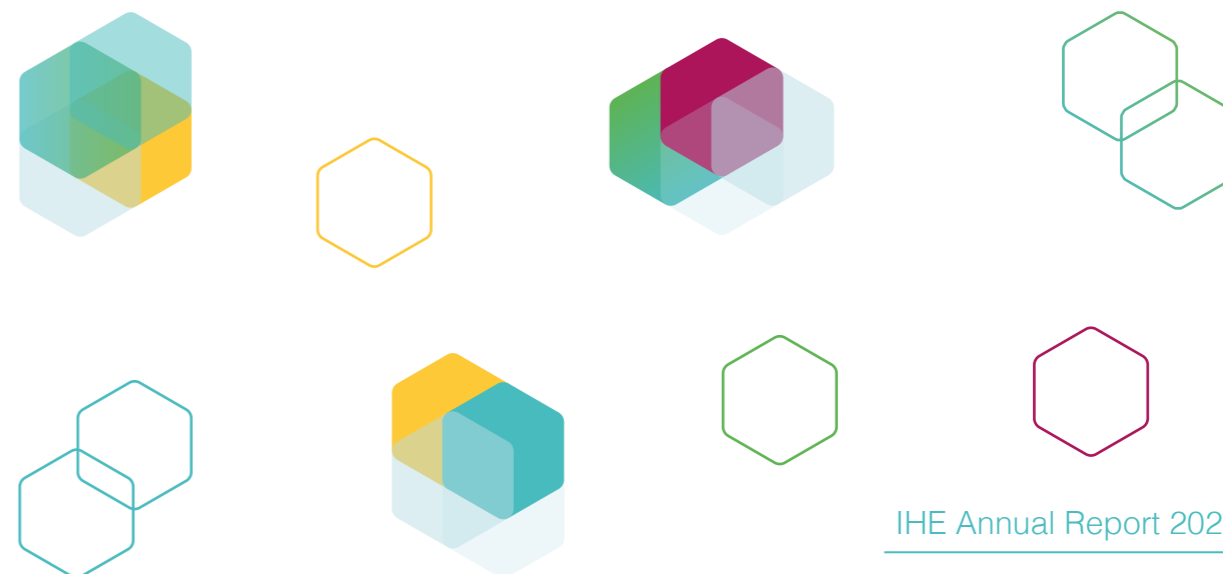
The year-long Impact Fellowship scheme welcomed its fourth group of researchers in November 2023. The scheme will train and guide its impact cohort to build their engagement skills and grow their network beyond university walls, building up a real-life, impact-driven, engagement activity at the end of the year.

### They are learning:

- How to engage with policymakers
- How to explain your research in simple terms so everyone can understand what they do
- How to work with audiences from widely diverse backgrounds
- How to work with community groups and patients
- How to measure their impact
- How to co-produce research with community members

## 2023/2024 IHE IMPACT FELLOWS

- Alessandro Rossi – UCL Electronic and Electrical Engineering
- Anestis Koulogiannis – UCL Mechanical Engineering
- Chloe He – Wellcome/EPSRC Centre for Interventional and Surgical Sciences
- Elizabeth Levitis – Centre for Medical Imaging Computing
- Emily Kostina – UCL Developmental Biology & Cancer Department
- Emmeline Brown – UCL Medical Physics & Biomedical Engineering
- Francois Sicard – UCL Arts and Sciences
- Gabrielle Baxter – Centre for Medical Imaging Computing
- Laurence Lovat – Wellcome/EPSRC Centre for Interventional and Surgical Sciences
- Lucie Gourmet – UCL Medical Physics and Biomedical Engineering
- Maxime Berg – UCL Mechanical Engineering
- Mazna Almatroudi – UCL School of Pharmacy
- Noora Almarri – UCL Electronic and Electrical Engineering
- Razvan Caramalau – Wellcome/EPSRC Centre for Interventional and Surgical Sciences
- Rohit Gupta – Wellcome/EPSRC Centre for Interventional and Surgical Sciences
- Roxana Ramirez Herrera – Wellcome/ EPSRC Centre for Interventional and Surgical Sciences
- Sarah Imdad – UCL Queen Square Institute of Neurology
- Zainab Rai – UCL Surgery and Interventional Science





Dr Oriol Roche i Morgo

## SCIENCE SHOWCASE AT THE BLOOMSBURY THEATRE

**On 26 April, we sat in the packed-out Bloomsbury Studio to hear the ripples our Impact Fellows were making in the healthcare engineering pond.**

The concept of our Science Showcase is simple: 5 minutes for our Impact Fellows to tell us about their project in simple to use language with a bit of comedy peppered in because who doesn't like a laugh?



On the day, our Impact Fellows blew us away. The talks were humorous, moving and informative – covering topics like how we can see inside babies' heads to test for autism and how we can train the next cohort of surgeons using AI.

The Showcase was hosted by Oriol Roche i Morgo who used to be an Impact Fellow last year and has come back to flex his hosting skills this year.

We're so incredibly proud of all the hard work that's gone into this year's Science Showcase. Our Impact Fellows have really come a long way and their ability to tell stories from their research is a testament to that.

## BLOG: IMPACT FELLOW, ORIOL, LEADS AN ART WORKSHOP

Dr Oriol Roche i Morgo, a 2021-2022 IHE Impact Fellow, tells us about an art workshop he ran in a school, which taught the children about x-ray imaging.

*As teenagers, sometimes even earlier, we are often confronted with a crude distinction: art versus science. The latter is concerned with the real world, with real things and real numbers; the former deals in creativity and fantasy. This is deeply ingrained in us; it can heavily influence our understanding of ourselves, our identity.*

*In November of last year I tried to break that binary. A professional artist and myself (I am a physicist and researcher) went to a school and delivered a workshop about the physics of x-ray imaging... through sculpture.*

*The school was Haberdashers Crayford Academy, in Dartford. At 9 am, I stood in front of a classroom of roughly 20 students, aged 13 to 17, and told them about x-rays. I explained that x-rays interact differently with different materials, and I told them about the new ways in which my group at UCL uses that information. They were attentive but silent.*

*Then, my colleague Lydia Smith, who is a sculptor by trade, took over and the students lit up: she guided them in making small-scale sculptures (5x5x5 cm<sup>3</sup>) with all sorts of unconventional materials (strawberries, tooth-picks, flowers...).*

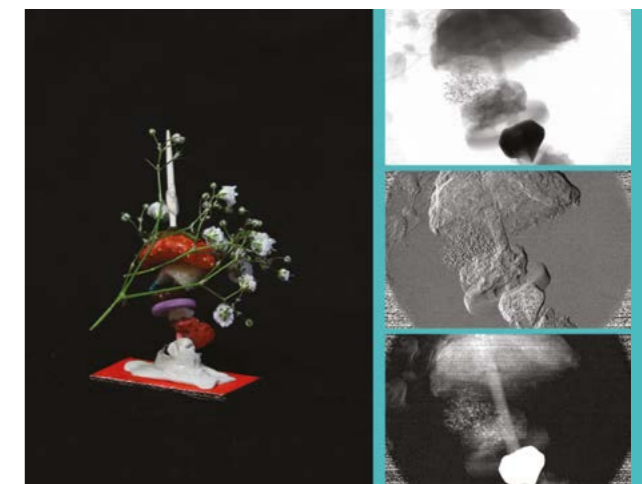


*They had to consider what they had just learnt about x-ray imaging, because after the workshop I would scan the sculptures at UCL's x-ray facilities. In the resulting images, the sculptures can be seen from a radically different point of view, with the internal structure of the materials becoming an integral part of the piece.*

*It was a lively 2-hour event with thoroughly engaged students, enquiring about how their materials would look under the x-rays and letting their instinct lead their creations. Art was in the service of science, and science was in the service of art: learning about x-rays was just as important as using their hands.*

*Bridging the perceived gap between art and science is a slow process. But I am hopeful that, with events like this, children and teenagers can be encouraged to see the things that artists and scientists have in common, rather than their differences.*

Oriol is an x-ray imaging researcher in UCL Medical Physics and Biomedical Engineering. Raised in Barcelona, he moved to London for his BSc in Physics with Medical Physics. He is interested in public engagement, which led him to become an IHE Impact Fellow in 2021. He loves exploring the boundary between art and science.





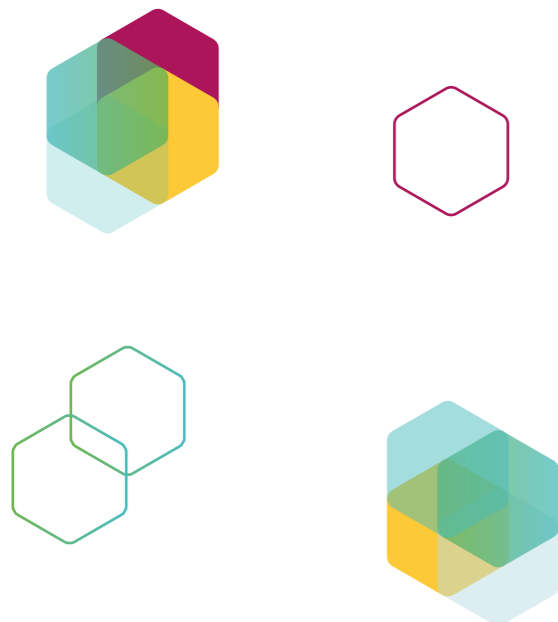
## CO-PRODUCTION WITH LOCAL TEACHERS IN SPAIN

**Carmen Salvadores Fernandez (WEISS) took the Impact Fellowship to her native Spain.**

Carmen's mother is a high school teacher in the León region, and on her trips back home Carmen regularly catches up with her mother's colleagues.

Working with the school's science and English teachers, Carmen devised an educational seminar for the students, blending science and language learning. Along with two fellow WEISS researchers, Carmen spent the day speaking to the young people in English and carrying out practical experiments based on her research group's work.

The seminar was an enormous success with the teachers and students, and the regional Education secretary even made an appearance.



# IN THEATRE INSTALLATION

**In Theatre was an interactive pop-up installation in Brick Lane, London, which explored how AI and robotics will revolutionise surgery now and in the future.**

The Wellcome / EPSRC Centre for Interventional and Surgical Sciences (WEISS) worked with The Liminal Space to bring together some of the most imaginative and futuristic innovations from researchers in engineering and clinical sciences at UCL. Over the 3-weeks that the pop-up installation was open, we welcomed over 2000 people in to see the project.

**The pop-up installation was housed in what was previously a cake shop in the heart of Brick Lane.**

As part of the In Theatre project, a report on how AI and surgery might lead to healthcare inequalities was commissioned by UCL's Policy Impact Unit, which is part of the Science Technology Engineering and Public Policy Department (STeAPP) at UCL. The report is based on a series of discussions that took place during two online workshops in July and September of 2022, with participants from the UK Government, academia and the wider community.

Visitors to In Theatre were led on a journey deep inside the human body and were sent whizzing through the high-tech machines used during surgery. They were invited to beat the buzzer to test just how steady their hands were compared with the arms of a robot surgeon and could sit in on a virtual robotic operation.

**The main objectives of the first workshop were to map the different ways in which AI and surgery might lead to inequalities and how those inequalities relate to current public understanding and concerns.**

As a follow-up, the second workshop focused on exploring what steps might be taken to ensure that the development of new surgical technologies don't inadvertently contribute to health inequalities.

# ROYAL SOCIETY SUMMER SCIENCE EXHIBITION

## UCL RESEARCHERS EXHIBIT DRUG MONITORING DEVICE AT ROYAL SOCIETY SUMMER SCIENCE EXHIBITION

In July 2023, researchers from all around the UK descended on London to exhibit at The Royal Society Summer Science Exhibition.



Among the exhibits was ChromaDose, a research project involving a consortium of UK scientists, clinicians and patients who are developing a point-of-care therapeutic drug monitoring (TDM) that could be available in hospitals by 2025.

The IHE supported the ChromaDose team with their exhibition, which featured a range of fun activities for visitors – including an interactive digital game, and arts and crafts table.



It is hoped the ChromaDose device will help to reduce the incidence of life-limiting health complications, such as heart problems and other treatment-related side effects experienced by up to 65% of the 10,000 children in the UK who have received anti-cancer medicines. The device will help doctors to calculate tailored doses for future patients.

The ChromaDose technology is based on an inexpensive and simple chemical analysis, which can be carried out quickly and easily at the bedside.

The three-year project – a collaboration between researchers, clinicians and patients from University College London, Newcastle University, Great Ormond Street Hospital, the University of Birmingham, the London In-Vitro Diagnostics Co-operative and manufacturer Vesynta Ltd – has received a £980,000 grant from the National Institute for Health and Care Research (NIHR).

“

*Because we were previously struggling to translate a lab-proven but complex scientific concept, we devised a simpler, more robust process that gives us surprisingly accurate results, even when used by a non-specialist.*

*The technique combines chromatographic separation and fluorescence-based quantification, which we deploy in a medicine specific disposable cartridge that can be analysed on a desktop.*”

Dr Stefan Guldin (UCL Chemical Engineering), co-lead on the ChromaDose project



# SCIENCE OF SURGERY

**In April 2023, the Wellcome/EPSRC Centre for Interventional and Surgical Sciences (WEISS) welcomed over 500 members of the public to Science of Surgery.**

The event was a fun-filled, interactive day of activities with WEISS scientists demonstrating and celebrating the innovative medical technology they are working on.

Taking place inside Charles Bell House, the hub for WEISS research, the event featured 25 different activity stations delivered by 80 of our researchers from all levels across the Centre.

Highlights included ultrasound levitation, nanorobots, give-it-a-go mock robotic surgery, and a behind-the-scenes tour of the lab and mock operating theatre.

The activities were developed by researchers from WEISS' main research groups, with a dedicated activity lead from each project's team managing their response. By designing the activities to be interactive and fun, the event staff were able to break down concepts for younger visitors while discussing research themes with those looking for more detail.



The WEISS Public Engagement team - Simon Watt and Phil Wiles - organised Science of Surgery. The event is part of a varied public engagement programme at the Centre, allowing WEISS staff to develop their research communication skills while providing a platform for the Centre to reach out to local organisations.

“ *It was wonderful to see so many families engage with the activities so enthusiastically. It's an important day for us as we share and celebrate the cutting-edge technological research different groups are working on. Hopefully, we might inspire some of the children to become MedTech scientists or clinicians themselves in the future. A huge thank you to all WEISS staff for their creativity, time and effort in putting the day together.* ”

**Dr Evangelos Mazomenos** WEISS' Deputy Director for Engagement and former IHE Impact Fellow

# PODCAST

## HEALTH IN A HANDBASKET PODCAST

**In autumn, we launched Health in a Handbasket, a new podcast series where we demystify healthcare engineering.**

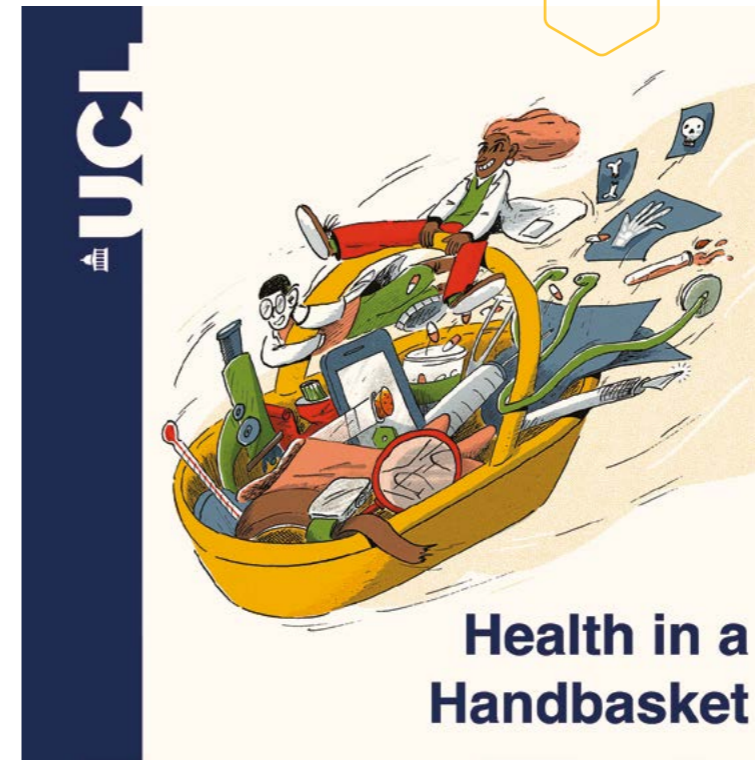
Each episode we meet people who are developing world-changing digital and medical technologies; we chat to them about their work, what gets them out of bed in the morning, and how they got to where they are in their career.



The health topics we cover range from diabetes to phantom limb syndrome.

The podcast is hosted by Ferdouse Akhter (IHE Marketing & Community Manager), produced by Alice Hardy (IHE Communications & Impact Manager) and edited by Cerys Bradley. Our artwork is by Ollie Silvester.

Health in a Handbasket is available on all podcast platforms, including Apple and Spotify.



## Health in a Handbasket



Dr Katherine Wang spoke to us about her device for lymphedema patients



# 5 GLOBAL



# GDI HUB AND IIT-D

## UCL AND INDIAN PARTNERS TO DRIVE DISABILITY INNOVATION THROUGH ASSISTIVE TECHNOLOGY

In July, the academic research and practice centre, based at UCL East, signed a new Memorandum of Understanding with colleagues from the Assistech Lab at Indian Institute of Technology Delhi (IIT Delhi) and R2D2 lab at Indian Institute of Technology Madras (IIT Madras).

As leaders in assistive technology (AT) research, the organisations plan to jointly deliver a collaborative AT Accelerator Program, an AT Innovation Portal, and an AT Academic Innovation Partnership to drive knowledge across different markets.

Assistive technology is needed by 1.13 billion people worldwide and the GDI Hub aims to collaborate with global partners to drive thinking, understanding and knowledge in the area.

The new strategic innovation programmes will foster partnerships with Indian Disabled People's Organisations (DPOs), industry and governments and facilitate the dissemination of knowledge about disability, AT, and innovation to emerging ventures within the disability innovation space.

Previously, GDI Hub researchers have worked with IIT Delhi colleagues to develop wheelchair-accessible maps of Delhi using innovative sensing platforms. The Street Rehab project was designed to gain a clear understanding of user needs, available technology and the accessibility of the city.

## SPOTLIGHT ON DR MADHAN KUMAR VASUDEVAN

Meet Madhan, an Indian researcher who now works as a Research Fellow in UCL Computer Science.

Tell us about yourself! Where did you grow up and study in India? What brought you to UCL?

*I grew up in Madurai, India, and received my PhD in Haptics, Human-Computer Interaction (HCI), and Computational Neuroscience at the Indian Institute of Technology (IIT) Madras in Chennai. The intersection of HCI, haptics, and neuroscience has been my passion.*

*This led me to UCL given its extraordinary strength in nourishing emerging technologies, cutting-edge research environment, and the opportunity to collaborate with leading experts in the field.*

What is your current research focus?

*My current research focus is on contactless haptic technology which uses ultrasound to give us the sense of touch. Furthermore, the funding I received through the Institute of Health Engineering encouraged me to additionally focus on the applications around healthy ageing challenges, specifically, how haptic technologies can be used to improve wellbeing.*

What was it like transitioning to a new country?

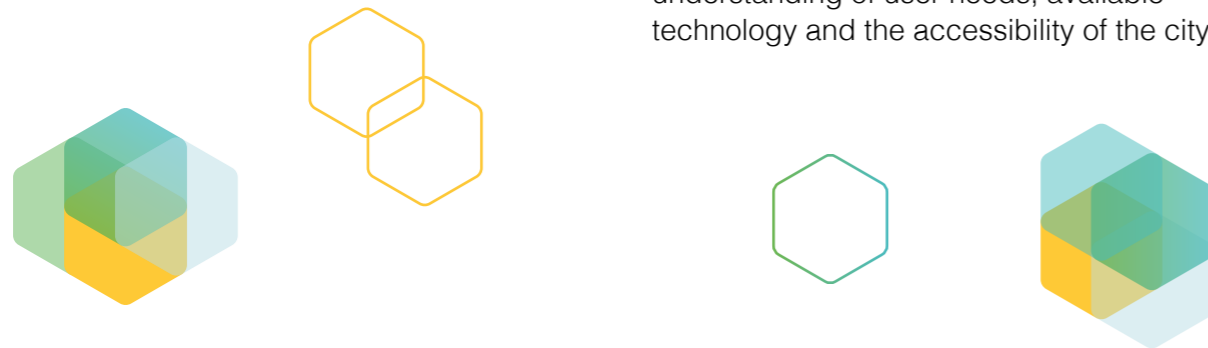
*Transitioning to the UK, especially to the vibrant city of London, was initially a mix of excitement and challenge. UCL community has been supportive and has a diverse cultural environment which made the transition smoother. Engaging with colleagues and students from around the world has enriched my experience both academically and personally.*

What is the best thing about living in London?

*To put it simply, the dynamic blend of cultures, ideas, and opportunities from all over the world. London's rich history, diverse neighbourhoods, and cultural events make it an exciting place to live and explore.*

What are your plans for the future?

*I aim to remain in academic research and secure funding to pursue further research on novel haptic technology and its application to healthcare challenges related to sensory and emotional wellbeing, especially through a cross-cultural approach.*



Dr Madhan Kumar Vasudevan

# VISIT TO INDIA

## UCL DELEGATION VISITS INDIA

Between 18 and 25 November 2023, a UCL delegation led by Professor Geraint Rees (UCL's Vice-Provost for Research, Innovation & Global Engagement) and Kirsty Walker (UCL's Vice-President for External Engagement) visited India to engage with key partners, prospective students and alumni to further strengthen our ties in the country.

UCL and India share a rich history of collaboration. Our connections span recruiting brilliant students, engaging with exceptional alumni, delivering transformative education and undertaking impactful research.

## AIIMS – ALL INDIA INSTITUTE OF MEDICAL SCIENCE

AIIMS is India's number one hospital for research. The hospital is almost like a city in itself, seeing more than 50,000 daily footfall. The staggering diversity of cases combined with clinical excellence provide incredible potential for collaboration.

## IITS – INDIAN INSTITUTES OF TECHNOLOGY

The Indian Institute of Technology are centrally funded technical institutes located across India and are renowned as the country's premier research and education institutions in the field of technology. There are strong synergies between the work done at IIT-Delhi, IIT-Madras, and UCL.

The UCL delegation met with the Chief Scientific Advisor to the Indian Government

HE Deputy Director (Translation) Professor Geoff Parker was part of the delegation. In collaboration with the Global Engagement Office, the IHE has fostered close ties with Indian partners over recent years – in particular with AIIMS, IIT-Delhi and IIT-Madras.

“

*The visit to India provided an excellent opportunity to make all-important personal contact with current collaborating centres in Delhi and with potential new partners in Bengaluru and Mumbai.*

*A theme common to all discussions was the potential for fruitful healthcare engineering collaborations building on shared areas of expertise and the opportunity to deploy new technologies in different healthcare systems with different challenges.*

*Our next step is to build on these discussions by determining what practical initiatives we can put in place to establish further funded collaborations.*”

Professor Geoff Parker,  
HE Deputy Director (Translation)



# INFECTIOUS DISEASE PARTNERSHIP

## UCL-AHRI PARTNERSHIP TACKLING INFECTIOUS DISEASES SECURES £72M FUNDING BOOST

Researchers at UCL and the Africa Health Research Institute (AHRI) at the forefront of HIV and TB research in South Africa have been granted more than £72m additional funding from Wellcome.

The seven-year grant will support AHRI's pioneering scientific research, focusing on understanding and responding to diseases that are the major causes of illness and death in South Africa. These include: HIV; tuberculosis (TB); emerging infections such as Covid-19, and neglected infections such as hepatitis B; and adolescent mental health.

Located in the South African province of KwaZulu-Natal, AHRI's vision is the optimal health and wellbeing of under-resourced populations.

As well as helping AHRI train the next generation of African scientists, the funding will enable the institute to expand its research to address key questions including:

- How can HIV be prevented in rural communities?
- How can HIV be cured?
- How can TB spread be prevented in rural communities?
- Do new vaccines prevent TB disease?
- How can new infections such as Covid-19 be identified early and controlled?
- How can mental health disorders in rural adolescents best be treated?

UCL is a key academic partner for AHRI. Twenty-eight faculty members drive its cutting-edge, interdisciplinary research. AHRI hosts a world-leading health and demographic surveillance system in rural northern KwaZulu-Natal, and its laboratories are among the most sophisticated in Africa.

# INTEGRATED HEALTH SERVICES IN AFRICA

## INTEGRATED HEALTH SERVICES IN AFRICA CAN IMPROVE PATIENT CARE AND SAVE MONEY

**Integrated health care for chronic high-burden conditions in sub-Saharan Africa is feasible and health services could deliver high-quality services for less cost than with the current approach of separate vertical care for each condition, a new study led by UCL researchers shows.**

Presently, health care services for non-communicable conditions such as diabetes and hypertension are fragmented and the quality of care is inequitable when compared with services for HIV. Much less than half of the people who start treatment for diabetes or hypertension on the continent remain in care one year later and about 2 million premature deaths are attributed annually to the effects of these two conditions. In contrast, the vast majority of people living with HIV are in regular care and virally suppressed. Mortality rates of people with HIV have fallen over 5-fold since their peak in the early 2000s.

The paper, which has been published by The Lancet, addresses this evidence gap. It reports a large study led by the National Institute for Medical Research in Tanzania, MRC/UVRI/LSHTM Uganda Research Unit and initially by LSTM, and later by the UCL Institute for Global Health.

The study involved multiple institutions from Tanzania, Uganda and Europe. It showed that integrated care in sub-Saharan Africa was associated with high levels of retention in care for people with diabetes or hypertension, that it did not adversely affect the rate of viral suppression among people with HIV, and that it was cost-saving for health care providers.

Corresponding author Professor Shabbar Jaffar (UCL Institute for Global Health) said:

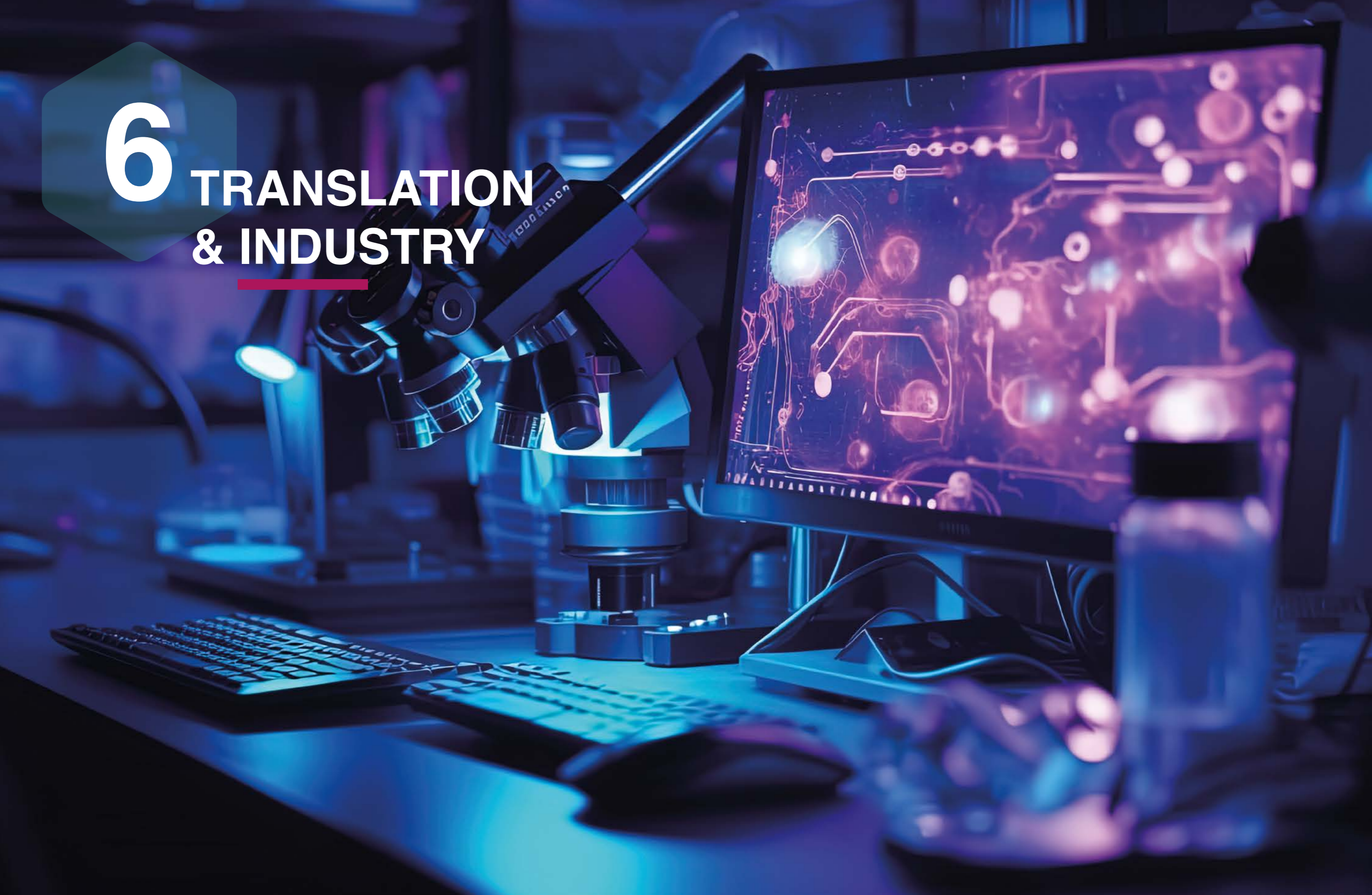
*I am very proud of all of the investigators. We worked as equal partners and because of this were able to pull off this most challenging of research studies.*

The INTE-AFRICA project is funded by the European Union's Horizon 2020 research and innovation programme. The research involved the National Institutes for Medical Research in Tanzania, The AIDS Support Organisation in Uganda, MRC/UVRI & LSHTM Uganda Research Unit, Liverpool School of Tropical Medicine, Tanzania NCDs Alliance, Shree Hindu Mandal Hospital in Dar es Salaam, Tanzania, Uganda's Ministry of Health, Amana Regional Referral Hospital, Tanzania, Tanzania's Ministry of Health, University of Liverpool, The National Forum of People Living with HIV Networks in Uganda, Makerere University College of Health Sciences in Uganda, London School of Hygiene & Tropical Medicine, University of East Anglia, University of Barcelona, and City University of New York Graduate School of Public Health and Health Policy.

6

TRANSLATION  
& INDUSTRY

---





# CENTRE FOR DIGITAL INNOVATION



**The UCL Centre for Digital Innovation (UCL CDI) is a collaborative initiative between UCL and Amazon Web Services (AWS), united in a joint mission to drive transformative digital innovations which effectively tackle pressing global societal challenges.**

The CDI Impact Accelerator helps accelerate impactful digital solutions, supporting start-ups and innovators to transform promising concepts into realities through mentorship and technical expertise. Via this scheme, the Centre has supported several healthcare technology ventures:

## AFFINITI AI

Affiniti AI is on a mission to make digital mental health support more engaging and personalised. By leveraging Generative Conversational AI they developed a purpose-built AI model designed to understand the needs of each user and provide them with tailored support and guidance.

Their participation in the CDI Impact Accelerator Programme enabled them to transform their functional prototype into a beta version product, which now serves as a demonstrator to clinics and investors.



## CHRONOSTICS

Chronostics™ is a medtech startup stemming from UCL research seeking to revolutionise computational medicine and healthcare. They specialise in building and deploying data-driven models to empower clinical trials and healthcare initiatives, with a key focus on unravelling the heterogeneity of age-related chronic conditions — a high priority challenge in modern medicine with a significant socio-economic burden.

Upon acceptance to the CDI Impact Accelerator, Chronostics was particularly impressed by AWS's global scalability, which can support the company's ambitions for growth. The CDI provided vital cloud DevOps support to propel chronostics toward establishing a scalable computational infrastructure to meet customer demand.



## PSYRIN

Psyryn is an innovative startup driven by its vision to create a harmonious clinical care system that integrates the expertise of clinicians with the power of AI, all to ensure the best possible patient outcomes in serious mental healthcare.

To achieve this, they have introduced a groundbreaking solution that utilises AI to analyse speech patterns, providing a rapid and objective standard of assessment for serious mental illness. In just 5 minutes of speech analysis, Psyryn's algorithms deliver valuable readouts, empowering mental health providers to assess early, monitor, and intervene effectively in cases of psychosis.

## ETHERA HEALTH

Ethera Health Ltd is a UK-based medical technology company specialising in digital tools to enhance patient care and healthcare efficiency. Born out of a cross-disciplinary initiative between academic practitioners at UCL Hospitals Medical Professors and UCL Computer Science, the company's primary focus is to address the challenge of increasing patient monitoring capability while reducing patient time spent in the hospital after critical surgery, thus freeing up hospital beds.

Their leading product, Halo-X, is a cloud-based platform that facilitates progress tracking and recovery assessment in clinical pathways post-acute interventions and chronic disease settings.

Through remote health monitoring and advanced analytics, the platform offers clinical insights to support decision-making and improve care services.



# HEALTHY AGEING CHALLENGE AWARDS

## IHE HEALTHY AGEING CHALLENGE AWARD: DRAGONS DEN EVENT

In 2022 we launched the IHE's Healthy Ageing Challenge Award where we gave four projects £10,000 each to develop a technological solution to the issue of ageing well.

At the end of the award period, all four projects were entered into a Dragon's Den competition, with one successful project going on to win a further £50,000 funding from the Rosetrees Trust.

On Tuesday 27 June, we held the event in High Holborn to see all four project leads demonstrate their proof of concepts and pitch for the extra £50,000.



## FINALISTS

### Dr Madhan Kumar Vasudevan

Are we using technology to its fullest extent? Madhan is working on how doing mindful exercises before sensory stimuli can elevate that stimulus. He looked at whether mindfulness before using haptics tech, or tech that stimulates the sense of touch or motion, can improve system performance of the haptic device thus showing how mindfulness can heighten your other experiences.

### Dr Moe Elbadawi

Moe's working on a pharmaceutical app that monitors and reminds patients when to take their medication, and how much of it to take. The patient takes a picture of the pharmaceutical box, and all the information is there! The app also has voice recognition so you can also speak to it, thus making it more accessible.

### Dr Cian O'Donovan

Cian is looking at what we're creating devices for. Are they going to be useful and improve people's lives? Do we think about whether the technology is actually accessible? Does the user have internet?

Cian is looking at "steering" the direction of research and changing research culture. He wants to make sure that the people who will use the tech have a hand at steering the wheel and directing research to what is important for them.

Cian wants to create a platform for collectively steering research projects and strengthen research clusters by evaluating them systematically. For example, we've got a lot of healthy ageing projects but they're all scattered and don't speak to each other – how do we do that? He also wants to provide recourses to mitigate the barriers researchers face and cultivate research that steers innovation in the direction we need rather than what we think the community needs.



### Dr Yu Wu

Yu is looking at frailty, and the associated risk of falling, hospitalisation and even mortality. Frailty itself is costing the NHS £5.8 Billion each year so it's a big problem. Healthy ageing can reduce the risk of frailty through exercise but there are some barriers to this, and this is what Yu is focusing on, especially post rehabilitation monitoring as well as injury avoidance exercises.

Current exercise technologies tell you how much you've done of something but not how well you've done it – for that you'll have to access specialist equipment or a sports coach, and that isn't feasible for a lot of people. Yu and his team are working on a specialist wearable motion system that analyses gait. It'll be like a wristwatch that fits around your waist and your ankles, depending on what you want to measure.

Using discrete sensors in hydrogel fluid, the device detects pressure. When you take a step, the step deforms the hydrogel, and the sensors pick this up. And hydrogel is what makes this product competitively viable as it's a cheaper material and so will provide low-cost manufacturing costs.



Dr Cian O'Donovan presenting his project

# REVOLUTIONISING HEALTHCARE WORKSHOP

## WORKSHOP: REVOLUTIONISING HEALTHCARE - THE IMPACT OF 3D PRINTING

**On Tuesday 26 September, the IHE and the UCL Translational Research Office co-hosted a workshop on point-of-care manufacturing.**

The event focused on the use of 3D-printing for manufacturing implants, devices and pharmaceuticals. Audience members heard from experts already operating in point-of-care manufacturing, who shared their experiences in this field – from the benefits and challenges of point-of-care manufacturing, through to space, sustainability and patient considerations.

They highlighted the role of 3D printing in this process, from the conceptual stage to the final implementation of implants, underscoring the significance of collaboration.

Hosted by Profs Mine Orlu (UCL School of Pharmacy) and Deepak Kalaskar (UCL Surgery and Interventional Sciences), the event was also an opportunity for participants to co-author a commentary article and be part of a new network of researchers and industry in this space.



### Expert speakers:

- ◆ Dr Allan Ponniah, Consultant Plastic Surgeon, Royal Free London NHS Trust - highlighted the practical applications of 3D printing in reconstructive surgery, underlining its potential to enhance surgical outcomes and patient care.
- ◆ Dr Jim Ashworth-Beaumont, Senior Orthotist, Royal National Orthopaedic Hospital NHS Trust - how 3D printing technology can play a pivotal role in this field, offering opportunities for customisation and improved patient outcomes.
- ◆ Dr Atanu Chaudhuri, Associate Professor of Technology and Operations Management, Durham University Business School - emphasised the importance of infrastructure and knowledge sharing in this transformative process.
- ◆ Florian Hess, PhD student, Merck - touched upon the potential of 3D printing to revolutionize pharmaceuticals, improving drug delivery and advancing clinical trials.
- ◆ Richard Evans, EMEA Business Development Manager Healthcare, and Stefan Leonhardt, Director Medical Devices, 3D Systems - both shared their journey of developing and implanting personalized medical devices.



# INNOVATION PROJECTS AND ENTERPRISES

## UCL SPIN OUT ODIN VISION ACQUIRED BY OLYMPUS TO SUPERCHARGE GLOBAL GROWTH

**In June, Odin Vision, a UCL spin out company that develops AI-driven endoscopy technology to help better detect cancer, was acquired by Olympus Corporation (Olympus) for up to £66 million.**

The company, spun out of research by UCL scientists, is a world-leading pioneer of cloud AI-enabled applications for endoscopy, that enables clinicians to detect some early stage colorectal and oesophageal cancers. It was launched in 2019 with the support of UCL Business (UCLB), which helps academic entrepreneurs to commercialise IP, in the form of new businesses.

The acquisition deal will see Olympus acquire Odin's entire portfolio of award-winning AI solutions, enabling Odin's life-saving tools to reach millions of new patients around the world.

**Commenting Peter Mountney, CEO of Odin Vision and Honorary Associate Professor at UCL Computer Science, said:**

*I'm incredibly proud of the team. We started with a university research project at UCL and transformed it into a commercial healthcare technology that will help millions around the world in the fight against cancer.*

## PHD STUDENT GHADA BIN SUWAYYID AWARDED FUNDING TO DELIVER INNOVATION IN WOMEN'S HEALTH

**Ghada's project will offer insights from UK-based, Muslim ethnic-minority women undergoing menopause to promote inclusivity in menopause digital platforms.**

The project, 'No more PAUSE for talking inclusion in MENOPAUSE', aims to explore the perspectives and experiences of UK-based, Muslim-minority women undergoing menopause. It will achieve this through a number of co-design workshops. These workshops will generate suggestions on improving digital health information platforms, including AI-powered health apps, for menopause to become more inclusive.



Addressing inadequate health data is one step toward reducing biases in current AI algorithms. This will make menopause digital platforms more inclusive for women from diverse communities. The project will be one of the first studies to look at Muslim women undergoing menopause here in the UK.

Ghada Bin Suwayyid's PhD work focuses on exploring the potential of mobile physical activity interventions for menopausal women in Saudi Arabia.

Her research interests are around understanding women's experience of menopause with regard to the use of mobile technologies to promote menopause education and behaviour change in women from diverse ethnic and cultural backgrounds.

The Innovation Challenge initiative is supported by funding from EPSRC Impact Acceleration Account, managed by UCL Innovation & Enterprise. The funding enables UCL researchers and industry partners to explore projects to deliver innovation in women's health in a collaborative way.

The industry partner for this project is the Adora menopause app, which seeks to bridge the digital divide in menopause AI technologies. Adora is a woman's health company with a female founder. It is developing an AI digital engagement service to educate women on the menopause and to help them access information and support they need to manage their symptoms.

**Ghada Bin Suwayyid said:**

*My collaborative research project with Adora menopause app will offer the opportunity to empower underrepresented women living in the UK to speak up and break their silence around menopause taboos.*



## PROFESSOR ELIZABETH MURRAY'S LEGACY CONTINUES AS HEALTHY LIVING REACHES 20,000 MILESTONE

Based on the HeLP Diabetes programme, led by the late Professor Elizabeth Murray and licensed by UCL Business, Healthy Living is a web-based structured education programme that supports people to learn more about Type 2 diabetes and improve their health and wellbeing.

Healthy Living, an initiative based on the late UCL Professor Elizabeth Murray's HeLP Diabetes programme, has reached a milestone 20,000 users, NHS England (NHSE) has announced. Over 20,000 people have now accessed information and advice to help them to live better with Type 2 diabetes.

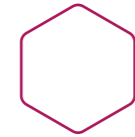
“

*I found it very informative and so helpful in understanding diabetes. With this new knowledge I feel able to make more informed decisions in managing my condition,*”

said one user of the programme, which is available nationally, and for free, for people living with the condition.

The news is a welcome benchmark for the legacy of Professor Murray, who died on 7 April 2023. She was a GP and will be remembered for her innovations, initially in medical education and subsequently for her international reputation in eHealth and the development of digital interventions aiming to find practical solutions to address a range of health problems.

Professor Murray's tenacity and determination led to the development of a web-based self-management programme for people with Type 2 diabetes (HeLP-Diabetes) being licensed by NHS England for national rollout.





At the time of her death, Professor Murphy was working on a digitally enabled, remote, supported rehabilitation for people with Long Covid (Living With Covid Recovery).

Overall, throughout her career, Elizabeth sought to make a difference and was driven by an ambition to see robustly conducted research and evidence-based educational practice implemented to make a difference to the lives of patients and medical staff.

Her commitment to the institutional life of UCL was demonstrated by her term as Head of Research Department of Primary Care and Population Health from 2015-2018. Elizabeth was also Deputy Director (Clinical) of the IHE from 2018-2021.

An NHSE article in the Healthy Living programme has recognised the valuable contributions made to the initiative by Professor Murray, UCL, UCL Business, and The Whittington Hospital NHS Trust.

A version of this article was originally published on the Institute of Epidemiology & Health Care website.

## UCL SPINOUT TACKLING EYE DISEASE ANNOUNCES £57M LAUNCH

**Tenpoint Therapeutics, which spun out of UCL in 2021, has announced its launch to address degenerative eye diseases.**

The biotechnology company uses pioneering cell engineering to replace damaged cells in the eye to tackle age-related or inherited sight loss. The technology could potentially restore sight to millions affected.

The experts at Tenpoint Therapeutics, from the UCL Institute of Ophthalmology, Moorfields Eye Hospital, Institut de la Vision in Paris and the University of Washington in the US, are the first to combine different types of cell-based therapeutics and enable treatments that are tailored to the nature of individual cases, replacing cells in the eye that have been damaged by age-related or inherited disease.

The £57m in funding will allow Tenpoint Therapeutics to develop its regenerative platform to target multiple cell types related to inherited and age-related conditions.

Tenpoint Therapeutics was supported in its spinout by UCL Business (UCLB), UCL's commercialisation company. The company's funding round was also supported by the UCL Technology Fund, as well as British Patient Capital, which enables long-term UK investment in highly innovative companies.



# NOTABLE VISITS

## A TALK WITH BARRY SHRIER, CEO AND FOUNDER OF GIANT HEALTH

**It was great to welcome the humorous and knowledgeable Barry Shrier to UCL and the Institute of Healthcare Engineering. Barry is founder of GIANT Health, a global community of people who are in health, tech and innovation. GIANT Health does something similar to the IHE in that it connects innovators to find solutions to the problems being faced in healthcare.**

During a colloquium in April, Barry covered how you can commercialise your health tech. Barry's own interest in improving healthcare stems from his own experiences of watching healthcare professionals take care of his elderly father and all the tools and devices they used.

The question of 'why' and 'what' is a good place to start if you're an entrepreneur. Why does this need to change? What can I do to improve things? And it all comes down to doing things that are new and different - but then again new and different has its own problems as Barry has come to know with three failed businesses.

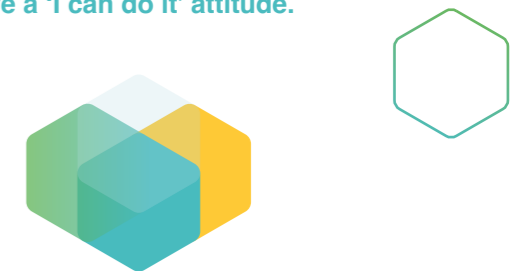
Regardless, failure should stop no one and as an entrepreneur. Barry doesn't just have one business - he has many. One of his biggest commercial successes was Liberty Electric Cars, which addressed global warming and climate change with clean engineering. Barry sold Liberty Electric Cars for over \$100 million and now focuses on Giant Health.



Apart from 'why' and 'what' you must also ask yourself whether the business is commercially viable, and the Business Model Canvas can help you do that. It's a framework to think about things and although a little simplistic in its evaluation, it can still help you see if a product is commercially viable.

When it comes to yourself, here's some things to think about:

- You need a team. Things like this are never done singularly, and you need to surround yourself with A's or network to find those A's.
- You must also learn to be open-minded and not have an ego when it comes to doing things. Nobody is really qualified to start a business, and no one knows it all, so hire those who do.
- Learn to be open minded, flexible and pivot when you need to.
- Have perseverance - a lot of entrepreneurs have had business failures - even the president Abraham Lincoln had many failures before he became one of the greatest presidents!
- Have a 'I can do it' attitude.



When it comes to innovations in the health-care sector, there's a few things to know:

- **Innovation will only happen if there is opportunity.**
- **Small thinking equals small results.**
- **Healthcare is tricky – there's the immediate conflict between the payer, user and the consumer and you need to define the needs of each of them. You need to be honest about those needs because there might be situations where finances might disallow you from solving an issue or helping people really in need.**
- **Healthcare is cautious, conservative and evidence based so it's slow returning. Your investors won't get easy and quick returns – for entrepreneurs it isn't as simple as calling some hospitals and getting your business off the ground. There are also the academic challenges of your business not meeting health system needs.**
- **Healthcare is complex and personal – you will be personally affected if your tool or device negatively or positively impacts lives.**

GIANT Health holds an annual event which helps facilitate healthcare innovation and supports health-tech entrepreneurs and investors.



## JEREMY HUNT VISIT TO UCL EAST

Jeremy Hunt, the Chancellor of the Exchequer, was among a number of government ministers to visit UCL East in November 2023 to mark the publication of the Independent Review of University Spinout Companies.

Also attending the event were university leaders, investors, spinout founders, and heads of technology transfer offices (TTOs), which are responsible for commercialising university research.

The review, whose recommendations the Chancellor accepted in full, provides best practice, "innovation-friendly" guidelines that aim to make the UK the best place in the world to start a spinout company. Ahead of the Autumn Statement on Wednesday, the Chancellor also announced £20 million for university-created businesses.

The Chancellor was given demonstrations of successful UCL spinouts including Tenpoint Therapeutics, which uses pioneering cell engineering to tackle age-related or inherited sight loss.

UCLB has 75 spinouts in its portfolio, including Autolus Therapeutics, which develops revolutionary CAR-T cancer therapies and, since launching in 2014, is now valued at over \$753 million and employs 400 people in London and Stevenage.

UCL President and Provost, Dr Michael Spence said:

*The review's recommendations, which we warmly support, recognise the vital role universities play in driving innovation, improving society and transforming lives.*

*We look forward to working closely with government, fellow universities and investors, to grow and accelerate the translation of cutting-edge research into the transformative businesses of the future.*

Dr Anne Lane, CEO of UCLB, said:

*For 30 years, UCLB has created successful spinout businesses from UCL's ground-breaking research, which have raised £2.75bn investment in the last five years alone.*

*As well as creating jobs and economic impact, these spinouts scale up solutions to complex societal challenges, from reducing carbon emissions to therapies for rare hereditary diseases.*

*The recommendations published in this review will help universities harmonise the creation of spinouts. We look forward to working even closer with fellow universities, government, and the investment community to ensure a healthy and sustained flow of investment back into academic research whilst supporting the emerging world-changing businesses of the next 30 years.*

7

# PEOPLE & OUR COMMUNITY

## IHE CORE TEAM



Prof Rebecca Shipley  
Director



Prof Marianna Obrist  
Deputy Director (Digital)



Prof Geoff Parker  
Deputy Director (Translation)



Dr Eric de Silva  
Research & Development  
Manager



Alice Hardy  
Communications & Impact  
Manager



Ferdouse Akhter  
Marketing & Community  
Manager

TEST

EVALUATE

LEARN

## IHE DIRECTORATE

Professor Rebecca Shipley	IHE Director, Professor of Healthcare Engineering in UCL Mechanical Engineering
Professor Geoff Parker	IHE Deputy-Director (Translation), Professor of Healthcare Engineering, Imaging and Enterprise in UCL Medical Physics and Biomedical Engineering
Professor Marianna Obrist	IHE Deputy-Director (Digital), Professor of Multisensory Interfaces in UCL Computer Science
Vacant	IHE Deputy Director (Clinical)

## IHE CORE TEAM

Dr Eric de Silva	Research & Development Manager
Ferdouse Akhter	Marketing & Community Manager
Alice Hardy	Communications & Impact Manager

## OUR MANAGEMENT BOARD

Dr Billy Dennis	Co-chair, Education Delivery Group	UCL Medical Physics and Biomedical Engineering
Dr Pilar Garcia Souto	Co-chair, Education Delivery Group	UCL Medical Physics and Biomedical Engineering
Professor Vivek Dua	Co-chair, Careers Delivery Group	UCL Chemical Engineering
Dr Martyna Michalska	Co-chair, Careers Delivery Group	UCL Mechanical Engineering
Dr Rupy Matharu	Co-chair, Engagement Delivery Group	UCL Civil, Environmental and Geomatic Engineering
Professor Mine Orlu	Co-chair, Translation & Industry Delivery Group	UCL School of Pharmacy
Professor Patty Kostkova	Co-chair, Global Delivery Group	UCL IRDR Centre for Digital Public Health in Emergencies
Professor Ifat Yasin	Co-chair, Global Delivery Group	UCL Computer Science

# COMMUNITY HIGHLIGHTS



## UCL RESEARCHERS WIN PRESTIGIOUS IET EMERGING TECHNOLOGY AWARD

**On 15 November, Professor Rui Loureiro and Dr Peter Snow received an IET Emerging Technology Award in Glasgow for their work improving quality-of-life for people with spine and nerve injuries, and post-amputation pain.**

The IET (Institution of Engineering and Technology) Excellence Awards shine a spotlight on groundbreaking innovations in engineering, science and technology.

The UCL and Royal National Orthopaedic Hospital (RNOH) team were finalists in two award categories, the Health Technology Award, and the Emerging Technology of the Year Award – the latter of which they won.

The award recognises Rui and Peter's work using virtual reality and robotics as a potential treatment for neuropathic pain. The team have recently completed their first in-human clinical feasibility studies, focusing on patients experiencing phantom limb pain following an amputation, patients with spinal cord injuries, and patients with upper limb nerve damage who may be at risk of needing an amputation.



Phantom limb pain is the perception of pain in a limb which is no longer there. The symptoms can range from mild to severe constant pain, while the underlying causes are not well understood. It is estimated that nearly 80% of people with an amputation experience phantom limb pain.

The team have developed a system called UCL TouchRehab which uses virtual reality and sensory feedback to let users see a surrogate of their missing arm. Users can control and feel the virtual limb as they interact with other virtual objects, which has been shown to have an effect on pain reduction.

The researchers conducted a clinical feasibility survey on two groups of patients with phantom limb syndrome – one group used the system with sensory feedback, and the other group didn't. Those who experienced sensory feedback reported more effective pain reduction. Patients who have used the UCL TouchRehab system have also reported improved mood and wellbeing, and better-quality sleep.







The IET Emerging Technology Award ceremony in Glasgow

For the next steps, the team are recruiting patients with spinal cord injuries and upper limb nerve damage to take part in clinical studies and have already begun a new study looking at shoulder pain. They plan to continue their work to integrate the system into the NHS as a service for pain management.

**Rui said:**

*The results so far are very encouraging. As we move onto longer-term studies, we will be looking at optimising the interventions for integration at the point of care and making the technology affordable enough to be used in people's homes.*

**On winning the award, Peter said:**

*We were initially surprised to even be finalists for two awards, so to win the Emerging Technology of the Year award is amazing.*

*The work couldn't have been achieved without the support of our various funders and clinical collaborators; however, it's the participants to whom we are most thankful. Many thanks to everyone we have worked with so far, and we look forward to working with many more in the future as we advance the work.*

This project is a collaboration between RNOH and UCL. The work was supported by the Defence Science and Technology Laboratory, the RNOH Charity, RNOH Trust, Wellcome Trust and the UCL/UCLH NIHR Biomedical Research Centre.

**BIOMATERIALS PROCESSING EXPERT WINS ROYAL ACADEMY OF ENGINEERING AWARD**

**Congratulations to Professor Mohan Edirisinghe OBE FREng, the Bonfield Chair of Biomaterials at UCL Mechanical Engineering, who was awarded the Royal Academy of Engineering's Colin Campbell Mitchell Award 2023.**

The annual award goes to an engineer, or small team of engineers, who have made an outstanding contribution to the advancement of any field of UK engineering.

Professor Edirisinghe, who leads UCL Engineering's Biomaterials Processing Lab, was recognised for his world-leading contribution to the industrial application of polymeric fibres by inventing novel fibre manufacturing vessels and processes.

He has pioneered a process called pressurised gyration, which can simultaneously combine flow rate, applied pressure and rotation speed and is applicable to all types of polymers worldwide.

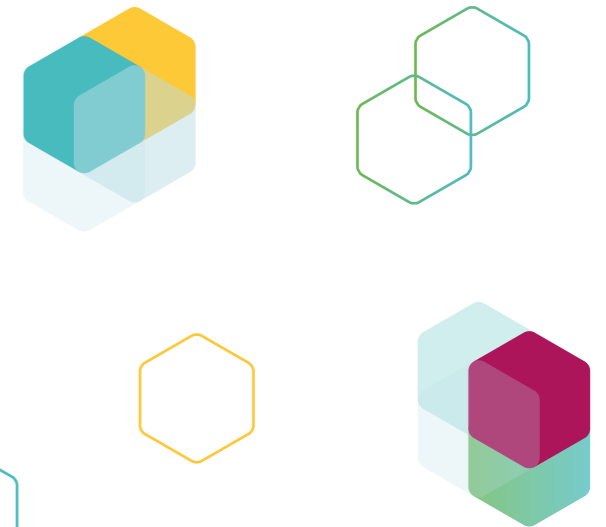
During the early stages of the Covid-19 pandemic, Professor Edirisinghe conducted research in response to a call from the Royal Academy of Engineering to test proposals for the design and development of a new respirator mask that could protect users across the world.

The research outputs from this work on antiviral face masks was sent to the Scientific Advisory Group for Emergencies (SAGE) and the World Health Organisation (WHO). Since then, work has advanced into larger scale production of multi-layered fibres in efforts supported by the Government of Kuwait.

Professor Edirisinghe and his team have also worked with microbiologists, hospitals and industry to develop a new generation of hospital water and air filters with wider application in schools, care homes and on public transport.

**Professor Edirisinghe (UCL Mechanical Engineering) said:**

*I am honoured to receive this prestigious award from the Academy, which is the culmination of 10 years developing the process of pressurised gyration and scalable manufacturing vessels with my colleagues at UCL and collaborating with the international research community mainly in Kuwait, Turkey, USA, and China.*



## TWO UCL ENGINEERING PROJECTS HONoured AT THE 2023 ENGINEERING TALENT AWARDS

The event, held in London on 8 September, recognised and honoured remarkable individuals and organisations that have made significant strides in promoting diversity and inclusion.

### INCLUSION PROGRAMME OF THE YEAR

The UCL x BADU 'Bridging The Gap' programme, a collaboration between the UCL Centre for Engineering Education and BADU Community, won Inclusion Program of the Year.

The programme provides mentoring and tutoring for Black and global majority young people aged 14-19 in East London with the support and resources needed to thrive in their professional journeys.

The four-year partnership has gone from strength to strength, with knowledge-sharing interventions between UCL staff, students, and the BADU community members, making UCL's research and educational resources accessible to East London communities while strengthening the local talent pipeline and supporting local culture.

In 2022, all participating pupils achieved A\*/A in STEM subjects; boys aged 15-16 achieved 100% A\*-B grades across all their GCSEs, accumulating 13 A\*s. All pupils chose UCL as one of their university options, and 89% of alums currently study at top Russell Group universities.



### INNOVATION OF THE YEAR

The UCL Global Disability Innovation (GDI) Hub won Innovation of the Year for the development of a new, refreshable tactile technology Tacilia.

The team aimed to allow children who are blind or have partial sight to be better able to engage with Science, Technology, Engineering, Arts and Maths (STEAM) education.

This project, led by Dr Tigmanshu 'Tigi' Bhatnagar, investigated the problems those pupils faced in the classroom and identified the need for a reconfigurable tactile interface that would help the children read books, explore shapes, design and learn to make senses of (usually) visual information such as graphs and charts.

Tacilia has been developed at UCL with collaborations across the Global Disability Innovation Hub, Institute of Making and UCL's Interaction Centre (UCLIC), with in-the-wild studies conducted in India with the Indian Institute of Technology Delhi (IITD).



# 8 AFTERWORD

### THANK YOU

We have done our best to acknowledge those involved throughout this report, but we know that our thanks extend far beyond those named. All our efforts are an interdisciplinary endeavour and would not be possible without the combined input of our researchers, professional staff, external partners, funders and the public.

### CONTACT US

We're always interested to hear from potential collaborators, members of the public and others who are interested in our research.

Web: [www.ucl.ac.uk/healthcare-engineering](http://www.ucl.ac.uk/healthcare-engineering)

Email: [healthcare-eng@ucl.ac.uk](mailto:healthcare-eng@ucl.ac.uk)

X: [@health\\_eng](https://twitter.com/health_eng)



## **ACKNOWLEDGEMENTS**

Content Development & Editing: Alice Hardy and Ferdouse Akhter  
Graphic Design: Janneke van Leeuwen/The Thinking Eye