Imperial College London

Enterprise

Imperial Enterprise – building immersive collaborations in Japan

Japan visit March 2023

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About Imperial

Imperial College London

Enterprise

Imperial College London's mission is to achieve enduring excellence in research and education in science, engineering, medicine and business for the benefit of society

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At a glance

17,000+
students

3,765
research and academic staff

190,000
alumni

Leadership

Professor Hugh Brady, President

Professor Mary Ryan, Vice-provost, Research & Enterprise

Professor Ian Walmsley, Provost

£1,163m Total income

£368.4m Research grants and contracts income

4 faculties

- Medicine
- Business
- Engineering
- Natural Sciences

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Imperial's world ranking

QS TOPUNIVERSITIES — **2023: 6th in the world**

THE Times Higher Education — **2023: 10th in the world**

SHANGHAI RANKING — **2022: 23rd in the world**

- Founded in 1907
- Regularly ranked among top ten global universities
- 100 RAEng Fellows, 80 MedSci Fellows
- More world-leading research than any other UK university (REF 2021)

World class reputation in science, engineering, medicine, business and computing

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Global Imperial

Times Higher Education

2023:
7th most international university in the world

- 63% of corporate research support is international
- Collaborations with peers in 192 countries in the last decade
- Over 56% (100,000+) research papers with international collaboration
- 190,000 alumni around the world
- 60% of students from outside the UK

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Academic strategy

Sustainable Society

We are helping society to become more sustainable by transforming manufacturing, attitudes to consumption and economic practices.

Healthy Society

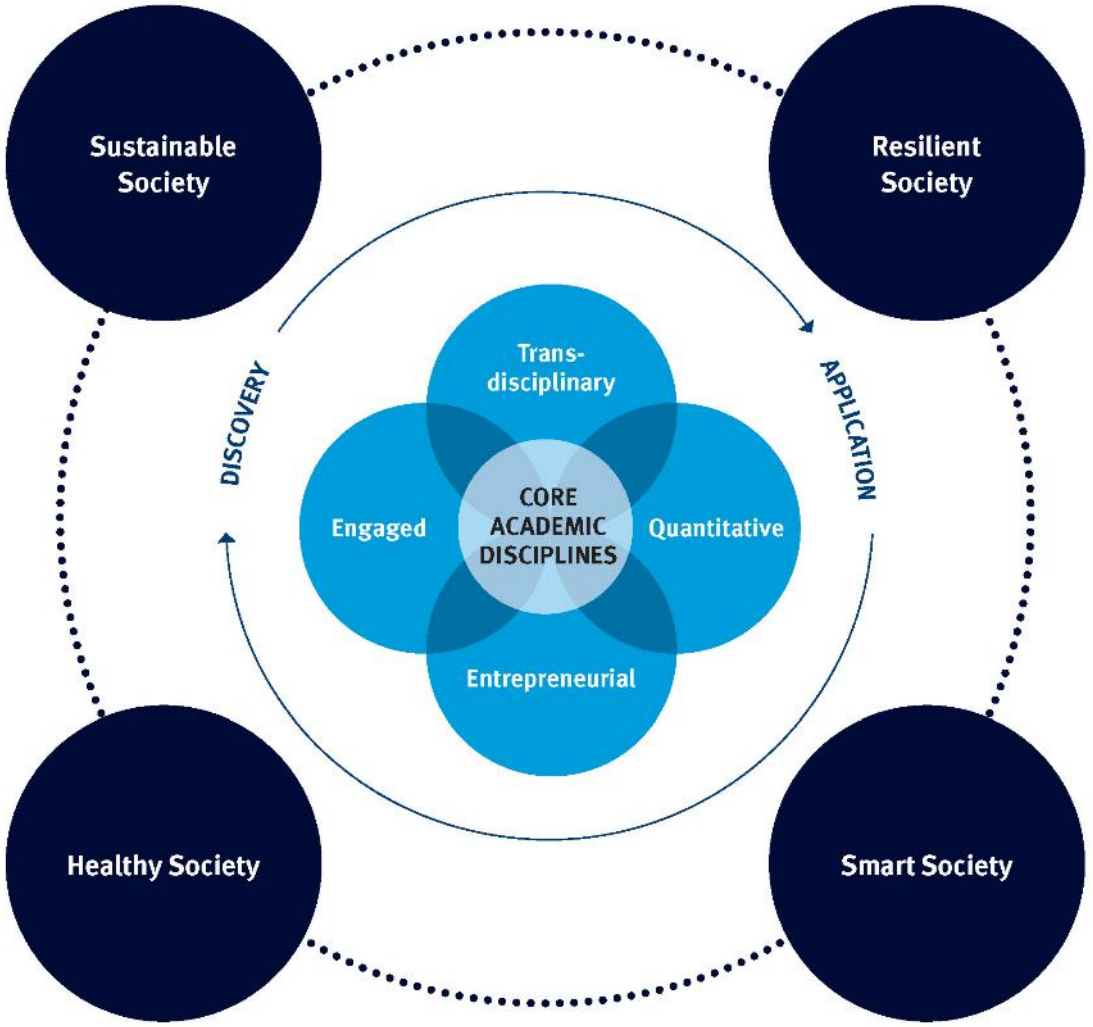
We are innovating new technologies and strategies to improve health services and support the prevention, diagnosis and treatment of disease by converging science disciplines and integrating them with clinical and public health practices.

Smart Society

We are enabling discoveries and developing new technologies in artificial intelligence, machine learning, statistics, data sciences and robotics, and helping to better understand how they will transform lives, environments and present new challenges to the world of work.

Resilient Society

We are developing understanding and technologies to enable stable and robust infrastructures that underpin the delivery of services – from water, fuel and power, to data, communications and the banking system – to make our society resilient.



Our four themes intersect and build upon our core academic disciplines and capabilities

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Key initiatives

Transition to Zero Pollution

An initiative to foster systems-thinking, discovery science, and cross-disciplinary research, building on work done to tackle GHG emissions and net-zero carbon to deliver a sustainable zero pollution future

DT-Prime

A commercialisation programme which transforms deep technology research into investable ventures which have huge transformational potential

I-X

I-X is delivering transformational research, teaching and innovation, co-locating staff, students and industry partners, and demonstrating a new model of co-discovery and co-creation in the digital space.

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Services & support for industry

Clinical samples

Imperial College Healthcare Tissue Bank and the Multiple Sclerosis & Parkinson's Tissue Bank provide industry partners with clinical samples for their own R&D purposes.

ICHTB

Clinical trials

The Imperial Clinical Trials Unit works on major international clinical trials. ICTU can lead studies at all stages of clinical development from advising on unmet medical needs in a therapeutic area, designing, co-ordinating or monitoring international studies to the analysis and communication of results.

ICTU
Imperial Clinical Trials Unit

Diagnostics evaluation

The London In-Vitro Diagnostic Cooperative provide a unique diagnostics evaluation service for diagnostics developers. Combining world-leading expertise in human factors studies with an extensive clinical network, they can provide real-world evidence needed at every stage of development.

NIHR | London In Vitro Diagnostics Co-operative

9 London campuses

6 teaching hospitals, world leading clinicians

White City Innovation District

CENTRAL LONDON Campus locations

Key

- Imperial College Campus
- Hospital and Campus
- Campus shuttle
- Underground station
- National Rail station

Campus shuttle

Stops at:

- SOUTH KENSINGTON CAMPUS
- WHITE CITY CAMPUS
- HAMMERSMITH CAMPUS

Free to staff and students on weekdays.

For more information search for

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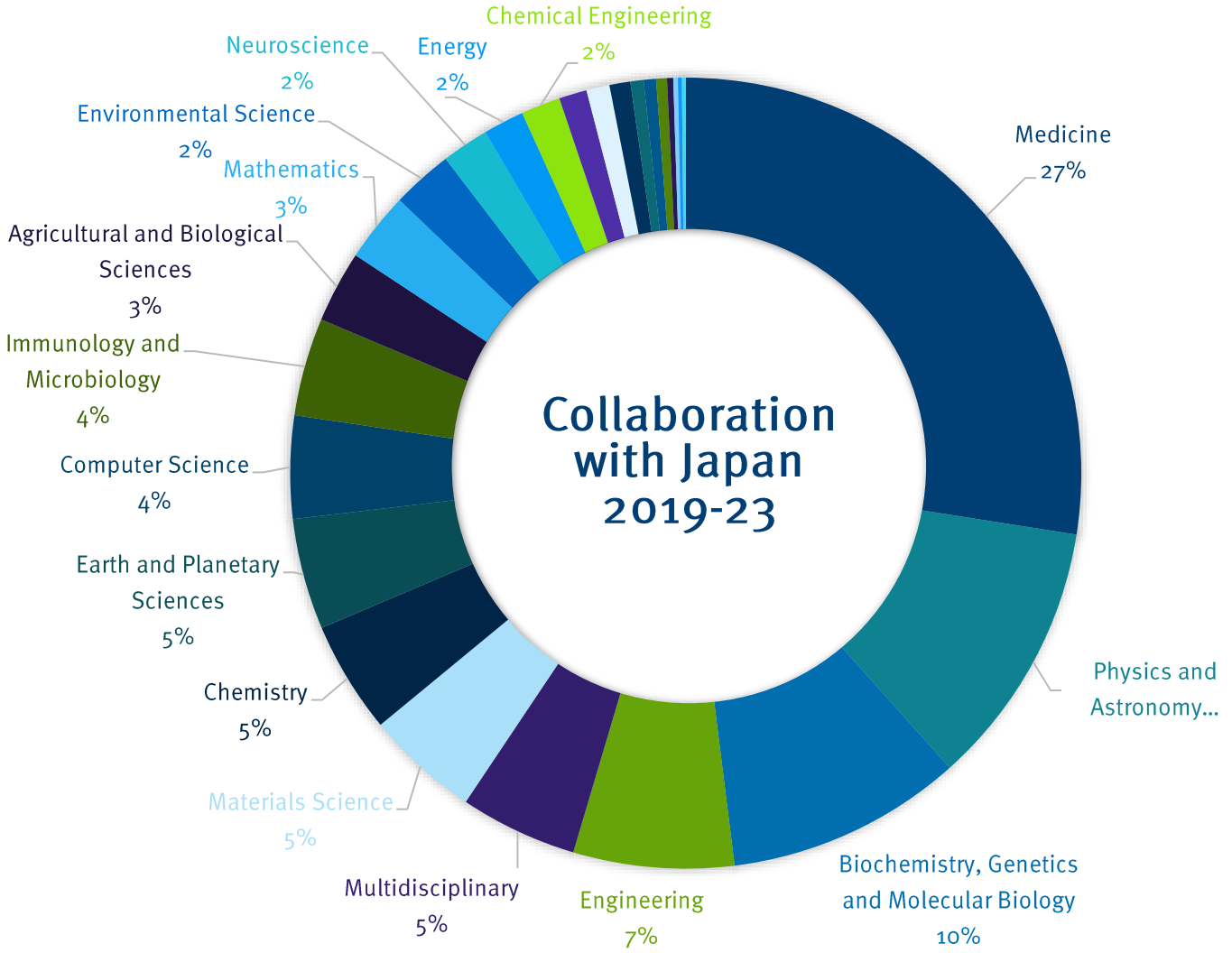
Imperial's research with Japan

Imperial works closely with most of Japan's top universities

- **Kyushu University** – Active collaboration for 20 years focusing on energy materials
- **Keio University** – Institute for Security Science and Technology working with Keio on setting up an international network of universities to address cybersecurity, including collaboration with Hitachi
- **Tokyo Institute of Technology** – Strategic ongoing research collaborations and jointly participated in Global Fellows Programme.
- **Kyoto University** – Exchange of best practice and research with research collaborations across broad areas including physics, medicine and biochemistry.



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Imperial and Japan

As one of the world's most international, innovative and entrepreneurial universities, we are seeking to grow partnerships in Japan and around the world

[More information]

Imperial has worked with over 25 Japanese businesses in the past decade, in projects worth approximately

£10 million

MITSUBISHI HEAVY INDUSTRIES
HONDA
HITACHI
NEC
ONO PHARMACEUTICAL CO.,LTD.
FUJITSU
SHIONOGI
astellas
Daiichi-Sankyo
Sumitomo Dainippon Pharma

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Enterprise – building collaborations

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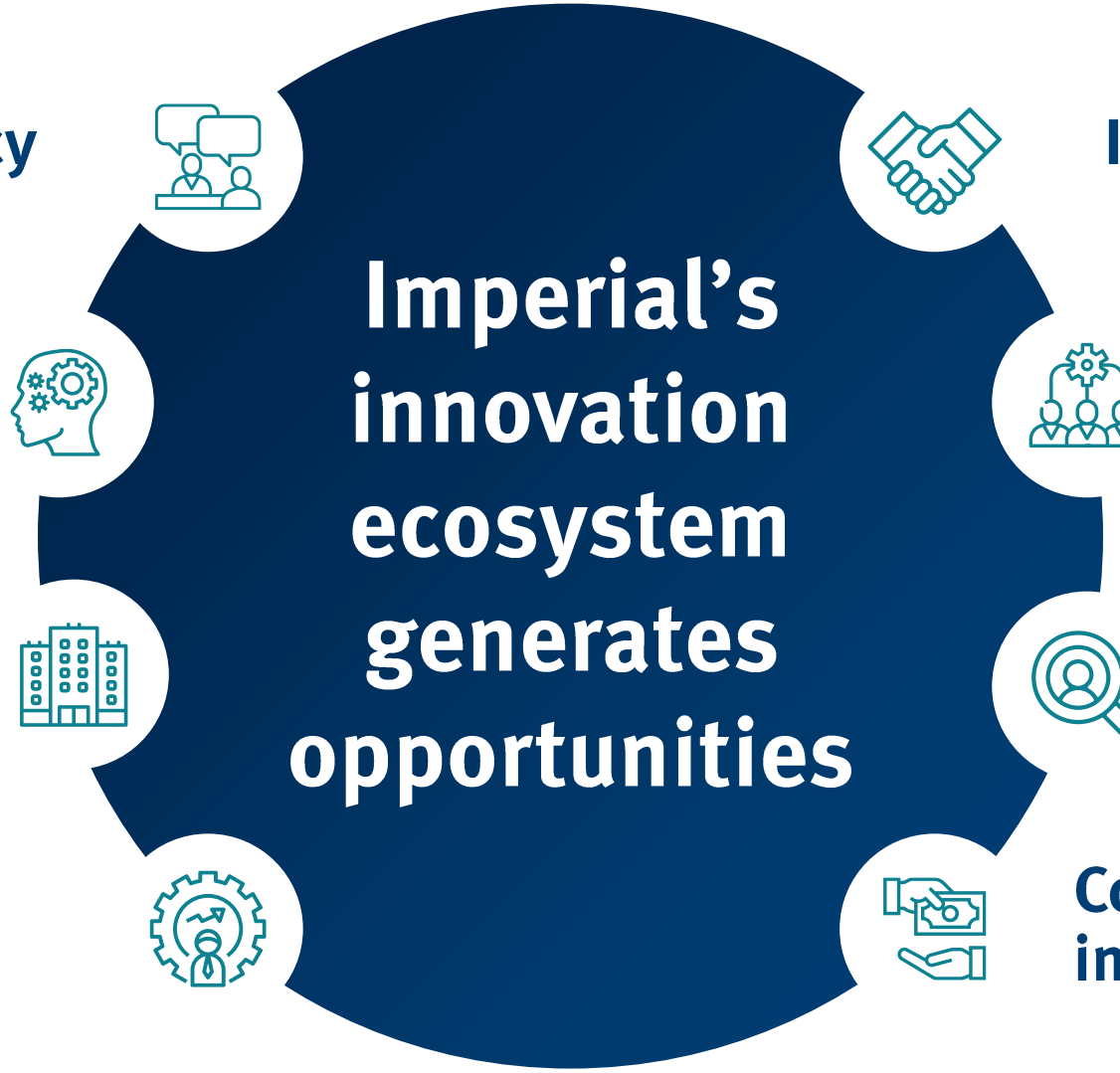

Consultancy

Industry partnerships

Executive education

Startup and co-location spaces

Engagement and networking

Recruitment

Entrepreneurship

Commercialisation and investment

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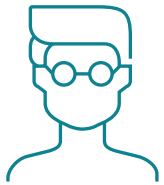
Imperial Enterprise offers partners access to and participation in our innovation ecosystem

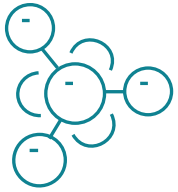
We offer our partners:



The **expertise** of Imperial academics

The **talent** of our students

The **entrepreneurial spaces** on our 9 campuses



Our high-tech **facilities**

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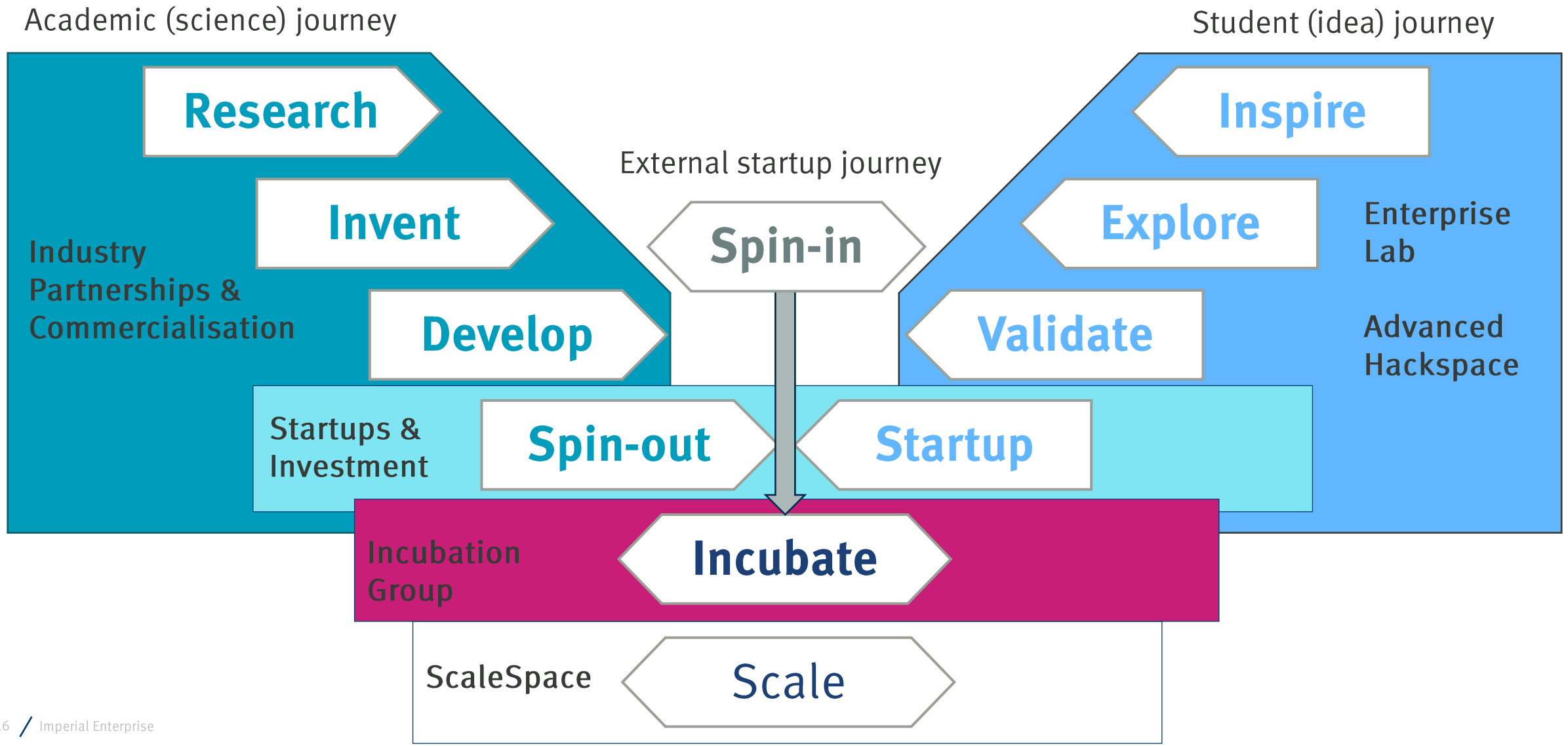
Enabling all founders



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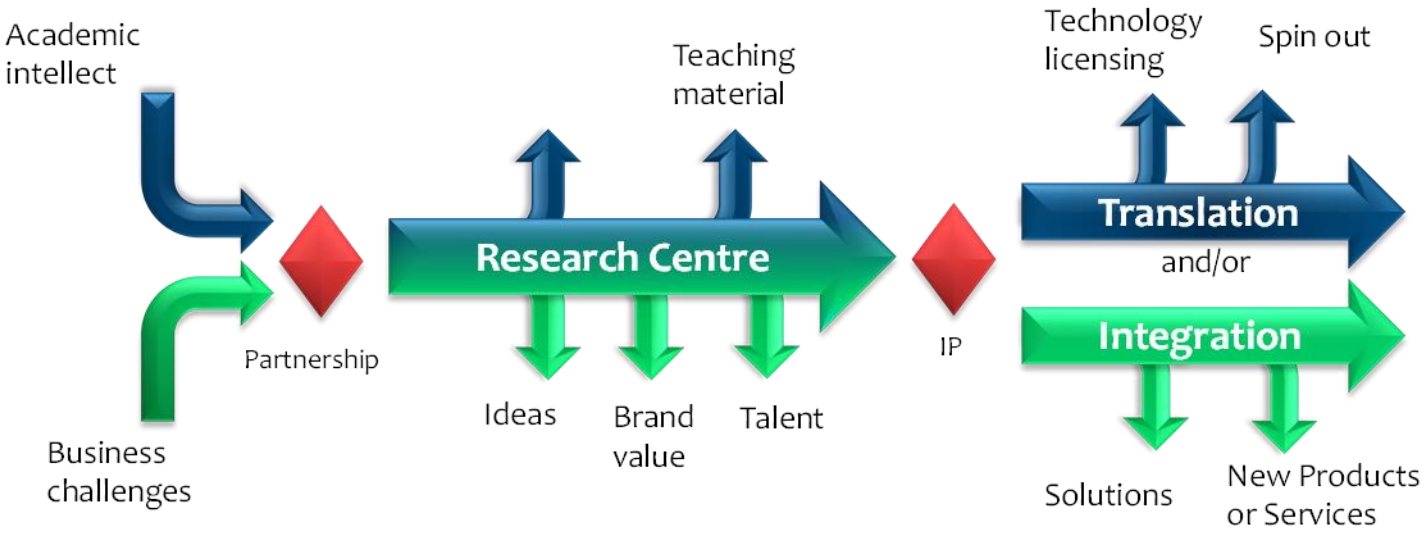
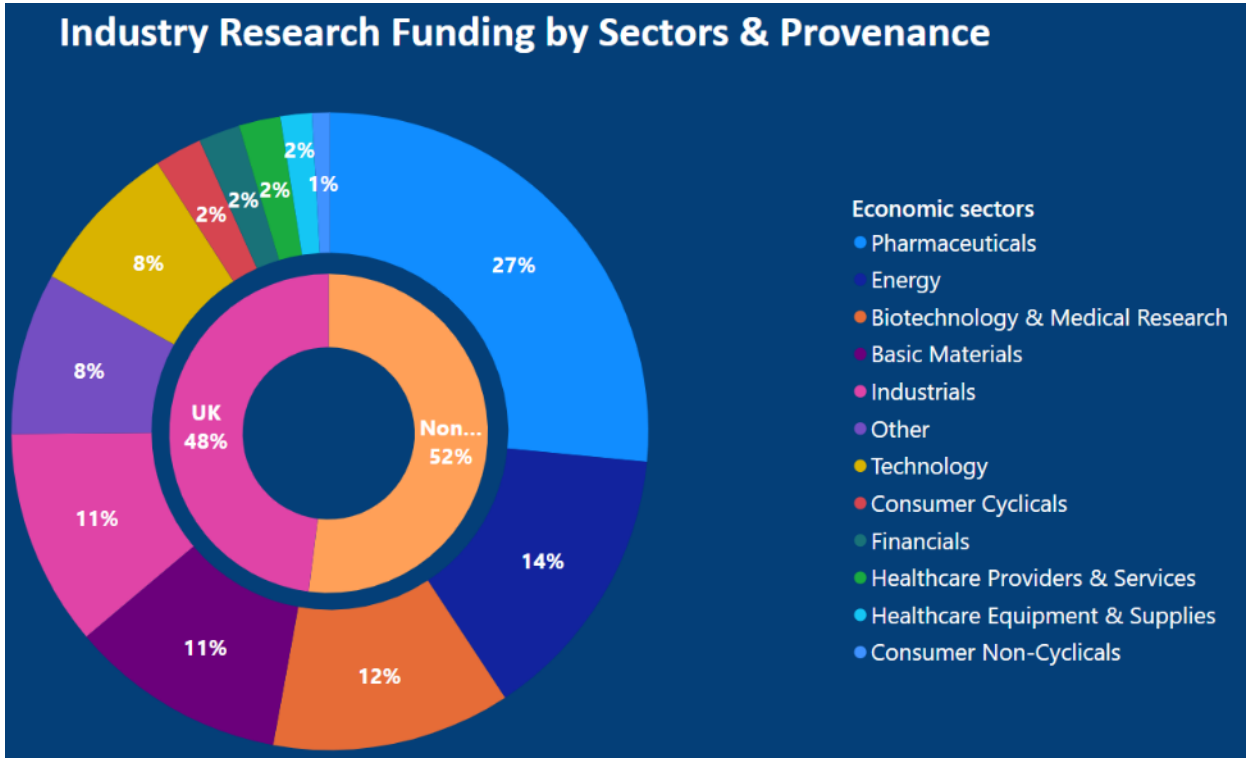
Industry partnerships

**Average/year direct funding £48m+ awards,
#2 in UK, #13 in US-UK**

35 Strategic Partners, 33 managed accounts, 150+ growth and prospects

In many cases these are the same groups that invent, protect and license or form new startups





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Major partners

200+
Corporate partners

Over £50m research funding
per year

Helping businesses innovate
globally

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Flexible partnering approaches

Flagship industry-funded centre

Multi-university industry collaboration

Therapeutic fund

Corporate engagement

Doctoral training centres

Multidisciplinary industry collaborations

Proof of concept funds

Sponsored research

Contract research

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Agilent Measurement Suite at Imperial College

"We look forward to continuing the partnership with Imperial College London and working together on bringing more solutions and innovation to the scientific community."

Maria Angeles Diaz
EMEA and India Sales Vice President & General Manager at Agilent Technologies

- Established March 2018, £4M state of the art laboratory hosted at Imperial College's Molecular Sciences Research Hub
- 36 instruments supporting interdisciplinary research in areas such as clinical diagnostics, biopharmaceuticals, energy and chemicals, environmental science, food testing and agriculture, and materials research
- Support development of PhD, MSc and undergraduates through establishment of a demo, training and seminar facility
- Drive further collaborative projects to the benefit of both partners, and to move cutting-edge research forward

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Immersive Partnership

340+
People Engagement

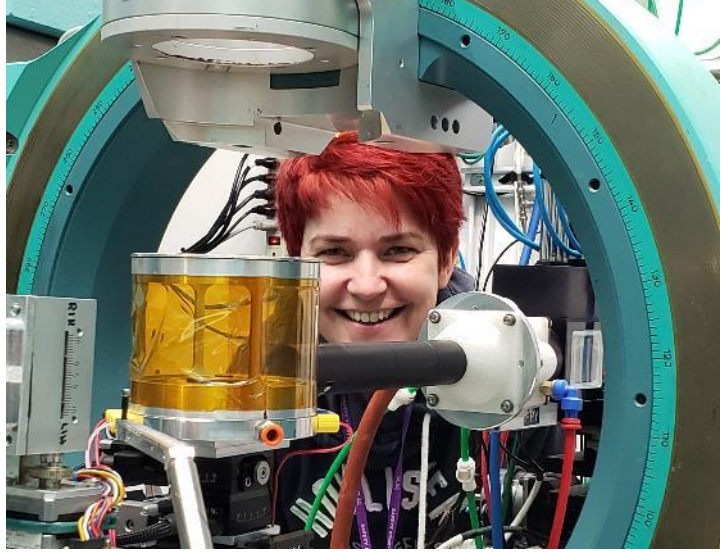
11
Departments

5
Research Centres

100+
Graduates hired

£40m+
R&D portfolio

150+
R&D & Consultancy contracts

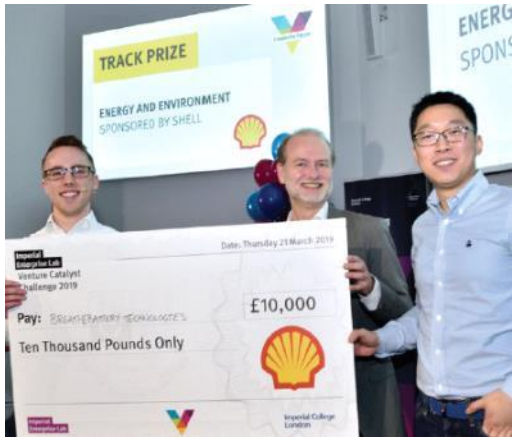


IMPACT

NEW METHANE AND ENVIRONMENT PROGRAMME (MEP)

The Methane and Environment Programme (MEP) was launched in May 2018, with the aim of conducting innovative research to improve our understanding of methane emissions and other environmental impacts associated with gas systems, and how to reduce them.

The team have already begun publishing some high impact research articles on the use of global warming potentials (GWP) and on the end-uses of gas for shipping and for hydrogen production. MEP works closely with industry partners including the Oil and Gas Climate Initiative and is a core member of the Methane Guiding Principles, an industry-led initiative to better understand, manage and eliminate methane emissions from gas supply chains.



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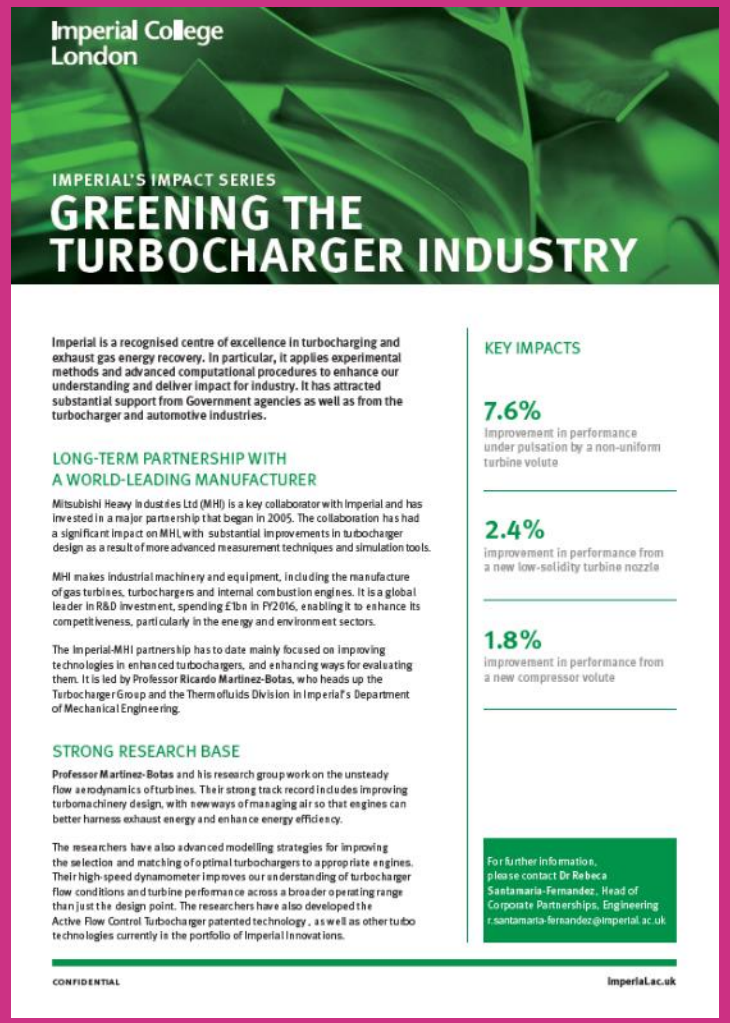
MITSUBISHI HEAVY INDUSTRIES, LTD.

Co-located Innovation to accelerate Translation

MHI is a key partner for Imperial, with a major partnership that began in 2005. The collaboration has had a significant impact on MHI, with substantial improvements in turbocharger design as a result of more advanced measurement techniques and simulation tools.

MHI-Imperial Future of Boosting Innovation Centre: Partnering with world-leading manufacturer in Japan to improve turbocharger design and develop cleaner engines



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IMPERIAL'S IMPACT SERIES

GREENING THE TURBOCHARGER INDUSTRY

Imperial is a recognised centre of excellence in turbocharging and exhaust gas energy recovery. In particular, it applies experimental methods and advanced computational procedures to enhance our understanding and deliver impact for industry. It has attracted substantial support from Government agencies as well as from the turbocharger and automotive industries.

LONG-TERM PARTNERSHIP WITH A WORLD-LEADING MANUFACTURER

Mitsubishi Heavy Industries Ltd (MHI) is a key collaborator with Imperial and has invested in a major partnership that began in 2005. The collaboration has had a significant impact on MHI, with substantial improvements in turbocharger design as a result of more advanced measurement techniques and simulation tools.

MHI makes industrial machinery and equipment, including the manufacture of gas turbines, turbochargers and internal combustion engines. It is a global leader in R&D investment, spending £1bn in FY2016, enabling it to enhance its competitiveness, particularly in the energy and environment sectors.

The Imperial-MHI partnership has to date mainly focused on improving technologies in enhanced turbochargers, and enhancing ways for evaluating them. It is led by Professor **Ricardo Martinez-Botas**, who heads up the Turbocharger Group and the Thermofluids Division in Imperial's Department of Mechanical Engineering.

STRONG RESEARCH BASE

Professor Martinez-Botas and his research group work on the unsteady flow aerodynamics of turbines. Their strong track record includes improving turbomachinery design, with new ways of managing air so that engines can better harness exhaust energy and enhance energy efficiency.

The researchers have also advanced modelling strategies for improving the selection and matching of optimal turbochargers to appropriate engines. Their high-speed dynamometer improves our understanding of turbocharger flow conditions and turbine performance across a broader operating range than just the design point. The researchers have also developed the Active Flow Control Turbocharger patented technology, as well as other turbo technologies currently in the portfolio of Imperial Innovations.

KEY IMPACTS

7.6%
Improvement in performance under pulsation by a non-uniform turbine volute

2.4%
improvement in performance from a new low-solidity turbine nozzle

1.8%
improvement in performance from a new compressor volute

For further information, please contact Dr Rebeca Santamaria-Fernandez, Head of Corporate Partnerships, Engineering
r.santamaria-fernandez@imperial.ac.uk

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"The work with MHI has not just advanced our understanding of exhaust turbochargers for cleaner engines, but it also has enabled new concepts based on this understanding"
Prof R Martinez-Botas

https://www.imperial.ac.uk/news/194666/imperial-mitsubishi-launch-turbocharger-centre-develop/

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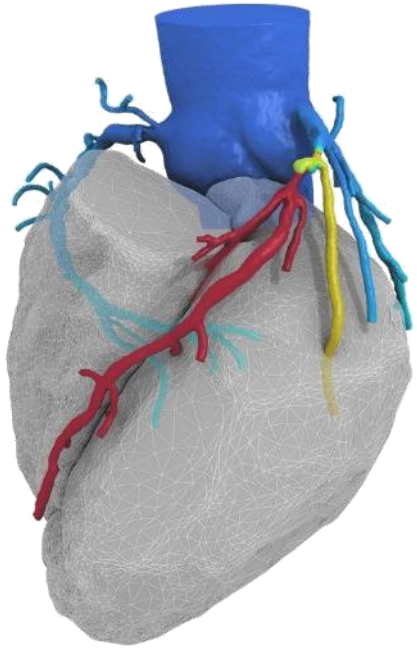
HeartFlow™ Enterprise

Engagement with Healthcare SME

Bringing personalised heart disease diagnosis closer



"The collaboration with HeartFlow will not only open new and exciting research directions, but it will also pave the way for bringing our latest deep learning technology into clinical practices and thus will have real impact on the healthcare of thousands of patients.“
Dr B Glocker

A new mode of engagement partnering with Californian SME to accelerate turning cutting-edge science into ground-breaking products that can positively impact how patients with suspected heart disease are diagnosed and managed

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Examples of Industry funded R&I Centres

+ Co-located Staff
+ 2-way engagement
+ Maximising impact
+ Fast response
+ Flexibility
+ Trusted partners

Cultivating strategic partnerships to foster knowledge exchange

Digital Rocks

Sustainable Gas

Advanced Interfacial Materials

Mobility & Lubricants

Shell Leonardo Centre

PETRONAS Centre for Engineering of Multiphase Systems

Leica Microsystems Imaging Hub

BP International Consortium for Advanced Materials

Agilent Measurement Suite at White City

Mitsubishi Heavy Industries

Rolls-Royce Vibration UTC, Nuclear Eng UTC

Heartflow Lab

dyson Robotic Vision Lab

ABB Pilot Plant

GlaxoSmithKline Engineered Medicines Lab

Lilly Pharma Systems Engineering

Jaguar Land Rover Spark Ignition Engine Combustion

Samsung Quantum Simulation

Sinopec Geophysics Academy

CRRC Rail Transportation Manufacturing

Lightweight Materials

Hitachi Inspire the Next

Hitachi and Imperial Centre for Decarbonisation and Natural Climate Solutions

Digital Demonstrator

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Licensing - Imperial.tech

Industry Partnerships and Commercialisation Team

- Help academics and businesses work together to develop new insights and technologies and translate them into commercial opportunities
- Team of experienced licensing professionals to navigate the most suitable arrangement with industry partners
- Support for commercialisation of technologies developed by Imperial researchers from all faculties
- Support for translational grant funding applications

More information

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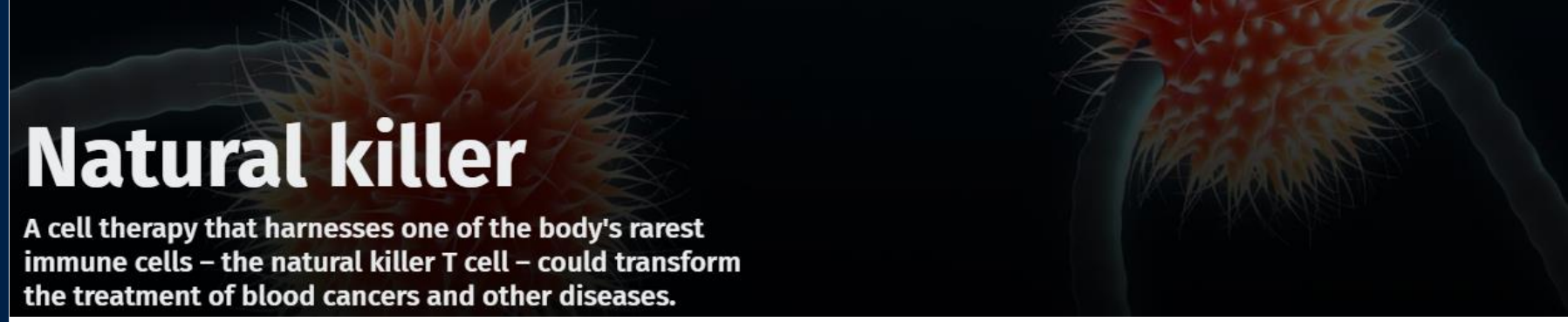
CAR-iNKT Therapy – licence deal



Summary

The immunotherapy, based on research by Professor Tassos Karadimitris and his team at Imperial's Centre for Haematology, harnesses the invariant natural killer T (iNKT) cell, a rare type of immune cell that works alongside antibodies and T cells as part of the body's natural immune defences. The therapy will use iNKT cells that have been combined with lab-made proteins known as chimeric antigen receptors (CARs), which cause the immune cells to recognise and activate against target cells such as cancers.

Arovella Therapeutics has benefited from a licensing deal and collaborative research, and has engaged Professor Karadimitris as an advisor through Imperial Consultants. Imperial College's Enterprise team helps companies such as Arovella Therapeutics access Imperial's expertise and resources in a range of ways including research partnerships, consultancy, technology licensing, and co-location.

More information

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Consultancy – Imperial Consultants

- Imperial Consultants – wholly owned subsidiary operating for over 30 years
- Mission to maximise economic and social impact by applying Imperial's cutting edge expertise and facilities to address real-world challenges
- Access to over 4000 leading academics
- Imperial Consultants can find the right consultant, with the right expertise to address your challenge.

More information

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Consultancy - examples

Disperse

Consultancy through ICON for general purpose guided wave inspection software developed through Imperial's research into non-destructive evaluation

More information

Robofold

Imperial's expertise in finite element modelling applied to help take the Robofold system into mass production

More information

Cystic Fibrosis Advisory

Imperial's expertise in Cystic fibrosis, drug development and clinical trials helped Proteostasis Therapeutics assess potential treatments to improve lung function.
More information

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Imperial Business Partners

- Imperial Business Partners (IBP) is the college's flagship industry partnership programme
- IBP brings your business closer to our world-leading experts, promising talent, emerging innovation, start-ups and scale-ups.

More information

"Through bespoke workshops and learning journeys on the future of manufacturing, we were able to provide our network with a credible vision of the pioneering technologies and innovative manufacturing processes disrupting the industry. The entrepreneurial ecosystem at Imperial College is truly inspiring."

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IBP Pathfinder – an energy provider gains insights into the electricity mix

- IBP leveraged the expertise of Imperial's Energy Future Lab to commission a report into electricity market design
- Report aimed to assess how electricity markets can be re-imagined for a significantly decarbonised electricity production mix by 2050
- Covered ways in which market design affects investment in renewable energy
- IBP curated roundtable discussion with the client, academic authors, and members of the UK's Department for Business, Energy and Industrial Strategy

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Imperial's innovation ecosystem – in action

proton dx

Rapid, portable, accurate point of care diagnostics

Dragonfly – launched product

Imperial Techcelerate Programme

2019

MedTech SuperConnector

2020

Startup formed

IP Licence

IVMS

2020

Office & Lab

2021

Angel investment

Innovate UK grant

2021

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Researcher profiles

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Professor Neena Modi

Vice Dean of International Professor of Neonatal Medicine

Bio

Neena Modi is Professor of Neonatal Medicine, Imperial College London, a fellow and council member of the UK Academy of Medical Sciences, and president-elect of the European Association of Perinatal Medicine.

Neena is a past-president of the British Medical Association, Medical Women's Federation, and Royal College of Paediatrics and Child Health. She has also headed The Neonatal Society and Academic Paediatrics Association of Great Britain and Ireland.

Neena leads a multidisciplinary neonatal research group, and the UK National Neonatal Research Database and eNewborn, an International Neonatal Research Database. Her work on the use of real-world health data for patient benefit has been widely acclaimed. She received the Royal College of Physicians of London, Excellence in Patient Care Award for Innovation 2018 (the National Neonatal Research Database: A road-map for NHS "big-data" to improve care, services and patient outcomes) and in 2022 the US FDA funded Critical-Path Institute, International Neonatal Consortium, Data Pioneer Award for contributions to health data research.

More information

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Professor Ramesh Wigneshweraraj

Professor of Molecular Microbiology

Bio

Ramesh Wigneshweraraj is Professor of Molecular Microbiology and Head of Section of Molecular Microbiology. He is also the Campus Dean for the Faculty of Medicine South Kensington Campus and member of the steering board of the Institute of Infection at Imperial College.

As a founding member of the Medical Research Council (MRC) Centre for Molecular Bacteriology and Infection (CMBI) at Imperial College, Professor Wigneshweraraj developed and led the CMBI's post-graduate research and teaching programme in bacteriology for ten years as the Director for the CMBI's clinical and non-clinical PhD training programmes, and subsequently served as the CMBI's interim Director. Among other advisory roles, Professor Wigneshweraraj is the Chair of the International Scientific Advisory Board of the Serbian government's initiative to develop a hub for innovation, entrepreneurship and multidisciplinary biomedical research in Belgrade.

Having trained at Imperial College, National Institute of Genetics in Mishima, Japan and the EMBL Outstation in Hamburg, Germany, Professor Wigneshweraraj research interests are on how RNA-RNA interaction networks affect gene expression, competitiveness, survival and antibiotic sensitivity of growth-arrested bacteria and the development of programmable RNA-targeting antibiotic alternatives.

More information

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Professor Masao Takata

Magill Chair in Anaesthetics & Head of Division of APMIC

Bio

Prof Takata holds the Magill Chair in Anaesthetics at Imperial College London, and is Head of the Division of Anaesthetics, Pain Medicine & Intensive Care within the Department of Surgery & Cancer. He is also an Honorary Consultant in Anaesthesia & Intensive Care at the Chelsea & Westminster Hospital, London UK.

Originally trained as a paediatric anaesthetist/intensivist in Japan and Canada, Prof Takata attained a broad range of research experience spanning from cardiorespiratory physiology at Johns Hopkins (USA), vascular molecular biology at Harvard (USA), to immunology at Kennedy Institute of Rheumatology (UK). After joining Imperial in 1998, he has established an internationally unique translational research programme in respiratory and critical care, investigating the molecular and inflammatory mechanisms of acute lung injury by use of combined in vivo, ex vivo and in vitro methodologies as well as clinical translational studies in perioperative and critical care patients. Specific research interests include: 1) novel inflammatory mechanisms/therapies in acute lung injury and ventilator-induced lung injury; 2) the roles of extracellular vesicles in acute respiratory distress syndrome and systemic organ injuries in critical care; 3) and more recently, diagnostic/therapeutic targets in emerging respiratory infections such as COVID-19. His research group has developed a wide range of collaborations across the College, its affiliated NHS hospitals and other institutions in the UK, Europe and Japan.

Prof Takata is an alumnus of Tokyo Medical & Dental University and has been working as an external executive director of the university since April 2020 to advise on its global strategies. He is currently a member of the Steering/Preparatory Committee for the creation of the new 'Institute of Science Tokyo' in Japan.

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Professor Kazuhiro Ito

Principal Research Fellow in Respiratory Molecular Pharmacology

Bio

Prof. Kaz Ito is a Principal Research fellow of respiratory molecular pharmacology in National Heart and Lung institute in Imperial College London.

His areas of expertise are development of inhaled/intranasal medicines, premature aging and respiratory infection using 3D culture primally cell model.

He also co-founded three biotech companies and led projects in two pharmaceutical companies in respiratory disease area, resulting in him being well known and highly respected in industrial pharmacological circles as well as a highly cited respiratory research scientist.

More information

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Dr Vanessa Sancho-Shimizu

Senior Lecturer in Paediatric Infectious Diseases

Bio

Vanessa Sancho-Shimizu Ph.D. is a UKRI Future Leaders Fellow and Senior Lecturer/Associate Professor in the Department of Infectious Disease at Imperial College London. Her lab is interested in understanding the genetic basis of life-threatening infections and has elucidated the first genetic aetiologies of childhood herpes encephalitis, critical COVID-19 disease, and invasive meningococcal disease.

Her research focusses specifically on assessing rare genetic variants identified via whole exome sequencing that affect responses to viral or bacterial infections including type I, II, II interferons, TLR signalling, autophagy, and other pathogen recognition pathways. She has established a specialized Paediatric Infectious Disease clinic to recruit patients who are otherwise healthy presenting with life-threatening infections in collaboration with her Paediatric colleagues and the NHS at St Mary's Hospital in London. Her lab has established the use of patient cell-based assays including iPSC derived neuronal cultures and cerebral organoids for identification and characterization of new inborn errors of immunity.

Dr Sancho-Shimizu is a Satellite Group Leader at the Francis Crick Institute, executive board member of the Centre for Paediatrics and Child Health at Imperial College London, elected member of the Henry Krunkel Society and steering committee member and co-lead for the international COVID Human Genetic Effort (COVIDHGE).

More information

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Dr Nick Powell

Clinical Reader in Gastroenterology

Bio

Dr Nick Powell is a Reader in Gastroenterology in the Faculty of Medicine at Imperial College, and an honorary consultant at Imperial College Healthcare Trust.

His work focusses on the molecular and cellular regulation of intestinal inflammation, mucosal immunology, precision medicine and immune-checkpoint inhibitor induced colitis. His team harnesses multi-omic platforms, particularly transcriptomics and metabolomics to decode the molecular interactions between the bacterial communities that colonize the gut and the mucosal immune system. This research primarily focuses on inflammatory bowel disease (IBD) and intestinal inflammation developing in cancer patients treated with immune checkpoint inhibitors. He has made important contributions to the understanding of innate lymphoid cells and mononuclear phagocytes in IBD.

Dr Powell recently chaired the British Society of Gastroenterology endorsed guidance on the management of immune-checkpoint inhibitor induced colitis, and the British Society of Gastroenterology Inflammatory Bowel Disease section and IBD Clinical Research Group position statement on SARS-CoV2 Vaccination. He is a member of the Scientific Advisory Group member (oncology) for the European Medicines Agency and a member of several international Clinical Trial Steering Committees for IBD studies (including IM011023, IM011024, IM011127).

Dr Powell is enthusiastically engaged with training the next generation of clinical and basic science academics. He is the Integrated Academic Training lead for Gastroenterology at Imperial and the co-lead for the Digestive Diseases theme of Imperial's Biomedical Research Centre.

More information

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Dr Masahiro Ono

Reader in Immunology

Bio

Dr Masahiro Ono is an immunologist and expert in T-cell regulation. His research focuses on mechanisms of T cell activation and regulation in autoimmunity, infections, and cancer. He is the pioneer of the Timer-of-Cell-Kinetics-and-Activity (Tocky, とき), which analyses temporal changes of T-cell activities in vivo using Fluorescent Timer protein.

Dr Ono did his undergraduate in Faculty of Medicine, Kyoto University (1993-1999, MD) and later was trained in dermatology. He did his PhD in 2002 - 2006 in the study of regulatory T cells (Tregs) and the transcription factors Foxp3 and Runx1, starting his immunology career. In 2009, he obtained a HFSP Fellowship, and joined University College London (UCL), when he extended his research to immunological genomics. In 2012, he was awarded a BBSRC David Phillips Fellowship, and established his lab in UCL. He joined Imperial in 2015 and was appointed as a Senior Lecturer in 2018. He was promoted to a Reader in Immunology in 2020.

More information

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Professor Ricardo Martinez-Botas

Professor of Turbomachinery

Bio

Ricardo has an MEng (Hons) Degree in Aeronautical Engineering from Imperial College London. He obtained a DPhil in the Rolls Royce University Technology Center at the University of Oxford University in 1993 with a thesis entitled Annular Cascade Aerodynamics and Heat Transfer.

He has developed the area of unsteady flow aerodynamics of small turbines, with particular application to the turbocharger industry. The contributions to this area centre on the application of unsteady fluid mechanics, instrumentation development and computational methods. The work has attracted support not only from Government agencies but also from industry. His group has become a recognised centre of turbocharger turbine aerodynamics, and more particularly in the application experimental methods and one dimensional calculation procedures.

Professor Martinez-Botas is the Mitsubishi Heavy Industries (MHI)-Imperial Future Boosting Innovation Centre, which aims to improve turbocharger design and develop cleaner engines. He is a Visiting Professor in the University Teknologi of Malaysia. He has published extensively in journals and peer reviewed conferences. He is Associate Editor of the Journal of Turbomachinery (ASME) and the Journal of Mechanical Engineering Science (IMechE).

He is currently the Theme Leader for Hybrid and Electric Vehicles of the Energy Futures Lab at Imperial College.

More information

Imperial College London

Enterprise

Professor Stephen Skinners

CeresPower/RAEng Research Chair in Electrochemical Devices for a Zero Carbon Economy

Bio

Stephen Skinner joined Imperial College in 1998 and was promoted to Professor in 2014. In March 2021 he was appointed Ceres Power/RAEng Research Chair in Electrochemical Devices for a Zero Carbon Economy.

His research interests are in materials for new energy technologies and is primarily concerned with the chemical and physical properties of solid oxide fuel cell electrolytes and electrodes and encompasses the electrical and structural characteristics of materials. He has extensive experience of the use of neutron and synchrotron facilities to undertake in-situ high temperature characterisation of new materials and in relating the structural characteristics of materials to their electrochemical properties. A particular field of interest is the development of interstitial oxide ion conductors for fuel cell applications. He has collaborated widely throughout Europe, Canada and Japan on new materials development and continues to develop links with research groups worldwide. His group are also engaged in the development of high temperature electrolysers based on both oxide ion and proton conducting oxides, permeation membranes, sensor coatings and solid state electrochemical sensors.

He is a Fellow of The Royal Society of Chemistry, a Fellow of the Institute of Materials, Minerals & Mining, and also a Fellow of the Higher Education Academy. Stephen is a member of The Electrochemical Society, The American Chemical Society and the American Ceramic Society. He is also a Chartered Chemist and Chartered Scientist.

More information

Imperial College London

Enterprise

Dr Ifan Stephens

Reader in Electrochemistry

Bio

Ifan leads the Interfacial Electrochemistry Group at the Department of Materials.

Ifan joined Imperial College in July 2017. Prior to Imperial, he was at the Department of Physics at the Technical University of Denmark (DTU); he was first employed as a postdoctoral researcher, then as assistant professor and finally as associate professor and leader of the Electrocatalysis Group there.

In 2015, Massachusetts Institute of Technology (MIT) appointed Ifan as the Peabody Visiting Associate Professor. He taught and conducted research at the Department of Mechanical Engineering at MIT for a whole semester.

Ifan's research aims to enable the large-scale electrochemical conversion of renewable energy to fuels and valuable chemicals and vice versa. Such processes will be critical in order to allow the increased uptake of renewable energy.

His focus is on the catalyst at the electrode, i.e. the electrocatalyst. It turns out that the electrocatalyst material defines the efficiency of several important electrochemical processes, including: electrolysis, fuel cells, the green synthesis of valuable chemicals, and batteries.

Ifan has discovered or co-discovered several new catalysts for the oxygen reduction reaction, which exhibited significant improvements in performance over the prior state-of-the-art (see Selected Publications). His research on hydrogen peroxide production led to the establishment of the spinout company, HP Now.

More information

Imperial College London

Enterprise

Licensing opportunities

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Healthcare, Medtech
Reference: 11062

More information

Technology

Detection and monitoring of COPD severity with wearable photoplethysmography

Problem addressed

Currently COPD detection is done by spirometry which is not a wearable instrument and requires medical staff training to be used effectively. Simple exercises like ball-blowing also exist for monitoring respiratory effort and breathing but these techniques are cumbersome and intrusive.

Using PPG for COPD detection does not require any calibration or medical training and can be used to constantly monitor disease indicators and severity of individuals using a wearable. With constant monitoring early signs of disease exacerbation and life-threatening worsening can be detected which will allow more effective patient treatment planning.

Benefits of Technology

- Algorithms and methods are implementable in existing wearable PPG hardware, such as smart watches or smart earphones
- Acts as a low-cost alternative to hospital examinations in a wearable form factor
- Enables 24/7, out of clinic monitoring of obstructive breathing disorders.
- Can be used to screen for COPD in consumer wearables.

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Biotechnology
Reference: 10430

More information

Technology

Active delivery of Zinc Fingers for in vivo enhancement of gene regulation. Universal method to enhance control of gene expression in vivo.

Problem addressed

Current Zinc Finger (ZF) Peptide therapies work well for months but the expression levels beyond 6 months are significantly lower than after initial injection. Typically, only about 25-30% of whole-brain gene targets are repressed with standard constructs beyond 6 months.

Our ZF active delivery constructs improve this situation by continuing 'drip-feeding' secreted cell-penetrating factors to bystander cells in the brain and other tissues by exploiting ZFs' intrinsic cell penetrating properties. These unique cell-penetration properties have not been coupled before to secrete in vivo, nor delivered with adeno-associated viruses.

Benefits of Technology

- Provides new zinc finger peptides and encoding nucleic acid molecules that can be used for the modulation of gene expression in vitro and/or in vivo.
- Therapeutic applications for clinical diseases where altered expression of genes is a key part of the disease aetiology.

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: ICT/Digital (Hardware)
Reference: 11073

More information

Technology

Low power nanomagnet storage and computing. Method to change the state of individual magnetic nanoparticles within a dense array using a low cost, low-power laser.

Problem addressed

Computation is forecasted to reach 30% of global energy production by 2030. However, systems using nano-magnetics could be up to 100,000 times more energy efficient than standard electronics as information is transferred as a wave, reducing global energy need.

Established nanomagnetic technologies require ultrafast and intense pulses of light from expensive high-power lasers and dependent on circular optical polarisation or a magnetic field. This technology uses extremely low power continuous wave lasers with linear polarization in the absence of a magnetic field.

Benefits of Technology

- All optical magnetic switching with extremely cheap low power lasers in the absence of a magnetic field.
- Low power, high density data storage well suited to hardware neural networks.
- Potential application in next-generation neuromorphic computation hardware
- Magnetic computing is theoretically 100,000 times more energy efficient data storage compared to standard electronics.
- Low cost materials such as aluminium, nickel and iron compared to existing techniques
- Continuous wave laser uses linear polarization and so is not dependent on circular optical polarization.

Imperial College London

Enterprise

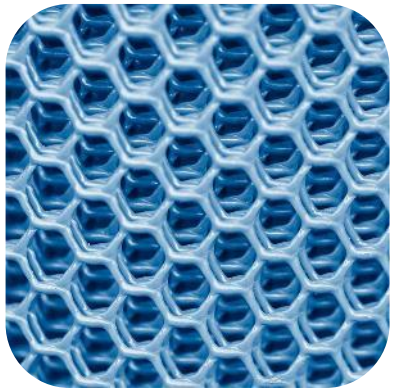
Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Chemicals
Reference: 6702

More information

Technology

Nanotube-grafted carbon fibres. Production method introducing carbon nanotubes to carbon fibre composites to give enhanced mechanical and electrical properties



Problem addressed

Carbon Fibre (CF) composites are state-of-the-art structural materials with excellent tensile properties, but there are critical limiting factors associated with the fibre-matrix interface, such as poor compression performance and poor interlaminar toughness.

Chemical Vapour Deposition (CVD) used to synthesise Carbon Nanotubes (CNT) in-situ on primary fibres is simple, economic and has shown promising results. However, the CVD process typically leads to damage of the underlying CF substrate through catalyst pitting, reducing the primary properties of interest. While protective coatings can mitigate this, such coatings create an additional weak interface and limit anticipated benefits of CFs.

Benefits of Technology

- CNT grafted CFs with superior mechanical and electrical properties
- CF tow left undamaged without the need for barrier coatings or vacuum processes
- Uniformly aligned and densely packed CNT growth within and along the carbon fibre tow
- Uniquely suitable for structural composite applications

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Industrials
Reference: 7237

More information

Technology

Seismic Metamaterials. Vibration defence structure to reflect and partially absorb seismic waves and vibration.

Problem addressed

Presently, the available technologies in the market are based on vibration isolation of structures and are difficult to implement because they involve the modification of the building itself.

Our invention provides a solution to this problem: Shielding vulnerable structures using large-scale metamaterials which inhibit the propagation of incoming seismic waves or ground vibration through interference effects can help to protect a much wider area without any direct modification to buildings.

Benefits of Technology

- Provides protection to buildings/structures over a wider range of frequencies
- Provides protection from low-frequency vibrations, for example from trains, machinery and road traffic
- Can be used to shield critically important buildings such as nuclear power plants, dams, bridges, hospitals, and refineries
- Does not involve any change to the building structure

Imperial College London

Enterprise

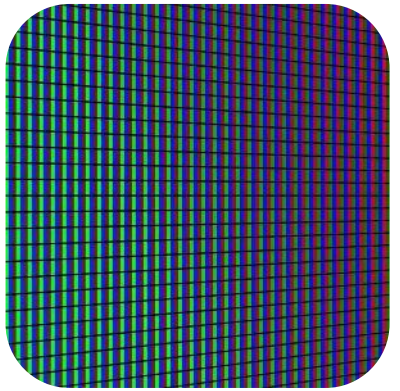
Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Technology equipment
Reference: 6191

More information

Technology

Circularly polarised organic light-emitting diodes. Simple, low-cost and scalable technology to fabricate solution-processed circularly polarised organic light-emitting diodes



Problem addressed

Current contrast-enhancing filters block 50% of conventional OLED display light, halving their energy efficiency. Our circularly polarised OLED emission addresses this limitation, increasing display lifetime (including blue pixels) and battery lifetime by over 50%.

The technology offers real gains in performance and can be easily slotted into existing solution-processed fabrication lines without the need for any significant investment.

Benefits of Technology

- Increased display lifetime
- (including blue pixels) by over 50%
- Minimum thickness (50-500nm) and smooth incorporation into CP-OLEDs/OLETs
- The colour of the light emitted is tuneable, making it adaptable to a wide range of applications
- Low-cost, simple, and scalable method

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Biotechnology, Electronics, Medical Devices, Medical research, Technology equipment
Reference: 10436

More information

Technology

Dual-View Oblique Plane Microscopy. A novel arrangement of oblique plane microscopy enables the benefits of dual-view single plane illumination microscopy to be obtained.

Problem addressed

While oblique plane microscopy has all the benefits of light sheet fluorescence microscopy (LSFM), there are a few problems to be addressed:

- Long optical train
- Anisotropic point spread function (PSF) – complicates image analysis
- Shadow/streak artefacts

This new Oblique Plane Microscopy geometry can acquire two orthogonal views of the sample that can then be fused in post-processing to reduce sample-induced image artefacts.

Benefits of Technology

- Benefits of LSFM (i.e. low light dose to specimen to minimise photobleaching and phototoxicity; no dichroic needed; no out-of-focus background to reject; each optically sectioned image acquired directly so no moving parts and image processing are required).
- It allows two views of the sample to be obtained whilst requiring only two microscope objectives in the remote-refocussing setup, which reduces cost compared to OPM.
- Only one computer-controlled actuator is required to achieve both switching between views and for scanning during acquisition of each view to future reduce cost.
- The folded remote-refocussing geometry increases the spatial resolution achieved.

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Electronics
Reference: 9258

More information

Technology

Enhanced Light Extraction from Light Emitting Diodes Utilizing a Nanoparticle Meta Grid. Allows enhancement of light extraction efficiency in light emitting diodes.

Problem addressed

Multiple different attempts have been made into researching how to enhance the light extraction efficiency of LEDs with the aim of achieving greater light output. Most of these attempts have focused on new encapsulating materials with higher refractive index to improve light extraction by reducing the critical angle loss.

The problem with this is that a larger refractive index leads to more light being reflected back adding to Fresnel loss. This leads to additional processes being incorporated to the existing LED production process, making manufacturing complex and economically challenging.

Benefits of Technology

- With the addition of a nanoparticle meta-grid, significant enhancement of light extraction efficiency of LED emission can be achieved.
- Due to an increase in LED light extraction efficiency, reduction in internal heating of the LED chip allows for a longer device lifetime.
- The process of manufacturing these systems is very simplistic, only requiring an addition step in existing LED manufacturing process.

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Engineering
Reference: 11175

More information

Technology

Porous metal mats for catalysis and energy applications.
Allows enhancement of light extraction efficiency in light emitting diodes.

Problem addressed

Conventional methods of producing porous metals (metal foam) are only able to produce ‹500 cm-1 specific surface area (SSA) material. This is insufficient for application in fields such as catalysis, lithium-ion batteries, fuel cells and electrolysers; in which performance is proportional to the SSA. Finding a mechanically strong and high-SSA porous metal substrate has been a key challenge in the further development of these fields.

Benefits of Technology

- Can be used as electrodes of batteries, fuel cells and electrolysers
- Can be used as catalysis or catalysis support
- High specific surface area (› 500 cm-1)
- Controllable Thickness (0.05 to 10 mm)
- Strong mechanical properties
- Variable Metal compounds (e.g. nickel, copper, iron, zinc and aluminium)
- The manufacture method can be easily scaled-up
- Cheap and easy-accessible raw materials
- Compatible with existing equipment

Imperial College London

Enterprise

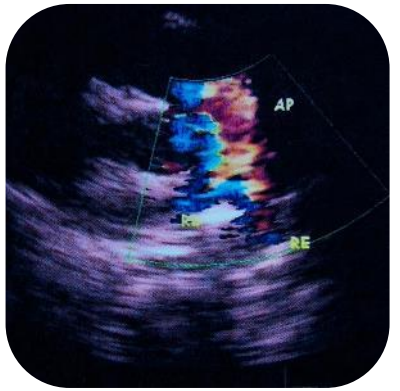
Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Healthcare
Reference: 7793, 8716

More information

Technology

ArterioWave – simple ultrasound-based diagnosis and monitoring of heart failure.



Problem addressed

People developing heart failure typically present to their GP with non-specific symptoms. For a definitive diagnosis, they should be referred to a specialist centre for echocardiography. However, 79% of patients are diagnosed after an emergency hospital admission, even though 41% had visited their GP with symptoms in the preceding 5 years (source: BHF).

Previous studies have shown that diagnosis and prognosis can be achieved by analysing waves in arteries. However, current methods of Wave Intensity Analysis are invasive, inaccurate or expensive. ArterioWave is non-invasive, accurate, inexpensive and simple to use, and will allow GPs, sonographers and nurses, as well as specialists, to offer patients earlier, easier, and more frequent evaluation of heart function in the community and on the ward.

Benefits of Technology

- Clinically proven parameters: Analyses of wave intensity indices that closely relate to heart failure in human trials
- Simple to use: Measures the function of heart through any arterial pulse accessible to ultrasound
- Easy data interpretation: Intuitive readout. No ultrasound image interpretation required
- Safe: Risk-free even for frequent use on patients with a high heart failure risk
- Maximised Compliance: A truly non-invasive technique that does not require catheter insertion or contrast agent

Imperial College London

Enterprise

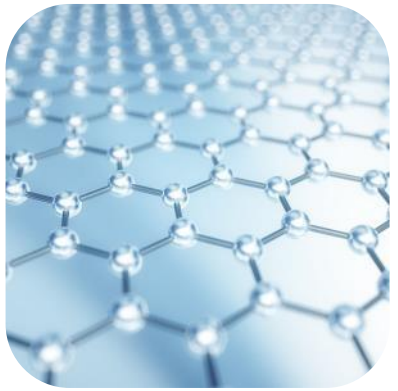
Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Chemicals
Reference: 8307

More information

Technology

Graphene fluidic exfoliation. Novel approach to liquid exfoliation to achieve more efficient and cost-effective production of 2D materials at any scale.



Problem addressed

It is challenging to scale-up and achieve mass production with the existing production methods of 2D materials. The exfoliation method is a core step in production of 2D materials. It uses a solvent to stabilise and prevent re-aggregation of the nanosheets separated from the layered raw material.

In existing exfoliation methods, spatial distribution of shear stress and velocity fields are non-uniform. This means fluid mechanics and shear stress distribution change with the dimensions of the container used in production. As a result, existing exfoliation methods have poor repeatability in product output and challenges in scaling-up the production.

Benefits of Technology

- Exfoliation process that can easily be scaled-up and scaled-out
- Apparatus provides controllable exfoliation conditions in a compact, continuous flow process
- Fluid flow characteristics can be finely controlled and is repeatable
- Apparatus provides homogenous mixing and shearing of precursor material
- Apparatus provides homogenous heat transport for heating/cooling applications
- More efficient and cost-effective production method of 2D materials at any scale
- Combined exfoliator and disperser of nanomaterials without requiring toxic solvents
- Production of 2D materials with greater environmental consideration

Imperial College London

Enterprise

Opportunity: Technology is available for licensing or collaborations to further develop and validate the technology.

Sectors: Pharmaceuticals
Reference: 8629

More information

Technology

A cytokine for wound healing and scar reduction. Novel approach to liquid exfoliation to achieve more efficient and cost-effective production of 2D materials at any scale.

Problem addressed

There are clear links with the time a wound takes to heal and the resultant scar which occurs after injury. Wounds heal in 3 sequential and overlapping phases, the first of which is re-epithelialistion to close the wound. A chronic wound is characterised by absent re-epithelisation at the skin surface, which perturbs subsequent steps in the wound healing process. Hence, avoiding chronic wound development and accelerating re-epithelialisation result in faster wound closure and reduced scar formation.

There is an unmet medical need for safe and effective therapies to promote wound closure and reduce scarring.

Benefits of Technology

- Promoting closure of skin wounds faster than other treatments
- Targeting the very first stage of wound healing, re-epithelialization, to reduce the risk of infection
- Faster re-epithelialisation can lead to reduction of scarring