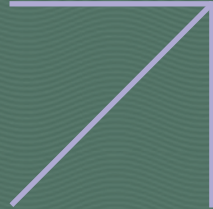




# Year in Review

For the  
year ended  
31 December  
2023



# 2023

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<b>10</b> Alumni Achievements	<b>12</b> Awards Granted in 2023	<b>16</b> Programmes
Research Fellowships <b>18</b>	Industrial Fellowships <b>22</b>	Enterprise Fellowships <b>28</b>
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# CHAIRMAN'S WELCOME



I am delighted to welcome you to the first edition of the 1851 Royal Commission's Annual Review within which we hope to share with readers the main elements of our activity last year and some of the incredible work being undertaken by the individuals and organisations we support.

I think it would be fair to observe that 2023 has been a period of resurgence and growth for the Royal Commission and its work. The largest group of new Fellows joined our research, design and innovation programmes and our public events and engagements attracted larger audiences and visitors numbers than for many years. The charity has continued to increase its commitment to supporting STEM education and educators as well as contributing to several impressive, community-based projects. Committing almost £5 million in funding to our charitable outputs has meant it has been a year of endeavour and achievement and has established a strong foundation for the ambitious strategy we wish to deliver in the future.

In 2023 we awarded 10 Research Fellowships, 15 Industrial Fellowships and 14 Industrial Design Studentships representing our most significant investment in young and

emerging research talent within the UK to date. In addition, we funded six new entrepreneurs through the enterprise programme run by our partners at the Royal Academy of Engineering as well as awarding the bi-annual Built Environment Fellowship. We also welcomed the fifth cohort of participants onto our Technical Teaching Fellowship initiative. Across all our long-term education and research programmes, there was a gender balance in successful applicants, an outcome not deliberately sought but wholly commendable that hopefully will be a trend continued into the future.

Our external public engagements this year included the annual Great Exhibition Road Festival which draws all the cultural and educational institutions and organisations based in South Kensington together over a weekend in June to share a street-based extravaganza of science, history and art.



**The Rt Hon Professor Lord Kakkar**  
KG KBE PC FMedSci

This was followed by the eighth recording of "The Engineers" with the BBC World Service in July. With the topic of lunar exploration the BBC presenter and regular host, Kevin Fong, encouraged leading engineers from NASA, ESA and UKSA to discuss humanity's return to the moon and all that entails, including a powerful rocket and capable spacecraft, a space station in lunar orbit and a permanent moon-base, in front of a live audience of over 700 and a global listening community of more than 90 million.

As part of our ongoing strategy to reinforce both STEM education in schools, and greater public awareness of the career opportunities in the science and technology arena, the Commission gave grants to an array of projects such as those being run by the British Science Association and Primary Engineer as well as providing support to the Humber Science Festival. Closer to home, we also acknowledged the achievements of our own community at our Alumni Science Evening and Fellows Reception, the latter in the presence of our ever supportive and engaged President, HRH The Princess Royal.

All of this activity relies on the enthusiasm and dedication of the many volunteers that

offer their support to our programmes, whether that be through serving on our various committees or overseeing the governance and strategic direction of the organisation itself right through to being a Royal Commissioner. My thanks go to them all for the magnificent personal contributions they have made to our endeavours.

Since the receipt of its supplementary charter some 172 years ago the 1851 Royal Commission has been committed to the vision of Prince Albert. This remains crucially aligned to the aspirations of modern Britain and our traditional ambition to be one of the world's most innovative and productive economies. Through our established education and research programmes and special awards scheme, as detailed in this document, our current fellows and partner organisations are making a significant contribution to such ambition and having a positive impact on the Science, Technology and Design environment of today while seeding the ground for tomorrow.

*Lord Kakkar*  
KG KBE PC FMedSci

**10**  
Research Fellowships awarded

**15**  
Industrial Fellowships awarded

**14**  
Industrial Design Studentships awarded

**6**  
Entrepreneurs funded

**700+**  
Spectators in a live audience

**90M**  
Globally listening





The Commission's aim is to 'make a difference' by providing educational fellowships and studentships to the very best early career scientists, engineers and designers.



# THE WORK OF THE 1851 ROYAL COMMISSION



Success is hard to measure within the confines of a single year but looked at over the longer term the Commission's achievement is evident, with 13 Nobel Prize winners and over 150 Fellows of the Royal Society among its previous award winners. The case studies of completing fellows and summaries of alumni achievements later in this document also bear witness to the Commission's success.

In addition to its core fellowship schemes, the Commission also provides special awards to its legacy institutions, to other organisations working to encourage STEM (science, technology, engineering and mathematics) education and to organisations that can help facilitate access to its incredible archives. Details of some of these awards and the impact they have made can also be found later in this document.

As well as the grants that it makes, the Commission itself

organises a number of educational and networking events for the benefit of its award holders, alumni, legacy institutions and the general public, which together make a significant contribution to STEM education.

The Commission was originally established by Royal Charter in 1850 under the Presidency of Prince Albert, to organise and stage the Great Exhibition. Held in the spectacular Crystal Palace, constructed in Hyde Park, it was the first ever World Fair, and the most successful. With over six million visitors, it also made a substantial profit.

Consolidated by Supplemental Charter, and enjoined to invest the surplus from the Great Exhibition strictly in accordance with the ends of the Exhibition "...[to] increase the means of industrial education and extend the influence of science and art upon productive industry" the Commission purchased

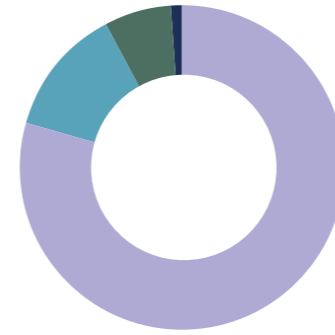
87 acres of land in South Kensington and helped establish its three great museums, the Royal Albert Hall and renowned institutions of learning, including Imperial College and the Royal Colleges of Art and Music.

When this huge undertaking was complete, there remained sufficient funds for the Commission to initiate, in 1891, a programme of fellowships and studentships to support pure research in science and engineering, applied research in industry, industrial design and other projects.

The Commission continues its work to this day, both managing its freehold estate and awarding almost £5m a year in research fellowships, design studentships and other grants. The provision of long leases to the legacy colleges and the Royal Albert Hall also makes a very substantial contribution to scientific, engineering and artistic education.

# THE YEAR IN NUMBERS

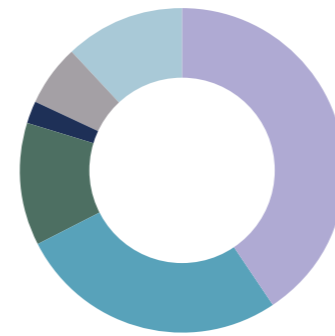
<b>10</b> Research Fellowships	<b>15</b> Industrial Fellowships	<b>6</b> Enterprise Fellowships	<b>5</b> Technical Teaching Fellowships	<b>1</b> Built Environment Fellowship	<b>14</b> Industrial Design Studentships
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**Activity Funded:**

**79.5% / £3,673,356**  
Fellowships & studentship programmes.  
**12.8% / £586,330**  
Special awards.

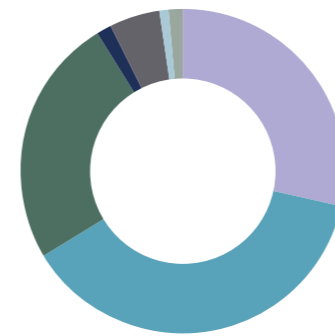
**6.6% / £303,835**  
Meetings & events.  
**1.1% / £51,991**  
Alumni relations & archival collection.



**Programmes & Awards:**

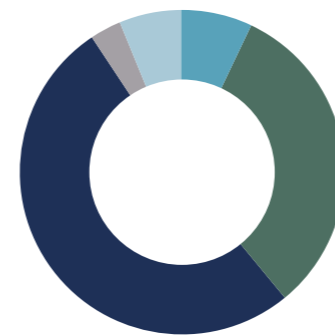
**40.7% / £1,692,455**  
Research Fellowships.  
**27.1% / £1,129,088**  
Industrial Fellowships.  
**12% / £501,813**  
Industrial Design Students.

**2.4% / £100,000**  
Built Environment Fellowships.  
**6% / £250,000**  
Enterprise Fellowships.  
**11.8 / £478,455**  
STEM Education & Outreach.



**Individuals supported:**

<b>39</b> Research Fellowships.	<b>34</b> Industrial Design Studentships.	<b>7</b> Enterprise Fellowships.	<b>2</b> Regenerative Design Fellowships.
<b>51</b> Industrial Fellowships.	<b>2</b> Built Environment Fellowships.	<b>1</b> Design Fellowship.	



**STEM Education & Outreach:**

**£586,330**  
General STEM Education support.  
**5.7% / £33,000**  
STEM – Secondary Education.  
**26.2% / £153,700**  
STEM – Primary Education.

**60.4% / £354,375**  
STEM – Community Awareness.  
**2.5% / £15,000**  
STEM – Further Education.  
**5.2% / £30,255**  
SouthKenZen+.



# ALUMNI ACHIEVEMENTS

The Royal Commission's Alumni community is an exceptional grouping of scientists, engineers, designers and innovators/entrepreneurs and the Commission takes great pride in their achievements and successes post their award. The following are just some of their achievements during 2023 that have been shared with us:



## Overseas Scholars

### Professor Jennifer Martin (1986)

- Awarded Ralph Slatyer Medal, Australian National University.

## Research Fellowships

### Professor Sinan Açıkgöz (2016)

- Awarded Manby Prize, Institution of Civil Engineers.

### Dr Steven Beard (1983)

- Member of the MIRI development team awarded the Royal Astronomical Society Group Achievement Award in Astronomy for the James Webb Space Telescope.

### Professor Helen Coxall (2000)

- Participated in a research expedition on board the RS Joides Resolution as part of the International Ocean Drilling Program Expedition 400 which recovered deep sediment cores on the margins of Northern Greenland for deciphering the long-term history of the Greenland ice sheet.

### Professor David Cumming (1996)

- Awarded IET Achievement Medal in Electronics.

### Dr Barnali Ghosh (2003)

- Awarded John Mitchell Award, Institution of Civil Engineers.

### Professor Brianna Heazlewood (2012)

- Appointed Professor of Chemical Physics, University of Liverpool.
- Awarded Philip Leverhulme Prize in Chemistry.

### Professor Adrian Horridge (1954)

- Published How do Bees (And Humans) See Grey Levels?

### Dr Russell Low (1995)

- Appointed President and CEO of Axcelis Technologies.

### Professor Emilio Martínez-Pañeda (2018)

- Appointed Associate Professor of Engineering Science, University of Oxford
- Awarded Young Investigator Medal, Spain's Royal Academy of Engineering.

### Professor Gavin Morley (2009)

- Appointed Professor, Department of Physics, University of Warwick
- Appointed lead PI for MAST-QG (Macroscopic superpositions towards

witnessing the quantum nature of gravity) funded by the Sloan and Moore Foundations.

### Professor Sir Steve Sparks (1974)

- Awarded Imperial College 2023 Distinguished Alumni Award.

### Professor Ed Tate (1999)

- Appointed to the GSK Endowed Chair in Chemical Biology, Imperial College London.

## Industrial Fellowships

### Professor Mike Clinch (1996)

- Elected Fellow of the Royal Academy of Engineering.

### Dr Mariastefania De Vido (2018)

- Selected to be included in the 100 Esperte, a high-profile Italian initiative to raise the profile of Italian female researchers and scholars.
- Technical lead for team that developed world record holding DiPOLE 10 J, 100Hz laser.

### Professor Rob Deaves (1994)

- Awarded Honorary Professorship, School of Engineering, University of Birmingham.
- Elected a Fellow of the Royal Academy of Engineering;

## Enterprise Fellowships

### Natalie Kerres (2021)

- Awarded Innovation UK Women in Innovation Award.

### Harish Pesala (2021)

- Awarded Innovate UK Young Innovators Award.

### Varun Sarwal (2020)

- Hammer Missions (adaptive flight automation software for UAVs) increased revenues by 500% in 2023, received backing from Ordnance Survey and saw increased take-up by companies, charities and search and rescue organisations.

## Built Environment Fellowship

### David Rudlin (2019)

- Published (with Vicky Payne and Lucy Montague) High Street: How our town centres can bounce back from the retail crisis.



# AWARDS GRANTED IN 2023



## Research Fellowships

### Dr Emma Banks

- **Subject:** Illuminating the mechanistic basis of virus-like gene transfer between bacteria
- John Innes Centre.

### Dr Alison Cribb

- **Subject:** Ecosystem engineers, resilience, and climate change through Earth history
- University of Southampton.

### Dr Larissa Gomes Franca

- **Subject:** Stimuli-responsive liquid crystal host materials for energy upconversion systems.
- University of Cambridge.

### Dr Freya Johnson

- **Subject:** Antiferromagnetic materials for fast and energy-efficient computing.
- University of Cambridge.

### Dr Dean Lomax

- **Subject:** Novel imaging elucidates hunting behaviours of giant 'sea dragons'.
- University of Bristol.

### Dr Giulia Rubino

- **Subject:** Undoing quantum operations using integrated photonics technologies.
- University of Bristol.

### Dr Lucas Sá

- **Subject:** Order and chaos in dissipative quantum matter.
- University of Cambridge.

### Dr Benito Wainwright

- **Subject:** How does evolution break functional barriers to fine-tune adaptation?
- University of St Andrews.

### Dr Daniel Wilson

- **Subject:** Transition-metal main-group cooperativity: A strategy for catalytic transformations with ammonia.
- University College London.

## Brunel Fellowship

### Dr Yabin Liu

- **Subject:** Tidal turbine cavitation and gust control with micro jets.
- University of Edinburgh.

## Industrial Fellowships

### Sara Abreu

- **Subject:** Investigation of factors affecting the downstream purification process of lentiviral vector manufacturing.
- **Sponsor:** Autolus.
- **Host:** University College London.

### Mark Bell

- **Subject:** Short range interferometric synthetic aperture radar (InSAR) for environmental modelling.
- **Sponsor:** Leonardo.
- **Host:** UK University of St Andrews.

### Gillian Cameron

- **Subject:** The role of digital interventions in supporting workplace mental health and wellbeing.
- **Sponsor:** Inspire.
- **Host:** Ulster University.

### Peter Doggart

- **Subject:** Artificial Intelligence enhanced electrocardiography in emergency departments.
- **Sponsor:** PulseAI.
- **Host:** Ulster University.



**Marina Economidou**

- **Subject:** Investigations into the ligand- and oxidation state-dependent extraction of residual palladium from pharmaceutically relevant molecules.
- **Sponsor:** GSK.
- **Host:** University of Strathclyde.

**Claudine Greenwood**

- **Subject:** Identification of covalent tools for essential parasite proteins implicated in tropical diseases.
- **Sponsor:** GSK.
- **Host:** University of Strathclyde.

**Aleksy Kwiatkowski**

- **Subject:** Closing the loop: A computational-experimental feedback approach for predicting macrocycle closure.
- **Sponsor:** MSD.
- **Host:** University of Oxford.

**Paul McHard**

- **Subject:** Autonomous robotic detection and correction of surface defects in manufacturing.
- **Sponsor:** HAL Robotics.
- **Host:** University of Glasgow.

**Anna Miller**

- **Subject:** Feed the world: harnessing nature's molecules for maximising future food productivity
- **Sponsor:** Syngenta
- **Host:** University of Oxford

**Sarah Oatway**

- **Subject:** Investigation of a novel sensory discrimination training device for the management of phantom limb pain.
- **Sponsor:** 2PD.
- **Host:** Teesside University.

**Samantha Ree**

- **Subject:** Separation techniques for the recovery of radionuclides suitable for cancer therapy from extant nuclear materials.
- **Sponsor:** National Nuclear Laboratory.
- **Host:** University of Manchester.

**Matthew Southern**

- **Subject:** Delivering novel 3D-rich building blocks for drug discovery.
- **Sponsor:** Sygnature Discovery.
- **Host:** University of Oxford.

**Fabian Spöndlin**

- **Subject:** Advancing computational methods for the functional characterisation of antibodies using structural and flexibility data.
- **Sponsor:** F. Hoffman-La Roche.
- **Host:** University of Oxford.

**Rebecca Stevens**

- **Subject:** High-throughput chemical synthesis and biological testing of proteolysis targeting chimeras.
- **Sponsor:** GSK.
- **Host:** University of Strathclyde.

**Kate Turley**

- **Subject:** Environmentally affective circadian lighting and IoT solution for healthy ageing.
- **Sponsor:** Chroma Lighting.
- **Host:** Ulster University.

**Enterprise Fellowships****Gregory Hargraves**

- **Company:** Paige.

**James Eaton**

- **Company:** IONETIC [Financially supported by the ERA Foundation].

**Idan Gal-Shohet**

- **Company:** Fibe.

**Beren Kayali**

- **Company:** Deploy Tech.

**Douglas Brion**

- **Company:** Matta-AI.

**Sanzhar Taizhan**

- **Company:** TaiSan Motors [Financially supported by the ERA Foundation].

**Built Environment Fellowship****Dr Xiang Xie**

- **Subject:** Integrating Self-programming Artificial General Intelligence in UK Clean Air Zones Using Large Language Models
- **Mentor:** Professor Mohamad Kassem, Newcastle University.

**Industrial Design Studentships****Mohamed Azman**

- Innovation Design Engineering (2nd year), Royal College of Art / Imperial College London.

**Chris Bellamy**

- BioDesign, Central Saint Martins.

**Grace Broom**

- Global Innovation design (2nd year), Royal College of Art / Imperial College London.

**Ruta Czaplinska**

- Innovation Design Engineering, Royal College of Art / Imperial College London.

**Joseph Jones**

- Global Innovation design (2nd year), Royal College of Art / Imperial College London.

**Tarika Kumar**

- Global Innovation design (2nd year), Royal College of Art / Imperial College London.

**Lucie Legrandois**

- Innovation Design Engineering (2nd year), Royal College of Art / Imperial College London.

**Julita Napieralska**

- Product Design Engineering, Brunel University.

**Ori Nevares**

- Global Innovation design (2nd year), Royal College of Art / Imperial College London.

**Peter Neyra**

- Design Products Royal College of Art.

**Holly Souza-Newman**

- Global Innovation design (2nd year), Royal College of Art / Imperial College London.

**Julia Szewczyk**

- Integrated Industrial Design, Loughborough University.

**Sabrina Tian**

- Global Innovation design (2nd year), Royal College of Art / Imperial College London.

**Guy Turner**

- Innovation Design Engineering, Royal College of Art / Imperial College London.

**Technical Teaching Fellowships****Paul Gartside**

- South Central Institute of Technology / Milton Keynes College.

**Amy Hollier**

- Heart of Worcestershire College.

**Bradley Collier & Kumaran Rajarathinam**

- Blackburn College.

**Kevin Pollard**

- MKC Training / Mid Kent College.



# PROGRAMMES

Research Fellowships

Industrial Fellowships

Enterprise Fellowships

Design Fellowships

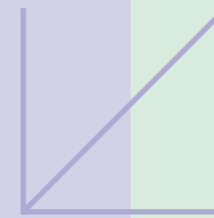
Regenerative Design Fellowships

Built Environment Fellowships

Industrial Design Studentships

Technical Teaching Fellowships

Sir Misha Black Awards





# RESEARCH FELLOWSHIPS

Giving early career scientists or engineers of exceptional promise the opportunity to conduct research of their own instigation. Open to candidates intending to conduct research in any of the physical or biological sciences, in mathematics, in applied science, or in any branch of engineering. The ultimate objective is to contribute to the knowledge base required for a healthy and innovative national culture. Around ten awards are made each year.

## Completed in 2023

### Dr Keith Andrews

Project: *Addressing diabetes: glucose recognition with a bespoke molecular glove*  
Host: University of Oxford

Keith describes the Fellowship as an overwhelming success. Although the science didn't always turn out as expected, looking back, the project has yielded more than he hoped for. The "molecular glove" that he set out to make (which he

refers to as an organic cage) looks very different to the initial design. This is because he soon discovered that the field of supramolecular cages (i.e., the state of the art for synthesising large, robust, soluble cage-shaped molecules) was not as advanced as the literature suggested. This led him to design new chemistry protocols to access the molecules he required. This went spectacularly, and he published his new procedure in January 2023. Remarkably, this new type of cage has ground-breaking properties, and has led to three high-profile academic collaborations. The cage shows strong host-guest recognition (i.e., it is an excellent "glove" to detect molecules) and one collaboration is incorporating these cages into electronic sensors. Whilst studying the potential for this cage to recognise glucose, Keith discovered two surprising and high impact functions. First, the cage performs chemical catalysis just like an enzyme. This data, which will be published soon with the title "Enzyme-like acyl transfer catalysis in a bifunctional organic cage", is the first clear example of this sort of catalysis in synthetic enzyme mimics and has yielded a strong proposal for the other key goal of the Fellowship: to selectively modify glucose. Because glucose is complex and hard to modify, new reactions will enhance access to sugar polymers for biomedical research (such molecules are used

in cell-signalling and for identifying bacteria). The second remarkable discovery was that, if polymers of glucose are threaded into the cage, it is possible to selectively break them down into glucose monomers. This has yielded further proposals to apply the cages as industrial catalysts for the conversion of waste biomass into glucose, which could be fermented to access biofuel. This Fellowship has therefore furthered the state of the art in supramolecular organic cage synthesis and initiated a new sub-field of supramolecular covalent organocatalysis.

Keith is now Assistant Professor of Organic Chemistry at Durham University where he hopes to translate the promising findings from his Fellowship into tools for studying enzymes and for biosustainable synthesis challenges.

### Dr Xianxin Guo

Project: *End to end optical training of neural networks*  
Host: University of Oxford

In his Fellowship proposal for end-to-end optical training of neural networks, Xianxin set forth some rather ambitious objectives. At the end of his Fellowship, Xianxin is delighted to report that he has successfully accomplished all of these goals, and the results have surpassed his initial expectations.

Over the past three years, Xianxin carried out a series of experiments as outlined in the proposal. Working closely with his fellow group members, he built a large-scale programmable optical matrix multiplier, which can serve as the core of advanced optical processors. Subsequently he constructed a large-scale optical neural network based on that optical multiplier. Finally, he built an all-optical neural network and achieved the world's first end-to-end optical training of neural networks. Remarkably, all the crucial operations were executed optically following the innovative optical training method detailed in the Fellowship proposal.

The impact of this Fellowship project extends far beyond groundbreaking research. Xianxin founded a spin-out, Lumai Ltd. (originally known as OxONN Ltd.) to commercialise the optical computing technology. Lumai has secured venture capital investment to develop advanced optical processors for high performance computing.

Xianxin is now Head of Research at Lumai, and his goal is to deliver optical computing to power the next generation of machine learning.

### Dr Thomas Macdonald

Project: *Exploring nanostructured*

*light absorbers: from optoelectronics to innovative photovoltaics*  
Host: Imperial College London / Queen Mary University of London

In the first year of his Fellowship, Tom developed a robust platform to investigate emerging nanomaterials, particularly phosphorene nanoribbons, in the field of optoelectronics. Simultaneously, he mentored students in synthesizing and analysing alternative nanomaterials like nanocrystals, studying their interactions within solar cells.

In the second year, Tom successfully established a framework to understand the crucial roles played by phosphorene nanoribbons in optoelectronics. He also participated in projects focused on comprehending interfaces in third-generation solar cells. By the end of the second year, he had gained insights into defects at perovskite solar cell interfaces, employing advanced microscopy at the Henry Royce Institute.

During the third year, Tom published his findings on phosphorene nanoribbons in respected journals such as the Journal of the American Chemical Society and Joule. Overall, Tom's Fellowship yielded 40 papers in top-tier journals including



Advanced Materials, Angewandte Chemie International Edition, and Nature Communications. Tom secured seven grants totalling over £1 million, along with a prestigious Royal Society University Research Fellowship, leading to his current role as a Senior Lecturer in Materials Science at Queen Mary University of London, specializing in nanomaterials in renewable energy conversion.

#### Dr Farid Shahandeh

*Project: Constructing a unified resource-theoretic framework to characterise quantum computation processes*  
Host: Swansea University / Royal Holloway, University of London

This ambitious project aimed to establish a toolbox for identifying the physical resources required by quantum computers. During his Fellowship, Farid demonstrated that contextuality, a phenomenon arising from the limitation of classical physics in modelling data, is a geometric property of many theories, including quantum mechanics. Moreover, he showed that when suitably adapted to computational schemes, quantum contextuality is an essential resource for any meaningful advantage. Shortly after, colleagues from Poland and Canada developed a linear program to characterise the contextuality of data. Although this program alone cannot

characterise resources in quantum computations, when combined with Farid's earlier findings, it paves the way to achieve the project's overarching goal in the near future. Consequently, Farid's project laid the foundations for understanding why quantum computers outperform classical computers in solving specific problems.

The Fellowship played a crucial role in fostering collaborations, leading to spin-off projects, such as partnerships with colleagues in Singapore, Spain, and Germany. It enabled Farid to effectively disseminate his results to the community and facilitating his organising the inaugural workshop Foundations of Quantum Computing (FQC2023) at RHUL, UK, on September 5-6, 2023. FQC2023 brought together experts and practitioners at the intersection of quantum computing and quantum foundations to exchange ideas, share insights, and cultivate collaborations on the fundamental aspects of quantum computing.

The Fellowship also facilitated support for Farid's PhD student, Mrs Zeynab Zolghadr. During her visit to the UK, she and Farid discovered that approximating quantum tomography, the most informative method for studying quantum systems, is impossible.

During the Fellowship, Farid secured a tenure-track lecturer position at Royal Holloway, University of London, ensuring the continuity of his research on this project.

#### Dr Benno Simmons

*Project: How invasive species transform a critical ecosystem function*  
Host: University of Exeter

Benno is an ecologist and biodiversity conservationist. His Fellowship focused on understanding and mitigating the threat invasive species pose to pollination, a critical ecosystem service that supports crops and wild plant species globally. Previously, methodological limitations had prevented the effects of invasive species on pollination being detected. Benno therefore aimed to deploy novel, more sensitive, techniques to understand the current and future threat invasive species pose. He discovered a number of important results during his fellowship, with perhaps the most notable resulting in a joint-first author publication in PNAS. In this paper, they showed that very small amounts of field data could be scaled up to make big picture conclusions about the health of entire ecological communities subject to species invasions. This finding has significant implications for monitoring biodiversity, as it allows ecosystems to be monitored

much more efficiently, with only tiny amounts of data required.

During his Fellowship, Benno was offered a permanent Lectureship in Ecological Data Science at the University of Exeter, which he started in October 2023. He is now a PI with a research group (simmons-lab.com), focused on using data science, AI and technology to help understand and reverse biodiversity loss. Notable projects running at the moment include using AI to identify species in camera trap images, working towards fully automated biodiversity monitoring.

#### Dr Adam Smith

*Project: Understanding strongly-correlated matter using quantum computers*  
Host: University of Nottingham

The 1851 Research Fellowship allowed Adam to pursue research into the applications of quantum computers for studying the physics of strongly correlated materials. Quantum computers perform computations in a radically new way that makes them more naturally suited to certain types of problems. One such problem is the simulations of quantum mechanics, a famously complex field of physics, which currently available computers struggle with. During his Fellowship Adam introduced new algorithms for quantum computers for simulating dynamics of

quantum systems. This is important for understanding experimental measurements of material properties and will ultimately guide the synthesis of new materials with desired properties.

After his first year, Adam was appointed Assistant Professor at the University of Nottingham and the remainder of his 1851 Fellowship was converted into a start-up grant. This allowed Adam to start his own research group by hiring a postdoctoral researcher, who has since been joined by a second postdoc and a PhD student. In 2023 Adam was awarded an ERC Starting Grant, with which he will extend the work started during his Fellowship and which will allow him to expand his research group further.

#### Dr Patrick Stowell

*Project: Cosmic ray neutron detectors for smart agriculture / civil engineering monitors*  
Host: Durham University / University of Sheffield

The 1851 Fellowship allowed Patrick to drive forward his research into cosmic ray sensing, a technique that allows non-invasive soil moisture sensing over typical field scales. Patrick has shown that new boron sensors can be used to build cosmic ray sensors over twenty times cheaper than existing systems, making them viable for irrigation monitoring on farms. The

Fellowship gave him the flexibility to set up partnerships between farms in the UK and abroad to test and optimise these systems. Partnering with Sao Paulo state's Lanapre Precision agriculture facility he developed hardware that allows cosmic ray sensors to be added to internet of things smart farm networks. Combined with COSMICSWAMP, a precision irrigation platform he developed, these sensors can be used to automatically perform studies of crop water stress and optimise irrigation in arid regions completely autonomously. COSMICSWAMP is now being tested at two pilot farm sites in South America with additional deployments expected in the coming year.

During the last few months of his Fellowship Patrick was offered a permanent lecturer position at the University of Sheffield, where he now works in both neutrino particle physics and applied neutron physics. He has taken over as the manager of the University of Sheffield neutron irradiation labs. Over the next few years, Patrick will be working to establish several dedicated neutron and gamma test stands in these labs with a focus on soil characterisation and monitoring using radiological techniques in partnership with colleagues at Leeds University smart farm and Rothamsted Research.



# INDUSTRIAL FELLOWSHIPS

Encouraging profitable innovation and creativity in British Industry – to the mutual benefit of the Fellow and their sponsoring company.

Industrial Fellowships are awarded to graduates with the potential to make an outstanding contribution to industry, for research supported by a company, leading to a patent, product or process improvement and a postgraduate award.

With our Industrial Fellowships, companies get the chance to craft a bespoke PhD from the ground up that supports company ambitions as well as employee interests, and forge strong links with leading academics, to share access to expertise, facilities and knowledge.



## Pursue a PhD whilst working

Fellows receive significant funding towards their fees and salary, enabling employers to offer exciting personal development opportunities for their brightest employees.

## Gain new IP whilst minimising R&D Costs

Fellows pursue a PhD whilst working, allowing companies to conduct innovative research that furthers their business objectives, and accelerates the creation of IP.

## Collaborative relationships

Fellows and their sponsoring companies will work closely with the PhD institution, forging strong and lasting links with leading academics.

### Completed in 2023

#### Daniya Aynetdinova

Project: *Cationic cyclisation cascades mediated by carbon electrophiles for the formation of novel polycyclic products*  
Host: *University of Oxford*  
Sponsor: *Vertex Pharmaceuticals (Europe)*

During her Fellowship, Daniya successfully completed her aim to develop a robust polyene cyclisation methodology with the results published in the well-respected scientific journal: *Chem. Eur. J.* 2023, 29, e2022037 (doi: doi.org/10.1002/chem.202203732).

This project has paved the way for a new research direction in the field of polyene cyclisation. In an industrial setting at Vertex Pharmaceuticals, the successful completion of this project has introduced a novel methodology for the efficient stereoselective construction of complex 3D molecules, applicable to the synthesis of steroid analogues. To demonstrate this, a formal synthesis of rac-18-nor-estradiol has been achieved.

A further objective, which was to develop a diastereoselective cascade heterocyclisation methodology, has also been achieved, demonstrating the robustness of the carbocation-triggered cyclisation approach.

Financial support from the Commission was critical in allowing Daniya to explore challenging enantioselective approaches to achieve carbo- and heterocyclisations.

Following her Fellowship, Daniya will be working at the University of Vienna as a postdoctoral researcher in the field of Organic Chemistry.

#### Maral Bayaraa

Project: *Satellite-enabled early warning system for geotechnical structures*  
Host: *University of Oxford*  
Sponsor: *Satellite Applications Catapult*

Maral's Fellowship research combined InSAR monitoring, geotechnical modelling, and deep learning to create tailings dam failure early warning systems. The Fellowship has produced valuable research outcomes (including two high quality journal publications), has provided a real-world context and demonstrators for academic work in the field, and promises to deliver a commercially viable early warning solution.

Maral's project received the Prototypes for Humanity award at COP28 in Dubai, within the category of Data Science and AI. This generated considerable media exposure, including on BBC radio 4 and in videos from the ceremony

with the Princess of Dubai. Maral was also awarded a Keeley senior scholarships prize from Wadham College, University of Oxford.

Maral has been able to engage with high level policymakers on the importance of her research, including engagement with the Deputy Prime Minister of Mongolia Mr. Amarsaikhan. Her research also led to a TV interview on Mongolian National Broadcasting MNB World and various podcasts.

Maral's research has already helped the Satellite Applications Catapult secure commercial mining projects. Her machine learning/AI expertise is opening up new opportunities, such as the development of an AI prototype within the Catapult's accelerator space commercialisation engine and the delivery of new sustainable finance interventions.

Maral remains with the Catapult, where she has been promoted to be a senior earth observation consultant.

#### Sam Bourne

Project: *Characterising genetic variants associated with pain to improve the clinical translation of novel therapies*  
Host: *University of Kent*  
Sponsor: *LifeArc*

Pain is a serious unmet medical need globally, and a major barrier



to addressing this is poor clinical translation. Indeed, other than reformulations of existing drugs, no novel disease-modifying pharmacological therapies have been approved over the past few decades. With pharmaceutical industries increasingly considering the disease area as high risk, innovative approaches are required to improve clinical success by selecting better prospective therapies and their appropriate patient population.

Sam's Fellowship undertook a large-scale approach to improve the clinical translation of novel pain therapies. This was done by examining human genetic biobanks that collectively comprise over 750,000 genomes to validate in-house pre-clinical analgesic drug targets and stratify complex patient populations. Over 135,000 mutations occurring in the general population were examined within 15 two-pore domain potassium channel (K2P) genes, which represent novel pain drug targets. Each of these was assessed for its ability to statistically influence individual's susceptibility to 136 pain-related traits. In total, 18 mutations were discovered that significantly modulate patient's likelihood of developing pain such as migraine, seeking clinical analgesic treatment or chronically using pain medications. Several mutations were shown for the first time to significantly alter the gene activity of ion-channels which prevent pain sensing signals from reaching the sensory cortices. These efforts have provided novel translational validation of K2Ps as drug targets in large-scale patient populations for the first time, while pointing towards appropriately stratified patient populations for which specific drugs may be of most effect. This genetic approach has supported LifeArc's efforts by de-risking their pre-clinical development for K2Ps and by adding weight to growing consensus in the literature for developing novel K2P analgesics. This work has improved LifeArc's

external reputation within industrial and academic fields, and particularly strengthened academic collaborations that will continue to be utilised in future projects.

Following the Fellowship, Sam will continue to take a leadership role as a drug discovery scientist at LifeArc. In particular, he will be applying the skills and knowledge he has gained to tackle new disease areas such as motor neuron disease.

#### Daniella Cheang

*Project: Can we keep borrowing from future generations?  
A green, biomimetic method for controlling chirality*  
Host: University of Oxford  
Sponsor: AstraZeneca

Forming carbon-carbon bonds is one of the most fundamental processes in organic chemistry and forms the basis of making materials for the pharmaceutical industry. Most biological molecules can exist in either a right-handed or left-handed form – a property known as chirality. These two forms are related by reflection in a mirror plane and are known as enantiomers. Nature has an innate ability to control chirality, and this can be seen in many natural materials. Chirality can have significant implication for drug candidates – one form may have therapeutic value, whereas the other may have reduced or even detrimental effects. Therefore, finding new ways to control chirality and form a molecule of single handedness are of high importance to the pharmaceutical industry. Daniella's project used hydrogen borrowing to mimic Nature's sophisticated enzymatic process. Hydrogen borrowing uses feedstock alcohols to elongate carbon chains in one step. During her Fellowship, Daniella developed different hydrogen borrowing methods for synthesising molecules of a single handedness, each with a different focus. In the first method,  $\beta$ -branched acyclic ketones were synthesised allowing

formation of sterically hindered carbon-carbon bonds with high enantioselectivity. The second method focused on the synthesis of  $\beta$ -branched cyclic ketones using a dynamic kinetic resolution strategy. Pharmaceutically relevant heteroatoms, such as nitrogen, were then incorporated to allow synthesis of enantioenriched gamma-aminobutyric acids from starting materials derived from simple racemic amino acids. These methods could be adapted to large scale setup and furthermore purification of the products by crystallisation was possible.

Following the Fellowship, Daniella will be taking up a research scientist position at Boehringer Ingelheim.

#### Marie Dale

*Project: Automated identification and predicted translocation of marine hull invasive species*  
Host: Durham University  
Sponsor: AkzoNobel

Shipping accounts for over 80% of global trade. In addition to transferring goods between ports, shipping can also result in the transfer of non-indigenous species. Biofouling is one of the main vectors for the spread of non-indigenous species, some of which may become invasive.

Invasive species are a major threat to the world's oceans as they cause biodiversity loss and damage to coastal industry and infrastructure. Up to 69% of known aquatic invasive species are introduced through transportation of biofouling; something which is only expected to worsen with the combination of increased trade and global climate change.

The global fleet is large, and resources are scarce – it is important these resources are deployed where invasive risk is greatest, to have the most impact. In her Fellowship research Marie has developed models to predict global species distribution



and translocation potential through biofouling transportation on ship hulls, identifying viable translocation pathways both now and in the future (accounting for climate change). These viable pathways can help identify high-risk vessels which may require further scrutiny e.g. by in-water inspection. To make in-water inspections practicable and cost effective at the scale required, the second part of Marie's research has focussed on developing a route to automated image recognition of non-indigenous species.

Following on from the Fellowship, Marie will continue her research and explore opportunities to commercialise the output within AkzoNobel. This supports AkzoNobel's ambition to develop solutions to minimise the impact of invasive species, to support the wider shipping community and ultimately support the goal to reduce the environmental impact of shipping.

#### Jack Kay

*Project: Discovery of novel antimicrobial peptides to combat current and emerging superbugs*  
Host: University of Plymouth  
Sponsor: Ingenza

Jack's Fellowship focused on the identification of a significant number of potent, natural and engineered, antimicrobial candidates, which have promising application in the treatment of antimicrobial-resistant infections in both humans and animals. The discovery of these molecules represents a significant advancement in the field of bacteriocins research, with the number of known 4-helix bundle bacteriocins increasing by more than an order of magnitude, from fewer than 12 to over 200, directly from work carried out in the Fellowship.

Through this Fellowship, Jack has created a pipeline of lead molecules originating from a variety of microbial sources, which are diverse in amino acid sequence, and potency, with the

full range of target specificity still to be tested. Promising candidate molecules will be exploited via partnership with Amprologix, which is a spin-out from the University of Plymouth leading the commercialisation of 4-helix bundle bacteriocin Epidermicin through pre-clinical toxicology studies and is seeking further funding to advance to the lead compound Epidermicin NI01 for topical therapy of skin infection, and it is expected further funding will be obtained with the data generated during the Fellowship.

The Fellowship has also enabled Ingenza to keep up with current advancements in the field of biotechnology and become active contributors at the exciting interface with machine learning. Throughout the project, machine learning methodologies were applied in efforts to understand the complex relationship





between amino acid sequence and observed activity of the 4-helix bundle bacteriocins. In doing so, the company has dramatically increased its in silico capabilities, as demonstrated by the development of a proprietary codon optimisation algorithm, a service it now offers as part of customer projects.

After completion of the Fellowship, Jack will continue working at Ingenza as a senior scientist in the Molecular Biology Department, further characterising the lead molecules identified and driving the development of Ingenza's in silico capabilities.

#### Joe Lawton

*Project: Remote plasma sputtering of high quality thermochromic thin films for energy conservation*  
Host: University of Surrey  
Sponsor: Plasma Quest

Joe's EngD project focussed on the investigation of Plasma Quest Limited's proprietary remote plasma sputtering technology in the production of important functional oxide

thin film materials. Functional oxide thin films and coatings are key materials across many technological industries with demanding film structure and property requirements and the understanding of process parameter selection to produce the desired material is paramount to realising new products or devices.

The project investigated the process-structure-properties relationship of remote plasma sputtering processes and routes towards low-temperature deposition for two key functional oxide materials: thermochromic VO<sub>2</sub> and TiO<sub>2</sub>. The research was unfortunately unsuccessful in producing a low-temperature route to thermochromic VO<sub>2</sub>. However the project identified key process parameters for controlling the growth and properties of TiO<sub>2</sub> thin films. The study also expanded the process knowledge for the use of substrate biasing technology in conjunction with remote plasma sputtering as a means for low-temperature

deposition of crystalline material onto a variety of different materials. The work feeds into the wider knowledge of the unique processing landscape of the remote plasma sputtering technology at Plasma Quest Limited. The research helps to inform decisions with the development of new technological capabilities and processes for other materials of interest.

Joe is currently finishing writing up his thesis and applying for new jobs in London.

#### Bojidar Rangelov

*Project: Discovering CT imaging biomarkers of exacerbations of COPD*  
Host: University College London  
Sponsor: GSK

During his Fellowship, Bojidar worked on developing machine learning and image analysis techniques applied to Chronic Obstructive Pulmonary Disease, and occasionally to other diseases. He advanced knowledge of the phenotypes and disease

progression of COPD, identified imaging biomarker candidates of exacerbations of COPD and developed a comprehensive, machine learning powered suite of CT analysis algorithms, which can be used to extract and analyse these imaging biomarkers of COPD. The results of his research can contribute to the design of pharmaceutical trials by inspiring the study of lung anatomy which might have previously been overlooked. Furthermore, the disease progression techniques have been gaining traction in the field and are considered for patient stratification. Finally, the image analysis suite can be used to analyse further CT datasets and quantify imaging biomarkers in both stable COPD and during exacerbations of the disease, in addition to being applicable to other respiratory diseases. While GSK does not intend to directly profit from the intellectual property of Bojidar's work, having access to the results of his research is expected to improve inefficiencies in data logistics and access, empower future image analysis studies and aid in patient stratification for clinical trials. Furthermore, the techniques Bojidar has developed should save costs on contracts with image analysis companies (which GSK has used in the past) by providing baseline results and endpoints which can be extracted in-house.

Following the Fellowship, Bojidar intends to continue developing in the machine vision and medical image analysis field by pursuing jobs in companies which focus on machine vision in the medical field. A great motivator is still the increased translation of engineering and AI to medicine and its impact on patient care. To this end, Bojidar is hopeful that in the future he will establish or find a role which would allow him to both spearhead research, collaborate with medical institutions, and translate technology into clinical practice.

#### Thomas Waddell

*Project: Causal modelling of obesity and multi-organ dysfunction through magnetic resonance imaging: applying Bayesian networks*  
Host: University of Oxford  
Sponsor: Perspectum

Tom's DPhil project focused on the application of Bayesian networks in healthcare, specifically in Type 2 diabetes and long covid. The project has resulted in three journal publications (with an additional paper currently under review) and several conference publications. The work has greatly contributed to building Perspectum's multi-organ imaging offering and evidence base in the space of metabolic disease and COVID-19. The project has allowed Perspectum to showcase the true utility of multi-organ imaging, showing how (for example) the individual facets of body composition affect the development of non-alcoholic steatohepatitis, a severe form of liver disease which Perspectum's flagship product explores. Tom's work has been presented at multiple international conferences, allowing Perspectum to build their brand awareness and collaborate with several key opinion leaders to assist with industry positioning of Perspectum technology. Furthermore, Tom's Bayesian-network models have been used by Perspectum to illustrate the importance of stepping away from 'black box' AI approaches in healthcare.

Following the Fellowship, Tom will be continuing his employment at Perspectum within the BD Pharma department, in a role that combines his scientific knowledge and the dissemination/communications skills that were greatly improved through the Fellowship.

#### Declan Williams

*Project: Flow versus batch chemistry in the safe manufacture of explosives*  
Host: University of Birmingham  
Sponsor: QinetiQ

Declan's project focused on the use of microreactors for the manufacture of explosives and in particular whether less hazardous approaches can be used in place of current batch processes. As part of this research project the manufacture of conventional explosives (RDX and HMX) and energetic plasticisers (K10 and GlyN), have all been investigated in flow, significantly improving safety and reproducibility. The travel bursary provided as part of the Fellowship also enabled Declan to establish valuable networks within the flow chemistry community.

Declan's research has helped QinetiQ to further its expertise, but also given a large scope to innovate. By leveraging the outputs of this research project and expertise gained, QinetiQ now present a new offering to customers.

On completion of the project, Declan will return to being employed by QinetiQ full time and will continue to conduct research into the use of flow chemistry and microreactor technology in the exploration of novel explosives. He hopes to continue collaborating with Birmingham University, and other organisations within academia and the defence industry, to further develop approaches to the manufacture of explosives in flow, developing innovative, sustainable, and safe methods that are suitable for the large-scale manufacture of explosives.

Declan has recently been awarded the Frank Carver Bursary by the International Pyrotechnics Society.



# ENTERPRISE FELLOWSHIPS

Funded by the 1851 Royal Commission the RAEng 1851 Enterprise Fellowship graduate scheme forms part of our shared commitment to stimulate excellence and encourage creativity and innovation in engineering by identifying and supporting the graduate founders and leaders of tomorrow's successful companies.

## Completed in 2023

### Rowan Armstrong

Company: *Bioliberty*

Bioliberty is a robotics start-up that aims to empower every human, particularly those affected by stroke, to live a longer independent life through assistive and rehabilitative robotics. In their recent report, 'Stroke rehabilitation in adults', the National Institute for Health and Care Excellence (NICE) suggested stroke survivors should get at least three hours a day, five days a week of rehabilitation. This will put considerable pressure on an already stretched NHS, so robotic solutions like theirs, which can be used without carer supervision, could be an extremely timely, cost-saving resource.

Lifeglov employs cutting-edge soft robotics technology for precise force generation and control, ensuring a tailored approach to rehabilitation. The device features adjustable force levels, allowing for

personalised hand rehabilitation that promotes optimal recovery. When coupled with BioLiberty's virtual therapy environment, Lifeglov becomes a versatile tool for stroke survivors at every stage of their rehab journey.

Acting as both a passive and active device, it can either facilitate movement independently or provide assistance to complete specific motions. In its passive mode, Lifeglov does all the work to help mobilise movement, while in the active mode, it collaborates with the user to help them complete movements. Bioliberty's soft robotics can detect subtle movements, and, through trained AI algorithms, translate these intentions into actions.

In April 2023, BioLiberty secured £2.3m in funding from a consortium of investors, including Archangels, the business angel investment syndicate. This new funding will go towards developing the machine learning and data collection elements of the product. This is extremely

important for therapists and other clinicians as it can help them monitor the progress of their patients as well as tailor their treatment.

Bioliberty has further exciting developments on the horizon, including the upcoming launch of Lifeglov in the US market. In the meantime, they are conducting clinical investigations in collaboration with a leading rehabilitation hospital in the US. These research efforts aim to substantiate the effectiveness of Bioliberty's technology in aiding individuals to achieve a more optimal level of function post-stroke.

### Joseph Bentley

Company: *ACT MEDICAL*

ACT Medical is a MedTech start-up looking to revolutionise the standard of care for penetrative trauma and reduce the mortality rates associated with violent crime. In London, it takes 7 minutes for an ambulance to arrive, but only 5 minutes for

a victim to bleed to death. Consequently, half of all violent trauma related deaths occur before the patient is able to reach definitive care. Providing first responders with a method of applying direct pressure to the wound site would drastically reduce the trauma mortality rate. This method needs to be intuitive, without knowledge of complex techniques such as wound packing, and easy to remove once the patient reaches surgery. ACT Medical are designing a device that directly addresses this need and aims to stem bleeding as quickly as current methods.

In July 2023, Joseph was awarded Entrepreneur of the Year and ACT Medical received the Innovation and Technology Award at the Generation Next Awards.

### Fergal Mackie

Company: *Metacarpal*

While foot and leg prosthetics have been incredibly successful at restoring the functional and psychological needs of amputees, the same cannot be said for hand devices. The NHS estimate, 26-45% of upper-limb amputees wear no prosthetic at all! And some estimates are even higher. This problem is worsened when you consider that for those missing only 1 hand, this typically leads to overreliance on the sound side that can rapidly develop into arthritis or similar problems.

Centrally, the problem here is that these health problems are actually less of a sacrifice than current upper-limb prosthetics.

No matter what, if any, device someone chooses - they must make a huge compromise to either their well-being, their function or their self-perception. Metacarpal is looking to make a product which does not compromise across any of these aspects.

Metacarpal aim to design a functional device, with accessible pricing, that's comfortable to wear all day long and looks so good that it makes the wearer feel good. They hope to achieve this with better materials and more advanced engineering than competitors.

In January 2023 Fergal was awarded a Young Innovators Award by Innovate UK and Metacarpal secured a Scottish Enterprise SMART grant to fund research and development.





# DESIGN FELLOWSHIPS



A biannual Fellowship for professionals and those at a more advanced stage in their career to explore important current issues identified by the Commissioners. Introduced in 2006, these fellowships encourage research culminating in tangible outputs of practical significance with the potential to feed into policy.

## Completed in 2023

### Aran Dasan

Subject: *Design for Resilience - Enki: Technologies for Resilient Biodiverse Oceans*  
Mentor: *Professor Michel Kaiser, Heriot-Watt University*

The ocean contains invisible underwater weather patterns. Temperature gradients, haloclines, cold water upwellings of nutrients, and climate-change induced warming waters.

These dynamic phenomena influence the presence of marine species who have preferred habitats. In terms of commercial fishing, this applies to target quota species as well as 'bycatch' species that fisheries do not wish to catch at all. Aran and his colleagues proposed 'Enki': an internet-connected ocean sensor for fishing vessels, to observe these underwater patterns and correlate them with their fishing catch, in order to inform future fishing practices - to avoid bycatch and spend less fuel in achieving their mandated fishing quotas.

Enki sensors are attached to commercial fishing gears, which create measurement profiles of the water column during the fishing process. They measure key parameters such as temperature, salinity, depth, location, and turbidity. These measurement profiles are automatically uploaded to the cloud, where they can be viewed by skippers and other interested parties via a web application for analysis.

During this project, Aran and his colleagues took Enki from an early concept through to field-tested software and hardware prototypes. Their process involved human-centred design, design engineering

and ecology. The prototypes were used by commercial crab fishing vessels in Orkney for a month. The results give an early indication of the usefulness of subsea measurements to inform responsible fishing practices. During the project, a strong academic collaboration was created with Heriot-Watt University, who are continuing to deploy Enki in new fisheries around the UK to further prove the concept's value to sustainable fishing.

### Professor Jacqui Cole

Subject: *Techno-push consumer-pull - Stimulating innovation of solar-powered windows for energy sustainable future cities: a user-centred approach*  
Mentor: *Professor Peter Littlewood, Argonne National Laboratory*

This project sought to understand the 'techno-push consumer-pull' of a next-generation photovoltaic device technology for use as solar-powered windows. These 'smart windows', which generate electricity from sunlight, could meet the entire energy demands of buildings for future cities, in a fully sustainable fashion. Achieving such a radical transformation requires driving 'smart windows' to innovation.

Jacqui is a research expert in this environmental technology. With this 'techno-push' in hand, she aimed to generate a concerted 'consumer-pull' on 'smart windows' by testing Rogers' five criteria for the successful diffusion of innovation: relative advantage, compatibility, complexity, trialability, observability.

The project focused on testing the last two of these criteria: observability and trialability. These tests took the form of a 'pop up' exhibit that was showcased to

720 members of the public at the Visitors Centre of the Rutherford Appleton Laboratory (RAL) in August 2022, during two open days of the ISIS Neutron and Muon Source. This 'smart window' technology was showcased to promote public awareness, while soliciting questions from attendees to obtain feedback on this technology from a 'consumer-pull' perspective. The nature of the questions that were raised revealed that macroeconomic considerations about pricing and technical readiness of the 'smart window' technology predominated public thinking. These findings were checked via a subsequent event that focused on a different demographic: school children; whereby, this technology was presented as part of Protect the Planet Day 2022. The same macroeconomic notions about the technology prevailed in the line of questioning from this different demographic of the population. Thus, it was concluded that while Rogers' criterion, observability, is important in the form of gaining public awareness of this technology, Rogers' criterion of relative advantage is also at the front of everyone's minds. The recent rise in energy prices owing to the global energy crisis is likely to be a key influence in this regard. i.e. timeliness of this exhibit is also important. Therefore, the "Techno-push" needs to frame its findings more in terms of these macroeconomic concerns, rather than worry too much about the fineries of which chemical colour one should use for the light-harvesting part of the device technology, except on account of its financial viability. Nonetheless, the "Techno-push" part of this project generated 44 publications about these solar cell components that stand to be useful to the research scientist in this field.





# BUILT ENVIRONMENT FELLOWSHIPS

The 1851 Research Fellowship in the Built Environment is intended to enable those at a more advanced stage in their career to explore important current issues, selected by the Commission.



## Completed in 2023

### Dr Tijana Blanusa

Subject: *Putting the 'Green' into Green Infrastructure*  
Mentor: *Dr Ross Cameron*

This project compared the performance of mixed hedge species with that of single species monocultures, and examined their ecological benefits.

Hedges were chosen as the study focus due to their simplicity, space-saving nature, and cost-effectiveness, offering promising solutions to local environmental issues and the replacement of conventional urban barriers. The project's objectives included establishing and conducting outdoor growing experiments, as well as applied research in an urban school. This explored the opportunities associated with using hedges as a tool for environmental education, engaging the school pupils in novel research aiming to address challenges in planting implementation on school grounds.

Results revealed that mixed hedges, especially during autumn and winter,

provided structural benefits for water retention. Moreover, the educational interventions positively influenced students' perceptions and appreciation of plants' environmental benefits, particularly in mitigating pollution and climate extremes.

Project outcomes will be showcased at the RHS Chelsea Flower Show in May 2024. Insights are already being incorporated into future planning of green interventions to support inclusion of planting into school grounds and its use as an educational resource, within the RHS's Campaign for School Gardening and the National Education Nature Park project. Looking further ahead, experiments will evaluate long-term hedge performance.

On a broader scale, these learnings contribute progress towards an overarching goal of creating green infrastructure that addresses the challenges posed by urbanisation and climate change, whilst championing more diverse, and more loved urban environments.

Tijana remains Principal Horticultural Scientist at the Royal Horticultural Society.



# INDUSTRIAL DESIGN STUDENTS

Our Industrial Design Studentships provide graduates in engineering and science with funding to study for a master's in Industrial Design with the objective of stimulating industrial design capability amongst the country's most able science and engineering graduates.



## Completed in 2023

### Erin Carr

Course: *Earthquake Engineering and Infrastructure Resilience*  
Institution: *University of Bristol*

Completing a masters is the only way for civil engineers in the UK to become chartered. Without the support of the Royal Commission, Erin says, it simply would not have been possible for her to further her studies in this way. The opportunity to study this specialised masters at the University of Bristol has further solidified Erin's ambitions and career path in disaster relief while giving her real hand-on experience during the earthquake in Turkey. This opportunity provided her with the skills, knowledge and hands on experience to successfully join the Institution of Structural Engineers Emergency Engineering Field Investigation Team (EEFIT), who create teams of structural engineers to carry out emergency

structural assessment and engineering in time of disasters. Erin's masters thesis, Parametric Finite Element Analysis of Concrete Beams Reinforced in Shear with Fibre Reinforced Polymers: Informing the National Annex to the new Eurocode for Design of Concrete Structures (EN1992), essentially looked at verifying experimental data of fibre reinforced concrete beams to inform the British National Annex of the Eurocodes, which is the set of building codes and standards civil engineers have to follow in order to build safe structures. This was the first time fibre reinforced concrete has been included into the codes signifying the research's importance, and it is hoped that the material's inclusion in the codes creates more confidence in construction in the UK for the future.

Erin says: "I will forever be thankful for the opportunity and support the Royal Commission has

given me to further my academic and professional ambitions which wouldn't have been possible otherwise. I thoroughly enjoyed this experience and am immensely proud to have been a part of the Royal Commission."

Erin is now working for Momentum Consulting Engineers in Bath and also continuing her nursing training.

### Jahan Daya

Course: *Global Innovation Design*  
Institution: *Royal College of Art / Imperial College London*

With a background in Mechanical Engineering, Jahan joined the Global Innovation Design course seeking to combine technical and creative practices in a multidisciplinary and multicultural environment.

The course aims to immerse its students in changing cultural contexts and enabled Jahan to







travel to Tokyo and New York where he focussed on honing his hands-on prototyping skills and learned a bit of Japanese. During the New York exchange at Pratt Institute, he worked on an experimental project to create biodegradable sunglasses frames from processed seafood waste (Chitosan). This project aimed to address the ever-increasing plastic waste issue in our oceans, generated from the production, sale, and loss of cheap sunglasses.

Upon returning to London, Jahan's final year solo project explored the problems surrounding shoulder injuries in swimming and water polo athletes and the complications arising when returning to their training. His project sought to give confidence and customised training benchmarks so that each athlete can monitor their rehabilitation and training progress while minimising the risk of re-injury. The outcome resulted in the development of a mobile app and wearable device fitted on both hands that tracks the athlete's motion to analyse their technique variations and muscular fatigue

levels. By identifying the rate and volume of fatigue incidents, the system can estimate acute and chronic shoulder strain and subsequently evaluate how their training affects their rehabilitation and their risk of re-injury. Athletes can use this data to make informed decisions to tailor their training so they may safely and quickly return to sport.

Following the Studentship, Jahan has secured a six-month internship at Gurin Energy, a renewable energy developer based in Singapore. The company focuses on the development, ownership, and operation of wind, solar, and storage solutions in Asia.

#### **Grace Duan**

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

During her Studentship Grace explored the interdisciplinary intersection between design and technology, diversifying her skillset with various projects, including developing the Leafeon System, a circular system that has the

potential to simultaneously bridge the nutrition gap and create more sustainable, organic agriculture by upcycling legume waste and surpluses into Leaf Protein Concentrate, a promising and innovative food source that is the cheapest, most abundant source of protein.

For the final major group project Grace looked at the growing problem of microplastics in our oceans and waterways. Current methods for detecting microplastics in water bodies are resource-intensive, requiring a great deal of expertise, expensive equipment, labour and time. MicroSentry is a low-cost and field-deployable in-situ sensor that can be attached to existing infrastructures such as data buoys, research vessels, and piers. It is designed to be used for continuous data collection, providing real-time representative data that is relevant to scientific research and contamination monitoring for water companies. The sensor not only detects microplastics but also transmits the data to a data visualisation platform providing readable data

for the public. This allows for easy access and understanding of the microplastic pollution levels in our water bodies. MicroSentry went on to be exhibited nationally and internationally, as well as making it to the finals of the Mayor's Entrepreneurship Competition 2023.

Following on from her studies, Grace is now an Associate Partner Manager at Amazon in London, working on the future of home devices.

#### **Daniel Hale**

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

In his first year, Daniel explored the future of distributed creation, geometric craft and circular manufacturing.

Daniel's second year group project, Pleural, aimed to create an autonomous device designed to help people with respiratory conditions combat mucus. Unlike anything else available, the innovative handheld device offers comprehensive guided chest physiotherapy to be carried out autonomously by patients at home. Pleural reached the finals of Imperial College's Venture Catalyst Challenge and the Mayor's Entrepreneur Competition and received a James Dyson Award and the Helen Hamlyn Award for Creativity.

For his solo project Daniel knew he wanted to work on something related to the environment and utilise principles of regenerative systems design. After becoming interested in the whales that drive the ocean nutrient cycle, he started looking into nutrient cycles at a domestic level and specifically addressing the mess that is the way we manage our biodegradable waste from the home. The final output from the project is a new kitchen sink appliance that processes all

biodegradable waste into usable biogas and nutrient fertiliser for regrowth.

Daniel is now a Mechanical Design Engineer with Shellworks, a design-led company that creates compostable packaging solutions made from naturally-derived materials.

#### **Eden Harrison**

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

During his industrial design studentship, Eden studied Innovation Design Engineering, transitioning from his prior work as a mechanical/structural engineer into the worlds of design and innovation. While in the first year of IDE, Eden worked on diverse projects, from vision-tracking and machine learning for gaze-prediction, to the computational modelling of flocking behaviour for sculpture. Eden's solo project during this year focused on the ability of phase-change materials to alleviate thermal stress in humanitarian camps.

During his second year, Eden worked with Liz Lee, Ori Blich and Juan Ignacio Rion to develop a novel biomaterial replacement for polystyrene that went on to place as a finalist in — amongst others — WE Innovate, the Mayor's Entrepreneur competition, and the Green Alley Award. It has also exhibited at major design festivals, from London to Dubai. This project has since flourished into a startup, Carbon Cell, winning a place on two competitive accelerator programmes and is currently based in Somerset house.

Eden's master's thesis, developed during the final six months of his second year, involved a novel post-humanist design approach to addressing underwater sound pollution. The result, 'reef dB', was

a national runner up for the James Dyson Award, as well as winning the Innovation Design Engineering 'Outstanding Achievement Award'. Since graduating Eden continues to work as CTO and co-founder for Carbon Cell, pushing the project towards a commercially successful future that can have a serious positive impact on our world.

#### **Samuel Jones**

Course: *Design Products*  
Institution: *Royal College of Art*

During his Studentship, Sam evolved his design practice through impactful projects that have explored topics such as minimising furniture waste, exploring innovative alternatives to cars, and repairing electronic appliances. These have been great test beds for learning, alongside being formed around some of the world's most currently pressing topics.

In addition to the core course, Sam made sure to actively engage in additional projects such as OPPO X RCA and Design for Good, while also attending numerous training courses, talks, on-site visits, and exhibitions. What stood out most to him was the opportunity to consistently engage with some of the best people in industry and education. He has made contacts that he would never have been able to reach otherwise, with whom he looks forward to staying connected for many more years to come.

Sam's graduation project was a focused exploration of how we can apply the convenience of cars to the micromobility realm. Even though it was intended as a platform for learning, it gathered great interest, showing potential for real impact. It has now become a valuable asset, poised for further development and ultimately, market realisation.

Following his Studentship, Sam has set up his own consultancy, Jam Scones Design.



### Steph Jump

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

During her master's programme, Steph researched how spatial skills are vital for succeeding in STEM but are not taught in schools. These skills forecast future mathematics success, foretell which students will choose STEM careers, and even predict who will drive STEM innovation.

On average, girls have less spatial experience than boys, making them three times more likely than boys to struggle with this ability. Low-income students also lag significantly behind their wealthy peers. Steph's research suggests that spatial training can even out girls' abilities with boys', increase women's engineering retention by up to 30%, and improve students' STEM grades regardless of gender or income.

During her Studentship, Steph developed spatial skills training games. She received a scholarship from the Pokémon Company, was a finalist in the London Mayor's Entrepreneurial Prize and a competitor in Imperial's WE Innovate Programme.

Following her Studentship, Steph has become the founder and CEO of Alytica ([www.Alytica.studio](http://www.Alytica.studio)), a start-up driving equity in STEM education through spatial skill training games.

### Vedika Lall

Course: *Global Innovation Design*  
Institution: *Royal College of Art / Imperial College London*

Vedika's major project during her Studentship focused on uterine contraction monitoring. The experience of contractions preceding labour is truly unique, as each woman encounters them in her own distinct way.

However, this crucial indicator of the mother's health is often overlooked and poorly communicated. Shockingly, over 40% of women struggle to discern whether they are in labour or not.

Uterine contraction monitoring is important because it is a critical biomarker of maternal health and a reliable indicator of labour progression to delivery. At present, uterine contractions are monitored using apps or manually, which is unreliable and frequently leads to women miscalculating.

Bia is an at-home uterine contraction monitoring system designed to seamlessly integrate into a mother's rest routine. Codesigned with recent mothers and clinicians from St. Mary's Hospital, London, Bia is intended to be comfortable and flexible; it incorporates a digital interface and novel sensing technology to listen, recognise and measure contraction activity reliably.

Bia is currently patent pending, and Vedika hopes to bring together a team to bring it to market. In the meantime, she is acting as a Design Mentor at the Srishti Manipal Institute of Art, Design and Technology.

### Jasper Mallinson

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

Jasper came from a background in design engineering, with personal roots in 'nuts and bolts making' – working at a younger age in roles across metal fabrication and carpentry. In the years before joining the Innovation Design Engineering programme, he worked in the world of tech start-ups, developing drones for humanitarian landmine clearance and microfluidic blood testing devices.

During his Studentship, Jasper focused on regenerative design

and digital fabrication, including using eco-acoustics to tackle agricultural soil degradation and modelling the natural shrinkage of fresh wood for use as a computational design tool.

His major project, Mechamorphis, explores the concept of 'augmented makers' – the reimagining of digital fabrication technologies (technologies that control tools through computers) to augment, rather than replace, human making abilities, developing a wearable robotic device that gives humans the capabilities of digital fabrication machines.

Jasper is now a Product Design Engineer at AcoustoFab, which focuses on mid-air ultrasound manipulation.

### Hunaid Nagaria

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

Hunaid entered the Innovation Design Engineering programme at Imperial and the RCA, wanting to build a practice around his interests in Industrial and Interaction Design. Receiving the Commission's support made it possible for him to explore themes in accessibility and how to build technology for people living with varying abilities and circumstances.

During the programme, Hunaid's solo pursuits focused on building technology that facilitated recreation, such as musical instruments for people living with dementia and a gaming controller for people living with Muscular Weakness, which turns anything you touch into a control interface. A key piece of work that lies outside these themes was the development of Guerrilla, a patent-pending device that tackles polluted road runoff as part of a group project. Hunaid's work in the IDE programme culminated in a distinction and recognition from



institutions such as the Mayor of London's office and the Interaction Design Association.

Since graduating, Hunaid and his co-founders have transitioned Guerrilla from an academic project to an award-winning startup approaching real-world trials.

Following this, Hunaid has joined the design team at Nothing(R), a leading consumer electronics manufacturer. As a Creative Technologist, Hunaid will work with the team on research and development for new products and helping to realise an alternative, more 'fun' future for consumer electronics.

### Fintan Pritchard

Course: *Integrated Industrial Design*  
Institution: *Loughborough University*

Fintan's course and continued education have allowed him to make substantial progress with various advanced skills and software within design. Surface modelling in solidworks

and Rhino alongside high-fidelity prototyping with CNC manufacture have equipped him to design and test complex and modern products with precision. Additionally, he pursued a good understanding of AI theory and product development, being one of only a few to successfully program a focused AI in TinyML, a new skill which is increasingly relevant and sought after.

Beyond these technical accomplishments, he enjoyed collaborating with designers with vastly different backgrounds and training, helping him develop his management and collaborative abilities. His business management project simulated a startup with the activity involving every aspect of running a business, from concept development and seeking investment to product distribution and everyday operation.

Following the course, Fintan is excited about returning to industry and optimistic about finding a position in a consultancy.

### Mia Shepherd

Course: *Product Design*  
Institution: *University of Strathclyde*

During her Studentship, Mia successfully navigated a variety of taught modules alongside an industrial group project and an individual endeavour, the latter of which was inspired by a personal passion for fibre arts (knitting, crochet, embroidery etc). Informed by her awareness of individuals within the crafting community who exclusively employ one hand for crocheting, she observed that remarkably, none of these crafters were utilising a commercially available assistive device. Furthermore, user-made solutions provided for their own specific needs, often lacking the versatility required to address all scenarios in which someone might exclusively use one hand. This could include relying on the arm's weight or clamping capability where only the hand dexterity is compromised compared to a complete upper limb amputation. Thus, Mia





discerned a critical gap to design an inclusive assistive device for single handed crocheting.

In collaboration with a stakeholder, Mia developed a novel solution providing for a spectrum of crafters ranging from those devoid of manual dexterity in one hand to those with a single amputation extending from the shoulder. Mia's solution goes beyond the current market by providing on-the-go use and independence, removing the need for reliance on additional surfaces for mounting or stability.

Following the Studentship, Mia has accepted a position at the University of Strathclyde as a doctoral candidate under the title of Designing Cycling Health. She intends to blend her experiences in Sports Engineering and Product Design to craft insightful contributions aimed at engaging more people in Glasgow with sustainable infrastructure.

### Annie Tang

Course: *Global Innovation Design*  
Institution: *Royal College of Art / Imperial College London*

During her Studentship, Annie embarked on a global journey from London to New York and Tokyo, delving into the intricacies of design on a worldwide scale. One notable project involved developing a medical device tailored for individuals with Chronic Fatigue Syndrome (CFS) to better manage their symptoms. This endeavour led Annie to investigate ways to adapt 12-lead electrocardiograms (ECGs) for continuous commercial application, facilitating the collection of high-quality heart rate (HR) and heart rate variability (HRV) data for both patients and researchers.

A novel solution emerged in the form of electrode 'tattoos'.

Another significant undertaking was a co-design initiative with residents of a social housing

complex. Here, the focus was on addressing the challenges faced by older residents in navigating an increasingly digitized world. Annie's collaborative efforts resulted in the creation of a print logbook complemented by online resources, offering a bridge to essential services.

Lastly, Annie explored methods to enhance the relationship dynamics within familial care pairs dealing with chronic conditions, aiming to boost morale and overall quality of life. Through interactive activities featuring guided questions and prompts, she sought to foster understanding, joy, and moments of respite for these caregiving pairs.

Following the Studentship, Annie plans to continue to apply these insights and methodologies to tackle real-world challenges in the field of design, striving to make meaningful contributions to global communities.

### Eve Townsend

Course: *Innovation Design Engineering*  
Institution: *Royal College of Art / Imperial College London*

With a background in physics, and study in optics and photonics, many of Eve's projects during her Studentship explored human-computer interactions in hybrid systems that combine physical and digital environments.

A good example is Loqui. Speech disorders affect 90% of individuals with Parkinson's Disease, while only 3-4% receive treatment for this. Speech symptoms can often predate diagnosis by over a decade, highlighting the importance of speech as a biomarker for the early detection of the disease. People with Parkinson's often have an altered perception of their own voice with an inability to self-correct for loudness, prosody and speech rate due to a lack of feedback in the brain's motor-control loop. This

inability to self-correct intensifies communication difficulties, greatly diminishing social interaction and quality of life.

Loqui is a wearable assistive technology that translates speech parameters into tactile biofeedback. The device addresses issues related to altered speech perception, volume and rate by providing biofeedback on the person's voice. The device is designed to accompany people with Parkinson's and speech therapists through speech exercises. More importantly, it enables people to use the device independently, outside of the training environment and in real-life conversations. By improving carryover and the transfer of skills into real situations, this can greatly improve the quality of life for those living with the disease.

Eve is now a Product Designer at Riverlane, a company aiming to unlock useful quantum computing.







The Royal Commission for the Exhibition of 1851, in partnership with the Education and Training Foundation launched the Technical Teaching Fellowship programme in 2018 with the aim to celebrate, develop and disseminate exceptional practice in technical teaching.

Fellowships are awarded to outstanding further education practitioners who are recognised for their high impact teaching practice and the delivery of effective outcomes for learners.

The 2023 Technical Teaching Fellows are all expected to share their learning and expertise across the sector as part of the award.



# TECHNICAL TEACHING FELLOWSHIPS

## Awarded in 2023

**Paul Gartside**  
 South Central Institute  
 of Technology /  
 Milton Keynes College

**Amy Hollier**  
 Heart of  
 Worcestershire College

**Bradley Collier &  
 Kumaran Rajarathinam**  
 Blackburn College

**Kevin Pollard**  
 MKC Training / Mid Kent College



A very limited number of Special Awards are made to worthy causes and individuals whose aims are consistent with the Commission's Supplementary Charter.

# SPECIAL AWARDS

However, apart from its programme of Fellowships and Studentship the Commission does not offer any Special Awards for university courses or postgraduate research.

By their very nature, Special Awards are not capable of clear description, since they are assessed by Commissioners on a case by case basis.

## Awarded in 2023

### STEM EDUCATION AND OUTREACH

**British Science Association**  
– Primary kit boxes.

**Primary Engineer**  
– Primary Engineer Curriculum.

**Smallpeice Trust**  
– Arkwright scholarships.

**British School at Rome**  
– Summer School placements.

**Education and Training Foundation**  
– Technical Teaching Fellowships.

**Oxford University Development Trust**  
– OXbOXes.

**University of Hull**  
– Humber Science Festival.

**Kids Invent Stuff**  
– Inventors' Club.

**Royal Botanic Gardens Kew**  
– Grow Wild.

**All Party Parliamentary Engineering Group**  
– Event sponsorship.

**Foundation for Science and Technology**  
– Debate sponsorship.

**Geological Society**  
– Megalosaurus Month.

**MadeHereNow**  
– Website support.

**J Mallinson & E Townsend**  
– STEM materials.

**G Lamb**  
– STEM outreach.

### SUPPORT FOR LEGACY ESTATE

**Imperial College London**  
– Great Exhibition Road Festivals 2025 & 2026.

**Science Museum Group**  
– Power Hall refurbishment.

**Exhibition Road Cultural Group**  
– SouthKenZEN+.

**Royal Society of Sculptors**  
– Florilegium.

# SIR MISHA BLACK AWARDS

The inclusion of the Sir Misha Black Awards in the Royal Commission's portfolio, effective from February 2020, reinforces its commitment to design education.

The Sir Misha Black Medal honours those who have given distinguished services to design education. It was the first, and is the only, international award to do so. The Sir Misha Black Award for Innovation in Design Education salutes innovation in design education in the United Kingdom.

## Completed in 2023

### Judah Armani

*Subject: Co-Creating an innovative and pioneering approach to Design Education to empower young people, with neurodiversity, who find themselves in extreme poverty and/or profoundly challenging circumstances.*

Over the last year Judah has collaborated on new initiatives focused around place-based probation services and developing education in American youth prisons.

### The following observations have been established:

1. Collaboration can lead to desistance from crime.
2. Collaboration increases communication - Social Capital.
3. Collaboration increases empathy - group accountability.
4. Collaboration increases the legitimacy of the initiative.

5. Collaboration fosters unity across a divided stakeholder group.

### In addition, through observing place-based service delivery, Judah has shown that:

1. Place based services makes the services more accessible.
2. Place based services improve the quality of services.
3. Place based services provides the scope for new emergent services.

These observations have led him to believe that through developing meaningful collaborations in prisons and place-based delivery of services across probation, the conditions for meaningful and genuine design education can take place in a profound and impactful manner. More so, the role of design within the development of the Criminal Justice System should be an imperative.

Judah was able to meaningfully journey with 50 men over the course of the year. In every location across Wales, England and America, profound development has taken place through impact measurement, full time employment and new education systems in place.



# THE YEAR AHEAD

It will be 175 years since the formation of the Royal Commission in 2025, and 2026 marks the same anniversary for the Great Exhibition itself.

In preparation, the Commission is starting to plan a number of initiatives and events, including a new history of the Commission, research into the impact of the Commission's educational programmes, a public exhibition and a public lecture series.

The Commission already provides funding, through its Special Award programme, for a number of STEM initiatives. Over the coming year, the Commission will also be exploring whether there is scope for it to do more directly in support of one or two key priority areas, such as improving STEM education in primary schools and widening provision of STEM apprenticeships.

The Commission recognises that its various award programmes are not as well-known as they might be and will also be looking to improve communication with its various stakeholders, including a revamped website, a new annual review document and new marketing materials.



# GOVERNANCE / FINANCIAL INFORMATION

## Commissioners and Committee Members

### President

- HRH The Princess Royal.

### Royal Commissioners (and Board of Management)

- The Rt Hon Professor Lord Kakkar KBE PC FMedSci, Chairman.
- Professor Jim Al-Khalili CBE FRS FInstP.
- The Rt Hon Lord Burnett of Maldon PC.
- Professor Dame Ann Dowling OM DBE FREng FRS.
- Mr Jim Eyre OBE.
- Professor Sir Andrew Hopper CBE FRS FREng FIET.
- Professor Lord Mair CBE HonDSc FREng FICE FRS.
- Dame Alison Nimmo DBE MRTPI FRICS HonFRIBA FICE.

- Ms Sandra Robertson.
- Professor Dame Carol Robinson DBE FRS FRSC FMedSci.
- Professor Eleanor Stride OBE FREng HonFIET.
- Professor Chris Wise RDI FREng FICE MISTRUCTE HonFRIBA FRSA.

### Ex Officio Commissioners

- The Lord President of the Council.
- The First Lord of the Treasury.
- The Chancellor of the Exchequer.
- The Secretary of State for Science, Innovation and Technology.
- The Secretary of State for the Environment, Food and Rural Affairs.
- The President of the Institution of Civil Engineers.
- The President of the Geological Society.





**Finance Committee**

- Ms Sandra Robertson, Chairman.
- Ms Sarah Arkle.
- The Rt Hon Lord Burnett of Maldon PC.
- Professor Sir Andrew Hopper CBE FRS FEng FIET.
- Dame Alison Nimmo DBE MRTPI FRICS HonFRIBA FICE.
- Mr Thomas Seaman.
- Mr Fabian Thehos CFA.

**Science and Engineering Fellowships Committee**

- Professor Dame Carol Robinson DBE FRS FRSC FMedSci, Chairman.
- Professor Jim Al-Khalili CBE FRS FInstP.
- Professor Gillian Bates FRS FMedSci.
- Professor Mike Benton FRS FRSE.
- Professor Martin Bridson FRS.
- Professor Andrew Briggs.
- Professor Neil Champness FRSC FLSW.

- Professor Anne Dell CBE FRS FMedSci.
- Professor John Dewey FRS.
- Professor Cyril Hilsum CBE FEng FRS.
- Professor Patrick Keogh FEng.
- Dr Sandra Knapp OBE FRS.
- Professor Rachel O'Reilly FRS FRSC.
- Professor Sheena Radford OBE FRS FMedSci.
- Dr Dame Frances Saunders DBE CB FEng FInstP.
- Professor Christopher Tout.
- Professor Stuart West.
- Professor John Wood CBE FEng.

**Brunel Fellowships Sub-Committee**

- Professor Dame Carol Robinson DBE FRS FRSC FMedSci, Chairman.
- Professor Dame Anne Dowling OM DBE FEng FRS.
- Professor William Powrie FEng FICE.
- Professor John Wood CBE FEng.

**Industry and Engineering Committee**

- Professor Dame Ann Dowling OM DBE FRS FEng, Chairman.
- Professor Cees de Bont.
- Professor John Clarkson FEng.
- Dr Nicholas de León.
- Professor Andrew Lewis FEng FRSC FAPS FIMMM CChem CSi.
- Professor Lord Mair CBE HonDSc FEng FICE FRS.
- Professor Ron Pethig.
- Dr Malcolm Skingle CBE DSc.
- Professor Dame Sarah Springman DBE FEng.
- Professor Adam Stokes.
- Professor Eleanor Stride OBE FEng.

**Built Environment and Design Fellowships Committee**

- Mr Jim Eyre OBE, Chairman.
- Professor Rachel Cooper OBE.
- Ms Kat Scott.
- Dr Andrea Siodmok EMPP FRSA HonDCL.

- Professor Chris Wise RDI FEng FICE MStructE HonFRIBA FRSA.

**Sir Misha Black Awards Committee**

- Ms Mary Mullin, Chairman.
- Professor Chris Wise RDI FEng FICE MStructE HonFRIBA FRSA.
- Professor Peter Childs.
- Dr Nicholas de León.
- Professor Malcolm Garrett MBE RDI FISTD.
- Professor Geoff Kirk RDI FEng.

**Staff**

- Mr John Lavery MVO, Secretary.
- Mr Amahl Smith ACA, Finance Director.
- Mrs Helen Harris, Fellowship Programme Manager.
- Mrs Angela Kenny RMARA, Archivist and Alumni Relations.
- Ms Kat O'Dea, Office Manager / Executive Assistant.

**Summary of Financial Information****Year ended 31 December 2023**

Fellowships & Studentships	£3,673,356	79%
Special Awards	£586,330	13%
Meetings and Events	£303,835	7%
Archives and Alumni relations	£51,991	1%
	<b>£4,615,512</b>	<b>100%</b>
Research Fellowships	£1,692,455	37%
Industrial Fellowships	£1,129,088	25%
Industrial Design Studentships	£501,813	11%
Built Environment Fellowship	£100,000	2%
Enterprise Fellowships	£250,000	5%
STEM Education & Outreach	£387,495	8%
South Kensington Estate	£376,545	8%
Networking Events for Fellows and Alumni	£126,125	3%
Archives	£51,991	1%
	<b>£4,615,512</b>	<b>100%</b>



