

# Royal Commission for the Exhibition of 1851

## Annual Report and Accounts

For the year ended 31 December 2024



### The Aims of the Royal Commission

The 1851 Royal Commission's governing document is its Supplemental Charter of 1851, which requires the Commission to  
*“increase the means of industrial education and  
extend the influence of science and art upon productive industry”.*

This was originally interpreted as a requirement to create a centre of intellectual excellence, which resulted in the acquisition of the South Kensington estate and its subsequent development with museums, academic establishments and the Hall of Arts and Sciences (the Royal Albert Hall).

Later, in 1890, the emphasis was switched to the support of individuals, starting with the award of Science Research Scholarships from 1891.

Today the Commission runs its own schemes for:

Research Fellowships  
Industrial Fellowships  
Industrial Design Studentships  
Built Environment Fellowships  
Fellowships in Design

In partnership with others it supports:

Enterprise Fellowships  
Technical Teaching Fellowships

It also supports worthy individuals and appropriate organisations by Special Awards.

The total number of individuals being supported in 2024 was 136



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## Chairman's Report

Within the opening of his memorandum on the appropriation of the surplus of the Exhibition of 1851 Prince Albert considers “it becomes necessary for the Royal Commission to mature some plan for itself on a careful and conscientious consideration of its position, power and duties, in order not to find itself at the end of its important labours driven into the execution of ill digested projects by the force of accidents or popular agitation”. Such conjecture was the driving force behind the realisation of the post Exhibition role for the organisation that it still fulfils today, and it is the test that I like to apply when reflecting on the passing year's activity. Judging the organisation's achievements using our first President's measure I am confident in reporting that the previous 12 months have seen commendable endeavour from all involved. With a commitment of over £5 million in charitable spending we have, amongst many things, welcomed another 38 outstanding young scientists, engineers and designers to the 1851 Fellowship community, supported an expanded sustainability and nature positive programme within the Albertopolis estate and embarked on a new and exciting national programme to support science teaching in the primary education sector.

2024 saw the award of 10 Research Fellowships, 12 Industrial Fellowships, one Design Fellowship and 11 Industrial Design Studentships. With an incredible spread of investigative study into such things as the hydrogen economy infrastructure, the design of analogue integrated circuits with quantum dot structures and decoding cellular communication, such projects represent a continuing and significant investment in emerging research talent within the United Kingdom. In addition, we continue to support innovation and entrepreneurship through the funding of Enterprise Fellowships in conjunction with our partners at the Royal Academy of Engineering. This year found four graduate start-up businesses supported in such a manner. We also welcomed the sixth and largest yet cohort of participants onto our Technical Teaching Fellowship initiative.

The Royal Commission recognises the value that external public engagements provide to our Fellowship holders. Such opportunities as participation in the annual Great Exhibition Road Festival, which is a tremendous showcase for all the cultural and educational institutions and organisations based in South Kensington, allows them to hone their communication skills as future spokespersons in the scientific community. This year, with the Commission's tent at the very centre of activity, 12 volunteers from our current programmes encouraged visitors to the festival to partake in experiments and demonstrations associated with elements of their research projects. It proved hugely popular with many – with one young participant announcing this was the only real “science stall” on the street!

Catering to an audience with more specific interests, we once again partnered with the BBC World Service to host and facilitate the ninth broadcast of *The Engineers* series. Eager listeners filled the Great Hall in Imperial College to capacity for the opportunity to listen to three renowned experts, working in different applications of Artificial Intelligence, discuss the promise and limitations of this rapidly expanding technology. Professor Regina Barzilay, Research Scientist at the Massachusetts Institute of Technology, Professor David Silver, Principal Scientist at Google DeepMind and Dr Paolo Pirjanian, a pioneer in developing emotionally intelligent robots to aid child development, provided fascinating insight and optimistic commentary on the opportunities this new global phenomenon presents to a world-wide radio audience of several millions.

The Royal Commission's special awards endeavour to reinforce STEM education in schools, and greater public awareness of the career opportunities in the science and technology environment, whilst also recognising the hugely important influence museums can play in igniting young people's imaginations and ambitions. This year the Commission gave grants to the Royal Observatory's First Light project and the National Space Centre's Outer Solar System Gallery redevelopment. Funding support was also provided to the Somerscience Festival and Durham University's Celebrate Science Festival as well as supporting the Institute of Physics summer public programme and the Royal Institution's ongoing Science in Schools initiative. Awards were also made to emerging and continuing work within the local SouthKenZEN+ project and the Royal College of Art. We also commissioned an exciting new five-year programme with STEM Learning to develop more inspirational teachers of science within the primary education sector.

The Royal Commission's greatest asset is its Fellows – both present and past – and we make every effort to encourage a spirit of community and pride within this grouping of nearly a thousand individuals. We arrange opportunities for the sharing of knowledge and achievement between the current Fellowship and their distinguished alumni colleagues. This year, six individuals from across all of the Royal Commission's permanent programmes shared their work with our President, Her Royal Highness The Princess Royal, current 1851 Fellows and committee members at the Presidential Dinner. In addition, four completing Fellows presented their research findings to a large audience, with a similar pedigree, at the Royal Society during the Alumni Science evening.

All such activity is only possible through the enthusiasm and dedication of the many volunteers that offer their support to our programmes. This may be through serving on our various committees or overseeing the governance and strategic direction of the organisation itself and I extend my deepest appreciation to all such individuals. This year we have seen the departure of a number of extremely distinguished and long serving members of our Science and Engineering Research Fellowships Committee as well as two Commissioners who have reached the end of their tenure of office. My heartfelt thanks go to Lord Mair and Jim Eyre who have served the Royal Commission with great distinction for the past decade, contributing selflessly to our objectives through committee membership, external representation, mentoring awardees and championing the Commission's actions and people at every opportunity. Fortuitously this does allow us to introduce new figures of distinction to the Commission and I have been delighted to welcome Professor Dame Sarah Springman and Professor Sadie Morgan to the Board of Management as new Royal Commissioners.

Finally, it is my privilege on behalf of the Board of Management to thank our President for her resolute patronage and interest. The Princess Royal's support for our activities, as well as her wider public example, provides inspiration and encouragement to all those involved with the Royal Commission. We are deeply honoured by Her Royal Highness's continued commitment to our purpose and people.

The Rt Hon Professor Lord Kakkar KG KBE PC FMedSci

## Secretary's Report

I can only add my own thanks to those of the Chairman for all the efforts of the incredible and rich mix of Commissioners, Committee Members, Fellows, Alumni and staff that make up the 1851 family. The Royal Commission is blessed to be supported by such a talented group of individuals and this report hopefully captures the notable achievements of many of that group.

One of the constant outputs of the Commission has been its encouragement of those seeking to find a suitable career in the STEM environment, and at a time when most young people are exposed to information overload and bombarded with choice, we are attempting to demonstrate relevancy and prospects through interaction with our awardees. Outwith the more normal elements of the Royal Commission's annual activity, we have extended outreach and external engagement opportunities for the current award holders this year. With the Great Exhibition Road Festival a key part of our calendar, we were excited to weave an additional element into the commitment through a project called London Wonder. This initiative offered Fellows the chance to visit selected secondary schools in East London – Barking and Dagenham - to talk about their research and personal experiences of their pathway to research or design careers to Key Stage 5 students, and to lead in exercises that encourage greater awareness of STEM talents and careers. The ultimate aim being for those students involved to also participate in the Commission's tent at the Festival itself. The pilot project received an extremely favourable response, and I am delighted to confirm that we will continue the programme for the next 4 years. Additionally, awardees have also represented the Commission at a number of All Party Parliamentary Engineering Group functions at the House of Lords as well as attending UK Engineering sponsored "Big Bang" at Parliament. In all cases they proved tremendous ambassadors for the Commission, whilst also perfecting their science communication skills by engaging with, and hopefully influencing, the many school students present. Current Fellows make tremendous role models for the next generation of scientists and engineers, and we will continue to seek out events that allow for such interaction in the future.

The problems and challenges faced by society today appear daunting but the generation of problem solvers and innovators that the Royal Commission supports always seem to confidently enjoy the prospect of making an impact in their chosen work environment. Complementing their efforts, but on a wider scale, are the labours of our partner organisations that are granted special awards by the Royal Commission, all of whom make a positive contribution in the STEM arena, whether it be in the classroom or the community. This report captures only a small snapshot of what is being achieved across the broad spectrum of "1851" activity and I hope that the reader will be as enthused by the individual or individuals undertaking the research or programme, as by their achievements.

John Lavery MVO

## The Work of the 1851 Royal Commission

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. 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 report 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 report.

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 some £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.

## Public Benefit

The Commission ensures that its work is for the public benefit and takes full account of the published Charity Commission guidance. The Commission's events and awards programmes and support of the legacy institutions represent identifiable benefits and are available to all eligible members of the public. They satisfy the primary charitable purpose of the advancement of education.



## Grant-making Policies

The Commission primarily pursues its charitable purposes through the award of grants to individuals and organisations. The Commission awards grants under a number of defined programmes. Full details of the terms and conditions for each programme, including application forms and deadlines where appropriate, are provided on the Commission's website. A brief summary of the major programmes which the Commission supports is provided below:

### **Schemes administered by the Commission:**

#### *Post-doctoral Research Fellowships in Science or Engineering*

These are intended to give early career scientists or engineers of exceptional promise the opportunity to conduct a research project of their own instigation; an ultimate objective is to contribute to the knowledge base required for a healthy and innovative national culture. Around eight to ten awards are made each year, including one or more Brunel Fellowships for engineering projects addressing the primary infrastructure needs of modern society. The awards are for up to three years, subject to annual review and encompass an annual stipend and some support for travel and other expenses.

#### *Industrial Fellowships*

These are intended to encourage profitable innovation and creativity in British industry. Projects in any science or engineering discipline will be considered. A variable number of awards – usually around ten to fifteen - is available each year depending on the financial value of individual awards granted. An ERA Foundation Fellowship for the electro-technology sector is awarded as part of the scheme. Fellowships are awarded to selected exceptional graduates with the potential to make an outstanding contribution to industry, for a programme of research, supported by their employing / sponsoring company, leading to a patent, product or process improvement in conjunction with a higher academic award. Awards are for up to three years, subject to annual review, and include a contribution towards living costs, a travel allowance, an honorarium for the host university and in appropriate cases a contribution towards university fees or towards the cost of enhancing the research project.

#### *Industrial Design Studentships*

These are intended to stimulate industrial design capability among the country's most able science and engineering graduates. A variable number of awards – usually around ten to fifteen - are offered each year for outstanding engineers or scientists who wish to develop their capabilities in industrial design by taking a recognised master's course and who aspire to become leading designers in British industry. The award is for up to two years and includes a stipend, materials allowance, travel allowance and contribution towards tuition fees.

#### *Fellowships in Design and the Built Environment*

Awarded in alternate years, these Fellowships each provide a stipend for up to two years to enable those at a more advanced stage in their career to explore important current issues, selected by the Commission.

### **Schemes administered by other organisations:**

#### *Enterprise Fellowships*

Awarded through the Royal Academy of Engineering (RAEng), these fellowships are open to outstanding UK-resident engineering graduates seeking entrepreneurial success. A package of tailored mentoring, training and grant funding will enable recipients to pursue commercialisation of their technological ideas. Originally three fellowships a year were available, but this has now been increased to six.



### *Technical Teaching Fellowships*

Awarded through the Education and Training Foundation (ETF), these fellowships are open to outstanding UK-resident Further Education practitioners who are recognised for their high impact teaching practice. Fellows are expected to share their expertise and learning across the sector as part of the award with the aim of supporting quality improvement in technical teaching and learning. Fellows will receive an award of £5,000 – £15,000 to support knowledge transfer activity and to ensure remission time is guaranteed. They will also be allocated a programme mentor to support them for the duration of the Fellowship and will attend developmental workshops.

### **Special Awards:**

Although the educational programmes described above represent the lion's share of its grant giving, the Commission also responds to all those requests for funding that commend themselves through the Special Awards procedure. Here the aim is to assist worthy individuals, organisations or projects whose aims in the broadest sense align to the Commission's, and all applications are carefully scrutinised at an appropriate level according to the amount of support requested. Grants range from a few hundred pounds to over a hundred thousand pounds. While Commissioners retain considerable flexibility in principle, in practice a majority of special awards are made either to institutions on the Commission's legacy estate or for educational outreach work by like-minded organisations seeking to draw the attention of the young to the opportunities presented by science, engineering and design. A small number of grants are also made to facilitate access to the Commission's archives.

In addition to the above schemes, the Commission also administers, in conjunction with the Sir Misha Black Awards Committee, two awards in the field of design education, for which nominations are sought each year. Full details are available on the Commission's website but in brief these are:

#### *Sir Misha Black Medal for Distinguished Services to Design Education*

Global in reach, the Medal acknowledges the important contribution of individuals to the teaching of design at all levels, from anywhere in the world – as designers, as champions, as mentors and as educators.

#### *Sir Misha Black Awards for Innovation in Design Education*

Salutes educators from across the United Kingdom and celebrates the innovative achievements of institutions and individuals. Recipients may receive a bursary of £10,000 to advance their work in innovative design education.

Together the Sir Misha Black Medal and Awards recognise those who by innovation, vision and contribution to theory or practice have measurably improved the education of designers and enhanced the profile of design education.

## Achievements in 2024

The core activity – and primary achievement – of the Commission is identifying early career science and engineering graduates of exceptional promise and supporting their work with its prestigious fellowships and studentships. Full details of the awards made during the year are given on pages 17 to 26.

The true impact of the Commission's award holders will only emerge over time, but some evidence of the success of the various programmes can be gleaned from the achievements of those Fellows who completed their awards during the year and the positions they go on to secure. A representative sample of case studies is provided on pages 27 to 50.

Many completing Fellows comment on the importance of their Fellowship to their success:

*Thank you 1851 for making my career!*

Dr Hannah Wauchope, Research Fellow 2020

*I would once again like to express my sincere thanks to the Royal Commission for the opportunities afforded to me; the academic freedom is unrivalled and certainly aided me in securing a full-time academic post.*

Dr Gregory Chaplain, Research Fellow 2021

*The three years I've spent on my 1851 Fellowship, hosted by the British Antarctic Survey in Cambridge, have been some of the best of my career so far. Having the freedom to pursue the research of my choice has been liberating and rewarding.*

Dr Jasmine Lee, Research Fellow 2021

*Receiving the Fellowship was transformative, providing not only financial stability but a strong community where I connected with inspiring, like-minded individuals. My PhD experience was greatly enriched by the fellowship's network, which kept me motivated over the past three years. I would like to extend my deepest gratitude to the 1851 Royal Commission and its dedicated team, who have been supportive, kind, and instrumental throughout my DPhil journey. This achievement would not have been possible without the support I have received.*

Dr Parijat Patel, Industrial Fellow 2021

*The awarding of an Industrial Fellowship has greatly improved my skills as an independent researcher and has enabled significant personal growth. Through the generous travel allowance, I have been able to attend and present my research at multiple international conferences. My dissemination and communication skills have greatly improved through delivering oral, power pitch, and poster presentations, and being able to attend such a breadth of conferences has taught me how to tailor my presentations to the relevant audience. At these conferences I have had interesting discussions with key opinion leaders, been able to obtain valuable feedback on my work, and have greatly expanded my research network. I have also been privileged to be able to discuss my work with the general public through presentations at events such as Oxford Pink Week and IF Oxford Science and Ideas Festival. These events enabled me to meet people whose lives are directly impacted by breast cancer which really drilled home the importance of this research area. The opportunity to present my research to HRH Princess Anne and to world-renowned scientists at the Presidential Dinner was unforgettable and will be a highlight of my career.*

Dr Isobel Gordon, Industrial Fellow 2021

*I am deeply grateful to the Royal Commission for supporting my academic and professional ambitions, which would not have been possible otherwise. The connections and friendships formed within this community have provided invaluable perspectives and solutions throughout the year.*

Julita Napieralska, Industrial Design Student 2023

For some, it is clear that without the award from the Commission, their project would not have gone ahead or would have been much more limited in scope:

*The fellowship enabled me to pursue a PhD while working in an industry I believe in, dedicated to developing the next generation of cancer treatments. I applied for this program because it offered a unique opportunity to enter cancer research directly, while advancing both my academic and technical skills. Unlike a typical PhD, this experience allowed me to guide the project's direction while gaining insight into the drug discovery and development process, expanding my technical and strategic understanding of scientific projects. Seeing my work's potential impact on the drug development pipeline added profound meaning to my research.*

*However, I encountered challenges following the acquisition of the original biotech (Adaptate Biotherapeutics) by Takeda,*

*The Royal Commission provided invaluable support throughout the project, particularly during challenges such as the company acquisition and my own health setbacks. This support was essential from the outset, as the project wouldn't have been possible without the Commission's funding, given the company's limited resources as a startup only a year into its establishment. Additionally, I found great fulfilment in the Commission's public engagement events, especially the school workshops, which reminded me of why I pursued cancer research*

Dr Shefali Bhumbra, Industrial Fellow 2021

*The Fellowship made it possible for me to work directly within industry while carrying out my PhD research, an invaluable and unusual position that enabled large-scale pilot trials in real-world settings. This direct implementation of lab scale research findings—particularly in field conditions at Hepworth Brewery—would not have been possible without the Fellowship, making this project uniquely impactful in translating laboratory results to industry applications and commercial case studies. The backing of the Royal Commission from as early as the proposal stage gave me confidence and support to my ideas that aimed to solve problems facing UK and international industry, invaluable for an early career researcher. This support is now paying dividends for WASE as we gain commercial traction in multiple industries from food and beverage to biodiesel, with integrated biosensing and control developed in this project being a key selling point for customers.*

Dr Kyle Bowman, Industrial Fellow 2021

Fellows appreciate the administrative support provided:

*One last thankyou to you for all your help over the past three years - everything to do with the Commission seems completely frictionless.*

Dr Gregory Chaplain, Research Fellow 2021

*Thank you for everything you do to support us (including but not limited to managing all the financial aspects! I love the simple claims process, and I don't look forward to going back to the bureaucratic university system).*

Dr Jasmine Lee, Research Fellow 2021

Academic and Industrial Supervisors are also very complimentary about the Commission's Fellowships:

*I would wholeheartedly agree that the interaction with the university department, in which an engaged and supportive academic supervisor has added a lot of value to the fellowship, has enhanced LifeArc's connection with the department and its work in areas of mutual interest. I would not hesitate to recommend the scheme to other organisations active in any relevant field, where suitable candidates and business objectives can be linked for the benefit of both.*

Dr Jonathan Large, Industrial Supervisor

*I would not hesitate to recommend the scheme to other organisations active in any relevant field. The scheme provides a unique opportunity to develop research links between academy and industry and the means to 'kick off' new research through a highly collaborative research model.*

Dr Richard Foster, Academic Supervisor

*The industrial fellowship has led to improved process development and validation of our Electro-Methanogenic Reactor. The research has led to further grant funding over £1 million and additional investment VC's and Corporate VC's including Engie and Hitachi.*

*A key piece of research was a pilot demonstration at a customer site – Hepworth Brewery. The successful pilot has led to a commercial contract with Hepworth Brewery worth £650,000. From the success of this it has led to additional customer interest leading to £1.5million in orders. We are now commissioning the first commercial Electro-Methanogenic Reactor plants at a variety of customer sites.*

*We have also further developed a relationship with the University of Westminster, and this has led to a Innovate UK grant with international partners in South Korea. Without the benefit of the Royal Commission Industrial Fellowship the pace of research and resources allocated to product development would have been significantly lower*

*We would recommend the industrial fellowship to other organisations, and we would also look to supporting other researchers to collaborate with WASE on collaborative PhDs going forward.*

Dr Thomas Fudge, Industrial Supervisor

A more complete picture of the impact of the Commission's awards comes from the honours and awards bestowed on more senior alumni – some highlights are given on pages 51 to 54.

Comprehensive data on the impact of the Commission's Fellowships is not yet available, but in respect of one programme, the Enterprise Fellowships awarded through the Royal Academy of Engineering, we do know that the awards offered to date, totalling some £2m, have resulted in at least 35 successful companies which have generated an additional £115m of external investment and created over 340 jobs, an impressive return on investment.

For other awards, we have only anecdotal data at present, but many alumni go on to achieve far reaching impact, as this example makes clear:

*After completing my studies as an Overseas Scholarship recipient at the University of East Anglia, I was immediately employed at the University of Nairobi, where I rose to become a Full Professor in Fisheries Biology in 2018.*

*As well as my academic duties, at different times I also served as the Principal Secretary and Permanent Secretary in the Ministries of Fisheries and Education, respectively, where I spearheaded major reforms and policies. Notably, I led the development of Kenya's first-ever Oceans and Fisheries Policy, culminating in the enactment of the Fisheries Management and Development Act (2016). My leadership saw the establishment of key institutions for Kenya's Blue Economy, including the Kenya Fisheries Service, Kenya Fish Marketing Authority, Kenya Fishing Industries Cooperation (KFIC) and Kenya Fish Levy Trust Fund. My tenure was marked by significant milestones, including commissioning research and patrol vessels such as RV Mtafiti and RV PV Doria, and operationalizing Kenya's Fisheries Monitoring, Control, and Surveillance (MCS) Center. We also secured EU certification for the export of farmed fish products, enhancing Kenya's global fisheries trade.*

*As part of Kenya's Vision 2030 flagship aquaculture program, I championed initiatives that increased aquaculture production from 4 MT in 2009 to over 54 MT in 2012, generating an annual income of Ksh. 6 billion (c £37m). Since then, aquaculture has continued to grow into an important sector of the economy. I also played a pivotal role in the administration of higher education by leading reforms in university education funding and chairing a national committee in 2024 to review Kenya's new Education Funding Model.*

*Beyond my national contributions, I collaborated with the Lake Victoria Fisheries Organization (LVFO) of the East African Community (EAC) and other regional bodies, fostering sustainable fisheries management and development across Africa. In 2024, I initiated a specialized Master of Science program in Fisheries, Aquaculture, and Socioeconomics, aimed at professionalizing public service fisheries officers across Africa with a view to achieve sustainable fisheries management and development benefiting local communities with food and livelihoods as well as the economies of the African states.*

Professor Micheni Ntiba, Overseas Scholar 1986

Another example, this time from the world of design:

*Receiving the Sir Misha Black Medal inspired me to consider ways in which I could build upon education to have a larger impact in the world, addressing the kinds of societal issues listed by the United Nations' Sustainable Development Goals. The answer I came up with was to set up an international non-profit organization that rewards educational institutions that train people to address societal issues and gives awards to those at the start of their careers who do societal work. Institutions need to have a societal curriculum that has graduates doing this work. Why early career? Because that's when people need encouragement the most: when they are just starting.*

*Don Norman Design Award (DNDA), a non-profit whose mission is to champion humanity-centered design (HCD+) globally, held its inaugural DNDA24 Summit in San Diego, California, USA, with attendees from more than 20 countries. The DNDA24 Laureates included projects on palliative care in a tribal settlement in India and community kitchens in Brazilian Favelas, and education programs including the Innovation Design Engineering programme offered by the Royal College of Art and Imperial College which many of the Commission's Industrial Design Students take.*

Professor Don Norman, Sir Misha Black Medal for Distinguished Services to Design Education 2021



This was the first year in which the Commission awarded Technical Teaching Fellowships as part of its core programme, following a five-year pilot. Testimonials from some of those who took part in the pilot illustrate the potential impact of the new programme:

*One of the greatest benefits of the Technical Teaching Fellowship is the freedom it provides to focus on projects that align with passions and strengths. For me, this meant engaging in curriculum development, course organisation and professional development creation. All of which allowed me to inspire educators and improve pedagogical practices. There has been an unparalleled opportunity for collaboration and networking. Working with organisations like Gatsby, Wellcome Connecting Science, STEM Learning and the Association of Science Education has not only expanded my professional connections but also broadened my understanding of cross-sector education. These partnerships have allowed me to contribute to projects that bridge the gap between academia and industry, from authoring T Level resources to developing cutting-edge courses like AI and Genomics. Beyond professional development, the Fellowship emphasises giving back to the community. A major initiative for me has been to establish the fifth UK AMGEN Biotech Experience hub in 2024 to provide free CPD and lab resources to the south-east. The Fellowship cultivates a strong sense of community- a spirit of collaboration and shared purpose, ensuring that the impact of the Fellowship extends far beyond individual achievements. The Technical Teaching Fellowship has been not only a career milestone but also a transformative journey making a lasting difference in the world of education.*

Alison Ackroyd, Technical Teaching Fellow 2022

*Since being awarded the Fellowship, I have had the privilege of engaging with incredible individuals and organizations, which I never would have had the chance to meet otherwise. The variety of events I have attended, as well as the remarkable people I've encountered, have not only broadened my horizons but also provided invaluable insights into fields far beyond my own. This has been one of the most rewarding aspects of the Fellowship — the ability to connect with individuals from such diverse backgrounds and fields, enriching my own work in ways I never anticipated. I am also delighted to share that this experience has played a pivotal role in my decision to pursue a career path I had never previously considered: a PhD. Without the Fellowship, this would not have felt like a realistic option, and I am deeply thankful for the encouragement and support it has given me to take this significant step in my academic and professional journey.*

Mr Bradley Collier, Technical Teaching Fellow 2023

Sadly, the Commission does not have the resources to continue all of its programmes indefinitely and some of the Fellowship schemes offered previously are no longer available. That does not mean, however, that they do not have an ongoing impact, as these testimonials from former Rome Scholars illustrate:

*My artistic journey was profoundly influenced by the year I spent painting in Rome, it shaped my artistic trajectory and established my reputation as an international artist, with numerous shows to follow in New York. I still make regular visits to Rome, as the Artistic Director of the Rome Art Program which brings art students to study in Rome each summer.*

Carole Robb, Rome Scholar 1979

*I feel I owe very much of my success to my scholarship year in Rome. It gave me not only a new and lasting direction in my subject matter, but it is also where I started creating unique collages - which have been a strong feature of my practice ever since. As well as that - and perhaps most importantly - it gave me time to grow as a person and, most particularly, to develop the self-confidence that is essential for creating a career in the visual arts with all the bumps in the road that one encounters in this profession. I will be forever in the Royal Commission's debt for financing my scholarship year. It had, and continues to have, a truly lasting and enormously beneficial effect on my life and career.*

Anne Desmet RA, Rome Scholar 1989

As well as its core fellowships and studentships, the Commission also runs a very successful Special Awards programme, supporting individuals and institutions with similar aims to the Commission.

This year, for the first time, as well as its reactive grants programme, the Commission has proactively invited proposals for a multi-year programme aimed at improving primary STEM education and is delighted to be partnering with STEM Learning to fund bespoke training for primary STEM teachers. As in previous years, many of the more reactive awards also reflect the Commission's continuing commitment to raising the awareness of the young to the opportunities presented by science and engineering. As well as the awards to Royal Museums Greenwich, the National Space Centre, the Institute of Physics, the Royal Institution, the Somerscience Trust and Durham University mentioned in the Chairman's Report, these included awards to Kids Invent Stuff for an exhibition showcasing children's STEM inventions, to Number Champions to provide numeracy support in primary schools, and to Fun Kids Radio for a series exploring war time inventions.

The impact of such Special Awards may take some time to become apparent, but a brief look at some of the awards made in the last few years gives a flavour of what can be achieved.

In 2020, the Commission gave an award of £9,800 to Physics Partners. The award enabled Physics Partners to record 14 videos, all of which have been uploaded to YouTube and to their website, which cover the major topics at GCSE Physics which research has suggested teachers find it difficult to teach. Each film covers some physics subject knowledge, presented through explanation, models, diagrams and exam questions. They also contain some pedagogical content knowledge (i.e. how to teach the topic), including the sequencing of teaching, explanations, concept cartoons, demonstrations and practicals. They are useful for all teachers of physics, but especially those working outside their main field of specialism (e.g. biology and chemistry teachers). To date, the films have been viewed 7,469 times. When asked to rate the film's helpfulness in preparing to teach the relevant concept on a scale of 1 to 5, the average response so far is 4.68. When asked what aspects had been most helpful, over 50% of respondents said that they had incorporated ideas from the film directly in their own teaching. Physics Partners have been told that the videos will be recommended viewing for trainee teachers.

In 2023, the Commission gave £6,000 to the Geological Society to support their Megalosaurus Month initiative. Held throughout February 2024, Megalosaurus Month celebrated the 200th anniversary of the first scientific description of a dinosaur by the Geological Society's former president, William Buckland. The Commission's funding was fundamental in enabling this significant public engagement initiative, which exceeded the Society's expectations in both reach and impact. Megalosaurus Month was a month-long festival celebration of geoscience, combining history, education and art to engage diverse audiences. The centrepiece was a life-sized replica of a Megalosaurus skeleton, prominently displayed in the Society's Upper Library at Burlington House in Piccadilly, London. Over 3,200 visitors, ranging from families and school groups to university students and the general public, participated in a variety of activities held across February 2024 designed to inspire, engage and educate. The activities included practical experiments, schools workshops, interactive quizzes, a dinosaur puppet show, education resources, archival material, drawing classes, lino printing, historical reenactments and a free public lecture, delivered by Professor Michael Benton, a member of the Commission's Science and Engineering Fellowships Committee.

In 2018, the Commission gave £100,200 to fund the construction of Open City Lab, a pioneering public engagement facility within the heart of We The Curious (WTC) in Bristol which opened to the public in May 2021 as part of Project What If, a community-led 1000m<sup>2</sup> exhibition space aiming to remove barriers to participation and learning. Open City Lab displays citizen-shaped active academic research, hosting partnerships with researchers, universities and thousands of visitors shaping active leading research.

The venue was forced to close for two years due to a roof fire in April 2022. WTC took this time to develop relationships with their communities. Better understanding their needs and the barriers they



experience to engagement with STEM learning has informed significant developments in WTC's inclusive practices and programs. In response to feedback, they adapted their education and inclusion programmes to work in community spaces and schools, delivering over 300 free activities to 40,786 children, adults and young people. They also introduced inclusive adaptations to their building, including a multi-faith and sensory room, improved wayfinding and specialist learning tools. Upon reopening, they launched open concession tickets, free entry for community groups and 50% concession on entry for schools with over 22% of pupils on free school meals.

WTC also continued their public engagement in research outside the venue with over 800 participants across a range of projects. Diverse and underserved audiences directly engaged with ongoing research, with research partners gaining valuable insights into the perspectives of people outside their academic sphere and making positive improvements to their research processes and outcomes, as well as real world applications.

Projects included:

- Let's Connect: Brainstorming with Swarm Robots, in partnership with Merihan Alhafnawi from Bristol Robotics Lab - 294 participants
- Safari Park of AniBotics, in partnership with David Smee from AniBotics – 220 participants. This also led to WTC being a co-author of a paper submitted to a Robotics academic conference by their Swarm Robots partner, allowing the public to feed into the R&D phase of toy development and scaffold conversations around conservation with children.
- Shopping Trolley Secrets pilot in partnership with Anya Skatova from the University of Bristol's Medical School - 188 participants from West of England Centre for Inclusive Living (a local disability charity) engaged new audiences in the conversation on the use of shopping data for public health research.
- TRIAD event, in partnership with the University of Bristol and University of Bath – 45 visitors experienced different designs of spaces in VR to gather insights into their own personal reactions to differently designed environments, raising awareness of inclusive design and the impact of design on wellbeing.
- Seagulls Project with Hannah More Primary School, based in an underserved community which was led by their interest in seagulls - 1,074 interactions. This work is celebrated in a film and exhibition next to Open City Lab, which is being expanded into WTC's Curious Partner Schools program.
- Online Sleep project - Researcher Chrissy Hammond has indicated that the public responses from WTC's online survey could have an immediate impact on the direction of her research.

Since reopening in July 2024, WTC have hugely exceeded their forecast number of visitors over the summer period to September, with a total of 80,997 (vs 67,202 forecast), including 1,796 community members, 19,933 members and 5,189 education admissions, all of which are increasing daily. Within the Lab over this time, 16,866 people (approx. 20% of all visitors to WTC) participated in the current Lab project 'Shopping Trolley Secrets' in partnership with Anya Skatova from the University of Bristol's Medical School and codeveloped with the Digital Footprint team at Bristol University, leading to over 6,000 research contributions and 400+ postcards written to researchers by visitors. This programme looks to understand public attitudes towards the use of shopping data i.e., loyalty card data such as Tesco's Clubcard, for public health research, engaging them from the very early stages in what could be an invaluable source of data into people's shopping habits. Would people donate their shopping data for research? How much could researchers discover from people's shopping habits?

The Shopping Trolley Secrets activity is due to end in January 2025 and will be followed by a new programme currently in development named 'Plates For The Planet.' This new programme explores the effect of what we put on our plates on the planet and people: WTC's Open City Research team are working with Thalia Gjersoe and Kath Lee from the University of Bath on a project researching what their visitors (particularly children and young people) know about diet and sustainability. They will be asking visitors what they would do if they could make the rules to make their (and the nation's) meals more eco-friendly.

As the examples above illustrate, the Commission funds a wide range of innovative STEM initiatives at varying scales, recognising that not all will achieve huge success, but in the hope that most will transform individual lives, and some will go on to have considerable reach. Needless to say, not all Special Awards proceed completely smoothly. Nevertheless, anecdotal evidence suggests that it is interventions such as these that can make all the difference in stimulating young people to become the scientists and engineers of tomorrow and the Commission remains committed to doing what it can.

As well as funding STEM outreach projects, the Commission also provides Special Awards to enhance its legacy estate in South Kensington and help the world leading institutions of Albertopolis to extend their reach. As explained in the Chairman's Report, the main awards this year have been to support the Royal College of Art's project to refurbish and enhance its Darwin Building, including reinstating the main entrance on what is now 1851 Place, and to the Exhibition Road Cultural Group to support the ongoing programme of work to stimulate collaboration between the Albertopolis institutions in their efforts to transform South Kensington into a zero emission, nature positive neighbourhood.

These awards, often for major capital projects, can take many years to complete but also have significant impact. To take one recent example, in 2022 the Commission gave £0.5m to the Natural History Museum's Urban Nature Project. The Commission's grant contributed to the Evolution Garden. In recognition of the Commission's support, the part of the garden between the historic Waterhouse building and the new Garden Kitchen café has been named the 1851 Garden, with a brass plaque installed. The Gardens have been a huge success with critics and the general public. The Evolution Garden attracts over 100,000 visitors a week and has rapidly become a civic space full of life and breadth of use. Visitor numbers are expected to increase further when the Garden Kitchen opens this Autumn offering refreshments and other facilities. The Urban Nature Project more generally has also been deemed a great success, with 897 teachers trained, 18,632 school children engaging with bespoke workshops and almost 45,000 adults and children participating in family urban nature activities.

## Future Plans

Commissioners are conscious that the ‘1851 family’ constitutes a tremendous resource of which much more use could be made. The Commission hopes to recruit an Alumni Manager to conduct research with alumni into what ongoing support from the Commission they would value, expand the offering for alumni and explore the scope for alumni to support current Fellows.

Commissioners also recognise that the Commission’s archive is a fascinating and valuable resource to which there is currently only limited access. The Commission plans to embark on a ten-year programme to digitize the most significant parts of the archive to make them more readily available to researchers, the 1851 family and interested members of the general public.

2026 will mark the 175<sup>th</sup> Anniversary of the Great Exhibition and the Commission is continuing 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, and a public lecture series. Commissioners also hope to capitalise on the anniversary to raise awareness of its award programmes amongst relevant audiences.

# Awards Granted in 2024

## Research Fellows

### **Dr Mohamed Elzeadani**

*Subject:* Enhancing connection ductility for the safe design of timber structures

*University of Cambridge*

Engineered timber has emerged as a promising material for more sustainable structural design. However, improved methods of connection design are required to ensure ductility under extreme loading. This project will investigate a promising new connection design method using a combination of experimental, numerical and analytical approaches to provide comprehensive design guidance.

### **Dr Daniel Heydecker**

*Subject:* Matching bounds in dynamical large deviations

*Imperial College London*

This project will investigate techniques in rare events (large deviations) of microscopic models. Often, the problem of whether a 'natural' quantification accurately describes the exponential unlikelihood of all trajectories is left open by a first investigation; this quantification is important for applications. This project will investigate physically important toy models.

### **Dr Sophie Koudmani**

*Subject:* Simulating galaxies and supermassive black holes in the multi-messenger era

*University of Hertfordshire*

Nestled in large galaxies' cores, supermassive black holes significantly influence their hosts, yet this process remains poorly understood. This project will leverage insights from idealised, general-relativistic black hole simulations to craft a multi-scale cosmological model and make predictions for electromagnetic and gravitational-wave observatories, ultimately aiming to unravel the black hole–galaxy connection.

### **Dr Adam McKenzie**

*Subject:* Into the void: a new architecture for next-generation semiconductor devices

*University of Glasgow*

This project will revolutionise semiconductor device design by pioneering a new paradigm for crystal growth, void-retaining epitaxy (VRE). It will unlock the potential of VRE as the manufacturing platform of choice for next generation devices and enable significant improvements in performance to meet the demands of key emerging applications.

### **Dr Elise Needham**

*Subject:* Decoding cellular communication with focused systems genetics

*University of Cambridge*

Inside cells, communication occurs through intricate cascades of protein modifications. However, the regulators and functions of most modifications are unknown. This project proposes an approach that incorporates principles of targeted biochemistry with systems genetics to comprehensively decode cellular communication. This development could transform biology, providing varied applications in medicine and agriculture.

### **Dr Harriet Stanway-Gordon**

*Subject:* CyPeMs: New modalities for targeting AMR and NDD

*Newcastle University*

Antimicrobial resistance and neurodegenerative diseases are significantly unmet areas of need in which conventional drug modalities are failing. This project involves the investigation of novel peptidomimetic structures (CyPeMs: cyclic peptide small molecule hybrids) for the identification of new therapeutic strategies within these areas, facilitated by DNA-encoded libraries.

**Dr Christina Woltz**

*Subject:* Tracking geochemical changes in organic fossils through time

*Imperial College London*

Organic microfossils record the emergence of eukaryotes over a billion years ago, yet most cannot be placed within eukaryotic lineages using morphology alone. By conducting vibrational spectroscopy of modern and fossilized eukaryotes, this project will test the robustness and utility of chemical signatures in the placement of microfossils within eukaryotic lineages.

**Dr Joseph Wynn**

*Subject:* Integrating across timescales for a dynamic perspective on avian migration

*University of Liverpool*

The yellow-browed warbler usually migrates from Siberia to South Asia, though has recently evolved a 10,000 km detour to Europe. Through genomic comparison of European birds to their Asian counterparts this project will determine the origins of this remarkable rerouting, in turn informing on how/why bird migration evolves in the Anthropocene.

## Brunel Fellow

**Dr Francesca Palmieri**

*Subject:* Damage and energy dissipation in clays due to cyclic loading

*Imperial College London*

This project will improve the modelling of clay degradation under cyclic loading. The proposed material model incorporates dissipated energy as measure of damage. The model is formulated based on experimental data and applied to the offshore wind turbines design addressing current challenges in soil-structure interaction problems.

## Ramsay Fellow

**Dr Aisha Bismillah**

*Subject:* Switchable supramolecular hosts capable of bio-inspired recognition and communication

*King's College London / Francis Crick Institute*

Enzymes are essential to life, for example they are key in processes like breathing. Through the unique combination of supramolecular self-assembly and chemical biology this project will create fully synthetic enzyme mimics, i.e., supramolecular hosts, with the functionality and binding specificity seen in their biological counterparts, raising their potential in applications including targeted drug delivery.

## Industrial Fellows

**Lucinda Abell Black**

*Subject:* Towards understanding sports injury epidemiology in women athletes: A multifactorial approach utilising novel smart leggings

*Sponsor:* KYMIRA

*Loughborough University*

The reasons why women athletes are ~3-6 times more at risk from anterior cruciate ligament injury compared to men is poorly understood, due to the inability to measure movement outside the laboratory. However, KYMIRA can enhance this much-needed research through smart leggings, which can measure kinematics in realistic sporting settings.

**Eve Andrews**

*Subject:* Circular economy for offshore wind - a bespoke metric and roadmap

*Sponsor:* SSE Renewables

*University of Strathclyde*

This project is focused on circular economy for the wind industry, particularly futureproofing offshore wind for sustainable decommissioning by making better decisions in design. This involves designing a bespoke metric which will measure the circularity of wind developments which will allow for incentivisation and drive behavioural change towards meaningful circularity.

### **Tina-Maria Burova**

*Subject:* A high-throughput platform for reactive fragment screening in cells against protein targets of therapeutic interest

*Sponsor:* GSK

*University of Strathclyde*

The timely and efficient discovery of chemical tools for disease-relevant proteins is important for drug discovery. This project aims to develop a technology for the high-throughput screening of reactive fragments in living cells, expediting the development of chemical tools for ‘undruggable’ proteins that cannot be studied outside of the cell.

### **Colm Dowling**

*Subject:* Transforming the prevention of suicide, self-harm, and interpersonal violence in care settings

*Sponsor:* Safehinge Primera

*Glasgow Caledonian University*

This research aims to identify ethical digital data science solutions to aid healthcare workers in efficiently identifying individuals at risk of suicide, self-harm, or violence by improving real-time health data collection, aggregation, synthesis and presentation, addressing the challenges faced by staff in mental healthcare settings and enhancing patient safety.

### **Alberto Gomez Saiz**

*Subject:* Design of analogue integrated circuits with quantum dot structures

*Sponsor:* Quantum Motion

*Imperial College London*

This project proposes to explore the unique properties of circuit elements based on quantum dots in combination with traditional electronic components to deliver novel analogue integrated circuits. The key aim will be to demonstrate a practical use case in which a QD-based analogue circuit outperforms existing cryoelectronic solutions.

### **Gareth Hart**

*Subject:* Enabling the hydrogen economy: Improving electrocatalyst performance and reducing iridium content through materials discovery

*Sponsor:* Johnson Matthey

*University of Warwick*

The production of renewable (green) hydrogen is key to defossilisation and prevention of further global warming. Current catalysts in these technologies rely on iridium, a precious metal with limited supply. This project will design new, efficient catalysts with reduced iridium content and scale up chemical synthesis for subsequent development.

### **Charlie Hutchings**

*Subject:* The impact and mitigation of materials degradation on assets in hydrogen economy infrastructure

*Sponsor:* Frazer-Nash Consultancy

*University of Surrey*

Hydrogen is required for an affordable, resilient, and decarbonised energy system. This project will experimentally investigate and assess the pervasive impact of hydrogen on material integrity. The acquired knowledge and models developed will support asset operators, standards bodies, and policymakers in interpreting, managing, and mitigating materials risks associated with hydrogen.

### **Katie Ollerton**

*Subject:* Transcending skin barriers: film formation, nanostrategies, skin mimic progress in personal care and pharmaceutical delivery

*Sponsor:* Unilever

*University of Liverpool*

This project seeks to develop innovative methods of characterising film microstructures and the delivery of active ingredients across numerous formulations, formats and environmental conditions using a non-animal skin model. Exploring formulation properties, particle size and residency time, this work will revolutionise transdermal research, benefitting both personal care and pharmaceutical domains.

### **Harry Palmer**

*Subject:* Affinity-guided platform for the high-throughput generation of homogeneous antibody-drug conjugates

*Sponsor:* GSK

*University of Strathclyde*

Chemotherapy is a common cancer treatment, despite frequent adverse effects for patients. As cancer rates increase, there is a growing need for improved treatments: antibody-drug conjugates seek to meet this need. This project aims to develop a novel high-throughput platform to rapidly design and synthesise safer, more effective antibody-drug conjugates.



**Maja Schmidt**

*Subject:* Real-time magnetocardiography pattern recognition

*Sponsor:* Neuramics

*University of Edinburgh*

The project aims to develop scalable artificial intelligence-enabled software to analyse multi-channel magnetocardiographic signals recorded by wearable magnetic sensors. This innovation allows the detection and classification of heart arrhythmia after ischemia in real-time, which is currently impossible outside hospital environments. It enhances remote at-risk monitoring, reducing mortality and healthcare costs.

**Ryan Teo**

*Subject:* Designing new antibiotics with a focus on gut health

*Sponsor:* Ineos

*University of Oxford*

Antibiotics revolutionised medicine but are challenged by antimicrobial resistance (AMR). Newly developed antibiotics prioritise potency, neglecting the harmful effects on the gut microbiome, thus losing the beneficial protection of colonisation resistance. This project aims to synthesise microbiome-friendly antibiotics, understanding their selectivity to develop more effective drugs that simultaneously delay AMR spread.

**Karina Wojdat**

*Subject:* Investigation of molecular distributions in solid dispersions for applications in pharmaceutical formulations

*Sponsor:* Sygnature Discovery

*University College London*

Solid dispersions, often amorphous, while widely applied in many industries, can hardly be considered well understood. Molecular distributions of the components of such mixtures seem to determine their final nature and properties. Gaining an understanding of those systems and a way of investigating them, could speed up their pharmaceutical formulation timelines.

## Enterprise Fellows

**Anthony Camu**

*Company:* Theia Robotics

Theia is a patented, novel, handheld/wearable, semi-autonomous electronic travel aid for people with visual impairment. Theia's real-time-guidance-system uses a graph-based Visual-Simultaneous-Localisation and Mapping (V-SLAM) method, which fuses RGB-D and IMU data (i.e., Visual Inertial Odometry) using an Intel RealSense D435i camera and a Raspberry Pi 4B; after 50km of testing Theia achieved on average  $\pm 50$ cm localisation accuracy in challenging lighting/weather conditions and GPS-denied environments.

**Alicia Graham**

*Company:* MadeSweetly

There is an urgent need for sustainable and healthy food alternatives amidst rising health issues and a broken and unsustainable food system. This is especially key in relation to excessive sugar consumption, which leads to issues such as obesity, cardiovascular diseases, and diabetes. MadeSweetly's innovative solution combines precision fermentation and synthetic biology to utilise *Yarrowia lipolytica* yeast for the sustainable production of sweet-tasting proteins as a sugar substitute.



**Matthew Moore**

*Company:* Drone Tector [Financially supported by the ERA Foundation]

The dangerous uses of small drones are increasing at a rapid pace. Drones' usage in the Red Sea has doubled shipping costs globally since November 2023. The disruptive presence of drones in airports grounds all aircraft for hours - the 2018 Gatwick incident cost all stakeholders over £50m. And drones have become a key weapon of war in Ukraine with more than 1600 drone attacks per month in 2024. The problem is that drones are often invisible to conventional detection systems, blending in with birds and other flying objects. Drone Tector has developed a new millimetre-wave drone detection radar that can differentiate between drones and birds (and other flying objects) and, crucially, between different drone models, allowing friend or foe detection and threat estimation.

**Teja Potocnik**

*Company:* Nanomation

Manufacturing semiconductors with nanomaterials improves chip power efficiency and enables functionalities not possible with existing materials. However, it is currently impossible for industry to use these materials given their random distribution on substrates which requires human intervention to place integrated circuits on top of the nanomaterial on the chip surface. Nanomation has developed the first automated nanofabrication system aimed at the semiconductor industry, utilising a nanoscale-optimised location system, computer-vision algorithms, and in-situ circuit routing that eliminates the need for human labour. The technology is compatible with conventional semiconductor fabrication equipment, and can also solve critical challenges for adjacent industries, including advanced microscopy, sensors, photonic integrated circuits and bioelectronics.

**Alex Shakeshaft**

*Company:* Enturi Solutions [Financially supported by the ERA Foundation]

Enturi has developed a patent-pending, game-changing micro wind turbine design offering compact and high-efficiency clean-power-generation to diversify the UK's green energy portfolio. With this core turbine technology, Enturi is developing portable single-turbine (6kW) and multi-turbine (20-100kW) distributed energy systems for the UK maritime sector, the Enturi aeroCharger and Enturi eStation. These non-grid connected renewable energy systems are portable for rapid implementation and relocation, as well as backed up with an ISO-complaint IoT system for secure data interoperability and transparency.

**Adhesh Shenoy**

*Company:* Guerilla.Co

Urban runoff, laden with pollutants like microplastics, toxic hydrocarbons, and heavy metals, presents a looming threat to our waterways, ecosystems, and public health with toxicity comparable to raw sewage. Guerilla.Co has developed a retrofittable device for existing drains utilising cutting-edge, membraneless, and energy-efficient technology to effectively separate pollutants at the source, surpassing the capabilities of traditional solutions. Integrated smart sensors deliver real-time data streams on water quality and pollutant levels, revolutionising the limited data acquisition offered by current methods.

## Design Fellow

### **Henry Hosker**

*Subject:* Biodiversity by Design: TRACES

*Mentor:* Professor Alfried Vogler, Natural History Museum

Capable of revealing entire ecological communities from microscopic bacteria to whales, eDNA is a revolutionary tool for monitoring biodiversity and informing conservation initiatives. However, current methods are limited by filter clogging from non-DNA particles, making sampling slow, expensive, and inefficient. TRACES solves this challenge by employing hydrocyclones as in-line prefilters, dramatically increasing sampling efficiency and enabling the collection of larger eDNA datasets.

This fellowship focusses on the development of TRACES. Combining leading-edge technology with thoughtful design, TRACES aims to create and deliver a streamlined, rigorously validated solution that seamlessly integrates into existing aquatic environmental sampling practices. By engaging conservationists, researchers, field technicians, and other stakeholders through an iterative co-design process, the TRACES system will tailor to meet real-world needs, and demonstrate the value of merging innovative, inclusive design practices with high technology in the context of biodiversity conservation. Rigorous scientific validation will demonstrate the effectiveness of TRACES in diverse environments, ensuring that its claims are backed by evidence. This work will culminate in a series of pilot projects which will put TRACES into the hands of its users, providing critical feedback while showcasing its value in the field.

TRACES looks to make aquatic eDNA sampling faster, cheaper, and more accessible, empowering conservation teams to collect richer data and make more informed decisions on large scales. By accelerating biodiversity monitoring, protection, and restoration efforts, TRACES offers a vital facilitation tool for addressing the global biodiversity crisis and protecting the ecosystems on which we all depend.

## Sir Misha Black Medal for Distinguished Services to Design Education

### **Dr Patricia Moore**

### ***Moore Design Associates***

Dr Patricia Moore, President of Moore Design Associates is a dedicated educator, serving universities throughout the Americas, Asia and Europe. As a pioneering figure in design, she is a leading authority on consumer lifespan behaviours and requirements.

For a period of three years from 1979 to 1982, in a daring experiment, she travelled throughout the United States and Canada disguised as women of more than 80 years of age. This experience of responding to people, products, and environments as an elder enabled an empathetic approach to design that informed much of her future work.

Since 1990, she has designed more than 300 Physical Medicine & Rehabilitation Environments for healthcare facilities throughout North America, Europe, China and Japan. She is a frequent international lecturer, media guest and the author of numerous books, including: *Disguised: A True Story*, and *Ageing, Ingenuity & Design*.

She is a Fellow of the Industrial Designers Society of America. Named by ID Magazine in 1997 as one of the '40 Most Socially Conscious Designers' in the world, she was selected in 2000 by a consortium of news editors and organisations as one of the '100 Most Important Women in America'. She has been awarded Honorary Doctorates from Syracuse University, Hasselt University, Sheffield University, the College for Creative Studies, and the Rochester Institute of Technology.

Throughout her illustrious career, she has paved the way for more inclusive and empathetic approaches to design and has been the recipient of honours almost too numerous to list, including being named by the Industrial Designers Society of America as 'Most Notable American Industrial Designer' in 2016. She was the recipient of The National Design Award in 2019, and in 2020 the 'Changemaker Award' awarded by the Center for Health Design. Most recently the World Design Organisation recognised her impressive design legacy, influence and leadership in awarding her the 2022 World Design Medal™.

## Honorary Sir Misha Black Medal for Distinguished Services to Design Education

### **Ms Mary V Mullin**

Mary Mullin is the former Chairman of the Sir Misha Black Awards Committee. She joined the Committee in 1993 and served as Chairman from 2003 until she stepped down in March 2024. In that time, she oversaw the introduction of the Award for Innovation in Design Education in 1998, and more recently the move to the Awards' current home under the auspices of the Royal Commission for the Exhibition of 1851.

Mary is Trustee of the Robin and Lucienne Day Foundation, Trustee of INSPIRE Trust, and Regional Adviser to the World Design Organisation. She served as Secretary General of the International Council of Graphic Design (ICOGRADA now ICO-D) for fourteen years, and as a founding Trustee for the ICOGRADA Foundation.

Her contribution to the promotion of design and education is extensive. Positions held include being the first woman elected to the Board of ICSID, serving as Vice President and developing its Interdesign Programme of events across Ireland and continental Europe. She remains a Founder Member of the Crafts Council of Ireland, has been a consultant for UNIDO, and was National Chairman of the DIA. She was Founding Director of the National Centre of Culture and Arts in Dublin (now the Museum of Modern Art). She ran her own consultancy practice in design and special event management in London from 1981 to 1998. Clients included the 'Boilerhouse' at the V&A, the precursor of the Design Museum; the Science Museum; the Design Research Unit and other leading design practices and commercial clients.

Mary is an Hon. Fellow of the RCA, the University of the Arts in Bournemouth, the International Society of Typographic Design, and Honorary Life Fellow of the RSA. In 2017 she was awarded the RSA Bi-Centenary Medal "for encouraging and promoting design across education and industry". In 2018, with Sir Christopher Frayling, she co-edited *Fitness for What Purpose*, a book documenting the 40 year history of the Sir Misha Black Awards.

### Sir Misha Black Award for Innovation in Design Education

#### **Ms Zowie Broach**

#### *Royal College of Art*

Zowie Broach has been Head of Programme, MA Fashion at the Royal College of Art since 2015. Previously she co-founded the avant-garde design studio and brand Boudicca, which was the first independent British label to show during Couture Paris, as well as exhibiting at Arts Institute of Chicago and the Tel Aviv Museum. More recently Boudicca featured as part of the London Design Museum's 'Rebel: 30 years of London Fashion'.

Boudicca, having staged the first ever fashion show to be live streamed back in 2004 by SHOW studio, continued to investigate the digital interface as a tool, and the exploration of identity and material. Keeping her eye firmly on both present and future,

Zowie is a principal investigator into whether machine intelligence can support and relate to the manual intelligence of Haute Couture. This relates strongly to the long-term consultation for Cartier she was part of, with a project about craft futurism.

Zowie Broach embraces fluidity of gender and identity, the merging of the physical and the digital, and bringing together different fields to create new futures and thought processes that go beyond the usual graduate collections or fashion practices, challenging a new disruption to the industry from graduates across high luxury to research, questioning and impacting a fashion future.

Zowie Broach has been voted into the top 500 Fashion Leaders, Business of Fashion for the last 8 years.

## Industrial Design Students

Zayna Ahmed	Innovation Design Engineering	Royal College of Art / Imperial College London
Zachary Berry	Innovation Design Engineering	Royal College of Art / Imperial College London
Daphné Biestro	Innovation Design Engineering	Royal College of Art / Imperial College London
Luke Hale	Innovation Design Engineering	Royal College of Art / Imperial College London
Gregory Hargraves	Innovation Design Engineering	Royal College of Art / Imperial College London
Muhammed Saym Hussain	Design Products	Royal College of Art
Khalil Ismail	Innovation Design Engineering	Royal College of Art / Imperial College London
Jérémie Kofman	Innovation Design Engineering	Royal College of Art / Imperial College London
Bana Quronfuleh	Innovation Design Engineering	Royal College of Art / Imperial College London
Lucinda Tam	Innovation Design Engineering	Royal College of Art / Imperial College London
Brigitte Zheng	MRes Design	Royal College of Art

## Technical Teaching Fellows

**Jen Deakin** *Runshaw College*  
This project will investigate using AI to enhance teaching and learning and its potential to alleviate current challenges faced by the education sector, such as teacher workload.

**Sophie Harris** *Derby College*  
This project aims to promote and embed sustainability within curriculum design.

**David Jones** *Pembrokeshire College*  
This project aims to create and embed a range of resources and toolkits to enable staff to deliver and embed vocational skill development within special needs education.

**Aine McGreeghan** *South Eastern Regional College, Northern Ireland*  
This project aims to identify education structures and approaches to support the increased retention, motivation and attainment of women and girls in engineering education.

**Daniel Pritchard and William Davies** *NPTC Group of Colleges (Newtown and Brecon College)*  
This project aims to share best practice in the delivery of Electric Vehicle education through a series of collaborative projects with other colleges and industry partners.

**Scott Rorrison** *Humberside Engineering Training Association*  
This project aims to harness the use of technology to help teachers imagine and create STEM lessons that are engaging and innovative.

## Special Awards Granted

### *STEM education and outreach*

**British Science Association** - Primary kit boxes  
**Somerscience Trust** - Somerscience Festival 2024  
**Kids Invent Stuff** - Exhibition  
**Big Ideas** - London Wonder  
**Number Champions** - Numeracy in primary schools  
**Durham University** - Celebrate Science 2024  
**Imperial College Union Design Engineering Society** - Hackathon  
**Foundation for Science and Technology** - Foundation Future Leaders Conference  
**Fun Kids Radio** - War time inventions  
**STEM Learning** - Bespoke training for primary STEM teachers  
**Royal Designers for Industry** - Summer schools  
**Royal Museums Greenwich** - First Light gallery  
**Royal Institution** - Science in Schools  
**National Space Centre** - Outer Solar System gallery  
**Institute of Physics** - Mimi's Tiny Adventure

### *Support for legacy estate*

**Exhibition Road Cultural Group** - SouthKenZen+ Project funding  
**Exhibition Road Cultural Group** - SouthKenZen+ Heat network  
**Royal College of Art** - Main entrance  
**Royal College of Music** - Colin Lawson Fund



## Awards completed in 2024

### Research Fellows

#### **Dr Thomas Breithaupt**

*Project:* Redefining the relationship between crystal defects and mantle flow

*University of Cambridge*

At the high temperatures and pressures of Earth's mantle, rocks flow. Over geological timescales, the resistance of rocks to flow controls plate tectonics. Over human timescales, it controls, for example, the response of the Earth's mantle to melting ice sheets, which in turn mediates sea level rise. However, to observe the flow of rocks in the laboratory, experiments must use forces far greater than those found in nature, making extrapolation unavoidable. However, historic models of rock flow were constructed from empirical power-laws, undermining confidence in their predictions.

During his Fellowship, Tom set out a radical new framework for modelling rock flow. By rooting this framework in the physics of interactions amongst the defects that accommodate rock flow, he placed extrapolation from laboratory to nature on a firm footing. In the manuscript detailing this work, published in the *Proceedings of the National Academy of Sciences*, he demonstrated that this framework could explain laboratory observations of steady rock flow. However, further work was required to test its underlying assumptions as well as demonstrate its applicability to non-steady flow. Tom subsequently conducted novel experiments to test the framework, involving both step changes and oscillations in the forces driving rock flow. The experiment results are in excellent agreement with the framework, increasing the credibility of its predictions for rock flow in Earth's mantle. The Fellowship also gave Tom the opportunity to develop fruitful collaborations across the rock deformation community with significant outcomes. One outcome of these collaborations is overturning the long-held belief that water weakens rocks at low-temperatures.

Tom is now a Research Associate at the University of Cambridge.

#### **Dr Gregory Chaplain**

*Project:* Novel development of elastic metamaterials

*University of Exeter*

Metamaterials are composite, structured materials which have exotic properties due to their underlying substructure (that is often periodic) rather than their chemical composition. There have been significant advances in the design and development of these exotic materials, particularly in the fields of optics and acoustics, where unprecedented wave control has allowed science-fiction-like invisibility cloaks to be realised. This Fellowship looked to advance elastic metamaterial counterparts to such devices, leveraging the additional physics present in the elastic system. Here the aim was to design, simulate and fabricate devices with a host of vibration control capabilities and then translate the physics unearthed back into acoustic (and electromagnetic) wave regimes, leading to new metamaterial paradigms for the control of waves in almost any system.

Significant advances in the modelling (both analytical and numerical) and experimental realisation of such structures has been achieved, with attention paid to the orbital angular momentum of elastic waves, particularly in pipes; the focussing of sound underwater (and analogously in electromagnetic antennas), using structured flat surfaces; beyond-nearest-neighbour metamaterials, that can control the flow of energy along structures with 'backwards' waves; topological (tuneable) elastic metamaterials, that allow 'protected' wave amplification; quasi-periodic acoustic metamaterials, that permit fractal rainbow trapping (the localisation of acoustic energy in designed locations); and the physical realisation and observation of predictions from theories in applied mathematics, particularly in the fields of Acoustic Rayleigh-Bloch waves on finite lattices, and Quantum Graph Theory.



In the realm of elasticity these devices have been poised as candidates for controlling vibrations, leading to enhanced isolation and energy harvesting capabilities.

Over the last three years Greg has published 12 peer-reviewed papers, with four more currently under review.

After the Fellowship, Greg is delighted to be staying at the University of Exeter as a Senior Lecturer in Metamaterials Physics and a co-investigator on an EPSRC Programme Grant (Meta-4D). His research will now focus on time-varying metamaterials, the ‘next-generation’ of this exciting field, where the properties of materials are structured in time, as well as space.

### **Dr Harvey Dale**

*Project:* Chemical origins of the genetic code: lost in translation

#### ***MRC Laboratory of Molecular Biology***

The coded biosynthesis of proteins – the translation of genes into functional molecules – is a defining pillar of life, used by all organisms on Earth. It is widely believed to have underpinned the existence of our Last Universal Common Ancestor (LUCA), yet we know neither how this process emerged, nor what evolutionary pressure drove its emergence. Interestingly, whilst the underlying chemistry of this process is highly efficient when mediated by sophisticated biomolecules, it is virtually useless in their absence. Given that many of these biochemical aides are themselves proteins, this poses a clear dilemma: how did life first learn to make proteins?

During his 1851 Fellowship, Harvey sought to explore this question from the perspective of an organic chemist, working with John Sutherland FRS at the MRC LMB and with additional generous support from the John Henry Coates Research Fellowship at Emmanuel College, Cambridge (elected 2022). At the LMB Harvey designed a chemical model system for a key step in protein biosynthesis – transpeptidation – and then studied it in unprecedented detail to reveal key facets of the underlying chemistry. He confirmed, building on classic work from others, that a very specific subset of amino acids is in fact highly predisposed to assemble, without biochemical assistance and in water, into proteins, and he demonstrated the mechanism underpinning this predisposition. Harvey’s findings have potentially significant implications for the RNA world hypothesis.

Harvey has now joined the specialist Physical Organic Chemistry group at Syngenta’s Jealott’s Hill International Research Centre as a Senior Process Chemist.

## **Dr Amparo Güemes**

*Project:* Development of neurotechnology systems for improving glucose control

*University of Cambridge*

Amparo's work focused on developing bioelectronic devices and algorithms to interface with the nervous system, advancing our understanding of how neural activity regulates glucose metabolism.

A major outcome of this Fellowship has been the development of a multimodal analytical framework for decoding and classifying metabolic information from the vagus nerve in anaesthetised rats and pigs, which contributes to our understanding of how vagus nerve activity influences glucose control.

Beyond vagus nerve studies, Amparo co-led a project focused on the enteric nervous system, where she developed thin-film neural devices implanted in the colonic wall to investigate gut electrophysiology. Additionally, she co-developed a new method for enhancing neural recordings by coating tungsten microwires for higher quality brain and peripheral nerve recordings. As part of the research objectives, she explored non-invasive neuromodulation through Temporal Interference (TI) for hepatic stimulation, aiming to regulate glucose levels by targeting the hepatic plexus. This study provided a foundation for future research on non-invasive methods of metabolic regulation.

Beyond her research, Amparo has been involved in several societal initiatives, including co-creating a UK Patient and Public Involvement (PPI) network for neurotechnology development.

The Fellowship has led to 10 publications (with six as first or co-first author), participation in 12 national and international conferences, and the initiation of four new collaborations with universities across Europe and the UK. The preliminary results from this Fellowship have enabled Amparo to secure additional funding for a pilot clinical study as an Early Career Researcher and to increase the recognition of her work through the prestigious 2023 Engineering Rising Talent Award from the L'Oréal-UNESCO For Women in Science program.

The Fellowship has also facilitated her transition into the next phase of her career as a Senior Research Associate at the University of Cambridge, where she will continue her research on neuro-metabolic interactions in epilepsy with the support of a Royal Academy of Engineering Research Fellowship. This five-year fellowship will allow her to delve deeper into the preclinical and clinical applications of the technologies and methods developed during the 1851 Research Fellowship, advancing our understanding of the neural regulation of metabolism in different disease conditions.

## **Dr Jasmine Lee**

*Project:* Mapping conservation actions for Antarctic biodiversity facing rapid global change

*British Antarctic Survey*

Jasmine's project focused on understanding threats facing terrestrial Antarctic biodiversity and more importantly, what we can do about them. Answering these questions led to journal publications in *Global Change Biology* and *Plos Biology*, where she found that climate-induced habitat transformation is likely to have substantial impacts on Antarctic species, and that mitigating climate change would provide the greatest conservation benefit.

As a conservation scientist Jasmine is aiming for real world impact and policy change and the support of the Commission enabled her to not only do her research, but also to present it in appropriate forums. Some of the highlights of the last three years include presenting her work at the 2023 Antarctic Treaty Consultative Meeting in Helsinki, meeting colleagues from all over the country at the UK Antarctic Science Conference and providing evidence in Westminster about the UK and the state of the Antarctic Environment. She also treasured the opportunities given by the Commission to participate in the Great Exhibition Road Festival and engage with the next generation of scientists, which was hugely inspiring.

Next, Jasmine is heading to Melbourne, Australia to take up a Discovery Early Career Researcher Award (DECRA) awarded by the Australian Research Council. Her new project will examine cumulative impacts in Antarctica, thus continuing the work she started with her 1851 Fellowship.

## **Dr Benjamin Walker**

*Project:* Multifilament methods on the microscale

*University College London / University of Bath*

Throughout his fellowship, Ben has explored microscale problems with macroscale applications. He has focused on developing our understanding of how microorganisms (such as bacteria and spermatozoa) swim and how they ultimately navigate their environment. His research has centred on a new area of enquiry: how do variations over time (such as in the undulating shape of the long, slender appendages that many 'microswimmers' use to move) alter our predictions of their long-term behaviours? Throughout the Fellowship, Ben has incorporated various sources of temporal variation into classical approaches for predicting swimmer behaviour. Much to his surprise, these details have turned out to have large consequences on our predictions and the intuition built upon them. For instance, in a study of a motile alga (*Chlamydomonas reinhardtii*), the rapid, small-scale variations in its shape and swimming speed were found to be sufficient to drive an experimentally observed behaviour; without these small-scale variations, the experimental observations and mathematical predictions were in disagreement.

Ben's Fellowship also led him to an unexpected project: VisualPDE.com. Along with collaborators at Durham University, he created this resource for exploring and communicating mathematics to broad audiences, enabling play and interactivity without the usual barriers that mathematics is associated with.

Early on in the Fellowship Ben took up a lectureship at the University of Bath and he has recently moved to University College London as a Lecturer in the Department of Mathematics. His research continues to involve microscale swimmers and is branching out into the study of broader fluids problems and biological growth.

## **Dr Harry Miller**

*Project:* Geometric approach to optimisation in quantum thermodynamics

*University of Manchester*

Harry's project was within the field of quantum thermodynamics, which is an area of research aiming to understand how thermodynamics influences the behaviour of microscopic systems such as atomic-scale thermal engines and information processing in quantum computing.

The purpose of the project was to figure out, from a broad theoretical perspective, how to reduce irreversible effects and improve thermodynamic performance of controlled quantum systems. The main approach taken was to use ideas from differential geometry to understand how to find optimal processes in quantum thermodynamics. This ended up being a successful strategy; Harry found that one can reach optimal limits by driving a system along a 'geodesic path,' which is the shortest curve connecting its initial and final configuration. The general concept was applied to a range of important problems in quantum thermodynamics. This included optimising the balance between efficiency and reliability of periodic quantum heat engines, exploring the role of quantum fluctuations in information processing tasks, and the derivation of fundamental thermodynamic trade-off relations for slowly driven systems. The Fellowship produced nine publications in total. Overall, the results of this research programme have helped to provide new insights into the nature of thermodynamic constraints in quantum regimes.

Harry now holds a Royal Society University Research Fellowship at the University of Manchester. His research is now focusing on extending these geometric methods to address systems that are driven significantly further from equilibrium over fast timescales, which promises to provide an even broader theoretical basis for thermodynamic optimal control.

## **Dr Hannah Wauchope**

*Project:* Understanding the biodiversity of the past to predict the future

*University of Exeter / University of Edinburgh*

Hannah's 1851 Fellowship aimed to understand how animal and plant species have responded to past climatic change, to enable us to make better predictions about the future. During her Fellowship, she demonstrated that smoothing of climate estimates over long time spans results in us often underestimating the amount of climate variability species have experienced since the last ice age, meaning we might also be underestimating many species' tolerances to climate change. Hannah tested the methodologies we use to forecast where species will occur in the future, by instead predicting models into the past, and testing these predictions against species' fossil locations. She found that our predictions of distributions often do not align with past locations – raising important questions for model trustworthiness. She is now working with students to extend these approaches and explore ways to calibrate the predictive models more accurately, to understand which species we can – and can't – make predictions for. Finally, during her Fellowship, Hannah continued to develop her portfolio of work in Arctic regions, by modelling Arctic species' responses to change and comparing these against past areas of climate stability, to see if such areas will remain stable into the future.

Hannah has now taken up a position as Lecturer in Ecology and Conservation at the University of Edinburgh where, based in large part upon her Fellowship work, she is developing a new undergraduate course focussed on understanding the impacts of climate change on environmental systems.

**Dr Matthew Westaway**

*Project:* Simple representations of modular Lie algebras

*University of Birmingham*

At the intersection of algebra and geometry lies Lie theory, and particularly “Lie-theoretic representation theory”. The goal of the research project was to deepen our understanding of the “modular representation theory of Lie algebras”, an exciting subfield of such research in which cutting-edge new tools had recently become available. Matthew’s research progressed along two tracks.

The first track involved exploring the application of tools from the related theory of “modular representations of algebraic groups” to the setting of Lie algebras. This track involved the publication of one paper, a preprint, and substantial progress towards another preprint (joint with Simon Goodwin). Matthew was able to generalise techniques from so-called “highest weight theory” to the world of Lie algebras (including “tilting modules” and “wall-crossing functors”), though also discovered the limitations to such an approach.

The second track focused on understanding a powerful tool called “parabolic induction” as it arises in Lie theory. In a preprint with Goodwin and Lewis Topley, he showed that in one important setting all objects with which we were concerned arise from parabolic induction. In another individual preprint, he obtained lengthy tables describing how (a form of) parabolic induction behaves on 289 objects called “nilpotent orbit covers”.

Finally, another preprint begins exploring the connection between these two tracks, and an ongoing collaboration with Goodwin and Topley aims to understand this connection further.

To continue this collaboration, Matthew has accepted a postdoctoral position with Topley at the University of Bath.

**Dr Niclas Westerberg**

*Project:* Reshaping the quantum vacuum for photon sources

*University of Glasgow*

Nic’s project focused on bridging the gap in our theoretical understanding between photon production and quantum vacuum forces on nano-optic scales. He approached this in a broad sense, setting out to study not only the production of quantum light itself but also its uses. Consequently, he developed new understandings of, and methods for tailoring, the production of quantum light by structuring the optical environment around an emitter. In collaboration with others, he also developed the Hong-Ou-Mandel microscope (which is where the quantum properties of light are used to produce images of objects that are invisible to conventional imaging) and established a new fluorescence lifetime sensing technique that works in entirely new regimes.

The Commission’s support allowed Nic to broaden his horizons further and study fundamental properties of light that are important in its interaction with matter. For instance, he determined the form of the helicity of light in structured optical media, a property which is crucial to understanding the interactions between light and many biologically relevant molecules.

Building on the work and connections made possible by the 1851 Fellowship, Nic will continue at the University of Glasgow as a Research Fellow, having secured grant funding as co-investigator on two grants – one on transformative healthcare technologies together with the Universities of Oxford and Ulster, and a second on light-atom based vector magnetometry working with the British Geological Society as well as European partners.

## **Dr Philip Wijesinghe**

*Project:* Revealing cell mechanics with light-sheet microscopy

*University of St Andrews*

“If the 20th century was the century of physics, the 21st century will be the century of biology.”—  
Craig and Cohen.

We have already witnessed remarkable breakthroughs, from rapid sequencing of the genome to tissue engineering, and are primed for new discoveries that will transform health and life. Now, the focus is on precision biology and medicine. Such endeavours require the quantification and modification of the function of life in its natural environment, and often on a molecular scale. It is imperative to support these efforts with new creative instruments and analysis methods.

Philip’s project has focused on developing a range of instruments and computational methods for functional imaging of life on the cellular scale. With colleagues, he has developed a method for rapid, 3D imaging of metabolic activity in living tissues using light-sheet microscopy, which can provide non-invasive assessment of embryos for in-vitro fertilisation. He has helped augment light-sheet microscopy with deep-learning based super-resolution for high-throughput and enhanced contrast. Another critical element to cell function is their motion and mechanics. Philip and his colleagues have developed an optical coherence microscopy method for quantifying such mechanics on a cellular scale, which can help unravel the mysteries of why some tumours metastasise while others remain benign. He has also fundamentally enhanced the depths to which these systems can image. To further assist analyses, Philip and his colleagues have developed a tool based on deep learning that can quantify motion in all microscopy methods. The Fellowship has enabled Philip to lead and contribute to this collaborative work as an independent academic.

The versatility of the 1851 Research Fellowship in terms of its remit and funding, has empowered Philip to take an unconventional approach to his research. Novel instruments require accessibility and translation to the end user, here, the biologist. The Fellowship has allowed Philip to develop and release software for computational imaging and motion estimation as open source without restriction. In contrast, the accessibility of hardware can come from rapid and efficient commercialisation. The Fellowship has facilitated Philip’s engagement with Scottish Enterprise at the University of St Andrews, and enabled collaboration with the University of Western Australia, resulting in two patents. Philip believes that innovation in advanced imaging for biomedicine lies in the close partnership of academia and industry.

After the conclusion of the Fellowship, Philip remains affiliated with the University of St Andrews and an adjunct fellow of the University of Western Australia, finalising the remaining advances for publication on a contract basis, as well as pursuing avenues for the commercialization of the technology.



## Brunel Fellow

### **Dr Edward Hart**

*Project:* Advancing main-bearing science for wind and tidal turbines

*University of Strathclyde*

The Brunel Fellowship allowed Ed to undertake extensive multidisciplinary work to establish a firm scientific foundation for the function and failure of main bearings in modern wind turbines. This included extensive modelling work concerning main bearing structural loading, lubrication, dynamics and micro-slip. These efforts revealed the highly variable nature of the operating conditions within a main bearing subjected to atmospheric turbulence. Existing design standards and processes were evaluated, critiqued and tested, revealing that current practice does not allow for the observed field failures to be accounted for. Ed led a significant international failure data collection and analysis exercise with international partners, revealing that main bearing field lives are close to half of their design life. Other important work included the rigorous reformulation and extension of a proposed bearing reliability methodology, allowing for improved granularity of life analyses when field data is incomplete or fragmented. Collaborative work with US partners allowed for high performance simulations of the atmospheric boundary layer to be undertaken, including the modelling and analysis of impacts of large-eddy passage on main bearing loading. Novel hydrodynamic bearing applications, as the main bearing in wind turbines, were also initiated and are ongoing. Further work was undertaken to evaluate main bearing operational conditions for tidal turbines, with important differences demonstrated compared to wind turbines. The Fellowship was successful in accelerating the development of our scientific understanding of this operations-critical component.

Ed is now a Senior Lecturer at the University of Strathclyde, where he continues to lead research in this and related fields. He was recently awarded a Researcher in Residence Fellowship to explore the role of digitalisation in drivetrain design, testing and monitoring.

## Industrial Fellows

### **Shefali Bhumbra**

*Project:* Developing a medicine designed to modulate cancer patients' immune system to selectively eliminate cancerous cells

*Sponsor:* Adaptate Biotheapeutics / Takeda

*Imperial College London*

Current cancer therapies often fail to fully eradicate tumours with minimal adverse effects, revealing a critical unmet need for many cancer patients. This project explored the potential of a novel antibody-based therapy with a focus on supporting Takeda's development of V $\delta$ 1-targeting antibody medicines. The therapy specifically engages V $\delta$ 1  $\gamma\delta$  T-cells—a unique immune cell type capable of recognizing and killing cancer cells—to enhance their effectiveness in eradicating B-cell leukaemias, a cancer affecting certain white blood cells. In her research, Shefali developed and validated this therapeutic approach, demonstrating that targeting V $\delta$ 1  $\gamma\delta$  T-cells with antibody-based medicines could improve their ability to eliminate these cancerous cells while maintaining safe activity in the presence of healthy cells, thus potentially reducing harmful side effects for the patient. The project demonstrated the efficacy of the V $\delta$ 1 therapy and began to clarify the mechanisms underlying its ability to enhance the V $\delta$ 1 cytotoxic response, providing insights for optimizing Takeda's V $\delta$ 1 engagers as cancer therapeutics.

This research has inspired Shefali to pursue a more comprehensive understanding of the immune system to effectively harness its potential in immunotherapy. While she gained in-depth knowledge of V $\delta$ 1  $\gamma\delta$  T-cells, she is eager to expand her expertise in immunology, believing that a broader perspective will enable her to develop more impactful therapeutic strategies for patients.



## **Kyle Bowman**

*Project:* Accelerating the commercial implementation of electromethanogenic reactors

*Sponsor:* WASE

*University of Westminster*

Kyle's Fellowship has significantly accelerated WASE's progress in developing its electromethanogenic reactor (EMR) technology. EMR efficiently converts wastewater into renewable energy through a bioelectrochemical process, demonstrating significant commercial viability and environmental impact by allowing businesses to utilise their waste to reduce fossil fuel usage.

Key milestones achieved include the successful pilot trial of the world's largest EMR at Hepworth Brewery, which treated real brewery wastewater. This pilot led to commercial sales of EMR units valued at over £650,000 and sparked additional orders exceeding £1.5 million. This success was instrumental in attracting £8 million in funding, with over £1 million of grants directly linked to the project's contributions.

The development of automated control and biosensing systems allows EMR to self-regulate and leverage electrical signals from microbial interactions as biosensors, a groundbreaking advance in monitoring reactor health and actively controlling reactor behaviour. Kyle also conducted metagenomic analyses, revealing how microbial communities interact differently within EMRs compared to anaerobic digestion (AD) systems.

Finally, Kyle conducted a techno-economic analysis to identify where EMR technology can most effectively enhance existing AD systems, showing that EMR integration can significantly boost their performance.

After the Fellowship, Kyle plans to continue advancing this technology, addressing new questions raised during the project to help WASE deliver sustainable solutions for wastewater treatment and renewable energy generation. This ongoing research will further strengthen WASE's ability to provide innovative, impactful solutions for the environmental and energy challenges faced by industries worldwide.

## **Liam Bussey**

*Project:* A quantum optical receiver for ultra-sensitive wireless digital communications

*Sponsor:* BT

*University of Birmingham*

During the course of the Fellowship, Liam significantly advanced the experimental capabilities of both BT and the University of Birmingham in developing a groundbreaking Rydberg atom-based radio frequency (RF) receiver. This innovative receiver offers a passive approach to converting RF signals into the optical domain, addressing the limitations of traditional metallic antennas and receivers. By enhancing the experimental setup, Kyle helped secure 20 patents in this cutting-edge technology and published three peer-reviewed papers, solidifying BT's position as leaders in this field.

The Rydberg atom-based receiver provides substantial improvements in sensitivity, tunability, and design simplicity, which can greatly enhance the performance of communication systems within BT. This technology promises to facilitate ultra-sensitive RF sensing and communication, making it ideal for applications in next-generation wireless networks, including 5G and beyond. The integration of this technology can lead to better signal quality, ultimately improving the reliability and efficiency of BT's services.

Following the completion of the Fellowship, Liam plans to continue working on the commercialization of quantum technologies, collaborating with industry partners to further pursue real-world applications.

Additionally, he aims to explore opportunities for expanding research efforts in quantum sensing and communications, through a career change moving to a larger research community.

### **Thomas Corner**

*Project:* Development of potent AspH inhibitors as novel small-molecule anti-cancer therapeutics

*Sponsor:* GSK

*University of Oxford*

Human 2-oxoglutarate-dependent (2OG) oxygenases catalyse the hydroxylation and N-demethylation of protein, polynucleotide, and small-molecule substrates. Catalysis by 2OG oxygenases is fundamental within biological processes, including e.g., hypoxia sensing, metabolism, epigenetic regulation, and DNA-damage repair. However, the functional and (patho)physiological roles of many 2OG oxygenases, and the therapeutic relevance of their inhibition, remains poorly understood.

During his industrial fellowship, Thomas' research focused on the design, synthesis and biochemical evaluation of small-molecule inhibitors that target the human 2OG oxygenases JMJD6 and FIH. Structure-based design, in combination with mass spectrometric (MS) studies, was employed to generate the most efficient and selective inhibitors of JMJD6 and FIH yet reported. In addition, a robust MS-based assay suitable for high-throughput JMJD6 inhibition studies was developed. It is anticipated that the JMJD6 MS assay will be highly valuable for future JMJD6 inhibitor development efforts.

Increased levels of JMJD6 are associated with tumorigenesis and cancer progression. JMJD6 is also reported to be involved in the generation of the androgen receptor splice variant 7 (AR-V7), which causes resistance towards anti-androgen therapies used for the treatment of advanced prostate cancer. JMJD6 inhibitors developed by Thomas were found to reduce the levels of AR-V7 in human prostate cancer-derived cells in a dose-dependent manner, a result that indicates JMJD6 inhibition may have therapeutic benefit for prostate cancer treatment.

FIH and the related 2OG oxygenases PHD1-3 regulate the response to hypoxia in humans. Small-molecule PHD inhibitors are used for anaemia treatment; by contrast, few selective inhibitors are reported. Thomas' optimised FIH inhibitors will be useful tool compounds to investigate the pleiotropic functional and physiological roles of FIH.

Following the Fellowship, Thomas has accepted a postdoctoral position at Yale University.

### **Jessica Crompton**

*Project:* Synthesis of quaternary stereocentres via hydrogen borrowing catalysis

*Sponsor:* GSK

*University of Oxford*

Medicinal chemists working in drug discovery often gravitate towards drug candidate molecules which are very 2D-like in shape, largely as a result of more simple synthesis. However, it has been demonstrated that the inclusion of quaternary stereocentres, which serve to make drug candidate molecules that are more three dimensional, can confer desirable properties onto the resulting molecule, potentially resulting in a more effective drug. However, many methods to make this motif use large excesses of hazardous reagents, generating large amounts of toxic waste. This project aimed to employ a more sustainable method – hydrogen borrowing catalysis – to enable the synthesis of useful quaternary stereocentres using benign starting materials and generating much less waste, which is an underexplored area in the literature.

Throughout the course of the project, Jess developed a variety of conceptually linked approaches to form a variety of small fragments using hydrogen borrowing catalysis, each containing the quaternary stereocentre motif. Jess initially developed two complementary approaches for the formation of small cyclic compounds (three-membered rings) using her method. Such small rings are often employed in drug discovery to block sites which can be metabolised, preventing rapid excretion of the drug candidate. This motif can also make the resulting molecule more rigid, resulting in greater complementarity to its proposed biological target. Her later approaches revolved around the synthesis of larger cyclic compounds, allowing more complex fragments to be synthesised for further functionalisation. Jess has published these approaches in high impact international journals demonstrating to the chemical community, including the pharmaceutical industry, that such useful fragments can be synthesised in a short sequence using more sustainable methods: a key focus for the industry.

On completion of her PhD, Jess will be taking up a position as a Synthetic Chemist at AstraZeneca, a leading UK pharmaceutical company.

### **Isobel Gordon**

*Project:* Quantitative MRI of the breast parenchyma to improve detection and diagnosis of breast cancer

*Sponsor:* Perspectum

*University of Oxford*

Breast cancer is the most common cancer in the UK and the worldwide leading cause of cancer death amongst women. MRI is widely regarded as the most sensitive technique in breast cancer imaging, but clinical protocols require the patient to receive an injection of contrast agent and to lie in an uncomfortable prone position. Furthermore, interpretation of patients' images is reliant on radiologists' experience and is semi-quantitative at best.

Isobel's research aimed to develop non-contrast, quantitative MRI methodologies to improve the diagnosis of breast cancer. Her work primarily focused on non-invasive measurement of the properties of breast adipose tissue. She identified biomarkers with the potential to improve lesion characterisation through examination of perilesional fat, and to improve breast cancer risk assessment through examining fat 'quality'. Isobel also evaluated a quantitative approach to measurement of breast density and assessed the feasibility of imaging women in the comfortable supine position using a specially developed support device known as the MR Bra.

Isobel's research has resulted in the publication of one paper and five abstracts, and she has contributed to two patents and one design registration. Isobel has presented her work at several well-respected international conferences and was selected as a scientific speaker at IF Oxford Science and Ideas Festival and Oxford Pink Week.

Perspectum are now considering the commercialisation of Isobel's research which has potential for implementation into several product offerings and for use in pharmaceutical collaborations.

Following completion of the Fellowship, Isobel will continue her research at Perspectum; she plans to further develop the MRI methodologies and to oversee the implementation of her research into product.

## **Amelia Markfort**

*Project:* AI technologies for the next generation of quantum imaging

*Sponsor:* Photek

*University of Leicester*

The ability to detect single photons has broad applications, ranging from particle tracking in large particle accelerator experiments like those at CERN, to medical imaging, space-based weather prediction, and LiDAR. The challenges of implementing algorithmic methods differ across these fields. They include handling large volumes of data and finding efficient ways to compress Gigabit-per-second (GBps) data streams, as well as de-noising MRI scans to improve the accuracy of medical diagnoses.

By leveraging machine learning techniques, Amelia's research has demonstrated a ten-fold improvement in spatial reconstruction compared to analytical methods, while maintaining a competitive timing resolution. Proof in principle studies have demonstrated that applying these techniques to a charge-sharing detector configuration is expected to enhance the spatial resolution of microchannel plate photomultiplier tubes while preserving picosecond timing precision.

To further ameliorate this result, statistical techniques such as Fisher's discriminant analysis reduce the dimensionality of the data, allowing a separation of 'correctly' reconstructed and 'incorrectly' reconstructed data to be observed linearly. Amelia's research provides a feasibility study of utilising these techniques to remove systematic errors from the data, demonstrating an increase in the reconstruction capabilities of a recognition image, with comparison of the modulation transfer function of both the analytical and machine learning methods of reconstructing single photon events using a multi-anode photomultiplier tube.

With current single-photon technology, there is a trade-off between spatial and temporal resolution. These results highlight the potential for achieving high resolution in both domains, which is crucial for applications like quantum sensing.

Following the Fellowship, Amelia remains at Photek where she has begun to undertake projects to develop particle detector products.

## **Poppy Oldroyd**

*Project:* Conducting polymer electrodes for interfacing with the brain

*Sponsor:* Johnson Matthey

*University of Cambridge*

Many implantable medical devices, such as pacemakers and deep brain stimulators, require replacement surgeries due to material degradation and electrode failure, posing significant risks and burdens for patients. Poppy's project aimed to address this challenge by developing more durable, flexible, and biocompatible electrodes using advanced materials and fabrication techniques. Traditional implantable electronic medical devices (IEMDs) rely on rigid metal electrodes that are prone to corrosion and structural failure. To improve long-term stability, Poppy investigated conductive polymers, particularly PEDOT:PSS, which offer superior flexibility, conductivity, and resistance to degradation. Poppy's work demonstrated that PEDOT:PSS electrodes lasted ten times longer than conventional metal alternatives, a modelled lifetime of 10 years in a patient compared to less than one. Additionally, Poppy developed a novel encapsulation method using PDMS, a soft and stretchable material, which significantly enhanced device longevity—achieving the longest-reported stability to date, with failure rates as low as 4.7% compared to 81% in standard metal electrodes. These advances pave the way for a new generation of all-polymer IEMDs that are safer, more reliable, and better suited for chronic neuromodulation.

Beyond neurological applications, Poppy successfully adapted this technology to monitor and stimulate the gastrointestinal system, where traditional rigid electrodes were ineffective. This work has the potential to revolutionize healthcare by reducing the need for repeat surgeries and improving patient outcomes. Poppy's research has been highlighted in two first-author publications, two first-author review papers, and one methods paper, demonstrating its broad impact on the field of bioelectronic medicine.

This work has directly benefited Johnson Matthey by advancing expertise in implant characterization and material performance. The company's medical device team gained insights into novel polymer-based implants, fabrication techniques, and reliability testing methodologies.

Following the Fellowship, Poppy transitioned to a postdoctoral research position at UCSF in the Department of Neurological Surgery with Professor Ritchie Chen. Here, she is leveraging the skills gained during her Fellowship to develop advanced optical devices for interfacing with the brain, further bridging the gap between materials science and neuroscience.

### **Parijat Patel**

*Project:* AI to improve cardiometabolic risk evaluation using CT (ACRE-CT)

*Sponsor:* Caristo Diagnostics

*University of Oxford*

Parijat's research project achieved significant success, leading to findings beneficial not only to her work but to other projects across the University's academic groups and Caristo's Cari-Heart product. The primary goal was to develop diagnostic models to predict diabetes from routine CT scans. This goal has been met, and Parijat is now planning a clinical trial to validate these findings for clinical use. The project used data from the ORFAN cohort, a research initiative applying AI to predict cardiovascular disease risk from a sample of 250,000 patients across the UK and internationally. Parijat was the first student in her group to work with this large dataset, which involved 100,000 patients' data. Through this, she developed data processing pipelines that store, process, and analyse raw CT data, enabling automated predictions applicable across various imaging projects within the academic group.

Parijat's work with CT data revealed valuable insights. Intensive quality control on predictions and selected analysable scans provided a better understanding of CT data, including image noise and artefacts, allowing her to enhance model robustness for use across diverse scanning environments. Looking ahead, she aims to further strengthen the diagnostic models. While the past three years have established a strong foundation, there is more work needed to transform this research into a viable product that could benefit society.

After the completion of her PhD, Parijat is eager to continue supporting Caristo by helping to translate this research into a practical and impactful tool over the next 2–3 years and hopefully start other similar interesting work side by side.



## **Shaun Smart**

*Project:* Determination of boundary conditions for occurrence of weld metal hydrogen cracking  
*Sponsor:* TWI / Stainless Metalcraft *University of Leicester*  
This Fellowship has enabled work to better understand the mechanism of weld metal hydrogen-assisted cold cracking in high strength carbon-manganese steel weldments.

Shaun has investigated weld metal hydrogen-assisted cold cracking in a systematic engineering way, including the cracking mechanism and morphology, cracking susceptibility, and the factors that contribute to cracking such as hydrogen behaviour during welding and hydrogen-steel microstructural interactions.

Shaun's research has helped to provide an understanding of the conditions in which hydrogen cracking may initiate, and which process variables, such as preheat, heat input and post heating, may be effective at eliminating weld metal hydrogen-assisted cold cracking.

The findings show that preheating is the most effective procedural parameter for reducing susceptibility to weld metal hydrogen-assisted cold cracking. Additionally, this work confirms that current guidance specified for the avoidance of heat affected zone hydrogen-assisted cold cracking is also effective for avoiding weld metal cracking. The work has also progressed the understanding of when weld metal cracking becomes dominant over heat affected zone cracking.

The results will be disseminated to the TWI membership base and used to shape industry guidance for the avoidance of weld metal hydrogen-assisted cold cracking.

Following the Fellowship, Shaun will continue as a Senior Welding Engineer at Stainless Metalcraft.

## **Elliott Smyth**

*Project:* Discovery of novel small molecules for the treatment of human coronaviruses  
*Sponsor:* LifeArc *University of Leeds*  
Elliott's Fellowship has focussed on identifying small molecule therapeutics to treat human coronavirus infections, including COVID-19. Despite widely available vaccines being in place, novel small molecule therapeutics and innovative approaches will continue to find important complementary applications in addressing different stages of COVID-19.

Elliott's project aimed to characterise and target a coronavirus-specific protein, non-structural protein 14 (NSP14). This enzyme is responsible for maintaining replication fidelity of coronaviruses, and in its absence, viral reproduction is severely affected. No marketed drug exists that targets NSP14, and there is strong evidence to suggest that inhibition could be a promising therapeutic strategy.

To investigate this, Elliott set about identifying molecules which could stop NSP14's enzymatic function. Optimisation of these molecules was carried out, aiming to synthesise potent inhibitors of NSP14 with suitable properties for oral treatment, by profiling these compounds in a suite of drug discovery assays. A pipeline of high-quality lead molecules was prepared and evaluated in anti-viral assays – showing an effective reduction in viral replication – and are in a promising position for further future development. This work has significantly de-risked NSP14 as a suitable target for the treatment of human coronaviruses, and enabled LifeArc to further strengthen and develop collaborations within industry and academia.

Following the Fellowship, Elliott will continue to work at LifeArc as a Senior Scientist in the Chemical Biology team, leading small molecule drug discovery projects. In particular, he will be applying the skills and knowledge he has gained to support LifeArc's 'Translational Challenge' areas of therapeutic interest.



## Industrial Design Students

### Mohamed Azman

Course: Innovation Design Engineering

*Imperial College London / Royal College of Art*

During his course, Azman worked on the systemic decentralisation of technological infrastructure, aiming to address vulnerabilities inherent in traditional centralised systems. His primary focus was on designing frameworks that enable equitable and resilient ecosystems, preserving the benefits of global connectivity while minimising the systemic risks associated with centralisation.

Azman's emphasis has been on developing robust foundations for decentralised open platforms capable of hosting diverse digital products and services. This approach seeks to empower local economies, mitigate monopolistic practices, and ensure fair trade. For instance, he explored open-source, cooperatively managed alternatives to conventional platforms, such as food delivery services, e-commerce platforms, and ride-hailing platforms, with the aim of creating a level playing field for local businesses through transparency and equitable free market opportunities.

The project also examined applications across various other domains such as next-generation urban mobility, green energy trade, financial market infrastructure, and other avenues. By embedding systemic decentralisation principles, these frameworks are designed to make economies more adaptable to external shocks and less vulnerable to influence from concentrated power structures, while retaining operational efficiencies and the advantages of economies of scale typically associated with centralised systems.

Azman is now continuing his work, focusing on the practical deployment of these frameworks. His efforts are centred on ensuring scalability, fostering synergy between top-down and bottom-up interests, and addressing socio-economic and regulatory challenges. By enabling businesses and communities to thrive independently yet cooperatively, this project aspires to transform technological and economic landscapes, paving the way for a more equitable and resilient future.

### Chris Bellamy

Course: BioDesign

*Central St Martin's*

Chris initially studied engineering at the University of Cambridge before starting his career at Jaguar Land Rover, helping to develop their first electric vehicle, the Jaguar I-Pace. He then stepped into the footwear and apparel industry, developing customisable and recyclable shoes, in the hope of reducing the impact of the 20+ billion pairs of shoes made each year.

After realising the incremental improvements to plastics and metals would never be sufficient to meet climate targets, Chris decided to change his career to work with living things.

He also identified the irrational side of human behaviour as critical to making sustainable innovations a success, and as such sought to pursue training in design and the arts, to better understand how to work in this space.

Chris's research during his degree focussed on how living materials could be used in our everyday lives, by co-evolving traditional knowledge with the latest scientific research.

His graduation research project *Lucid Life / Marama Ora* was inspired by corals' symbiotic relationships, and he developed a contemporary living material encapsulating bioluminescent micro-algae, which emits light in response to touch.

In collaboration with Polynesian artisans, traditional knowledge and science came together to co-create a series of artifacts which demonstrate how living materials can reconnect us to nature through intercultural and interspecies collaboration.

His work received multiple awards including winning the Arts Thread Global Creative Graduate Showcase, the Mills Fabrica Prize for Innovation, the Swarovski Prize for Biodesign and making the NOVA Shortlist for Fresh Creative Talent.

Chris is now continuing to work as a biodesigner full time. He has received commissions for his work from prestigious clients such as Somerset House and is collaborating with renowned designers and organisations internationally to further develop his research around living materials.

### **Grace Broom**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

During her Global Innovation Design course, Gracie focused on research into nightlife and safeguarding. In Tokyo, she collaborated on an immersive, sensor-based lighting installation for a nightclub in Shibuya, designed to respond dynamically to the crowd. In New York, she undertook a spatial design project aimed at creating sustainable, affordable housing. As part of this, she worked with the domestic abuse shelter Safe Haven in Texas to co-design a 3D-printed transitional home for survivors moving out of shelters. These projects shaped her final work, exploring the intersection of nightlife safety, women's safety, and safeguarding.

This research led to *Reporti*, a real-time incident reporting platform designed to enhance safety at live events such as concerts, festivals, and nightclubs. *Reporti* allows attendees to discreetly report incidents such as medical emergencies, assaults, or suspicious behaviour, without the need to physically search for security or medical staff. Particularly beneficial for bystanders and individuals with mobility challenges, the platform operates without mobile data or app downloads, creating a direct digital link between the crowd and the control room. Ultimately, *Reporti* supports venues and event organisers better understand and manage safety incidents.

After successfully pitching *Reporti* and securing investment, Gracie is now developing it as a business, refining the platform for commercial release.

### **Joseph Jones**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

Joseph's background is in Mechanical Engineering. He enrolled on the Global Innovation Design program to gain a more holistic insight into the creation process and to work as part of a multicultural and multidisciplinary team.

The course gives students the opportunity to be immersed in different cultures to better understand the influences that cultural and geographic factors can have on the design process. International exchanges took Joseph to Tokyo and Singapore where he developed design skills and also greatly improved his personal confidence.

Starting in Tokyo and continuing in Singapore he entered a design competition run by the Design Education Trust to reimagine an everyday object and make it more engaging through the use of motion. For his proposal, Joseph was inspired by Shibuya crossing in Tokyo to reimagine pedestrian crossing lights, combining them with an orrery planetarium and Calder mobile. This design saw Joseph win the competition and receive £8,000 to turn the design into a reality.

For his final project upon returning to London, Joseph worked with the London wheelchair rugby team, the GB paralympic wheelchair rugby team and his dad (an ex-paralympian) to create a machine learning based computer-vision tool for sports analysis and broadcast graphics with the intention of generating more interest in the sport and making it more accessible.

Following the Studentship and in the run up to the Paris Paralympics there was a great deal of interest in his final project and Joseph appeared on several broadcast and radio programs discussing it, including ITV London, London Live, BBC Radio London, and BBC World Service. Joseph hopes to continue working in the field of design for disability into the future.

### **Tarika Kumar**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

During her Studentship, Tarika focused on how design can be used to make technology more accessible and responsive to different needs. She explored ways to bring together insights from architecture, design research, and digital tools to create products and systems that work well for a broad range of people. This included looking at how we communicate beyond words and symbols—things like touch, movement, and space—and considering how those factors shape the way we interact with the world around us.

Tarika says one of the most rewarding parts of the experience was working with others who are also thinking about these challenges. Conversations with designers, engineers, and researchers enabled by the Commission helped her refine her ideas and test them in practical settings. Along the way, she developed approaches that help designers think more critically about inclusivity, not as an afterthought but as a fundamental part of the design process.

Since finishing the course, Tarika has continued this work in her academic research and involvement in projects that apply these ideas outside of academia, bringing research into real-world practice. She is clear that the support of the Studentship was invaluable in giving her the space and resources to develop these ideas, and she is excited to see where they lead next.

### **Lucie Legrandois**

*Course:* Innovation Design Engineering

*Imperial College London / Royal College of Art*

During her Studentship, Lucie transitioned from her prior experience as a mechanical and material engineer, to a transdisciplinary design engineer. Combining her technical skills with human-centred research, she expanded her practice to deliver socio-ecosystemic innovations, for social and environmental challenges.

During her Master's, Lucie worked on a wide variety of projects, including flood prevention, natural glue for low-carbon clothes, waste sorting in new areas, sexual abuse reporting, and low-tech passive sensors for small greenhouses.

Her final solo project, *TOUPY*, is a toolkit developed for therapists interested in movement therapies and playful approaches for trauma healing, working particularly with survivors of sexual assaults in regaining confidence in interpersonal connections. This research, at the intersection of exposure therapies, social circus practices, consent games, and psychology, was shortlisted for the Helen Hamlyn Design Awards.

Following her Studentship, Lucie has joined the multi-awarded biomaterial start-up *Carbon Cell*, as a design engineer. At the same time, she co-founded her own venture, *OmniLabs Research*, a studio dedicated to care technologies. Their first product is designed to gamify stroke telerehabilitation through music, mixed reality, and assistive robotics. The company is working across Singapore and the UK, and recently won two research grants, as well as being supported by different programmes and competitions. Lastly, Lucie has joined the pool of Teaching Assistants at Imperial College London, to keep working closely with the staff that supported her during her studies.

## **G Antonio Alberti Leonett**

*Course:* Design Thinking

*Cranfield University*

Antonio joined Cranfield University with a background in mechanical and manufacturing engineering, seeking to combine his technical expertise with design and innovation. Throughout the course, he explored a variety of taught modules and contributed to several impactful projects.

One of his group projects involved redesigning airline passenger service products with circular economy principles, aiming to eliminate single-use plastics and ensure effective recycling or upcycling. Another project focused on creating an educational toy for disabled children, addressing user behaviour trends, sustainability, and technology to promote inclusivity. Additionally, Antonio collaborated on developing a start-up concept to support families in third countries, providing an educational platform that preserves heritage, culture, and language for children.

During his first year, Antonio worked on a dissertation that aimed to develop a model enabling effective collaboration between fluid dynamic engineers and designers using Design Thinking principles.

For his individual thesis in the second year, Antonio addressed the challenges of lysimeter design at Cranfield University's Large Glass House facility. By integrating principles of Design Thinking and Engineering, his research tackled health, safety, and environmental inefficiencies. The innovative lysimeter design reduced health and safety risks, eliminated repetitive and prolonged tasks, and significantly improved workflow efficiency with a sixfold reduction in soil layer processing time. The modular, user-centred design incorporated stakeholder engagement, usability testing, and iterative refinement, resulting in a robust and adaptable solution that aligns with modern research needs.

Antonio's work highlights his ability to bridge technical and creative disciplines, delivering innovative, sustainable solutions. His projects reflect a strong commitment to addressing real-world challenges through interdisciplinary collaboration and design-led approaches.

Antonio is now starting a new position as a Technical Service Manager for the EAME region at International Paper, a global leader in fibre-based products. The company specialises in manufacturing corrugated packaging, pulp, and paper products, supporting customers in diverse industries with sustainable and innovative solutions.

## **Julita Napieralska**

*Course:* Product Design Engineering

*Brunel University*

During her master's year, Julita focused on enhancing her design skills with an emphasis on human factors and future-focused innovation. The course's international cohort broadened her perspective, and her projects primarily tackled sustainability, client briefs, and RSA competitions. Highlights included being shortlisted for the Roberts Radio client brief and the RSA "In Your Skin" project, refining her client communication and industrial brief analysis skills.

Julita is particularly passionate about medical design, as demonstrated in her undergraduate work addressing diverse health challenges. Projects included developing a smart device and app for physiotherapy, combining data-driven clinical insights with gamified user experiences, and during the master's, a patch-testing system using chromogenic nitrocellulose paper to map skin-based vitamin deficiencies. These efforts aimed to foster better self-awareness and challenge societal beauty standards.

For her master's major project, Julita designed wearable technology for anxiety screening. This discreet armband collects passive and active data, distinguishing between anxiety and depression across their spectrum. The device integrates with an app to provide personalized feedback, leveraging Cognitive Behavioural Therapy and aligning with NHS and private healthcare systems. It evaluated sensor accuracy and algorithmic analysis to identify individual behavioural patterns when experiencing anxiety. The project prioritized data privacy and extensive user studies, ensuring inclusivity and user willingness to share sensitive information.

Alongside her studies, Julita worked part-time as a workshop technician at Plus X, honing her expertise in design for manufacture and material selection. Post studies, Julita has secured a full-time role as a design engineer at Cordon Technologies, an agritech company specializing in vineyard spraying machinery. Her role involves developing precision technologies to minimize over spraying and deliver targeted nutrition to vine clusters, advancing sustainable agriculture practices. Julita has also opened her own limited company to pursue freelance consultancy work, as she has done for the past four years.

### **Ori Nevares**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

During his Global Innovation Design course, Ori focused on behavioural change design. He explored ways a behaviourally informed research approach and design intervention can target and change specific behaviours. His first application of this was on the topic of misinformation and fake news. He created a prototype for a digital overlay on one's phone that prompts the user to select if they think a news article is credible or trustworthy. This extra level of friction on one's news sources aims to help develop critical thought which is the most effective means to tackle this pervasive issue of our time.

In his final project Ori focused on exploring ownership psychology of books and how a gamified intervention could help reduce the hoarding of these items in our homes. The outcome was an app which allowed users to place tagged books into the world and track where and who they encounter as they move from reader to reader. The more people they reach the more points the owner gets. This aimed to encourage more collaborative and circular consumption behaviours.

Ori has now taken up a product design role with a local fintech startup (Lendable) where he is applying his behavioural design toolkit to help people improve their financial position. He is designing interventions to help people properly manage their debt, improve their credit scores, and reach their financial goals.

### **Peter Neyra**

*Course:* Design Products

*Royal College of Art*

During his Studentship, Peter merged design, science, and engineering to tackle challenges in both biodiversity and audio innovation. His primary project was *Selva*, an airborne eDNA sampling device delivering real-time ecological data for regenerative agriculture. This work achieved commercial validation with major partners, including a 10,000-acre pilot commitment from rewilding initiatives and interest from Danone and Swiss Re. It was shortlisted for the Terra Carta Design Lab, leading Peter to pitch to Sir Jony Ive and present at the Royal Society, illustrating how design-led solutions can drive environmental progress.

In parallel, Peter explored cutting-edge audio research, visiting IRCAM in Paris to study wave field synthesis and immersive sound experiences. Peter developed an electronic drum system built with open-source technology from the Centre for Haptic Audio Interaction Research in Weimar. Peter is now co-applying for an IMPACT research grant with a PhD candidate at Queen Mary University to translate neural-network-based material-sound modelling into a hardware interface that allows real-time, expressive manipulation of digital timbres.



Since completing his Studentship, Peter has continued refining *Selva's* commercial roadmap while advancing new frontiers in interactive audio. This cross-disciplinary approach — combining applied research, inventive prototyping, and market impact — reflects the Commission's vision of innovation that benefits both society and the environment.

### **Tori Simpson**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

Tori came from a background in social data science and fine art - having completed a BSc in Social Science and Data Science at UCL, and a Foundation Year in 3D Fine Art at City and Guilds of London Art School. Her work experience prior to her master's degree includes working for In2ScienceUK as a data analysis intern, and co-founding Opportutoring Edinburgh, a non-profit providing English language education to refugee children.

During her studentship, Tori focussed on design towards social good, across a range of fields including conservation, healthcare, generative AI, and disaster preparedness. She completed placements at Nanyang Technological University in Singapore - where she collaborated with The University of the Philippines Cebu to work on a designed toolkit for community action in disaster preparedness, and Tsinghua University in Beijing. She also spent a summer working as a visiting researcher at Kyushu University in Japan, focussing on design for citizen-led conservation initiatives.

Her major project, *co-cook*, explores how stroke survivors and family carers can better collaborate towards stroke survivors' long-term rehabilitation, following the stroke survivor's return home from clinical care. *Co-cook* is a rehabilitation platform, with accompanying tools, that allows stroke survivors to do their rehab whilst cooking with family members, providing an example of how we can better consider the home ecosystem when designing rehabilitation tools. *Co-cook* was co-designed with stroke survivors, their family carers, and clinicians, and the project was completed in collaboration with The Helix Centre, as well as supported by The Stroke Association and Stroke Hub Wales.

Tori is now a UX/UI designer at The Helix Centre, working across projects in stroke, dementia, and healthy ageing.

### **Holly Souza-Newman**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

Before starting her master's in Global Innovation Design, Holly worked as a biological scientist with skills in laboratory and computational biology. During her studies, she developed *SolidSound*, a community calendar that was shortlisted in the Top 12 of the Grand Challenge. In her first year, she co-founded *Cyanoskin*, a biotech startup that created a living paint designed for carbon capture. *Cyanoskin* won Imperial College's Venture Catalyst Challenge (VCC) in 2024, receiving a £30,000 prize and several awards for innovation, sustainability, and future cities.

For her final master's project, Holly focused on creating an AI application for gut microbiome prediction, which developed into *Gutted*. She also participated in several other competitions, winning the Interplay £8K Sculpture Award for Urban Elegance, the Hercules Cambridge Design Tournament, and placing third in the Generative AI Cambridge Hackathon.

The Studentship played a key role in supporting her studies, allowing her to fully dedicate herself to her coursework and projects without financial worry. The Studentship also enabled her to explore entrepreneurial and creative opportunities, such as competitions and collaborations.



Holly has since been invited to join an early stage fintech startup focusing on female financial empowerment. She is also continuing to develop her coding and technical skills, using her experience to take on new challenges and grow in the tech and innovation space.

### **Julia Szewczyk**

*Course:* Integrated Industrial Design

*Loughborough University*

Thanks to the studentship award, Julia was able to pursue a master's degree that significantly enhanced her core design knowledge and expanded upon the skills she gained during her undergraduate studies. The program allowed her to delve into more complex and specialized areas of industrial design, equipping her with advanced techniques and a deeper understanding of the industry.

The Studentship enabled Julia to work with cutting-edge technologies such as artificial intelligence, which are becoming pivotal in the design process. One of the highlights of her year was developing an extravasation detection device for premature newborns. This project was met with enthusiasm by both medical and industry professionals, and the award was instrumental in enabling her to create high-quality prototypes and conduct in-depth testing.

Additionally, Julia had the privilege of competing in the Ford Smart Mobility Challenge alongside her team. They designed an innovative dockless bike parking solution aimed at addressing e-bike littering in urban areas. Their design prioritized restoring pedestrian access, particularly benefiting individuals with disabilities. The project earned 3rd place in the Ford Mobility Accelerator 2024 - an achievement of which Julia is incredibly proud.

Overall, the Studentship has been transformative, providing Julia with the resources and opportunities to advance her skills, explore new technologies, and gain valuable experience. It has laid a solid foundation for her future career in industrial design.

Following the course, Julia will be starting a graduate role as a designer at Arup.

### **Sabrina Tian**

*Course:* Global Innovation Design

*Imperial College London / Royal College of Art*

During her Studentship, Sabrina completed her second year of the MA/MSc Global Innovation Design program with Merit. With a dual background in design and cognitive science, she refined her skills in prototyping, electronics, policy, and research to tackle multidisciplinary challenges. In her first year, Sabrina integrated psychology, electronics, and cultural ethnography, bridging technical and social sciences to create impactful solutions.

The program's global approach allowed her to study media design in Tokyo and industrial design in New York. In New York, she collaborated with Pratt's K-12 Center to co-design a smart kite that enabled children to collect air quality data as part of NYC's 2050 climate goals.

For her thesis, Sabrina developed *Ubiroot*, a system embedding nano-sized tags for real-time chip monitoring and traceability, revolutionizing the semiconductor industry. By addressing the \$75 billion faulty chip market, *Ubiroot* minimizes reliance on rare minerals, reduces e-waste, and supports circular supply chains. The project gained international recognition, being exhibited at Asia Design Week 2024, receiving an Honourable Mention at the 2024 Design Intelligence Awards, and featuring in academic publications on sustainability and biodesign.

Following her studies, Sabrina is continuing to design interactive experiences and products as a Research Fellow at MIT's Senseable City Lab, an urban innovation lab that explores how digital technologies are transforming urban environments and uses data-driven insights to create interactive solutions that enhance cities' sustainability, efficiency, and quality of life.

## **Jacob Wellsbury**

*Course:* Innovation Design Engineering

*Imperial College London / Royal College of Art*

Jacob's Studentship allowed him to bolster his mechanical engineering skills with a design thinking approach, giving him the means and confidence to tackle a broader range of problems with new approaches.

In his first year, Jacob had the opportunity to work with an incredible range of collaborators, from architects to fashion designers, and with both the private and public sectors. During this time, he was able to develop his aesthetic, collaboration, and design process skills.

In his second year, Jacob applied these skills to a project where he was able to leverage both his background in engineering and his heritage. He developed STACKS, a software and hardware package to help sustain dry-stone walling as a culturally and economically valuable activity. With inadequate funding and few dry-stone wallers to repair the 85% of the UK's 180,000 miles of dry-stone wall that are in disrepair, STACKS lowers the skills barrier for walling by non-experts.

Since graduating, Jacob has been working as a Prototyping Engineer for Shellworks, creating home-compostable alternatives to plastic cosmetic packaging. He has also been continuing his research into dry-stone walling, with the Heritage Science Lab at UCL showing interest in STACKS.

## **Enterprise Fellows**

### **Anthony Camu**

*Company:* Theia

*Technology:* Electronic travel aid for the visually impaired

There are 338,000,000 visually impaired people in the world, yet 28,000 guide dogs. The guide dog is a very effective aid, although it is not a scalable solution. Theia Robotics have been developing a device that replicates the main features of a guide dog, using similar technologies found in autonomous cars yet scaled down into a product visually impaired users can hold comfortably in their hand. With a goal to significantly reduce levels of cognitive load required when walking and navigating, Theia have developed a novel feedback interface to pair with their navigation system. Based on generating gyroscopic forces, Theia's handheld device can intuitively communicate complex walking manoeuvres and physically 'lead' users much like a guide dog pulling you along a path. Anthony and his team of robotics engineers have tested their prototypes through several iterations with encouraging results, notably with non-sighted test participants walking within a maximum deviance of 50 centimeters from their routes. Theia plan to bring their first product to market by Q4 2025.

### **Idan Gal-Shohet**

*Company:* Fibe

*Technology:* Textile fibres from potato harvest waste

Fibe is a material science startup developing textiles out of potato harvest waste. Since Idan was awarded the prestigious Enterprise Fellowship, Fibe has successfully closed its £1m pre-seed investment round led by Patagonia's investment arm. Fibe has also raised a total of £750k in grants and £50k in industry funding since beginning the programme. During 2025 Fibe will be opening its seed fundraise with the aim of raising £3m to build a pilot production facility and generate revenue for the first time.

Fibe's technology has gone from TRL2 to TRL4-6 including a patented fibre extraction bioprocess that is non-toxic, free of harsh chemicals, and safe for aquatic ecosystems. The company has also developed the world's first potato stem harvester for industrial-scale feedstock collection and proprietary bench-top fibre extraction technology, outperforming off-the-shelf solutions in efficiency and versatility. Most importantly, Fibe successfully spun the world's first yarn and swatch from potato fibres using a cotton line in late 2024.

The team has grown from 6 to 14 including senior biochemist Dr. Richard Amaee and farmers to support Fibe's scale-up operation. The company has developed an in-depth recruitment system and performance expectations including a company culture manifesto. Fibe expects its team to reach 20+ by next year.

### **Beren Kayali**

*Company:* Deploy Tech

*Technology:* Flat-packed concrete water storage units

During her Fellowship, Beren was selected for UNICEF's Innovation 30 programme which gave her a lot of exposure to the NGO/Humanitarian Aid sector. She also made it into Forbes 30 Under 30 in the manufacturing category and was selected for the Women of the Year Vodafone Business Award. Meanwhile, DeployTech won a grant from the World Food Programme for \$100,000 to deploy 17 of their units in Jordan for a pilot project.

### **Alex Shakeshaft**

*Company:* Enturi

*Technology:* Micro wind turbine [Financially supported by the ERA Foundation]

The support from the Commission has been instrumental in accelerating growth and impact at Enturi Solutions Ltd. Over the past months, Enturi has made significant strides in commercial readiness, securing key funding, advancing intellectual property protections, and expanding its operational footprint. Enturi successfully closed a pre-seed investment round with SFC Capital and Britbots in April 2024, providing essential match funding for an Innovate UK SMART Grant award, enabling Enturi to conduct full-scale system trials at a major UK port, demonstrating the viability of the technology for decarbonising maritime operations. In recognition of Enturi's commitment to sustainable energy solutions, Enturi was nominated for the Earthshot Prize 2025, further validating the company's efforts to drive meaningful carbon reductions in the maritime sector. To support Enturi's expanding operations, the company moved into a newly renovated facility in Queensferry, North Wales. This new space provides the infrastructure needed for advanced R&D, testing, and assembly, positioning the business for the next phase of growth. Additionally, Enturi made substantial progress in securing intellectual property protections, successfully registering three design rights and four trademarks in the UK, strengthening the competitive advantage and reinforcing the brand moving forward. These milestones highlight the transformative impact of the Commission's award, and the team at Enturi are excited for what's ahead as the company continues to push the boundaries of clean energy innovation.

### **Sanzhar Taizhan**

*Company:* TaiSan Motors

*Technology:* Sustainable battery technology for electric mobility [Financially supported by the ERA Foundation]

The Fellowship was pivotal in transforming Sanzhar's battery startup vision into reality. It helped him to raise £1.3m and get customers onboard. This collaboration facilitated access to state-of-the-art facilities and mentorship from leading experts, accelerating the development of innovative energy storage solutions. Sanzhan comments that the Commission's commitment to fostering innovation and bridging academia and industry has been instrumental in advancing his work, contributing significantly to the progress of sustainable battery technology.

## Technical Teaching Fellows

### **Kevin Pollard**

*Mid Kent College*

The objective of Kevin's Fellowship project was to engage with colleagues to raise awareness and debunk negative perceptions of technology in learning. Using the Technological Pedagogical Content Knowledge (TPACK) model framework, he researched current practices and needs, while workshops, events, and conferences facilitated collaboration and knowledge sharing.

Kevin provided multiple briefings to industry collaborators showcasing innovations in training and tools that can enhance learning outcomes. These briefings also resulted in securing funded projects and future collaboration opportunities. Other briefings have resulted in collaborative partnerships, providing secondment opportunities for the lecturers who want to expand their learning and development knowledge.

Visits to other colleges highlighted exceptional practices in technology use by lecturers, enhancing efficiency and effectiveness. At City of Wolverhampton College, Kevin exchanged best practices and identified additional skills to share. This led to online workshops, hints, and videos on software optimization, particularly MS360, which were shared with colleagues at Mid Kent College through articles and workshops.

Participating in an online JISC Roundtable discussion allowed Kevin to contribute insights on technology-enhanced learning for Technical Education and T Level learning, focusing on Gen Z & A, impactful tech implementation, and supporting lecturers and students.

Overall, the Fellowship project enabled Kevin to conduct valuable research, share best practices nationwide, and foster collaboration between lecturers, emerging technology companies, and educational hierarchies, enhancing understanding and promoting the benefits of these technologies.

Kevin has now been appointed Senior Learning Development Manager for Mid Kent College.

### **Bradley Collier and Dr Kumaran Rajarathinam**

*Blackburn College*

This Fellowship aimed to promote and implement integrated curriculum design and assessment practices in engineering education through partnership working between educational institutions, industry professionals, and sector colleagues.

Throughout the project, Bradley and Kumaran had the opportunity to share their project, its progress and outcomes, with various key audiences including T Level mentors and staff from across the country and significant employers such as AMS Neve and Accrol Papers. By participating in 1851 events, including the Presidential Dinner and Great Exhibition Road Festival, and a local Festival of Making, they were also able to share their work with the wider 1851 community and the general public. They delivered cross-college CPD on how others could use the framework designed as part of the project in their own teaching, supporting other colleagues as appropriate. The primary focus for impact has been employer engagement within the Lancashire area alongside using the framework to impact project-based learning across the engineering curriculum. Without the funding from the Commission, employers would not have engaged in the way they have. Equipment purchased during the project has informed project-based learning across the North West.

Following the Fellowship, Bradley has been inspired to do a PhD.

## Alumni Awards, Honours and Achievements

A selection of the alumni appointments, publications, honours and awards notified to the Commission. The Commission encourages all alumni to keep their alumni profiles up to date so that their successes can be celebrated.

### Overseas Scholars

Professor David Black (1960)

- Awarded Doctor of Science (honoris causa), University of New South Wales

Professor Jennifer Martin (1986)

- Appointed Professor Emerita, University of Queensland
- Awarded Lawrence Bragg Medal, Society of Crystallographers in Australia and New Zealand
- Delivered the Bragg Lecture at the SCANZ Crystal35 conference in Fremantle

Professor Robin Stuart (1981)

- Appointed Honorary Fellow, Royal Canadian Geographical Society and awarded a specially struck Quest Medal

### Research Fellows

Dr Jo Ashbourn (2002)

- As the Director of the St Cross Centre for the History and Philosophy of Physics, organised conferences on Physics and the Science of Living Things, The Philosophy of Cosmology and Paradoxes in Physics

Dr Susannah Bourne-Worster (2018)

- Awarded Royal Society University Research Fellowship, Department of Chemistry, Durham University
- Appointed Assistant Professor, Department of Chemistry, Durham University

Professor Edwin Constable (1982)

- Appointed Founding President, Council for Scientific Integrity, Switzerland

Dr Stephen Cox (2017)

- Appointed Assistant Professor in Computational Chemistry / Data Science, Durham University

Dr Russell Garwood (2012)

- Awarded Humboldt Research Fellowship

Dr Xianxin Guo (2020)

- Lumai (start-up formed during Fellowship) successfully raised £7.2m to continue development of the world's most energy efficient AI accelerator powered by optical computing
- Selected into the Schott Scale Up Accelerator Programme hosted by the Royal Academy of Engineering

Professor Dong Liu (2015)

- Appointed Associate Professor in Engineering Science, University of Oxford and Tutorial Fellow at Trinity College
- Appointed Secretary, Engineering Ceramics Division, American Ceramic Society and Co-chair of the UK Chapter
- Appointed a member of the EPSRC's Research Infrastructure Strategic Advisory Team

Professor Apala Majumdar (2006)

- Elected Fellow of the Royal Society of Edinburgh

Professor Rachel Oliver (2003)

- Awarded OBE for services to materials engineering

Professor Emilio Martínez-Pañeda (2019)

- Received John Argyris Award, International Association for Computational Mechanics

Professor KC Sivaramakrishnan (2015)

- Awarded SIGPLAN Programming Languages Software Award for work on OCaml programming language

## Industrial Fellows

Dr Christopher Baylis (1999)

- Appointed Chair of the British Standards Institute Committee AW/9 (Microbiology)

Dr Laurence Devesse (2017)

- Awarded Rosalind Franklin Society Award

## Industrial Design Students

Mr Matt Batchelor (2010)

- Designed an aluminium packaging system for personal care and cleaning products that uses the global beverage can supply chain but has a different cap and crenelated seam to differentiate it from a normal drinks can for the sake of safety. The system has won several industrial design and industry awards, including a Red Dot Best of The Best, an iF award and a D&AD Wooden Pencil and will be launching shortly through his companies Instrument and Meadow

Mr Michael Korn (2005)

- Launched Blue Garage, a social enterprise to support creative designers, engineers and entrepreneurs in SE London
- KwikScreen (medical furniture company) appointed preferred partner of Steelcase in USA



## Enterprise Fellows

Mr Ryan Beal (2022)

- Recognised in Forbes 30 under 30 list for sports
- Closed second funding round for SentientSports for the continued development of work in AI in sports including technology to help protect athletes from online abuse

Mr Joseph Bentley (2022)

- Accepted on to the Royal Academy of Engineering Enterprise Hub's EXPLORE programme focused on market expansion for ACT Medical, a device that stops catastrophic bleeding from open wounds

Ms Rebecca Donaldson (2021)

- Blue Tap, which designed a chlorine dosing system that inserts the correct amount of chlorine into a piped water system according to WHO guidelines, was acquired by Thermofluidics Ltd

Mr Henrik Hagemann (2016)

- Puraffinity raised £6.7m to drive development of its customised membranes for the removal of PFAS chemicals from water

Mr Gregory Hargraves (2023)

- Page Braille, a device which creates braille files that can be stored, downloaded and shared, will be available through Sight and Sound Technology, the UK's leading provider of hardware and software for the blind

Mr Ming Kong (2016)

- TGO raised £2m to drive development of its smart 3D sensing material to replace buttons and trackpads

Mr Fergal Mackie (2022)

- Metacarpal has secured £800k in seed funding to accelerate development of its mechanical bionic hand

Ms Bella-Trang Ngo (2020)

- Brarista, which has developed AI-enabled bra-fitting software that replicates the process of professional fitting online, is now receiving support from Tech Nation's Libra programme

Dr Atif Syed (2018)

- Wootzano, which has developed an electronic skin for robots, was named North East Business of the Year

Ms Reka Tron (2021)

- Multus Biotechnology opened a new production facility capable of producing 500 tonnes of cultivated meat per year

## Built Environment Fellows

Dr Tijana Blanus (2021)

- Exhibited outcomes of Fellowship project (on the advantages of mixed hedging for wildlife and flood control) at RHS Chelsea Flower Show
- Co-convened 3rd ISHS Greener Cities symposium at RHS Wisley

Ms Roberta Marcaccio (2015)

- Published *The Hero of Doubt: Selected Writings by Ernesto Nathan Rogers*

Ms Deborah Saunt (2009)

- Following her tenure as the Eero Saarinen Visiting Professor of Architectural Design at the Yale School of Architecture, *What about Learning?* is being published in book form by the architectural publishers Actar

## Rome Scholars

Ms Anne Desmet RA (1989)

- Held a major exhibition *Anne Desmet: Kaleidoscope/London* at Guildhall Art Gallery (first ever solo exhibition by a woman artist at this museum)
- Participated in *Mini Picture Show* and *Society of Wood Engravers 87<sup>th</sup> Annual Exhibition* at Bankside Gallery
- Participated in *Countercurrents* podcast with Professor Roger Kneebone
- Member, RA Summer Exhibition Committee

Ms Carole Robb (1979)

- Fulbright Commission acquired a Carole Robb painting as part of a new permanent art collection by Fulbright Scholars

# Report by the Chairman of the Finance Committee

## *Introduction*

The Board of Management has appointed the Finance Committee as a sub-committee to supervise the Commission's finances and investments; this Committee meets at least twice a year. I would like to thank all members of the Committee for their ongoing valuable contribution in overseeing the Commission's finances.

During 2024 there were four formal meetings of the Committee. In the January and February meetings we reviewed the Commission's investment policy and discussed the most appropriate investment strategy to achieve the Commission's investment objectives. At the May meeting we interviewed and appointed new investment managers to implement the agreed investment strategy. We also reviewed the annual accounts and met with the Commission's auditors. At the November meeting the Committee reviewed and appointed new legal advisers.

## *Investment Objective and Spending Policy*

The Commission is expected to exist in perpetuity, and it is not anticipated that the demand for its funding will diminish. Accordingly, the financial objective of the Commission is to at least maintain the real value of its assets whilst generating a stable and sustainable return to fund grant making. Over the long term, the Commission aims to disburse 4% of the trailing three-year average value of the portfolio per annum. The investment objective is to achieve at least a 4% real return over the long term.

## *Investment Performance*

While inflation and interest rates are hopefully stabilising, tighter monetary policy, geopolitical uncertainty and market volatility are all set to continue, with the risk of a recession in some markets. The Commission recognises that meeting the investment objective over the short to medium term will be challenging and so remains flexible in its disbursement policy.

The annualised real return over the past ten years has been 5.9%. High inflation and disappointing equity returns in 2022 mean that the investment objective has not been met over shorter periods, however, the five year and three year real returns being 3.7% and 1.1% respectively.

Despite the volatile geopolitical environment and challenging economic environment, including the ongoing war in Ukraine, hostilities in the Middle East, persistent high inflation and elevated interest rates, equity and bond markets performed well in 2024 with the MSCI ACWI Index up 19.6% for the year and the Bloomberg Barclays Global Aggregate Index (GBP Hedged) up 3.0%. Against this backdrop the Commission achieved a total return net of fees of approximately 18.0% (2023: 13.6%). CPI + 4% was 6.5% (2023: 8.0%).

## *Asset Allocation*

During the year under review, the Committee amended the asset allocation from 80% equities, 15% property, 5% cash and bonds to 85% equities, 5% property (the South Kensington Estate), 10% cash and bonds, with ranges of plus or minus 5% in each case. The new allocation has been adopted in recognition of the more volatile investment environment, the improved returns from corporate bonds and a decision to exclude from the portfolio, for the purposes of setting a strategic asset allocation, some property holdings which are let on long leases for nominal rent and are not expected to generate market returns in the short to medium term (but which further the Commission's charitable objectives by providing accommodation to legacy institutions and are also held for their long-term potential).

In arriving at the new strategic asset allocation, and appointing investment managers to implement it, the Committee took advice from Stanhope Consulting, who modelled the expected risk and return profiles of various possible asset allocations and advised on which investment managers had investment styles that best fitted the Commission's investment objectives and best complemented each other.

The Finance Committee will revisit the strategic asset allocation at least every three years and consider the need for tactical deviations from it on at least an annual basis.

## *ESG considerations*

The Commission recognises that its investments have wider impacts and seeks to align its investment strategy with its aims, reflecting the views of its stakeholders and taking into account broader public benefit. The Commission expects its investment managers to integrate Environmental, Social and Governance (ESG) considerations into the normal investment process and to fulfil the requirements of the UK Stewardship Code, actively engaging with the companies in which they invest to promote best practice corporate behaviour and sustainable business practices. The Commission has one ethical exclusion which is tobacco.

The Commission recognises that climate change is a key challenge for the next decade and that limiting global temperature rises will require significant change in business, investment, technology development and fossil fuel use. The Commission monitors the carbon emissions of its equity portfolio and through its investment managers seeks to reduce these emissions over time.

## *Financial performance for the calendar year to 31 December 2024*

Over the 12-month period the investment assets (including directly held property not considered part of the strategic asset allocation and cash held outside the portfolio) generated income of £2,259,719 (2023: £2,559,838). When combined with capital gains of £23,017,136 (2023: capital gains of £16,630,182) this meant that, after grants and other expenditure, the total funds of the Commission increased from £143,838,891 to £162,548,711 as at 31 December 2024.

Expenditure on core Fellowships and Studentships increased from £3,963,890 to £4,224,615. A greater number of large Special Awards also meant that total expenditure on charitable activities increased from £4,957,163 to £5,983,370.

Expenditure on raising funds – which primarily comprises investment and property management fees – decreased from £766,633 in 2023 to £642,408 in 2024, the drop primarily reflecting decreased exposure to segregated funds and increased investment in pooled funds where fees have been deducted in calculating unit prices.

### *Going concern*

The Commissioners do not believe there are any material uncertainties that call into doubt the Commission's ability to continue and the accounts have therefore been prepared on a going concern basis.

The Commission, like every other organisation, has been impacted by the pandemic, Russia's invasion of Ukraine and the hostilities in the Middle East, which have resulted in ongoing supply chain disruption, persistent high inflation, increased interest rates and a cost-of-living crisis. Investment markets have been much more volatile, and the day-to-day value of the Commission's portfolio has inevitably reflected that. The Commission is a long-term investor, however, and Commissioners remain confident in the underlying strength of the portfolio; they see no evidence at this stage of any permanent loss of value – indeed, the portfolio has shown significant gains over the past year. Similarly, while the Commission has had to defer or write off a certain amount of rent, there is not considered to be any risk to the long-term value of the estate. The Commission has sufficient assets, and sufficient liquidity, to ride out the current market disruptions. The Commission's core grant-making activity has therefore continued largely as planned and Commissioners expect it to continue to do so.

### *Reserves Policy*

The Commission's funds originated from the surplus arising from the Great Exhibition of 1851 and have been enhanced by careful stewardship of the assets invested over many years. They are technically unrestricted, giving the Commissioners the ability to spend the funds as they wish in fulfilment of the charitable objectives of the Commission.

Given the Commission's flexibility to spend capital if required, the Commissioners do not consider that there is any merit in identifying an optimum level of free reserves that might be readily available if required but will respond appropriately to spending needs identified as and when circumstances arise.

### *The Commission's Auditor*

In 2008, Moore Kingston Smith LLP was appointed the Commission's auditor following a competitive tender. The audit partner meets with the Finance Committee at least once each year. In the interests of good governance, the audit manager changes at least every five years and the audit partner at least every ten years.

## Statement of Commissioners' Responsibilities

The Commissioners are responsible for preparing the Trustees' Report and the financial statements in accordance with applicable law and United Kingdom Accounting Standards (United Kingdom Generally Accepted Accounting Practice.)

The law applicable to charities in England and Wales requires the Commissioners to prepare financial statements for each financial year which give a true and fair view of the state of the affairs of the Commission and of the incoming resources and application of resources of the Commission for that period. In preparing these financial statements, the Commissioners are required to:

- select suitable accounting policies and then apply them consistently;
- observe the methods and principles in the Charities SORP;
- make judgements and estimates that are reasonable and prudent;
- state whether applicable accounting standards have been followed, subject to any material departures disclosed and explained in the financial statements;
- prepare the financial statements on the going concern basis unless it is inappropriate to presume that the Commission will continue in business.

The Commissioners are responsible for keeping proper accounting records that disclose with reasonable accuracy at any time the financial position of the Commission and enable them to ensure that the financial statements comply with the Charities Act 2011, the Charity (Accounts and Reports) Regulations 2008 and the provisions of the Royal Charter. They are also responsible for safeguarding the assets of the Commission and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

The Annual Report on pages 2 to 58 and 63 to 90 was approved by the Commissioners on 9 July 2025.

Ms Sandra Robertson



# Independent Auditor's Report to the Commissioners of Royal Commission for the Exhibition of 1851

## *Opinion*

We have audited the financial statements of the Royal Commission for the Exhibition of 1851 for the year ended 31 December 2024 which comprise the Statement of Financial Activities, the Summary Income and Expenditure Account, the Balance Sheet, the Cash Flow Statement and notes to the financial statements, including a summary of significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom Accounting Standards, including FRS 102 'The Financial Reporting Standard Applicable in the UK and Republic of Ireland' (United Kingdom Generally Accepted Accounting Practice).

In our opinion the financial statements:

- give a true and fair view of the state of the charity's affairs as at 31 December 2024, and of its incoming resources and application of resources, for the year then ended;
- have been properly prepared in accordance with United Kingdom Generally Accepted Accounting Practice; and
- have been prepared in accordance with the requirements of the Charities Act 2011.

## *Basis for opinion*

We conducted our audit in accordance with International Standards on Auditing (UK) (ISAs (UK)) and applicable law. Our responsibilities under those standards are further described in the *Auditor's responsibilities for the audit of the financial statements* section of our report. We are independent of the charity in accordance with the ethical requirements that are relevant to our audit of the financial statements in the UK, including the FRC's Ethical Standard, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

## *Conclusions relating to going concern*

In auditing the financial statements, we have concluded that the Commissioners' use of the going concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work we have performed, we have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the charity's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

Our responsibilities and the responsibilities of the Commissioners with respect to going concern are described in the relevant sections of this report.

## *Other information*

The other information comprises the information included in the annual report, other than the financial statements and our auditor's report thereon. The Commissioners are responsible for the other information. Our opinion on the financial statements does not cover the other information and, except to the extent otherwise explicitly stated in our report, we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit or otherwise appears to be materially misstated. If we identify such material inconsistencies or apparent material misstatements, we are required to determine whether there is a material misstatement in the financial statements or a material misstatement of the other information. If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact.

We have nothing to report in this regard.

#### *Matters on which we are required to report by exception*

We have nothing to report in respect of the following matters where the Charities Act 2011 requires us to report to you if, in our opinion:

- the information given in the Commissioners' Annual Report is inconsistent in any material respect with the financial statements; or
- the charity has not kept adequate accounting records; or
- the financial statements are not in agreement with the accounting records and returns; or
- we have not received all the information and explanations we required for our audit.

#### *Responsibilities of Commissioners*

As explained more fully in the Commissioners' responsibilities statement set out on page 58, the Commissioners are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view, and for such internal control as the Commissioners determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Commissioners are responsible for assessing the charity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Commissioners either intend to liquidate the charity or to cease operations, or have no realistic alternative but to do so.

#### *Auditor's responsibilities for the audit of the financial statements*

We have been appointed as auditor under section 144 of the Charities Act 2011 and report in accordance with regulations made under section 154 of that Act.

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

Irregularities, including fraud, are instances of non-compliance with laws and regulations. We design procedures in line with our responsibilities, outlined above, to detect material misstatements in respect of irregularities, including fraud. The extent to which our procedures are capable of detecting irregularities, including fraud is detailed below.

*Explanation as to what extent the audit was considered capable of detecting irregularities, including fraud*

The objectives of our audit in respect of fraud, are: to identify and assess the risks of material misstatement of the financial statements due to fraud; to obtain sufficient appropriate audit evidence regarding the assessed risks of material misstatement due to fraud, through designing and implementing appropriate responses to those assessed risks; and to respond appropriately to instances of fraud or suspected fraud identified during the audit. However, the primary responsibility for the prevention and detection of fraud rests with both management and those charged with governance of the charity.

Our approach was as follows:

- We obtained an understanding of the legal and regulatory requirements applicable to the charity and considered that the most significant are the Charities Act 2011, the Charity SORP, and UK financial reporting standards as issued by the Financial Reporting Council.
- We obtained an understanding of how the charity complies with these requirements by discussions with management.
- We assessed the risk of material misstatement of the financial statements, including the risk of material misstatement due to fraud and how it might occur, by holding discussions with management.
- We inquired of management and those charged with governance as to any known instances of non-compliance or suspected non-compliance with laws and regulations.
- Based on this understanding, we designed specific appropriate audit procedures to identify instances of non-compliance with laws and regulations. This included making enquiries of management and obtaining additional corroborative evidence as required.

As part of an audit in accordance with ISAs (UK) we exercise professional judgement and maintain professional scepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purposes of expressing an opinion on the effectiveness of the charity's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Commissioners.

- Conclude on the appropriateness of the Commissioners' use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the charity's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the charity to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

#### *Use of our report*

This report is made solely to the charity's Commissioners, as a body, in accordance with Chapter 3 of Part 8 of the Charities Act 2011. Our audit work has been undertaken so that we might state to the charity's Commissioners those matters we are required to state to them in an auditor's report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to any party other than the charity and charity's Commissioners as a body, for our audit work, for this report, or for the opinion we have formed.

Statutory auditor

2 Appold Street  
London  
EC2A 2AP

Moore Kingston Smith LLP is eligible to act as auditor in terms of Section 1212 of the Companies Act 2006.

# Royal Commission for the Exhibition of 1851

## Statement of Financial Activities for the Year Ended 31 December 2024

		Unrestricted Funds 2024 £	Unrestricted Funds 2023 £
	Notes		
<b>Income from:</b>			
Donations	4	2,000	1,000
Investments	5	2,259,719	2,559,838
Other	6	6,015	5,103
<b>Total income</b>		<b>2,267,734</b>	<b>2,565,941</b>
<b>Expenditure on:</b>			
Raising funds	7	642,408	766,633
Charitable activities	8	5,983,370	4,957,163
<b>Total expenditure</b>		<b>6,625,778</b>	<b>5,723,796</b>
<b>Net expenditure before gains and losses on investments</b>		<b>(4,358,044)</b>	<b>(3,157,855)</b>
<b>Net gains / (losses) on investments</b>			
Gains / (losses) on property		154,478	(559,000)
Gains on investments		22,862,658	17,189,182
<b>Total of net gains on investments</b>		<b>23,017,136</b>	<b>16,630,182</b>
<b>Net income</b>		<b>18,659,092</b>	<b>13,472,327</b>
<b>Other recognised gains and losses</b>			
Actuarial gains / (losses) on defined benefit pension scheme	14	50,728	(9,173)
<b>Net movement in funds</b>		<b>18,709,820</b>	<b>13,463,154</b>
<b>Reconciliation of funds</b>			
Total funds brought forward		143,838,891	130,375,737
Net movement in funds		18,709,820	13,463,154
<b>Total funds carried forward</b>		<b>162,548,711</b>	<b>143,838,891</b>

The notes on pages 66 to 83 form part of these accounts. Notes 1-2 provide details of the Commission's objectives and accounting policies.

# Royal Commission for the Exhibition of 1851

## Balance Sheet as at 31 December 2024

	Notes	Total Funds 2024 £	Total Funds 2023 £
<b>Fixed asset investments</b>			
Investment properties	15	19,220,350	19,595,350
Listed investments	16	149,969,167	129,015,824
Cash held as part of the investment portfolio		165,408	1,114,160
		<hr/>	<hr/>
		169,354,925	149,725,334
<b>Current assets</b>			
Debtors	17	485,974	318,915
Cash at bank and in hand		1,267,369	1,425,099
		<hr/>	<hr/>
		1,753,343	1,744,014
<b>Liabilities</b>			
Creditors: Amounts falling due within one year	18	(4,640,555)	(4,078,902)
		<hr/>	<hr/>
<b>Net current liabilities</b>		(2,887,212)	(2,334,886)
		<hr/>	<hr/>
<b>Total assets less current liabilities</b>		166,467,713	147,390,448
		<hr/>	<hr/>
Creditors: Amounts falling due after more than one year	18	(3,645,002)	(3,206,557)
		<hr/>	<hr/>
<b>Net assets excluding pension liability</b>		162,822,711	144,183,891
		<hr/>	<hr/>
Defined benefit pension scheme liability	14	(274,000)	(345,000)
		<hr/>	<hr/>
<b>Net assets</b>		<u>162,548,711</u>	<u>143,838,891</u>
<b>The funds of the Charity:</b>			
<b>Capital Funds</b>			
Balance as at 1 January		143,838,891	130,375,737
Movement in year		18,709,820	13,463,154
		<hr/>	<hr/>
<b>Balance as at 31 December</b>		<u>162,548,711</u>	<u>143,838,891</u>

Approved by the Commissioners on 9 July 2025 and signed on their behalf by:

Ms Sandra Robertson  
Chairman, Finance Committee

Mr John Lavery  
Secretary

The notes on pages 66 to 83 form part of these accounts.



# Royal Commission for the Exhibition of 1851

## Statement of Cash Flows for the Year Ended 31 December 2024

	<b>Total Funds 2024 £</b>	<b>Total Funds 2023 £</b>
<b>Cash flows from operating activities</b>		
Donations received (excluding donations in kind)	2,000	1,000
Grants and award paid	(4,146,875)	(4,691,655)
Payments to suppliers	(1,099,846)	(1,115,782)
Payments in respect of employees	(372,738)	(350,414)
Other payments	(35,968)	(32,029)
<b>Cash used in operating activities</b>	<b>(5,653,427)</b>	<b>(6,188,880)</b>
<b>Cash flows from investing activities</b>		
Dividends, interest and rent from investments	2,101,518	2,648,366
Proceeds from sale of investments	119,813,534	24,930,798
Purchase of investments	(117,368,107)	(23,823,555)
<b>Net cash provided by investing activities</b>	<b>4,546,945</b>	<b>3,755,609</b>
<b>Change in cash and cash equivalents in the reporting period</b>	<b>(1,106,482)</b>	<b>(2,433,271)</b>
<b>Cash and cash equivalents brought forward</b>	<b>2,539,259</b>	<b>4,972,530</b>
<b>Cash and cash equivalents carried forward</b>	<b>1,432,777</b>	<b>2,539,259</b>
<b>Disclosed as:</b>		
Cash held as part of the investment portfolio	165,408	1,114,160
Cash at bank and in hand	1,267,369	1,425,099
	<b>1,432,777</b>	<b>2,539,259</b>

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 1. STATUS AND OBJECTIVES

The Commission for the Exhibition of 1851 was set up by Royal Charter in 1850 to plan and promote the Exhibition of Works of Industry of all Nations, which was to be held in London in 1851. When the affairs of the Great Exhibition had eventually been wound up, the Commissioners were appointed, under a Supplemental Charter, as a permanent body to administer the surplus funds at their disposal. These were to be applied in order to “increase the means of industrial education and extend the influence of science and art upon productive industry”.

### 2. ACCOUNTING POLICIES

The accounts are prepared under the historic cost convention, modified by the revaluation from time to time of certain fixed assets, and in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (effective January 2015) (FRS102), Accounting and Reporting by Charities: Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (effective January 2019) (SORP) and the Charities Act 2011.

In the estimation of the trustees (the Commissioners), there are no material uncertainties that call into doubt the Commission’s ability to continue and the accounts have therefore been prepared on a going concern basis.

The Commission, like every other organisation, has been impacted by the pandemic, Russia’s invasion of Ukraine and war in the Middle East, which have resulted in ongoing supply chain disruption, persistent high inflation, increased interest rates and a cost-of-living crisis. Investment markets have been much more volatile, and the day-to-day value of the Commission’s portfolio has inevitably reflected that. The Commission is a long-term investor, however, and Commissioners remain confident in the underlying strength of the portfolio; they see no evidence at this stage of any permanent loss of value. Similarly, while the Commission has had to defer or write off a certain amount of rent, there is not considered to be any risk to the long-term value of the estate. The Commission has sufficient assets, and sufficient liquidity, to ride out the current market disruptions. The Commission’s core grant-making activity has therefore continued largely as planned and Commissioners expect it to continue to do so.

The Commission meets the definition of a public benefit entity under FRS102.

The financial statements are presented in sterling which is the functional currency of the charity. Monetary amounts are rounded to the nearest pound.

#### (a) Investments

- (i) Are shown in the balance sheet at market value; any unrealised gain over original cost is shown in the statement of financial activities.
- (ii) Income on investments is included in the accounts when receivable.
- (iii) Cash held as part of the investment portfolio includes short-term deposits held temporarily with the company’s bankers pending re-investment.

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 2. ACCOUNTING POLICIES (Continued)

#### (b) Donations, legacies and similar income

Donations, legacies and similar income are included in the year in which they are receivable, that is, when the Commission becomes entitled to the income. Donations received for general purposes are included as unrestricted funds. Where the wishes of the donor are legally binding on Commissioners, donations are accounted for as Restricted Funds with their use limited to that defined by the donor.

#### (c) Fixed Assets and Depreciation

All purchases of capital items under £10,000 are written off in the year of purchase. Capital items over £10,000 are depreciated over their estimated useful economic lives. Currently no items are being depreciated.

#### (d) Investment Properties

All the Commission's properties are let to provide an income on a full repairing lease. All properties are inspected regularly by the Commission's Surveyors and revalued by them from time to time. The last full revaluation was undertaken at 31 December 2024 and was based on the existing use and occupation of the land, and the duration of leases at ground rents and rack rents. These valuations are reviewed and adjusted annually as described in note 15.

#### (e) Realised and Unrealised Gains and Losses on Investments

Gains and losses on investments and assets held for the Commission's use are treated in accordance with the Statement of Recommended Practice. They are recognised in the statement of financial activities for the year in which they occur.

#### (f) Cash and cash equivalents

Cash and cash equivalents include cash in hand, deposits held at call with banks, other short-term liquid investments with original maturities of three months or less, and bank overdrafts. Cash held on capital account pending investment by the charity's investment managers, together with cash for investment in transit between investment managers, is disclosed within fixed asset investments; all other cash and cash equivalents is disclosed within current asset investments.

#### (g) Lease premiums and licences

Premiums received for lease extensions are treated as capital receipts and included within gains / (losses) on property transactions. Certain other premiums received which do not materially affect the underlying value of the Commission's investment are treated as income receipts.

#### (h) Charitable activities

The primary charitable activity is the making of grants and awards. Grants and awards payable are accounted for on an accruals basis. Multi-year grants are accounted for in full in the year that the grant is awarded. The Commission recognises future liabilities discounted to their present value where material.

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 2. ACCOUNTING POLICIES (Continued)

#### (h) Charitable activities (continued)

The majority of grants and awards are made to individuals who have been granted Fellowships or Studentships by the Commission. A limited number of awards are made to Institutions in furtherance of their educational needs. Some support is also provided to the legacy institutions on the Commission's South Kensington estate and to organisations facilitating access to the Commission's archives. A full analysis is shown in note 9.

The Commission also undertakes some direct charitable activities, in particular networking and educational events organised for the Commission's Fellows, Students, Alumni and the general public. Further details are shown in note 10.

#### (i) Allocation of support costs

Support costs are allocated on the basis of board or staff time as appropriate.

#### (j) Financial instruments

The Commission has elected to apply the provisions of Section 11 *Basic Financial Instruments* and Section 12 *Other Financial Instruments Issues* of FRS 102 to all of its financial instruments.

Financial instruments are recognised in the Commission's balance sheet when the Commission becomes party to the contractual provisions of the instrument.

##### *Basic financial assets*

Basic financial assets, which include trade and other debtors and cash and bank balances, are initially measured at transaction price including transaction costs and are subsequently carried at amortised cost using the effective interest method unless the arrangement constitutes a financing transaction, where the transaction is measured at the present value of the future receipts discounted at a market rate of interest.

##### *Other financial assets*

Other financial assets, including investments in equity instruments which are not subsidiaries, associates or joint ventures, are initially measured at fair value, which is normally the transaction price. Such assets are subsequently carried at fair value and the changes in fair value are recognised in the statement of financial activities, except that investments in equity instruments that are not publicly traded and whose fair values cannot be measured reliably are measured at cost less impairment.

Trade debtors, loans and other debtors that have fixed or determinable payments that are not quoted in an active market are classified as 'loans and receivables'. Loans and receivables are measured at amortised cost using the effective interest method, less any impairment.

##### *Basic financial liabilities*

Basic financial liabilities, including trade and other creditors, are initially recognised at transaction price unless the arrangement constitutes a financing transaction, where the debt instrument is measured at the present value of the future payments discounted at a market rate of interest.

Debt instruments are subsequently carried at amortised cost, using the effective interest rate method.

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 2. ACCOUNTING POLICIES (Continued)

#### (j) Financial instruments (continued)

Trade creditors are obligations to pay for goods or services that have been acquired in the ordinary course of business from suppliers. Accounts payable are classified as current liabilities if payment is due within one year or less. If not, they are presented as non-current liabilities. Trade creditors are recognised initially at transaction price and subsequently measured at amortised cost using the effective interest method.

##### *Other financial liabilities*

Derivatives, including interest rate swaps and forward foreign exchange contracts, are not basic financial instruments. Derivatives are initially recognised at fair value on the date a derivative contract is entered into and are subsequently re-measured at their fair value. Changes in the fair value of derivatives are recognised in the statement of financial activities in finance costs or finance income as appropriate, unless they are included in a hedging arrangement.

#### (k) Retirement benefits

Payments to defined contribution retirement benefit schemes are charged as an expense as they fall due.

The cost of providing benefits under defined benefit plans is determined separately for each plan using the projected unit credit method and is based on actuarial advice.

The net interest element is determined by multiplying the net defined benefit liability by the discount rate, taking into account any changes in the net defined benefit liability during the period as a result of contribution and benefit payments. The net interest is recognised in the statement of financial activities.

Remeasurement changes comprise actuarial gains and losses and the return on the net defined benefit liability excluding amounts included in net interest. These are recognised immediately in the statement of financial activities in the period in which they occur.

The defined net benefit pension liability in the balance sheet comprises the total of the present value of the defined benefit obligation (using a discount rate based on high quality corporate bonds).

#### (l) Significant judgements and key sources of estimation uncertainty

In the application of the charity's accounting policies, Commissioners are required to make judgements, estimates and assumptions about the carrying value of assets and liabilities that are not readily apparent from other sources. The estimates are based on historical experience and other factors that are considered to be relevant. Actual results may differ from these estimates. The key sources of estimation uncertainty that have a significant effect on the amount recognised in the accounts are:

- the valuation of investment properties, which are stated at their estimated fair value based on professional valuations as disclosed in Note 15;

- the valuation of multi-year grant commitments, which take into account estimates of future inflation, early withdrawal rates, claim rates and other factors affecting the final amount payable; in this context, given other uncertainties, discounting for the time value of money is not considered material;

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 2. ACCOUNTING POLICIES (Continued)

#### (m) Significant judgements and key sources of estimation uncertainty (continued)

- the valuation of the defined benefit pension scheme liability, which is based on actuarial assumptions and a professional valuation as set out in Note 14;
- the valuation of future minimum lease payments under non-cancellable operating leases, which are discounted for inflation in accordance with Bank of England targets and ignore the potential effects of leasehold enfranchisements, as set out in Note 15.

### 3. FUNDS

All the Commission's income and capital is expendable at the discretion of the Commissioners and is therefore shown as a single unrestricted fund. The Commissioners had previously designated part of the unrestricted fund as a Special Projects Fund. However, during the year under review they decided that maintaining a separate fund for such projects was not helpful and the Special Projects Fund has been rolled back into the general unrestricted fund. Fund movements are disclosed in Note 20.

### 4. DONATIONS

The Commission received donations of £1,000 each from The Faculty of Royal Designers for Industry and The Royal Academy of Engineering. The donations were for the general charitable purposes of the Commission, but with an expressed wish that they be used to support the activities of the Sir Misha Black Awards Committee. The donations were therefore used to part fund the event at which the 2024 Medals and Award were presented. The Commissioners are very grateful to The Faculty of Royal Designers for Industry and The Royal Academy of Engineering for their support.

### 5. INVESTMENT INCOME

	2024 £	2023 £
Rental income from UK properties	670,741	776,165
Income from managed investments	1,503,994	1,735,350
Interest on cash deposits	84,984	48,323
	<u>2,259,719</u>	<u>2,559,838</u>

### 6. OTHER INCOME

	2024 £	2023 £
Licence income	6,015	5,103
	<u>6,015</u>	<u>5,103</u>



# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 7. COST OF RAISING FUNDS

	2024 £	2023 £
Investment management fees	467,771	567,067
Property management fees	113,643	120,068
Legal fees	2,430	27,094
Allocated support costs (note 11)	58,564	52,404
	<u>642,408</u>	<u>766,633</u>

### 8. CHARITABLE ACTIVITIES

	Grants (note 9) £	Direct costs (note 10) £	Allocated support costs (note 11) £	2024 £	2023 £
Fellowships and studentships	3,887,351	162,094	175,170	4,224,615	3,963,890
STEM education and outreach	878,225	151,147	63,401	1,092,773	444,253
Support for legacy estate	406,482	35,182	63,401	505,065	433,303
Archives and alumni relations	-	93,242	67,675	160,917	115,717
	<u>5,172,058</u>	<u>441,665</u>	<u>369,647</u>	<u>5,983,370</u>	<u>4,957,163</u>

### 9. GRANTS AWARDED

#### a. Fellowships and studentships

	2024 No.	2024 £	2023 No.	2023 £
Research Fellowships	10	2,005,165	10	1,692,455
Industrial Fellowships	12	802,901	15	1,129,088
Industrial Design Studentships	11	546,152	14	501,850
Built Environment Fellowship	-	-	1	100,000
Design Fellowship	1	100,000	-	(37)
Regenerative Design Fellowships	-	-	-	-
Enterprise Fellowships	6	375,000	4	250,000
Technical Teaching Fellowships	5	48,133	-	-
Sir Misha Black Awards Bursaries	1	10,000	-	-
Total fellowships and studentships	<u>46</u>	<u>3,887,351</u>	<u>44</u>	<u>3,673,356</u>

All of the fellowships and studentships were awarded to individuals. The Annual Report includes more information on the awards granted, including where relevant details of each of the institutions at which individual recipients are carrying out their studies / research.

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 9. GRANTS AWARDED (continued)

#### b. STEM education and outreach

	2024 £	2023 £
STEM Learning – Bespoke training for primary STEM teachers	500,000	-
Royal Museums Greenwich – First Light gallery	100,000	-
Royal Designers for Industry – Summer schools	71,000	-
Institute of Physics – Mimi's Tiny Adventure	52,500	-
Royal Institution – Science in Schools	50,000	-
National Science Centre – Outer Solar System gallery	40,000	-
Durham University – Celebrate Science 2024	15,000	-
Big Ideas – London Wonder	14,400	-
Fun Kids Radio – War time inventions	13,400	-
Number Champions – Numeracy in primary schools	12,000	-
Kids Invent Stuff – Exhibition / Inventors Club	10,000	10,000
Somerscience Trust – Somerscience Festival 2024	5,000	-
British Science Association – Primary kit boxes	2,925	83,700
Foundation for Science and Technology – Future Leaders Conference / Debate sponsorship	2,500	9,500
Imperial College Union Design Engineering Society - Hackathon	2,000	-
Primary Engineer – Primary Engineer Curriculum	-	45,000
British School at Rome – Summer School placements	-	19,500
Education and Training Foundation – Technical Teaching Fellowships	-	15,000
Oxford University Development Trust - OXbOXes	-	15,000
University of Hull – Humber Science Festival	-	11,000
All Party Parliamentary Engineering Group – Meeting sponsorship	-	10,000
Royal Botanic Gardens Kew – Grow Wild	-	10,000
Geological Society – Megalosaurus Month	-	6,000
J Mallinson and E Townsend – STEM materials	-	750
G Lamb – STEM outreach	-	500
MadeHereNow – Website development	-	2,000
Smallpeice Trust – Arkwright Scholarships	-	23,000
	890,725	260,950
Less: Past awards written back where not utilised in full	(12,500)	(14,875)
	878,225	246,075

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 9. GRANTS AWARDED (continued)

All 15 of the STEM education and outreach grants in 2024 were awarded to institutions (2023: two of the STEM education and outreach grants were awarded to individuals with the remaining 13 awarded to institutions).

#### c. Support for legacy estate

	2024	2023
	£	£
Royal College of Art – Main entrance	250,000	-
Exhibition Road Cultural Group – SouthKenZEN+ Project work	90,000	30,255
Exhibition Road Cultural Group – SouthKenZEN+ Heat network	70,000	-
Royal College of Music – Colin Lawson Fund	2,000	-
Imperial College London - Great Exhibition Road Festival 2025 and 2026	-	200,000
Science Museum – Power Hall refurbishment	-	100,000
Royal Society of Sculptors – Florilegium at Great Exhibition Road Festival 2023	-	10,000
	<hr/>	<hr/>
	412,000	340,255
Less: Past awards written back where not utilised in full	(5,518)	-
	<hr/>	<hr/>
	406,482	340,255
	<hr/>	<hr/>

All of the grants in support of the legacy estate in both 2024 and 2023 were awarded to institutions.

#### d. Archives and alumni relations

No awards were made in this category in 2024 or 2023.

In total, 19 grants were made to institutions and 46 to individuals (2023: 17 grants to institutions and 46 to individuals).

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 10. DIRECT COSTS

					2024	2023
	Fellowships and studentships	STEM education and outreach	Support for legacy estate	Archives and alumni relations	£	£
Promotion and selection costs	97,786	-	-	-	97,786	76,708
Networking and educational events	64,308	151,147	4,268	18,169	237,892	215,304
Estate memberships, projects and advice	-	-	30,914	-	30,914	30,587
Archive supplies and acquisitions	-	-	-	66,709	66,709	26,139
Alumni website and expenses	-	-	-	8,364	8,364	7,088
	<u>162,094</u>	<u>151,147</u>	<u>35,182</u>	<u>93,242</u>	<u>441,665</u>	<u>355,826</u>

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 11. SUPPORT COSTS

	Cost of raising funds	Fellowships and studentships	STEM education and outreach	Support for legacy estate	Archives and alumni relations	2024	2023	Basis of allocation
	£	£	£	£	£	£	£	
Governance costs (note 12)	9,439	9,439	7,551	7,551	3,776	37,756	27,180	Board time
Staff costs (note 13)	41,523	140,085	47,207	47,207	54,011	330,033	294,495	Staff time
Retired staff pension costs	1,854	6,255	2,108	2,108	2,412	14,737	16,238	Staff time
Facility costs	1,097	3,702	1,248	1,248	1,427	8,722	5,123	Staff time
Office costs	3,021	10,191	3,434	3,434	3,929	24,009	35,471	Staff time
Legal and professional fees	1,192	4,020	1,355	1,355	1,550	9,472	7,891	Staff time
Travel and entertaining	438	1,478	498	498	570	3,482	7,657	Staff time
	58,564	175,170	63,401	63,401	67,675	428,211	394,055	

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 12. GOVERNANCE COSTS

	2024 £	2023 £
Audit fees (including VAT)		
- Current year	15,000	15,000
- Prior year under / (over) accrual	(1,056)	-
Actuarial fees	2,220	2,220
Annual report	17,548	4,994
Meeting costs	4,044	4,966
	<u>37,756</u>	<u>27,180</u>

### 13. STAFF COSTS AND RELATED PARTY TRANSACTIONS

	2024 £	2023 £
Salaries (including benefits in kind)	260,099	231,903
Employers NI	24,601	20,713
Pension contributions	43,834	40,954
Training and development	1,499	925
	<u>330,033</u>	<u>294,495</u>

The average number of employees during the year analysed by function was: -

	2024 No.	2023 No.
Support and administration	4.0	4.0
Archive	1.0	1.0
	<u>5.0</u>	<u>5.0</u>

The full-time equivalent number of employees during the year analysed by function was: -

	2024 No.	2023 No.
Support and administration	2.8	2.8
Archive	0.4	0.4
	<u>3.2</u>	<u>3.2</u>



# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 13. STAFF COSTS AND RELATED PARTY TRANSACTIONS (continued)

One employee earned between £60,000 and £70,000 and one employee earned between £90,000 and £100,000. Pension contributions of £9,636 and £13,545 respectively were paid in respect of these employees. (2023: one employee earned between £80,000 and £90,000; pension contributions of £12,600 were paid in respect of that employee)

Commissioners do not receive remuneration. During the year re-imbursements were made to three Commissioners in respect of travelling and other expenses totalling £1,442 (2023: to three Commissioners totalling £1,423). One Commissioner received an honorarium of £1,600 as a member of the Science and Engineering Fellowships Committee in recognition of specialist services provided in assessing potential candidates (2023: one Commissioner received £900).

The total amount paid in respect of key management personnel (i.e., the Secretary and Finance Director), including employer's national insurance and employer pension contributions, was £203,353 (2023: £180,997).

There were no other related party transactions during the year (2023: none).

### 14. PENSIONS AND OTHER LONG-TERM EMPLOYEE BENEFITS

All current and new members of staff are eligible to join a personal pension scheme of their choice with the Commission contributing 15% of salary (2023: 15% of salary). There is no requirement for employee contributions. Staff may opt to sacrifice some of their salary in return for an additional employer contribution. Employer contributions of £43,834 (2023: £40,954) were made in the year of which £952 (2023: £886) were outstanding at the year-end. There were no prepaid contributions at the year-end (2023: £nil).

All current and new members of staff also benefit from an unfunded / uninsured death in service scheme under which the Commissioners (at their absolute discretion) may pay a nominated beneficiary a lump sum equivalent to 18 months' salary if an employee dies while employed by the Commission. No liability for the scheme is recognised in the accounts as Commissioners do not believe there is any sensible way to estimate the liability. Actuarial calculations based on assumptions comparable to those used in valuing the defined benefit pension liability (see below) suggest that any liability in respect of the death in service scheme would in any case be immaterial.

All current and new members of staff also benefit from a Group Income Protection policy with Canada Life which covers basic salary and pension contributions for staff unable to work due to long term illness.

The Commission operates an unfunded pension scheme in the UK (the 'Scheme'). The Scheme is an unregistered, non-contributory defined benefit scheme. As the Scheme is unfunded, no contributions are paid by the Commission, other than to meet benefits as they fall due. As no triennial valuations are carried out, a valuation is carried out at the balance sheet date each year by an independent qualified actuary.

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 14. PENSIONS AND OTHER LONG-TERM EMPLOYEE BENEFITS (continued)

The Scheme was closed to new members on 14 July 2004. As at 31 December 2024, all four remaining members of the Scheme are receiving a pension and there is no further accrual of benefits. There is therefore no service cost for the year. The amount recognised in arriving at net expenditure for the year is an expense of £14,737 (2023: £16,238) which is fully in respect of net interest on the net liability. As regards the unfunded, defined benefit pension scheme:

*The principal assumptions used by the actuary were:*

	FRS102 Valuation 2024 (% p.a.)	FRS102 Valuation 2023 (% p.a.)
<i>Financial assumptions</i>		
Gross investment return		
In-service members		
Pre-retirement	N/A	N/A
Post-retirement	N/A	N/A
Current pensioners	4.8%	4.5%
Pensionable earnings increases	N/A	N/A
Price inflation	3.7%	3.6%
Pension increases	3.7%	3.6%
Allowance for administration expenses	0.0%	0.0%
<i>Demographic assumptions</i>		
Mortality		
Pre-retirement	N/A	N/A
Post-retirement	101%/104% S3PA CMI 2023 1%	101%/104% S3PA CMI 2022 1%
Withdrawal allowance	No allowance	No allowance
Early retirement allowance	No allowance	No allowance
Proportion married	90%	90%
Wife's age	3 years younger than husband	3 years younger than husband

The assumptions used by the actuary are best estimates chosen from a range of possible actuarial assumptions which, due to the timescale covered, may not necessarily be borne out in practice.

*Value of Scheme assets and liabilities:*

	2024 £	2023 £
Market value of Scheme assets	-	-
Present value of Scheme liabilities	(274,000)	(345,000)
Scheme deficit	(274,000)	(345,000)
Related deferred tax asset	-	-
Net liability	(274,000)	(345,000)

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 14. PENSIONS AND OTHER LONG-TERM EMPLOYEE BENEFITS (continued)

#### *Movements in the year:*

	2024	2023
	£	£
Scheme deficit at beginning of year	(345,000)	(357,000)
Current service cost	-	-
Interest on obligation	(14,737)	(16,238)
Actuarial gain / (loss) on liabilities	50,728	(9,173)
Benefits paid directly by employer	35,009	37,411
	<hr/>	<hr/>
Scheme deficit at end of year	(274,000)	(345,000)
	<hr/>	<hr/>

The interest on obligation of £14,737 (2023: £16,238) is disclosed within Support costs (note 11) while the actuarial gain on liabilities of £50,728 (2023: loss of £9,173) is disclosed within Other recognised gains and losses on the face of the SOFA.

### 15. INVESTMENT PROPERTIES AND OPERATING LEASES

	2024	2023
	£	£
<i>(a) Movements in value of investment properties</i>		
Balance at 1 January	19,595,350	20,765,350
Sales during the year	(210,000)	(365,000)
Unrealised loss on year-end revaluation	(165,000)	(805,000)
	<hr/>	<hr/>
Valuation at 31 December	19,220,350	19,595,350
	<hr/>	<hr/>

The valuation as at 31 December 2024 shown above resulted from a full revaluation of the properties at 31 December 2024, undertaken by Daniel Watney LLP, Chartered Surveyors and Property Consultants. The valuation was carried out on an open market value basis in accordance with the RICS Appraisal and Valuation Manual and is based on existing usage and occupation of the land, and the duration of leases at ground and rack rents. All of the investment properties are located in the UK.

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 15. INVESTMENT PROPERTIES AND OPERATING LEASES (continued)

#### (b) Operating leases – lessor

The Commission is entitled as landlord to income from investment properties under operating leases. Future minimum lease payments under non-cancellable operating leases, discounted for inflation, for each of the following periods are as follows:

	2024 £	2023 £
Not later than one year	77,750	94,538
Later than one year and not later than five years	-	-
Later than five years	11,054,796	10,903,421
	<u>11,132,546</u>	<u>10,997,958</u>

The Commission's investment properties are let for periods ranging up to 999 years. All leases are on full repairing and insuring terms. Leases of residential property are potentially subject to leasehold enfranchisement; this has been ignored in arriving at the above figures.

### 16. INVESTMENTS

	2024 £	2023 £
<b>(a) Movements in listed investments</b>		
Market value 1 January	129,015,824	112,318,792
Acquisitions at cost	117,406,203	23,917,758
Disposals at cost	(85,890,586)	(20,252,654)
Net gains / (losses) on revaluation	(10,562,274)	13,031,928
	<u>149,969,167</u>	<u>129,015,824</u>
Market value 31 December	149,969,167	129,015,824
	<u>128,360,319</u>	<u>96,844,702</u>
Value at cost 31 December	128,360,319	96,844,702

#### (b) Geographic breakdown

	2024 £	2024 £	2023 £	2023 £
	Listed investments	Cash	Listed investments	Cash
In the UK	36,381,298	150,711	54,650,992	1,114,072
Outside the UK	113,587,869	14,697	74,364,832	88
	<u>149,969,167</u>	<u>165,408</u>	<u>129,015,824</u>	<u>1,114,160</u>

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 16. INVESTMENTS (continued)

All investments are listed on a recognised stock exchange.

There were no individual holdings the market value of which is considered to be material in the context of the portfolio as a whole.

### 17. DEBTORS

	2024 £	2023 £
Rents receivable		
- in hands of surveyors	277,856	132,886
- in arrears	143,067	126,391
	<hr/> 420,923	<hr/> 259,277
Other debtors	18,416	28,243
Prepayments	46,635	31,395
	<hr/> 485,974	<hr/> 318,915
	<hr/> <hr/>	<hr/> <hr/>

### 18. CREDITORS

Amounts falling due within one year	2024 £	2023 £
Grants payable	4,497,521	3,866,077
Other creditors	143,034	212,825
	<hr/> 4,640,555	<hr/> 4,078,902
	<hr/> <hr/>	<hr/> <hr/>

	2024 £	2023 £
<b>Analysis of other creditors</b>		
Investment management fees	56,896	145,301
Property management fees	30,043	24,398
Audit fees	15,000	15,000
Other legal and professional fees	5,313	12,478
Others	35,782	15,648
	<hr/> 143,034	<hr/> 212,825
	<hr/> <hr/>	<hr/> <hr/>

# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 18. CREDITORS (continued)

Amounts falling due after more than one year	2024 £	2023 £
Grants payable	3,645,002	3,206,557
Due in one to two years	2,298,118	2,195,140
Due within two to five years	1,346,884	1,011,417
	3,645,002	3,206,557

The analysis of grants payable by award is as follows

Award	Period of commitment	2024 £	2023 £
Fellowships and studentships			
- Research Fellowships	3 years	3,604,299	3,321,439
- Industrial Fellowships	3 years	2,265,007	2,286,548
- Industrial Design Studentships	2 years	347,817	286,942
- Built Environment Fellowships	2 years	50,000	80,000
- Design Fellowships	2 years	110,000	55,000
- Regenerative Design Fellowships	2 years	87,500	132,500
- Enterprise Fellowships	1 year	187,500	62,500
- Sir Misha Black Award Bursaries	1 year	5,500	1,000
STEM education and outreach	1 year	909,900	196,250
Support for legacy estate	3 years	575,000	640,455
		8,142,523	7,072,634

### 19. FINANCIAL INSTRUMENTS

	2024 £	2023 £
<b>Carrying amount of financial assets</b>		
Debt instruments measured at amortised cost (debtors excluding prepayments)	439,339	287,520
	439,339	287,520
<b>Carrying amount of financial liabilities</b>		
Measured at amortised cost	8,285,557	7,285,459
	8,285,557	7,285,459



# Royal Commission for the Exhibition of 1851

## Notes to the Financial Statements for the Year Ended 31 December 2024

### 20. FUNDS

	At 1 January £	Income £	Expenditure £	Gains / (losses) £	Transfers £	At 31 December £
<b>Unrestricted</b>						
General	140,728,684	2,267,734	(6,625,778)	23,067,864	3,110,207	162,548,711
Designated						
- Special Projects	3,110,207	-	-	-	(3,110,207)	-
	<u>143,838,891</u>	<u>2,267,734</u>	<u>(6,625,778)</u>	<u>23,067,864</u>	<u>-</u>	<u>162,548,711</u>

In 2021, the Commissioners set up a designated Special Projects Fund. However, during the year under review they decided that maintaining a separate fund for such projects was not helpful and the Special Projects Fund has been rolled back into the general unrestricted fund. The designated fund had comprised listed investments and was administered as part of the unrestricted fund.

## Administrative Information

### Structure, Governance and Management

The Commission is constituted as a limited company incorporated by Royal Charter. Its governing documents are the original Charter dated 3 January 1850 and a Supplemental Charter dated 2 December 1851.

The Commission may have up to twelve trustees, known as Royal Commissioners, at any one time, who together constitute the Board of Management, which meets formally twice a year. Commissioners are chosen to bring wide experience in areas relevant to the Commission's work – science, engineering, industry, design, architecture and finance. To maintain an appropriate balance of skills, Commissioners normally serve for 10 years, and Commissioners themselves identify possible successors, who may serve on a committee prior to election. Following election by the Board of Management, Commissioners are only appointed with the approval of the President.

All other committees are advisory in remit, are subordinate to the Board of Management and report to it, and all committee Chairmen are Commissioners. *Ad hoc* committees may be formed for limited periods and specific purposes. Any committee other than the Board of Management may have non-Commissioners as members subject to the wishes of the Chairman of that committee. All committees, except *ad hoc* committees, meet at least once annually. All committees are serviced by the Secretary and, where appropriate, by the Finance Director.

The Secretary also provides full briefing and induction programmes for all new Commissioners and committee members when appointed. As part of this introduction Commissioners are provided with a Governance Book containing full details of the Commission's history, role, strategy, procedures and Commissioners' responsibilities, as well as the relevant Charity Commission guidance for trustees. During their tenure, further opportunities for Commissioners to develop their knowledge of areas relevant to the Commission's activities are provided as appropriate.

Day to day running of the Commission is delegated to the Secretary, assisted by a small staff team. Matters of strategy, and all grants greater than £5,000, are decided by Commissioners.

Full details of Commissioners and Committee members in post during the year, as well as the small staff team, are provided on pages 86 to 88. Details of the Commission's professional advisers are provided on page 89.

### Remuneration

Commissioners are not remunerated in their role as trustees of the charity and do not receive benefits other than reimbursement of expenses incurred in attending meetings.

In order to maximise funds available for grant making, Commissioners are determined to keep staff numbers and associated office costs to a minimum. To attract and retain experienced staff of the right calibre, however, Commissioners recognise the need to set salaries in line with those for other grant-making charities in the London area, based on sector benchmarks and other publicly available data.

Salaries for all staff, including key management personnel, are reviewed annually by the Chairman of the Board and the Chairman of the Finance Committee as part of the performance appraisal process. Pay awards are dependent on performance and set based on increases in the cost of living and average salary increases for the sector. There are no automatic increments and no bonus scheme.

Commissioners recognise the importance of helping employees make adequate provision for retirement. All employees are therefore eligible to receive a 15% employer pension contribution to the pension scheme established for auto-enrolment purposes or a personal pension of their choice. All employees also benefit from a Group Income Protection policy that will cover basic salary and pension contributions if they are unable to work due to long-term illness. At their absolute discretion, Commissioners may pay a nominated beneficiary a lump sum equivalent to 18 months' salary if an employee dies while employed by the Commission. All employees are also entitled to an interest free season ticket loan. All of the above benefits are available to all employees, including key management personnel. Employees do not receive any other benefits.

## Risk Policy

In discharging their responsibilities for the management of risk, it is the policy of the Commissioners to identify, analyse and seek to manage any risks to the ability of the Commission to carry out its role effectively and meet the obligations of its Royal Charter.

To this effect the Commissioners have given consideration to the major risks to which the Commission is, or may be, exposed. A full risk register has been drawn up, which is reviewed regularly. Insurance brokers have been appointed to advise on areas where risk can be effectively mitigated through insurance. Compliance risks are mitigated through taking and following appropriate professional advice.

The main remaining areas of strategic and operational risk and the steps taken to address them are summarised below.

### *Investments: security, performance, liquidity*

The Commission has a diversified portfolio, both in terms of investments held and managers appointed. It has adopted investment and disbursement policies designed to maintain the real value of the portfolio over time and hence the support available to current and future beneficiaries. Sufficient liquidity is held outside the portfolio to meet short term commitments. Commissioners have delegated review of investment performance to a Finance Committee comprising individuals with relevant expertise.

### *Grant-making: applications, assessment, administration*

Commissioners have appointed specialist committees to review fellowship applications, work closely with other organisations active in the STEM arena to avoid unnecessary duplication or administrative effort and have appointed a communications company to assist with marketing of the awards to ensure they are brought to the attention of eligible recipients. Commissioners regularly seek feedback from potential applicants and other stakeholders to ensure the awards remain relevant.

### *Legacy estate: character, experience, relevance*

Commissioners take an active interest in the estate, seek to facilitate relevant initiatives across legacy institutions and provide financial support where possible to ensure the estate remains a beacon of excellence and inspiration in the worlds of science, engineering and design.

## Commissioners and Committee Members

### President

HRH The Princess Royal

### Commissioners (and Board of Management)

The Rt Hon Professor Lord Kakkar KG KBE PC FMedSci  
*Chairman, Board of Management*

Professor Jim Al-Khalili CBE FRS FInstP  
The Rt Hon Lord Burnett of Maldon PC DL  
Professor Dame Ann Dowling OM DBE FREng FRS  
Professor Sir Andrew Hopper CBE FRS FREng FIET  
Professor Sadie Morgan OBE HonFRAIA HonFRIBA HonFICE FRSA  
Dame Alison Nimmo DBE MRTPI FRICS HonFRIBA FICE  
Ms Sandra Robertson  
Professor Dame Carol Robinson DBE FRS FRSC FMedSci  
Professor Dame Sarah Springman DBE FREng  
Professor Eleanor Stride OBE FREng HonFIET  
Professor Chris Wise RDI FREng FICE MStructE HonFRIBA FRSA

Professor Dame Sarah Springman was appointed to the Board on 4 March 2024  
Professor Sadie Morgan was appointed to the Board on 29 August 2024  
Professor Lord Mair retired from the Board on 9 July 2024  
Mr Jim Eyre retired from the Board on 11 December 2024

### 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 Energy Security and Net Zero  
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 DL  
Professor Sir Andrew Hopper CBE FRS FREng 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 Mike Benton FRS FRSE  
Professor Martin Bridson FRS  
Professor Andrew Briggs  
Professor Neil Champness FRSC FLSW  
Professor Martin Dawson FRS FRSE FIEEE FOSA FInstP  
Professor Anne Dell CBE FRS FMedSci  
Professor John Dewey FRS  
Professor Marian Holness FRS  
Professor Patrick Keogh FREng  
Dr Sandra Knapp OBE FRS  
Professor Rachel O'Reilly FRS FRSC  
Professor Rachel Oliver OBE FREng  
Professor Neil Ranson  
Professor Ann Rosser FRCP  
Dr Dame Frances Saunders DBE CB FREng FInstP  
Professor Christopher Tout  
Professor Dominic Vella  
Professor Stuart West  
Professor John Wood CBE FREng

Professor Martin Dawson was appointed to the Committee on 18 November 2024  
Professor Marian Holness was appointed to the Committee on 16 October 2024  
Professor Rachel Oliver was appointed to the Committee on 28 October 2024  
Professor Neil Ranson was appointed to the Committee on 13 November 2024  
Professor Ann Rosser was appointed to the Committee on 6 November 2024  
Professor Dominic Vella was appointed to the Committee on 21 October 2024  
Professor Gillian Bates retired from the Committee on 31 May 2024  
Professor Cyril Hilsum retired from the Committee on 31 May 2024  
Professor Sheena Radford retired from the Committee on 31 May 2024

## Brunel Fellowships Sub-Committee

Professor Dame Carol Robinson DBE FRS FRSC FMedSci *Chairman*  
Professor Dame Anne Dowling OM DBE FREng FRS  
Professor William Powrie FREng FICE  
Professor John Wood CBE FREng

## Industry and Engineering Committee

Professor Dame Ann Dowling OM DBE FRS FREng *Chairman*  
Professor Cees de Bont  
Mr Mike Carr OBE FREng HonDTech CEng FIET  
Professor John Clarkson FREng  
Dr Nicholas de León  
Professor Andrew Lewis FREng FRSC FAPS FIMMM CChem CSI  
Professor Ron Pethig  
Dr Malcolm Skingle CBE DSc  
Professor Dame Sarah Springman DBE FREng  
Professor Adam Stokes  
Professor Eleanor Stride OBE FREng

Mr Mike Carr was appointed to the Committee on 29 November 2024  
Professor Lord Mair retired from the Committee on 9 July 2024

## Built Environment and Design Fellowships Committee

Professor Chris Wise RDI FREng FICE MIStructE HonFRIBA FRSA *Chairman*  
Professor Rachel Cooper OBE  
Professor Sadie Morgan OBE HonFRAIA HonFRIBA HonFICE FRSA  
Ms Kat Scott  
Dr Andrea Siodmok EMPP FRSA HonDCL

Professor Sadie Morgan was appointed to the Committee on 11 December 2024  
Mr Jim Eyre retired from the Committee on 11 December 2024

## Sir Misha Black Awards Committee

Professor Malcolm Garrett MBE RDI FISTD *Chairman*  
Professor Chris Wise RDI FREng FICE MIStructE HonFRIBA FRSA  
Professor Peter Childs  
Dr Nicholas de León  
Professor Geoff Kirk RDI FREng

Ms Mary Mullin retired from the Committee on 4 March 2024

## Staff

Mr John Lavery MVO  
Mr Amahl Smith ACA  
Mrs Helen Harris  
Mrs Angela Kenny RMARA  
Ms Kat O'Dea

Secretary  
Finance Director  
Fellowship Programme Manager  
Archivist and Alumni Relations  
Office Manager / Executive Assistant



## Professional Advisers

### Bankers

The Royal Bank of Scotland plc  
London Drummonds (B) Branch  
49 Charing Cross  
London SW1A 2DX

### Surveyors

Daniel Watney LLP  
165 Fleet Street  
London EC4A 2DW

### Auditor

Moore Kingston Smith LLP  
9 Appold Street  
London EC2A 2AP

### Actuaries

XPS Pensions  
Albion  
Fishponds Road  
Wokingham RG41 2QE

### Legal Advisers

Lee Bolton Monier-Williams LLP  
1 The Sanctuary  
London SW1P 3JT

### Insurance Brokers

Howden  
3rd Floor  
Quadrant House  
Croydon Road  
Caterham CR3 6TR

### Investment Consultant

Stanhope Consulting  
35 Portman Square  
London W1H 6LR

### Investment Managers

Baillie Gifford & Co Limited  
Calton Square  
1 Greenside Row  
Edinburgh EH1 3AN

BlackRock Asset Management Ireland Limited  
2 Ballsbridge Park  
Ballsbridge  
Dublin 4  
Republic of Ireland

JP Morgan Asset Management (UK) Ltd  
60 Victoria Embankment  
London EC4Y 0JP

Osmosis Investment Management  
36-38 Botolph Lane  
London EC3R 8DE

Schroder & Co. Limited  
1 London Wall Place  
London  
EC2Y 5AU

The Children's Investment Fund  
TCI Fund Services (Ireland) Limited  
Ella House  
39-43 Merrion Square  
Dublin 2  
Republic of Ireland

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