



Innovation through collaboration

The Industry Fellowship scheme

THE
ROYAL
SOCIETY

Since 1998, the Royal Society has awarded over 200 Industry Fellowships. 85% have led to successful, long-term collaborations between industry and academia.

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Introduction

For nearly 40 years, the Royal Society Industry Fellowship scheme has been helping world leading scientists form successful collaborations between industry and academia.

The flow of knowledge, ideas and people between industry and academia is essential in turning research discoveries into commercial practice. It drives innovation, enabling research to be translated into positive impacts for the economy and for society.

The Royal Society Industry Fellowship scheme has been instrumental in helping leading scientists form successful, long-term collaborations between universities and businesses, providing them the time and support to work in both sectors. Industry Fellows have operated in all regions of the UK and in many industry sectors and academic disciplines, demonstrating the relevance of these types of collaborations across the economy.

The Industry Fellowship has profound impacts on the careers of those who receive it. It enhances the holder's professional development, builds new networks and grows their understanding of the translation of research. As a result, Industry Fellows have been very successful in securing further funding for their research, allowing them to bring it to commercial application. For many, the fellowship has also acted as a springboard, advancing their career or giving them the confidence to make a permanent move.

Working across industry and academia should be accepted as a normal career path, and it is important to encourage and incentivise scientists who move between sectors. Their achievements should be recognised and rewarded, and held in the same regard as those of individuals who have worked solely in one sector or the other.

This booklet collects the stories of ten Royal Society Industry Fellows. It describes their experiences of the scheme, the benefits the fellowship has had on their career and their research, and also on the universities and companies they have worked for. We hope their stories will encourage others to apply for the scheme and follow a similar path to achieve innovation through collaboration.

The Royal Society Industry Fellowship scheme enhances knowledge exchange between industry and academia in the UK by providing opportunities for individual scientists to work on collaborative projects. The scheme supports either industry scientists to work at a university, or academic scientists to work in a company, for up to two years full-time (or four years part-time). Fellowships are awarded based upon the quality of the science, the track record of the applicant and the potential impacts of the project on the individual and both organisations.

“I am very proud of the long association between Rolls-Royce and the Royal Society. The Industry Fellowship scheme continues to prove its worth and plays an important role for Rolls-Royce in helping to develop world-leading researchers, scientists, and engineers.”

Mark Jefferies

Chief of University Research Liaison, Rolls-Royce

The scheme currently receives financial support from Rolls-Royce, the Royal Society of Chemistry and the Society of Chemical Industry. The scheme has also received support from BP, AstraZeneca and the Schering-Plough Research Institute in the past.

More information about our schemes can be found on our website at royalsociety.org/industry



I am proud to chair the Industry Fellows College, which promotes excellence in innovation by providing mentorship to early career scientists and encouraging networking within the wider Industry Fellows community.

Royal Society Industry Fellows are members of a class-leading scheme, with a collective wealth of expert knowledge and experience in establishing collaborations between industry and academia.

The impact of these Industry Fellows clearly shows the potential for scientists to collaborate across sector boundaries, reaping benefits for society and the economy whilst still maintaining research excellence as the core driver of their work.

Professor Joe Sweeney

Chair of the Industry Fellows College

Expansion of the scheme

To build on its success, the Royal Society is expanding the Industry Fellowship scheme and offering new opportunities for mobility between industry and academia.

Entrepreneurs in Residence

The Entrepreneur in Residence scheme, first awarded in 2018, supports outstanding industrial scientists and entrepreneurs to spend time working in a university.

Impacting both research and teaching, they will expose academic staff and students to cutting-edge industrial science and grow an entrepreneurial culture within universities.

Enhanced support

Launched in 2016, the Industry Fellows College brings together current and past award holders to provide them with regular networking and training events across the UK.

Current Industry Fellows have the opportunity to apply for funding for PhD studentships and undergraduate summer placements. These schemes support the fellows' research and provides the next generation of scientists with experience of an industry-focused project.

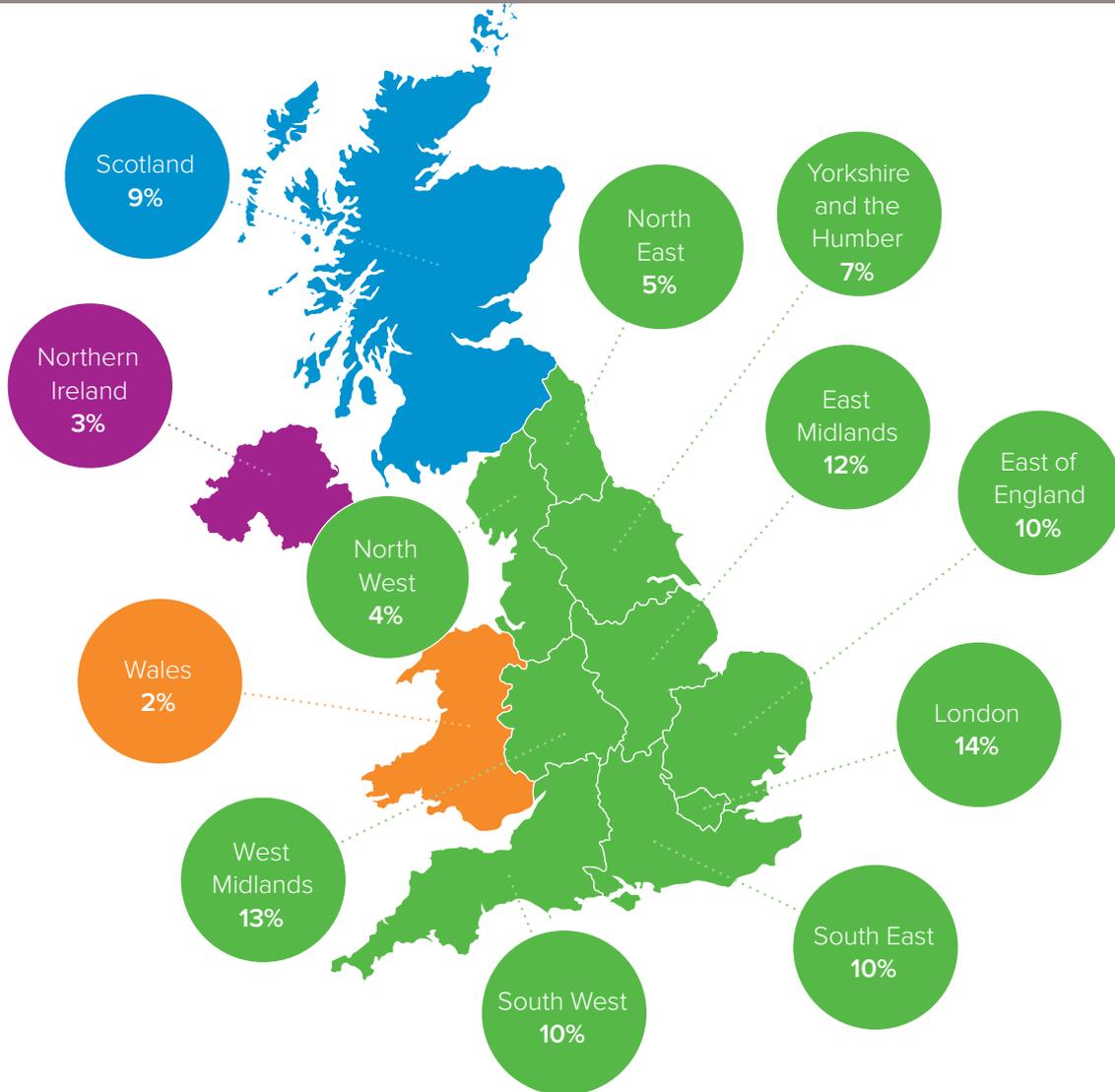
Short Term Industry Fellowships

Launched in spring 2018, this new scheme allows researchers to apply for shorter term fellowships up to a year in length.

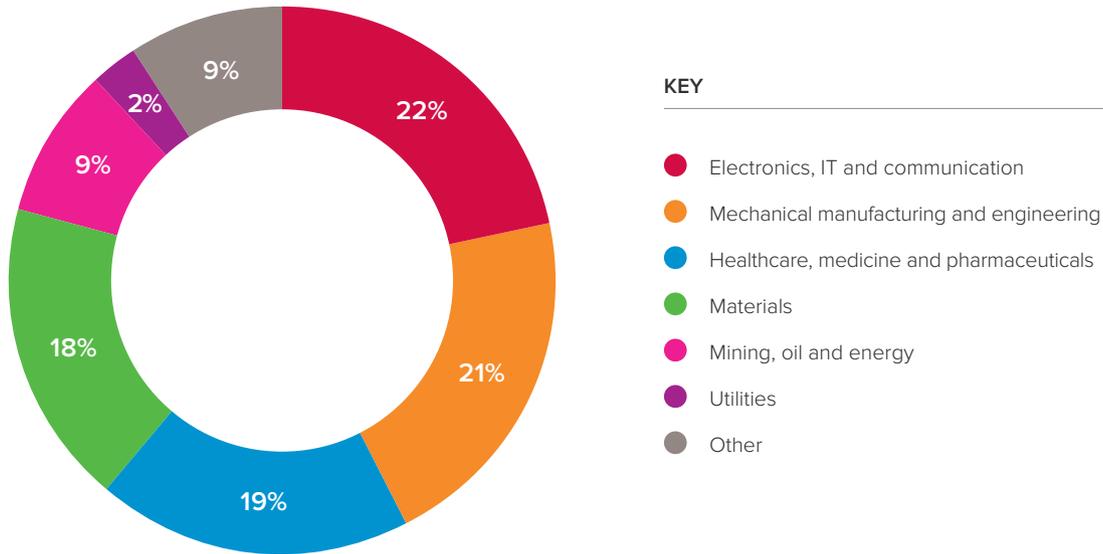
These have been designed in response to feedback about the scheme, to encourage more collaboration between universities and early stage companies.

Industry Fellows at a glance

Where are the Industry Fellows employed?



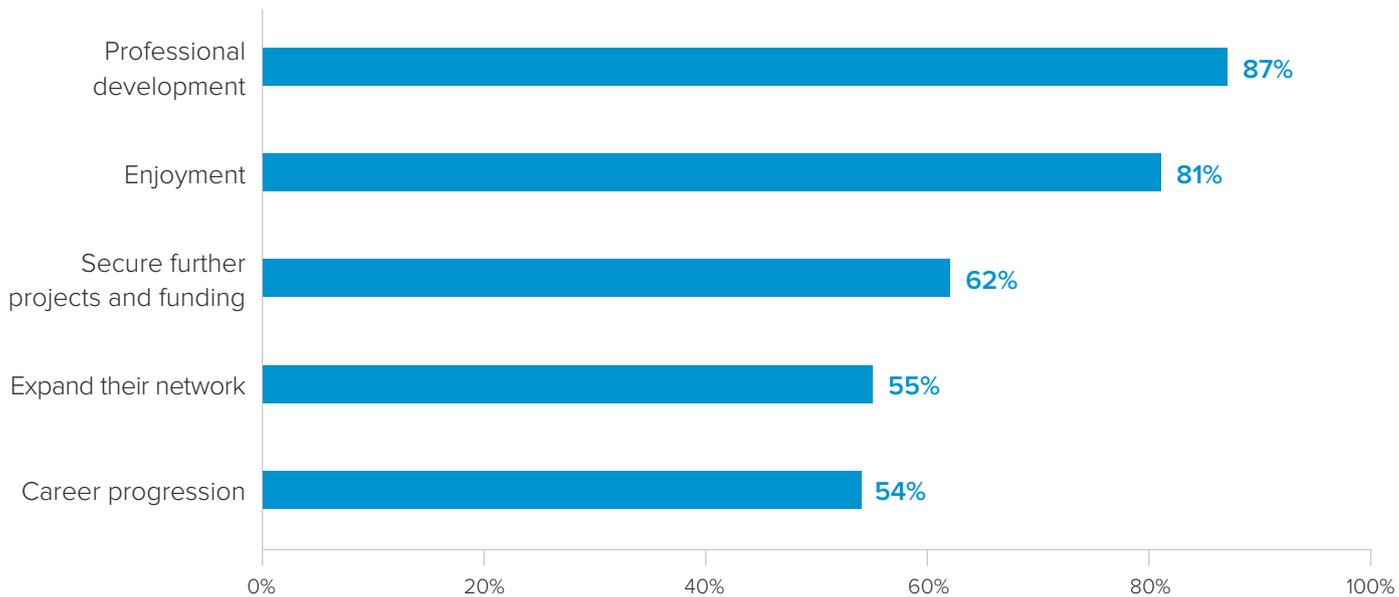
Which sectors do the Industry Fellows work in?



Since 2003, Industry Fellows have secured £161 million of further funding as a result of their Industry Fellowship.

Over 40 universities and 80 companies have been involved with the Industry Fellowship scheme since 2003.

How do Industry Fellows benefit from the scheme?



84% of Industry Fellows apply to the scheme to foster better ties between industry and academia.

61% highlighted career development as an important reason for applying.

Data from an independent review carried out by the Technopolis group, 2017.

Professor Maziar Nekovee

Fellowship 2006 – 2010

Employer BT

Host University College London

Maziar is Professor of Telecoms and Mobile Technologies at the University of Sussex. Previously, he had worked in the telecommunications industry, most recently as Chief Engineer and Head of 5G Research at Samsung UK, and prior to that as a senior scientist at BT.

His current research focusses on improving the connectivity and speed of mobile wireless communication, in particular the next generation known as 5G, which is close to commercialisation. “5G relies on the more focused sending of radio signals in the millimetre wave frequency range of the electromagnetic spectrum, to support applications like virtual reality and self-driving cars. This means if you are supporting cars, mobile users and trains, very sophisticated beamforming and multi-antenna technologies are needed to track these signals.”

Maziar was awarded his Industry Fellowship whilst he was at BT and was hosted by Professor Peter Coveny’s Centre for Computational Science at University College London. “Back then, I was looking at networks of connected cars on the roads talking to each other or a base station. By using high-fidelity simulations running on some of the world’s most powerful supercomputers, we showed that we can greatly reduce the build-up of traffic congestion, by coordinating cars on the road.”

Maziar’s research benefited from this collaboration because at that time BT didn’t have the supercomputing facilities and the more specialist knowhow needed to carry out the computer intensive simulations required. “My head of lab was very supportive, and I had a good arrangement where I could work from our London office and come back to the BT labs in Martlesham one day a week. Being in London really helped my career to take off by putting me in the centre of everything and letting me collaborate with UCL and other universities. At the same time I stayed involved with frontline research at BT and other mobile industry players.”

Since his time at Samsung, Maziar has transitioned into academia becoming Head of Department at the University of Sussex. “I was attracted to my new role at the University of Sussex because I have always liked being at the interface between industry and academia. With 5G being standardised by industry the research is going back to universities, possibly moving to 6G next.”

“The Industry Fellowship helped me to create an ecosystem around myself containing collaborators from across industry and academia. This space between engineering and fundamental science is where lots of exciting things can happen.”



“Having developed my collaboration with Element Six for several years, the Industry Fellowship was a natural progression – it has allowed me to properly explore a space that I thought had significant potential.”



Professor Julie Macpherson

Fellowship 2014 – 2018

Employer University of Warwick

Host Element Six

Julie, a Professor of Electrochemistry at the University of Warwick, develops electrochemical sensors. “Boron doped diamond is an interesting material to work with as it has extreme properties – it can sense in environments for periods of time that other sensors wouldn’t last or work in.” Julie was awarded an Industry Fellowship in 2014, working with Element Six, the world leaders in synthetic diamond production. Through the Fellowship, she has been developing materials for state of the art sensors that have a variety of applications, such as more robust and universally accurate pH detectors.

“Together with Element Six we figure out how to grow designer diamond materials, and through my Industry Fellowship, I’ve had the time and freedom to go out and talk to end users of the different proposed sensor technologies.” For Julie, it’s the perfect partnership – one in which Element Six provide the infrastructure and resources and her team identify the applications.

Julie’s collaboration with Element Six goes back to 2006. “After a student research project that sparked Element Six’s interest, they took the decision to invest in us to develop electroanalysis grade diamond materials. Out of that partnership came my understanding of what this material could do for us in the sensing arena and that’s when I applied for the Industry Fellowship.”

Julie’s association with the Royal Society is long-standing. “I started my academic career back in 1999 with a Royal Society University Research Fellowship, working more on fundamental concepts. At the end of this eight year period I was promoted to Chair by my host department. After this, I started to focus on the more applied applications of my work and the Industry Fellowship, awarded in 2014, has been instrumental in giving me the time to exploit the wide range of possible opportunities.”

The scheme has exceeded Julie’s expectations of what she thought she’d achieve. She has secured further funding from the Royal Society, Innovate UK and associated end users, to progress her sensor technology, and has established contacts with new companies.

Ultimately, Julie appreciates the flexibility of her Industry Fellowship. “Everybody I know on the scheme has their own take on it and uses it in a slightly different way to achieve the maximum benefit – that’s one of the many appealing features of the scheme.”

Professor Stuart Reid

Fellowship 2013 – 2017

Employer University of the West of Scotland

Host Gas Sensing Solutions

Stuart is Professor of Biomedical Engineering at the University of Strathclyde and a member of the Laser Interferometer Gravitational-Wave Observatory (LIGO) scientific collaboration. His research falls into two main categories: the development of laser mirror coatings for gravitational wave detectors, and a process known as nanokicking, which is the use of nanoscale vibration to manipulate cell behaviour. “The two are linked because for gravitational wave detectors we use massive laser interferometers to measure tiny ripples in space and time, and for nanokicking we use very small lab based interferometers to measure nanoscale vibrations.”

Whilst working at the University of the West of Scotland in 2013, Stuart was awarded an Industry Fellowship to work with Gas Sensing Solutions, based in Cumbernauld and Glasgow. “One of the reasons I was interested in working with Gas Sensing Solutions was that they were growing perfect crystal systems that we wanted to exploit for high-performance mirror coatings.” This collaboration allowed Stuart to both help the company develop their gas sensor technology and, in the process, understand more about how to make the coatings he required.

“After the initial production process in the company, we brought the gas sensors back to the university for some additional processing. That felt like a really nice collaboration, because it was only possible by using technology that was in both places.”

As part of his Industry Fellowship, Stuart also mentored two Royal Society undergraduate summer students. “It can be difficult to give undergraduate students a proper flavour of what research is, but when they do they often enjoy it. The summer student scheme is a great half way house between industry and academia, providing them with the familiarity of a university but allowing them to engage with industry as well.”

Following his Industry Fellowship, Stuart was awarded funding from the Science and Technology Facilities Council and continues to collaborate with Gas Sensing Solutions. “The Fellowship has allowed me to leverage funding to expand our project work, accelerating the research activities that I was involved in and helping me progress within academia.”



“There is no doubt that my Industry Fellowship has played a massive role in my career progression. It really protected my time which allowed me to help make the project a success.”

“I do think the Royal Society fits a niche that other funders don’t really fill – a recognition that it’s the people that are important.”



Professor Alison McMillan

Fellowship 2007 – 2011

Employer Rolls-Royce

Host University of Bristol

Now a Professor of Aerospace Technology at Wrexham Glyndŵr University, Alison was working at Rolls-Royce during her Industry Fellowship in 2007, on secondment to their University Technology Centre for Composites at the University of Bristol.

“At that time I was interested in modelling interfaces in failing composite materials. This involves all sorts of mechanistic complications and it’s not just about predicting failure on-set – you need to be able to predict a material’s performance during its failure.”

It became clear to Alison that from her personal research point of view, there was a key problem. Internally, Rolls-Royce could only go as far as the testing and broad modelling of failing materials, but she had a much stronger academic interest to study failure further in a theoretical fashion. On the basis of her industrial insights, Alison concluded that there were important fundamental research questions that were not being tackled by the academic community.

As well as her work at Bristol, she also collaborated with a number of other British and European universities during this time. “When visiting universities, I wanted to make the distinction that I wasn’t visiting to support my day to day work at Rolls-Royce. Instead, my Industry Fellowship was for taking research directives further than my job would normally allow.”

The Industry Fellowship had a lasting impact on Alison’s career, most significantly leading to a transition into academia not long after its completion. “I’d had a career transition in mind before my Industry Fellowship, but there was the barrier of not having an academic track record. I needed a university that respected both academic credentials but also industrial experience.” The Industry Fellowship helped to bridge the gap between industry and academia, and in 2011 Alison was appointed as Professor of Aeronautical Engineering at the University of South Wales.

“Having moved back to academia, I’ve found other people that are like me with similar sorts of backgrounds. It’s empowering, because we can work together and understand academic issues from an industrial point of view. My students also value having someone who has been through the industrial route.”

Professor Cathie Rae

Fellowship 2009 – 2013

Employer University of Cambridge

Host Rolls-Royce

Cathie is a Professor in the Rolls-Royce University Technology Centre at the University of Cambridge and a specialist in high temperature nickel alloys used in aero engines. She develops new alloys and studies their microstructure and mechanical properties.

In 1982, Cathie was awarded a Rolls-Royce research fellowship at the University of Cambridge, full time for three years and two years part time after the birth of her son. “After an eight year gap in my career where I had two more children followed by a period of teaching foundation year physics, I came back to research in Cambridge in 1997 as a postdoctoral researcher.” Following this significant break, Cathie worked her way up the career ladder and achieved a lectureship position after 5 years. “I had quite a strange career, and it was very hard work.”

Cathie was awarded her Industry Fellowship in 2009, hosted at Rolls-Royce, with an eye to extending and deepening her already established relationship with the company. The Industry Fellowship gave her the chance to go and spend time in Rolls-Royce, sitting in committees and meetings she wouldn’t normally attend as an academic.

“Though I had a realisation about how complicated the production of an engine is, I began to understand the sort of constraints that would frustrate me as an academic, such as why research projects are sometimes terminated. You then appreciate things are on very tight timelines and have to plug into production schedules.”

The Industry Fellowship has given Cathie a deeper respect and more realistic view of what Rolls-Royce does, and has succeeded in strengthening her relationship with them. She now better understands the context of her research and what Rolls-Royce’s drivers were. “I was able to see how my research fitted into the most enormous flowchart of an engine, from designing it to taking off on the runway, and how production schedules are absolutely key to the company’s survival.”



“The biggest outcome from my Industry Fellowship, aside from the research itself, was that it improved my confidence and my view of myself as a scientist.”

A man with short, dark hair, wearing a light blue checkered shirt and a patterned tie, is smiling and looking slightly to his left. He is outdoors, with tall, dry grass in the foreground and a brick building with windows in the background.

“My Industry Fellowship has allowed me to do something quite unique at NNL – establish a brand new research area and a brand new collaboration with a university from scratch.”

Professor Nick Smith

Fellowship 2013 – 2017

Employer National Nuclear Laboratory

Host University of Manchester

Nick is a Technology Manager in geology and NNL Laboratory Fellow in geocharacterisation and remote laser characterisation at the National Nuclear Laboratory (NNL). In 2013, he was awarded an Industry Fellowship, hosted by the University of Manchester, to look at remote sensing of materials in potentially extreme, nuclear industry environments, using techniques such as stand-off laser-induced breakdown spectroscopy (LIBS) and stand-off Raman spectroscopy. “At the time, we proposed technology similar to NASA’s Curiosity Rover, a concept that became the foundation for my project proposal.”

Nick’s collaboration with the University of Manchester was born out of a desire to be directly involved with research himself and to encourage NNL to collaborate more with academia.

“I spent the first year of my Industry Fellowship engaging with university colleagues to establish the proposed lines of research. Towards the end of that year, NNL launched its Internal Research and Development programme, which provided some funding to set up part-time PhD projects at the university for two NNL colleagues in photonics characterisation. By pooling resources with an existing research team with complementary interests, we were able to launch the PHLAME (Photonics and Laser Analysis of Materials and Environments) Research Group at the University of Manchester in 2015.”

The commencement of an EPSRC-funded project in 2017, of which Nick is a co-investigator, provided three new post-doctoral researchers and established a new collaboration with Lancaster University. It also created new links to national and international nuclear industry organisations and companies.

“The Industry Fellowship was invaluable. The amount of paperwork and talking to people needed to set up a research group meant that it really wouldn’t have been possible without it.” Nick was successful in his planned goals, with a number of papers in the process of being published and prototypes developed that NNL are set to commercialise. Ultimately, Nick has succeeded in establishing a sustainable research programme that will exist beyond his Industry Fellowship.

Professor Ursula Gompels

Fellowship 1999 – 2003

Employer London School of Hygiene and Tropical Medicine

Host GlaxoSmithKline

Ursula is Professor of Molecular Virology at the London School of Hygiene and Tropical Medicine, where she studies immune mediation of infections, virus genomics and adaptation to gene therapeutic systems. She was awarded her Industrial Fellowship in 1999, hosted by GlaxoSmithKline (GSK) at their research and development site in Stevenage, Hertfordshire.

“During my Industry Fellowship, I was investigating both the fundamentals and applications of immune mediation molecules for vaccines. GSK were doing applied work in related areas at the time, so I decided it would be useful to work with them.”

To support her collaborative project at GSK, Ursula applied for a PhD studentship, which was awarded by the BBSRC. “A paired studentship led to greater outcomes on my project, and provided the student with further training and research opportunities. Ultimately, their project had a more translational goal.”

Ursula was attracted to the Royal Society Industry Fellowship because she wanted to explore the opportunities that industry offered without leaving academia. “I saw both fundamental and application based research as being equally important, and the Royal Society has always been bridging the two worlds.”

Ursula’s Industry Fellowship allowed her to leverage funding to continue with her research after its completion, feeding into a body of work that culminated in patents granted in 2015 and 2017. This allowed her to establish the spin-out company Virokine Therapeutics with a former colleague from her time at GSK.

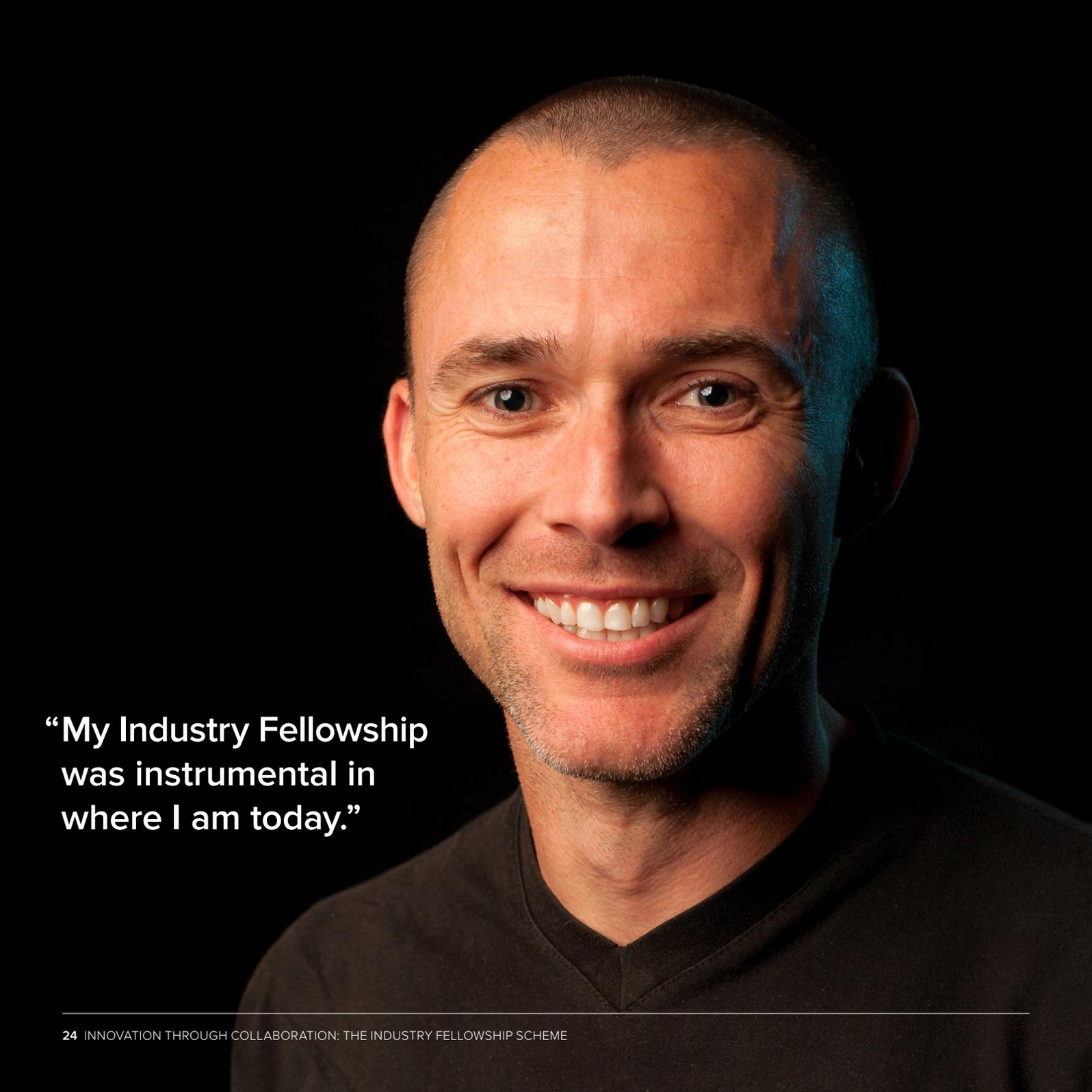
“The spin-out company was the culmination of a 20 year research programme. I saw the opportunity to take my research to commercialisation before my Industry Fellowship and pursued this, and over the past 5 years the company has evolved.”

The company uses ‘virokines’, signalling proteins from viruses that can attract unique combinations of immune cells to an inoculation site to make vaccines work. They are applying this to nucleic acid vaccines to produce brand new immunotherapeutic treatments.

“My Industry Fellowship was an invaluable opportunity to see how the patent process worked and how scientific research could be translated into application, something that wasn’t so easy for me to develop in academia.”

“When you spend time in industry you realise just how collaborative it is, and how important your networks are in business.”

Credit: A Koerber, LSH™.



**“My Industry Fellowship
was instrumental in
where I am today.”**

Dr Dale Elgar

Fellowship 2009 – 2012

Employer Scientifica

Host University College London

Dale is an electrophysiologist who started working at the laboratory manufacturing company Scientifica in 2007. A desire to be directly involved in scientific research encouraged Dale to apply for an Industry Fellowship to work with Dr Jesper Sjöström, a Scientifica customer and researcher at University College London.

By building a work station that allowed for multiple patching of cells and two-photon microscopy, they set out to study how the brain works and to observe signal transmission between cells. Dale was able to test a number of pieces of hardware that Scientifica was refining at the time and use them in the lab. “The amount of insight I gained in that time brought about a huge amount of benefit to the company after the fellowship.”

After his Industry Fellowship, Dale moved into a more engineering based role. “My new role taught me many new aspects of business but I felt myself becoming distant from the researchers and their needs. I felt that I could help neuroscientists more by doing things a little differently and decided to pursue this further.”

Using the insight he’d gained from his Industry Fellowship, Dale left Scientifica in April 2017 and together with his former colleague Dr Bruno Pichler, established Independent NeuroScience Services (INSS), based in East Sussex. Their company is building bespoke and customisable multi-photon systems for neuroscientists.

Dale is eager to encourage companies to think about the Industry Fellowship. “Though the short-term gain of an Industry Fellowship may not be obvious, the long-term gain for companies and individuals can be life changing – it has been for me.”

Professor Karen Wilson

Fellowship 2011 – 2015

Employer Cardiff University

Host Johnson Matthey

Karen is Professor of Catalysis at the Royal Melbourne Institute of Technology (RMIT), having recently left her role as Research Director and Professor of Catalysis at the European Bioenergy Research Institute (EBRI) at Aston University. In her previous position at Cardiff University in 2011, she was awarded an Industry Fellowship to work with Johnson Matthey on the development of catalysts for biofuel synthesis. “At the time, biodiesel was something of increasing interest to Johnson Matthey. They wanted to understand more about the fundamentals of how catalysis worked in biofuel processes and I needed to see the bigger picture of what industry in my area needed from me.”

Through this collaboration, Karen and Johnson Matthey were able to study catalysts under realistic working conditions and design some new catalysts for industrial applications. “My Industry Fellowship allowed me to get to know the company better, to develop working relationships and build a closer partnership.”

Karen was drawn to the scheme due to its part time flexibility and industrial focus. “At the time I had a permanent academic position, and the Industry Fellowship was rare in that it enabled permanent staff members to complete a part time fellowship with industry.”

Working with Johnson Matthey on this project inspired Karen to refocus her research on the refining of biomass into fuels and speciality chemicals, and subsequently encouraged her move to Aston University.

“My Industry Fellowship allowed me to establish important links and understand the real world challenges of my research. In catalysis particularly, you need to work closely with companies and adapt your research to meet their needs.”

“Being associated with the Royal Society gave other people confidence in my abilities and showed them that I had a track record. It ultimately gave me the credibility of a prestigious fellowship.”



“The title ‘Industry Fellow’ is very helpful for me, as it shows the people I work with and the companies I serve that although I am associated with the Royal Society, I also care about industry, not just academia.”



Professor Xiang Zhang

Fellowship 2012 – 2016

Employer Lucideon

Host University of Cambridge

Xiang is Head of Medical Materials and Devices and Principal Consultant at Lucideon, a materials consultancy company based in Stoke on Trent. “My role is to set the business and scientific direction for a company. Just as humans need doctors when they are suffering from health problems, so do companies when they have problems with their materials.”

Before joining the company in 2010, Xiang had been a director at Cambridge NanoTech, a principal scientist at Abbott Laboratories and had held a fellowship at the University of Cambridge.

Xiang develops new biomaterials, such as bone-mimics for transplants, by studying their structure-property relationships down to the nanometre scale. “Scientific challenges often come from industry, not from me, and we provide solutions to them. The potential for our work is dictated by the market, so it is important that I set the right direction and establish the market lead.”

Xiang’s motivation for doing an Industry Fellowship, awarded in 2012 and hosted by the University of Cambridge, was to see if research and development could be joined more effectively from an industry perspective. “How can we make science for industry work in the shortest time with the least cost, and why do we always do research first then development later? I wanted to try combining the two together myself, which has worked well in major EU projects with ReBioStent and HyMedPoly.”

With funding from Lucideon and the EU, Xiang has set up an industrial PhD project that has continued beyond his Industry Fellowship. “If a high-tech company like Lucideon doesn’t engage with the most advanced research then it loses its market position in light of science and technology development. If I am not at the forefront of my field, how can I serve companies to the highest standard?”

Xiang’s proudest achievement from the Industry Fellowship was that he was able to realise his vision of combining research and development more efficiently. He wrote three books during his time, alongside the completion of several projects with research funding of over £15 million.



Image

A boron-doped diamond device
used in electrochemical sensors.

© Professor Julie Macpherson,
University of Warwick.



The Royal Society is a self-governing Fellowship of many of the world's most distinguished scientists drawn from all areas of science, engineering, and medicine. The Society's fundamental purpose, as it has been since its foundation in 1660, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity.

The Society's strategic priorities emphasise its commitment to the highest quality science, to curiosity-driven research, and to the development and use of science for the benefit of society.

These priorities are:

- Promoting excellence in science
- Supporting international collaboration
- Demonstrating the importance of science to everyone

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