Labs to riches

Celebrating UK innovation, translation and commercialisation

THE ROYAL SOCIETY

Labs to riches brings together leaders in academia, industry and government to promote the importance of research and development to the UK economy and to celebrate the achievements of some of our leading innovative thinkers and entrepreneurs.

Supporting industry and innovation

The increasing importance of the knowledge-driven economy means that translating ideas and skills from the research base to industry, business and the wider community is crucial to future prosperity.

To support this process of translation, world-class research and development in UK industry it is essential to transform innovative ideas into commercially successful products.

The Royal Society is committed to innovative science wherever it is found. We are proud of the outstanding track record of industry innovation in the UK and this is reflected across our Fellowship.

Building on the Royal Society's commitment to supporting innovative scientific research, we are launching a five-year strategy to promote industrial science and translation. The strategy will reintegrate science and industry across the Society's work and promote the value and importance of science by connecting academia, industry and government.

This initiative is led by the Royal Society's Science, Industry and Translation Committee, which is chaired by Sir Simon Campbell CBE FMedSci FRS and Dr Hermann Hauser CBE FREng FRS, and whose membership includes leading scientists and entrepreneurs.

We will bring scientists and industrialists together to build relationships, facilitate translation, and engage fully in the life of the Society. Industrial science will be highlighted across our programme of scientific events and excellent industrial scientists will continue to be recognised through our industry schemes, medals, awards and prize lectures. The Society will also continue to advise Government on how best to support the science and innovation system, and make clear the importance of academic and industrial science to the future of the UK.

Dr Mercer was an enthusiastic inventor and entrepreneur and the Brian Mercer Awards aim to encourage these qualities in the next generation of scientists.

The Brian Mercer Awards

The Royal Society is committed to stimulating innovative and creative science and encouraging knowledge exchange between the UK's science, engineering and industrial bases.

Labs to riches celebrates this support for innovation in science and technology. A highlight of the event is the formal presentation of the Brian Mercer Awards.

The Brian Mercer Awards were established in 2001 by a generous bequest from the late Dr Brian Mercer OBE FRS, marking a significant step for the Royal Society in its work towards supporting and encouraging innovation in science and technology.

The Awards are presented in the areas of the built environment, clean technology and energy, electrotechnology and nanoscience.

Image (taken c. 1980) © Wally Talbot

Winners

Brian Mercer Award for Innovation 2014

The Brian Mercer Award for Innovation provides funding of up to £250,000 for researchers to develop an already proven concept or prototype into a near-market product that can be commercially exploited.

Dr Jade Alglave
University College London

Her near-market tool is timely, has wide applicability and is already being integrated by major multiprocessor developers.

.cat: a standard verification format for hardware chips

We can no longer ignore the flavour of concurrency that dominates the hardware produced every day: multiprocessors by ARM, AMD, IBM, Intel, or NVidia are found in devices ranging from smartphones to supercomputers, cars to airplanes. Programming software to run on multiprocessors is a form of concurrent programming, where multiple computations are executed during overlapping time periods. Sadly, due to the great number of possible outcomes of a given program, concurrent programming is error-prone and “buggy”, and difficult to test.

Formal memory models (i.e. precise mathematical descriptions) of hardware and software are needed to help programmers, compiler writers and hardware designers. Although the multiprocessor industry is shadowed in secrecy, Dr Alglave has developed a tool to test and model proprietary hardware. Her near-market tool is timely, has wide applicability and is already being integrated by major multiprocessor developers into their testing suites.

Professor Michael Kelly
University of Cambridge

This new method can make 70,000 devices at a time, all with electrical results within 1% of each other.

Manufacture, Sale and Evaluation of Tunnel Detector Diodes

Originally, electronic devices were made in one material, silicon for transistors and gallium arsenide for lasers and other optical devices. The discovery in the 1970s of how to grow single crystals of more than one material separated by sharp interfaces led to superior performances of devices used in computation and optical communications. But for devices which exploit the phenomenon of quantum tunnelling, the layers were not uniform or reproducible enough to achieve sufficient performance.

Professor Kelly and his collaborators have devised a way to manufacture layers of crystals with improved quantum tunnelling properties. This new method can make 70,000 devices at a time, all with electrical results within 1% of each other; a precondition for the low-cost, commercially viable manufacture of electronic devices such as tunnel diodes. The next step is to work with customers to scale-up manufacture and demonstrate the performance of these new devices in commercial applications.

The Royal Society industry and innovation schemes provide funding to promote links between academic and industrial scientific research.

Winners

Brian Mercer Feasibility Award 2014

The Brian Mercer Feasibility Awards allow researchers to investigate the technical and economic feasibility of commercialising an aspect of their scientific research.

The Royal Society is grateful to the Engineering and Physical Sciences Research Council (EPSRC), The Lord Leonard and Lady Estelle Wolfson Foundation and The ERA Foundation for supporting these awards.

Professor Crispin Barnes
University of Cambridge

Professor Barnes' magnetic lab-on-a-chip systems enable the simultaneous identification and continuous monitoring of chemicals.

Magnetic nanotagging technology for oil field reservoir mapping and fluid flow tracing

Companies in the oil and gas industry desire continuous, "cradle to grave" tracking of all fluids going into a well. However, current static sensor technology usually does not measure what is happening within reservoirs and the use of radioactive tracers raise health and safety concerns and do not always work.

Professor Barnes has developed a technology for tagging, tracing and screening large numbers of chemical and biological compounds. By merging state-of-the-art Digital Magnetic Tagging techniques with microelectronics and microfluidics, Professor Barnes' magnetic lab-on-a-chip systems enable the simultaneous identification and continuous monitoring of chemicals, especially for applications on site.

This platform technology based on customisable magnetic microchips offers low-cost, miniature analysis systems for the recognition of chemicals. Potentially, these systems will revolutionise a plethora of applications, including the tracing and tagging of oil in pipelines and the mapping of the fluid flow in oil fields.

Dr Gareth Conduit
University of Cambridge

Dr Conduit's computational tool can design new materials in seconds, allowing their optimisation to be brought into design processes for the first time.

Concurrent materials design

Through the Stone Age to the present day, the discovery of new materials has been at the heart of human history. Yet despite their central importance in enabling new technologies, new materials are still developed using the same experiment driven trial and error approach of our ancestors.

Dr Conduit has developed the first tool that can automatically computationally design a material with specified physical properties. At present, engineers and materials scientists must design new objects and products around the shortcomings of pre-existing but non-ideal materials. Dr Conduit's computational tool can design new materials in seconds, allowing their optimisation to be brought into design processes for the first time. The next step is to broaden the scope of the tool across the entire realm of materials. This will drive the development of new high specification products that serve their function better, are cheaper, and have less impact on the environment representing a substantial benefit to society.

Professor Dmitry Shchukin
University of Liverpool

The application of organic coatings is the most common and cost effective method of improving protection and durability.

Smart Nanoadditives for Eco-Friendly Self-Healing Coatings

The destructive effects of the environment and corrosion induced degradation of metals are important problems which not only determine service life of stationary and mobile structures but also increase environmental pollution and decrease safety.

The application of organic coatings is the most common and cost effective method of improving protection and durability. An active protection against coating defects is also necessary to provide a long-term solution and new environmental regulations are driving the search for new types of autonomous protective coatings.

A strategy, based on the incorporation of nanocapsules into current commercial paints, has the potential to avoid environmental damage while providing levels of protection that will reduce material waste losses and increase service lifetime.

The main objective of Professor Shchukin's project is to study the up-scaling and commercial feasibility of new active anticorrosion coatings based on nanocapsules that have already been developed at the laboratory scale.

Dr Stephen Gruppetta
City University London

The potential benefit to society is high in developed countries and even higher in developing countries.

Assessing the clinical potential of Structured Illumination Ophthalmoscopy – a low-cost retinal disease diagnostic tool

Sight loss is often preventable if the eye disease responsible is detected at an early stage. However, during these early stages diseases have little or no noticeable effect on vision and patients only report symptoms when the disease has advanced to the stage that irreversible sight loss has already started to occur. Therefore, images obtained of the retina must be of sufficiently high quality to enable abnormal changes to be identified.

The technology Dr Gruppetta has developed enables high quality 3D imaging of the living retina using a potentially inexpensive device. The technique uses standard and widely available light sources and detectors and has no lateral scanning mechanisms such as those that make other technologies complex. The motivation behind this project is to fill the technology gap in retina imaging that exists between inexpensive basic ophthalmoscopes and high-end expensive devices. The potential benefit to society is high in developed countries and even higher in developing countries.

The Royal Society

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, reflected in its founding Charters of the 1660s, 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 are:

- Promoting science and its benefits
- Recognising excellence in science
- Supporting outstanding science
- Providing scientific advice for policy
- Fostering international and global cooperation
- Education and public engagement

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