

QUEEN ELIZABETH PRIZE FOR ENGINEERING

Presented to Dr Robert Langer

On 26 October 2015 Her Majesty The Queen presented the Queen Elizabeth Prize for Engineering (QEPrize) to a chemical engineer who has made revolutionary advances and leadership in engineering at the interface with chemistry and medicine, Dr Robert Langer.

Dr Langer received the QEPrize trophy in a ceremony at Buckingham Palace. Influential international engineering economies were represented, with Ambassadors and High Commissioners from countries including the United States, China, Japan, Germany, South Korea, South Africa, Singapore and India in attendance. They were joined by senior business leaders from the QEPrize donor companies and young engineers from the QEPrize Engineering Ambassadors Network.

The day also marked the release of the first QEPrize Create the Future Report. The Report revealed the changing nature of engineering perceptions across 10 key markets and provided a fascinating insight with country comparisons alongside expert commentary from the fields of commerce, science, academia and the full breadth of engineering disciplines.

DR ROBERT LANGER

Robert Langer is one of 11 Institute Professors at the Massachusetts Institute of Technology (MIT) in Cambridge, USA. This is MIT's highest honour. His laboratory at MIT – with over 100 students, postdoctoral students, and visiting scientists at any one time



Photo by David Parry

– is the world's largest academic biomedical engineering laboratory. He has over 1000 issued and pending patents, over 200 major prizes to his name, and is the most cited engineer in history (Science, 2014). His work has helped lay the foundation for long-lasting treatments for brain and prostate cancers, endometriosis, schizophrenia, diabetes and the drug-coated cardiovascular stents that alone have benefited 10 million heart patients.

A chemical engineer by training, Dr Langer was the first person to engineer polymers to control the delivery of large molecular weight drugs for the treatment of diseases such as cancer and mental illness. His unconventional thinking toppled the established view that

controlled-release drug delivery would not work for large molecules like proteins, which are very sensitive to their surroundings.

From the start, Dr Langer's work has been characterised by a truly interdisciplinary approach. He developed his first drug delivery system during the 1970s while working with Dr Judah Folkman, a Harvard

inhibit it. Once he had discovered how to create polymer micro- and nano-particles that could support and release sensitive protein-based drugs in the body, he used this technique to test possible drugs to control angiogenesis. He and Dr Folkman isolated the first substances that blocked angiogenesis; such substances have been used to treat over 20 million patients.

... fascinating insight with country comparisons ...

professor and surgeon at Boston Children's Hospital. Folkman hypothesized that the growth of cancerous tumours could be restricted by stopping angiogenesis, the formation of new blood vessels, and he asked Langer to find a way to

Together with another Harvard surgeon, Dr Joseph Vacanti at Massachusetts General Hospital, Dr Langer helped to pave the way for major innovations in tissue engineering, pioneering synthetic polymers that could deliver cells to form specific

tissue structures. This concept led to the development of a new kind of artificial skin, now approved by the FDA for use on burn victims and patients with diabetic skin ulcers. Many other such systems, including ones for new cartilage formation and spinal cord repair, are now in clinical trials.

Professor Lord Broers FREng FRS HonFMedSci, Chair of Judges for the QEPrize, said: "Robert Langer has made an immense contribution to healthcare and to numerous other fields by applying engineering systems to biochemical problems. Not only has he revolutionised drug delivery, but his open-minded approach to innovation and his ability to think 'outside the box' have led to great advances in the field of tissue engineering. He is a truly inspiring leader who has attracted brilliant people to these relatively new and exciting areas of research and is extremely involved in the commercial development of his group's research."

One of Dr Langer's most recent projects is a microchip-based implant capable of storing and releasing precise doses of a

Foundation, as are new ways of providing single-step immunizations for polio and other vaccines, providing long-acting malaria drugs, and providing essential minerals. All of these new techniques are currently being pursued in Dr Langer's lab.

... most cited engineer in history ...

THE CREATE THE FUTURE REPORT

The inaugural Create the Future Report is an international survey of attitudes towards engineering surveying respondents in global centres for engineering including the US, Germany, Japan, Turkey, India and Brazil.

The report reveals that:

- * Engineering tops the list of professions seen as most vital for economic growth. Other professions include business leader, lawyer, doctor and teacher.

- * 57% believe engineering is critical in solving the world's problems, particularly in the US, UK and Germany

- * In Japan engineering is seen as a driver of innovation

... new and exciting areas of research ...

drug on-demand or at scheduled intervals for up to 16 years. Microchips, the company he co-founded to commercialise the development, announced in December 2014 that it has completed clinical demonstration. Unlike traditional drug delivery platforms, Microchips Biotech's implant can respond to wireless signals, which can activate, deactivate, or modify the frequency or dose of the drug, without being removed from the patient. The company is looking initially at three areas for such an implant: diabetes, female contraception, and osteoporosis, which all require regular, long-term dosage. The contraceptive approach is funded by the Gates

- * Interest in engineering remains higher amongst men (66% vs. 43%) but the gap is closing fast in emerging economies such as India and Brazil

- * People in the US, Germany and India show the highest numbers rating engineering as a top career opportunity

- * Interest in engineering still lags behind wider STEM subjects (Science, Technology, Engineering, Mathematics), 55% vs 91%

- * 71% of people think engineers' contribution to society is undervalued, they deserve much more recognition

The Create the Future Report is supported by insights and opinion from leaders of some of the world's leading companies as well as eminent engineers from medicine, energy, IT and infrastructure.

Lord Browne of Madingley FREng FRS, Chairman of the

Queen Elizabeth Prize for Engineering Foundation, said of the QEPrize Create the Future Report:

"The QEPrize Create the Future report shines a light on a great many positive changes in our industry. As an engineer, I am enormously encouraged to see that the public thinks engineers are capable of solving the world's greatest problems. It is also encouraging to see that people think the priority for engineers should be improving renewable energy and healthcare, not just traditional engineering infrastructure such as bridges and buildings.



Dr Langer at work in his laboratory

"There is a responsibility on governments, industry, academics, teachers, parents and grandparents to encourage young people to share in the excitement of engineering innovations and the endless possibilities of a career in this vital sector."

THE QUEEN ELIZABETH PRIZE FOR ENGINEERING

Launched in 2011, the Queen Elizabeth Prize for Engineering is a global £1 million prize that celebrates ground-breaking innovations in engineering. The prize rewards an individual or team of engineers whose work has had a major impact on humanity.

The winners of the first QEPrize in 2013 were the five

pioneers of the internet and the World Wide Web. Robert Kahn, Vinton Cerf and Louis Pouzin made seminal contributions to the protocols that together make up the fundamental architecture of the internet. Sir Tim Berners-Lee created the World Wide Web and vastly extended the use of the internet beyond email and file transfer. Marc Andreessen, while a student and working with colleagues, wrote the Mosaic browser which made the internet available to everyone.

Alongside highlighting such ground-breaking achievements, the QEPrize celebrates engineering as a discipline and career choice, shining light on the excitement and importance of engineering and encouraging young people to get involved in the area.

One avenue open to young engineers is to become a QEPrize Engineering Ambassador. This growing international network brings together practicing early-career engineers who act as evangelists for their profession, speaking to teachers, parents, schoolchildren, politicians and journalists about their jobs.

It is just one of the many ways that the QEPrize celebrates and shares stories of engineering success, raising the international public profile of engineering and inspiring new generations of engineers to take up the challenges of the future.

For further details, please visit www.qeprize.org