

# A nurturing of young talent

The Royal Academy of Engineering is set to bring the discipline into sharp focus, discovers **Thea Jourdan**

## INTERVIEW

Philip Greenish (right) is the chief executive of the Royal Academy of Engineering, which recently launched its "Making Things Better" campaign. Here, he answers some questions about the campaign, which aims to raise £16.5 million for the Academy's education and engagement work and to create a national Forum for Engineering.



The second part of the campaign is to create a forum for engineering at the Academy's building on Carlton House Terrace, also home to other national academies, including the Royal Society and British Academy. This will transform the building to provide a world-class venue for engineers and all those who are interested in engineering to meet, collaborate and share their knowledge. It will become a focal point for independent, expert advice and practical action, and will be used to influence policy makers and for public debate.

### Q: WHAT ARE THE MAIN AIMS OF THE CAMPAIGN?

We want to bring engineering to the centre of society. The sector is crucial to society in so many respects – from dealing with the consequences of climate change to improvements in healthcare and the renewal of our ageing infrastructure.

It's also central to much of the country's industry and to the success of the economy. Manufacturing accounts for around half of the country's exports. The campaign will bring this forcefully to the attention of those who inform and who make national policy. More specifically, it will help young people and those who influence them to recognise the great careers available to them.

### Q: WHAT WILL IT INVOLVE?

The first part of the campaign will fund existing and new programmes that will attract more young people from a range of backgrounds into all levels of engineering. We want them to understand the huge variety of careers that their science and maths courses, as well as engineering via the new engineering diploma, can lead to.

It's vital to keep young people interested and engaged throughout their time at secondary school. We do this in a number of ways, from engineering clubs for young people through to professional development for teachers, so they can guide students.

We've tested the principles in the last four years via the highly successful London Engineering Project, which connected schools with local industry and universities through a range of school-based programmes. We deliberately chose some of the most challenging areas of London. We've shown how, with the right support, girls, young people from minority ethnic communities and those from families with no history of higher education can achieve their potential. We now need to do more.

### Q: WHAT ABOUT ENGINEERING AT UNIVERSITY LEVEL?

UK universities are excellent, but many courses need to change to meet employers' needs and students' expectations. At degree level, engineering is both a practical and an academic subject. There is a strong case for increasing links with industry to bring more relevance into the students' work and we will do this by introducing more visiting professors and teaching fellows with industry experience. We will also be helping to spread best practice to university departments and to make the case for a greater share of resources.

### Q: HOW HAS INDUSTRY RESPONDED TO THE CAMPAIGN?

We've had a huge amount of support, not least because industry realises it needs to have a skilled workforce, and it wants a choice. Many major trusts, foundations and leading global engineering companies have pledged support for the campaign – including significant contributions from BAE Systems, BP, National Grid, Shell International, Rolls-Royce and Petrofac.

BAE Systems, for example, is funding the Engineering Engagement Project, which aims to widen participation in science, technology, engineering and mathematics by supporting teaching and learning in these areas at Key Stage 3. The project will provide training for Engineering Diploma teachers, funding for school science clubs, and training for science and engineering ambassadors.

There is a serious shortage of people with the non-graduate, technician skills critically important for many industries. The situation will only get worse as people retire – unless we do something about it.

# Natural selection

Studying wonders in nature and reflecting their intricate systems in modern technology is helping engineers to create some revolutionary innovations, finds **Gabrielle Collett-White**

Nature has been perfecting the design of living organisms for millions of years. Little wonder, then, that revolutionary technologies from helicopters to Velcro have emerged because engineers have copied ideas existing in the natural world – a process called biomimetics.

"Perhaps the father of biomimetics was Leonardo da Vinci, who was inspired by the study of birds to design his flying machines," says Paul Jackson, chief executive of EngineeringUK. Da Vinci's attempts may not have got off the ground 500 years ago, but eventually the Wright brothers put their creative minds to the problem – and undertook their first successful flight in 1903.

Some of today's most exciting nature-inspired technologies are found in robotic engineering. The latest developments include miniature dragonfly robots for use in combat, and cockroach-inspired machines that can run over rugged terrain.

Elsewhere, the shell of a deep-sea snail is providing inspiration to develop toughened armour for use in aircrafts and sports equipment. And photosynthesis, the natural process whereby plants draw energy from sunlight, is being studied to find



Flight of fancy: the Blue Morpho butterfly has inspired a radio-frequency tagging device; top, the "bug eye" camera

a way to produce renewable energy. This year, BAE Systems, the British defence and aerospace company, has used

biomimetics as the theme for its annual Schools Roadshow. The show will be seen by around 40,000 young people and focuses on how engineers and scientists have used animals and plants to inspire the design of some of the world's most iconic inventions – from helicopters to submarines. BAE Systems' chairman, Dick Olver, says: "This is a fantastic opportunity for us to show young people the practical applications of science and engineering in the real world, as well as outlining the rewarding careers available."

## AN EYE FOR DETAIL

Structural engineer Pete Winslow, from engineering firm Expedition, has spent the last year working on the roof of the new Velodrome in the 2012 Olympic Park. Inspired by the dynamism of racing, the double curved roof has no internal support structure and is held up by a complex web of steel cable. While the architects did not necessarily draw direct inspiration from nature, the engineers saw clear parallels.

"When you take a look at a spider's web, you'll notice that the fine strands are able to withstand an enormous amount of external pressure. Even when a fly lands, there is very little movement," says Winslow. "We want to replicate that."

"Engineers are naturally inquisitive," he adds. "We study structures in nature – sea arches, for example – to see how they withstand substantial forces, such as sea and wind. We can then apply this knowledge to the construction of buildings and bridges."

Similarly, when the Ministry of Defence asked for a tiny, lightweight camera with an exceptionally wide field of view, BAE Systems scientist Leslie Laycock and his team used the eye of a little-known wasp parasite for inspiration.

"There are a great many different animal eye forms in nature, but we discovered that the xenos peckii – a parasitic fly that lives on a wasp – provided the answer to our problem," says Laycock, who has worked at BAE Systems for more than 30 years.

The eye of this particular parasite comprises 50 lenses, each focused in a different direction. By replicating this design in nature, the "bug eye" camera is able to produce a high-resolution image that has a 120-degree field of view. The camera's applications

include use on unmanned aircraft and night-vision equipment, and it took a year from conception to production of the finished article. "By stealing from nature, we can speed up the process, because we already have a blueprint that we're able to work from," says Laycock.

## OUT OF THE BLUE

There may seem little to link a butterfly with radio-frequency identification (RFID) tags, but one such insect has revolutionised the technology. RFID tags are often used on valuable assets, such as laptops or tools, so that they can be tracked.

The problem with traditional RFID tags is that they work less well when used around liquids and to mark metal. So, when challenged by a client to devise tags for metal surgical tools, the team at QinetiQ, the defence technology and security company, turned to biomimetics in order to find a solution.

James Brown was on the team and is now the technical manager of Omni-ID, the company spun out of QinetiQ to market the tags. "The Blue Morpho butterfly wing is made up of tiny scales, and each scale is marked by a pattern of grooves," says Brown. These grooves reflect light in a special way, creating a vivid metallic blue colour, which has nothing to do with pigment.

The team then looked at how they could mimic the butterfly scales to develop an RFID tag, which affects radio waves in the same way that a butterfly's wings affect light. The result was a tag made up of a complex structure of metal layers. These layers reflect a strengthened radio wave signal, even if the tag is placed in an environment that is wet, such as a crate of cut flowers. A traditional RFID tag placed in liquid would not be able to send a reliable signal.

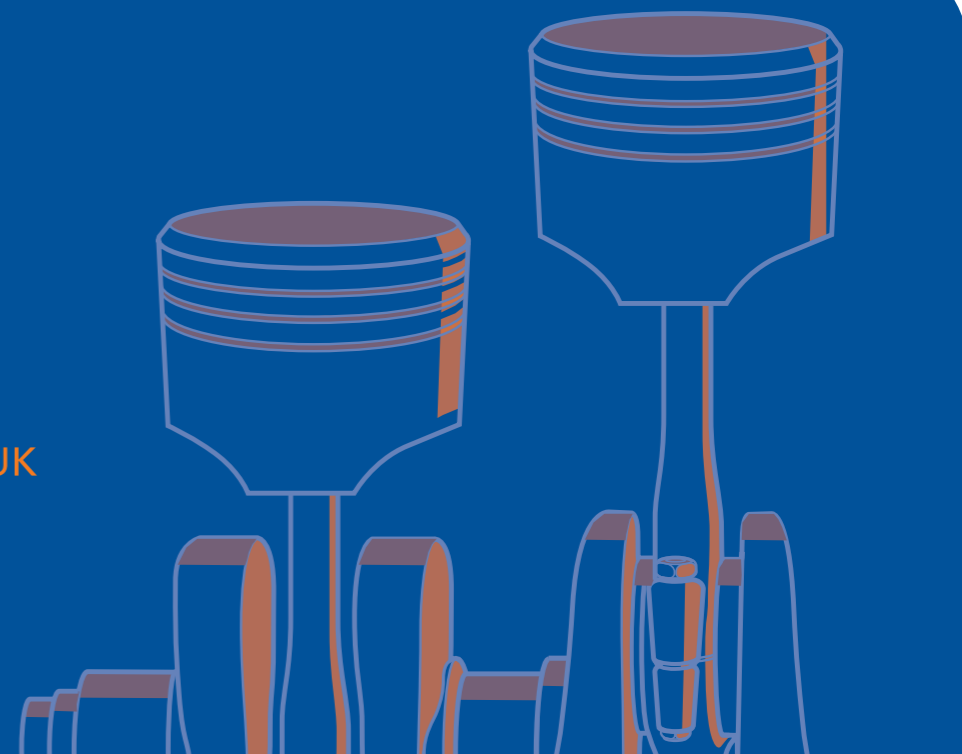
The technology also allowed the team to produce lightweight tags, which are smaller in size than a postage stamp. "The tags are even being used for health and safety," says Brown. "In one mining company, they are placed on the tools and hard hats of engineers to ensure that they are using the correct tools for specific jobs."

Engineers.

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