



# Technologies for the future

**Technology is at the heart of human progress.** Advances in the development of human society were made by learning to shape materials into tools, accessing new resources, cultivating plants and improving their yields, creating new methods for communication and, most importantly, transforming medicine and healthcare. While the face of technology has changed dramatically, these principles remain, and York researchers are at the forefront of shaping the future in many of these areas.

The search for novel materials continues and we are now able to simulate, manipulate and study materials at the atomic level. Creation of sufficient energy to meet growing demand is a major driver, and we are exploring both small-scale renewables and large-scale nuclear fusion.

Our industrial biotechnology research improves crop yields and produces high-value chemicals from biomatter. In communications, we lead a major initiative in quantum technology that aims to make communications absolutely secure. Our healthcare technology research ranges from studying fundamental processes at the sub-cellular level to driving the development of advanced diagnostic and therapeutic tools. York researchers are pioneering key technological innovations for the benefit of the next generation and beyond.

## Our research excellence

- The Departments of Biology, Chemistry, Maths and Physics are home to nine Fellows of the prestigious Royal Society, the highest recognition for research excellence in the UK.
- The Department of Physics ranks third in the UK for research grant awards from the Engineering and Physical Sciences Research Council (EPSRC), the main funding body for technology research in the UK.
- In the most recent research excellence assessment (REF 2014), Biology at York was placed in the top ten in the UK and first for its impact outside academia, demonstrating that York's Biology research has had major influence on environmental policy, industry and health.



## Case study

### A new approach to personalised medicine

Silicon photonic biosensors are highly sensitive and can be manufactured on a large scale using the tools of the silicon microelectronics industry. These sensors tend to measure a single biomarker, similar to a pregnancy test. Modern, personalised medicine requires clinicians to conduct multiple tests to provide a more accurate and individual diagnosis. A solution to this problem has been pioneered by researchers at York who developed a novel combination of silicon's electrical conductivity with its optical properties, which will allow clinicians to take multiple measurements at once. Identifying this solution required the interdisciplinary skills of Dr Steve Johnson (Electronics), Dr Alison Parkin (Chemistry) and Professor Thomas Krauss (Physics).

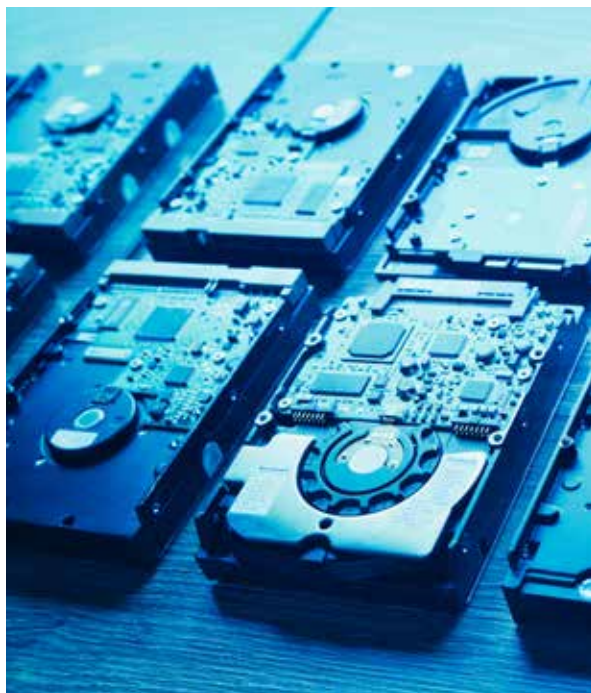
José, J-C., et al. The electrophotonic silicon biosensor. *Nature Communications*, 7: 12769.

## Case study

### Developing the next generation of heat assisted magnetic recording (HAMR)

Understanding the phenomenon of exchange bias is essential for improving the performance of magnetic recording media such as the hard disks in desktop computers, data centres and backup storage devices. Led by Professor Kevin O'Grady, pioneering work by York researchers on the exchange bias effect in collaboration with industry leaders Seagate and Western Digital has resulted in much improved performance, to the extent that every magnetic hard disk reader in the world is now designed based on the underpinning physical insight developed at York. Building on this significant impact, Seagate has directly funded a \$450k project exploring exchange bias in the next generation of heat assisted magnetic recording (HAMR) media.

O'Grady, K., Fernandez-Outon, L.E., and Vallejo-Fernandez, G. (2010). A new paradigm for exchange bias in polycrystalline thin films. *Journal of Magnetism and Magnetic Materials*, 322(8), 883-899



## Partnerships and impact

- As part of the £270m UK Quantum Technologies Programme, EPSRC funded a national network of four Quantum Technology Hubs. York leads the Quantum Communications Hub that aims to deliver quantum encryption systems to enable secure transactions and transmissions of data, across a range of users in real-world applications from government agencies and industrial set-ups to commercial establishments and the wider public. (Professor Tim Spiller)
- Nuclear fusion researchers in the York Plasma Institute are at the forefront of unlocking one of the most promising energy sources of the 21st century by trying to replicate the sun's energy source on earth. Their work is focused on the international ITER tokamak, currently under construction in the South of France, as well as being closely linked to the UK's national fusion research programme at the Culham Centre for Fusion Energy near Oxford. (Professor Howard Wilson)
- The York-led Digital Creativity Labs are a centre of excellence for impact-driven research in games, interactive media and the rich space where they converge. The DC Labs build on an £18m investment by three UK research councils, four universities and over 80 collaborative partner organisations, including major digital gaming companies. (Professor Peter Cowling)
- Researchers at York's Department of Electronic Engineering have been applying wireless communications to high-altitude platforms since 1999. They have coordinated or participated in numerous collaborative academic and industrial projects, involving partners such as the European Space Agency, BT Research and Innovation, Thales and Airbus, as well as being responsible for six out of the top ten most cited publications in the area (source: Google Scholar). York is now also home to the interdisciplinary Centre for High Altitude Platform Applications, which is pioneering technologies for wireless communications, environmental monitoring and atmospheric science applications. (Professor David Grace)



Stratobus airship used as a high-altitude platform

For more information on the University of York's interdisciplinary research themes see [www.york.ac.uk/research](http://www.york.ac.uk/research)

#### Professor Dan Watts

Research Champion for Technologies for the Future  
daniel.watts@york.ac.uk

#### Professor Deborah Smith

Pro-Vice-Chancellor for Research  
pvc-research@york.ac.uk

#### Neil Graddage

Research Development Manager  
neil.graddage@york.ac.uk  
+44 (0) 1904 328185