SWINBURNE UNIVERSITY OF TECHNOLOGY

SHAPING THE FUTURE

Swinburne University in Melbourne, Australia, is a rising star in the global university rankings. Here is a snapshot of some of the recent impact its research has had.

INCREASINGLY, NEW KNOWLEDGE FROM UNIVERSITIES MUST LEAD TO THE BETTERMENT OF INDIVIDUALS, organisations and nations – and do so in a pragmatic and timely manner. This is true research impact.

At Swinburne University of Technology, we are taking advantage of our size, agility and industry knowhow to create a research and innovation ecosystem that transforms industries and shapes lives and communities.

Swinburne has established five new outward-facing research institutes that bring together our expertise in data science, health innovation, smart cities, social innovation and manufacturing futures. These institutes build on the depth and excellence of discipline-specific research undertaken by university research centres. The five institutes — underpinned by the digital innovation capability platform — work coherently as a whole-of-solution shop for our partners, locally and internationally.

Professor Aleksandar Subic, Deputy Vice-Chancellor (Research & Development)

SEEING THE WORLD THROUGH A DIFFERENT LENS

"Light seemed really clean and bright to me. I wasn't thinking logically, it just felt right," said Baohua Jia, Associate Professor at Swinburne University of Technology of her decision to pursue a career in physics. In keeping with her philosophy that research should lead to practical outcomes that can change lives, she turned her attention to solar cell technologies.

Solar cells are made of multiple layers of semiconducting materials that convert light into electricity. To improve their efficiency, Baohua, working with her team, looked at how extremely small materials interact with light, a field known as nanoplasmonics, and developed a low-cost solar cell that can be manufactured using current technologies. "If more light enters the solar cell, a higher efficiency can be achieved," she explained.

The solar cell is 1,000 times thinner than current cells, and by placing it onto a glass pane, it could replace expensive rooftop solar cells with windows capable of powering the whole building.

Baohua continues to work on solar cells, but has recently turned her attention to graphene, whose astonishing properties promise to revolutionise many of today's technologies.

The work has led to the development of a lens a billionth of a metre thick that can be placed onto the tip of an optical fibre capable of producing images with the quality and sharpness of much larger glass lenses.

"In the future mobile phones could be much thinner, without having to sacrifice the quality of their cameras," said Baohua.

BUSINESS DEVELOPMENT PROGRAMS YIELD BIG BANG FOR BUCKS

A Victorian state government program designed to help Australian businesses make connections and improve their international exports resulted in an extra Aus$1.8 million influx to the Australian economy per participant, a Swinburne University of Technology study has found.

Beth Webster and colleague Alfons Palangkaraya pored over data from more than one million Australian businesses to see if government programs for small to medium-sized businesses provide bang for their buck.

Previous analysis focused on case studies and small sample sizes, which Webster compared unfavourably with drug-testing protocols — "Would you be happy using a drug that had only been tested on ten people?"

In contrast, Webster and Palangkaraya used an empirical method characterised by strong scientific elements, including controls.

The team had the unenviable task of whittling down 40 million data points, gathered between 2002 and 2014, to a more manageable level. By examining more than a decade's worth of data, the team were able to reduce political sensitivity and to allow time for the programs to have an effect.

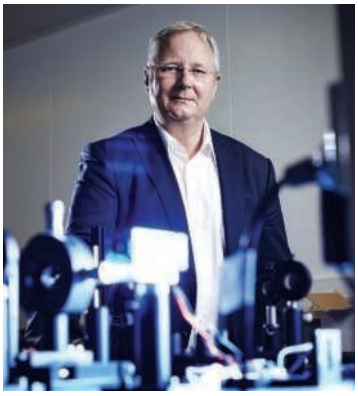
HIGH-STAKES CHIPS

David Moss, director of Swinburne University of Technology's Centre for Micro-Photonics in Melbourne, in collaboration with colleagues from around the world, has demonstrated a computer chip that overcomes two of the most challenging obstacles to commercial realisation of quantum computing technology — generating a continuous, high-volume supply of quantum particles, and producing the device using conventional mass-fabrication techniques.

"Our device represents an unprecedented leap in the quality, sophistication and sheer number of quantum entangled photon pairs that can be generated on an integrated chip," said Moss.

Moss's device utilised what is known as an optical frequency comb — an optical configuration that produces a regular series of extremely precise and equally spaced 'colours' or optical lines. The comb naturally produces photon pairs at precise frequencies.

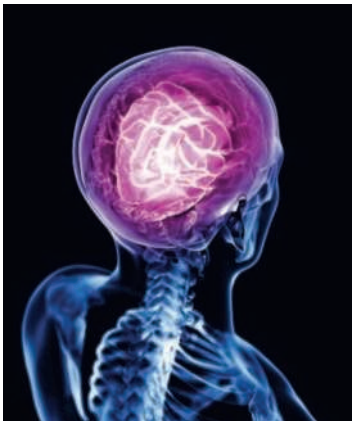
"The level of sophistication of quantum computing increases dramatically with the level of entanglement one can achieve," said Moss. "We believe that this platform is capable of generating



four-photon correlated states, and this represents an important step in this direction as a possible source of photons for a quantum supremacy demonstration."

FINDING A VOICE OF REASON

The causes of auditory hallucinations — hearing voices — have occupied Professor Susan Rossell for more than two decades. A cognitive neuropsychologist at Swinburne University of Technology, she used powerful new imaging technology to study why some people hear voices and



what can be done to help them manage it.

One insight was that voice-hearing appears to be an abnormal experience of a very normal human phenomenon — internal self-talk. "We all have internal dialogue but we can choose to listen to our thoughts or not listen to our thoughts," Rossell said. Most people are able to tune out this internal voice, along with all the other extraneous auditory stimuli we are constantly exposed to, such as traffic noise, birds, and other conversations. But this 'attention inhibition' switch is what Rossell thinks might be malfunctioning in conditions such as schizophrenia.

This discovery was profound for Rossell and her patients. "When we worked out that hearing voices was just a normal linguistic experience, it was incredibly relieving for the sufferers because we were able to tell our patients that this is part of normal language," she said. "They really like it, because they've been told for years that their brain is wrong."

Read more about Swinburne's exciting world of research in our new magazine
www.swinburne.edu.au/research