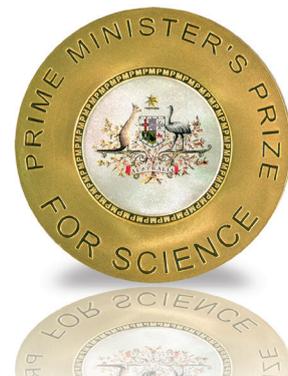




Australian Government

THE PRIME MINISTER'S PRIZES FOR SCIENCE



RICHARD PAYNE

MALCOLM MCINTOSH PRIZE FOR PHYSICAL SCIENTIST OF THE YEAR



Re-engineering nature to fight for global health

Richard Payne makes peptides and proteins. He sees an interesting peptide or protein in nature, say in a blood-sucking tick. Then

he uses chemistry to recreate and re-engineer the molecule to create powerful new drugs, such as anti-clotting agents needed to treat stroke.

His team is developing new drugs for the global challenges in health including tuberculosis (TB), malaria, and antibiotic-resistant bacterial infections. They're even developing synthetic cancer vaccines. His underlying technologies are being picked up by researchers and pharmaceutical companies around the world and are the subject of four patent applications.

For his revolutionary drug development technologies, Professor Richard Payne from The University of Sydney has been awarded the 2016 Malcolm McIntosh Prize for Physical Scientist of the Year.

Drugs based on proteins found in nature have huge medicinal potential. Take stroke for example—the leading cause of disability in Australians. Blood-sucking leeches, ticks and mosquitoes all produce powerful anti-clotting proteins to ensure they get a good feed from their victims. But turning these proteins into drugs is difficult and usually involves making the proteins in mammalian or insect cells, then harvesting and trying to purify the protein.

Richard's technologies bypass those challenges. Instead he recreates the protein in the chemistry laboratory, building it one amino acid at a time. Along the way he can tweak the pure protein to fine-tune its performance.

He has recreated the anti-clotting agents found in ticks and modified them to make them into potent anti-clotting drugs that cause less bleeding than currently used anticoagulant therapies. These drugs are expected to enter pre-clinical assessment in the next year.

The complications and cost of conventional drug discovery has meant that new drugs that are desperately needed to treat TB and malaria—two enormous global health problems—have been slow to emerge.

Following support from the Bill and Melinda Gates Foundation for his PhD at Cambridge, Richard is prioritising the use of his new technologies to tackle global health issues. For malaria he's developing modified versions of gallinamide A, a peptide-based natural product found in marine bacteria in the West Indies, that have shown excellent results at clearing a malarial infection *in vivo*. He's also working with compounds from soil bacteria that show strong antibiotic effects and kill drug-resistant strains of TB.

One third of the world's population (about two billion people) are thought to be infected with TB. It kills more than 1.5 million people per year and is becoming resistant to most of the drugs used to treat it. Richard hopes that his TB drug candidates will lead to new and effective drugs within the decade.

Richard and his team have also developed the first fully synthetic cancer vaccine candidates possessing all the components required to stimulate an immune response for the eradication of tumours.

Certain proteins on cell surfaces are decorated with sugar molecules. Richard has shown that cancer cells produce more of these sugar molecules and that they have different chemical structures to the molecules on normal cells. He's made segments of these sugar-derived proteins and shown that they can generate antibodies that attack cancer cells selectively. Work is underway to test these potential vaccines in models of pancreatic cancer and breast cancer.

Richard Payne is Professor of Organic Chemistry and Chemical Biology at The University of Sydney. He is an Australian Research Council Future Fellow. He was appointed as a full Professor in 2015 at the age of 34.



Career profile, Professor Richard Payne

QUALIFICATIONS

- 2002 Bachelor of Science (Honours) (Chemistry), University of Canterbury, New Zealand
- 2006 PhD (Organic Chemistry and Medicinal Chemistry), University of Cambridge, UK

CAREER HIGHLIGHTS

- 2015 The Leo Dintenfass Memorial Award, The Rebecca L. Cooper Medical Research Foundation
- 2015–ongoing Professor of Organic Chemistry and Chemical Biology, The University of Sydney
- 2015 *Medicinal Chemistry Communications* (Royal Society of Chemistry) Emerging Investigator Lectureship
- 2015 Distinguished Lectureship Award, Chemical Society of Japan
- 2014–ongoing Early–mid career researcher (EMCR) member, National Chemistry Committee, Australian Academy of Science
- 2014 Edgeworth David Medal, The Royal Society of NSW
- 2014–2017 Australian Research Council Future Fellow, The University of Sydney
- 2014 Le Fèvre Memorial Prize, Australian Academy of Science
- 2014 Travel Award, *Carbohydrate Research* Young Investigator Symposium

- 2013 Tregear Award in Peptide Science, Australian Peptide Association
- 2012 Athel Beckwith Lectureship, Royal Australian Chemical Institute
- 2012–ongoing Business Events Sydney Future Leader
- 2012–ongoing Cure Cancer Australia Ambassador
- 2011 Rennie Memorial Medal, Royal Australian Chemical Institute
- 2011–ongoing NSW representative, Australian Peptide Association
- 2008–2014 Lecturer, Senior Lecturer, Associate Professor, The University of Sydney
- 2008 Biota Award in Medicinal Chemistry, Royal Australian Chemical Institute
- 2006–2008 Postdoctoral Research Associate, The Scripps Research Institute, La Jolla, California, USA
- 2006–2008 Lindemann Fellowship, The English-Speaking Union
- 2003–2006 Gates Cambridge Scholarship, Bill and Melinda Gates Foundation

Further reading

- sydney.edu.au/science/people/richard.payne.php
sydney.edu.au/science/chemistry/~payne/index.html