THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

AIBN Annual Report 2013

AIBN Annual Report 2013

Vice-Chancellor's message 1

Director's message 2

Board marks first full year 3

Scientific Advisory Committee 4

Research highlights 2013 5

Alexandrov Group:
Expression system gives protein insights 6

Bernhardt Group:
Insight into nanomaterials from Theory and Computation 7

Cooper-White Group:
Researchers closer to clarifying stem cell clues 8

Drennan Group:
Ceramic system stability explored 9

Gray Group:
Clinical trial closer for Hendra virus therapy 10

Halley Group:
Polymer projects successfully finalised 11

Kendall Group:
Invention nears commercialisation 12

Mahler Group:
Cancer therapy in clinical trials 13

Martin Group:
Research converts Spinifex 14

Middelberg Group:
Advancing understanding of biological interactions 15

Monteiro Group:
Drug delivery mechanism fights cancer 16

Nielsen Group:
Complex system design and analysis 17

Trau Group:
Grants advance rapid point-of-care diagnostics 18

Vinu Group:
Research generates international collaborations 19

Wang Group:
Collaboration builds better batteries 20

Wells Group:
Web portal gains traction 21

Whittaker Group:
Collaborations tackle diagnosis and fabrication 22

Wolvetang Group:
Disease models test regenerative medicines 23

Yu Group:
Breakthrough technologies patented 24

Appointments 25

Associate Group Leaders 26

ARC Fellowships 28

Awards flow to AIBN 29

Funding 30

Commercialisation activities & industry engagement 31

Suppressing anti-inflammatory drug side effects with nanomaterials 32

TenasiTech nanoparticle additive validated 33

DSM scale-up facility opened 34

QSAFI completes significant work 35

Philanthropic initiative to support research 36

IAP links researchers with industry 37

Internship brings industry relevance 38

International collaborations 39

Consortium exchanges valuable information 40

Merck, Vaxxas collaboration 41

Researchers' bid for better batteries and reduced emissions 42

Point-of-care device gains momentum 43

Dow partnership develops 44

ICBNI promotes in-depth collaborations 45

Queensland-China workshop 46

Facilities & research environment 47

Infrastructure facilitates research 48

Research agreement for protein experts 50

Mentoring & career development 51

Commercial relevance part of PhD studies 52

PhD first step to building a research career 53

Bridge between research and industry 54

Expertise and equipment aids career 55

Graduate combines research and mentoring 56

Engagement 57

Community engagement 58

School engagement 59

Sister city relationship builds knowledge 60

Student experience 61

RHD report 62

Graduates 2013 64

Student association builds stronger community 68

Summer intake engages future researchers 69

Research higher degree students 70

Grants & publications 71

Grants 72

Publications 74

Patents granted in 2013 82

Thank you 84

Contact AIBN 84

Vice-Chancellor's message

It is my pleasure to offer some thoughts for this 2013 report of the Australian Institute for Bioengineering and Nanotechnology, because much can be said about AIBN's focus on developing tangible, sustainable outcomes for society, the environment and economies.

AIBN continues to pursue excellence in research and forge connections that help it deliver impacts for the benefit of state, national and global communities.

With support from funding agencies, industry, collaborators, philanthropists, the AIBN board and its Scientific Advisory Committee, AIBN people are pushing the frontiers of science with a clear eye on the practical implications of their work.

In a determined quest for solutions to knotty and expensive problems, they are also pooling resources and expertise with colleagues within UQ. These include researchers in some of UQ's newest multidisciplinary entities, such as the Dow Centre for Sustainable Engineering, and the Solar Biofuels Research Centre.

Positive AIBN case studies are too numerous to detail here, but examples include:

- Working with Merck towards using the Nanopatch to administer vaccines without the need for needles, syringes and refrigeration
- Collaborating with a new Chinese enterprise, Leling Shengli New Energy, and UQ's School of Chemical Engineering, which aims for better hybrid car batteries
- Developing a prototype for diagnosing gastrointestinal diseases, in concert with the Seattle Biomedical Research Institute and the University of Washington
- Compiling data about the economic competitiveness of biofuels – a component of a project involving Boeing, Virgin Australia, Mackay Sugar, IOR Energy, James Cook University and various UQ research units.

As part of its future-proofing endeavours, AIBN has nurtured a growing number of research higher degree students in recent years, with a record 27 doctors of philosophy and masters of philosophy conferred in 2013.

These UQ/AIBN alumni are vital not only for national and international knowledge leadership, but also for their future contributions to the productivity and prosperity of communities and corporations.

I strongly encourage these graduates, as well as students currently linked to AIBN, to value themselves as assets not only to academia and research, but also to industry and society. They have the knowledge to help catalyse beneficial changes in industries that have far-reaching impacts.

I thank all AIBN staff and partners, including philanthropists, who are instrumental to positive AIBN outcomes. Please maintain your keen focus on innovating to benefit people and the environment, because you will help establish the settings for sustainable prosperity for many generations to come.

Professor Peter Høj
Vice-Chancellor and President
The University of Queensland

Director's message

The lifeblood of any vibrant research institute is its people and during 2013 our staff and students continued to excel in research excellence, impact and commercial vision.

Since moving into our custom-designed $76 million building in 2006, AIBN has grown to an institute of 450 staff and students with an annual turnover of $35 million. The high quality of the institute's research was confirmed by the latest national Excellence in Research in Australia exercise, which saw AIBN research ranked at 5, the highest ranking possible at 'above world standard', in the six categories covered by our research.

The Vice-Chancellor has already commended the record number of graduates from our research higher degree student cohort of 125. These graduates have taken up positions with leading companies and academic groups in Australia and around the world. Many of the successes of our staff and students are described in the pages of this report, and I will single out only a few by way of example.

At the more junior end of our researchers we have James Biggs, from Associate Professor Ernst Wolvetang's group, who has been offered the prestigious Herchel Smith Fellowship grant to complete his PhD with the top stem cell group at Harvard Medical School. James first started working in AIBN as a first-year undergraduate summer student with Ernst, and he continued throughout his undergraduate science degree, completing an honours program and publishing a seminal paper as lead author.

At the mid-career level, Associate Group Leader Dr Simon Corrie was awarded the 2013 Queensland Young Tall Poppy Science Award in recognition of his scientific excellence towards developing new devices for medical diagnostics.

At the senior level, we congratulate Professor Anton Middelberg, AIBN Group Leader and Deputy Director, who was appointed as UQ's Pro Vice-Chancellor Research and International, and Professor Justin Cooper-White, Group Leader and a member of the AIBN executive, who was appointed a CSIRO Office of the Chief Executive Science Leader.

It is particularly pleasing that our people not only contribute to UQ by providing high quality research, achieving more than 300 scholarly publications in 2013, but more than 25 of our researchers actively contribute to the university's undergraduate and postgraduate coursework teaching programs. This is a key role we play in training the next generation of young scientists.

Towards the end of the year, we were delighted when Dr Zoe Cahill joined AIBN in the pivotal role of Deputy Director (Operations).

The year saw the ongoing success of our researchers in attracting competitive and industry funding at national and international levels. In what was a challenging year in Australia with reductions in research funding at both state and federal levels, AIBN enjoyed continued success in national competitive grant schemes.

AIBN researchers will lead two new Australian Research Council (ARC) Linkage Project grants with co-investment from Vaxxas and Leling Shengli New Energy, nine new ARC Discovery Project grants, two Discovery Early Career Research Awards, and two Future Fellowships. Four AIBN researchers will lead the Queensland node of a multistate collaborative ARC Centre of Excellence in Convergent Bio-Nano Science and Technology.

Of importance is the institute's continuing growth in National Health and Medical Research Council (NHMRC) support, with 2013 being a landmark year in which three AIBN researchers attracted NHMRC Project Grants as lead investigators, and two Early Career Fellowships were awarded.

AIBN's Industrial Affiliates Program (IAP) continued to deliver during 2013. Major developments occurred with two 'Premier' members of the initiative. In October 2013 DSM Biologics' $65 million scale-up facility for the Good Manufacturing Practice (GMP) standard production of biologics was officially opened. These protein-based human therapeutics are made using DNA technology, and now make up seven of the top 10 selling human therapeutics worldwide.

The opening was particularly significant for me, as my involvement dates back to 2001 when the Federal Government conducted the Pharmaceutical Action Agenda that found Australia should develop a national contract manufacturing organisation facility capable of GMP production of biologics for Australian researchers and other global users. AIBN's involvement in the project started about 10 years ago, and it was particularly pleasing the DSM Biologics CEO, who launched and drove the project, said the presence of the strong base in biologics capability at AIBN played a key role in the company's decision to invest in Brisbane.

The year saw AIBN host its annual conference overseas for the first time. We were delighted to accept a kind invitation from Professor Bai Chunli, a member of AIBN's Scientific Advisory Committee and now President of the Chinese Academy of Sciences, to hold the conference in Beijing. The conference, opened by Frances Adamson, Australian Ambassador to China, was an outstanding success. It was followed by visits to the National Centre for Nanoscience and Technology, in Beijing; a workshop at Fudan University, in Shanghai; and a joint conference with CSIRO and the Shanghai Science and Technology Council.

International collaborations play a major part in AIBN's research activities and in 2013 we had 309 formal collaborations with researchers, both corporate and public sector, across 29 countries around the world. The highest number of international collaborations was with groups in the USA (103), followed by China (33) and the UK (27). These collaborations take the form of industrial research contracts or collaborative research programs, often involving staff and student exchanges and ideally culminating in joint publications.

An example of one such collaboration running throughout 2013 was in Professor Lars Nielsen's synthetic biology group where he arranged for Dr Daniel Klein-Marcushamer to spend alternating six-month periods between AIBN and the Joint

Bio-Energy Institute at Berkeley in California. This collaborative research on the techno-economic evaluation of bio sustainable jet fuel production has been co-funded by the US Department of Energy and the Queensland Government.

Another major development in 2013 was that, after more than nine years' involvement by AIBN, the $12 million Dow Centre for Sustainable Engineering Innovation started activities at UQ. Professor Eric McFarland, from the University of California, was appointed the inaugural Director.

We are grateful to all members of the AIBN board for their assistance and counsel during a year that saw several major developments at university and government levels. We were delighted when board member Professor Chris Lowe agreed to lead our new Scientific Advisory Committee, membership of which is listed on page 4.

Fellow board members all contributed on a wide range of topics. Susan Pond helped with several government and commercialisation matters; Kathy Hirschfeld contributed in areas of governance and career planning; Bob McCarthy brought his considerable experience in government and corporate interactions; and Max Lu provided invaluable advice on university and government interactions. Chairman Euan Murdoch provided inspirational leadership and contributed on many levels, including officially launching the AIBNcubator Technology Translation Fund at an IAP networking event in November.

I would like to acknowledge UQ's senior management for their interest and support shown to AIBN during the year. Professors Peter Høj (Vice-Chancellor), Debbie Terry (Senior Deputy Vice-Chancellor), and Max Lu (Deputy Vice-Chancellor (Research)) all gave generously of their time during the year and their ongoing commitment to the institute played a strong role in our continuing successes. We wish Professor Terry well in her new role as Vice-Chancellor of Curtin University, in Perth, WA, and congratulate Professor Max Lu who takes over in the new role of UQ Provost in 2014.

Professor Peter Gray
AIBN Director

Board marks first full year

The AIBN board marked its first full year in 2013, assisting Director Professor Peter Gray and members of the Executive in matters relating to the institute's governance, defined strategic goals, progress against goals, and funding levels required to support AIBN's ongoing operations and strategic initiatives.

Chairman Euan Murdoch chaired a full-day board meeting at AIBN in January, leading discussions on many issues of key importance for the institute and engaging in more detailed discussions with several group leaders.

UQ Vice-Chancellor and President, Professor Peter Høj, joined the board for lunch, enabling informal discussions on areas of common interest, including research excellence and effective industry and government partnerships.

The board meeting was followed by the annual retreat for AIBN group leaders, associate group leaders and section heads, with presentations and robust discussions to formulate institute strategies for the challenging year ahead. AIBN board members joined the retreat for the afternoon of the first day and contributed to discussions on AIBN's 10-year vision and the strategy to be adopted in pursuing major new research collaborations.

The board subsequently met in August, where the main topics discussed were the UQ Faculty Review being conducted during 2013; autonomy for large research institutes like AIBN; and the board's final approval for AIBNcubator, a philanthropic fund established to source proof-of-concept seed funding.

Mr Murdoch demonstrated his support for AIBN's Industrial Affiliates Program when he chaired the program's Showcase and Networking function in November and launched the AIBNcubator fund.

The AIBN board was established in 2012, met for the first time in July 2012, and quickly embraced its broad ambit, including providing advice on funding opportunities, commercialisation paths, extension activities, and growth strategies on strategic and operational levels.

The board reviews AIBN's progress in research, internationalisation, commercialisation, governance and management. It is also charged with advising on matters such as raising AIBN's international profile to maximise benefits to Queensland and Australia generally, and assisting to maintain AIBN's high visibility and reputation in research, industry, government and public domains.

Members are high-calibre representatives with broad ranging experience and expertise in the university, industry, community and government sectors.

Mr Murdoch is the founder of Herron Pharmaceuticals. His career has included positions on the Queensland Biotechnology Advisory Council, the Reserve Bank of Australia, the Small Business Advisory Board, the Australian Food and Grocery Council, the Complementary Healthcare Council of Australia, Harvest Fresh Cuts Pty Ltd and Sigma Pharmaceuticals.

Board members are Kathy Hirschfeld, Professor Chris Lowe, Professor Max Lu, Bob McCarthy, Dr Susan Pond and Professor Gray.

Scientific Advisory Committee

AIBN established the Scientific Advisory Committee (SAC) in 2013 to advise the board and Director Professor Peter Gray on the institute's future scientific directions and research strategies.

SAC's members are recognised experts in their fields and their diverse research interests reflect the breadth of scientific disciplines brought together at AIBN.

SAC Chair **Professor Chris Lowe** creates a link to the AIBN board through his long-standing membership of that advisory body, and bringing a wealth of knowledge in healthcare biotechnology, biopharmaceuticals, biosensors and diagnostics, technology development and commercialisation.

University College London's **Professor Barry Buckland** brings to SAC a background in industrial research and development, academia and commercialisation in biochemical engineering and bioprocessing.

Professor Martin Pera has more than 25 years of experience in human pluripotent stem cell research, conducted at the Eli and Edythe Broad Centre for Regenerative Medicine and Stem Cell Research at the University of Southern California; Monash University; the University of Melbourne, Florey Neuroscience and Mental Health Institute; and the Walter and Eliza Hall Institute of Medical Research.

Research at the interface between organic, supramolecular and macromolecular chemistry, liquid crystals, nanoscience and biology is the focus of **Professor Virgil Perce's** work at the University of Pennsylvania.

Professor Bai Chunli is a well-known chemist and leading scientist in nanoscience and President of the Chinese Academy of Sciences. He has research interests in the fields of scanning tunnelling microscopy and molecular nanotechnology.

The University of Melbourne's Professor **Thomas W Healy AO** has a list of honours recognising a lifetime of contributions to colloids and interface science, mentoring in Australasian science, and support for philanthropic activities.

CSIRO Fellow and Distinguished Research Fellow **Professor Andrew Holmes** brings to SAC expertise in electroactive organic and polymeric materials, biological chemistry, and natural product synthesis gained during a career at Cambridge, University College London, Imperial College and the University of Melbourne.

Professor Laura Poole-Warren combines research in biomaterials and tissue engineering with senior leadership positions at the University of New South Wales, government advisory bodies and university strategy and policy bodies.

Professor Martin Lavin has an international reputation for his work on genetic disorder ataxia-telangiectasia. His work at UQ's Centre for Clinical Research also focuses on genetics; neurodegenerative diseases; early detection of prostate cancer; and evaluation of snake venom proteins with therapeutic potential.

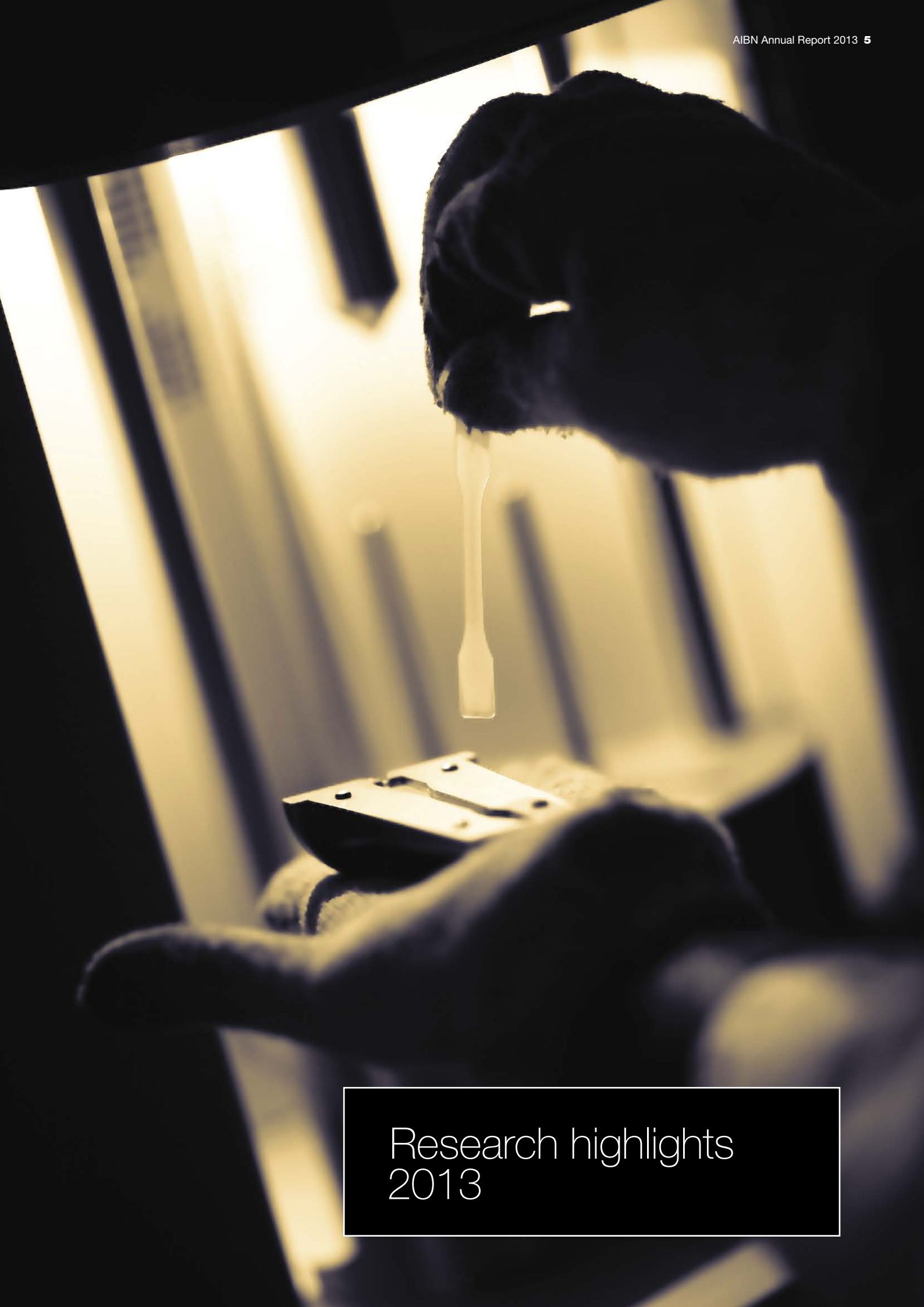
Biochemical engineer **Professor Harvey W Blanch's** work at the University of California (Berkeley) brings to SAC insights into protein interactions, DNA electrophoresis and mammalian cell metabolism.

Flinders University's **Professor Colin Raston** is the South Australia Premier's Professorial Research Fellow in Clean Technology, with projects in clean technology and green chemistry, process intensification, nanotechnology and self-assembly.

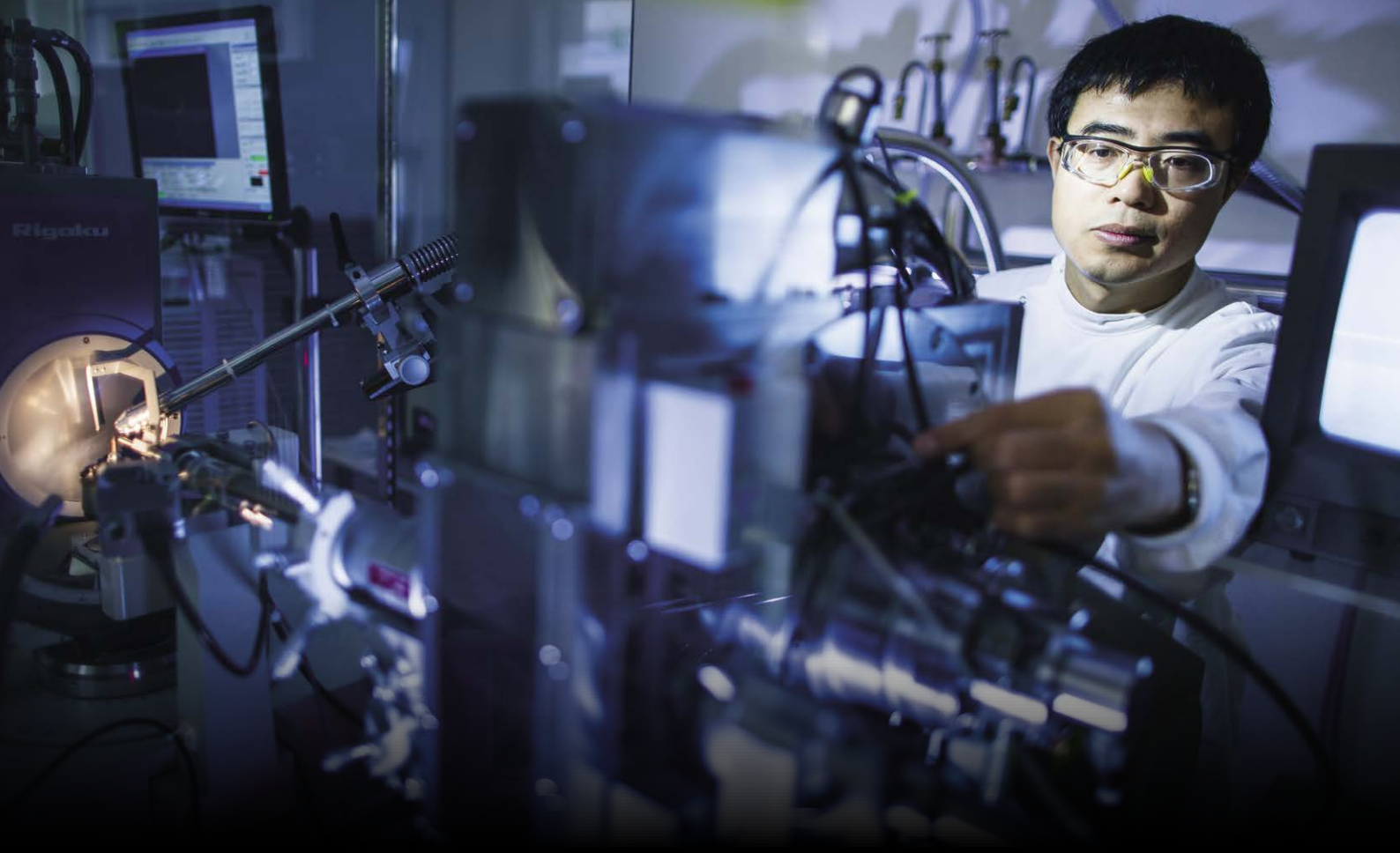
Dr Anita Hill is chief of CSIRO Process Science and Engineering and is working to build Australia's international standing in the field of nanostructured materials and processes.

SAC's responsibilities include identifying future strategic opportunities for fields of research, collaboration and the institute's cross-disciplinary foci; and identifying unique funding opportunities for AIBN activities.

The committee will assist in providing global visibility for AIBN activities; propose strategies for training and developing researchers and research students to build scientific capacity and capability in a multi-disciplinary and global environment; and provide research strategy and goal recommendations to the AIBN board.



Research highlights 2013



Expression system gives protein insights

AIBN *Professor Kirill Alexandrov* has applied synthetic biology principles to analyse and design protein-based molecular nano-machines in 2013 that give insights into heart and muscle diseases.

Professor Alexandrov's research group developed a novel cell-free protein expression system based on the single-celled organism *Leishmania tarentolae*, converted to a high-throughput format in 2013.

Using the technology, researchers have dramatically decreased the cost of deciphering the protein interaction networks encoded in human genomes.

The technique gives insights into the workings of proteins important in disease progression in the heart and muscles.

The technology is likely to be adopted by researchers around the world after being published in new open-access scientific journal *eLife*.

Professor Alexandrov's research group developed synthetic protein signal transduction and amplification cascades with potential for use in human diagnostics and cellular engineering, resulting in two patent applications.

The project has attracted a Prostate Cancer Foundation of Australia grant, enabling Professor Alexandrov's group to translate work in synthetic biology into diagnostics for prostate cancer.

Professor Alexandrov's research group focuses on synthetic biology and the study of basic biology that underlies disease. The aim is to construct life from standard parts by exploiting and manipulating biological systems.

A detailed understanding of cell surface organisation at the molecular level is important for therapeutic strategies to combat changes associated with cell transformation in human diseases such as cancer.

Professor Alexandrov is developing treatments for cancer, blindness, thrombosis and excessive bleeding using knowledge-based design of biological systems, taking advantage of new methods for rapid in vitro synthesis and engineering of proteins and protein-based machines.

The methods are vital in biotechnology, as production and analysis of proteins determines the expense and speed of the discovery and creation of new vaccines, therapeutics and diagnostic methods.

Professor Alexandrov's research group combines the technology with molecular spectroscopy to quantitatively analyse protein dynamics and protein-protein interactions.

Professor Alexandrov extended a collaboration with Perth biotechnology company Phylogica LLC on the discovery of pharmaceutical peptides with the support of an Australian Research Council (ARC) Linkage grant awarded in 2013.

The collaboration aims to develop technologies for identifying peptides capable of binding to pharmacological targets.

Professor Alexandrov was an ARC Future Fellow when he joined UQ in 2008 as a joint appointment between AIBN and the Institute for Molecular Bioscience.

He was a plenary, keynote or invited speaker at several international and national conferences in 2013, including at Queenstown Research Week in New Zealand, the Lorne Proteins Conference, the Australian Genomic Technologies Association conference, the ComBio Meeting in Perth and the Cell Signalling Symposium at the University of Melbourne.

Alexandrov Group
www.aibn.uq.edu.au/kirill-alexandrov

Insight into nanomaterials from Theory and Computation

AIBN *Professor Debra Bernhardt's* research group continued to gain international recognition in the use of non-equilibrium statistical mechanics and thermodynamics in 2013, and to develop advanced nanomaterials with applications in energy storage and conversion.

Professor Bernhardt is the director of the new AIBN Centre for Theoretical and Computational Molecular Science, bringing together leading UQ researchers developing and using theories and computational techniques for molecular science.

Professor Bernhardt and her group use a range of theoretical and computational approaches to develop a fundamental understanding of the behaviour of matter and study new materials and fluids.

Non-equilibrium statistical mechanics and thermodynamics

Her recent work has demonstrated how dissipation of a system remains important in highly non-equilibrium systems where the temperature and entropy become undefined.

Investigating fundamental studies into how systems behave outside equilibrium will provide the know-how for understanding and developing improved devices, materials and fluids.

Professor Bernhardt's research group published work in *Physical Review Letters* in 2013, detailing how fluctuations in a nanosized region can be quantified which has implications for the design and performance of nanoscale devices.

Advanced materials

Professor Bernhardt is applying theoretical and computational molecular science to a wide range of problems including transport in nanopores, fluctuation phenomena, and design of materials, gas separation, energy storage and conversion.

The work exploits classical simulation methods and quantum mechanical calculations to advance nanomaterials for energy transport and conversion; CO_2 capture; catalysis and fuel cells.

Increasing concerns about the atmospheric CO_2 concentration and its impact on the environment is motivating Professor Bernhardt's research group to discover new materials and technologies for efficient CO_2 capture and conversion. Group members model how nanomaterials can be used to capture and store CO_2 using density functional theory calculations. They collaborated with AIBN Professor Max Lu in 2013, publishing results relating to charge-controlled switchable CO_2 capture on boron nitride nanomaterials in the *Journal of the American Chemical Society*.

The group received funding from the Asian Office of Aerospace Research and Development to investigate ways to build stronger materials using metal matrix composites. Researchers in the group have been examining the strength of interactions between carbon and boron nitride nanotubes with aluminium and titanium to ultimately develop a composite material that is light yet strong.

AIBN's Dr Chenghua Sun received an Australian Research Council (ARC) Future Fellowship in 2013 to develop high-performance material efficiently converting solar energy to hydrogen – a clean fuel.

Professor Bernhardt is a Fellow of the Royal Australian Chemical Institute and was an invited speaker in 2013 at Kavli Institute of Theoretical Physics China's program on small system non-equilibrium fluctuations at the Chinese Academy of Science; and at the Joint European Thermodynamics Conference in Italy.

Two PhD students from China visited Professor Bernhardt's group in 2013. Huize Yu from Harbin Institute of Technology's Department of Materials Science and Engineering conducted research on catalysts to obtain hydrogen from metal hydrides. Meng Wang from China University of Petrolium (East China) examined materials for CO_2 capture.

Other visitors included Professor Shih-Jye Sun from the National University of Kaohsiung in Taiwan; and Professor Lamberto Rondoni from the Polytecnico di Torino in Italy.

Bernhardt Group
www.aibn.uq.edu.au/debra-bernhardt

Researchers closer to clarifying stem cell clues

Funding for a new lab, research projects and collaborations are taking *Professor Justin Cooper-White* closer to clarifying the microenvironmental cues that regulate stem cell behaviours and translating the insights into biomaterial scaffolds and microdevices to direct stem cells to turn into desired functional cells, tissues and even organs.

The biomaterials and devices are used to generate multiple tissues and organs, including knee meniscus and articular cartilage, intervertebral and cervical disc, heart, bone and kidney.

Professor Justin Cooper-White's Tissue Engineering and Microfluidics (TEaM) lab works at the interface of stem cell biology, materials science, engineering and microfluidics to examine the basic signals needed to repair and regenerate diseased or damaged tissues.

Researchers need to generate cells that can function appropriately to complete repairs.

Different signals bombard stem cells when they are grown in vitro, so researchers investigate how they react to each of the signals to determine simple, effective ways to ensure the cells form the correct tissue types.

The TEaM lab secured new funding of about $3 million in 2013, including Professor Cooper-White's five-year appointment as a CSIRO Office of the Chief Executive (OCE) Science Leader.

As one of only 13 OCE Science Leaders appointed from around Australia, Professor Cooper-White will establish a new lab and research program at CSIRO's Division of Materials Science and Engineering in Melbourne.

"The OCE Science Leader position will allow me to work closely with CSIRO people who have significant expertise in material synthesis, bio-surface engineering, and cell and matrix biology," Professor Cooper-White said.

Funding for large-scale collaborations is important for speeding the discovery process and enabling faster translation of learning from the lab to real-world medical treatments.

Professor Cooper-White was successful in Australian Research Council (ARC) and National Health and Medical Research Council (NHMRC) grant rounds in 2013.

An ARC grant will fund a research project focusing on developing smart hydrogels that determine how mecho-sensitive stem cells are and use the cue to direct tissue genesis.

An NHMRC grant funds work on kidney regeneration, in collaboration with Professor Melissa Little from UQ's Institute for Molecular Bioscience and AIBN Associate Professor Ernst Wolvetang, and on engineering osteochondral tissue to repair cartilage defects, resulting from sporting injuries or conditions such as osteoarthritis.

In the work on osteochondral defect repair, stem cells derived from bone marrow will be used to produce cartilage and bone microtissues of only 100 to 200 cells each that can be assembled into tissues suitable for cartilage defect repair and combined with scaffolds to ensure functional tissue repair.

In 2013, the lab began investigating whether molecules called microRNAs play an important role in how stem cells respond to the biomaterial systems being developed in the lab – and how that may determine their ability to generate bone, cartilage, muscle and fat.

The lab is also focused on developing stimuli-responsive nanoparticles for delivering microRNAs and DNA targeting heart tissue regeneration after a heart attack.

TEaM lab researchers published 24 papers in 2013 in high profile journals; discovered, patented and are hoping to commercialise a new molecule that enhances chondrogenesis in human mesenchymal stem cells; and cemented collaborations with international peers.

Professor Cooper-White was awarded a Visiting Professorial Fellowship at Politecnico di Milano, spending five months at the institute in 2013 conducting research, establishing collaborations and teaching post-graduate courses in stem cell dynamics and biomaterials and biomimetics.

The TEaM lab hosted international PhD and Masters students from world-renowned collaborators in Italy, the UK, Switzerland and India.

Cooper-White Group
www.aibn.uq.edu.au/justin-cooper-white

Ceramic system stability explored

Research collaborations and expertise in microscopy and microanalysis have given AIBN *Professor John Drennan* valuable insights into bioengineering and nanotechnology developments in 2013.

Professor Drennan's collaborations have involved diverse research fields, including the stability of various ceramic systems, metal stearate formation using synchrotron radiation, and developing next-generation fuel cell materials.

His appointments as Centre for Microscopy and Microanalysis director and AIBN Affiliate Group Leader provide a synergy that enables insights into materials research and shapes the centre's strategic direction.

In conjunction with partners at the Queensland University of Technology and the University of the Sunshine Coast, the centre successfully obtained a significant grant in 2013 to purchase a dual beam scanning electron microscope.

The instrument will be installed in 2014 and enable users to observe samples, cut sections, expose selected surfaces and obtain elemental and crystallographic information simultaneously. Designed to examine a range of materials, the instrument will benefit AIBN researchers in a multitude of fields.

In 2013, the Australian Synchrotron highlighted papers from Professor Drennan's research group on metal stearate formation as part of its annual assessment of significant works that have resulted from using synchrotron radiation.

In 2013, PhD student Gillian Osmond worked with Professor Drennan's group on a series of experiments on paint fragments from significant Queensland artworks and identified trends and elemental distributions key to art conservation in paintings containing significant quantities of zinc oxide.

Professor Drennan's collaboration with the CSIRO Division of Materials continued in 2013 and resulted in a paper outlining the effect of reducing atmospheres on the stability of various ceramic systems, building on his body of work detailing the control of microstructure of oxide materials and the effect on physical properties.

Drennan Group
www.aibn.uq.edu.au/john-drennan

Professor Drennan's research also involved collaborating with colleagues at the National Institute for Materials Science (NIMS) on ceramic materials based on cerium oxide. The research's focus was on developing fuel cell materials for the next generation of efficient energy producing systems.

Professor Drennan published six papers with his NIMS collaborators, including publication in Langmuir and the Journal of Materials Chemistry.

A 2013 paper in the Journal of Materials Science, outlining the microstructural changes in a candidate material subjected to extreme temperatures, defined the framework for future work on hypersonic vehicles.

Professor Drennan's input helped provide detailed protocols on how to access materials for potential application.

Hypersonic vehicles are air-breathing aircraft that will fly greater than five times the speed of sound. UQ is a world leader in hypersonic research and has a continuing program to develop the technology of hypersonic flight engines.

Limitations are not in the engine's design but the material it is made from. Frictional heating is estimated to result in components reaching temperatures of more than 3000oC. The materials work to develop protective coatings for hypersonic vehicles is continuing and new grant applications for 2014 are in place with new collaborators.

Gray Group
www.aibn.uq.edu.au/peter-gray

Clinical trial closer for Hendra virus therapy

Major developments were recorded in 2013 in research programs in the fields of stem cells and the production of biologics.

AIBN Director and Group Leader Professor Peter Gray has headed research in the areas, with support from new funding, publication of important new research relating to scalable growth of human stem cells and moves towards a clinical trial of an anti-Hendra virus monoclonal antibody.

Professor Gray has been involved in an on-going collaboration with fellow AIBN Group Leader Professor Michael Monteiro and Dr Zhongfan Jia to develop novel thermoresponsive polymers that enable the scalable growth of human stem cells with no need for enzymes and chemical inhibitors during sub-culturing.

The collaboration, involving Dr Andrew Prowse, Xiaoli Chen, and Dr Trent Munro, has been an outstanding success and has developed novel, patented, thermoresponsive nanobridges that use a simple temperature drop to enable subculturing of the cells, without adding enzymes or chemicals.

The first paper on the research was published in 2013 in the journal Biomacromolecules and the work is being presented by invitation at key international conferences.

Professor Gray's research in biologics received a boost in 2013, with visits from US collaborators on the anti-Hendra virus monoclonal antibody project, Professor Christopher Broder from the Uniformed Services University of the Health Sciences and Dr Dimiter Dimitrov from the National Cancer Institute, National Institute of Health.

Discussions during the visit and the success of the collaboration to date resulted in plans to further expand joint activities involving additional antibodies.

Professor Gray's research collaboration with Dutch pharmaceutical manufacturer DSM Biologics had another milestone in 2013, when Queensland Science Minister Ian Walker opened the new $65million Good Manufacturing Practice 'biologics plant of the future' in Brisbane.

In October, Queensland Health Minister Lawrence Springborg, Queensland Agriculture Minister Dr John McVeigh and NSW Primary Industries Minister Katrina Hodgkins announced the Hendra project would receive $1.2 million to fund a clinical trial.

The trial will be led by Dr Geoff Playford at the Princess Alexandra Hospital and use a human monoclonal antibody capable of neutralising Hendra virus, manufactured at AIBN's National Biologics Facility (NBF).

The funds augment a previous $400,000 grant from the National Health and Medical Research Council (NHMRC) for the trial.

Developing the process to make and characterise the antibody has involved a concerted effort of 12 members of Professor Gray's research group.

During 2013, Dr Munro moved to a new position as Head of Cell Line Development at Amgen at Thousand Oaks in California. "Trent made a major contribution to building up the research activities at AIBN," Professor Gray said. "It is pleasing to see him taking the opportunity to work for one of the top global biotech companies."

Dr David Chin, who had built up and was leading the NBF, moved to a senior position at Biosceptre International Ltd, based in Sydney and Cambridge in the UK. At Biosceptre, Dr Chin will work closely with Sir Greg Winter, a pioneer in the development of monoclonal antibodies for clinical application.

The NBF is now co-managed by Dr Martina Jones, with responsibility for antibody technology, and Dr Jeff Hou, who will oversee cell line and bioprocess development.

Halley Group
www.aibn.uq.edu.au/peter-halley

Polymer projects successfully finalised

Two polymer research projects were successfully finished in 2013, building on key relationships with industry partners and resulting in publications and patents for Professor Peter Halley's research group.

The projects were funded with Australian Research Council (ARC) Linkage Project grants and involved work on texture modified foods and developing biopolymers from waste streams.

They were part of a focus in Professor Peter Halley's research group on biofluid and biopolymer processing to develop materials and processes for sustainable product development.

Professor Halley's research develops high-value bioplastics for use in farming, food packaging, solar cells and medical treatment.

Texture-modified foods

An ARC project with industry partners RSL Care and Two Short Giraffes involved researching novel cooking and processing methods to improve the safety and nutrition of texture modified foods.

The research developed specialised medical food for patients with dysphagia, resulting in difficulty in swallowing.

"The project developing new commercially ready formulations and cooking processes, in combination with industry partners, as well as meeting fundamental research goals, was extremely rewarding for my research group," Professor Halley said.

Biopolymers from waste streams

In another ARC-funded research project, Dr Bronwyn Laycock headed development of biopolymers from waste streams, using novel methods for preparing polyphdroxyalanoate co-polymers and blends.

The work was patented in 2013 and reported in literature, including the highest impact factor polymer journal, *Progress in Polymer Science*.

"The project built on earlier UQ links with industry, including ex-UQ graduates assisting PhD students in industrial trials. It was an example of a successful industry-embedded research project," Professor Halley said.

Cooperative Research Centre

In 2013, Professor Halley continued to lead research projects in sustainable polymers. He has an active role in the Cooperative Research Centre (CRC) for Polymers, with continued Federal Government funding until 2017 and links to more than 20 domestic and international industry and research providers.

CRC research includes developing sustainable polymers for agriculture and AIBN Professor Lianzhou Wang's work on polymer solar cells.

Dr Laycock has taken over from Professor Halley as project leader of the CRC's agricultural films project, linking UQ with Integrated Packaging, Queensland University of Technology, Monash University, Green Australia and CSIRO.

"Our CRC polymers projects led by Dr Laycock and Professor Wang are vital in developing new practical, sustainable polymer systems for water, food and energy applications," Professor Halley said.

Starch films for packaging

Professor Halley's research group continued a project using ARC Linkage Project funding, finishing in 2015, in collaboration with UQ start-up company Plantic Technologies. Dr Paul Luckman led work on thin starch films for packaging with researchers from UQ and the Queensland Alliance for Agricultural and Food Innovation.

"Dr Luckman and the team have continued excellent work on the thin films packaging project, producing a world first in the development of new ultrathin packaging film processes," Professor Halley said.

Starch-ionic liquid-nanocomposites

In another project, Professor Halley and Dr Fengwei Xie used an ARC Discovery grant to collaborate with Queen's University Belfast, Warwick University and the University of Alabama on starch-ionic liquid-nanocomposites.

In 2013, Professor Halley was a member of the organising committee for the Royal Australian Chemical Institute's Australian Polymer Symposium; and a member of the European Polymer Federation's technical committee for the European Polymer Congress in Pisa, Italy.

Professor Halley has a three-year appointment as head of UQ's School of Chemical Engineering, starting in 2014. "This is a great opportunity for key senior researchers to lead exciting projects, manage stakeholder relationships and to grow their own careers at UQ," he said.

Using his international expertise in bio-based polymers and translational polymer research, Professor Halley also accepted a role as Co-Director of UQ's Queensland Centre for Advanced Materials Processing and Manufacturing.

Invention nears commercialisation

Work towards commercialising an AIBN invention aimed at delivering vaccines without needles and syringes has been augmented with pioneering research into how naturally occurring mechanisms in the skin can enhance a person's immune response.

Biomedical engineer and AIBN Group Leader **Professor Mark Kendall** is collaborating with Translational Research Institute Chief Executive Officer and Director of Research Professor Ian Frazer and start-up company Vaxxas on the research, using almost $600,000 in funding from an Australian Research Council (ARC) Linkage Grant.

The research will involve input from immunologists, dermatologists, engineers and vaccinologists and a combined three-year budget of more than $1 million to build on Professor Kendall's work on the Nanopatch, a device being developed to deliver dry-coated vaccine into the skin.

Thousands of small projections on the Nanopatch are designed to deliver a vaccine to abundant immune cells in the skin, whereas traditional needle and syringe delivers to the muscle, where there are few immune cells.

Research has demonstrated the Nanopatch achieves protective immune responses in small animal models with doses up to 100 times smaller than required for a needle and syringe.

It has the potential to overcome needle-stick injuries and cross contamination. Because vaccines are dry-coated to the Nanopatch, it may not need refrigeration, potentially making transport much cheaper and easier, particularly to developing nations.

Vaccines for various diseases including influenza and human papillomavirus can potentially be dry-coated into the Nanopatch.

The ARC funding, announced in 2013, was one highlight in a successful year for Professor Kendall's AIBN research group and the second calendar year of operations for Vaxxas, established to advance the Nanopatch towards clinical testing and product development.

Professor Kendall gained global exposure for his work on the Nanopatch in 2013, presenting a TED Global talk in Edinburgh, Scotland and recording more than 600,000 online views for the presentation's video on the TED Global website in the first three months.

Chemical engineer Dr Simon Corrie expanded the Nanopatch's capability with research into disease detection, funded using an ARC Discovery Early Career Researcher Award. Combining materials chemistry with molecular biology, Dr Corrie will investigate the potential of using the Nanopatch's microscopic needles to quickly detect biomarkers that point to the presence of infectious diseases such as dengue fever and malaria.

Work in Professor Kendall's research group is also continuing on a planned field trial in Papua New Guinea, using funding linked to a Rolex Award for Enterprise awarded to Professor Kendall in 2012 to assess usability of the patch and applicator under developing-country field conditions.

The field trial, and blank Nanopatch trials in Brisbane using human volunteers, are precursors to potential clinical trials.

In parallel activities, Vaxxas staff are working with US-based pharmaceutical giant Merck to establish the efficacy, quality and stability of a Merck vaccine dry-coated to the Nanopatch, as part of an agreement that includes Merck funding for a development program to explore use of the Nanopatch in conjunction with an important vaccine.

Vaxxas was founded with $15 million in capital investment in 2011, which was one of Australia's largest investments in a start-up biotechnology company, and has grown to a staff of 20.

The Vaxxas board includes representation from co-investors OneVentures, Brandon Capital, HealthCare Ventures and UQ's main commercialisation company UniQuest.

Kendall Group
www.aibn.uq.edu.au/mark-kendall

Cancer therapy in clinical trials

Mahler Group
www.aibn.uq.edu.au/stephen-mahler

Collaboration between AIBN *Associate Professor Stephen Mahler* and Sydney bioscience company EnGeneIC Ltd led to human clinical trials of a cancer therapy in 2013.

Associate Professor Mahler led a group of researchers aiming to develop new biologic medicines in 2013, including nanoparticles that carry cytotoxic drugs directly to cancer cells.

Targeting the nanoparticles' delivery is accomplished through conjugation of monoclonal antibody fragments to nanoparticles of various compositions, including polymers, proteins and lipids.

Antibody-conjugated nanoparticles are characterised by combinations of methodologies, including plasmon surface resonance and fluorescence-activated cell sorting to demonstrate binding to targets; and in vitro and in vivo bioassays to demonstrate function.

Collaborating with EnGenIC has enabled development of enhanced targeting ability for therapeutic drugs.

EnGeneIC has developed a novel drug delivery platform, the EnGeneIC Delivery Vehicle (EDV), capable of being loaded with high concentrations of various cytotoxic drugs.

EDVs are designed to be ingested, break down and release the cytotoxins contained inside to kill the cancer cells.

"EDVs have proved to be functional," Associate Professor Mahler said. "However, the antibody targeting system needs to be optimised for ease of manufacture and to progress through the regulatory hurdles required in clinical development of a novel therapeutic."

Using antibody engineering techniques, Associate Professor Mahler's research group has been working with AIBN colleagues to develop single chain novel bispecific antibodies potentially capable of targeting EDVs to many different types of cancer cells.

The antibody engineering techniques can optimise properties such as stability and binding affinity to cancer cells.

The work enables EDV targeting to be accomplished in a simpler manufacturing process, while also enhancing EDV targeting efficiency to tumour cells.

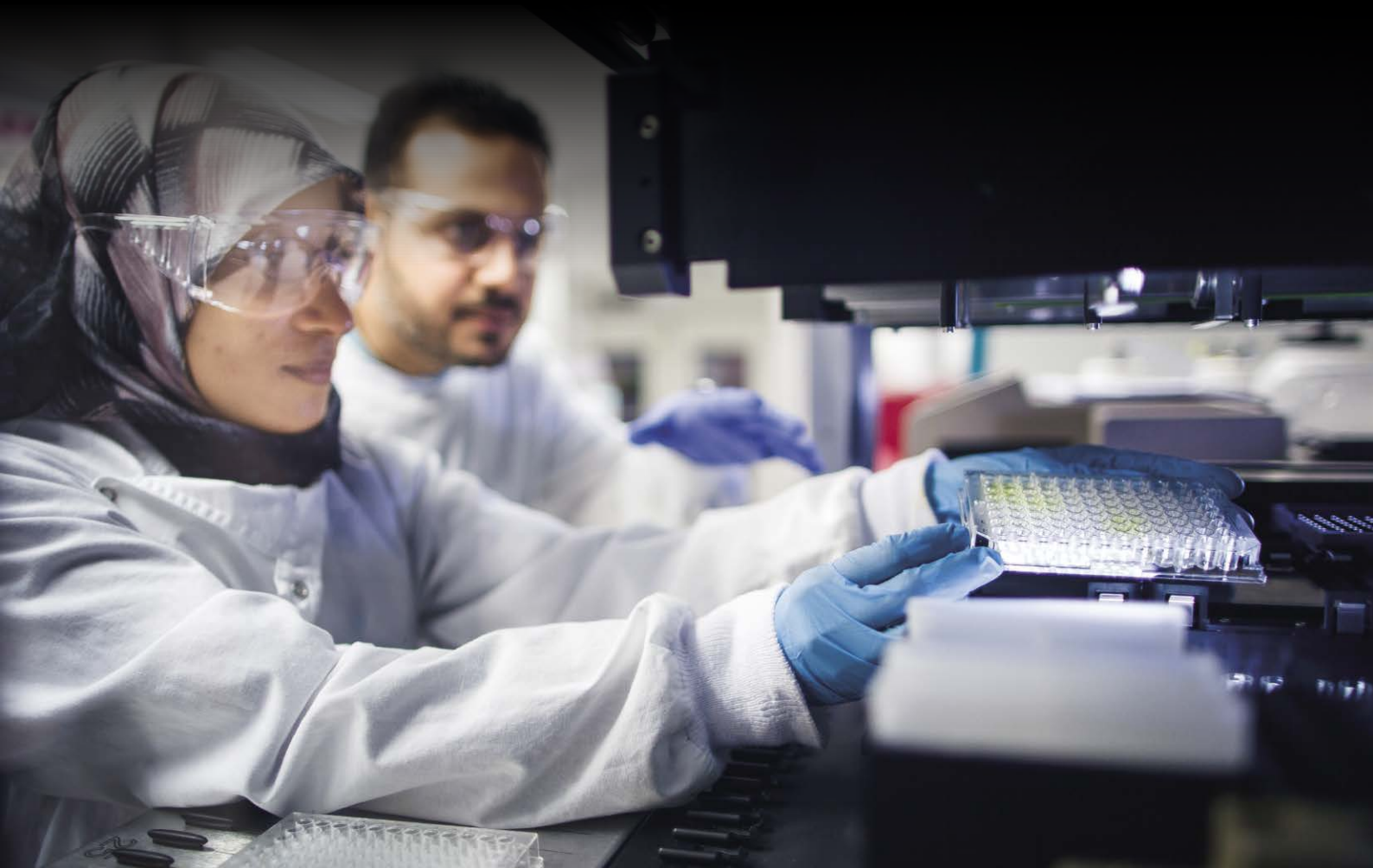
"With EnGeneIC, we are now investigating other targets such as mesothelin, a cell surface protein found in several malignancies including mesothelioma, ovarian, lung and pancreatic cancer," Associate Professor Mahler said.

"We are using our knowledge in recombinant protein expression to produce mesothelin, aid in our research and develop anti-mesothelin antibodies.

"Future studies will look at human mesothelioma xenograft models to assess tumour regression, using EDVs targeting mesothelin."

EnGeneIC began working with AIBN as a client of the institute's National Biologics Facility in 2008 and continued the collaboration with an Australian Research Council (ARC) Linkage Project grant.

Associate Professor Mahler has made significant contributions to the fields of biopharmaceutical discovery, development and delivery, including developing technology for producing human antibody biopharmaceuticals. He was an invited speaker to three international conferences in Singapore in 2013.



Martin Group
www.aibn.uq.edu.au/darren-martin

Research converts Spinifex

AIBN researchers under the leadership of *Professor Darren Martin* are at the core of an initiative that could grow to include industry partners and Aboriginal communities in developing renewable materials from an Australian native grass.

Professor Martin's AIBN research group has turned Spinifex into a nanomaterial called nanofibrillated cellulose with a high surface area and exceptional mechanical properties.

The material's properties make it suitable for a wide range of applications, including as components in air and water filters, battery separators, metal replacements and wound dressings.

"We are excited at the results so far and confident we can develop a truly scalable process to convert Spinifex as a renewable feedstock for a superior nanofibrillated cellulose," Professor Martin said.

"We can then think about building on the research to develop a multitude of applications for the material and investigate the infrastructure needed to source Spinifex in an efficient, sustainable and responsible manner."

In collaboration with research groups led by Professor Paul Memmott from UQ's School of Architecture, Professor Susanne Schmidt from the School of Agriculture and Food Sciences and indigenous industry partner the Myuma Group, owned and managed by the Indjalandji-Dhidhanu traditional ownes of the Camooweal area, the project has secured almost $75,000 in funding.

A UQ Collaboration and Industry Engagement Fund seed research grant enables Professor Martin's research group to develop a process to make and scale up the material.

It provides support for Professor Schmidt's team to determine the best species of Spinifex to use; and enables Professor Memmott's team to work with Aboriginal communities to source the grass and investigate harvesting methods.

AIBN student Nasim Amiralian began the Spinifex conversion process as part of her PhD studies, creating ropey nanofibres that were thinner and longer than generally achieved in the industry.

Spinifex enables the use of a process involving unrivalled mild chemical pre-treatments and minimal mechanical energy to make nanofibrillated cellulose with an extremely small diameter of three to four nanometres and a high aspect ratio.

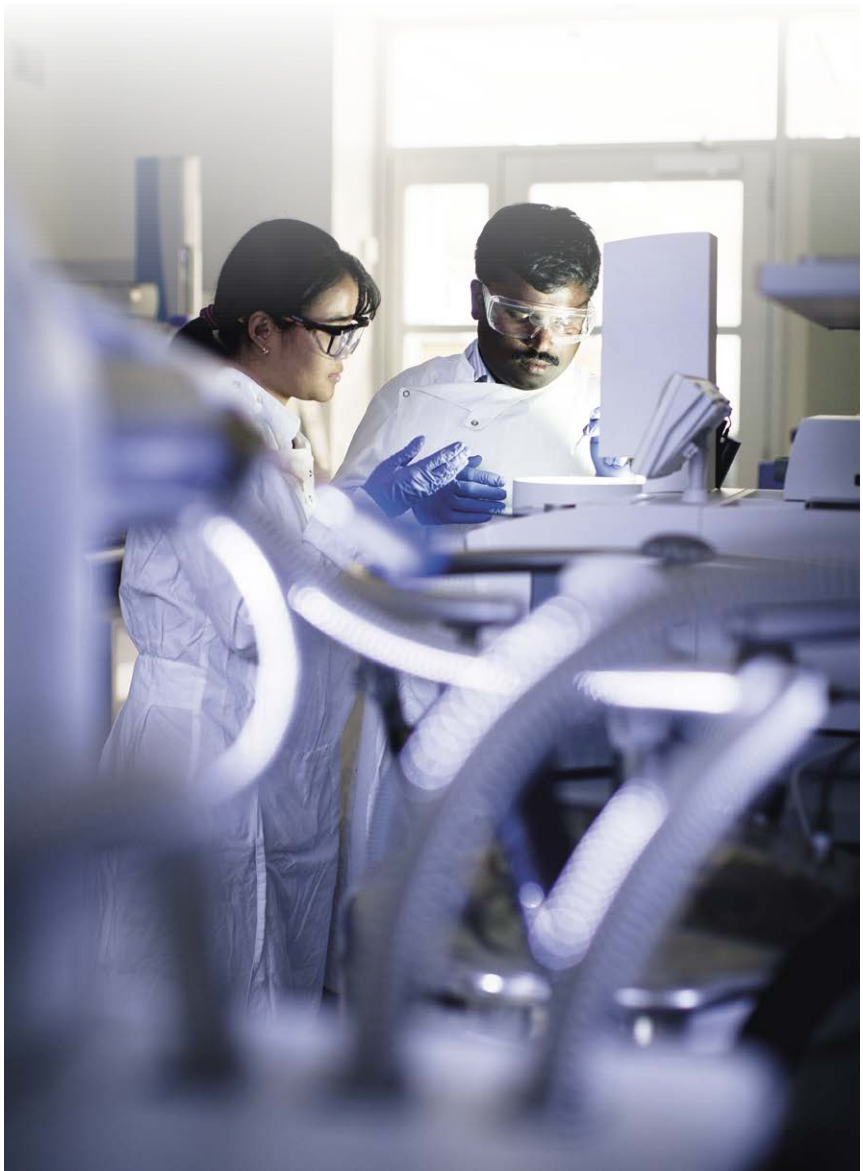
Ms Amiralian made 'nanopaper' from the cellulose with a toughness that is critical for non-woven applications, such as filtration membranes and electronic spacers, where the formation of tears and defects can render the product useless.

Professor Martin said preliminary testing has been conducted on the nanofibrillated cellulose, with plans to continue refining the process to enable scale up to industrially relevant quantities.

"When benchmarked against other leading academic and commercially available materials, Spinifex nanofibrils have the highest aspect ratio of any cellulose nanofibrils to date," he said.

"Their preparation requires no aggressive chemical pre-treatment and uses the lowest total mechanical energy of any known cellulose nanofibrils. It means Spinifex has the potential to address the technological bottleneck that has so far limited the widespread translation of nanocellulose technology."

Professor Martin has well-developed skills and expertise in nanomaterial commercialisation as Chief Scientific Officer for TenasiTech, a start-up company commercialising a polymer nanocomposites platform applied to large polyurethane and acrylic polymer markets and applications.



Middelberg Group
www.aibn.uq.edu.au/anton-middelberg

Advancing understanding of biological interactions

Research into controlling biological interactions and understanding how to better design bio-inspired systems, products and manufacturing processes has been significantly advanced in *Professor Anton Middelberg's* lab in 2013.

The research is showing potential in targeted delivery of therapeutics; slow-release applications in drug delivery, vaccination and insecticides; new-generation vaccine design; and developing a vaccine platform capable of making doses much cheaper.

Self-assembled targeting nanoemulsion

Professor Middelberg's research group is at the forefront of moves to overcome chemical challenges that limit the targeted delivery of therapeutics such as cancer drugs, with a world-first self-assembled targeting nanoemulsion.

The nanoemulsion comprises pharmaceutical-grade oil droplets stabilised by a surfactant made up of designer peptides, overcoming issues with poorly soluble chemotherapeutics going off-target and delivering the payload to healthy cells rather than tumours.

Professor Middelberg and Dr Bijun Zeng are co-inventors of the technology, developing the nanoemulsion using an Australian Research Council Discovery grant and a Queensland Government 2010 Smart Futures Premier's Fellowship for Professor Middelberg.

Dr Frank Sainsbury is further developing the technology, building on publication and a coveted frontispiece in Small in 2013, providing proof of concept for the precise targeting that can be achieved.

"The project will develop a platform for the delivery of cytotoxic chemotherapeutics to cancer cells," Professor Middelberg said.

"We believe nanoemulsions can be used to sequester poorly soluble drugs and selectively deliver them to cancers, minimising off-target effects and significantly increasing payloads reaching target cells."

Biomimetic formation of silica capsules

Professor Middelberg's research group is also developing emulsion-templated silica capsules for slow-release applications in drug delivery, vaccination and insecticides, resulting in a patent application in 2013.

Australian Postdoctoral Fellow Dr Chun-Xia Zhao and PhD student David Wibowo are leading the work on bio-forming of silica around oil droplets for an environmentally sustainable approach.

Using E Coli to produce designed mineralising biosurfactants, the researchers are able to stabilise the emulsion and form a shell that encapsulates the oil core. The thickness of the shell accurately determines the release of the encapsulated active components.

Professor Middelberg said the technology showed potential to out-perform existing commercial termite eradication products.

"The delayed release of the insecticide gives termites that ingest the capsules ample time to transfer it to others in the colony and improve area-wide control of termite populations," he said.

Computational modelling of a VLP

Computational modelling, conducted under the leadership of Dr Natalie Connors, has helped Professor Middelberg's research group design a new-generation vaccine to target rotavirus.

Using Grand Challenges Explorations funding from the Bill & Melinda Gates Foundation and working in collaboration with Dr Philip Dormitzer from Swiss multinational pharmaceutical company Novartis, Dr Connors and Dr Linda Lua assembled a virus-like particle (VLP) with a rotavirus antigen.

The VLP has a rotavirus antigen of 19kDa, rather than small peptides generally used in industry, without disrupting the structure.

Professor Middelberg said the VLP, a synthetic that mimics a virus but contains no genetic material, was presented to an antigen-detecting antibody and was recognised – confirming the rotavirus antigen was "authentically presented".

"The computational modelling and simulation was able to predict the best design and has enabled large antigens to be introduced to an established VLP platform," he said.

"With such a successful Phase I result, we have the opportunity to apply for a larger Phase II grant from the Bill & Melinda Gates Foundation to test for immunogenicity in the animal model."

Synthetic biology

Synthetic biology is also being employed in Professor Middelberg's vaccine research and is demonstrating potential in developing a platform capable of rapid scale up and making doses for less than 1 cent each.

Using bacteria to create a designer viral capsomere gives researchers under project leader Dr Nani Wibowo the potential to develop vaccines quickly and cheaply for use in animals and humans, addressing global One Health concerns about diseases spreading from one to the other.

With the support of a Pathfinder proof-of-concept grant from UniQuest, the research is showing protective efficacy in vaccinating against influenza and will be broadened to test for efficacy in other diseases.

Drug delivery mechanism fights cancer

***Professor Michael Monteiro* continued research in engineering polymer nanoparticles in 2013 and published his work on a new drug delivery mechanism against cancer.**

His work has established an international reputation in the field of 'living' radical polymerisation to create complex polymer architectures. Polymers made by this technique have well-defined chain length and architecture.

The technique's advantage is the wide range of functional monomers that can be incorporated into making the architectures, enabling the manufacture of materials for biomedical applications, coatings and electronic devices.

Professor Monteiro is now building designer polymers for various biomedical applications, including vaccines, drug delivery and stem cells.

With continued support from an Australian Research Council Discovery Project grant, Professor Monteiro's research group has engineered polymer nanoparticles for a potent anti-cancer drug delivery mechanism.

Combining novel polymer architectures with small interfering RNA (siRNA) enables delivery of the self-assembled nanoparticles and has the potential to kill cancerous cells found in tissues or organs.

In 2013, Professor Monteiro published his work on developing a new polymer with the potential to act as a drug delivery device in the journal *Nature Communications*.

Researchers in his group developed the polymer system using strategies inspired by the influenza virus. The polymer is designed to mimic the virus's physical chemistry mechanism of escape from the cell.

The cationic polymer works by delivering siRNA to a cancerous cell line and then stopping the cancer from developing. The polymer releases its payload at the optimal time for the best therapeutic effect, is less toxic to the cells and has not shown any side effects.

The new drug delivery device has the potential to treat cancer independently without further chemotherapy treatment.

"siRNA has shown real promise in treating many types of cancers," Professor Monteiro said. "The research has the potential to aid in the treatment of infectious disease and genetic disorders."

Professor Monteiro's group has a patent on the device and hopes to move towards clinical trials in four years.

Another research field for the group is producing unique cyclic polymers for use in high temperature vesicle formation to enable researchers to understand and mimic cell membranes of microorganisms found in hot springs.

The physical properties of cyclic polymers are very different to every-day linear polymers used in most products.

The polymers are also used for inducing faster crystallisation in crystalline polymers.

Professor Monteiro collaborated with AIBN colleague Professor Peter Gray to build a thermoresponsive complex polymer architecture for expansion and release of human embroyonic stem cells.

Producing the type of cell source for investigating regenerative medicines and studying disease progression had been a significant challenge for researchers.

The new development of this pioneering polymer and work from AIBN was published in 2013 in Biomacromolecules.

In 2013, Professor Monteiro was an invited plenary speaker at a UNESCO event in South Africa; an invited lecturer and co-chair for the International Polymer Colloids Group meeting in Shanghai, China; and an invited speaker at the American Chemical Society conference in New Orleans in the US.

Professor Monteiro was appointed an editor for *European Polymer Journal* in 2013 and invited to join the e *Biomacromolecules* editorial board.

Monteiro Group
www.aibn.uq.edu.au/michael-monteiro

Complex system design and analysis

Professor Lars Nielsen **leads the systems and synthetic biology group and its development of experimental and computational tools to analyse and design complex biological systems.**

Applications are wide ranging, from microbial production of sustainable aviation fuels and chemicalsto production of blood cells for transfusion. Much of the research is conducted in close collaboration with industry.

Working closely with industry, the microbial systems biology team, headed by Dr Esteban Marcellin, has characterised non-model organisms to great depth. A large knowledge base has been developed for the erythromycin producer, *Saccharopolyspora erythraea*, revealing complex, high-order regulation during the switch from primary to secondary metabolism. The study also revealed 300 new coding genes and 350 ncRNA that were missed during conventional annotation.

The team started several new industrial collaborations: with Dow on propionic acid production (using Swiss cheese bacteria); with Zoetis on animal vaccines against *Clostridium tetani* (lockjaw bacterium); and with LanzaTech on gas fermenting bacteria capable of converting steel mill waste gas into valuable chemicals.

The Queensland Sustainable Aviation Fuel Initiative reached its first major milestone with the publication of a comprehensive techno-economic analysis of the production of jet fuel from algae, Pongamia or sugarcane.

The associated synthetic biology program, focusing on engineering limonene production from sugar into microbes, published several papers on novel engineering tools and a seminal paper on monoterpene toxicity.

The later demonstrated that monoterpenes like limonene cause phase toxicity via cell wall damage rather than the previously assumed membrane damage and greatly affects strategies adopted to develop tolerant strains.

Team member Tim Brennan presented his work at the three minute thesis competition and was the UQ 2013 people's choice and runner up. Team leader Claudia Vickers won the UQ Foundation Research Excellence Award.

The blood stem cell team licensed two patents to the Centre for Commercialisation of Regenerative Medicine (CCRM) in Toronto following demonstrations that AIBN protocols for large scale production of neutrophils and other blood cells for transfusion were compatible with CCRM's stem cell expansion technology.

If a preclinical evaluation is successful, the cells produced will be used as infection prophylaxis in patients undergoing chemotherapy. In collaborative work, red blood cells produced using the protocols were used to demonstrate that the malaria parasite, *Plasmodium falciparum*, preferentially infects blood cell progenitors.

Nielsen Group
www.aibn.uq.edu.au/lars-nielsen

Group Leader **Professor Matt Trau**
www.aibn.uq.edu.au/matt-trau

Grants advance rapid point-of-care diagnostics

Research at the interface between chemistry, nanotechnology, biology and medicine is bringing AIBN scientists closer to developing diagnostics, understanding disease epigenetics, and moving towards specialised treatment methods.

Group Leader **Professor Matt Trau's** research group is leveraging Australian Research Council (ARC) funding and a National Breast Cancer Foundation (NFCF) grant to isolate and detect circulating tumour cells, reduce the onset of advanced breast cancer, and develop rapid point-of-care diagnostics.

A collaboration with the Seattle Biomedical Research Institute and the University of Washington has support from the US National Institutes of Health worth $5 million to develop a point-of-care diagnostic device for gastrointestinal disease.

Professor Trau said 2013 had been a productive year in cementing collaborations and ensuring research projects had funding to make progress towards translating new discoveries and nanotechnology innovations into the clinic.

Tunable nano-shearing

Professor Trau and Dr Muhammad Shiddiky secured an ARC Discovery Project grant in 2013 to further understand and develop a new diagnostic technology, tunable 'nano-shearing', capable of detecting even low concentrations of tumour cells in cancer patients.

The device uses a phenomenon discovered in Professor Trau's research group involving fluids being electronically driven within a few nanometres of an electrode detector, filtering cells and molecules in blood, serum or platelets with much greater sensitivity and specificity than current circulating tumour cell detection technology.

The Discovery Project funding builds on an ARC Discovery Early Career Researcher Award (DECRA) to Dr Shiddiky in Professor Trau's lab, resulting in a patent and 15 publications about the highly innovative microfluidic technology's early development.

The nanoshearing effect engenders nanoscaled fluid motion near solid surfaces that can be used to simultaneously attract specific cells to a receptor, capturing them for examination, while washing away the wrong cells or molecules responsible for false positives.

The nanoshearing mechanism is tunable, meaning electric forces can be altered to capture any number of proteins, cells or DNA – each pointing to the potential presence of different cancers in the body.

"Progression of cancer is characterised by the invasion of cancer cells from the primary cancer site through the bloodstream and results in metastatic colonies in different parts of the body," Professor Trau said.

"The invading cancer cells typically account for a small number of all cells in blood, serum or platelets, making them difficult to isolate and use for diagnosis.

"Preliminary results suggest the tuneable control of the 'nanoshearing' phenomena in our microfluidic device can significantly improve cell capture and specificity performance."

Rapid, multiplexed point-of-care diagnosis

Dr Yuling Wang is using spectroscopy, plasmonic nanoassembly and microfluidics to develop a new-generation diagnostic technique with the support of an ARC DECRA, awarded in 2013.

She will establish a detection platform for rapid, highly sensitive, point-of-care diagnostics capable of detecting biomarkers that point to the presence of tumours in breast cancer patients without requiring lab analysis.

The project aims to develop surface-enhanced Raman spectroscopy of active super-plasmonic anisotropic nanoassemblies in a miniaturised flow-through system for rapid and ultrasensitive detection of multiple cancer biomarkers.

In developing a platform designed for ultra-sensitivety, Dr Wang aims to overcome current diagnostic disadvantages, including slow, labour-intensive techniques, the need for labs, and insensitivity resulting in a high percentage of false negatives.

Epigenetic diagnosis

Professor Trau's work on early detection of breast cancer involves clinical testing of biomarkers and creating a technology platform, with leadership of a multidisciplinary project using $5 million in NBCF funding.

Researchers in nanotechnology, epigenetics, oncology and pathology from around Australia are involved in a multi-faceted approach to better understanding breast cancer and improving outcomes for patients.

The project involves collecting biopsy and serum samples to determine how cancerous tumours respond to chemotherapy; understanding the disease's epigenetics; and using nanoscaled epigenetic-based biosensors for predicting progression.

Professor Trau's work draws on his experience as a cross-disciplinary researcher in academia and industry, including positions as a Fulbright Research Fellow at Princeton University in the US and a research scientist at the Dow Chemical Company and ICI Pty Ltd.

He has been a visiting professor at two of the world's largest cancer research centres – the Dana Farber Cancer Research Institute at Harvard Medical School, in Boston; and the Fred Hutchinson Cancer Research Centre, in Seattle.

Vinu Group
www.aibn.uq.edu.au/ajayan-vinu

Research generates international collaborations

nternational collaborations and publications have resulted from *Professor Ajayan Vinu's* research into the fabrication of nanoporous materials and their application, including for energy storage devices, in 2013.

Professor Vinu is using solar energy to develop carbon-neutral liquid fuels, with members of his research group developing a novel, stable and clean hybrid energy storage and conversion device that continuously supplies energy using naturally abundant resources such as sunlight, water and CO_2.

The device is composed primarily of nanoporous semiconductors including carbon nitrides, phosphides, polymers and carbon based materials, ensuring it is stable and are cost-effective for converting CO_2 into fuels such as methanol.

The research group will integrate the technology with direct methanol fuel cells, solar cells, batteries and supercapacitors to develop an ultimate energy storage and conversion device for the continuous supply of energy for mobile and automobile applications.

"This novel technology will not only reduce CO_2 levels but also provide a source of clean energy," Professor Vinu said. "Energy produced from the device will be used to reduce CO_2 molecules in a continuous process."

With continued support from a $1 million Australian Research Council (ARC) project grant, his research group continued research in 2013 on synthesis of nanoporous carbon nitride materials with extremely high surface areas, large pore volumes and tunable pore diameters.

The materials can be functionalised with semiconductor nanoparticles, and on nanostructured electrode materials for supercapacitors and fuel cells.

The group's research was published in several papers in 2013 in journals including Chemcatchem, Journal of Materials Chemistry and ChemPhysChem.

Professor Vinu collaborated with Professor Katsuhiko Ariga from the National Institute for Materials Science in Japan to design a nanosensor for risk management in cancer patients. The Japanese team used materials developed in Professor Vinu's group to make a device for selective sensing for carcinogenic aromatic amines. The work was published in the American Chemical Society's journal *Applied Materials and Interface*.

Professor Vinu initiated a collaboration with Professor Bharat Bhanudas Kale from the Centre for Materials for Electronics Technology in India in 2013 to investigate the photocatalytic properties of nanostructure materials developed at AIBN for hydrogen production. The collaboration led to a publication in the journal *Environmental Science and Technology*.

Professor Vinu is recognised as one of the top international researchers in the field of nanoporous materials.

He was awarded a Japan Society for the Promotion of Science senior invitation fellowship and elected a Fellow of the Royal Society of Chemistry and a Foreign Fellow of Maharashtra Academy of Sciences in 2013.

Professor Vinu was invited to be an Editor-in-Chief of *Advanced Porous Materials* and an editorial board member of *Scientific Reports*, a journal of Nature Publishing Group.

Wang Group
www.aibn.uq.edu.au/lianzhou-wang

Collaboration builds better batteries

Federal Government funding and collaborating with international industry has advanced research projects in *Professor Lianzhou Wang's* labs to overcome re-blocking of blood vessels and develop better batteries for hybrid cars.

Professor Wang's research group secured Australian Research Council (ARC) Linkage Project funding to develop high-performance electrode materials for lithium-ion batteries by using nanostructured carbons to modify the battery's cathode. The group is supplying the materials to Chinese collaborators from Leling Shengli New Energy.

Early career researcher Dr Sophia Gu received a Peter Doherty Biomedical Early Career Fellowship from the National Health and Medical Research Council to further work on a system for delivering medicines or genes to targeted sites where blood vessels have re-narrowed after angioplasty surgery.

Both projects are part of a principal research focus in Professor Wang's research group to address major global challenges of securing clean, sustainable energy and water supplies and advancing innovative, equitable health care.

High-performance electrode materials

Dr Denisa Jurcakova, Professor Wang and Professor Max Lu are heading research involving modifying cathodes with nanostructured carbons to increase their electrical conductivity and enhance their power and energy performance.

The relationship between synthetic conditions, structure and electrochemical performance will be established to underpin innovative technologies in low carbon emission transportation and efficient energy storage systems for renewables.

Using $480,000 in ARC funding, the research will be conducted in collaboration with UQ's School of Chemical Engineering and involve an AIBN delegation visiting Leling Shengli's scale-up facilities.

"The project will lead to a new family of cathode materials for li-ion batteries with high energy and power densities," Professor Wang said.

"Outcomes will include creating new knowledge in the fields of functional materials and potentially valuable intellectual property on new methods and processes for making novel lithium-ion batteries," Professor Wang said.

The project addresses two significant issues: using clean energy and reducing carbon emissions.

Anti-restenotic drug delivery system

Dr Gu aims to overcome side effects and maximise the benefit of therapies targeting restenosis, a re-blocking of blood vessels following surgery to remove clots.

Surgery frequently injures vessel walls, causing restenosis at the site. Therapeutics and stents developed to prevent restenosis often have side effects.

Combining knowledge and techniques in nanotechnology, biomedicine and vascular biology, Dr Gu is working closely with supervisor Associate Professor Zhi Ping (Gordon) Xu on a safe, inexpensive, efficient delivery system for therapeutics, genes or peptides.

The delivery system will consist of a nano-scaled vector, a target antibody and therapeutic cargoes, including drugs, genes and peptides.

The nano-vector aims to shield the therapeutic cargo from attack in the blood stream, sustain the cargo's release over time and increase cell uptake efficiency.

Target antibodies will direct the nano-vector to the injured vessel wall, where two important cells in the restenosis process, vascular smooth muscle cells and endothelial cells, are targeted and their growth modified.

Dr Gu said the research would involve a series of in vitro and in vivo testings of the delivery system to determine its efficacy and safety.

"The research presents a potential new range of therapeutic agents that prevent patients from developing clots after surgery, lower morbidity and mortality, and reduce the economic burden for health care providers and government," she said.

The research is under the supervision of Professor Wang, a materials scientist with an international reputation in characterisation and application of functional nanomaterials for use in renewable energy conversion and storage systems, including photocatalysts; rechargeable lithium batteries; and new generation solar cells.

Professor Wang is an ARC Future Fellow; the recipient of an STA Fellowship of Japan and an ARC Queen Elizabeth II Fellowship; and has attracted more than 12 ARC grants, two CSIRO Flagship Cluster project grants and major Queensland Government funding.

Wells Group
www.aibn.uq.edu.au/christine-wells

Web portal gains traction

The portal Stemformatics.org gained international traction in 2013, becoming a widely-adopted resource for the stem cell community and resulting in collaborations and publications for the research group of AIBN *Associate Professor Christine Wells*.

The portal is a public and proprietary database of experiments describing human and animal stem cells and how they differentiate to become more mature cells, tissues and organs.

Associate Professor Wells and her research group worked with collaborative entity Stem Cells Australia to support researchers using the portal for visualisation of gene expression, gene set analysis and community-annotated stem cell gene lists.

Stemformatics grew from a portal with about six users to more than 1200 visitors in 2013, including stem cell researchers from Canada, the US and UK, Japan, Germany, India and the Netherlands.

The portal's ability to share and visualise data derived from different laboratories in the stem cell research community – or under different experimental conditions – was highlighted in a publication in *Stem Cell Research* in 2013.

One research collaboration involving AIBN, CSIRO, Monash University, UQ's Institute for Molecular Bioscience and the University of Melbourne, used the portal to identify unsafe human induced pluripotent stem cell lines using a robust surrogate assay for pluripotency and published results in the journal *Stem Cells*.

Another group from Kyoto University collaborated directly with Associate Professor Wells, sending two researchers to AIBN to be trained in analysis, enabling a deeper understanding of data gathered relating to stem cell-drug interactions.

With a joint appointment as reader at the University of Glasgow's Institute of Infection, Immunity and Inflammation, Associate Professor Wells has seen her Scottish colleagues increasingly using Stemformatics to further their research.

A significant amount of traffic to the portal came from Canada in 2013, reflecting the interest from collaborators involved in Project Grandiose, a multidisciplinary initiative aiming to understand how cells reprogram or revert to their original cell type.

Associate Professor Wells said biologists around the world recognised Stemformatics as a beneficial enabling platform, easy to navigate without specialist training and a resource accessible without the need for direct collaborations being established.

"It enables a sharing of information with the stem cell community as a whole and yet allows me the freedom to target collaborations with researchers who have interests directly aligned with mine."

The portal strengthens the focus Associate Professor Wells places on international collaboration, including those with Professor John Quackenbush from the Dana Farber Cancer Research Institute in Boston, US; Professor Winston Hide from the Harvard School of Public Health; Dr Jessica Mar from the Albert Einstein School of Medicine, New York; Professor Albin Sandelin from the University of Copenhagen, Denmark; and Professor Michael Rehli from University Hospital Regensburg, Germany.

Associate Professor Wells has a senior role in the genome consortium Functional Annotation of the Mammalian genome (FANTOM), with involvement since its inception at Riken Omics Sciences Centre in Yokohama, Japan in 1998.

She is on the editorial board of the open access journals *Plos Genetics*; *Genomics, Proteomics & Bioinformatics*; and *Biology Direct*. She is also an editorial board member of the journals *Differentiation, Genomics and Genomics Data*.

Collaborations tackle diagnosis and fabrication

Australian Research Council (ARC) Australian Professorial Fellow and Group Leader *Professor Andrew Whittaker* collaborated with industrial and international partners during 2013 to work towards improving diagnosis and treatment of disease including cancer; and fabricating the next generation of computer chips.

Bringing together polymer chemistry, nanotechnology, photolithography, biomaterials science and magnetic resonance, Professor Whittaker's research group aims to develop innovative solutions to major health and nanotechnology challenges.

Molecular imaging

Professor Whittaker was part of a successful bid to secure $2 million in Australian Cancer Research Foundation funding for a Molecular Oncology Translational Imaging Facility, dedicated to improving patient outcomes and enabling significant expansion of oncology research.

The facility will operate within the UQ Centre for Clinical Research (UQCCR) at the Royal Brisbane and Women's Hospital research precinct and involve leadership roles from researchers at CSIRO, the QIMR Berghofer Medical Research Institute, UQCCR and AIBN.

Professor Whittaker will work collaboratively towards developing a hybrid imaging technology combining elements of magnetic resonance imaging (MRI) and positron emission tomography (PET) to improve and validate the present generation of oncology screening platforms.

The platforms have the potential to significantly impact on diagnosis and treatment of head and neck, breast, ovarian and prostate cancers.

Diagnosis and drug delivery are the focus of a project aiming to develop novel theranostic particles using a $370,000 ARC Discovery grant.

Associate Group Leader and ARC Future Fellow Dr Kris Thurecht will use the funding to work with the University of Nottingham's Professor Cameron Alexander and the QIMR Berghofer Medical Research Institute's Dr Glen Boyle to investigate how the chemistry and morphology of nanomaterials affect a cell's ability to recognise the nanoparticles.

The collaboration will use a melanoma model to determine how nanomaterials can be designed to interact in a specific manner with cells and deliver a drug payload to diseased cells.

In a separate project, Professor Whittaker and Dr Thurecht will use $545,000 in funding to collaborate with prostate cancer expert Professor Pamela Russell from Queensland University of Technology on early detection technologies.

The collaboration will use the National Health and Medical Research Council (NHMRC) project grant to investigate a highly-sensitive molecular imaging agent developed in Professor Whittaker's research group for detecting prostate cancer.

Photolithography

ARC Linkage project funding in 2013 has enabled polymer chemists in Professor Whittaker's research group to work with electronic materials scientists from the Dow Chemical Company to develop new classes of highly sensitive polymers for faster, smaller, cheaper computer chips.

The collaboration has secured a grant of $360,000 to develop a novel, broadly-based platform of materials that differs from current technologies relying on chemical amplification processes to manufacture integrated circuits.

A greater understanding of the material's structure and effect on photolithographic performance is the focus of another ARC grant involving Professor Whittaker, Dr Kevin Jack and Dr Hui Peng.

Additional ARC Discovery funding of $420,000 will investigate how a resist's structure can vary depending on its thickness; the effect of uneven distribution of diluting agents; and the impact of additives on composition and, ultimately, performance.

ARC Discovery funding has also been provided to support ARC Future Fellow Associate Professor Idriss Blakey and Dr Jack in developing photoreactive block copolymers so sensitive that exposure to light can generate patterns on the chips.

The smaller feature size and an ability to control their placement will result in improved computing capacity and significant improvement in energy efficiency.

Whittaker Group
www.aibn.uq.edu.au/andrew-whittaker

Wolvetang Group
www.aibn.uq.edu.au/ernst-wolvetang

Disease models test regenerative medicines

Researchers working with AIBN *Associate Professor Ernst Wolvetang* continued investigating chromosome 21 in 2013, building on their knowledge of Down syndrome and Alzheimer's disease.

Associate Professor Wolvetang's research involves reprogramming human cells to generate in vitro models of disease and animal cells for testing cell-based regenerative medicine approaches.

He is leading the derivation of footprint-free induced pluripotent stem cells (iPSC) in Australia, with a focus on neuronal, renal and cardiac diseases.

Researchers working with Associate Professor Wolvetang at AIBN turn skin and blood cells from people with genetic diseases into stem cells.

The research gives unprecedented insight into the genetic and epigenetic basis of disease and enables drug screening, particularly when combined with use of microfluidic devices.

The aim is to identify gene regulatory network changes that underlie prevalent, rare and novel brain diseases and subsequently focus on bioinformatically predicted targets using stem cell-based assay platforms.

Associate Professor Wolvetang's research group works closely with genome biologists, tissue engineers and nanoparticle scientists.

While investigating chromosome 21 genes, the researchers built on a finding that neurons derived from Down syndrome iPSCs showed changes similar to those found in patients with Alzheimer's disease.

The research attracted National Health and Medical Research Council (NHMRC) funding and sparked a collaboration with Professor Hiroaki Kitano from the Systems Biology Institute in Tokyo, Japan.

Associate Professor Wolvetang's research group established clustered regularly interspaced short palindromic repeats genome editing technology to interrogate the gene regulatory networks underlying Alzheimer's disease pathology in Down syndrome, in collaboration with AIBN Associate Professor Christine Wells.

Correcting or introducing disease mutations into the DNA from reprogrammed stem cells combined with in-depth gene expression analysis reveals the complexity of gene regulatory networks underlying human development and disease.

"The research is vital for a country with an ageing population, presenting a significant economic and financial burden in the future," Associate Professor Wolvetang said.

On a more fundamental level, the research group is unravelling the molecular basis of cognition and memory using in vitro human stem cell-derived neurons and astrocytes, and helped identify a long non-coding RNA potentially involved in schizophrenia.

"At a molecular level we still know very little about the sequence of events in neurons that ultimately lead to memory formation and cognition," Associate Professor Wolvetang said. "We are interested in recapitulating early brain developmental steps using various bioengineering approaches."

Associate Professor Wolvetang continues to work closely with Professor Martin Lavin from UQ's Centre for Clinical Research and patient advocacy organisation BrAshAT on the rare disease ataxia-telangiectasia.

The group has produced the first hindbrain cells from iPSC that should enable unprecedented insights into the reasons for malfunctions in that form of the disease.

Other developments include a collaboration with Professor Melissa Little from UQ's Institute for Molecular Bioscience on novel renal diseases; and with her colleague Dr Ryan Taft on a new class of poorly understood leukodystrophies.

By leveraging the power of iPSC technology, genome editing and in vitro differentiation strategies, the group aims to understand the basis of disease. Such tools are set to enable development of new and better therapeutics and cell-based therapies to treat a range of debilitating diseases.

Associate Professor Wolvetang is a chief investigator in the Australian Research Council's special research initiative Stem Cells Australia; and the recipient of three NHMRC project grants and a UQ Collaboration and Industry Engagement Fund grant.

Yu Group
www.aibn.uq.edu.au/michael-yu

Breakthrough technologies patented

AIBN research into functional materials synthesis and its applications in drug and vaccine delivery, battery materials and water treatment made significant progresses in 2013, with two breakthrough technologies patented and published.

Professor Chengzhong (Michael) Yu is using his internationally recognised expertise in materials science to head an AIBN research group making rapid progress in developing new technologies using nanomaterials.

New nanomaterials for drug delivery

Professor Yu received $450,000 in Australian Research Council (ARC) funding in 2013 to lead a project designing nanoparticles that overcome poor stability, low efficacy and unwanted toxicity associated with some medical delivery methods.

His research group developed a new family of silica-based nanoparticles for enhancing the solubility of hydrophobic drugs and targeted drug delivery of therapeutic molecules to cancer cells.

The work was published in the journals *Advanced Materials* and *Journal of the American Chemical Society* in 2013.

"There is a lack of safe and efficient carriers, developed from nanomaterials, that deliver genes or therapeutic drugs into cells," Professor Yu said.

"The delivery of various therapeutic molecules into cells is crucial in modern medicine. It is an ongoing challenge to develop non-viral carrier systems with good safety and high delivery efficiency.

"We have been working on a new concept that can be applied to the generation of a new material platform for gene and pharmaceutical delivery."

Nanomaterials for lithium-ion batteries and water treatment

Professor Yu's research into functional nanomaterials extends to clean energy and environmental protection, with projects in developing new generation lithium-ion batteries and toxin removal from water.

Lithium-ion batteries have monopolised the market in power supplies for portable electronics since their commercialisation in 1990 and are now being investigated for sustainable transport and stationary energy storage applications.

Professor Yu and AIBN colleague Dr Liang Zhou have developed an advanced technology to produce electrode materials used in lithium-ion batteries at a low price, with high capacity and rate performance, and safety for emerging applications.

The research resulted in the technology being patented in 2013 and published in the journal *Chemical Communications*.

"We use a simple, scalable spray-drying method to prepare both anode and cathode materials with finely controlled nanostructures to address critical issues such as material pulverisation, electrode disintegration and capacity fading due to the large volume variation during the lithiation and de-lithiation process," Professor Yu said.

"Our strategy could extend to the fabrication of various functional nanomaterials with a broad spectrum of applications."

Professor Yu's research group engineered functional nanomaterials to remove toxins from contaminated water to combat the global threat of water contamination and eutrophication.

Researchers working with Professor Yu developed new strategies to prepare low-cost, high-performance absorbents for removing toxic cations and anions, through understanding the chemisorption mechanism at the nanoscale and the relationship between nanostructure and adsorption capacity.

The functional nanomaterials developed had practical applications for removing phosphates and arsenic from contaminated water.

Industrial collaboration

Collaborations with industry were boosted in 2013, with Professor Yu's research group forging links with FMC Corporation through a UQ Collaboration and Industry Engagement Fund.

With Dr Neena Mitter from the Queensland Alliance for Agriculture and Food Innovation, the group started a contracted research in collaboration with Elanco to develop new technologies for improved animal health.

Appointments

Senior AIBN researchers have been appointed to prestigious positions in 2013, recognising their expertise, scientific contribution, leadership and strengths in collaboration.

Professor Max Lu

Professor Max Lu's outstanding contribution to science was recognised in 2013 with his appointment as an Australian Academy of Science Fellow.

The appointment recognises significant contributions in materials science and chemical engineering, including new insights into the surface chemistry and modifications of nanoporous materials; molecular engineering of membranes; and efficient photocatalysis for clean energy and water.

Professor Lu was one of 20 Fellows elected to the academy, comprising Australia's leading research scientists. The academy recognises and supports research excellence, advises government, sponsors scientific conferences, publishes scientific books and journals, fosters international scientific relations and promotes science education and public awareness.

Fellows are elected by academy members.

Professor Anton Middelberg

UQ appointed internationally recognised chemical engineer Professor Anton Middelberg as Pro-Vice-Chancellor (Research and International), with leadership in key aspects of the university-wide research and internationalisation portfolio.

He will support the Deputy Vice-Chancellor (Research) in improving UQ's research performance and have oversight and policy direction of the university's programs of funding, training and professional development for early career researchers.

Professor Middelberg will be the designated person for research integrity under the Australian Code for the Responsible Conduct of Research; will work with the Deputy Vice-Chancellor (International) to develop international strategy linked to research; and will advance UQ's strategic partnerships in parts of Europe, Asia and South America.

He remains an AIBN Group Leader, overseeing team research in engineering, biosurfactants and bio-inspired nanomaterials.

Professor Justin Cooper-White

Chemical engineer and regenerative medicine scientist Professor Justin Cooper-White was appointed a CSIRO Office of the Chief Executive (OCE) Science Leader.

The five-year position will see Professor Cooper-White split his time between CSIRO and his roles at AIBN and UQ's School of Chemical Engineering.

Through the appointment, he will continue research to enhance, repair and ultimately replace damaged or diseased tissues including bone, cartilage and heart muscle.

The position provides high-performing researchers with the resources and freedom to deliver outstanding scientific impacts to CSIRO and the Australian community.

"The OCE Science Leader position will allow me to work closely with CSIRO people with significant expertise in material synthesis, bio-surface engineering, and cell and matrix biology," Professor Cooper-White said.

Professor Peter Halley

Professor Peter Halley was appointed Head of UQ's School of Chemical Engineering in 2013, while remaining an AIBN Group Leader.

He will oversee the school's provision of programs and leadership in chemical engineering education, research and development; and expert consulting to support the process industries, especially in the disciplines of chemical, biological, environmental and metallurgical engineering, integrated water management and energy studies. The school has a staff of 35 academics, including 17 professors.

Professor Halley will continue collaborating with the emerging leaders in his AIBN research group, such as Dr Bronwyn Laycock, Dr Paul Luckman and Dr David Xie, working on bio-based sustainable polymers and materials.

His school appointment is for 2014 to 2016.

Assoc. Professor Christine Wells

Associate Professor Christine Wells holds a joint appointment at the University of Glasgow's Institute of Infection, Immunity and Inflammation, providing her research with a broader clinical and translation focus, particularly in the area of immune regulation.

The bioinformatics and collaboration know-how Associate Professor Wells brings will be used to increase the capacity of Glasgow researchers working on diverse projects, including parasitic infections in Africa; acute tissue damage from coronary blockages and cerebral stroke; and chronic inflammation from rheumatoid arthritis.

Her AIBN research group will benefit from stronger clinical linkages and specialist knowledge in immune cell biology developed in Glasgow.

"We are working towards building new models of collaboration and data integration that will benefit the international community working to solve the clinical problems associated with chronic infection or chronic inflammatory diseases," Associate Professor Wells said.

Associate Group Leaders

Associate Professor Idriss Blakey

ARC Future Fellow and Associate Group Leader

Research: Rational design, synthesis and self assembly of functional polymers and nanomaterials for nanofabrication, sensors and biomedical imaging agents.

Associate Professor Idriss Blakey is an Australian Research Council (ARC) Future Fellow (2010-2014), lead chief investigator on an ARC Discovery project and a chief investigator on an ARC Linkage project in partnership with the Dow Chemical Company.

His contributions to polymer science and nanotechnology have been published by leading publishers including Wiley, the American Chemical Society and the Royal Society of Chemistry. Associate Professor Blakey is a regular reviewer and adjudicative reviewer for more than 20 journals and for granting bodies including the ARC, the Wellcome Trust, the US Department of Energy and the Australian Synchrotron.

He has been lead chief investigator on three other ARC Discovery grants and chief investigator on three other ARC Linkage projects grants in partnership with Intel Corporation and Sematech, a consortium of leading semiconductor companies.

Associate Professor Blakey has been a recipient of a Queensland Government Fellowship, working with Sematech on developing advanced polymers for use in computer chip manufacture. He has one fully granted patent and two patents at the PCT stage.

Dr Simon Corrie

ARC Discovery Early Career Research Award Fellow and Associate Group Leader

Research: Design, fabrication and testing of microprojection array technology for rapid, multiplexed biomarker detection via skin application.

Dr Simon Corrie is a recipient of the ARC's prestigious Discovery Early Career Researcher Award (2013-2016).

He has developed several molecular technologies with applications in diagnostics, publishing the work in Royal Society of Chemistry and American Chemical Society journals and presenting it at international conferences. He regularly reviews journal articles for a range of publications and reviews ARC fellowship and grant applications.

After completing his PhD in physical chemistry, Dr Corrie received an American Australian Postdoctoral Fellowship in 2007 to work in Professor Nancy Kiviat's HPV Research Laboratory at the University of Washington in Seattle, gaining experience in developing clinically-relevant diagnostic technologies. Dr Corrie returned to Queensland as a lead chief investigator on an ARC Discovery project and Smart Futures Fellowship to join Professor Mark Kendall's research group at AIBN, developing novel diagnostics technologies based on micropatches applied to the skin.

Dr Annette Dexter

ARC Future Fellow and Associate Group Leader

Research: Design and bioproduction of helical peptides as functional surfactants and responsive gelling agents for cell growth and drug delivery; specific ion effects in the control of selfassembling systems.

Dr Annette Dexter is a founder and ongoing consultant to AIBN's first start-up company, Pepfactants Pty Ltd.

At the TechConnect Summit in Boston in 2006, Pepfactants received an Emerging Technology Award. The company won the Queensland Government's Best Technology Award and the UQ Business School Enterprize Competition in the same year.

Dr Dexter is sole or joint inventor on three patents comprising the key intellectual property of Pepfactants. She has presented data at two national meetings of the American Chemical Society, the seventh World Congress of Chemical Engineering and the annual meeting of the American Institute of Chemical Engineers.

Reports in Australasian Science, New Scientist, Materials Today and The Economist have highlighted Dr Dexter's work and a video of rapid-phase emulsion separation has been receiving hits on YouTube.

AIBN recognises the work of early and mid-career researchers through the appointment of Associate Group Leaders. They are senior members of the AIBN research community and are fundamental to the institute's ongoing success and long-term viability. Associate Group Leaders' activities may develop to a level where they can be considered for promotion to AIBN Group Leader.

Dr Trent Munro

Queensland Government Fellow and Associate Group Leader

Research: Production of complex therapeutic recombinant proteins known as biologics or biopharmaceuticals and engineered scaffolds for stem cells.

Dr Trent Munro is a Queensland Government Fellow. He has given presentations at many national and international conferences. He won UQ's Trailblazer competition in 2011 and was awarded the Sanofi-Aventis Vision Award for Better Health at the national final. Dr Munro obtained his PhD in protein biochemistry from UQ in 2001.

He completed postdoctoral studies at the Department of Cell Biology, Harvard Medical School; and the Wellcome Trust and Cancer Research UK Gurdon Institute, at the University of Cambridge. Dr Munro returned to Australia in 2006 to take up a position at AIBN, where he is an Associate Group Leader and a founding member of the National Biologics Facility.

Dr Munro has published widely in the fields of mammalian cell therapeutics and stem cell bioengineering.

In 2013, Dr Munro accepted a position at Amgen in the US. Amgen is a leader in biotechnology and is involved in the discovery, development, manufacturing and delivery of innovative human therapeutics.

Dr Muhammad Shiddiky

ARC DECRA Fellow and Associate Group Leader

Research: Microfluidic devices and electrochemical nanobiosensors for detecting and diagnosing cancer and other diseases.

Dr Muhammad Shiddiky is an ARC DECRA Fellow. Before joining AIBN, he was a postdoctoral research fellow in the School of Chemistry at Monash University. He has published regularly in high-impact and high-ranking journals in chemistry, miniaturised systems and electrochemical biosensors, including *JACS, Analytical Chemistry, Lab on a Chip, Scientific Reports, Chemistry: a European Journal, Langmuir and Chemical Communications*. Dr Shiddiky has maintained an average citation count for his referred publications of more than 20 per publication. In 2014, Dr Shiddiky received an ARC Discovery grant as joint chief investigator with AIBN Group Leader Professor Matt Trau. He is the recipient of a 2010 UQ Postdoctoral Research Fellowship and 2011 UQ ECR Award.

Dr Shiddiky is co-editor of two edited books published by Nova Science Publishers, US; and lead author of three book chapters and a major review article. His contributions in the research field have been acknowledged with invitations to present at eight national and international conferences and be joint guest editor for a special issue of the international journal Sensors. Dr Shiddiky is a regular reviewer for more than 15 top-ranking journals in the fields of chemistry, miniaturised systems and electrochemical biosensors and for granting bodies including the ARC. He has two patents at the PCT stage.

Dr Kristofer Thurecht

ARC Future Fellow and Associate Group Leader

Research: Design and synthesis of architectural polymers applied to molecular imaging and drug delivery in nanomedicine.

Dr Kristofer Thurecht is an ARC Future Fellow with appointments at AIBN and UQ's Centre for Advanced Imaging.

Dr Thurecht has been recognised for scientific excellence with a 2012 Queensland Young Tall Poppy Science Award and a 2010 UQ Foundation Research Excellence Award for his work in developing polymer 'theranostics'. Since obtaining his PhD in 2005, he has received four competitive national and international fellowships, including an Australian Postdoctoral Research Fellowship in 2008; and simultaneous awards of a British Ramsay Centenary Fellowship and an 1851 Research Fellow in the UK in 2007.

He has contributed scientific and review articles to leading journals in his field, including invited articles in the Emerging Young Investigator issue of Chemical Communications and a Young Talent article in Macromolecular Chemistry and Physics. Dr Thurecht has been chief investigator on grants from various funding bodies, including ARC Discovery grants; ARC Linkage Grants, with international pharmaceutical company Eli Lilly; a National Health and Medical Research Council (NHMRC) grant; funding from the Prostate Cancer Foundation of Australia and the National Breast Cancer Foundation; and he is chief investigator within the newly established ARC Centre of Excellence in Convergent Bio-nano Science and Technology. He is co-inventor on two patents.

Associate Professor Zhi Ping (Gordon) Xu

ARC Future Fellow and Associate Group Leader

Research: Clay nanomaterials for drug delivery and vaccines.

Associate Professor Zhi Ping (Gordon) Xu is an ARC Future Fellow (2013-2016). Since 2004, he has received several fellowships and awards, including an ARC Australian Postdoctoral Fellowship (2005-2007), an ARC Australian Research Fellowship (2008-2012) and the UQ Foundation's Research Excellence Award (2009).

Associate Professor Xu and his colleagues have received funding from the ARC and the NHMRC totalling more than $6.5 million. Associate Professor Xu is an ARC and a NHMRC referee.

ARC Fellowships

Four AIBN researchers received Australian Research Council (ARC) fellowships in 2013 to further their work in polymer synthesis for regenerative medicine, vaccination, diagnostics and developing clean fuels.

Dr Zhongfan Jia

Dr Zhongfan Jia received a Future Fellowship to develop a method for sculpting three-dimensional polymer nanostructured scaffolds that control the growth of stem cells for use in regenerative medicine.

The scaffolds are designed to form reversible gels and through surface chemical functionality provide extracellular microenvironment cues to encourage cell growth and maintain pluripotency.

Dr Jia's research will involve creating three-dimensional scaffolds that interact with cells in a controlled way and generate fundamental knowledge for cellular interactions with scaffolds on two- and three-dimensional environments.

The method will have the potential to generate large quantities of a patient's own stem cells and ultimately be used to generate individualised tissues and organs on demand with no rejection issues.

Dr Chenghua Sun

Dr Chenghua Sun was awarded a Future Fellowship to investigate the potential of red titanium and solar energy to produce hydrogen from water for use as a clean fuel source.

Using computational science approaches, the research aims to develop high-performance photocatalysts for hydrogen production and gain a greater understanding of central issues in solar energy, such as charge recombination, transport and transfer.

Dr Sun said the materials had the potential to improve the performance of solar energy and make it a viable, sustainable energy alternative to coal, oil and gas.

"The powerful capacities offered by computational modelling will lead to more efficient materials development," he said.

Dr Frank Sainsbury

Biomolecular engineer Dr Frank Sainsbury received a Discovery Early Career Research Award (DECRA) to develop a nano-container capable of delivering vaccines to specific immune cells and stimulate a broadly protective response against infectious diseases such as influenza.

Dr Sainsbury aims to engineer virus-like particles particles, forming them as spherical shells made from structural virus proteins with an interior cavity that can carry immunogenic antigens to specific immune cells.

He said the particles had the potential to simplify manufacturing, leading to rapid production at lower cost, and make new-generation vaccines more readily available around the world, including in developing countries.

"Due to the continued threat of emerging and re-emerging diseases, there is a need for more effective vaccine strategies," he said.

"A prominent example of infectious disease for which new vaccine paradigms are required is influenza. Despite the development of new vaccines for this pathogen, every year influenza kills 250,000 to 500,000 people during annual seasonal epidemics with the potential for this number to rise to millions in pandemic instances."

Dr Yuling Wang

Dr Yuling Wang will use her DECRA to establish a detection platform for rapid, highly-sensitive, point-of-care diagnostics capable of detecting biomarkers that point to the presence of tumours in breast cancer patients.

The research will use spectroscopy, plasmonic nanoassembly and microfluidics to develop a new-generation diagnostic technique that will give breast cancer patients a diagnosis without the need for lab analysis.

"Current diagnostic techniques are labour-intensive, slow and can be insensitive with a high percentage of false negative results," Dr Wang said.

"A simple, sensitive diagnostics test, with multiplexing capability, bypassing the need for intensive laboratory processing, would result in faster diagnosis in timecritical situations and significant savings in costs."

Future Fellowship funding aims to address opportunity gaps for mid-career researchers and academics, many of whom would otherwise be lost to international competitors. The DECRA scheme aims to provide more focused support and create more opportunities for early career researchers.

Awards flow to AIBN

AIBN staff with expertise in areas as wide-ranging as industry-research partnerships, materials chemistry, systems and synthetic biology, and protein expression have been recognised with awards in 2013.

AIBN Adjunct Professor and board member **Robert McCarthy AM** was recognised for service to public administration in Queensland, particularly in economic development, agriculture and natural resource management, with an AM in the Queen's Birthday Honours List.

While Director-General of the Department of State Development and Innovation, Mr McCarthy laid the groundwork for diversifying Queensland's economy and developing new industries based on science and innovation.

Since he retired from the department, Mr McCarthy has continued the work at AIBN, with a key role in progressing research efforts in biofuel technology and securing funding for industry-research partnerships.

Mr McCarthy was instrumental in the Queensland Sustainable Aviation Fuel Initiative expanding beyond AIBN to include major international companies such as Boeing, GE and Virgin Australia.

UQ Deputy Vice-Chancellor (Research) and AIBN Group Leader **Professor Max Lu** was among only six Queensland Greats, named at a Queensland Week ceremony in 2013, in recognition of his significant contributions to society.

Professor Lu is known for his work on nanoparticles and nanoporous materials for clean energy and environmental technologies.

UQ Vice-Chancellor and President, Professor Peter Høj, congratulated Professor Lu, saying he projected Queensland innovation on to the world stage and attracted international investment to the state's research and development.

Chemical engineer **Dr Simon Corrie** was recognised for scientific excellence with a 2013 Queensland Young Tall Poppy Science Award.

The award recognised Dr Corrie's work in Professor Mark Kendall's AIBN lab, aiming to combine materials chemistry with molecular biology to create an affordable, widely available diagnostic device to test blood faster, without a need for needles and syringes.

The Australian Institute of Policy and Science created the Tall Poppy Campaign to recognise and celebrate Australian intellectual and scientific excellence and encourage younger Australians to follow in the footsteps of the nation's outstanding achievers.

Dr Claudia Vickers won a UQ Foundation Research Excellence Award for her work applying synthetic biology to develop a bio-production process for limonene, a chemical found in lemons and other citrus fruits that can be used to make clean, renewable jet fuel.

The award recognises demonstrated excellence and promise of future success in research, and the leadership potential of individual researchers in fields where there is evidence of strategic importance and significance.

Dr Vickers will use the funds to continue work in modifying baker's yeast to produce the synthetic limonene in Professor Lars Nielsen's AIBN lab, as part of a project converting sucrose to useful bioproducts.

Dr Hui Peng's work to improve medical implants and combat infection, conducted in AIBN Professor Andrew Whittaker's lab, was given a boost in 2013, with a UQ Postdoctoral Fellowship for Women.

Dr Peng will use more than $300,000 in funding to design polymer coatings for biomedical devices, potentially including artificial hips or knees; screws and plates; pacemakers; cochlear implants; and drug delivery devices such as stents; to control their interactions with the body's cells.

Biomedical devices are designed to support, repair or protect the human body. They can sometimes cause unfavourable responses in the body, including infection, inflammation and rejection.

Dr Hui Peng

The fellowship assists eligible women to re-establish their academic research careers after a career break or interruption.

The **Protein Expression Facility (PEF) team** based at AIBN received the UQ Chancellor's Award for Team Excellence, as part of the university's acknowledgement of the exceptional work of professional staff.

PEF team members Cindy Chang, Bradley Ryan, Christopher Munro and Emilyn Tan received the award from UQ Chancellor John Story and Vice-Chancellor Professor Peter Høj in February.

The awardees were selected on criteria including quality service; process improvement and innovation; and knowledge transfer and community connection.

Funding

AIBN researchers have been successful in securing funding in 2013 from government, a research fundraising body and philanthropic organisations.

In a highly competitive environment, the funding successes were a measure of AIBN's research excellence, industry focus and a dynamic, multidisciplinary research environment.

Australian Research Council

AIBN researchers are leading projects that attracted nine Australian Research Council (ARC) Discovery Project (DP) grants totalling more than $5.7 million.

Professor Debra Bernhardt will lead work on two DP grants totalling $810,000, including investigations of heat flow in lithium ion batteries which resulted in aircraft being grounded; and the properties of nonequilibrium steady states.

Professor Michael Yu will use $450,000 to lead research in designing safe, efficient nanoparticles for targeted delivery in gene therapy, cancer treatment and bio-imaging.

Professor Michael Monteiro will design polymer nanoparticles that interact with, or mimic, biological systems using new synthetic approaches to introduce function with predictable behaviour using $420,000.

Professor Lars Nielsen and **Dr Claudia Vickers** have secured $376,000 to understand biochemistry inside microbial cells so they can engineer the cells to produce industrially useful biochemicals, including biofuels, pharmaceuticals and rubbers.

Dr Kris Thurecht will lead a $370,000 research collaboration aiming to manipulate nanomaterial properties to develop better diagnostic, treatment and monitoring capabilities for patients.

Professor Justin Cooper-White and **Dr Jess Frith** will work with collaborators on a $365,000 project aiming to drive adult stem cells, called mesenchymal cells, to regenerate damaged or diseased tissue using smart biomaterials.

Associate Professor Idriss Blakey aims to use light to control the nanostructure of a new generation of materials used in high-performance computer chips, hard drives, batteries and membranes, with $360,000 in funding.

Professor Matt Trau and **Dr Muhammad Shiddiky** will share $330,000 to develop a new diagnostic technology capable of detecting even low concentrations of tumour cells in cancer patients.

Two AIBN researchers received ARC Discovery Early Career Research Awards and two were awarded Future Fellowships.

Centre of Excellence

The Queensland node of the Centre of Excellence in Convergent Bio-Nano Science and Technology will be established at AIBN, using a share of $26 million in ARC funding to enable integrated, multi-disciplinary research to be conducted for seven years.

AIBN **Professor Mark Kendall** will be node director and oversee research projects that bring science disciplines together to understand living systems, such as the human body, with nanoscale precision.

Researchers involved include AIBN's **Professor Andrew Whittaker**, **Dr Thurecht** and **Dr Simon Corrie**; and **Professor Rob Parton** from UQ's Institute for Molecular Bioscience.

National Health and Medical Research Council

Researchers will share more than $2.3 million in National Health and Medical Research Council (NHMRC) funding to advance medical initiatives.

Associate Professor Ernst Wolvetang will lead a project with AIBN colleague **Associate Professor Christine Wells**, using $756,000 to investigate gene networks that cause Alzheimer's disease in Down syndrome patients.

Using genome editing technology, the researchers will study induced pluripotent stem cells with an additional chromosome 21, characteristic of people with Down syndrome, to determine if editing the chromosome can halt Alzheimer's onset.

Associate Professor Wells secured $586,000 in funding as lead investigator to determine the role of the C-type lectin Mincle protein in cardiovascular disease.

Working with colleagues from UQ and Monash University, she aims to protect heart and brain tissues damaged during a stroke or heart attack by blocking Mincle to prevent its damaging influence.

Professor Cooper-White will lead research to engineer an osteochondral tissue to repair cartilage defects using $423,000.

He will lead a team including UQ and Queensland University of Technology researchers aiming to assist the body to repair cartilage defects resulting from sporting injuries or conditions such as osteoarthritis.

Dr Sophia Gu and **Dr Amirali Popat** received Peter Doherty Biomedical Early Career Fellowships from the NHMRC to further work in targeted medical delivery and overcoming side effects of drug dependence among bowel disease and colon cancer patients.

Queensland and NSW governments

The Queensland and NSW governments allocated $1.2 million in 2013 for a clinical trial of a human monoclonal antibody, manufactured at AIBN using a production process developed at the institute, capable of neutralising Hendra virus.

The trial aims to prove the safety of the only known effective treatment for humans exposed to Hendra virus using an antibody developed through a long-standing association between Australian researchers and the US laboratories of Professor Christopher Broder at the Uniformed Services University of the Health Sciences and Dr Dimiter Dimitrov of the National Cancer Institute, National Institute of Health.

National Breast Cancer Foundation

Dr Thurecht will lead research involving multimodal imaging, aptamer targeting and therapy combined with gene therapy to target triple negative breast cancer, using $99,943 from the National Breast Cancer Foundation's Novel Concept Award.

Triple negative breast cancer refers to forms of the disease that do not express the genes for estrogen, progesterone or growth factor receptors targeted using chemotherapies, forcing clinicians to combine therapies.

JEM Foundation

Private philanthropic organisation the JEM Foundation continued to fund research at AIBN in 2013, with a focus on amniotic membrane-derived mesenchymal stem cells and their ability to be steered to turn into different tissue types.

Work in the lab of **Associate Professor Wells** has resulted in the journal *Stem Cells Translational Medicine* accepting a review paper for publication, detailing a high incidence of contaminating maternal cell overgrowth in human placental mesenchymal stem and stromal cell cultures.

Commercialisation activities & industry engagement

Suppressing anti-inflammatory drug side effects with nanomaterials

AIBN researchers are working with specialty company Oxford Pharmascience Group to develop pharmaceuticals that reduce gastric irritation.

Dr Sophia Gu, Professor Max Lu and Associate Professor Zhiping (Gordon) Xu have developed a process to manufacture high quality layered double hydroxide (LDH), a synthetic clay nanomaterial that breaks down in the stomach without obvious side effects.

The active component of pharmaceuticals such as ibuprofen is inserted between LDH layers so its bitter taste cannot be detected in the mouth, but is released in the stomach for uptake into the body.

Oxford Pharmascience is involved in a trial of super generics, specifically an advanced formulation of ibuprofen, and the company is scaling up manufacture as part of its ongoing development.

UQ's main commercialisation company UniQuest was instrumental in establishing the collaboration and negotiated a licence agreement with Oxford Pharmascience, giving it access to the technology.

AIBN researchers continue to work with Oxford Pharmascience in commercialising the LDH technology.

Oxford Pharmascience Chief Executive Officer Marcelo Bravo said proof of concept had been established in an animal model and a program to develop the technology was well advanced.

In pre-clinical studies, the technology demonstrated not only improved taste but, surprisingly, reduced another key drawback of some therapeutics, common gastric side effects including irritation, ulceration and bleeding compared to the same effective dose of ibuprofen.

Ibuprofen belongs to a class of drugs known as non steroidal anti-inflammatory drugs (NSAIDs), which has more than 30 million daily users worldwide and annual sales of $12 billion – despite the gastrointestinal side effects.

Oxford Pharmascience is developing a range of safer NSAIDs with much lower gastric irritation, starting with 400mg ibuprofen.

The company develops advanced yet practical pharmaceutical technologies to enable reformulation that adds value to off-patent and soon-to-be off-patent drugs.

It does not manufacture or sell its own pharmaceutical products but instead seeks to licence its technologies to a network of partners, mainly leading pharmaceutical companies with prescription and over-the-counter branded portfolios.

TenasiTech nanoparticle additive validated

Chemical companies, original equipment manufacturers, systems houses and suppliers representing all tiers of the materials supply chain have been involved in 2013 in successfully validating a nanoparticle additive developed at AIBN to improve plastic properties and performance.

The additive produced numerous thermoplastic polymers with greater strength, durability and scratch and tear resistance, providing avenues for application in high-performance sporting goods, car parts, plexiglass, rubber seals, industrial and engineering components, and materials for energy conversion.

Validation opens the way for AIBN start-up company TenasiTech to commercialise the additive and start generating revenue to grow the business into a self-sustaining and profitable enterprise.

AIBN Group Leader and Professor and TenasiTech chief scientific officer Darren Martin played a major role in the validation, working with industry leaders in multiple fields and demonstrating that the additive was easy to handle using existing manufacturing processes and equipment.

The additive consistently and cost-effectively produced acrylic and polyurethane polymers with the improved properties, even when the process was scaled up to industrially-relevant quantities.

"The technology is so well validated at multiple levels, we believe it is more a matter of how many products it will be used for, rather than if the technology will make it into consumer products," Professor Martin said.

His research group at AIBN, including Dr Grant Edwards, Dr Celine Chaleat, Dr Pratheep Kumar Annamalai and Nunna Pardhasaradhi, has been working on additives for both poly(methyl methacrylates) (PMMA) and thermoplastic polyurethane (TPU) products.

In 2011, Professor Martin secured co-development partnerships with three companies and the additives began being used in commercial trials.

Support from the Queensland Government and venture fund Uniseed, totalling $1.4 million, enabled TenasiTech to take a leap forward in 2012 and seek to secure a slice of the multi-billion dollar global polyurethane and acrylic markets, with other target polymer classes under development.

Professor Martin said the additive was essentially synthetic plates of one nanometre thick with a special surface chemistry, enabling easy uptake and mixing into plastic. The efficiency of the additives meant they made up only about one per cent, or less, of the resulting plastic's weight.

"Our additive is actually in the material, not just on the surface. It can handle all sorts of secondary manufacturing and forming processes – and it is cheaper than using coatings," he said.

"You just drop in our nanoparticle additive and it doubles the scratch resistance or improves dimensional stability or durability. Nobody has to invent a new machine to process the material."

DSM scale-up facility opened

Dutch pharmaceutical manufacturer DSM Biologics opened a high-tech contract manufacturing facility in Brisbane in 2013, taking a major step in establishing a fully integrated biotechnology industry in Queensland.

The $65 million facility will be used to develop next-generation smart medicines, using mammalian cells to produce biologics and therapeutics.

DSM indicated one of the critical factors in its decision to invest in Queensland was the research facilities and expertise available at AIBN.

DSM Biologics will operate the scale-up facility, owned by the Queensland Government entity Biopharmaceuticals Australia (BPA), and produce clinical and commercial grade biologics for global markets.

DSM Biologics President Manja Bouman said the facility was "an important addition to the Australian biotechnology industry and will be a key contributor to the entire Asia-Pacific region".

The Hon. Ian Walker, Minister for Science, Information Technology, Innovation and the Arts (cutting the ribbon) and Dr Lukas Utiger, President and CEO of DSM Pharmaceutical Products

AIBN Director Professor Peter Gray said working in collaboration with DSM was exciting, given the company had a global reputation for biologics production.

"Having DSM operating a scale-up facility in Brisbane means Queensland research can be taken from the lab, through manufacturing, to the market," Professor Gray said.

"Researchers want their work to make a difference to the lives of people outside the lab. Working on biologics at AIBN is about providing improvements in human health."

The opening cements a collaboration between DSM, AIBN and the Queensland Government announced in 2012 and focusing on biologics, medicines based on natural proteins made using DNA technology.

Biologics offer new treatment options for a range of diseases, including cancer and auto-immune disorders, and may be used where medical conditions have no other treatments. They offer the only known potential treatment for Hendra virus infection.

The collaboration makes it possible for development and potential large-scale commercial production of the experimental Hendra virus antibody, among other therapeutics, in Queensland.

Australia has a vibrant biotechnology industry, but previously had no custom mammalian-based biopharmaceutical manufacturing operation. The Queensland Government formed BPA, which has partnered with DSM to bring the new facility and operation to Brisbane.

QSAFI completes significant work

AIBN researchers completed significant work on the viability of aviation biofuels in 2013, as part of a project involving academia and industry partners, with government support.

The unique study involved AIBN, UQ's Institute for Molecular Bioscience, the Queensland Alliance for Agriculture and Food Innovation and the Centre of Excellence for Integrative Legume Research; James Cook University; and leading companies Boeing, Virgin Australia, Mackay Sugar Ltd and IOR Energy.

As part of the Queensland Sustainable Aviation Fuel Initiative, the collaborators published their results in the international journal *Biofuels, Bioproducts and Biorefining* and presented them at the Boeing-hosted Aero Environment Summit in Sydney.

AIBN researchers examined the engineering and associated financial viability of biofuel production. The work involved detailed techno-economic modelling of the processes to convert three feedstocks – sucrose from sugar cane; microalgae; and oily seeds from a tree called Pongamia – to produce a minimum selling price for aviation biofuel.

The results from Dr Daniel Klein-Marcuschamer showed that using current proven technologies, the biofuels would be economically competitive with crude oil at a price per barrel of $301 (sugarcane), $374 (Pongamia seeds) and $1,343 (microalgae).

More importantly, the research demonstrated which parts of each process were most expensive and would most benefit from future research.

Experimental research in Professor Lars Nielsen's AIBN lab focused on converting sucrose to useful biofuel components using systems and synthetic biology.

The target component chemical is limonene, a natural product found in the peel of citrus fruits. Limonene has the potential to be an important component of sustainable aviation fuel because of its chemical properties.

Extracting limonene from citrus peel at the amounts required to make fuels is not feasible, so Dr Claudia Vickers is modifying baker's yeast to produce it. The approach has greater potential for large-scale production, even though present yields are not yet high enough to be commercially viable.

PhD student Tim Brennan developed strategies to ensure the yeast remained healthy and productive during biosynthesis of the engineered form of limonene in the fermentation process.

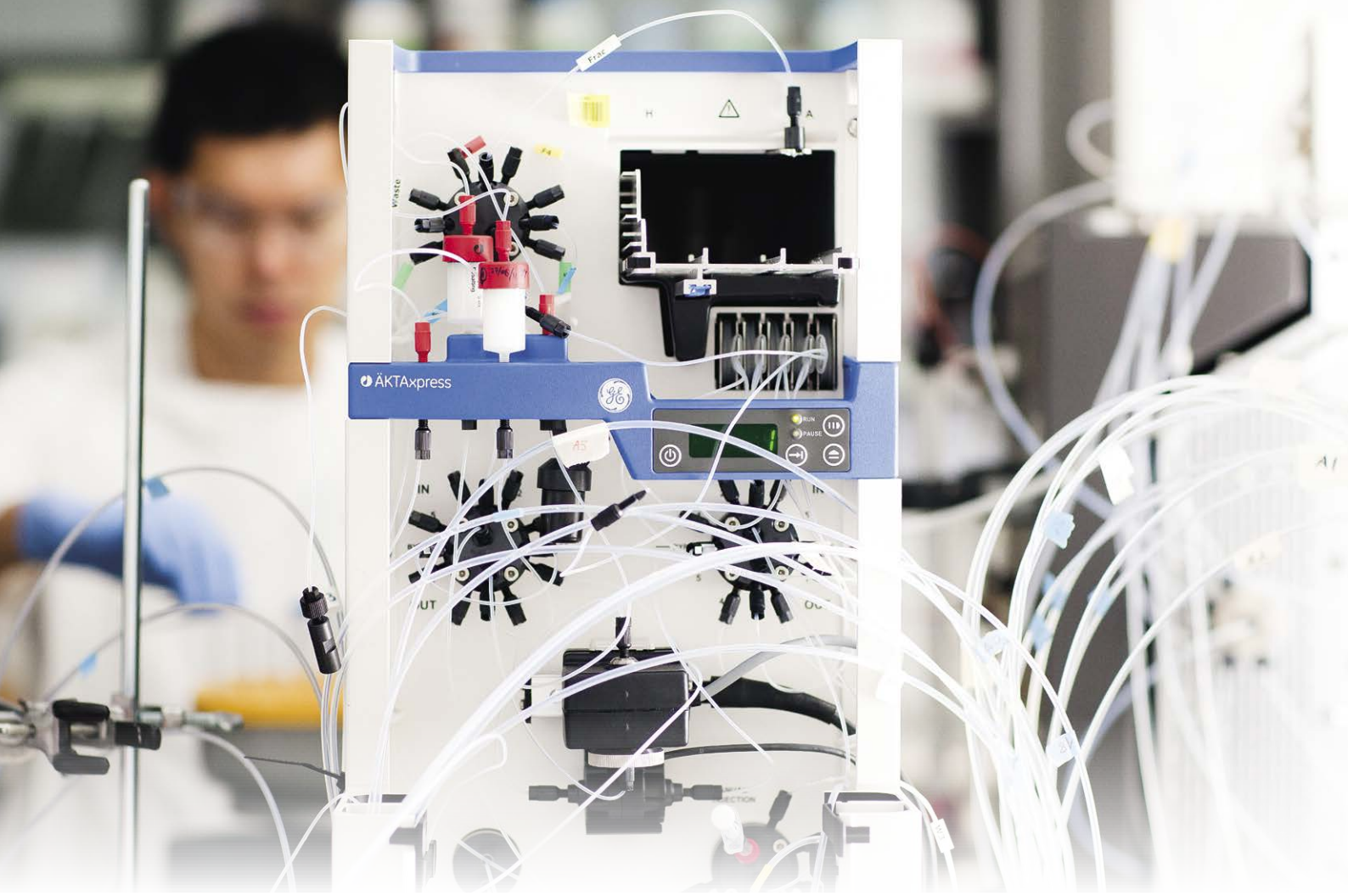
"My work has explored molecular mechanisms of the interaction of the synthetic limonene and the yeast that produced it," Mr Brennan said.

The World Economic Forum found air transport consumed 10 per cent of global transportation energy in 2010 and that was projected to increase to 13 per cent by 2030.

Unlike ground transport, where electric or hydrogen cars may provide an alternative, aviation depends on liquid fuels with high energy content. The aviation industry therefore has a strong desire for fuels that have the required properties, and are cost effective and sustainable.

Success in making biofuels viable would allow Australian agricultural industries to diversify their product portfolios, with the potential for new manufacturing plants in rural areas such as north Queensland.

The research results are on a Wiki page at qsafi.aibn.uq.edu.au



Philanthropic initiative to support research

AIBN launched a philanthropic initiative in 2013 to support translating academic research into commercial outcomes.

The AIBN Technology Translation Fund (AIBNcubator) aims to raise funds through philanthropic donations to help overcome a shortage of pre-seed and seed funding in Australia, acknowledged to contribute to a lack of commercial outcomes from discovery research.

The vision is to create a seed funding pool for selected projects to finance the gap between academic research and early product development and provide training and experience to scientists and students in a low-risk, supportive environment.

AIBN Director Professor Peter Gray said the fund would help take selected projects to an "investment-ready" stage and support researchers in developing skills in entrepreneurship and product development.

Both outcomes were critical for translating Australia's investment in research into outcomes meeting commercial and social needs, Professor Gray said.

"Funding will encourage researchers to focus their time on an almost investment-ready project and not spread themselves too thinly across a range of projects," he said.

"We will not only create the next generation of entrepreneurs through the training and development associated with AIBNcubator, we will also enhance our ability to attract the best and brightest national and international researchers and students."

Professor Gray said AIBNcubator would not solve a nationwide funding problem, but was the institute's way of taking proactive action.

"Everyone recognises there is a gap. Existing granting bodies fund research to a point where a potential commercial outcome can be envisaged. At that point, researchers have limited options for further grants and this creates a gap for research projects that are not ready for seed investment or other forms of commercialisation.

"By nurturing these projects within the AIBN, with funding from AIBNcubator, we will increase the prospect for investment from angel investors, venture capitalists and commercial partners."

An investment committee, comprising experienced investment and commercialisation experts, will assess research projects proposed for AIBNcubator funding.

The committee includes AIBN Deputy Director (Commercialisation) Dr Ian Nisbet, CM Capital's Dr Carrie Hillyard, UniQuest's Dr Dean Moss, Uniseed's Dr Peter Devine, the Medical Research Commercialisation Fund's Dr Chris Nave, UQ Business School's Dr Tim Kastelle, Oncolin's Dr Jim Aylward and Jim Kalokerinos.

Projects considered for inclusion in the AIBNcubator portfolio will be assessed on criteria including commercial opportunity, the quality of the science, capacity for leveraging other funding sources and the inventor's track record and commitment.

www.aibn.uq.edu.au/AIBNcubator

IAP links researchers with industry

AIBN's Industrial Affiliates Program (IAP) continued to bring researchers and industry partners together in 2013, through formal membership, service provision and networking events.

The program enables industry partners to build awareness of – and gain access to – AIBN's research and expertise; and the institute to improve the industrial relevance of its research programs through direct engagement with IAP members.

Networking events attracted a strong contingent of senior members of AIBN staff and guests representing executive management from major companies, government departments and academia.

Networking events

Biotech entrepreneur Dr Jim Aylward was guest speaker at an April 13 Thought Leaders' dinner, entertaining and inspiring an audience that included Her Excellency Penelope Wensley AC, Governor of Queensland, and her husband Stuart McCosker.

The dinner at Customs House, Brisbane, was the fifth in a successful series aiming to bring the well-considered thoughts of guest speakers to an event involving question-and-answer sessions and significant discussion among diners.

The diners also included Queensland Chief Scientist Geoff Garret AC, former Queensland Chief Scientist Peter Andrews AC, and DSM chief executive officer Scott Lorimer.

Dr Aylward described the challenges of moving from a long-standing career at CSIRO to becoming an entrepreneur trying to develop and commercialise his own invention, a novel treatment for solar keratosis, also known as sunspots, a condition that commonly precedes skin cancer.

During the process, Dr Aylward founded Peplin Ltd. The company and its product, now known as Picato®, was ultimately acquired by Leo Pharmaceuticals, which retains a manufacturing presence in Queensland.

AIBN Deputy Director Dr Ian Nisbet said the April dinner heard one of the great success stories of the Australian biotech industry and engagement with people such as Dr Aylward was important to the institute's activities directed towards translating research into products.

On November 14, AIBN researchers detailed their projects as part of IAP's Showcase and Networking function.

Professor Mark Kendall spoke about the product development and commercialisation of the vaccine delivery device Nanopatch, with much of the activity now under the umbrella of spin-out biotechnology company Vaxxas.

Associate Professor Ernst Wolvetang detailed his research group's work in using reprogrammed human skin cells to understand development, at the genetic level, of diseases such as Alzheimer's disease and Down syndrome.

Associate Professor Idriss Blakey told the audience of about 70 people about the potential for his research in rational design, synthesis, and self-assembly of functional polymers and nanomaterials in developing new-generation sensors and biomedical imaging agents.

AIBN board chairman Euan Murdoch chaired the event and launched the AIBNcubator Technology Translation Fund that aims to raise up to $2 million through philanthropic donations to provide proof-of-concept funding for AIBN projects.

Membership

IAP has been operating for a little more than three years and has more than 20 member companies, ranging from large multinationals to small domestic start-up companies. IAP provides a project-independent basis for interaction between AIBN and industry, with the ultimate identification of collaborative projects one of the program's critical success factors.

AIBN Director Professor Peter Gray said IAP activities reflected the institute's commitment to promoting and developing the growth of innovative industries; and ensuring research does not remain at the laboratory bench, but is translated into positive outcomes.

"AIBN's focus is on developing enduring relationships with Australian and international industry, underpinning a vibrant innovation economy in Queensland and Australia," he said.

"IAP allows companies to make the most of the facilities and capabilities AIBN has available to support their growth and innovation."

Internship brings industry relevance

An internship has given AIBN graduate Huey Wen Ooi an opportunity to combine credible research techniques with industrial relevance following submission of her PhD thesis in 2013.

Dr Ooi spent five months working with staff at Anteo Diagnostics and learning about product development and commercialisation as part of the Australian Mathematical Sciences Institute intern program.

With support from AIBN supervisor Professor Andrew Whittaker, she approached Anteo and secured a placement involving immunological studies to determine performance of the company's 'molecular glues'.

Anteo Diagnostics develops and commercialises proprietary surface coatings for use in the diagnostics and biotech industries, including Mix&Go, described as a 'molecular glue' to immobilise delicate biological molecules such as antibodies to synthetic surfaces.

"Anteo provided me the opportunity to work in a commercial environment and gain exposure to general commercial activities, such as intellectual property, product development and meeting compliance obligations," Dr Ooi said.

"I was part of a small group comprising all levels of the organisation, enabling me to observe the general issues many Australian companies in the biotechnology industry face."

The placement added to the skills Dr Ooi gained during her PhD at AIBN, where she designed and prepared precisely-structured thermo-responsive hydrogels for potential use in pharmaceutical drug delivery.

"During my PhD, I was trained to solve problems and think critically. The skills definitely were useful during my internship at Anteo – and I expect they will be in my entire career.

"It was also helpful that AIBN has research groups in different disciplines that allow an exchange of knowledge and experience."

Professor Whittaker supported Dr Ooi during her studies with travel to national and international conferences and an opportunity to visit renowned biomaterials scientist Professor Kristi Anseth at the University of Colorado in the US.

"Through the conferences, I was exposed to the latest ongoing research. Visiting Professor Anseth's lab was a great experience and an opportunity for learning and networking."

Dr Ooi received assistance from AIBN Deputy Director (Commercialisation) Dr Ian Nisbet during the internship's application process, ensuring a smooth transition to the industrial research environment at Anteo.

"I would like to be involved in research that has affiliation with industry. I like to see my research turned into products that are useful to consumers. Being in Anteo has certainly helped to reinforce my interest.

"Many scientists at Anteo were experienced in research as well as commercialisation. I was fortunate to work closely with a few senior scientists who were always generous with their knowledge, experience and opinions.

"I have certainly learnt a lot about the drive behind research in the industry and how different it is compared to academia. I also learnt how to perform different immunological experiments and the required product performance to meet current market needs.

"The internship has been an invaluable experience that will certainly benefit me in my research career."

Dr Ooi will soon start a postdoctoral fellowship at the Karlsruhe Institute of Technology in Germany with internationally-renowned scientist Professor Christopher Barner-Kowollik.

International collaborations

Consortium exchanges valuable information

AIBN Associate Professor Christine Wells continued exchanging valuable information with collaborators from the Functional Annotation of the Mammalian Genome (FANTOM) consortium in 2013, including hosting research leaders from the US and Denmark.

Associate Professor Wells contributes findings from her research group's work into the networks of genes that drive stem cell differentiation and immune activation – and can access FANTOM's network of specialist researchers, tools and protocols.

Exchanges between her AIBN research group and members of the FANTOM community in 2013 strengthened key collaborations with leaders in genome biology, bioinformatics, biostatistics and stem cell biology in Japan, Germany, Denmark and the US.

Professor John Quackenbush from Boston's Dana Farber Cancer Institute and Harvard University visited AIBN in July and Professor Albin Sandelin from the University of Copenhagen was at the institute in October.

Involvement in FANTOM also opened doors for Associate Professor Wells, enabling her to visit the Centre for Regenerative Medicine at the University of Edinburgh; the University of Copenhagen; and the University Hospital Regensburg in Germany in 2013.

PhD student Edward Huang subsequently spent time in the Regensburg lab of Professor Michael Rehli, where researchers focus on mononuclear phagocyte biology and epigenetics of cell differentiation.

Associate Professor Wells said: "Participation in the consortium demands a great deal of commitment in terms of time, intellectual input and resources to validate the major findings pertinent to our own particular research areas.

"The demands are weighed against the excitement and privilege of working with a wonderful international community of scientists – and to experience the breadth of ambition in terms of scale and resources offered by Riken in Japan," she said.

"The work I have undertaken as part of FANTOM has benefited my own research enormously. The work has shaped my philosophy of how the genome is regulated and encouraged me to tackle big-picture questions when considering my own contributions to large or small collaborations."

Associate Professor Wells continued to collaborate with scientists from Canada; South Korea; the Netherlands; the Australian National University, in Canberra; Sydney's Victor Chang Institute; and AIBN as part of Project Grandiose.

The researchers are working together to understand how cells reprogram or revert to their original cell type.

Associate Professor Wells brings a depth of understanding of bioinformatics capacity to a joint appointment at the University of Glasgow's Institute of Infection, Immunity and Inflammation, announced in 2013.

The appointment enables her to establish a clinical focus and translational linkages for her AIBN research into immune regulation and cellular differentiation and activation.

Merck, Vaxxas collaboration

A collaboration involving US-based pharmaceutical giant Merck and Australian spin-out biotechnology company Vaxxas continues to move Professor Mark Kendall's vaccine delivery device the Nanopatch through product development and towards commercialisation.

Vaxxas staff work in parallel with Merck's experienced vaccine development scientists to establish efficacy, quality and stability of a Merck vaccine dry-coated to the Nanopatch, a silicon wafer with thousands of small projections designed to target abundant immune cells in the skin.

Vaxxas is supplying the dry-coated patches and working with Merck on studies, with Professor Kendall overseeing the work as Vaxxas founder, director and chief technology officer, as well as the Nanopatch inventor and an AIBN Group Leader.

The agreement includes Merck funding for a development program to explore using the Nanopatch in conjunction with an important vaccine.

It gives Merck an option to exclusively licence the Nanopatch for use with the vaccine and potentially two others, with payments flowing to Vaxxas.

Outside the Merck program, Vaxxas is moving the Nanopatch toward clinical studies, building on research in small animal models that demonstrated the Nanopatch more efficiently protects against influenza virus when compared to doses administered using a traditional needle and syringe.

Professor Kendall designed the Nanopatch for thermostability and ease of use and is working closely with his AIBN research group to realise the potential for the delivery devices to be transported without needing refrigeration and delivery by non-specialist personnel.

Eliminating the need for what is known as "the cold chain" and administration by higher cost health care professionals would lower vaccination costs and enable wider, faster distribution in developing countries.

Professor Kendall said the Merck partnership provided external validation of the technology under development by Vaxxas and the research conducted at his AIBN lab with the support of competitive research grants from the Australian and Queensland governments.

He co-founded Vaxxas in 2011 with a $15 million investment from Australian and US investors to advance the Nanopatch towards commercialisation.

UQ's main commercialisation company, UniQuest, led the Nanopatch technology before Vaxxas was created.

Researchers bid for better batteries and reduced emissions

Collaboration with industry in China has enabled AIBN researchers to leverage a competitive funding grant and further their work in developing better batteries for hybrid cars, aimed at enhancing performance and reducing emissions.

Dr Denisa Jurcakova, Professor Lianzhou Wang and Professor Max Lu are heading research involving AIBN, UQ's School of Chemical Engineering and Chinese collaborators from Leling Shengli New Energy.

The research has a focus on developing high performance electrode materials for Lithium-ion batteries, by using nanostructured carbons to modify the battery's cathode, through which an electric current flows.

The project has received $480,000 in Australian Research Council Linkage Project funding, with $300,000 in additional support from industry.

Funding will enable the researchers to design new cathode materials and supply them to Leling Shengli for a trial to determine suitability for scale-up to industrial quantities.

Two postdoctoral research fellows and two PhD students will work exclusively on the project.

The funding also allows for exchanges, with Leling Shengli sending a delegation to AIBN, including the company's chief executive officer Yuancheng Zhang and manager Jun Lei, to discuss details of the project.

In return, the researchers will visit Leling Shengli in mid 2014 to see the company's scale-up facilities.

Professor Wang said the project addressed important issues, including the need to move to clean energy and reduce carbon emissions.

"Effective storage is crucial for use of renewable energies, since zero emission vehicles need high-capacity batteries," he said.

"The research will create new knowledge in the field of functional materials and new methods and processes for making high-performance Lithium-ion batteries.

"It will lead to a new family of low-cost cathode materials for Li-ion batteries, important for energy storage systems, particularly for the hybrid transportation industry."

Professor Wang said collaboration with industry was the most effective way to ensure the reseachers' expertise in functional nanomaterials was coupled with Leling Shengli's experience in industrial scale-up.

"The cathode materials we are developing show promise for use in high-capacity batteries, but it is important they can be produced at a low cost around the world to ensure the technology has the best chance of being adopted.

"Leling Shengli will play a role in the scale-up trial of the new cathode materials and will work with other battery companies to try large-scale production, if that becomes applicable, in the coming three years."

Point-of-care device gains momentum

Development of a point-of-care diagnostic device for gastrointestinal disease is gaining momentum as part of a collaboration between AIBN, the Seattle Biomedical Research Institute and the University of Washington (UW).

A prototype of the device has been developed, findings published in *Chemical Communications* in 2013, and a provisional patent lodged. A follow-up publication in *Biosensors and Bioelectronics* later in the year expanded on the device's portability.

The collaboration has the support of a US National Institutes of Health grant worth $5 million, with AIBN Professor Matt Trau and UW Professor Gerard Cangelosi listed as lead investigators.

Other groups involved include the Programs for Assessment of Technology in Health Research Institute, in Seattle; the International Centre for Diarrhoeal Disease Research (ICDDR), in Bangladesh; and the University of Virginia, in the US.

The project involves UW providing biological materials, samples of disease targets and the first prototype of a new protein binding molecule that was further developed in Professor Trau's AIBN lab.

During the project, Professor Trau's research group developed an entirely new class of inexpensive to manufacture protein capture molecules as a replacement for monoclonal antibodies, which are currently used for disease detection. The new class of nano-scaled antibody molecules contain a 50 nanometer cellular wall fragment that is incorporated into an engineered protein. The new class of protein capture molecules, called nano-scFvs, has been patented jointly by UW and UQ.

To demonstrate the protein binders' viability, several molecules were engineered to capture biomarkers in a patient's blood sample that point to the presence of gastrointestinal disease. The nano-scFv molecules were coated on a portable device to allow for quick analysis, without samples needing to be sent to a lab.

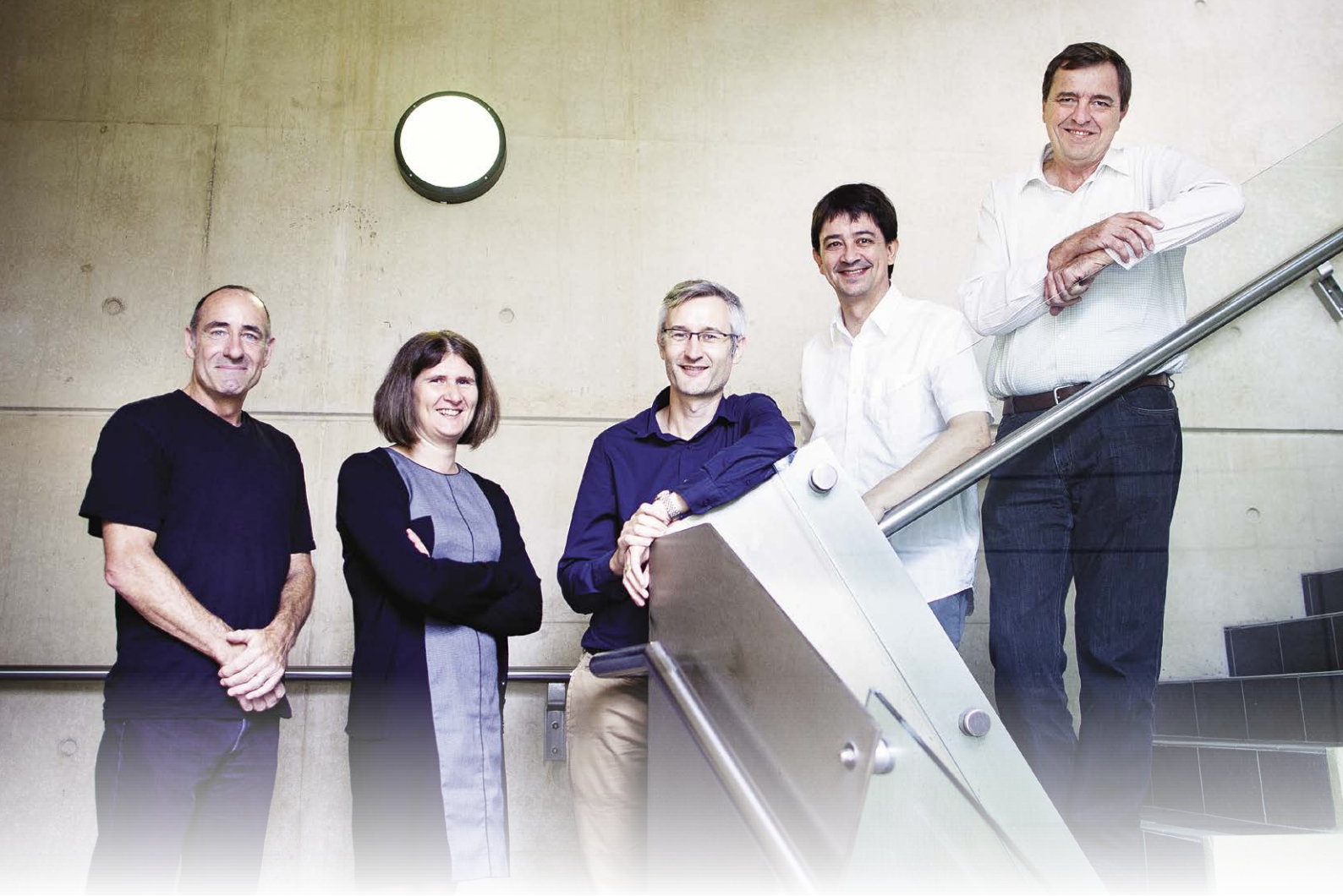
Professor Trau said the diagnostic device targeted the waterborn pathogen *Entamoeba histolytica*, endemic in developing countries such as Bangladesh.

E histolytica enters people's digestive systems when they consume contaminated food or water, causing gastrointestinal issues such as amoebic colitis, acute dysentery or chronic diarrhoea. About 100,000 people die annually from *E histolytica*.

"*E histolytica* is treatable, but first an accurate diagnosis is required," Professor Trau said. "Ensuring our device is inexpensive and close to point of care will be of great benefit in developing countries, which lack the money and infrastructure to analyse remote samples in laboratories.

"We believe a device such as ours will one day allow clinicians to detect *E histolytica* infection – and other infectious diseases – in some of the most remote and impoverished regions on earth."

Professor Trau said AIBN's expertise in nanobiotechnology, particularly surface chemistry and diagnostic device development, complemented UW's insights into tackling infectious diseases and ICDDR's knowledge of gastrointestinal disease and treatments in developing countries.



Professor Eric McFarland, Celestien Warnaar, Dr Robert Speight, Professor Lars Nielsen, Barry Ball

Dow partnership develops

A partnership between AIBN and the Dow Chemical Company moved into a new phase in 2013, with the appointment of a director and staff to the Dow Centre for Sustainable Engineering Innovation and development of research projects and collaborations.

The centre will deliver a research program in industrial sustainability and sustainable living, providing solutions to important engineering-related issues facing society in the 21st century, using a generous $10 million donation from Dow.

The new centre involves collaboration between UQ's School of Chemical Engineering, AIBN and the Global Change Institute (GCI), with the headquarters to be based at UQ's Hawken Building and some researchers at a centre node at AIBN.

Professor Eric McFarland was appointed the Dow Chair of Chemical Engineering and centre director in July and began developing relationships with colleagues at UQ, around Australia and in the US, resulting in collaborations on new projects.

Contact was established with Brisbane Airport Corporation, resulting in a letter of intent to collaborate on sustainable technologies and practices.

In a collaboration with the Dow Materials Institute at the University of California, Santa Barbara, Professor McFarland brought together researchers from UQ, industry representatives and academics to brainstorm future sustainability issues. There are plans to hold a similar workshop in 2015.

AIBN Professor Lars Nielsen was appointed the centre's deputy director; Celestien Warnaar made centre manager; and Barry Ball and Dr Robert Speight seconded for maintaining relationships with industry, government and academia.

The centre will focus on identifying innovative and cost-effective research needed to achieve long-term sustainability and engage with academia, industrial partners and the community while leveraging the significant capabilities at UQ.

The centre's establishment cements a relationship with Dow dating from 2007, when AIBN Director Professor Peter Gray signed the first research collaboration agreement with the company.

In 2011, Professor Nielsen and Professor Paul Lant developed a plan for a Dow Chair linked to the centre.

Agreement was reached soon after to establish the UQ-Dow Alliance and a subsequent strategic partnership was unveiled in April 2012, bringing together cutting-edge research expertise in energy, water and sustainability with world-class science and engineering education and resulting in the centre's establishment.

Mr Ball and Dr Speight were instrumental in developing the centre's business plan in 2012 and leaders from the three UQ collaborators provided input in the centre's terms of reference.

Professor Gray; School of Chemical Engineering Head and AIBN Group Leader Professor Peter Halley; and GCI Director Professor Ove Hoegh-Guldberg were appointed as members of the centre's board, joining UQ Vice-Chancellor and President Professor Peter Høj; then UQ Deputy Vice-Chancellor (Research) Max Lu; Dow Australia & New Zealand managing director Craig Arnold; and Dow appointed representative Noel Williams.

ICBNI promotes in-depth collaborations

The International Conference on BioNano Innovation (ICBNI) 2013, held in Beijing in September, provided an ideal platform to promote in-depth scientific collaborations between China and Australia.

The conference featured 36 invited speakers from China, Australia and France presenting complementary research expertise in parallel symposia, reflecting the themes Bio, Nano and Polymers.

Chinese Academy of Sciences (CAS) President Bai Chunli hosted the conference, following his plenary address at ICBNI in Brisbane in 2012 when an invitation was extended to host the 2013 conference in Beijing.

Then CSIRO Group Executive Dr Calum Drummond and CAS Professor Lei Jang were high-level invited plenary speakers.

Chinese conference speakers represented CAS, Fudan University, the China University of Petroleum, Peking University, Donghua University, Soochow University, Wuhan University, Tsinghua University, and the Key Laboratory of Advanced Energy Materials Chemistry.

Australian speakers represented AIBN, CSIRO, the University of Melbourne, the University of New South Wales, and the University of South Australia.

The conference committee included AIBN Professors Chengzhong (Michael) Yu, Matt Trau, Lars Nielsen, Andrew Whittaker, Anton Middelberg and Debra Bernhardt, and Petrina Gilmore.

A series of workshops and joint symposia in Beijing and Shanghai after the conference enabled researchers to explore areas of overlap in which complementary synergies pointed to potential collaborations.

A National Center for Nanoscience and Technology workshop attracted researchers from Queensland and China with shared interests in microfluidics, novel antibiotics, nano delivery methods and imaging agents.

The Shanghai joint symposium, organised by Fudan University and AIBN, adopted the theme Frontiers in BioNano Innovation, with a full day program with oral presentations and posters. The symposium began with the signing of a memorandum of understanding between the two institutions.

Also in Shanghai, AIBN researchers participated in a multi-day symposium, networking events and high-level meetings involving AIBN, UQ, CSIRO, the Science and Technology Commission of Shanghai Municipality, and the Shanghai Association for Science and Technology.

Following on from the activities, AIBN researchers will investigate various opportunities for future collaboration, such as hosting Chinese students at the institute and pursuing formal links through funding applications.

Hubei University's Professor Zushun Xu hosted AIBN Professor Andrew Whittaker for a seminar as part of the World Famous Scientists Lecturing in Hubei project.

The exchange will continue with Professor Xu scheduled to visit AIBN in 2014 and one of his students using an Endeavour Research Fellowship to work in Professor Whittaker's research group on novel imaging agents.

The success of engagement fostered by ICBNI and associated bilateral talks and workshops has led to several researchers from CAS confirming their intention to participate in the NanoBio Australia 2014 conference in Brisbane.

Professor Peter Gray, Director, AIBN; Her Excellency Ms Frances Adamson, Australian Ambassador to the People's Republic of China; Professor Chunli Bai, President, Chinese Academy of Sciences; Cathryn Hlavka, Minister Counsellor (Education and Research), Australian Embassy; and Mr Jinghua Cao, Deputy Director of the Bureau of International Cooperation, Chinese Academy of Sciences

Queensland-China workshop

Professor Chengzhong (Michael) Yu

AIBN hosted experts in health and medical research from top Chinese institutions for a workshop in 2013, strengthening professional networks and providing an important exchange of information.

The Queensland-China Workshop on Human Health and Medical Research on October 29 featured speakers from the Chinese Academy of Sciences, Fudan University, Tibet University and DTRM Biopharma.

AIBN Group Leader and materials science expert Professor Chengzhong (Michael) Yu was a workshop session chair and AIBN Director Professor Peter Gray presented research on biologics as human therapeutics and described opportunities for collaboration in the field between China and Australia.

Professor Yang Ye from the Shanghai Institute of Materia Medica at the Chinese Academy of Sciences delivered an address detailing the identification of bioactive compounds responsible for the therapeutic benefits derived from traditional herbal medicine.

DTRM Biopharma president and chief executive officer Dr Wei He spoke about small molecule drug innovation and development, while Griffith University's Dr Chris Davis detailed potential solutions to infectious diseases through engagement with China.

Dr Hui Wang from the Shanghai Institute for Biological Sciences at the Chinese Academy of Sciences described the discovery of a novel cancer preventative and therapeutic agents from traditional Chinese medicine.

Queensland University of Technology (QUT) Professor Zee Upton's research at the Institute for Health and Biomedical Innovation into clinical, technological and social innovation for life-long health was presented.

Closing the workshop was a presentation from Fudan University and Tibet University Professor Yang Zhong dealing with the genetic diversity of medicinal plants on the Tibetan Plateau.

The workshop was part of a series of events bringing together senior representatives from Queensland's research and business sector with representatives of the Chinese Government, industry and research institutes.

The events were designed to improve business and collaboration opportunities in areas such as human health and medical research; agricultural biotechnology, including food research and safety; and energy.

A Queensland Government initiative, the events were planned in partnership with UQ, QUT and Griffith University.

Facilities & research environment

Infrastructure facilitates research

Cutting edge research is progressing at AIBN in part because of support infrastructure based at the institute, with expertise in nanofabrication, metabolomics, biologics, protein expression, stem cells, microscopy and microanalysis.

Nanofabrication

The Australian National Fabrication Facility, Queensland node (ANFF-Q) continued to achieve in 2013, with success in securing new facilities, $2.3 million in funding, and further industrial engagement.

ANFF-Q increased its capabilities with an extra cleanroom, a state-of-the-art atomic force microscope, a silicon carbide epitaxial reactor for silicon carbide electronics, a Nanoscribe Photonic Professional GT for three-dimensional nanoprinting and an e-beam evaporator.

Dr Elliot Cheng was appointed as a professional officer in 2013, bringing with him a wealth of experience in scanning electron microscopy and e-beam lithography.

Support was provided to researchers from universities around Australia needing polymer and glass substrate patterning for drug delivery and cell culture, and fabrication of nanoelectronics, micro-electronic mechanical systems and biomicrofluidic device platforms.

ANFF-Q also supported researchers developing new medical devices, sensors and photonics through its vast array of tools and professional training and assistance.

Staff initiated coffee tours and twilight tours to encourage industry to visit the facility. They launched ANFF-Q's epitaxial reactor – the only tool of its kind – in June, attracting an enthusiastic and varied audience.

ANFF-Q hosted an industry seminar, entitled Disruptive Innovation, at the Queensland Museum in March with more than 60 attendees from government, industry and academia.

The continued engagement and broadening of capabilities played a significant role in increasing ANFF-Q's commitment to industry in 2013. Industry clients increased from 10 to 22.

ANFF-Q increased client numbers from 213 to 255 and usage hours expanded substantially in 2013, concurrent with the extra capabilities and services offered.

With support from the Federal Government's renewed National Collaborative Research Infrastructure Scheme and interim body Collaborative Research Infrastructure Scheme, ANFF-Q aims to continue its sustained growth.

The funding will enable maintaining and upgrading equipment, staff training and capacity building to ensure ANFF-Q is at the cutting edge of nanofabrication.

Biologics

The National Biologics Facility (NBF) housed at AIBN has continued to work with academia and industry to expand activities in 2013.

NBF brings research and the biopharmaceutical industry together, enabling scientists to translate their discoveries into solutions for Australia, through a comprehensive platform service ranging from drug discovery to clinical grade protein manufacturing.

In 2013, the facility added a suite of new equipment; collaborated with biomedical researchers working to treat graft versus host disease; manufactured clinical grade material for a clinical trial of a Hendra virus antibody; and worked with industry on cell line development.

NBF expanded its capabilities by developing new antibody discovery libraries using Pathfinder funding from research commercialisation company UniQuest.

The libraries form the foundation for mAbLAb, a dedicated laboratory for phage display and antibody engineering focusing on developing new antibodies for targeted disease treatment.

The facility continued collaborations with institutions, including Queensland Health, UQ, the University of NSW, the Mater Medical Research Institute, the Royal Adelaide Hospital, the QIMR Berghofer Medical Research Institute, the Baker IDI Heart and Diabetes Institute and CSIRO, enriching innovation and translational research.

Ongoing alliances and contract servicing for commercial partners illustrate the importance of NBF's quality management system to meet the requirements of regulatory agencies, such as Australia's Therapeutic Goods Administration.

NBF continued to be represented at domestic and international gatherings with involvement at the 2013 meeting of the European Society for Animal Cell Technology, in Lille, France; and engagement in the Asia Pacific region at Cell Culture Engineering World Asia 2013, in Singapore; and the International Conference on BioNano Innovation, in Beijing, China.

Staff also participated in the Nano and Advanced Materials and Technology workshop and the Shanghai Joint-Symposium on Frontiers in BioNano Innovation in China.

NBF is part of the BioProcessing Network, bringing together Australia's industry leaders from organisations such as CSL, Hospira, DSM and CSIRO for an annual symposium.

Supporting translational research

In a collaboration supported by UQ, the Queensland Government, Therapeutics Innovation Australia and TransBio, NBF is assisting in developing a monoclonal antibody to treat graft versus host disease.

Starting as a collaboration with the Mater Medical Research Institute, the project involved NBF staff isolating a monoclonal antibody targeting the human protein CD83 using the facility's dedicated phage display laboratory. A collaboration between AIBN and TransBio is continuing to work towards developing the monoclonal antibody.

In another collaboration, Biosceptre International continues to demonstrate support and trust in NBF as one of its longest collaborating partners. NBF has played a significant part in Biosceptre's research and development, through producing and characterising lead antibodies. NBF continues its support of

Biosceptre as it gains momentum into the clinic to test its novel cancer target, known as nf-P2X$_7$.

Clinical support capabilities

NBF's full capacities were tested in 2013, when scientists and engineers manufactured clinical grade material for a world-first clinical study to prove the safety of the only known effective treatment for humans exposed to the deadly Hendra virus.

The landmark study combines US expertise from Professor Christopher Broder, at the Uniformed Services University of the Health Sciences, and Dr Dimiter Dimitrov, from the National Cancer Institute at the National Institutes of Health; and Queensland knowledge from Princess Alexandra Hospital clinician Dr Geoffrey Playford.

Metabolomics

Metabolomics Australia, Queensland node (MA-Q) continued to supply key metabolomics and analytical support in 2013 for projects requiring the discovery, identification and quantification of endogenous and exogenous metabolites.

Users accessed the expertise of node leader Professor Lars Nielsen, node manager Dr Mark Hodson, and analysts Dr Manuel Plan and Panagiotis Chrysanthopoulos to conduct metabolomics analyses on various sample types.

MA-Q projects in 2013 covered a spectrum of metabolomics applications. AIBN projects included analysis to assess the production of industrial chemicals, bioplastics from sugarcane, biopesticides from insect cell viruses and biofuels from yeast fermentations. Analysis of biofuel production is an integral part of the Queensland Sustainable Aviation Fuel Initiative's work to produce advanced aviation biofuel from sugarcane. Yeast engineering and analysis is performed in partnership with the US biotech company Amyris.

MA-Q made progress in 2013 in applying profiling to fermentation time-course measurements, using high resolution mass spectrometry equipment, acquired with Federal and Queensland government funding, for open metabolomic analysis.

Collaborations within UQ involved measuring anaesthetic levels in *Drosophila* for the Queensland Brain Institute; analysing central carbon and nucleotide concentrations in plasma and brain tissue for the School of Biomedical Sciences; and measuring auxin in avocados for Queensland Alliance for Agriculture and Food Innovation research; and metabolic consequences of equine laminitis for the School of Veterinary Science.

MA-Q was involved in supervising four PhD projects at UQ's School of Chemistry and Molecular Biosciences; the Pharmacy Australia Centre of Excellence at the School of Pharmacy; and the School of Veterinary Science, hosting two of the students within the analytical facility during 2013.

In the wider research community, MA-Q provided metabolomic analysis for wheat and sugarcane research groups at CSIRO; Queensland University of Technology researchers working on banana biofortification and *Chlamydia* metabolism; and diabetes research at the Garvan Institute in Sydney.

Dr Louise Conwell, from the Royal Children's Hospital, in Brisbane, continued collaborating with MA-Q in 2013 on research into juvenile diabetes, while industrial partners, such as the Dow Chemical Company, Pfizer, Zoetis and LanzaTech, took advantage of node facilities through collaborations with Professor Nielsen's research group.

Research agreement for protein experts

The Protein Expression Facility (PEF) based at AIBN has entered into a research agreement with Sentinext Therapeutics to develop a bioprocess for the Enterovirus 71 vaccine against hand, foot and mouth disease.

The agreement with the Malaysian biotechnology company came as epidemics of the disease were reported in Asia. Hong Kong and Japan experienced more than a three-fold increase in cases in 2013 compared to 2012.

Sentinext chief scientific officer Dr Jane Cardosa and vice president of finance Michelle Gan visited PEF in 2013 to initiate development of insect-cell-based virus-like particle vaccines for enteroviruses. They welcomed PEF director Dr Linda Lua to their facility in Penang later in the year.

It was a highlight in a successful year for PEF, with a prestigious UQ award, an international conference poster win, expansion of the team, and installation of new equipment to increase capabilities.

A unique facility in Australia, PEF enables cutting edge research through comprehensive services in recombinant protein production, including molecular cloning, microbial expression, animal cell culture and protein purification.

A successful Australian Research Council (ARC) Linkage Infrastructure, Equipment and Facilities (LIEF) grant enabled installation of bioreactors for up to 25L production, for both microbial and animal cell cultures.

PEF was recognised for quality service, process improvement and innovation, knowledge transfer, and community connection when staff members won the UQ Chancellor's Award for Team Excellence.

The team grew during 2013, with three new members enabling PEF to complete more than 200 projects for more than 40 groups, such as global biopharmaceutical company CSL; Bioproton Pty Ltd; and the Department of Agriculture, Fisheries and Forestry.

Stem cell facility's importance acknowledged

Acknowledgement in journal articles in 2013 has highlighted the significance of StemCore's services to the progression of stem cell research in Australia.

StemCore's provision of expert staff, support services, training and technology platforms was acknowledged in papers in *Stem Cells Translational Medicine*, *Stem Cells* and *Biotechnology Journal*.

StemCore manager Victoria Turner said her team, based at AIBN, successfully supported vital stem cell research through providing specialist stem cell products and services to scientists in the field. The facility has been working with more than 25 independent research groups encompassing more than 60 scientists.

StemCore offers cell line characterisation and stem cell culture support services, enabling researchers to focus on cutting edge science by freeing them of labour-intensive, time-consuming activities.

StemCore services equip scientists to increase the pace and standard of their research into a multitude of diseases, including schizophrenia, Down syndrome and Ataxia telangiectasia.

Ms Turner said the StemCore team worked closely with AIBN researchers in 2013, but also grew its customer base to incorporate the first international clients, establishing potential future collaborations and expanding the company's international profile.

Presenting at the Sino-Australian Regenerative Medicine and Cell Therapy Forum in Lanzhou, China, enabled StemCore staff to foster international networking opportunities and meet the aims of raising the international profile and providing opportunities for scientific collaboration.

AIBN Associate Professors Christine Wells and Ernst Wolvetang continued to provide scientific oversight as StemCore's senior scientists in 2013, enabling the facility to remain at the forefront of cutting edge stem cell research in Australia.

CMM

Purpose-built laboratories within AIBN's building enable researchers to access microscopy and microanalysis services.

The Centre for Microscopy and Microanalysis (CMM) promotes, supports and initiates research and teaching in microscopy and microanalysis, and develops the disciplines themselves.

Its capabilities increased in 2013, resulting from an ARC LIEF grant, with live molecular imaging now available to researchers using super resolution microscopy, photon and spinning disk confocal microscopy.

CMM secured other LIEF grants totalling more than $2.7 million to install an advanced X-ray facility for surface and in-situ materials characterisation, and a dual column-focused ion beam and scanning electron microscope.

Staff under the supervision of AIBN Affiliate Group Leader and CMM manager Professor John Drennan made significant contributions to other funding applications regarded as strategically important.

The equipment and staff expertise enabled AIBN Group Leader Professor Mark Kendall to use scanning electron microscopy capabilities to develop the vaccine delivery device the Nanopatch as part of a push to advance the technology towards clinical testing and product development.

CMM support of researchers in the physical sciences and materials included providing cryoelectron microscopy services to AIBN Group Leader Professor Matt Trau's work on nanomaterials.

Support services are also extended to industry, encompassing a combination of small-to-medium enterprises and major organisations, including Rio Tinto, G James Glass, and Australian clinical-phase biotechnology company Lipotek.

Start-up company TenasiTech, founded by AIBN Professor Darren Martin, uses CMM for electron microscopy of its polymer nanocomposite materials for quality control and raw material characterisation.

Mentoring & career development

Commercial relevance part of PhD studies

As well as gaining research capabilities at AIBN, Dr Andrew Cameron credits the institute with skilling him in determining a research project's potential and focusing on commercial relevance.

Since his PhD was awarded in July 2012, Dr Cameron has been appointed a postdoctoral researcher at the Royal College of Surgeons in Ireland (RCSI), enabling him to pursue his interest in technology innovation and follow a commercialisation career path.

Dr Cameron completed a Graduate Certificate in Research Commercialisation at the end of his PhD studies, working closely with members of AIBN's Innovation and Commercial Development team as part of a course internship.

The internship involved Dr Cameron developing a business plan for an AIBN research project and helped him determine the commercial potential of the research.

Dr Cameron is part of the RCSI's tissue engineering research group, headed by Professor Fergal O'Brien. The research is developing clinical therapies and moving the technology towards commercialisation through start-up company SurgaColl Technologies.

The company enables Dr Cameron to see the link between his tissue engineering research and commercialisation pathways. His research at RCSI focuses on developing a collagen-based, tissue-engineered scaffold for ocular regeneration.

"The close collaboration the RCSI group has with numerous clinicians also provides valuable feedback that can be used in the development of these therapies," Dr Cameron said. "I am interested in helping to facilitate the translation of research into applications that have a societal impact."

Dr Cameron started his PhD studies in February 2007, with AIBN Professor Justin Cooper-White as his supervisor.

"I worked with Professor Cooper-White during the final year of my undergraduate degree. This was the first time I had done any research and it fortified an interest in undertaking a PhD in tissue engineering.

"When I was offered a chance to commence a PhD in a new, state-of-the-art institute, I felt very fortunate. Professor Cooper-White was extremely supportive and challenged me to perform to the best of my ability."

Dr Cameron's PhD had a focus on understanding the effect of biomaterial properties on stem cell behaviour.

"The skills I use in my new position at RCSI were all initially developed during my PhD. AIBN provides an abundance of cutting-edge equipment that enabled me to develop a broad range of technical skills.

"The interdisciplinary backgrounds and depth of expertise that the researchers at AIBN have meant I was able to learn about topics from a wide variety of fields.

"The research produced at AIBN is globally recognised as being of a high standard and there are numerous researchers who are held in high esteem by the international scientific community. This recognition can accelerate a young researcher in future employment."

Dr Cameron conducted research in Professor Cooper-White's tissue engineering and microfluidics group at AIBN in collaboration with UQ's Institute for Molecular Bioscience and financial support from the Cooperative Research Centre for Polymers.

"At AIBN I was involved with teaching, which kept me up-to-date. I enjoyed the challenge of trying to convey information and transfer knowledge, which are important skills.

"I travelled to Japan for an international conference during my time at AIBN and that encouraged me to apply for international opportunities after my PhD. I am delighted to have started my new position in Dublin."

PhD first step to building a research career

Support at AIBN during her PhD studies has helped Dr Dipti Vijayan take the first steps towards building a research career aimed at advancing knowledge in disease prevention and treatment.

Dr Vijayan received valuable intellectual and technical insights during studies under the supervision of AIBN Associate Professor Christine Wells.

The studies had a focus on how immune cells expressing Mincle, a lectin that helps recruit white blood cells to a fungal infection, respond to an opportunistic fungus called *Candida albicans*.

After graduating in 2013, Dr Vijayan secured a position at the highly-regarded Garvan Institute in Sydney as a research officer, investigating the role of a particular cytokine, a substance secreted by immune cells, believed to be linked to the development of autoimmune diseases such as lupus and cancer.

"I really hope that one day my contribution to medical research could provide significant progress in advancing medical knowledge and improving patient care," she said.

The work involves using techniques such as flow cytometry, immunohistochemistry, tissue immunofluorescence and enzyme-linked immunosorbent assays and draws on technical skills gained at AIBN.

Dr Vijayan said students at AIBN received technical and analytical skills, exposure to a range of scientific disciplines and competence in communication, presentation and creativity required of early career researchers.

"I consider myself extremely fortunate to have been associated with a multidisciplinary institute that pushed me to think the 'big picture' involves an amalgamation of disciplines.

"I am thankful to AIBN for giving me opportunities to improve my presentation and communication skills. I believe the skills are extremely important to a scientist."

Dr Vijayan was first author on a 2012 paper in *Immunology and Cell Biology* that was singled out for an editorial highlight, further emphasising the skills she developed during her PhD studies.

At AIBN, she worked closely with Associate Professor Christine Wells, a supervisor who strategically positioned her research on the international stage and instilled a strong collaborative ethic in her students.

Dr Vijayan also gained valuable insights into the work of Professor Lars Nielsen, a leader in developing experimental and computational tools to analyse and design complex biological systems.

"I saw how they progressed their research projects, leveraged funding, built collaborative networks around the world and advanced the field of knowledge," she said. "I would like to be able to hone skills in those areas to further my research career.

"I envisage my research at the Garvan will provide mechanisms that further our understanding of lupus. Understanding the fundamental immunological processes and their dysfunction is important for better and effective therapeutics."

Dr Vijayan said the research was both important and intriguing.

"There are several deadly diseases such as lupus, HIV and cancer that we still know very little about.

"It is only when you know how diseases are caused that you can work out ways to prevent them. The constant search for answers to these problems is what I find extremely challenging and motivating."

Bridge between research and industry

Dr Andrew Prowse moved from a lab-based position to one involving management and commercialisation in 2013 and credits AIBN with giving him the skills needed to ensure a smooth transition.

After six years at AIBN, Dr Prowse took up a position as a project manager at the Centre for Commercialization of Regenerative Medicine (CCRM) in Toronto, Canada.

He is overseeing about six projects at CCRM, working with other managers to balance the workload of scientists; developing experimental projects and outlines; and facilitating

interaction between scientific team members and the global research community.

Dr Prowse is still working in the lab, though the focus is slightly different. "The work is more commercially focused. CCRM is a bridge between academia and industry," he said.

CCRM has brought together a renowned group of stem cell scientists and bioengineers to fulfil regenerative medicine's promise to treat many diseases affecting the world's population.

The centre aims to harness the power of stem cells, biomaterials and molecules to repair, regenerate or replace diseased cells, tissues and organs as part of an initiative to potentially treat, manage and cure some of the most devastating and costly diseases.

"Previously I was involved in research for the improvement of knowledge in general," Dr Prowse said.

"Now I am taking knowledge developed in academia and helping to move forward towards a product or therapy."

Dr Prowse worked on embryonic stem cell expansion, methodologies and procedures at AIBN as part of Professor Peter Gray's research group.

"We focused on the parameters for improving embryonic stem cell expansion – the extracellular matrix, media and oxygen control, smart surfaces and cardiac differentiation."

During his time at AIBN, Dr Prowse produced six publications and credits AIBN's multidisciplinary nature for giving him the skills needed to transition to management at CCRM.

He worked under the supervision of Professor Gray, a pioneer of biotechnology research and development in Australia who has held academic positions and gained commercial experience.

Professor Gray has held positions at University College London and the University of California, Berkeley; and worked for Eli Lilly and Co and the Cetus Corporation in the US.

Dr Prowse said insights gained from working alongside Professor Gray, as he oversaw AIBN's growth to 450 people and an annual turnover of $40million, was invaluable.

"I was fortunate to see how the institute grew and developed, with the desire to produce solid scientific research at the core of all the activities," Dr Prowse said.

"I was exposed to a multitude of scientific disciplines and gained skills needed for lab-based research, analysis and progress towards commercialisation."

Highlighting the value of professional networks, Dr Prowse will work at CCRM with Dr Nick Timmins, with whom he originally shared an AIBN office.

"We became good friends at AIBN through a mutual interest in science and extracurricular activities and the contact remained after he left," Dr Prowse said.

"Nick moved to CCRM about two years ago to help establish the centre and get projects off and running. Moving to Canada was made easier because of the connection with Nick."

Expertise and equipment aids research career

AIBN's interdisciplinary environment, state-of-the-art facilities and unique expertise enable Dr Claudia Vickers to exploit her interests in metabolic engineering for production of industrially-useful biochemicals.

Dr Vickers is interested in replacing current industrial practices, heavily reliant on petrochemicals, with sustainable approaches using systems and synthetic biology for metabolic engineering of organisms.

She trained in plant molecular biology at UQ and CSIRO Plant Industry and spent three years in England developing a research program focused on a group of natural compounds called isoprenoids, investigating their biological functions and industrial applications.

Returning to UQ, Dr Vickers joined Professor Lars Nielsen's systems and synthetic biology group in 2007 to pursue an interest in biological production of useful isoprenoid compounds.

"I joined AIBN because it is the only institute in Australia that has access to the equipment and expertise required for a full-scale metabolic engineering research program, including specialised metabolic modelling and systems biology expertise from Professor Nielsen," she said.

Dr Vickers has built a research team within Professor Nielsen's group, linking her diverse research areas through understanding fundamental biology and applying it to industrial production of natural compounds.

She has developed a sucrose-to-bioproducts program and an industrial isoprenoids program, focused on converting sucrose from sugarcane into industrially-useful biochemicals.

A UQ Foundation Research Excellence Award in 2013 was among the highlights of a successful year for Dr Vickers. The award recognises demonstrated excellence and promise of future success in research; and leadership potential in strategically important fields.

Dr Vickers and Professor Nielsen received an Australian Research Council Discovery grant in 2013 to investigate the biochemistry and regulation of carbon flux through isoprenoid metabolic pathways, enabling Dr Vickers to improve yields of industrially-useful isoprenoids in engineered microbes.

Dr Vickers supported a successful Marie Curie Fellowship application from University of Barcelona graduate Dr Jordi Perez-Gil and will welcome her to AIBN in 2014 to work on isoprenoid metabolism and examine the potential of developing novel antibiotics.

While Dr Vickers has a focus on research, she is also interested in teaching and mentoring at graduate and undergraduate levels. She has affiliated positions at UQ's School of Chemical Engineering and School of Chemistry and Molecular Biosciences, and is a founding member of AIBN's Early Career Researcher Support Committee.

"I have been extremely fortunate to have had excellent mentors throughout my career. I have learned an enormous amount from them and from my own experiences in research science. I think it's my responsibility to pass that on as best I can to the next generation."

Dr Vickers has benefitted from the interdisciplinary nature of AIBN's research environment, which has complemented the network of collaborators she developed during her studies and while overseas.

"My research career has given me the opportunity to travel widely. I have developed large networks of international collaborators throughout Europe, America and Australasia."

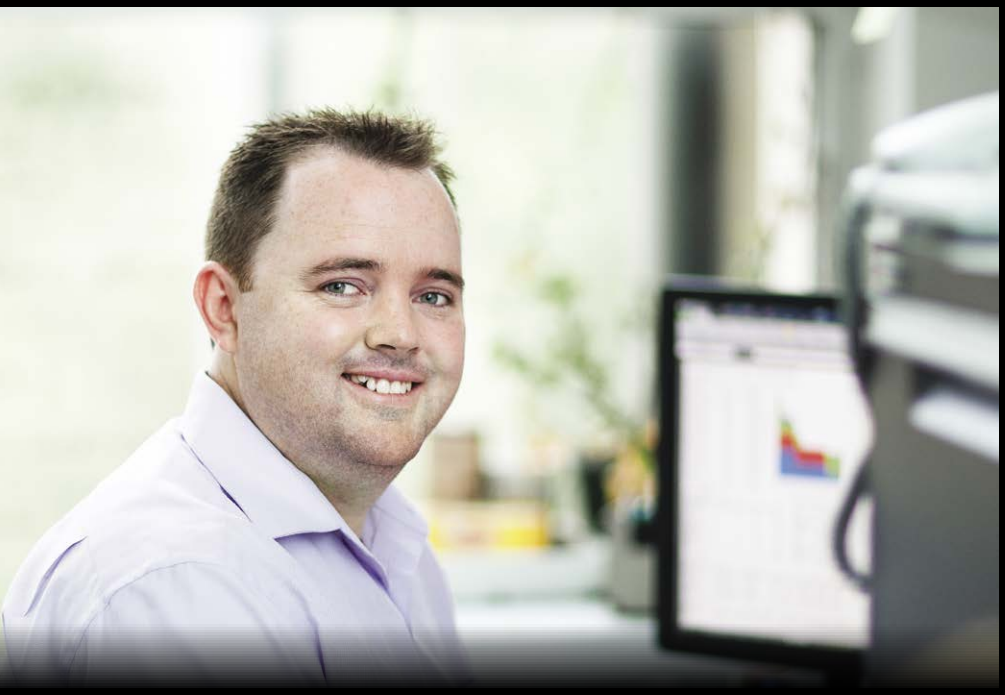
Dr Vickers is also very active in science outreach and communication, and has made several educational videos, posted on YouTube.

"I find it extremely rewarding talking to people about science. Much of our research is funded by taxpayers and I believe it's really important to communicate – and justify – how we spend that money."

Dr Vickers is recognised in Australia as a key member of the synthetic biology community, with previous roles as an advisor to the Federal Government and the American-based Institute of Science for Global Policy. She was a keynote speaker at a synthetic biology workshop at Macquarie University in November.

Dr Vickers will chair the synthetic biology session at the NanoBio Australia conference in July 014 and run a dedicated synthetic biology workshop entitled From Talk to Action: Developing and Funding SynBio Research in Australia.

Graduate combines research and mentoring



Dr Paul Luckman is taking an unusual approach to building what he hopes will be a successful career in teaching, supervision and research.

Since Dr Luckman completed his PhD at AIBN in July 2013, he has taken on several diverse roles that involve working with industry, supervising research projects and mentoring a new generation.

Dr Luckman has a research management role in Professor Peter Halley's AIBN research group, working with start-up company Plantic Technologies to develop smart packaging materials with support from an Australian Research Council linkage grant.

The role will focus on building consulting relationships and coordinating research projects in Professor Halley's group for the company.

It is a significantly different role to one he temporarily took over from AIBN Professor Darren Martin in 2013 as co-ordinator and lecturer of the biomaterials course for UQ's School of Chemical Engineering.

Teaching is something Dr Luckman has done since enrolment as an undergraduate, when he tutored high school and then UQ students.

"I find teaching one of the most rewarding aspects so far in my career. It is incredibly challenging and has enabled me to be a better public speaker," he said.

"I like the social interaction. Learning how people learn, apart from being a fascinating topic, has helped me become a better student in my own studies.

"I want the next generation to understand more about science, engineering and research. I see myself communicating science to larger audiences to improve public engagement with science."

Dr Luckman also has mentoring and supervision responsibilities in Professor Halley's research group at AIBN, moving into a leading role at the Centre for High Performance Polymers in 2013 to improve research and development with potential industry partners.

The role involves working with multiple research partners in industry and generating income for AIBN through consulting partnerships.

"During my career I would like to devote myself to improving the environment that surrounds research in Queensland, including funding and support. In a similar way, I would like to work with local industry, building ties to leading scientific research and universities."

From a scientific prospective, Dr Luckman has worked across several fields concurrently. His PhD project was in tissue engineering.

Dr Luckman presented his research in Florida while completing his PhD under Professor Justin Cooper-White's supervision.

"Professor Cooper-White taught me to be ambitious, to have the drive to succeed and to strive to for continuous improvement," he said.

"There are several reasons why I chose AIBN to undertake my PhD and continue my career path. AIBN's strength lies in its diversity of research and the expertise and equipment within the institute.

"In a traditional research setting in either a science or engineering laboratory, it is challenging to bring one field into the other. There are very few places in the world that have AIBN's cross-over. Opportunities for novel research are easier to take advantage of than if you were in a more traditional research institute."

Engagement

Community engagement

AIBN researchers took science out of the lab and into the public arena as part of community engagement activities during 2013, helping to achieve a greater understanding of the impact science has on people's everyday lives.

The researchers spoke to large audiences and videos of their presentations were posted online to take their messages around the world.

Professor Mark Kendall was the only presenter from Australia to give a TEDGlobal talk in Edinburgh, Scotland in June, detailing the potential global reach of his vaccine delivery device the Nanopatch.

The video of the presentation, delivered to a select audience of about 1000 people at TEDGlobal 2013, was uploaded to the TEDGlobal website and attracted more than 600,000 views within three months.

Professor Kendall said the TEDGlobal presentation introduced a broad, international audience to the technology developed in his AIBN lab and advanced through spin-out company Vaxxas towards clinical testing and product development.

The Nanopatch has been developed to deliver a dry-coated vaccine into the skin, achieving protective immune responses in small animal models with doses up to 100 times smaller than required for a needle and syringe.

"It is significant and a great honour to be invited to present at TEDGlobal, given the large, international audience and the calibre of fellow presenters," Professor Kendall said.

Using the slogan Ideas Worth Spreading, TED Global presentations bring together the world's most fascinating thinkers and challenges them to present talks in 18 minutes or less.

Professor Kendall was also involved in a panel discussion for UQ's Global Leadership Series, a lively program of events for alumni and the community aimed at unearthing matters that have impact and shape people's ideas of the world.

The discussion on improving the reach of vaccines to the developing world with Nanopatches featured Translational Research Institute Director of Research Professor Ian Frazer AC; Head of Clinical Research at the National Centre for Immunisation Research and Surveillance Professor Robert Booy; and Queensland Chief Scientist Dr Geoff Garrett AO. AIBN Director Professor Peter Gray was the moderator.

The commercial and social implications of Professor Kendall's research were detailed in a keynote address at a Young Women in Science and Engineering presentation at St Aidan's Anglican Girls' School in May.

Held as part of a larger Aspiring Women in Science Conference, the presentation's audience included more than 100 female high school students from around Queensland contemplating further study at university level and careers in science, and their parents and teachers.

Professor Kendall provided insights into personal and academic attributes likely to be beneficial for successful careers in science and engineering and outlined his own career in the field.

Professor Justin Cooper-White delivered a TEDx talk to an audience of more than 300 people at the State Library in Brisbane about engineering and designing human tissues.

The video of the presentation, called ONExHEART, has been posted by TEDxBrisbane on YouTube and continues to attract viewers.

Professor Cooper-White detailed tissue engineering efforts that aim to regenerate heart tissue and arrest cardiovascular disease, which is responsible for more than 30 per cent of deaths in Australia.

"We are truly passionate about making heart failure a thing of the past," Professor Cooper-White said of his AIBN research group and collaborators. "I truly think that it will be possible, with a lot more hard work, to mend a broken heart."

TEDx is a program of local, self-organised events that bring people together to share a TED-like experience. At TEDx events, TEDTalks video and live speakers combine to spark deep discussion and connection in small groups.

School engagement

Researchers and students at AIBN engaged with a growing list of schools in 2013, with building tours, student lab placements and school visits.

Outreach activities involved 17 schools from south-east Queensland, including those on the Gold and Sunshine coasts and at Toowoomba, Warwick and Coomera.

AIBN Professor Anton Middelberg engaged with remote and rural students when he conducted an online science class for Charleville School of Distance Education, teaching Year 5 and 6 students about electricity and conductivity using copper and zinc lodged in lemons.

To encourage the learning, Professor Middelberg has started planning for Charleville School of Distance Education students to spend a day at AIBN in 2014 as part of a week-long experience of city life in Brisbane.

High school students were offered a chance to experience life in a lab during 2013, with four-day placements providing an insight into the life-cycle of research from experimentation and collaboration to commercialisation.

The 30 students involved in placements came from 10 schools, with Natalie Young coming from Toowoomba's The Glennie School to secure a place in Professor Matt Trau's lab for an insight into nanoscience, nanotechnology and molecular diagnostics.

Tours of AIBN labs were arranged for students from Albany Creek State High; Brisbane Boys' College; St John Fisher College; the Queensland Academy for Science, Mathematics and Technology (QASMT); Scots PGC College in Warwick; Mt Creek State High School on the Sunshine Coast; and Emmanuel College on the Gold Coast.

Students at UQ's St Lucia campus for the Spark Engineering Camp, the International Youth Leaders Forum and UQ Open Day also gained access to AIBN labs for conducted tours.

The tours are conducted as part of the AIBN Ambassador Program to demonstrate the breadth of research at AIBN and explain real-life applications of the work.

AIBN researchers also travelled to schools as part of the institute's outreach activities, with QASMT welcoming Dr Esteban Marcellin, Dr Mirjana Dimitrijev Dwyer, Dr Darren Korbie and Dr Simon Corrie for presentations on strategically-designed proteins for drug delivery and food stabilisation; molecular technologies for diagnostics; and genetics for personalised medicine.

AIBN's outreach activities aim to foster an interest in science; create an understanding of the value of science in the lives of Queenslanders; and present science to students as a potential area of study and a career path.

Sister city relationship builds knowledge

Chinese undergraduate medical student Jiang He improved his research skills, analytical thinking and understanding of the research culture during a three-month placement at AIBN in 2013, as part of a Shenzhen-Brisbane Sister City Research Scholarship.

Mr He studied nanotechnology at AIBN under Associate Professor Zhi Ping (Gordon) Xu's supervision while receiving credit for his fifth-year undergraduate degree at Shenzhen University.

The research scholarship enabled Mr He to work with Associate Professor Xu on developing nanoparticles aimed at delivering biomolecules that manipulate the body's anti-cancer cells to stimulate a strong immune response.

Targeting diseased parts of the body while leaving healthy cells untouched should reduce the side effects of broad-spectrum treatments such as chemotherapy, in which medicines flood the entire body and also destroy healthy cells.

Mr He said his experience at AIBN had reinforced his interest in a career in biomedical research, starting with a PhD in either Australia or the US.

"We have been solving problems through physics and chemistry for hundreds of years, but there are still lots of questions, especially in significant areas of human health," Mr He said.

"I would like to be involved in solving those problems. With Gordon Xu, I have been improving my research skills, analytical thinking and understanding the research culture."

Mr He said his visit to Brisbane was his first trip outside China and had given him a more global outlook.

Associate Professor Xu said the placement provided a valuable exchange of knowledge and ideas, important in opening the research field to the next generation of early career researchers.

"It is important for researchers to have a global outlook and collaborate with top people in their fields in various parts of the world," he said.

The scholarship is part of a sister city arrangement between Brisbane and Shenzhen, a city of 10 million people in Guangdong Province near Hong Kong.

Brisbane Lord Mayor Graham Quirk said sister city relationships delivered real opportunities and results for Brisbane and Shenzhen businesses, students and residents.

"This is a great opportunity for a student from Shenzhen to work with and learn from world-class researchers at AIBN.

"Through this scholarship opportunity, students from both cities can learn from each other and develop new skills while contributing to advances in biomedical research."

AIBN has a wide engagement with the global research community, including training people from universities, research institutes and industries in other countries.

As part of its development and engagement program, AIBN encourages students and early career researchers to engage with outside groups to develop networks and skills for the foundation of a successful scientific career.

Student experience

RHD report

Student achievements in 2013 demonstrate AIBN's research productivity, effective support infrastructure and inclusive recruitment strategies.

The institute had records in the number and quality of research higher degree completions in 2013, student commencements and scholarships awarded.

A record 27 research students were awarded higher degrees in 2013, with 26 gaining a PhD and one an MPhil – a marked increase on the 15 students awarded in 2012.

PhDs were awarded to Yosephine Andriani, Colin Archer, Jessica Cameron, Xiaojing Chen, Yam-Mi Chuang, Pamela Jaramillo Ferrada, Erika Fiset, Sandy Budi Hartono, Kelly Kitchens, Atikah Kadri, Jakov Kulis, Peng Li, Mervyn Liew, Paul Luckman, Leila Matindoost, Sean Muir, Hoang Quan Nguyen, Huey Wen Ooi, Azlin Fazlina Osman, Tania Rivera Hernandez, Suriana Sabri, Anne Sandstrom, Nghia Truong Phuoc, Dipti Vijayan, Jie Yang and Yian Zhu.

An MPhil was awarded to Khaled Sebakhy.

As a measure of research performance during candidature, 18 of the students who submitted their thesis in 2013 met the eligibility criteria for the Dean's Award for Research Higher Degree Excellence, which is based largely on examiners requiring minor or no changes to the thesis.

Dr Yang and Dr Kulis were recipients of the award in 2013, recognising a demonstrated excellence in a research higher degree and commended for substantial contribution to their field of research.

The success can be attributed to AIBN's aim of generating outstanding research and, in the process, a new generation of outstanding researchers.

AIBN has an inclusive strategy to attract and cultivate talented students with an interest in research as a potential career. The strategy encompasses laboratory tours for high school students, research internships for undergraduates and research projects for Honours, Masters and PhD students.

Research students are primarily attracted to innovative projects the institute's leading researchers undertake and the results they produce. AIBN encourages students through policies that reward timely progress, promote publication and provide support when needed.

Student achievements

James Briggs was selected for one of only seven Herchel Smith Fellowships awarded annually to students across the entire graduate sciences intake at Harvard, allowing him to join an intake of about 60 PhD students to study RNA genes and their role in shaping the epigenome.

This will continue a collaboration with Harvard Assistant Professor John Rinn that started when Mr Briggs was completing his Honours under the supervision of AIBN's Associate Professor Ernst Wolvetang and the Institute for Molecular Bioscience's Professor John Mattick and Dr Guy Barry.

Patrick Fortuna won UQ's inaugural John Kapeleris Medal for Biotechnology for his Masters studies, completed jointly between AIBN and the School of Chemistry and Molecular Biosciences.

The Masters study was conducted in AIBN Associate Professor Ernst Wolvetang's laboratory, where Mr Fortuna was employed as a research assistant since his graduation and started his PhD in late 2013.

PhD student **Stefano Meliga** was listed as first author when his mathematical modelling work was published in 2013 in the prestigious *Journal of Controlled Release*. It adds to Engineers Australia's National Committee on Applied Mechanics recognition of the work, with the postgraduate student best paper award at the Australasian Congress of Applied Mechanics at the University of Adelaide.

Mr Meliga's modelling simulates the application to skin of microscopic needles on a silicon wafer, called the Nanopatch, which can be coated with vaccines against key diseases including influenza, human papillomavirus, herpes simplex, and the West Nile and Chikungunya viruses.

PhD students **Tim Brennan** and **Nilay Thakar** were among 20 Australians, selected on academic achievement and scientific potential, for a European Molecular Biology Lab scholarship to attend its PhD Symposium in Heidelberg, Germany.

The travel also enabled Mr Brennan to work with world leaders in yeast metabolic engineering research in Professor Jens Nielsen's lab at Chalmers University of Technology in Gothenburg, Sweden.

Mr Brennan continued AIBN's success at the Three-Minute Thesis (3MT) competition, named runner-up at UQ's 2013 final and being selected by the audience as the people's choice winner.

He was awarded for the explanation of his research as part of the Queensland Sustainable Aviation Fuel Initiative in using sources such as sucrose from sugarcane to make renewable jet fuel.

The 3MT competition challenges students to strip away jargon and explain their research in a compelling way to a general audience within three minutes. It is a trade-marked UQ innovation in research communication now adopted by more than 80 universities in 12 countries.

The National Stem Cell Foundation of Australia award financially supported Mr Thakar to

attend the Australian Society for Stem Cell Research conference in Brisbane, where he won the best poster presentation award.

He completed a three-year term in 2013 on the coveted International Society for Stem Cell Research Junior Investigator Committee, representing postdoctoral researchers and medical and graduate students, fostering networking and augmenting meeting attendance through travel grants and merit awards.

PhD students **Kripal Singh Lakhi** and **Geoffrey Lawrence** received poster awards at the International Workshop and Seminar on Green Energy Conversion in Nagano, Japan, recognising the quality of data from their research into new materials.

The students received Graduate Travel Awards from the University of Yamanashi to attend the seminar, giving them a chance to meet researchers and students from around the world.

Mr Lawrence also received a prize for best oral presentation at the 21st International Conference on Materials and Technology in Portorož, Slovenia in 2013, ahead of 40 other researchers from Europe, China, and North and South America.

Donna Capararo received a UQ Graduate School International Travel Award and won a Centennial Scholarship from the Royal Aeronautical Society for travel to the Department of Coatings and Polymeric Materials at North Dakota State University in Fargo, the US.

Ms Capararo spent three month on a research exchange, working with Professor Stuart Croll's team on molecular modelling of polymer networks.

Karin Taylor was awarded a European Society for Animal Cell Technology bursary to present at the organisation's conference in Lille, France, recognising the quality and scientific interest of her submission.

Ms Taylor was also selected to present a poster at the 9th annual Protein and Antibody Engineering Summit in Boston in the US.

The Australasian Society for Biomaterials and Tissue Engineering awarded **Clementine Pradal** an ASBTE Conference Travel Award to present at the annual conference in South Australia's Barossa Valley.

She was also invited to present at the Asian Biomaterials Congress, an international conference in Hong Kong in June.

Nathan Boase received the award for best oral presentation at the Royal Australian Chemical Institute Queensland Polymer Group Student Symposium.

Mr Boase also presented a poster at the World Molecular Imaging Congress in Savannah, Georgia, in September.

Camila Orellana was runner-up in the Young Investigator Awards for her oral presentation at the Bioprocessing Network 2013 Conference on the Gold Coast.

www.aibn.uq.edu.au/future-students

James Briggs

Graduates 2013

Yosephine Andriani

Qualifications: ST (equivalent to BEng) *Widya Mandala Catholic University Surabaya, Indonesia,* MScEng (Chem Eng) *National Taiwan University of Science and Technology*, PhD (Biomedical Engineering) *UQ*

PhD awarded: November 2013

Principal supervisor:
Professor Darren Martin

Thesis title: Biocompatibility and toxicity of synthetic organoclay nanofillers and biomedical polyurethane nanocomposites

Research project: The research has been driven by the advancement of Cochlear implants, requiring new insulation materials capable of accommodating a smaller and more intricate design of electrode arrays. Polyurethanes have long been attractive polymeric biomaterials due to their biocompatibility, processability and tailorable mechanical properties. For future designs of some next generation medical device components, the mechanical properties of existing polyurethanes are inadequate. In the project, the viability of silicone-based polyurethane/organoclay nanocomposites was investigated for long-term implantable medical devices, particularly for the next generation of Cochlear implants.

Graduate position: Scientist, patterning and fabrication, Institute of Materials Research and Engineering, Singapore

Colin Archer

Qualifications: BEng *UNSW*, BSc *UNSW*, PhD *UQ*

PhD awarded: November 2013

Principal supervisor: Professor Lars Nielsen

Thesis title: Understanding the phenotypic asymmetry in *Escherichia coli*

Research project: The research involved developing and characterising multi-omics datasets to explain diversity amongst strains of *E coli*, a popular host for biotechnological applications. The focus was on genes, proteins and metabolites that could explain large observed differences between strains in carbon source use, growth rate and organic acid production. Each significantly influence the commercial viability of a bioprocess.

Graduate position: Data engineer, developer and licensee of RBlockchain, an R software package providing real-time network analysis and tracking of transactions across cryptocurrency blockchains and marketplaces

Jessica Cameron

Qualifications: BEng (Biomechanical) (Hons)/BSc (Mathematics) *University of Sydney*, PhD *UQ*

PhD awarded: November 2013

Principal supervisor:
Professor Andrew Whittaker

Thesis title: Hydrogels for wound healing applications

Research project: The goal of the research was to develop and characterise materials to form part of a bandage for chronic and acute wounds. A range of hydrogels were synthesised and the structure of the polymers was studied at different scales. The hydrogels were analysed to determine their ability to maintain a physiologically ideal, moist environment for reepithelialisation and wound closure. The ability of the hydrogels to deliver various drug molecules was also measured.

Graduate position: Student of a Masters of Biostatistics

Yami Chuang

Qualifications: BSc (Hons) *UQ*, GCertResCom *UQ*, PhD *UQ*

PhD awarded: July 2013

Principal supervisor:
Associate Professor Idriss Blakey

Thesis title: Directed self assembly of rationally designed block copolymers: Towards an advanced lithography process for reducing line edge roughness

Research project: Devices controlled by computer chips impact on almost every aspect of people's lives, enabled by the ability to build faster and more energy efficient chips. However, the development of the next generation of devices has been inhibited by issues with materials used in their manufacture. A major issue has been the ability to accurately manufacture transistors, components that make up computer chips, with dimensions in the order of 30nm, or 1000 times thinner than the width of a human hair. The objective of the research was to improve the ability to manufacture transistors at those length scales. The approach used electrostatic and thermal properties of rationally designed polymers to significantly improve the manufacturability of transistors. The research outcomes show a potential to improve manufacturing processes in computer chip manufacture, ultimately influencing production yields and chip performance.

Graduate position: Postdoctoral researcher at the University of Hasselt, Belgium, with research projects focused on developing a photo-ATRP polymerisation method that could be used for developing biomaterials

Pamela Ferrada

Qualifications: Bs Biochem (Hons) *Austral University of Chile*, PhD *UQ*

PhD awarded: January 2013

Principal supervisor:
Professor Justin Cooper-White

Thesis title: Cartilage tissue engineering using mesenchymal sromal cells from human term placenta

Research project: The research focused on the isolation and characterisation of mesenchymal stromal cells (MSCs) from the amniochorionic fetal membrane of human term placenta. Two major goals of this project were the comparative characterisation of amnion, chorion and bone marrow-derived MSCs, and the effect of low oxygen tensions on expansion and differentiation potential of placental derived stem cells *ex vivo*. The studies demonstrated the enhanced cartilage forming ability of chorion derived MSCs in comparison to amnion and bone marrow cells, and therefore, their great potential as a cell source for cartilage tissue engineering applications.

Graduate position: Research consultant at Just Outcomes Pty Ltd

Erika Fiset

Qualifications: BSc (Chem) *Universite Laval*, MSc (Chem) *Universite Laval*, PhD *UQ*

PhD awarded: December 2013

Principal supervisor: Dr Denisa Jurcakova

Thesis title: Nitrogen-rich porous carbons for supercapacitors

Research project: The thesis focused on the synthesis and characterisation of nitrogen-rich porous carbon materials as carbon electrodes for supercapacitors to understand the combined effect of carbon porous structures and surface nitrogen functionalities on the energy storage mechanism. The optimal porosity of electrode materials, the effect of microporosity and particle size of double-layer capacitance mechanism was first investigated using silicon carbide-derived carbons as a model of electrode materials without nitrogen surface functional groups. The synergistic effects of porosity and surface chemistry on the capacitive performance were then investigated by using nitrogen-rich porous carbons synthesized from different melamine precursors.

Graduate position: Postdoctoral research fellow at the Laboratory of Chemical and Environmental Engineering at Universitat de Girona, dealing with bioelectrochemical systems for water treatment

Sandy Budi Hartono

Qualifications: ST *UKWMS*, MPhil *UQ*, PhD *UQ*

PhD awarded: December 2013

Principal supervisor:
Professor Chengzhong (Michael) Yu

Thesis title: Synthesis of porous nanoparticles as carriers in therapeutic delivery

Research project: The research focused on the synthesis of large pore mesoporous silica nanoparticles (LPMSN), including their functionalisation, characterisation and application in gene and drug delivery. Novel and facile approaches have been established to develop composites of LPMSN and various polycations, showing advantages such as high binding capacity, strong ability to deliver genetic molecules and low cytotoxicity. The system was tested to deliver functional siRNA against minibrain-related kinase and polo-like kinase 1 in osteosarcoma cancer cells. Modification of the LPMSN endowed the system with multi-functions, such as time-dependant release and co-delivery of gene and drug molecules. The results showed that modified LPMSN had great potential for efficient gene therapy.

Graduate position: Lecturer and research scientist at Widya Mandala Catholic University, Surabaya, focusing on synthesis of porous materials for gene and drug delivery and bio-molecules separation

Tania Rivera Hernandez

Qualifications: BEng (Biotech) *UPIBI-IPN*, *Mexico*, PhD *UQ*

PhD awarded: May 2013

Principal supervisor:
Professor Anton Middelberg

Thesis title: Bioengineering virus-like particles for vaccine development

Research project: The research focused on the design, manufacture and in vivo evaluation of several vaccine candidates against group A streptococcus infection using a virus-like particle-based platform for antigen presentation. The project demonstrated the ability of VLPs to raise antigen-specific immune responses in mucosal surfaces, highlighting their potential application as intranasal vaccine delivery systems.

Graduate position: Postdoctoral research fellow at the School of Chemistry and Molecular Biosciences, UQ

Kelly Hitchens

Qualifications: BBiomolSc (Hons I) *Griffith*, PhD *UQ*

PhD awarded: December 2013

Principal supervisor:
Associate Professor Christine Wells

Thesis title: Dissecting the role of Mincle in the macrophage response to trehalose-6,6'-dimycolate and mycobacteria.

Research project: Trehalose-6,6'-dimycolate (TDM), a component of mycobacterial cell walls, is a critical mediator of tuberculosis pathology in animal models. Despite its importance, there is a lack of a clear perspective on the molecular mechanisms mediating TDM-induced host responses. The thesis addressed the role of Macrophage inducible C-type Lectin (Mincle) in early host responses to TDM, particularly Mincle's function in orchestrating inflammatory responses. The thesis implicated Mincle in directing a subset of TDM-induced macrophage responses via multiple mechanisms. The research also demonstrated that primary human monocytes stimulated with TDM recapitulated the majority of the host response to mycobacteria.

Graduate position: Postdoctoral researcher at AIBN

Atikah Kadri

Qualifications: BEng (Chemical Engineering with Fuel Technology, Hons) *University of Sheffield*, MSc (Engineering) *University Malaya*, PhD *UQ*

Dr Erika Fiset

PhD awarded: December 2013

Principal supervisor:
Associate Professor XiangDong Yao

Thesis Title: The roles of carbon nanotubes, metal organic frameworks and transition metals in a Magnesium-based hydrogen storage system.

Research project: The project focused on improving hydrogen storage performance by co-doping carbon nanotubes with pre-synthesized titanium and vanadium catalyst respectively in magnesium hydride. The possibility of introducing metal organic framework as catalyst was also investigated.

Graduate position: Senior lecturer at Universiti Teknologi Mara, Malaysia

Anne Marie Kozak

(formerly Sandstrom)

Qualifications: BSc (Textile chemistry), MSc (Textile chemistry) *UC Davis*, PhD (Bioengineering) *UQ*

PhD awarded: April 2013

Principal supervisor:
Professor Justin Cooper-White

Thesis title: Development of methods for plasma polymerization of surfaces in two and three dimensions for tissue engineered interfaces

Research project: The thesis focused on the characterisation and optimisation of plasma polymer surfaces to enhance the in-vitro differentiation of mesenchymal stem cells to chondrocytes (cartilage cells) and osteoblasts (bone cells).

Graduate position: Applications scientist at Izon Science US Ltd, Cambridge, Massachusetts

Peng Li

Qualifications: BEng *WHUT (China)*, MEng *CTH, Sweden,* PhD *UQ*

PhD awarded: October 2013

Principal supervisor:
Associate Professor Zhi Ping (Gordon) Xu

Thesis title: Control, preparation and characterisation of inorganic nanocrystals as long-term micronutrient foliar ertilisers

Research project: Control, preparation and characterisation of nanocrystals as potential long-term suspension foliar fertilisers for supplementing micronutrients to plants were investigated to correct the micronutrient deficiency in crop plants. To overcome the disadvantages of conventional fertilisers, such as phytotoxicity or low efficacy, suitable ion concentrations of zinc, manganese, copper, and iron in their fertiliser suspensions were proposed. The particle morphology was rationally designed to be one-dimensional nanoscale for good adherence on leaf surfaces. Successful preparation of selected nanocrystals via industry-applicable method could be used to solve the global problems of low yield and quality in crop production against continuously increasing population.

Graduate position: Technical manager, Tianjin Dawnrun Group (Australia) Pty. Ltd

Paul Luckman

Qualifications: BEng(Hons) *UQ,* MEng *UQ*, PhD *UQ*

PhD awarded: July 2013

Principal supervisor:
Professor Justin Cooper-White

Thesis title: Development of novel materials and scaffold fabrication methodologies for soft tissue engineering applications

Research project: The focus for the thesis was to develop a scaffold that varied regionally in moduli and had the correct microstructure to direct cell response tailored for the meniscus tissue engineering applications. The work aimed to develop scaffold fabrication techniques and scaffold materials for use in fabricating a scaffold for the meniscus tissue engineering. In the process, several novel tissue scaffold fabrication methodologies were developed, including an adaptation to the thermally-induced phase separation process for photo-curable polymers; and a novel method for controlling isotherms during thermally-induced phase separation to control scaffold pore architectures.

Graduate position: Postdoctoral researcher at the Centre for High Performance Polymers at AIBN, with primary research focused on the development of thermoplastic biopolymer films for renewable packaging applications

Leila Matindoost

Qualifications: BSc *Isfahan University of Technology*, MSc *Guilan University*, PhD *UQ*

PhD awarded: July 2013

Principal supervisor: Dr Steven Reid

Thesis title: *In vitro* production of budded virions in group I and group II *Alphabaculoviruses*

Research project: The thesis investigated the factors involved in the production of wild type *Helicoverpa armigera* nucleopolyhedrovirus budded virus, in *Helicoverpa zea* cells.

Graduate position: Assistant Professor at Shahid Beheshti University in Tehran, Iran

Sean Muir

Qualifications: BE (Chem, Hons I), BSc (Chem), PhD *UQ*

PhD awarded: August 2013

Principal supervisor: Professor Max Lu

Thesis title: Sodium borohydride production and utilisation for improved hydrogen storage

Research project: The project aimed to develop a system for safe, controllable on-board hydrogen storage based on sodium borohydride, allowing hydrogen to be stored in aqueous solution and released on demand with a catalyst. Improvements made to the system included a new method for preparing a higher activity catalyst; a novel reactor design which could achieve a higher hydrogen storage capacity than conventional designs; and a new process for regenerating sodium borohydride using low-cost input materials.

Graduate position: Senior engineer, Research Assignments Program, the Dow Chemical Company, Michigan, US

Hoang Quan Nguyen

Qualifications: BBiotech (Hons) *UQ*, PhD *UQ*

PhD awarded: December 2013

Principal supervisor: Dr Steven Reid

Thesis title: Genome-scale transcriptomic study of *Helicoverpa Zea* host cells and *H. armigera* baculovirus infections in vitro

Research project: Baculovirus-insect cell technologies are being developed for the production of eukaryotic proteins, veterinary and human vaccines, delivery vectors for gene-therapy, and biopesticides. However, cell-virus interactions make baculovirus-based manufacturing processes inherently complex. The thesis uses a genome-scale transcriptomic approach to investigate the interactions at the mRNA levels of a *Helicoverpa Zea* cell line and a *H. armigera* virus, aiming to identify genes important for high productivity of *in vitro* production of baculoviruses using insect cell culture. The study provided insights on the systemic process of virus production in infected cells and identified host genes that are important for virus propagation in insect cell culture.

Graduate position: Postdoctoral researcher at the RIKEN research institute, Japan, working in a research project funded by the European Human Frontier Science Research Program for studying roles of noncoding RNAs in DNA damage repair to find RNA markers and RNA regulators in DNA damage response pathways.

Huey Wen Ooi

Qualifications: BBiotech (Nanotechnology), PhD (Polymer chemistry) *UQ*

PhD awarded: August 2013

Principal supervisor:
Professor Andrew Whittaker

Thesis title: Precisely-structured thermo-responsive "click" hydrogels

Research project: The conventional method for preparing hydrogels is using free radical polymerisation, whereby the final structure of the network is determined by statistical processes. For these networks, the properties are described in averages and cannot be defined precisely. Since the emergence of living radical polymerisation techniques, polymer chains with different functionalities of narrow molecular weight distributions are easily synthesised. The methods, combined with coupling reactions, create the possibility of synthesising homogeneous precisely-structured networks. The research project involved designing and preparing precisely-structured thermo-responsive hydrogels using reversible-deactivation radical polymerisation coupled with high fidelity reactions such as "click" chemistry for cross-linking reactions.

Graduate position: Postdoctoral fellow at Karlsruhe Institute of Technology, Germany, working with Professor Christopher Barner-Kowollik and Professor Matthias Franzreb

Azlin Fazlina Osman

Qualifications: BEng (Hons), MSc (Materials engineering) *Universiti Sains Malaysia,* PhD (Nanotechnology) *UQ*

PhD awarded: April 2013

Principal supervisor:
Professor Darren Martin

Thesis title: Biomedical thermoplastic polyurethane nanocomposites: structure-property relationships

Research project: The viability of siloxane-based thermoplastic polyurethane (TPU) nanocomposites was investigated as new insulation materials for implantable and electrically active medical devices. The effect of an organically modified nanosilicate (organosilicate) being added to the underlying TPU morphology and mechanical properties was thoroughly studied and reported.

Graduate position: Senior lecturer at Universiti Malaysia Perlis

Nghia Truong Phuoc

Qualifications: BSc *HCMUS,* MSc *HCMUS*, PhD *UQ*

PhD awarded: November 2013

Principal supervisor:
Professor Michael Monteiro

Thesis title: Synthesis of functional polymers and nanostructures for siRNA delivery

Research project: The objective of the thesis was to synthesize well-defined polymers and 3D functional polymeric nanostructures for siRNA delivery. The polymers and nanostructures were designed and synthesized to address long-standing barriers in siRNA delivery, focusing on endosome escape and siRNA unpacking.

Graduate position: Lecturer at Vietnam National University, Ho Chi Minh City

Suriana Sabri

Qualifications: BS (Hons) *Universiti Putra Malaysia*, MS *Universiti Putra Malaysia*, PhD *UQ*

PhD awarded: November 2013

Principal supervisor: Dr Claudia Vickers

Thesis title: Metabolic engineering for production of industrial isoprenoids from sucrose using *Escherichia coli*.

Research project: The research focused on the development of an efficient microbial host, *E coli*, that uses sucrose as a carbon source for production of biochemicals, in particular isoprene. Sucrose is a preferred feedstock for microbial fermentation because it is cheap, abundant in nature and relatively environmentally friendly. Sucrose use in *E coli* is poorly understood and most industrial *E coli* strains cannot use sucrose. The major outcomes of the thesis are development of a detailed understanding of the molecular control of sucrose use in *E coli W*; development of a molecular biology tool for integration of large DNA sequences onto

Dr Sean Muir

the *E coli* chromosome; successful transfer of methylerythritol phosphate (MEP) pathway genes from plant into *E coli* for isoprene production; and identification of a negative regulation control for the MEP pathway. The combination of sucrose utilisation and improved isoprenoid pathway flux in one strain enables access to a cheap and environmentally friendly carbon source for production of an industrially important class of biochemicals. Development of cheaper and more environmentally friendly bioprocesses will improve the ability of bioprocesses to compete with current petrochemical-derived routes for manufacture of many products.

Graduate position: Senior lecturer, Department of Microbiology, Universiti Putra Malaysia

Khaled Omar Sebakhy

Qualifications: BSc, MSc (Chemical Engineering) *Alexandria University*, MPhil (Polymer Chemistry) *UQ*

MPhil awarded: February 2013

Principal supervisor:
Professor Michael Monteiro

Thesis title: RAFT-Mediated Polymerization in Nanoreactors

Research project: The synthesis of well-defined polymer nanoparticles in water has been quite a challenge, especially in the synthesis of particles with good control over both particle size distribution (PSD) and molecular weight distribution (MWD). The research involved developing a novel process to synthesise nanoparticles with excellent control over particle size and molecular weight using RAFT-mediated polymerization of styrene.

Dipti Vijayan

Qualifications: BBiotech *Mumbai University*, MBiotech *UQ,* PhD *UQ*

PhD awarded: June 2013

Principal supervisor:
Associate Professor Christine Wells

Thesis title: The role of human Mincle in the innate immune response to *Candida albicans*

Research project: How immune cells expressing Mincle respond to the opportunistic fungus *Candida albicans* formed the crux of the thesis. The research identified, for the first time, a reciprocal pattern of Mincle expression on monocytes or neutrophils within the same donor. The expression dichotomy was accompanied by strong functional polarisations. Mincle on monocytes favoured the induction of inflammatory cytokines and Th17 cells, while the receptor on neutrophils strongly correlated with fungal uptake and killing. Together this suggests a monocyte+/neutrophil- phenotype will favour regulation of mucosal fungal infections, but the reciprocal phenotype of neutrophil+/monocyte- is desirable for a systemic infection, where clearance is important. It is envisaged that future clinical studies may exploit this pattern of Mincle expression to help identify increased susceptibility in the clinic, both in patients with chronic mucosal infection and acute-care patients at risk of developing systemic infections.

Graduate position: Research officer at the Garvan Institute, Sydney, with a focus on understanding the role of a cytokine(IL-27) in autoimmune diseases such as lupus and cancer

Mervyn Liew Wing On

Qualifications: BSc (Biotechnology, Hons I) *Universiti Malaya*, Malaysia, PhD *UQ*

PhD awarded: February 2013

Principal supervisor:
Professor Anton Middelberg

Thesis title: Scalable and intensified bioprocessing for virus-like particle manufacture

Research project: The research project focused on the development of scalable and intensified upstream viral structural protein production and downstream virus-like particle (VLP) assembly and formulation bioprocesses that enable low-cost, mass manufacture of VLP vaccines. The intensified bioprocesses developed in the research project is crucial for the distribution and real-world utility of VLP vaccines, especially in underdeveloped countries where vaccines remain cost-prohibitive.

Graduate position: Senior lecturer, Institute for Research in Molecular Medicine, Universiti Sains Malaysia.

Jie Yang

Qualifications: BChem, *Shandong University*; PhD, *UQ*

PhD awarded: December 2013

Principal supervisor:
Professor Chengzhong (Michael) Yu

Thesis title: Functionalized porous materials with controlled structures for the removal ofphosphate and arsenic from wastewater

Research project: The accumulation of phosphorus or arsenic in aquatic systems results in a deterioration in water quality. Excess input of phosphorus in natural waters is the main cause of a serious environmental issue, eutrophication. Water containing even low concentrations of arsenic is very toxic and thus has a strong adverse effect on human health. To protect the natural environment and improve water quality, phosphorus and arsenic adsorbents with high performance based on porous materials with controlled structures were developed. The study also aimed to establish the fundamental correlation between the pore structure and adsorption performance and to provide guidelines for the design of phosphorus and arsenic adsorbents with high performance.

Graduate position: Lecturer Sichuan University, China

Yian Zhu

Qualifications: BSc *Nanjing University, China,* MSc *Nanjing University*, China, PhD *UQ*

PhD awarded: September 2013

Principal supervisor: Associate Professor Zhi Ping (Gordon) Xu

Thesis title: Synthesis and modification of fluorescent quantum dots for live-cell imaging

Research project: Since the first demonstration of the biomedical potential of quantum dots (QDs) in 1998, QD-based bio-research has increased exponentially. QDs have become a powerful tool in the study of cell and molecular biology, molecular imaging and medical diagnostics, due to their unique optical properties. But QDs also have some disadvantages that hinder their broad applications. The thesis developed a series of novel strategies on the synthesis and modification of fluorescent CdTe QDs, with remarkable improvement in the fluorescence retention and biocompatibility. Further cell experimental results indicated the great potential of these highly fluorescent nanoparticles in biomedical imaging.

Graduate position: Postdoctoral researcher at School of Medicine, Translational Research Institute, UQ, with research investigating *in vivo* biodistribution of QDs and developing QDs-based nanoprobes for targeted imaging

Student association builds stronger community

The AIBN Student Association (ASA) continued to assist in building a stronger institute community in 2013, with frequent and diverse social and academic events.

The ASA provides a support network and promotes co-operation between students and research groups at AIBN.

Good attendance was recorded at 17 events the ASA hosted during the year, with a focus on cultural diversity to ensure student inclusion and engagement of the entire cohort.

Overseeing the full calendar of events were ASA president Nathan Boase, vice president Amanda Pearce, secretary Li-Yen Wong, treasurer Thomas Bennett, social representatives Yadveer Grewal and Samuel Richardson, academic representatives Donna Capararo and Xiaoli Chen and webmaster Will Anderson.

They provided support to students in 2013 through PhD skills workshops, with speakers sharing their knowledge in applicable fields of lab and library research, networking, collaboration and thesis presentation.

Speakers included Colorado School of Mines biopolymers expert Professor John Dorgan, who answered questions about making connections and applying for positions in overseas labs, covering topics such as how to make contact, explaining skill sets in a meaningful way, writing a curriculum vitae and networking.

AIBN graduate and UQ tutor Dr Paul Luckman spoke at the workshop about the most successful way of using a range of graphics to illustrate research results in a thesis.

UQ Library's Research Information Services representative Phil Yorke Barber provided a presentation on using oft-untapped library resources such as patents and ways to successfully navigate through the records.

Additional ASA activities included institute Christmas and Melbourne Cup functions; a Halloween party; Chinese New Year and Malaysian Independence pot luck lunches; trivia and games nights; and Friday afternoon functions to mark St Patrick's Day, Cinco de Mayo, the Tour de France and Oktoberfest.

Sporting events aimed at building institute social interaction included supported bike rides and the annual staff-versus-students soccer and cricket matches.

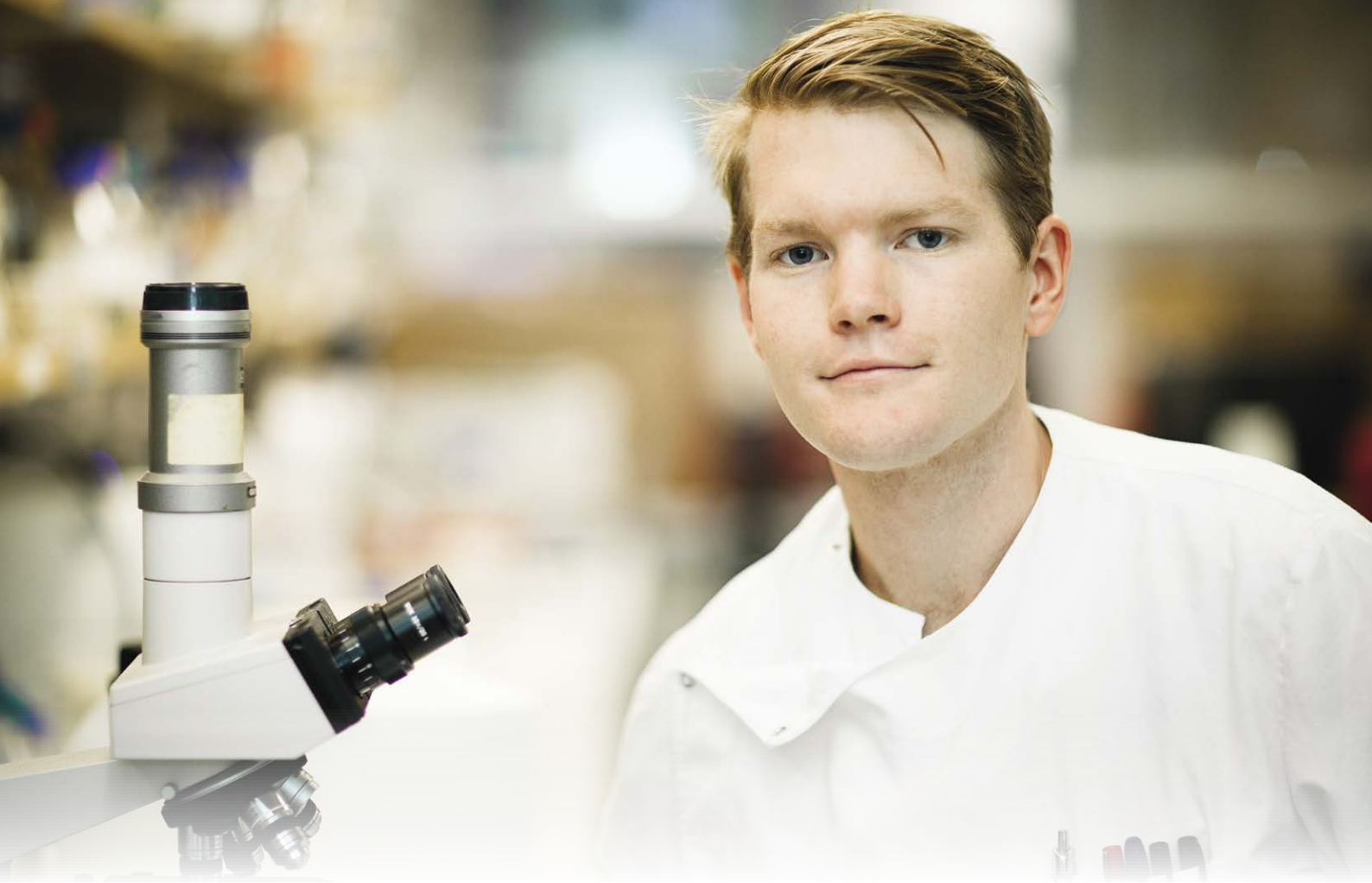
Mr Boase said the focus on linking ASA events to important cultural celebrations from Spain, Germany, China and Malaysia was successful in securing large and diverse crowds of staff and students.

"Running culturally diverse events was a highlight for the ASA in 2013," he said. "A strong sense of community was evident and people in attendance represented all areas of the institute."

The ASA took an active role in promoting, supporting and participating in the Three Minute Thesis competition, a UQ innovation that challenges students to strip away jargon and explain their research in a compelling way to a general audience within three minutes.

Members played leading roles in the AIBN Ambassador Program.

ASA executive officers took numerous groups of visitors around the AIBN building during the year, presented demonstrations of their research and explained their relevance to improving people's lives. It was part of tours organised for school groups, prospective PhD students, industry delegations, visiting researchers and the public.



Alex Bowler

Summer intake engages future researchers

AIBN's Summer Research Scholarship Program has attracted 40 undergraduate students studying in Germany, the UK and India; the University of New South Wales; Queensland University of Technology and UQ.

The program enables AIBN to engage with researchers of the future as part of eight to 12 weeks of focused research during the traditional end-of-year holiday break.

It was established to enable highly motivated undergraduate students to gain valuable research skills, access cutting-edge research facilities, receive career mentoring and cultivate scientific curiosity.

Patrick Ottensmeyer was studying at the University of Bielefeld in Germany when a fellow student told him about AIBN, particularly the work of Professor Peter Gray's research group into the development of biopharmaceuticals with animal cell cultures.

Mr Ottensmeyer said his research project in Professor Gray's lab strengthened his decision to work in the field and taught him about transfecting animal cell cultures and working under Good Manufacturing Practice conditions.

"Everything I learned I would not have learned in a classroom," he said. "I prefer 'learning by doing'. I knew a lot of the theoretical parts, but it all makes more sense after doing the research at AIBN."

UQ student Lewis Chambers spent a third consecutive summer in the AIBN labs, where he investigated the lifetime of free radicals in a specific class of materials known as ionic liquids.

Time spent in Professor Andrew Whittaker's lab enabled Mr Chambers to develop technical skills, present scientific information and communicate with fellow scientists.

"I have learned to be much more self-directed in the lab and found I was motivated to consider research as a career because the work is so intellectually stimulating – and the people are, too."

UQ chemical engineering student Alex Bowler worked in Professor Lars Nielsen's lab, engineering bacteria and exploring various metabolic and regulatory pathways to produce industrially relevant compounds such as biofuels or antibiotics.

"I feel the benefit of the program is being thrust into a real working lab environment. It takes so much more planning and critical thinking than I could have imagined," Mr Bowler said

The program's 2013-14 cohort completed their projects with professional 10-minute presentations of their research and submitted written reports of their work.

The program develops laboratory, analytic, writing and presentation skills, but more importantly defines for students whether or not research is a viable career path for them. For those who are excited by their AIBN research there are genuine opportunities to continue a trajectory through Honours and PhD towards a career in research.

Visit www.aibn.uq.edu.au/undergraduate

Research higher degree students

Prasanna Lakshmi Abbaraju
Rufika Shari Abidin
Yusilawati Ahmad Nor
Suad Alateeq
Mohamed Ahmed Alfaleh
Samah Alharbi
Eid Alosime
AbdulKarim AlSultan
Nasim Amiralian
Will Anderson
Yosephine Andriani
Melisa Anggraeni
Colin Archer
Aditya Ardana
Luqman Atanda
Anushree Balachandran
Thomas Bennett
Mercy Rose Benzigar
Nathan Boase
Valentin Bobrin
Mareike Bongers
Marion Brunck
Maria Buchsteiner
Sandy Budi Hartono
Teera Butburee
Suzanne Kathryn Butcher
Jessica Cameron
Donna Capararo
Liyu Chen
Weiyu Chen
Xiaojing Chen
Xiaoli Chen
Yam-Mi Chuang
Panagiotis Chrysanthopoulos
Jacob Coffey
Holly Corbett
Guanghui Cui
Alexandra Depelsenaire
Thanh Tam Doan
Hai-Yan Dong
Liam Fearnley
Erika Fiset
Nicholas Fletcher
Patrick Fortuna
Wanli Johnny Fu
Mikhail Gavrilov
Marianne Gillard
Ricardo Axayacatl Gonzalez Garci
Stephen Goodall
Yadveer Grewal
Gency Gunasingh
Ryan Harrison
Hadi Hezaveh
Alejandro Hidalgo-Gonzalez
Kelly Kitchens
Md Daloar Hossain
Cheng Huang
Siddharth Jambhrunkar
Pamela Jaramillo Ferrada
Stalin Joseph
Atikah Kadri
Jakov Kulis
Kripal Singh Lakhi
Geoffrey Lawrence
Kebaneilwe Lebani
Chang Lei
Peng Li
Mervyn Liew
Soo Lim
Derong Lu
Paul Luckman
Carlos Luna Flores
Yiming Ma
Elizabeth Mason
Aini Syahida Mat Yassim
Sainimili Vaubula Mateyawa
Leila Matindoost
Timothy McCubbin
Michael Mehlman
Anand Kumar Meka
Stefano Meliga
Khairatun Najwa Mohd Amin
Sean Muir
Swathi Mukundan
Jamileh Nabizadeh
Taryn Naidoo
Amir Nemati Hayati
Hwee Ing Ng
Hoang Quan Nguyen
Yuting Niu
Huey Wen Ooi
Camila Orellana
Azlin Fazlina Osman
Gillian Osmond
Ellen Otte
Harish Padmanabhan
Amanda Pearce
Bingyin Peng
Nicolas Pichon
Clementine Pradal
Ramanathan Pudhukode
Vaidyanathan
Swasmi Purwajanti
Samuel Richardson
Tania Rivera Hernandez
Pedro Andres Eduardo Saa Higuera
Khaled Sebakhy
Suriana Sabri
Anne Sandstrom
Andrea Schaller
Jessica Schwaber
Athanasia Amanda Septevani
Arjun Seth
Abu Ali Ibn Sina
Faheem Amir Solangi
Hao Song
Michael Song
Marcos Saul Soto Perez
Xiaoran Sun
Jie Tang
Karin Taylor
Alemu Tekewe Mogus
Nguyen Tran Thi Dat
Nghia Truong Phuoc
Dipti Vijayan
Jarurin Waneesorn
Kewei Wang
Yangyang Wen
David Wibowo
Thomas Williams
Li-Yen Wong
Yanheng Wu
Chun Xu
Shiyu Yan
Jie Yang
Tianyu Yang
Yannan Yang
Meihua Yu
Bijun Zeng
Cheng Zhang
Hongwei Zhang
Jun Zhang
Liang Zhao
Yao Zheng
Ruifeng Zhou
Yian Zhu
Yingdong Zhu
Huali Zuo

*List includes graduating students and those in a UQ RHD program undertaken at AIBN during 2013

Grants & publications

Grants

Fellowships and Project Grants awarded to AIBN researchers where funding commenced in 2013

Type	Granting Scheme	Chief Investigators	Title	Duration	Total Funding Awarded
Australian Competitive Grant Income	ARC Discovery Projects	A/Prof Aijun Du, Dr Yun Hau Ng,	Non-precious fuel cell cathode catalysts from carbon-based nanohybrids: a computational to experimental quest	2013-2015	$330,000
Australian Competitive Grant Income	ARC Discovery Projects	Prof Ian Frazer, Prof Mark Kendall	Sterile inflammation as a determinant of adaptive immunity	2013-2015	$500,000
Australian Competitive Grant Income	ARC Discovery Projects	Prof Andrew Whittaker, Dr Kevin Jack, Dr Hui Peng	Understanding and controlling the structure of thin polymer films used in photolithography	2013-2015	$420,000*
Australian Competitive Grant Income	ARC Discovery Projects	A/Prof Christine Wells, Dr Kim-Anh Le Cao, A/Prof Arthur Tenenhaus	The Stemformatics gene expression compendium: development of multivariate statistical approaches for cross platform analysis	2013-2015	$269,000*
Australian Competitive Grant Income	ARC Discovery Projects	Dr Chenghua Sun, Prof Huagui Yang, A/Prof Gang Liu	To identify and understand highly reactive surfaces for solar hydrogen production	2013-2015	$260,000*
Australian Competitive Grant Income	ARC Discovery Projects	Prof Chengzhong Yu, Dr Amanda Nouwens, Dr Indira Prasadam	Optimisation of functional mesoporous materials for low-abundance biomarkers quantification towards biodiagnostic applications	2013-2015	$340,000*
Australian Competitive Grant Income	ARC Discovery Projects	A/Prof Lianzhou Wang, A/Prof Shanqing Zhang, Dr Zhen Li	Designing plasmon-enhanced photocatalysts for solar-driven water pollutant removal	2013-2015	$341,000
Australian Competitive Grant Income	ARC Discovery Projects	A/Prof Lianzhou Wang, Dr Xu Zong	Self-cleaning thin films for anti-reflective solar cell coatings	2013-2015	$396,000
Australian Competitive Grant Income	ARC Discovery Projects	Dr Denisa Jurkacova, Prof Max Lu, Prof Lianzhou Wang	Development of high performance cathode materials for Li-ion batteries	2013-2016	$480,000
Australian Competitive Grant Income	ARC Discovery Projects	Prof Mark Kendall, Prof Ian Frazer	Investigating a novel, physical adjuvant for improving immune responses of vaccines	2013-2016	$595,688
Australian Competitive Grant Income	ARC Discovery Projects	Dr Zhongfan Jia	Engineered polymer scaffolds for controlled proliferation and differentiation of stem cells	2013-2017	$754,947*
Australian Competitive Grant Income	ARC Discovery Projects	Dr Chenghua Sun	Computer-Aided Design of High-Performance Photocatalysts for Solar Hydrogen Production Based on Red Titanium Dioxide	2013-2017	$717,079
Australian Competitive Grant Income	ARC Discovery Early Career Researcher Award	Dr Simon Corrie	Polymer micropatches applied to the skin for integrated capture and detection of circulating biomarkers	2013-2015	$375,000*
Australian Competitive Grant Income	ARC Discovery Early Career Researcher Award	Dr Jess Frith	An innovative platform using non-coding ribonucleic acids (RNAs) to control stem cell differentiation outcomes	2013-2015	$375,000*
Australian Competitive Grant Income	ARC Discovery Projects	A/Prof Lianzhou Wang, A/Prof Shanqing Zhang, Dr Zhen Li	Designing plasmon-enhanced photocatalysts for solar-driven water pollutant removal	2013-2015	$341,000
Australian Competitive Grant Income	ARC Discovery Projects	A/Prof Lianzhou Wang, Dr Xu Zong	Self-cleaning thin films for anti-reflective solar cell coatings	2013-2015	$396,000

**Administered by AIBN*

Type	Granting Scheme	Chief Investigators	Title	Duration	Total Funding Awarded
Australian Competitive Grant Income	NHMRC Project Grants	Prof Melissa Little, A/Prof Ernst Wolvetang, Prof Justin Cooper-White	Directed differentiation of human embryonic stem cells to kidney progenitors	2013-2015	$630,158
Australian Competitive Grant Income	NHMRC Project Grants	Dr Ryan Taft, A/Prof Ernst Wolvetang, Dr Guy Barry, Prof Merlin Butler	Investigation of processed snoRNAs as cryptic regulators of the imprinted Prader-Willi syndrome locus	2013-2015	$650,802
Australian Competitive Grant Income	NHMRC Project Grants	Prof Pamela Russell, Prof Andrew Whittaker, Dr Kristofer Thurecht	Simultaneous imaging and drug delivery for prostate cancer theranostics	2013-2015	$545,362
Australian Competitive Grant Income	NHMRC Project Grants	Prof Mark Walker, Prof Victor Nizet, A/Prof Christine Wells	Interaction of group A streptococci with intracellular innate immune defence	2013-2015	$789,524
Australian Competitive Grant Income	NHMRC Project Grants	Prof Michael Roberts, Prof Mark Kendall	Specific targeting of nanosystems by cutaneous delivery	2013-2015	$951,201
National and International Grant Income	National Breast Cancer Foundation	Prof Matt Trau, A/Prof Glenn Francis, Prof Susan Clark, Prof John Forbes, Prof Melissa Brown, Prof Alexander Dobrovic, Prof Rodney Scott	Enabling clinical epigenetic diagnostics: the next generation of personalised breast cancer care	2013-2018	$5,000,000*
National and International Grant Income	Asian Office of Aerospace Research and Development	Prof Debra Bernhardt	Composite reinforcement using boron nitride nanotubes	2013	$47,801*
National and International Grant Income	Australian Mathematical Sciences Institute Industry Internship Program	Prof Andrew Whittaker, Miss Huey Ooi	AMSI Internship – Huey Wen Ooi – Anteo Diagnostics	2013	$20,000*
National and International Grant Income	CSIRO	Prof Justin Cooper-White	CSIRO OCE Science Leader Fellowship	2013-2017	N/A*
National and International Grant Income	CRIS grant administered by Monash University (via the Australian National Fabrication Facility Limited (ANFFL))	Prof Justin Cooper-White	Australian National Fabrication Facility	2013-2014	$249,000
Contract Research and other Industry Income	Uniquest Pty Ltd	Prof Darren Martin	Nanocomposite R&D	2013-2014	N/A*
Contract Research and other Industry Income	Uniquest Pty Ltd	A/Prof Stephen Mahler, Dr Rob Speight	QM6 process investigations	2013	N/A*
Contract Research and other Industry Income	Uniquest Pty Ltd	Dr Annette Dexter	Peptide based fluids for oil and gas applications	2013	N/A*
Contract Research and other Industry Income	Uniquest Pty Ltd	Dr David Chin, Dr Martina Jones	The manufacture of a recombinant antibody	2013-2014	N/A*
Contract Research and other Industry Income	Uniquest Pty Ltd	Dr Jane Kenna, Dr Lien Chau, Dr Elliott Cheng, Dr Imelda Keen, Dr Haiqing Li, Dr Elena Karan, Dr Javaid Khan, Prof Justin Cooper-White	ANFFQ – stone dust replacement – project 3	2013-2014	N/A*
Contract Research and other Industry Income	DSM Biologics Company Australia Pty Ltd	Prof Peter Gray, Dr David Chin, Dr Jeff Hou	DSM funded program	2013-2014	N/A*
Contract Research and other Industry Income	Queensland Health	Prof Peter Gray, A/Prof Stephen Mahler, Dr David Chin	Safety assessment of anti-hendra virus antibody in humans	2013-2015	N/A*
Research Donation	Philanthropic Gift	Prof Matt Trau	Personalised nano-medicine	2013	$250,000*
Other	Therapeutic Innovation Australia	Prof Peter Gray	TransBio project	2013-2014	$100,000*

**Administered by AIBN*

Publications

Edited Book

Shiddiky M, Wee E, Sakandar R, Trau M, eds. (2013) *Microfluidics, Nanotechnology and Disease Biomarkers for Personalized Medicine Applications*. United States: Nova Science Publishers

Book Chapters

Amiralian N, Nouri M. (2013) Circular and Ribbon-Like Silk Fibroin Nanofibers. In *Research in Novel Materials*, ed. Rafiqul I, pp. 191-206. New York, United States: Nova Science Publishers

Behrendorff JBYH, Johnston WA, Gillam EMJ. (2013) DNA Shuffling of Cytochrome P450 Enzymes. In *Cytochrome P450 Protocols*, ed. Phillips IR, Shephard EA, Ortiz de Montellano PR, pp. 177-88. New York, United States: Humana Press

Belcher C, Marshall R, Edwards G, Martin D. (2013) The Commercialization of Nanotechnology: The Five Critical Success Factors to a Nanotech-Enabled Whole Product. In *Nanotechnology Commercialization*, ed. Takuya T, pp. 171-204. Australia: Pan Stanford Publishing

Chau LT, Frith JE, Mills RJ, Menzies DJ, Titmarsh DM, Cooper-White JJ. (2013) Microfluidic Platforms for Informed Tissue Scaffold Development. In *Microfluidic Devices for Biomedical Applications*, ed. Xiujun L, Yu Z, pp. 363-87. Cambridge, UK: Woodhead Publishing

Chen H, Nordon RE. (2013) Application of Microfluidics to Study Stem Cell Dynamics. In *Emerging Trends in Cell and Gene Therapy*, ed. Danquah MK, Mahato RI, pp. 435-70. New York, United States: Springer New York

Chen H, Wang L. (2013) Semiconductor-Based Nanostructures for Photoelectrochemical Sensors and Biosensors. In *Nanoscale Sensors*, ed. Li S, Wu J, Wang ZM, Yiang YJ, pp. 87-118. Heidelberg, Germany: Springer

Huynh CT, Lee DS. (2013) Injectable Temperature- and pH/Temperature-Sensitive Block Copolymer Hydrogels. In *Polymeric and Self Assembled Hydrogels: From Fundamental Understanding to Applications*, ed. Loh XJ, Scherman OA, pp. 139-66. Cambridge, United Kingdom: Royal Society of Chemistry

Jiao Y, Hankel M, Du A, Smith SC. (2013) Porous Graphene and Nanomeshes. In *Graphene Chemistry: Theoretical Perspectives*, ed. Jiang D, Chen Z, pp. 129-51. Chichester, West Sussex, United Kingdom: John Wiley & Sons

Jorfi M, Amiralian N, Biyani MV, Annamalai PK. (2013) Biopolymeric Nanocomposites Reinforced with Nanocrystalline Cellulose. In *Biomass-based Biocomposites*, ed. Thakur VK, Singha AS, pp. 277-304. Shrewsbury, Shropshire, United Kingdom: Smithers Rapra Technology

Klaysom C, Ladewig BP, Lu GQM, Wang L. (2013) Recent Advances in Ion Exchange Membranes for Desalination Applications. In *Functional Nanostructured Materials and Membranes for Water Treatment*, ed. Duke M, Zhao D, Semiat R, pp. 125-61. Weinheim, Germany: Wiley-VCH Verlag

Li Z, Lu G, Sun Q, Smith SC, Zhu Z. (2013) Colloidal Semiconductor Nanowires. In *One-Dimensional Nanostructures: Principles and Applications*, ed. Zhai T, Yao J, pp. 65-104. Hoboken, NJ, United States: John Wiley and Sons Inc.

Liang F, Arora N, Zhang KL, Yeh DCC, Lai R, Pearson D, Barnett G, Whiley D, Sloots T, Corrie SR, Barnard RT. (2013) A New, Multiplex, Quantitative Real-Time Polymerase Chain Reaction System for Nucleic Acid Detection and Quantification. In *Nucleic Acid Detection: Methods and Protocols*, ed. Kolpashchikov DM, Gerasimova YV, pp. 51-68. New York, United States: Humana Press

Osborne GW. (2013) Flow Cytometry of Neural Cells. In *Neural Progenitor Cells: Methods and Protocols*, ed. Reynolds BA, Deleyrolle LP, pp. 135-44. New York, United States: Humana Press

Punyadeera C, Slowey PD. (2013) Saliva as an Emerging Biofluid for Clinical Diagnosis and Applications of MEMS/NEMS in Salivary Diagnostics. In *Nanobiomaterials in Clinical Dentistry*, ed. Subramani K, Ahmed W, Hartsfield JK, pp. 453-68. Kidlington, Oxford, United Kingdom: Elsevier

Reid JC, Williams SR, Searles DJ, Rondoni L, Evans DJ. (2013) Fluctuation Relations and the Foundations of Statistical Thermodynamics: A Deterministic Approach and Numerical Demonstration. In *Nonequilibrium Statistical Physics of Small Systems: Fluctuation Relations and Beyond*, ed. Klages R, Just W, Jarzynski C, pp. 57-82. Weinheim, Germany: Wiley-VCH Verlag

Wee EJH, Shiddiky MJA, Trau M. (2013) Detecting DNA Methylation for Cancer Diagnostics and Prognostics. In *Microfluidics, Nanotechnology and Disease Biomarkers for Personalized Medicine Applications*, ed. Shiddiky M, Wee E, Sakandar R, Trau M, pp. 117-32. New York, United States: Nova Publishers

Zhao C-X, Middelberg APJ. (2013) Stimuli-Responsive Peptide Nanostructures at the Fluid-Fluid Interface. In *Protein Nanotechnology: Protocols, Instrumentation, and Applications*, ed. Gerrard JA, pp. 179-94. New York, United States: Humana Press

Zhou JZ, Xu ZP, Qian G. (2013) Effective Phosphate Removal Using Ca-based Layered Double Hydroxide Materials. In *Nanotechnology for Water and Wastewater Treatment*, ed. Lens P, Virkutyte J, Jegatheesan V, Seung-Hyun K, Al-Abed S, pp. 153-68. London, UK: IWA Publishing

Zhou Y, Chakravorty N, Xiao Y, Gu W. (2013) Mesenchymal Stem Cells and Nano-Structured Surfaces. In *Stem Cell Nanotechnology: Methods and Protocols*, ed. Turksen K, pp. 133-48. New York, United States: Humana Press

Zong X, Lu GM, Wang L. (2013) Nanomaterials for Water Splitting. In *Nanocatalysis: Synthesis and Applications*, ed. Polshettiwar V, Asefa T, pp. 495-560. Hoboken, NJ, United States: Wiley

Journal Articles

Abidin NIZ, Rolfe B, Owen H, Malisano J, Martin D, Hofstetter J, Uggowitzer PJ, Atrens A. (2013) The in vivo and in vitro corrosion of high-purity magnesium and magnesium alloys WZ21 and AZ91. *Corrosion Science* 75: 354-66

Abulateefeh SR, Spain SG, Thurecht KJ, Aylott JW, Chan WC, Garnett MC, Alexander C. (2013) Enhanced uptake of nanoparticle drug carriers via a thermoresponsive shell enhances cytotoxicity in a cancer cell line. *Biomaterials Science* 1: 434-42

Ai K, Liu Y, Ruan C, Lu L, Lu G. (2013) Sp2 C-dominant N-doped carbon sub-micrometer spheres with a tunable size: A versatile platform for highly efficient oxygen-reduction catalysts. *Advanced Materials* 25: 998-1003

Aisha AF, Ismail Z, Abu-Salah KM, Siddiqui JM, Ghafar G, Abdul Majid AMS. (2013) *Syzygium campanulatum* korth methanolic extract inhibits angiogenesis and tumor growth in nude mice. *BMC Complementary and Alternative Medicine* 13: 168.1-.11

Ali SA, Baumann K, Jackson T, Wood K, Mason S, Undheim EAB, Nouwens A, Koludarov I, Hendrikx I, Jones A, Fry BG. (2013) Proteomic comparison of *Hypnale hypnale* (Hump-Nosed Pit-Viper) and *Calloselasma rhodostoma* (Malayan Pit-Viper) venoms. *Journal of Proteomics*, *91* : 338-343

Al-Shehri S, Henman M, Charles BG, Cowley D, Shaw PN, Liley H, Tomarchio A, Punyadeera C, Duley JA. (2013) Collection and determination of nucleotide metabolites in neonatal and adult saliva by high performance liquid chromatography with tandem mass spectrometry. *Journal of Chromatography B* 931: 140-7

Anand C, Joseph S, Lawrence G, Dhawale DS, Wahab MA, Choy J-H, Vinu A. (2013) Mesoporous gallosilicate with 3D architecture as a robust energy-efficient heterogeneous catalyst for diphenylmethane production. *ChemCatChem* 5: 1863-70

Anand C, Priya SV, Lawrence G, Dhawale DS, Varghese S, Wahab MA, Prasad KS, Vinu A. (2013) Cage type mesoporous ferrosilicate catalysts with 3D structure for benzylation of aromatics. *Catalysis Today* 204: 125-31

Anand C, Priya SV, Lawrence G, Mane GP, Dhawale DS, Prasad KS, Balasubramanian VV, Wahab MA, Vinu A. (2013) Transesterification of ethylacetoacetate catalysed by metal free mesoporous carbon nitride. *Catalysis Today* 204: 164-9

Anand C, Srinivasu P, Mane GP, Talapaneni SN, Benzigar MR, Priya SV, Al-deyab SS, Sugi Y, Vinu A. (2013) Direct synthesis and characterization of highly ordered cobalt substituted KIT-5 with 3D nanocages for cyclohexene epoxidation. *Microporous and Mesoporous Materials* 167: 146-54

Anand C, Sugimura T, Komura K, Kubota Y, Kim J-H, Seo G, Vinu A, Sugi Y. (2013) The isopropylation of biphenyl over H-mordenite: roles of 3- and 4-isopropylbiphenyls. *Korean Journal of Chemical Engineering* 30: 1043-50

Anderson W, Kozak D, Coleman VA, Jämting AK, Trau M. (2013) A comparative study of submicron particle sizing platforms: accuracy, precision and resolution analysis of polydisperse particle size distributions. *Journal of Colloid and Interface Science* 405: 322-30

Andriani Y, Jack KS, Gilbert EP, Edwards GA, Schiller TL, Strounina E, Osman AF, Martin DJ. (2013) Organization of mixed dimethyldioctadecylammonium and choline modifiers on the surface of synthetic hectorite. *Journal of Colloid and Interface Science* 409: 72-9

Andriani Y, Morrow IC, Taran E, Edwards GA, Schiller TL, Osman AF, Martin DJ. (2013) In vitro biostability of poly(dimethyl siloxane/hexamethylene oxide)-based polyurethane/layered silicate nanocomposites. *Acta Biomaterialia* 9: 8308-17

Anggraeni MR, Connors NK, Wu Y, Chuan YP, Lua LHL, Middelberg APJ. (2013) Sensitivity of immune response quality to influenza helix 190 antigen structure displayed on a modular virus-like particle. *Vaccine* 31: 4428-35

Ataee-Esfahani H, Liu J, Hu M, Miyamoto N, Tominaka S, Wu KCW, Yamauchi Y. (2013) Mesoporous metallic cells: design of uniformly sized hollow mesoporous Pt-Ru particles with Tunable Shell Thicknesses. *Small* 9: 1047-51

Babur BK, Ghanavi P, Levett P, Lott WB, Klein T, Cooper-White JJ, Crawford R, Doran MR. (2013) The Interplay between chondrocyte redifferentiation pellet size and oxygen concentration. *PLoS One* 8: e58865.1-e.12

Bai Y, Xing Z, Yu H, Li Z, Amal R, Wang L. (2013) Porous titania nanosheet/nanoparticle hybrids as photoanodes for dye-sensitized solar cells. *ACS Applied Materials and Interfaces* 5: 12058-65

Barry G, Briggs JA, Vanichkina DP, Poth EM, Beveridge NJ, Ratnu V, Nayler SP, Nones K, Hu J, Bredy T, Nakagawa S, Rigo F, Taft RJ, Cairns MJ, Blackshaw S, Wolvetang EJ, Mattick JS. (2013) The long non-coding RNA Gomafu is acutely regulated in response to neuronal activation and involved in schizophrenia-associated alternative splicing. *Molecular Psychiatry* (Advance online publication 30 April 2013)

Behrendorff JBYH, Vickers CE, Chrysanthopoulos P, Nielsen LK. (2013) 2,2-Diphenyl-1-picrylhydrazyl as a screening tool for recombinant monoterpene biosynthesis. *Microbial Cell Factories* 12: 1-11

Bie P, Liu P, Yu L, Li X, Chen L, Xie F. (2013) The properties of antimicrobial films derived from poly(lactic acid)/starch/chitosan blended matrix. *Carbohydrate Polymers* 98: 959-66

Blakey I, Merican Z, Thurecht KJ. (2013) A method for controlling the aggregation of gold nanoparticles: Tuning of optical and spectroscopic properties. *Langmuir* 29: 8266-74

Brennan TCR, Kroemer JO, Nielsen LK. (2013) Physiological and transcriptional responses of saccharomyces cerevisiae to d-limonene show changes to the cell wall but not to the plasma membrane. *Applied and Environmental Microbiology* 79: 3590-600

Briggs JA, Mason EA, Ovchinnikov DA, Wells CA, Wolvetang EJ. (2013) Concise review: new paradigms for Down syndrome research using induced pluripotent stem cells: tackling complex human genetic disease. *Stem Cells Translational Medicine* 2: 175-84

Briggs JA, Sun J, Shepherd J, Ovchinnikov DA, Chung T-L, Nayler SP, Kao L-P, Morrow CA, Thakar NY, Soo S-Y, Peura T, Grimmond S, Wolvetang EJ. (2013) Integration-free induced pluripotent stem cells model genetic and neural developmental features of Down syndrome etiology. *Stem Cells* 31: 467-78

Brzoska AJ, Hassan KA, de Leon EJ, Paulsen IT, Lewis PJ. (2013) Single-step selection of drug resistant *Acinetobacter baylyi* ADP1 mutants reveals a functional redundancy in the recruitment of multidrug efflux systems. *PloS One* 8: e56090.1-e.11

Bye J, Meliga S, Ferachou D, Cinque G, Zeitler J, Falconer R. (2014) Analysis of the hydration water around bovine serum albumin using terahertz coherent synchrotron radiation. *Journal of Physical Chemistry A*, 118(1): 83-88. epub 2013 print 2014

Cameron A, Frith J, Gomez G, Yap A, Cooper-White J. (2014) The effect of time-dependent deformation of viscoelastic hydrogels on myogenic induction and Rac1 activity in mesenchymal stem cells. *Biomaterials*, 35(6): 1857-1868. epub 2013 print 2014

Chauhan S, Richards GJ, Mori T, Yan P, Hill JP, Ariga K, Zou J, Drennan J. (2013) Fabrication of a nano-structured Pt-loaded cerium oxide nanowire and its anode performance in the methanol electro-oxidation reaction. *Journal of Materials Chemistry A*, *1* 20: 6262-6270

Chen C, Sun Q, Ren D-X, Zhang R, Bai F-Y, Xing Y-H, Shi Z. (2013) Bromoperoxidase mimic as catalysts for oxidative bromination-synthesis, structures and properties of the diversified oxidation state of vanadium(III, IV and V) complexes with pincer N-heterocycle ligands. *CrystEngComm* 15: 5561-73

Chen H, Cornwell J, Zhang H, Lim T, Resurreccion R, Port T, Rosengarten G, Nordon RE. (2013) Cardiac-like flow generator for long-term imaging of endothelial cell responses to circulatory pulsatile flow at microscale. *Lab On a Chip* 13: 2999-3007

Chen K-E, Richards AA, Caradoc-Davies TT, Vajjhala PR, Robin G, Lua LHL, Hill JM, Schroder K, Sweet M J, Kellie S, Kobe B, Martin J. (2013) The structure of the caspase recruitment domain of BinCARD reveals that all three cysteines can be oxidized. *Acta Crystallographica Section D*, *69* 5: 774-784.

Chen M, Cooper H, Zhou JZ, Bartlett PF, Xu ZP. (2013) Reduction in the size of layered double hydroxide nanoparticles enhances the efficiency of siRNA delivery. *Journal of Colloid and Interface Science* 390: 275-81

Chen WY, Marcellin E, Steen JA, Nielsen LK. (2013) The role of hyaluronic acid precursor concentrations in molecular weight control in *Streptococcus zooepidemicus*. *Molecular Biotechnology* Online First: 1-10

Chen Y-Z, Cui X-B, Hu J-M, Zhang WJ, Li S-G, Yang L, Shen X-H, Liu C-X, Pan Q-F, Yu S-Y, Yuan X-L, Yang L, Gu W-Y, Chen J-Z, Wang L-D, Li F. (2013) Overexpression of PLCE1 in Kazakh esophageal squamous cell carcinoma: implications in cancer metastasis and aggressiveness. *Apmis* 121: 908-18

Chen Z, Wu C, Gu W, Klein T, Crawford R, Xiao Y. (2014) Osteogenic differentiation of bone marrow MSCs by -tricalcium phosphate stimulating macrophages via BMP2 signalling pathway. *Biomaterials*, 35(5): 1507-1518. epub 2013 print 2014

Cheng L, Chen Z-G, Yang L, Han G, Xu H-Y, Snyder GJ, Lu G-Q, Zou J. (2013) T-shaped Bi2Te3-Te heteronanojunctions: Epitaxial growth, structural modeling, and thermoelectric properties. *Journal of Physical Chemistry C* 117: 12458-64

Chirila T, Lee H, Oddon M, Nieuwenhuizen M, Blakey I, Nicholson T. (2014) Hydrogen-bonded supramolecular polymers as self-healing hydrogels: Effect of a bulky adamantyl substituent in the ureido-pyrimidinone monomer. *Journal of Applied Polymer Science*, 131(4). epub 2013 print 2014

Chirila TV, Suzuki S, Bray LJ, Barnett NL, Harkin DG. (2013) Evaluation of silk sericin as a biomaterial: in vitro growth of human corneal limbal epithelial cells on *Bombyx mori* sericin membranes. *Progress in Biomaterials* 2: 1-10

Chokkalingam A, Kawagoe H, Watanabe S, Moriyama Y, Komura K, Kubota Y, Kim J-H, Seo G, Vinu A, Sugi Y. (2013) Isopropylation of biphenyl over ZSM-12 zeolites. *Journal of Molecular Catalysis A-Chemical* 367: 23-30

Chuan YP, Rivera-Hernandez T, Wibowo N, Connors NK, Wu Y, Hughes FK, Lua LHL, Middelberg APJ. (2013) Effects of pre-existing anti-carrier immunity and antigenic element multiplicity on efficacy of a modular virus-like particle vaccine. *Biotechnology and Bioengineering* 110: 2343-51

Chuan YP, Wibowo N, Connors NK, Wu Y, Hughes FK, Batzloff MR, Lua LHL, Middelberg APJ. (2013) Microbially synthesized modular virus-like particles and capsomeres displaying group A streptococcus hypervariable antigenic determinants. *Biotechnology and Bioengineering* Early View: 1-9

Clark M, Gray M, Mooney J. (2013) New graduate occupational therapists' perceptions of near-misses and mistakes in the workplace. *International Journal of Health Care Quality Assurance* 26: 564-76

Coffey JW, Corrie SR, Kendall MAF. (2013) Early circulating biomarker detection using a wearable microprojection array skin patch. *Biomaterials* 34: 9572-83

Coles DJ, Rolfe BE, Boase NRB, Veedu RN, Thurecht KJ. (2013) Aptamer-targeted hyperbranched polymers: towards greater specificity for tumours in vivo. *Chemical Communications* 49: 3836-8

Connors NK, Wu Y, Lua LHL, Middelberg APJ. (2013) Improved fusion tag cleavage strategies in the downstream processing of self-assembling virus-like particle vaccines. *Food and Bioproducts Processing* 92 (2): 143–151

Crichton ML, Chen X, Huang H, Kendall MAF. (2013) Elastic modulus and viscoelastic properties of full thickness skin characterised at micro scales. *Biomaterials* 34: 2087-97

Cui XB, Chen YZ, Pang Xl, Liu W, Hu JM, Li SG, Yang L, Zhang WJ, Liu CX, Cao YW, Jiang JF, Gu WY, Pang J, Yang L, Yuan XL, Yu SY, Li F. (2013) Multiple polymorphisms within the PLCE1 are associated with esophageal cancer via promoting the gene expression in a Chinese Kazakh population. *Gene* 530: 315-22

Curtis ASG, Reid S, Martin I, Vaidyanathan R, Smith CA, Nikukar H, Dalby MJ. (2013) Cell interactions at the nanoscale: piezoelectric stimulation. *IEEE Transactions On Nanobioscience* 12: 247-54

Dal'Molin CGdO, Nielsen LK. (2013) Plant genome-scale metabolic reconstruction and modelling. *Current Opinion in Biotechnology* 24: 271-7

Dang C, Cribb TH, Osborne G, Kawasaki M, Bedin AS, Barnes AC. (2013) Effect of a hemiuroid trematode on the hemocyte immune parameters of the cockle *Anadara trapezia*. *Fish and Shellfish Immunology* 35: 951-6

Dargaville BL, Vaquette C, Rasoul F, Cooper-White JJ, Campbell JH, Whittaker AK. (2013) Electrospinning and crosslinking of low-molecular-weight poly(trimethylene carbonate-co-L-lactide) as an elastomeric scaffold for vascular engineering. *Acta Biomaterialia* 9: 6885-97

Davie SJ, Reid JC, Searles DJ. (2013) Free energy calculations with reduced potential cutoff radii. *Journal of Chemical Theory and Computation* 9: 2083-9

Dean K, Sangwan P, Way C, Zhang X, Martino VP, Xie F, Halley PJ, Pollet E, Averous L. (2013) Glycerol plasticised chitosan: a study of biodegradation via carbon dioxide evolution and nuclear magnetic resonance. *Polymer Degradation and Stability* 98: 1236-46

Deng Z, Butcher N, Mortimer G, Jia Z, Monteiro M, Martin D, Minchin R (2014) Interaction of human arylamine n-acetyltransferase 1 with different nanomaterials. *Drug Metabolism and Disposition*, 42(3): 377-383. epub 2013 print 2014

Deng ZJ, Liang M, Toth I, Monteiro M, Minchin RF. (2013) Plasma protein binding of positively and negatively charged polymer-coated gold nanoparticles elicits different biological responses. *Nanotoxicology* 7: 314-22

Dey P, Blakey I, Thurecht KJ, Fredericks PM. (2013) Self-assembled hyperbranched polymer-gold nanoparticle hybrids: understanding the effect of polymer coverage on assembly size and SERS performance. *Langmuir* 29: 525-33

Dey P, Olds W, Blakey I, Thurecht KJ, Izake EL, Fredericks PM. (2013) SERS-based detection of barcoded gold nanoparticle assemblies from within animal tissue. *Journal of Raman Spectroscopy* 44: 1659-65

Dhawale DS, Mane GP, Joseph S, Anand C, Ariga K, Vinu A. (2013) Enhanced supercapacitor

performance of N-doped mesoporous carbons prepared from a gelatin biomolecule. *ChemPhysChem* 14: 1563-9

Diao M, Taran E, Mahler S, Nguyen T, Nguyen A. (2014) Quantifying adhesion of acidophilic bioleaching bacteria to silica and pyrite by atomic force microscopy with a bacterial probe. *Colloids and Surfaces B: Biointerfaces*, 115: 229-236. epub 2013 print 2014

Duan J, Zheng Y, Chen S, Tang Y, Jaroniec M, Qiao S. (2013) Mesoporous hybrid material composed of Mn3O4 nanoparticles on nitrogen-doped graphene for highly efficient oxygen reduction reaction. *Chemical Communications* 49: 7705-7

Duxenneuner M, Fischer P, Windhab E, Cooper-White J. (2014) Simultaneous visualization of the flow inside and around droplets generated in microchannels. *Microfluidics and Nanofluidics*, 16(4): 1-13. epub 2013 print 2014

Dwyer M, Brech M, Yu L, Middelberg A. (2014) Intensified expression and purification of a recombinant biosurfactant protein. *Chemical Engineering Science*, 105: 12-21. epub 2013 print 2014

Dwyer MD, He L, James M, Nelson A, Middelberg APJ. (2013) Insights into the role of protein molecule size and structure on interfacial properties using designed sequences. *Journal of the Royal Society Interface* 10 (80)

Emmanuelawati I, Yang J, Zhang J, Zhang H, Zhou L, Yu C. (2013) Low-cost and large-scale synthesis of functional porous materials for phosphate removal with high performance. *Nanoscale* 5: 6173-80

Fadhillah F, Zaidi SMJ, Khan Z, Khaled MM, Rahman F, Hammond PT. (2013) Development of polyelectrolyte multilayer thin film composite membrane for water desalination application. *Desalination* 318: 19-24

Fan Y, Abrahamsen G, Mills R, Calderon CC, Tee JY, Leyton L, Murrell W, Cooper-White J, McGrath JJ, Mackay-Sim A. (2013) Focal adhesion dynamics are altered in schizophrenia. *Biological Psychiatry* 74: 418-26

Fang H-T, Liu M, Wang D-W, Ren X-H, Sun X. (2013) Fabrication and supercapacitive properties of a thick electrode of carbon nanotube-RuO2 core-shell hybrid material with a high RuO2 loading. *Nano Energy* 2: 1232-41

Fearnley L, Davis M, Ragan MA, Nielsen LK. (2013) Extracting reaction networks from databases-opening Pandora's box. *Briefings in Bioinformatics* DOI 10.1093/bib/bbt058

Filippich C, Wolvetang EJ, Mowry BJ. (2013) Will brain cells derived from induced pluripotent stem cells or directly converted from somatic cells (iNs) be useful for schizophrenia research? *Schizophrenia Bulletin* 39: 948-54

Foo JYY, Wan Y, Schulz BL, Kostner K, Atherton J, Cooper-White J, Dimeski G, Punyadeera C. (2013) Circulating fragments of n-terminal pro-b-type natriuretic peptides in plasma of heart failure patients. *Clinical Chemistry* 59: 1523-31

Foster A, Barnes N, Speight R, Morris PC, Keane MA. (2013) Role of amine oxidase expression to maintain putrescine homeostasis in *Rhodococcus opacus*. *Enzyme and Microbial Technology* 52: 286-95

Frith JE, Cameron AR, Menzies DJ, Ghosh P, Whitehead DL, Gronthos S, Zannettino ACW, Cooper-White JJ. (2013) An injectable hydrogel incorporating mesenchymal precursor cells and pentosan polysulphate for intervertebral disc regeneration. *Biomaterials* 34: 9430-40

Frith J, Menzies D, Cameron A, Ghosh P, Whitehead D, Gronthos S , Zannettino ACW, Cooper-White JJ. (2014) Effects of bound versus soluble pentosan polysulphate in PEG/HA-based hydrogels tailored for intervertebral disc regeneration. *Biomaterials*, 35(4): 1150-1162. epub 2013 print 2014

Frith JE, Titmarsh DM, Padmanabhan H, Cooper-White JJ. (2013) Microbioreactor array screening of Wnt modulators and microenvironmental factors in osteogenic differentiation of mesenchymal progenitor cells. *PLoS One* 8: e82931.1-e.15

Fuchs AV, Kotman N, Andrieu J, Mailänder V, Weiss CK, Landfester K. (2013) Enzyme cleavable nanoparticles from peptide based triblock copolymers. *Nanoscale* 5: 4829-39

Fuchs AV, Ritz S, Pütz S, Mailänder V, Landfester K, Ziener U. (2013) Bioinspired phosphorylcholine containing polymer films with silver nanoparticles combining antifouling and antibacterial properties. *Biomaterials Science* 1: 470-7

Garaje SN, Apte SK, Naik SD, Ambekar JD, Sonawane RS, Kulkarni MV, Vinu A, Kale BB. (2013) Template-free synthesis of nanostructured CdxZn1-xS with tunable band structure for H2 production and organic dye degradation using solar light. *Environmental Science and Technology*, *47* 12: 6664-6672

Gauci CG, Jayashi CM, Lightowlers MW. (2013) Vaccine development against the *taenia solium* parasite: The role of recombinant protein expression in *Escherichia coli*. *Bioengineered* 4: 343-7

Gauthier E, Laycock B, Cuoq FJJ-M, Halley RJ, George KA. (2013) Correlation between chain microstructural changes and embrittlement of LLDPE-based films during photo- and thermo-oxidative degradation. *Polymer Degradation and Stability* 98: 425-35

Geisler K, Hughes RK, Sainsbury F, Lomonossoff GP, Rejzek M, Fairhurst S, Olsen C-E, Motawia MS, Melton RE, Hemmings AM, Bak S, Osbourn A. (2013) Biochemical analysis of a multifunctional cytochrome P450 (CYP51) enzyme required for synthesis of antimicrobial triterpenes in plants. *Proceedings of the National Academy of Sciences of the United States of America* 110: E3360-E7

George KA, Shadforth AMA, Chirila TV, Laurent MJ, Stephenson S-A, Edwards GA, Madden PW, Hutmacher DW, Harkin DG. (2013) Effect of the sterilization method on the properties of *Bombyx mori* silk fibroin films. *Materials Science and Engineering: C* 33: 668-74

Goonaseker CS, Jack KS, Cooper-White JJ, Grondahl L. (2013) Attachment of poly(acrylic acid) to 3-aminopropyltriethoxysilane hydroxyapatite. *Journal of Materials Chemistry B* 1: 5842-52

Grewal YS, Shiddiky MJA, Gray SA, Weigel KM, Cangelosi GA, Trau M. (2013) Label-free electrochemical detection of an *Entamoeba histolytica* antigen using cell-free yeast-scFv probes. *Chemical Communications* 49: 1551-3

Grewal Y, Shiddiky M, Spadafora L, Cangelosi G, Trau M. (2014) Nano-yeast–scFv probes on screen-printed gold electrodes for detection of *Entamoeba histolytica* antigens in a biological matrix. *Biosensors and Bioelectronics*, 55: 417-422. epub 2013 print 2014

Gu W, Chen C, Zhao K-N. (2013) Obesity-associated endometrial and cervical cancers. *Frontiers in Bioscience* 5: 109-18

Gu W, Jia Z, Truong NP, Prasadam I, Xiao Y, Monteiro MJ. (2013) Polymer nanocarrier system for endosome escape and timed release of siRNA with complete gene silencing and cell death in cancer cells. *Biomacromolecules* 14: 3386-9

Gu W, Wu C, Chen J, Xiao Y. (2013) Nanotechnology in the targeted drug delivery for bone diseases and bone regeneration. *International Journal of Nanomedicine* 8: 2305-17

Gu,Y, Wu H, Xiong Z, Al Abdulla W, Zhao X. (2014) The electrocapacitive properties of hierarchical porous reduced graphene oxide templated by hydrophobic CaCO3 spheres. *Journal of Materials Chemistry A*, 2(2): 451-459. epub 2013 print 2014

Gu Z, Rolfe BE, Thomas AC, Xu ZP. (2013) Restenosis treatments using nanoparticle-based drug delivery systems. *Current Pharmaceutical Design* 19: 6330-9

Guan J-L, Simon AK, Prescott M, Menendez JA, Liu F, Wang F, Wang C, Wolvetang E, Vazquez-Martin A, Zhang J. (2013) Autophagy in stem cells. *Autophagy* 9: 830-49

Guillet-Nicolas R, Popat A, Bridot J-L, Monteith G, Qiao SZ, Kleitz F. (2013) pH-responsive nutraceutical-mesoporous silica nanoconjugates with enhanced colloidal stability. *Angewandte Chemie International Edition* 52: 2318-22

Guo Z, Johnston WA, Kovtun O, Mureev S, Brocker C, Ungermann C, Alexandrov K. (2013) Subunit organisation of in vitro reconstituted HOPS and CORVET multisubunit membrane tethering complexes. *PloS One* 8: e81534.1-e.8

Han G, Chen Z-G, Sun C, Yang L, Cheng L, Li Z, Lu W, Gibbs ZM, Snyder G J, Jack K, Drennan J, Zou J. (2014) A new crystal: layer-structured rhombohedral In3Se4. *CrystEngComm*, *16* 3: 393-398. epub 2013 print 2014

Han G, Chen Z-G, Yang L, Cheng L, Drennan J, Zou J. (2013) Phase control and formation mechanism of new-phase layer-structured rhombohedral In3Se4 hierarchical nanostructures. *Crystal Growth and Design*, *13* 11: 5092-5099.

Han G, Chen Z-G, Yang L, Cheng L, Jack K, Drennan J, Zou J. (2013) Thermal stability and oxidation of layer-structured rhombohedral In3Se4 nanostructures. *Applied Physics Letters*, *103* 26: 263105.1-263105.5.

Hartono SB, Phuoc NT, Yu M, Jia Z, Monteiro MJ, Qiao S, Yu C. (2014) Functionalized large pore mesoporous silica nanoparticles for gene delivery featuring controlled release and co-delivery. *Journal of Materials Chemistry B* 2, 718-726 epub 2013 print 2014

Huang C, Sun T, Hulicova-Jurcakova D. (2013) Wide electrochemical window of supercapacitors from coffee bean-derived phosphorus-rich carbons. *ChemSusChem*, 6(12): 2330-2339.

Huang Z, Lingam HK, Chen X, Porter S, Du A, Woodard PM, Shore SG, Zhao J-C. (2013) Synthesis, structural analysis, and thermal decomposition studies of [(NH3)(2)BH2]B3H8. *RSC Advances* 3: 7460-5

Huynh HT, Tran TTB, Chan LCL, Nielsen LK, Reid S. (2013) Decline in baculovirus-expressed recombinant protein production with increasing cell density is strongly correlated to impairment of virus replication and mRNA expression. *Applied Microbiology and Biotechnology* 97: 5245-57

Jardine KJ, Meyers K, Abrell L, Alves EG, Yanez Serrano AM, Kesselmeier J, Karl T, Guenther A, Chambers JQ, Vickers C. (2013) Emissions of putative isoprene oxidation products from mango branches under abiotic stress. *Journal of Experimental Botany* 64: 3697-709

Jarnbhrunkar S, Yu M, Yang J, Zhang J, Shrotri A, Endo-Munoz L, Moreau J, Lu G, Yu C. (2013) Stepwise pore size reduction of ordered nanoporous silica materials at angstrom precision. *Journal of the American Chemical Society* 135: 8444-7

Jia Y, Sun C, Cheng L, Wahab MA, Cui J, Zou J, Zhu M, Yao X. (2013) Destabilization of Mg-H bonding through nano-interfacial confinement by unsaturated carbon for hydrogen desorption from MgH2. *Physical Chemistry Chemical Physics* 15: 5814-20

Jia Z, Monteiro MJ. (2013) Synthesis of cyclic polymers via ring closure. *Advances in Polymer Science* 262: 295-328

Jia Z, Truong NP, Monteiro MJ. (2013) Reversible polymer nanostructures by regulating SDS/PNIPAM binding. *Polymer Chemistry* 4: 233-6

Jiao W, Li N, Wang L, Wen L, Li F, Liu G, Cheng H-M. (2013) High-rate lithium storage of anatase TiO2 crystals doped with both nitrogen and sulfur. *Chemical Communications* 49: 3461-3

Jiao Y, Du A, Hankel M, Smith SC. (2013) Modelling carbon membranes for gas and isotope separation. *Physical Chemistry Chemical Physics* 15: 4832-43

Kadri A, Jia Y, Chen Z, Yao X. (2013) Effect of titanium based complex catalyst and carbon nanotubes on hydrogen storage performance of magnesium. *Science China-Chemistry* 56: 451-8

Kappler U, Nouwens AS. (2013) The molybdoproteome of *Starkeya novella* - insights into the diversity and functions of molybdenum containing proteins in response to changing growth conditions. *Metallomics* 5: 325-34

Keen I, Cheng H-H, Yu A, Jack KS, Younkin TR, Leeson MJ, Whittaker AK, Blakey I. (2013) Behavior of lamellar forming block copolymers under nanoconfinement: implications for topography directed self-assembly of sub-10 nm structures. *Macromolecules* Article ASAP: 1-8

Kilic B, Wang L, Ozdemir O, Lu M, Tuzemen S. (2013) One-dimensional (1D) ZnO nanowires dye sensitized solar cell. *Journal of Nanoscience and Nanotechnology* 13: 333-8

Kim K-M, Kang J-H, Vinu A, Choy J-H, Oh J-M. (2013) Inorganic nanomedicines and their labeling for biological imaging. *Current Topics in Medicinal Chemistry* 13: 488-503

Klein-Marcuschamer D, Blanch HW. (2013) Survival of the fittest: An economic perspective on the production of novel biofuels. *AIChE Journal* 59: 4454-60

Klein-Marcuschamer D, Chisti Y, Benemann JR, Lewis D. (2013) A matter of detail: assessing the true potential of microalgal biofuels. *Biotechnology and Bioengineering* 110: 2317-22

Klein-Marcuschamer D, Turner C, Allen M, Gray P, Dietzgen RG, Gresshoff PM, Hankamer B, Heimann K, Scott PT, Stephens E, Speight R, Nielsen LK. (2013) Technoeconomic analysis of renewable aviation fuel from microalgae, *Pongamia pinnata*, and sugarcane. *Biofuels, Bioproducts and Biorefining* 7: 416-28

Kohnke M, Delon C, Hastie ML, Nguyen UTT, Wu Y-W, Waldmann H, Goody RS, Gorman JJ, Alexandrov K (2013) Rab GTPase prenylation hierachy and its potential role in Choroideremia disease. *PloS One*, 8(12):e81758.

Konarova M, Beltramini JN, Lu M. (2013) Synthesis and hydrogen storage properties of magnesium nanoparticles with core/shell structure. *Materials Science Forum* 736: 120-6

Konarova M, Tanksale A, Beltramini JN, Lu GQ. (2013) Effects of nano-confinement on the hydrogen desorption properties of MgH2. *Nano Energy* 2: 98-104

Konigsberg D, Nicholson TM, Halley PJ, Ahn KH. (2013) Technical note: correcting for shear strain in an oscillatory squeeze flow rheometer. *Rheologica Acta* 53: 103-7

Konigsberg D, Nicholson TM, Halley PJ, Kealy TJ, Bhattacharjee PK. (2013) Online process rheometry using oscillatory squeeze flow. *Applied Rheology* 23 (3) 35688 1-10

Kopittke PM, Lombi E, McKenna BA, Wang P, Donner E, Webb RI, Blamey FPC, de Jonge MD, Paterson D, Howard DL, Menzies NW. (2013) Distribution and speciation of Mn in hydrated roots of cowpea at levels inhibiting root growth. *Physiologia Plantarum* 147: 453-64

Kosaki Y, Izawa H, Ishihara S, Kawakami K, Sumita M, Tateyama Y, Ji Q, Krishnan V, Hishita S, Yamauchi Y, Hill JP, Vinu A, Shiratori S, Ariga K. (2013) Nanoporous carbon sensor with cage-in-fiber structure: Highly selective aniline adsorbent toward cancer risk management. *Acs Applied Materials & Interfaces* 5: 2930-4

Kroemer JO, Nunez-Bernal D, Averesch NJH, Hampe J, Varela J, Varela C. (2013) Production of aromatics in *Saccharomyces cerevisiae*- a feasibility study. *Journal of Biotechnology* 163: 184-93

Kuntaiah K, Sudarsanam P, Reddy BM, Vinu A. (2013) Nanocrystalline Ce(1-x)Sm(x)O(2-delta) (x=0.4) solid solutions: structural characterization versus CO oxidation. *RSC Advances* 3: 7953-62

Lashtabeg A, Smart M, Riley D, Gillen A, Drennan J. (2013) The effect of extreme temperature in an oxidising atmosphere on dense tantalum carbide (TaC). *Journal of Materials Science* 48: 258-64

Lau ETL, Giddings SJ, Mohammed SG, Dubois P, Johnson SK, Stanley RA, Halley PJ, Steadman KJ. (2013) Encapsulation of hydrocortisone and mesalazine in zein capsules. *Pharmaceutics* 5: 277-93

Laycock B, Halley P, Pratt S, Werker A, Lant P. (2013) The chemomechanical properties of microbial polyhydroxyalkanoates. *Progress In Polymer Science* 38: 536-83

Lee LK, Bryant KJ, Bouveret R, Lei P-W, Duff AP, Harrop SJ, Huang EP, Harvey RP, Gelb MH, Gray PP, Curmi PM, Cunningham AM, Church WB, Scott KF. (2013) Selective inhibition of human group IIA-secreted phospholipase a 2 (hGIIA) signaling reveals arachidonic acid metabolism is associated with colocalization of hGIIA to vimentin in rheumatoid synoviocytes. *Journal of Biological Chemistry* 288: 15269-79

Leese C, Fotheringham I, Escalettes F, Speight R, Grogan G. (2013) Cloning, expression, characterisation and mutational analysis of L-aspartate oxidase from *Pseudomonas putida*. *Journal of Molecular Catalysis B: Enzymatic* 85-86: 17-22

Lei C, Qian K, Noonan O, Nouwens A, Yu C. (2013) Applications of nanomaterials in mass spectrometry analysis. *Nanoscale* 5: 12033-42

Leite-Silva VR, Le Lamer M, Sanchez WY, Liu DC, Sanchez WH, Morrow I, Martin D, Silva HDT, Prow TLW, Grice JE, Roberts MS. (2013) The effect of formulation on the penetration of coated and uncoated zinc oxide nanoparticles into the viable epidermis of human skin in vivo. *European Journal of Pharmaceutics and Biopharmaceutics* 84: 297-308

Li H, Cooper-White JJ. (2013) Hyperbranched polymer mediated fabrication of water soluble carbon nanotube-metal nanoparticle hybrids. *Nanoscale* 5: 2915-20

Li H, Cooper-White JJ, Kim I. (2013) Facile and controllable incorporation of gold nanoparticles within one-dimensional self-assemblies of hyperbranched polymers. *Soft Matter* 9: 5270-6

Li L, Wang Y, Xu ZP, Zhu Z. (2013) Catalytic ammonia decomposition for CO-free hydrogen generation over Ru/Cr2O3 catalysts. *Applied Catalysis A: General* 467: 246-52

Li M, Hasjim J, Xie F, Halley PJ, Gilbert RG. (2013) Shear degradation of molecular, crystalline, and granular structures of starch during extrusion. *Starch-Staerke* Early View: 1-11

Li N, Zhang Q, Liu J, Joo J, Lee A, Gan Y, Yin Y. (2013) Sol-gel coating of inorganic nanostructures with resorcinol-formaldehyde resin. *Chemical Communications* 49: 5135-7

Li P, Wang W, Sun Q, Li Z, Du A, Bi S, Zhao Y. (2013) Insights into the mechanism of the reaction between tetrachloro-p- benzoquinone and hydrogen peroxide and their implications in the catalytic role of water molecules in producing the hydroxyl radial. *ChemPhysChem* 14: 2737-43

Li Q, Sun Q, Gu J, Tan X. (2013) A computational study of the addition reaction of cyclopropenylidene with methyleneimine. *Russian Journal of Physical Chemistry A* 87: 806-12

Li Z, Wang SX, Sun Q, Zhao HL, Lei H, Lan MB, Cheng ZX, Wang XL, Dou SX, Lu GQ. (2013) Ultrasmall manganese ferrite nanoparticles as positive contrast agent for magnetic resonance imaging. *Advanced Healthcare Materials* 2: 958-64

Li Z-P, Mori T, Auchterlonie GJ, Zou J, Drennan J. (2013) Microstructure evolution of yttria-doped ceria in reducing atmosphere. *Renewable Energy* 50: 494-7

Li Z-P, Mori T, Zou J, Drennan J. (2013) Defects clustering and ordering in di- and trivalently doped ceria. *Materials Research Bulletin*, *48* 2: 807-812.

Liang F, Lai R, Arora N, Zhang KL, Yeh C-C, Barnett GR, Voigt P, Corrie SR, Barnard RT. (2013) Multiplex-microsphere-quantitative polymerase chain reaction: nucleic acid amplification and detection on microspheres. *Analytical Biochemistry* 431: 23-30

Liao T, Sun C, Sun Z, Du A, Smith S. (2013) Chemically modified ribbon edge stimulated H-2 dissociation: a first-principles computational study. *Physical Chemistry Chemical Physics* 15: 8054-7

Licona-Cassani C, Lara A, Cabrera-Valladares N, Escalante A, Hernandez-Chavez G, Martinez A, et al. (2014) Inactivation of pyruvate kinase or the phosphoenolpyruvate: sugar phosphotransferase system increases shikimic and dehydroshikimic acid yields from glucose in *Bacillus subtilis*. *Journal of Molecular Microbiology and Biotechnology*, 24(1): 37-45. epub 2013 print 2014

Ling T, Song J-G, Chen X-Y, Yang J, Qiao S-Z, Du X-W. (2013) Comparison of ZnO and TiO2 nanowires for photoanode of dye-sensitized solar cells. *Journal of Alloys and Compounds* 546: 307-13

Liu J, Duan C, Zhou J, Li X, Qian G, Xu ZP. (2013) Adsorption of bacteria onto layered double hydroxide particles to form biogranule-like aggregates. *Applied Clay Science* 75-76: 39-45

Liu J, Yang T, Wang D-W, Lu GQ, Zhao D, Qiao SZ. (2013) A facile soft-template synthesis of mesoporous polymeric and carbonaceous nanospheres. *Nature Communications* 4:2798

Liu T-Y, Hussein WM, Jia Z, Ziora ZM, McMillan NAJ, Monteiro MJ, Toth I, Skwarczynski M. (2013) Self-adjuvanting polymer-peptide conjugates as therapeutic vaccine candidates against cervical cancer. *Biomacromolecules* 14: 2798-806

Liu X, Yu L, Xie F, Petinakis E, Sangwan P, Shen S, Dean K, Ammala A, Wong-Holmes S. (2013) New evidences of accelerating degradation of polyethylene by starch. *Journal of Applied Polymer Science* 130: 2282-7

Lu D, Jia Z, Monteiro MJ. (2013) Synthesis of alkyne functional cyclic polymers by one-pot thiol-ene cyclization. *Polymer Chemistry* 4: 2080-9

Lua L, Connors N, Sainsbury F, Chuan Y, Wibowo N, Middelberg A. (2014) Bioengineering virus-like particles as vaccines. *Biotechnology and Bioengineering*, 111(3): 425-440. epub 2013 print 2014

Luk JZ, Cooper-White J, Rintoul L, Taran E, Grondahl L. (2013) Functionalised polycaprolactone films and 3D scaffolds via gamma irradiation-induced grafting. *Journal of Materials Chemistry B* 1: 4171-81

Mahony D, Cavallaro AS, Stahr F, Mahony TJ, Qiao SZ, Mitter N. (2013) Mesoporous silica nanoparticles act as a self-adjuvant for ovalbumin model antigen in mice. *Small* 9: 3138-46

Maisonneuve BGC, Roux DCD, Thorn P, Cooper-White JJ. (2013) Effects of cell density and biomacromolecule addition on the flow behavior of concentrated mesenchymal cell suspensions. *Biomacromolecules* 14: 4388-97

Maliger R, Halley PJ, Cooper-White JJ. (2013) Poly(glycerol-sebacate) bioelastomers-kinetics of step-growth reactions using Fourier Transform (FT)-Raman spectroscopy. *Journal of Applied Polymer Science* 127: 3980-6

Mane GP, Dhawale DS, Anand C, Ariga K, Ji Q, Wahab MA, Mori T, Vinu A. (2013) Selective sensing performance of mesoporous carbon nitride with a highly ordered porous structure prepared from 3-amino-1,2,4-triazine. *Journal of Materials Chemistry A* 1: 2913-20

Marcellin E, Licona-Cassani C, Mercer TR, Palfreyman RW, Nielsen LK. (2013) Re-annotation of the *Saccharopolyspora erythraea* genome using a systems biology approach. *BMC Genomics* 14: Provisional: 1-18

Marcellin E, Mercer TR, Licona-Cassani C, Palfreyman RW, Dinger ME, Steen JA, Mattick JS, Nielsen LK. (2013) *Saccharopolyspora erythraea's* genome is organised in high-order transcriptional regions mediated by targeted degradation at the metabolic switch. *BMC Genomics* 14: 15.1-.9

Martínez VS, Dietmair S, Quek L-E, Hodson MP, Gray P, Nielsen LK. (2013) Flux balance analysis of CHO cells before and after a metabolic switch from lactate production to consumption. *Biotechnology and Bioengineering* 110: 660-6

Mateyawa S, Xie DF, Truss RW, Halley PJ, Nicholson TM, Shamshina JL, Rogers RD, Boehm MW, McNally T. (2013). Effect of the ionic liquid 1-ethyl-3-methylimidazolium acetate on the phase transition of starch: dissolution or gelatinization? *Carbohydrate Polymers* 94: 520-30

Matindoost L, Hu H, Chan L, Nielsen L, Reid S. (2014) The effect of cell line, phylogenetics and medium on baculovirus budded virus yield and quality. *Archives of Virology*, 159(1): 91-102. epub 2013 print 2014

Mayoral B, Hornsby PR, McNally T, Schiller TL, Jack K, Martin DJ. (2013) Quasi-solid state uniaxial and biaxial deformation of PET/MWCNT composites: structural evolution, electrical and mechanical properties. *RSC Advances* 3: 5162-83

McDonald T, Tan K, Hodson M, Borges K. (2014) Alterations of hippocampal glucose metabolism by even versus uneven medium chain triglycerides. *Journal of Cerebral Blood Flow and Metabolism*, 34(1): 153-160. epub 2013 print 2014

McQualter R. (2013) Sugarcane becomes a biodegradable plastic factory. *Australian Canegrower* (2013): 14-5

Meliga SC, Farrugia W, Ramsland PA, Falconer RJ. (2013) Cold-induced precipitation of a monoclonal IgM: a negative activation enthalpy reaction. *Journal of Physical Chemistry B* 117: 490-4

Meliga SC, Flaim C, Veidt M, Kendall MAF. (2013) The mechanical stress caused by micro-projection arrays penetrating the skin for vaccine delivery. *Australian Journal of Multi-Disciplinary Engineering* 10: 173-84

Menzies DJ, Cameron A, Munro T, Wolvetang E, Grondahl L, Cooper-White JJ. (2013) Tailorable cell culture platforms from enzymatically cross-linked multifunctional poly(ethylene glycol)-based hydrogels. *Biomacromolecules* 14: 413-23

Mercer TR, Edwards SL, Clark MB, Neph SJ, Wang H, Stergachis AB, John S, Sandstrom R, Li G, Sandhu KS, Ruan Y, Nielsen LK, Mattick JS, Stamatoyannopoulos JA. (2013) DNase I-hypersensitive exons colocalize with promoters and distal regulatory elements. *Nature Genetics* 45: 852-9

Mercer TR, Mattick JS. (2013) Structure and function of long noncoding RNAs in epigenetic regulation. *Nature Structural & Molecular Biology* 20: 300-7

Michel G, Searles DJ. (2013) Local fluctuation theorem for large systems. *Physical Review Letters* 110

Middelberg APJ, Lua LHL. (2013) Virus-like particle bioprocessing: challenges and opportunities. *Pharmaceutical Bioprocessing* 1: 407-9

Mody KT, Popat A, Mahony D, Cavallaro AS, Yu C, Mitter N. (2013) Mesoporous silica nanoparticles as antigen carriers and adjuvants for vaccine delivery. *Nanoscale* 5: 5167-79

Mohd Hidzir N, Hill DJT, Taran E, Martin D, Grondahl L. (2013) Argon plasma treatment-induced grafting of acrylic acid onto expanded poly(tetrafluoroethylene) membranes. *Polymer* 54: 6536-46

Mohr J, Chuan YP, Wu Y, Lua LHL, Middelberg APJ. (2013) Virus-like particle formulation optimization by miniaturized high-throughput screening. *Methods* 60: 248-56

Mondal, S. (2014) Influence of solvents properties on morphology of electrospun polyurethane nanofiber mats. *Polymers for Advanced Technologies*, 25(2): 179-183. epub 2013 print 2014

Mondal S, Memmott P, Martin D. (2013) Preparation and characterization of green bio-composites based on modified spinifex resin and spinifex grass fibres. *Journal of Composite Materials* DOI: 10.1177/0021998313486500

Mondal S, Memmott P, Martin D. (2013) Preparation and characterization of spinifex resin based bio-polyurethane/thermoplastic polyurethane blends. *Polymer-Plastics Technology and Engineering* 52: 1535-41

Montano-Herrera L, Pratt S, Arcos-Hernandez MV, Halley PJ, Lant PA, Werker A, Laycock B. (2013) In-line monitoring of thermal degradation of PHA during melt-processing by Near-Infrared spectroscopy. *New Biotechnology* In Press Available online 24 October 2013

Mousavioun P, Halley PJ, Doherty WOS. (2013) Thermophysical properties and rheology of PHB/lignin blends. *Industrial Crops and Products* 50: 270-5

Nagadia R, Pandit P, Coman WB, Cooper-White J, Punyadeera C. (2013) miRNAs in head and neck cancer revisited. *Cellular Oncology* 36: 1-7

Najumudeen A, Kohnke M, Solman M, Alexandrov K, Abankwa D. (2013) Cellular FRET-Biosensors to detect membrane targeting inhibitors of N-Myristoylated Proteins. *PLoS One*, 8(6): e66425.1-e66425.5.

Navone L, Casati P, Licona-Cassani C, Marcellin E, Nielsen L, Rodriguez E, Gramajo H. (2014) Allantoin catabolism influences the production of antibiotics in *Streptomyces coelicolor*. *Applied Microbiology and Biotechnology*, 98(1): 351-360. epub 2013 print 2014

Nguyen AT, Gomez D, Bell RD, Campbell JH, Clowes AW, Gabbiani G, Giachelli CM, Parmacek MS, Raines EW, Rusch NJ, Speer MY, Sturek M, Thyberg J, Towler DA, Weiser-Evans MC, Yan C, Miano JM, Owens GK. (2013) Smooth muscle cell plasticity fact or fiction? *Circulation Research* 112: 17-22

Nguyen NH, Kulis J, Sun H-J, Jia Z, Van Beusekom B, Levere ME, Wilson DA, Monteiro MJ, Percec V. (2013) A comparative study of the SET-LRP of oligo (ethylene oxide) methyl ether acrylate in DMSO and in H2O. *Polymer Chemistry* 4: 144-55

Nguyen Q, Chan LCL, Nielsen LK, Reid S. (2013) Genome scale analysis of differential mRNA expression of *Helicoverpa zea* insect cells infected with a *H. armigera* baculovirus. *Virology* 444: 158-70

Nguyen Q, Nielsen LK, Reid S. (2013) Genome scale transcriptomics of baculovirus-insect interactions. *Viruses* 5: 2721-47

Nguyen TTD, Nghia TP, Gu W, Jia Z, Cooper MA, Monteiro MJ. (2013) Timed-release polymer nanoparticles. *Biomacromolecules* 14: 495-502

Niu Y, Yu M, Hartono SB, Yang J, Xu H, Zhang H, Zou J, Zou J, Dexter A, Gu W, Yu C. (2013) Nanoparticles mimicking viral surface topography for enhanced cellular delivery. *Advanced Materials* 25: 6233-7

Olguin Y, Villalobos P, Carrascosa LG, Young M, Valdez E, Lechuga L, Galindo R. (2013) Detection of flagellin by interaction with human recombinant TLR5 immobilized in liposomes. *Analytical and Bioanalytical Chemistry* 405: 1267-81

O'Neill BP, Purnell MP, Kurniawan ND, Cowin GJ, Galloway GJ, Nielsen LK, Brumbley SM. (2013) Non-invasive monitoring of sucrose mobilization from culm storage parenchyma by magnetic resonance spectroscopy. *Bioscience, Biotechnology, and Biochemistry* 77: 487-96

Ooi HW, Jack KS, Peng H, Whittaker AK. (2013) "Click" PNIPAAm hydrogels - a comprehensive study of structure and properties. *Polymer Chemistry* 4: 4788-800

Ooi HW, Jack KS, Whittaker AK, Peng H. (2013) Photo-initiated thiol-ene "click" hydrogels from RAFT-synthesized poly(N-isopropylacrylamide). *Journal of Polymer Science. Part A, Polymer Chemistry* 51: 4626-36

Ooi H, Peng H, Jack K, Whittaker A. (2014) Understanding the diffusion of dextrans in 'Click' PNIPAAm hydrogels. *Australian Journal of Chemistry*, 67(1): 85-92. epub 2013 print 2014

Ormsby R, McNally T, Mitchell C, Musumeci A, Schiller T, Halley P, Gahan L, Martin D, Smith, SV, Dunne NJ. (2014) Chemical modification of multiwalled carbon nanotube with a bifunctional caged ligand for radioactive labelling. *Acta Materialia*, 64: 54-61. epub 2013 print 2014

Ozaydin-Ince G, Matin A, Khan Z, Zaidi SMJ, Gleason KK. (2013) Surface modification of reverse osmosis desalination membranes by thin-film coatings deposited by initiated chemical vapor deposition. *Thin Solid Films* 539: 181-7

Palanisamy R, Connolly AR, Trau M. (2013) Accurate detection of methylated cytosine in complex methylation landscapes. *Analytical Chemistry* 85: 6575-9

Pandit P, Cooper-White J, Punyadeera C. (2013) High-yield RNA-extraction method for saliva. *Clinical Chemistry* 59: 1118-22

Paper JM, Scott-Craig JS, Cavalier D, Faik A, Wiemels RE, Borrusch MS, Bongers M, Walton JD. (2013) αFucosidases with different substrate specificities from two species of Fusarium. *Applied Microbiology and Biotechnology* 97: 5371-80

Patel R, Ruehle DA, Dorgan JR, Halley P, Martin D. (2013) Biorenewable blends of polyamide-11 and polylactide. *Polymer Engineering and Science* Early View: 1-10

Paterson SM, Casadio YS, Brown DH, Shaw JA, Chirila TV, Baker MV. (2013) Laser scanning confocal microscopy versus scanning electron microscopy for characterization of polymer morphology: sample preparation drastically distorts morphologies of poly (2-hydroxyethyl methacrylate)-based hydrogels. *Journal of Applied Polymer Science* 127: 4296-304

Paterson SM, Shadforth AMA, Shaw JA, Brown DH, Chirila TV, Baker MV. (2013) Improving the cellular invasion into PHEMA sponges by

incorporation of the RGD peptide ligand: The use of copolymerization as a means to functionalize PHEMA sponges. *Materials Science and Engineering C* 33: 4917-22

Pearson FE, McNeilly CL, Crichton ML, Primiero CA, Yukiko SR, Fernando GJP, Chen X, Gilbert SC, Hill AVS, Kendall MAF. (2013) Dry-coated live viral vector vaccines delivered by nanopatch microprojections retain long-term thermostability and induce transgene-specific T cell responses in mice. *PLoS ONE* 8: e67888.1-e.9

Peatey CL, Watson JA, Trenholme KR, Brown CL, Nielson L, Guenther M, Timmins N, Watson GS, Gardiner DL. (2013) Enhanced gametocyte formation in erythrocyte progenitor cells: A site-specific adaptation by *Plasmodium falciparum*. *The Journal of Infectious Diseases* 208: 1170-4

Petrasovits LA, McQualter RB, Gebbie LK, Blackman DM, Nielsen LK, Brumbley SM. (2013) Chemical inhibition of acetyl coenzyme A carboxylase as a strategy to increase polyhydroxybutyrate yields in transgenic sugarcane. *Plant Biotechnology Journal* 11: 1146-51

Plaza MG, Thurecht KJ, Pevida C, Rubiera F, Pis JJ, Snape CE, Drage TC. (2013) Influence of oxidation upon the CO2 capture performance of a phenolic-resin-derived carbon. *Fuel Processing Technology* 110: 53-60

Polanco JC, Ho MSH, Wang B, Zhou Q, Wolvetang E, Mason E, Wells CA, Kolle G, Grimmond SM, Bertoncello I, O'Brien C, Laslett AL. (2013) Identification of unsafe human induced pluripotent stem cell lines using a robust surrogate assay for pluripotency. *Stem Cells* 31: 1498-510

Pradal C, Jack KS, Grondahl L, Cooper-White JJ. (2013) Gelation kinetics and viscoelastic properties of pluronic and alpha-cyclodextrin-based pseudopolyrotaxane hydrogels. *Biomacromolecules* 14: 3780-92

Prasad KPS, Dhawale DS, Joseph S, Anand C, Wahab MA, Mano A, Sathish CI, Balasubramanian VV, Sivakumar T, Vinu A. (2013) Post-synthetic functionalization of mesoporous carbon electrodes with copper oxide nanoparticles for supercapacitor application. *Microporous and Mesoporous Materials* 172: 77-86

Prè MD, Morrow I, Martin DJ, Mos M, Del Negro A, Padovani S, Martucci A. (2013) Preparation and characterization of down shifting ZnS:Mn/PMMA nanocomposites for improving photovoltaic silicon solar cell efficiency. *Materials Chemistry and Physics* 139: 531-6

Puttick S, Davis AL, Butler K, Irvine DJ, Licence P, Thurecht KJ. (2013) The influence of domain segregation in ionic liquids upon controlled polymerisation mechanisms: RAFT polymerisation. *Polymer Chemistry* 4: 1337-44

Qian K, Huang X, Yu C. (2013) Synthesis and engineering of functional graphene films for matrix-free LDI mass spectrometry detection. *Protocol Exchange* (2013)

Qian K, Liu F, Yang J, Huang X, Gu W, Jambhrunkar S, Yuan P, Yu C. (2013) Pore size-optimized periodic mesoporous organosilicas for the enrichment of peptides and polymers. *RSC Advances* 3: 14466-72

Qian K, Yu C. (2013) Mass spectrometry imaging of invisible micro-patterns on graphene substrate. *Protocol Exchange* (2013)

Qian K, Zhou L, Liu J, Yang J, Xu H, Yu M, Nouwens A, Zou J, Monteiro MJ, Yu C. (2013) Laser engineered graphene paper for mass spectrometry imaging. *Scientific Reports* 3: 1415.1-.7

Raphael AP, Meliga SC, Chen X, Fernando GJP, Flaim C, Kendall MAF. (2013) Depth-resolved characterization of diffusion properties within and across minimally-perturbed skin layers. *Journal of Controlled Release* 166: 87-94

Rauf S, Shiddiky MJA, Trau M. (2013) "Drill and fill" lithography for controlled fabrication of 3D platinum electrodes. *Sensors and Actuators B: Chemical* 185: 543-7

Rauf S, Shiddiky MJA, Trau M, Dimitrov K. (2013) "Drill and fill" lithography: fabrication of platinum electrodes and their use in label-free immunosensing. *RSC Advances* 3: 4189-92

Rivera-Hernandez T, Hartas J, Wu Y, Chuan YP, Lua LHL, Good M, Batzloff MR, Middelberg APJ. (2013) Self-adjuvanting modular virus-like particles for mucosal vaccination against group A streptococcus (GAS). *Vaccine* 31: 1950-5

Ruehle DA, Perbix C, Castaneda M, Dorgan JR, Mittal V, Halley P, Martin D. (2013) Blends of biorenewable polyamide-11 and polyamide-6,10. *Polymer* 54: 6961-70

Ryan AC, Hewitt CN, Possell M, Vickers CE, Purnell A, Mullineaux PM, Davies WJ, Dodd IC. (2013) Isoprene emission protects photosynthesis but reduces plant productivity during drought in transgenic tobacco (*Nicotiana tabacum*) plants. *New Phytologist* Early View: 1-12

Sabri S, Nielsen LK, Vickers CE. (2013) Molecular control of sucrose utilization in *Escherichia coli W*, an efficient sucrose-utilizing strain. *Applied and Environmental Microbiology* 79: 478-87

Sabri S, Steen JA, Bongers M, Nielsen LK, Vickers CE. (2013) Knock-in/Knock-out (KIKO) vectors for rapid integration of large DNA sequences, including whole metabolic pathways, onto the *Escherichia coli* chromosome at well-characterised loci. *Microbial Cell Factories* 12: 60.1-.14

Sainsbury F, Varennes-Jutras P, Goulet M-C, D'Aoust M-A, Michaud D. (2013) Tomato cystatin SlCYS8 as a stabilizing fusion partner for human serpin expression in plants. *Plant Biotechnology Journal* 11: 1058-68

Samiee L, Shoghi F, Vinu A. (2013) Fabrication and electrocatalytic application of functionalized nanoporous carbon material with different transition metal oxides. *Applied Surface Science* 265: 214-21

Sandstrom AM, Jasieniak M, Griesser HJ, Grondahl L, Cooper-White JJ. (2013) Effects of varying heptylamine and propionaldehyde plasma polymerization parameters on mesenchymal stem cell attachment. *Plasma Processes and Polymers* 10: 19-28

Schmidt SA, Jacob SS, Ahn SB, Rupasinghe T, Kroemer JO, Khan A, Varela C. (2013) Two strings to the systems biology bow: co-extracting the metabolome and proteome of yeast. *Metabolomics* 9: 173-88

Searles DJ, Johnston BM, Evans DJ, Rondoni L. (2013) Time reversibility, correlation decay and the steady state fluctuation relation for dissipation. *Entropy* 15: 1503-15

Sebakhy K, Gavrilov M, Valade D, Jia Z, Monteiro M. (2014) Nanoparticles of Well-defined 4-Arm stars made using nanoreactors in water. *Macromolecular Rapid Communications*, 35(2): 193-197. epub 2013 print 2014

Seger B, McCray J, Mukherji A, Zong X, Xing Z, Wang L. (2013) An n-type to p-type switchable photoelectrode assembled from alternating exfoliated titania nanosheets and polyaniline layers. *Angewandte Chemie-International Edition* 52: 6400-3

Sierecki E, Giles N, Polinkovsky M, Moustaqil M, Alexandrov K, Gambin Y. (2013) A cell-free approach to accelerate the study of protein-protein interactions in vitro. *Interface Focus*, 3(5).

Soleh M, Foo J, Bailey U, Tan N, Wan Y, Cooper-White J, Schulz BL, Punyadeera C. (2014) A rapid and cost-effective method of producing recombinant proBNP and NT-proBNP variants in *Escherichia coli* for immunoassay of heart failure. *Biotechnology Letters*, 36(1): 133-140. epub 2013 print 2014

Song G, Sun Q, Hou Y-N, Zhan R, Wei D-M, Shi Z, Xing Y-H. (2013) Synthesis, structure and quantum chemistry study of the 4-Iodopyrazole copper complexes. *Chinese Journal of Inorganic Chemistry* 29: 2150-6

Sun C. (2013) Computational prediction of hydrogen sulfide and methane separation at room temperature by anatase titanium dioxide. *Chemical Physics Letters* 557: 106-9

Sun C, Searles DJ. (2013) Origin of the visible light absorption of boron/nitrogen co-doped anatase TiO2. *Journal of Physical Chemistry C* 117: 26454-9

Sun Q, Li Z, Searles DJ, Chen Y, Lu G, Du A. (2013) Charge-controlled switchable CO2 capture on boron nitride nanomaterials. *Journal of the American Chemical Society* 135: 8246-53

Sun Q, Wang M, Li Z, Li P, Wang W, Tan X, Du A. (2013) Nitrogen removal from natural gas using solid boron: a first-principles computational study. *Fuel* 109: 575-81

Sun Q, Wang M, Li Z, Ma Y, Du A. (2013) CO2 capture and gas separation on boron carbon nanotubes. *Chemical Physics Letters* 575: 59-66

Sun Z, Liao T, Kim J-G, Liu K, Jiang L, Kim JH, Dou SX. (2013) Architecture designed ZnO hollow microspheres with wide-range visible-light photoresponses. *Journal of Materials Chemistry C* 1: 6924-9

Sun Z, Liao T, Liu K, Jiang L, Kim JH, Dou SX. (2013) Robust superhydrophobicity of hierarchical ZnO hollow microspheres fabricated by two-step self-assembly. *Nano Research* 6: 726-35

Sylvester PD, Ryan HE, Smith CD, Micallef AS, Schiesser CH, Wille U. (2013) Perylene-based profluorescent nitroxides for the rapid monitoring of polyester degradation upon weathering: an assessment. *Polymer Degradation and Stability* 98: 2054-62

Tan X, Li Z, Sun Q, Li P, Wang W, Wang M, Chen Y. (2013) Theoretical study on the reaction mechanisms between propadienylidene and R-H (R=F, OH, NH2, CH3): an alternative approach to the formation of alkyne. *Structural Chemistry* 24: 33-8

Thomson DAC, Cooper MA. (2013) A paramagnetic-reporter two-particle system for amplification-free detection of DNA in serum. *Biosensors and Bioelectronics* 50: 499-501

Titmarsh DM, Chen H, Wolvetang EJ, Cooper-White JJ. (2013) Arrayed cellular environments for stem cells and regenerative medicine. *Biotechnology Journal* 8: 167-79

Titmarsh DM, Ovchinnikov DA, Wolvetang EJ, Cooper-White JJ. (2013) Full factorial screening of human embryonic stem cell maintenance with multiplexed microbioreactor arrays. *Biotechnology Journal* 8: 822-34

Tong CL, Boulos RA, Yu C, Iyer KS, Raston CL. (2013) Continuous flow tuning of ordered mesoporous silica under ambient conditions. *RSC Advances* 3: 18767-70

Torres FA, Meng P, Ju L, Zhao C, Blair DG, Liu K-Y, Chao S, Martyniuk M, Roch-Jeune I, Flaminio R, Michel C. (2013) High quality factor mg-scale silicon mechanical resonators for 3-mode optoacoustic parametric amplifiers. *Journal of Applied Physics* 114: 014506.1-.6

Torriero AAJ, Shiddiky MJA, Burgar I, Bond AM. (2013) Homogeneous electron-transfer reaction between electrochemically generated ferrocenium ions and amine-containing compounds. *Organometallics* 32: 128-36

Tran NTD, Jia Z, Truong NP, Cooper M, Monteiro MJ. (2013) Fine tuning the disassembly time of thermoresponsive polymer nanoparticles. *Biomacromolecules* 14: 3463-71

Truong NP, Gu W, Prasadam I, Jia Z, Crawford R, Xiao Y, Monteiro MJ. (2013) An influenza virus-inspired polymer system for the timed release of siRNA. *Nature Communications* 4 Article number:1902

Valade D, Wong LK, Jeon Y, Jia Z, Monteiro MJ. (2013) Polyacrylamide hydrogel membranes with controlled pore sizes. *Journal of Polymer Science Part A-Polymer Chemistry* 51: 129-38

Vaquette C, Cooper-White J. (2013) A simple method for fabricating 3-D multilayered composite scaffolds. *Acta Biomaterialia* 9: 4599-608

Varghese S, Anand C, Dhawale D, Mane GP, Wahab MA, Mano A, Raj GAG, Nagarajan S, Vinu A. (2013) Highly selective synthesis of ortho-prenylated phenols and chromans by using a new bimetallic CuAl-KIT-5 with a 3D-cage-type mesoporous structure. *ChemCatChem* 5: 899-902

Vasireddy V, Mills J, Gaddameedi R, Basner-Tschakarjan E, Kohnke M, Black A, Alexandrov K, Zhou S, Maguire AM, Chung DC, Mac H, Sullivan L, Gadue P, Bennicelli JL, French DL, Bennett J. (2013) AAV-mediated gene therapy for Choroideremia: preclinical studies in personalized models. *PLoS One*, 8(5): e61396.1-e61396.13.

Velasco D, Chau M, Therien-Aubin H, Kumachev A, Tumarkin E, Jia Z, Walker GC, Monteiro MJ, Kumacheva E. (2013) Nanofibrillar thermoreversible micellar microgels. *Soft Matter* 9: 2380-3

Vickers CE, Bydder SF, Zhou Y, Nielsen LK. (2013) Dual gene expression cassette vectors with antibiotic selection markers for engineering in *Saccharomyces cerevisiae*. *Microbial Cell Factories* 12: 96.1-.11

Vinu A, Ariga K. (2013) New ideas for mesoporous materials. *Advanced Porous Materials* 1: 63-71

Vu DT, Huang L, Nguyen AV, Du Y, Xu Z, Hampton MA, Li P, Rudolph V. (2013) Quantitative methods for estimating foliar uptake of zinc from suspension-based Zn chemicals. *Journal of Plant Nutrition and Soil Science* 176: 764-75

Vukovic J, Bedin A-S, Bartlett PF, Osborne GW. (2013) A novel fluorescent reporter CDy1 enriches for neural stem cells derived from the murine brain. *Stem Cells and Development* 22: 2341-5

Wahab MA, He C. (2013) Structural and optical properties of titanium functionalized periodic mesostructured organosilica framework via evaporation-induced self-assembly method. *Journal of Nanoscience and Nanotechnology* 13: 2771-6

Wahab MA, Jia Y, Yang D, Zhao H, Yao X. (2013) Enhanced hydrogen desorption from Mg (BH4)2 by combining nanoconfinement and a Ni catalyst. *Journal of Materials Chemistry A* 1: 3471-8

Wang DK, Varanasi S, Fredericks PM, Hill DJT, Symons AL, Whittaker AK, Rasoul F. (2013) FT-IR characterization and hydrolysis of PLA-PEG-PLA based copolyester hydrogels with short PLA segments and a cytocompatibility study. *Journal of Polymer Science Part A: Polymer Chemistry* Early View: 1-14

Wang D-W, Sun C, Zhou G, Li F, Wen L, Donose BC, Lu GQ, Cheng H-M, Gentle IR. (2013) The examination of graphene oxide for rechargeable lithium storage as a novel cathode material. *Journal of Materials Chemistry A* 1: 3607-12

Wang D-W, Zeng Q, Zhou G, Yin L, Li F, Cheng H-M, Gentle IR, Lu GQM. (2013) Carbon-sulfur composites for Li-S batteries: status and prospects. *Journal of Materials Chemistry A* 1: 9382-94

Wang H, Qian Z, Ma S, Zhou Y, Patrick JW, Duan X, Jiang Y, Qu H. (2013) Energy status of ripening and postharvest senescent fruit of litchi (*Litchi chinensis Sonn.*). *BMC Plant Biology* 13:55

Wang H, Rauf S, Padmanabhan H, Dimitrov K. (2013) Nanodumbbells as multi-functional diagnosis probes. *Journal of Nanoparticle Research* 15: 1633.1-.9

Wang K, Peng H, Thurecht KJ, Puttick S, Whittaker AK. (2013) pH-responsive star polymer nanoparticles: potential F-19 MRI contrast agents for tumour-selective imaging. *Polymer Chemistry* 4: 4480-9

Wang Q, Butburee T, Wu X, Chen H, Liu G, Wang L. (2013) Enhanced performance of dye-sensitized solar cells by doping Au nanoparticles into photoanodes: a size effect study. *Journal of Materials Chemistry A* 1: 13524-31

Wee EJH, Rauf S, Koo K, Shiddiky MJA, Trau M. (2013) mu-eLCR: a microfabricated device for electrochemical detection of DNA base changes in breast cancer cell lines. *Lab on a Chip* 13: 4385-91--91

Wells CA, Mosbergen R, Korn O, Choi J, Seidenman N, Matigian NA, Vitale AM, Shepherd J. (2013) Stemformatics: visualisation and sharing of stem cell gene expression. *Stem Cell Research* 10: 387-95

Weng Z, Li F, Wang D-W, Wen L, Cheng H-M. (2013) Controlled electrochemical charge injection to maximize the energy density of supercapacitors. *Angewandte Chemie-International Edition* 52: 3722-5

Williams S, Searles D, Evans D. (2014) On the relationship between dissipation and the rate of spontaneous entropy production from linear irreversible thermodynamics. *Molecular Simulation*, 40(1-3): 208-217. epub 2013 print 2014

Williams TC, Nielsen LK, Vickers CE. (2013) Engineered quorum-sensing using pheromone-mediated cell-to-cell communication in *Saccharomyces cerevisiae*. *ACS Synthetic Biology* 2: 136-49

Wu L, Jiang HB, Tian F, Chen Z, Sun C, Yang HG. (2013) Ti0.89Si0.11O2 single crystals bound by high-index {201} facets showing enhanced visible-light photocatalytic hydrogen evolution. *Chemical Communications* 49: 2016-8

Wu L, Xing J, Hou Y, Xiao FY, Li Z, Yang HG. (2013) Fabrication of regular ZnO/TiO2 heterojunctions with enhanced photocatalytic properties. *Chemistry-A European Journal* 19: 8393-6

Wu L, Yang BX, Yang XH, Chen ZG, Li Z, Zhao HJ, Gong XQ, Yang HG. (2013) On the synergistic effect of hydrohalic acids in the shape-controlled synthesis of anatase TiO2 single crystals. *CrystEngComm* 15: 3252-5

Wu X, Lu G, Wang L. (2013) Effect of sodium on photovoltaic properties of dye-sensitized solar cells assembled with anatase TiO2 nanosheets with exposed {001} facets. *Journal of Colloid and Interface Science* 391: 70-3

Wu X, Lu G, Wang L. (2013) The effect of photoanode thickness on the performance of dye-sensitized solar cells containing TiO2 nanosheets with exposed reactive {001} facets. *Journal of Materials Research* 28: 475-9

Xie DF, Martino VP, Sangwan P, Way C, Cash GA, Pollet E, Dean KM, Halley PJ, Averous L. (2013) Elaboration and properties of plasticised chitosan-based exfoliated nano-biocomposites. *Polymer* 54: 3654-62

Xie F, Pollet E, Halley PJ, Averous L. (2013) Starch-based nano-biocomposites. *Progress in Polymer Science* 38: 1590-628

Xing J, Chen ZP, Xiao FY, Ma XY, Wen CZ, Li Z, Yang HG. (2013) Cu-Cu2O-TiO2 nanojunction systems with an unusual electron-hole transportation pathway and enhanced photocatalytic properties. *Chemistry: An Asian Journal* 8: 1265-70

Xu Y, Zhang J, Zhou J, Chen C, Liu Q, Qian G, Xu ZP. (2013) CN and heavy metal removal through formation of layered double hydroxides from mixed CN-containing electroplating wastewaters and pickle acid liquor. *Chemical Engineering Journal* 215-216: 411-7

Xu ZP. (2013) Nanotechnology in pharmaceutical design. *Current Pharmaceutical Design* 19: 6227-8

Xu ZP, Li L, Cheng C-Y, Ding R, Zhou C. (2013) High capacitance electrode materials based on layered double hydroxides prepared by non-aqueous precipitation. *Applied Clay Science* 74: 102-8

Yan K, Li H, Wang X, Yi C, Zhang Q, Xu Z, Xu H, Whittaker AK. (2014) Self-assembled magnetic luminescent hybrid micelles containing rare earth Eu for dual-modality MR and optical imaging. *Journal of Materials Chemistry B* 2(5): 546-555. epub 2013 print 2014

Yan P, Mineshige A, Mori T, Wu Y, Auchterlonie G, Zou J, Drennan J. (2013) Microanalysis of a grain boundary's blocking effect in lanthanum silicate electrolyte for intermediate-temperature solid oxide fuel cells. *ACS Applied Materials and Interfaces*, 5(11): 5307-5313.

Yan P, Mori T, Wu Y, Li Z, Auchterlonie GJ, Zou J, Drennan J. (2013) Microstructural and chemical characterization of ordered structure in yttrium doped ceria. *Microscopy and Microanalysis* 19: 102-10

Yan S, Gu W, Xu ZP. (2013) Re-considering how particle size and other properties of antigen-adjuvant complexes impact on the immune responses. *Journal of Colloid and Interface Science* 395: 1-10

Yang D, Peng S, Hartman MR, Gupton-Campolongo T, Rice EJ, Chang AK, Gu Z, Lu GQ, Luo D. (2013) Enhanced transcription and translation in clay hydrogel and implications for early life evolution. *Scientific Reports* 3: 3165.1-.6

Yang J, Zhang H, Yu M, Emmanuelawati I, Zou J, Yuan Z, Yu C. (2013) High-content, well-dispersed gamma-Fe2O3 nanoparticles encapsulated in macroporous silica with superior arsenic removal performance. *Advanced Functional Materials* Early View: 1-10

Yang J, Zhou L, Zhang J, Zou J, Yuan Z, Yu C. (2013) Confinement of chemisorbed phosphates in a controlled nanospace with three-dimensional mesostructures. *Chemistry-A European Journal* 19: 5578-85

Yang T, Liu J, Zheng Y, Monteiro MJ, Qiao SZ. (2013) Facile fabrication of core-shell-structured Ag@Carbon and mesoporous yolk-shell-structured Ag@Carbon@Silica by an extended Stober method. *Chemistry-A European Journal* 19: 6942-5

Yang Y, Karmakar S, Yu M, Popat A, Yu C. (2014) Synthesis of silica vesicles with small sizes and reduced aggregation for photodynamic therapy. *Chemistry Letters* 43, 316–318 epub 2013 print 2014

Yeow B, Coffey JW, Muller DA, Grondahl L, Kendall MAF, Corrie SR. (2013) Surface modification and characterization of polycarbonate microdevices for capture of circulating biomarkers, both in vitro and in vivo. *Analytical Chemistry* 85: 10196-204

Yu H, Du A, Song Y, Searles DJ. (2013) Graphyne and graphdiyne: versatile catalysts for dehydrogenation of light metal complex hydrides. *Journal of Physical Chemistry C* 117: 21643-50

Yu H, Pan J, Bai Y, Zong X, Li X, Wang L. (2013) Hydrothermal synthesis of a crystalline rutile TiO2 nanorod based network for efficient dye-sensitized solar cells. *Chemistry: A European Journal* 19: 13569-74

Yu M, Jambhrunkar S, Thorn P, Chen J, Gu W, Yu C. (2013) Hyaluronic acid modified mesoporous silica nanoparticles for targeted drug delivery to CD44-overexpressing cancer cells. *Nanoscale* 5: 178-83

Yu M, Karmakar S, Yang J, Zhang H, Yang Y, Thorn P, Yu C. (2014) Facile synthesis of ultra-small hybrid silica spheres for enhanced penetration of 3D glioma spheroids. *Chemical Communications* 50, 1527-1529 epub 2013 print 2014

Yu NYC, Schindeler A, Peacock L, Mikulec K, Fitzpatrick J, Ruys AJ, Cooper-White JJ, Little DG. (2013) Modulation of anabolic and catabolic responses via a porous polymer scaffold manufactured using thermally induced phase separation. *European Cells and Materials* 25: 190-203

Yu ZB, Xie YP, Liu G, Lu GQ, Ma XL, Cheng H-M. (2013) Self-assembled CdS/Au/ZnO heterostructure induced by surface polar charges for efficient photocatalytic hydrogen evolution. *Journal of Materials Chemistry A* 1: 2773-6

Zayas HA, Lu A, Valade D, Amir F, Jia Z, O'Reilly RK, Monteiro MJ. (2013) Thermoresponsive polymer-supported L-proline micelle catalysts for the direct asymmetric aldol reaction in water. *ACS Macro Letters* 2: 327-31

Zayas HA, Truong NP, Valade D, Jia Z, Monteiro MJ. (2013) Narrow molecular weight and particle size distributions of polystyrene 4-arm stars synthesized by RAFT-mediated miniemulsions†. *Polymer Chemistry* 4: 592-9

Zeng BJ, Chuan YP, O'Sullivan B, Caminschi I, Lahoud MH, Thomas R, Middelberg APJ. (2013) Receptor-specific delivery of protein antigen to dendritic cells by a nanoemulsion formed using top-down non-covalent click self-assembly. *Small* Early View: 1-7

Zhang B, Li X, Liu J, Xie F, Chen L. (2013) Supramolecular structure of A- and B-type granules of wheat starch. *Food Hydrocolloids* 31: 68-73

Zhang B, Wang D, Hou Y, Yang S, Yang XH, Zhong JH, Liu J, Wang HF, Hu P, Zhao HJ, Yang HG. (2013) Facet-dependent catalytic activity of platinum nanocrystals for triiodide reduction in dye-sensitized solar cells. *Scientific Reports* 3 Article number:1836

Zhang B, Xiong S, Li X, Li L, Xie F, Chen L. (2014) Effect of oxygen glow plasma on supramolecular and molecular structures of starch and related mechanism. *Food Hydrocolloids*, 37: 69-76. epub 2013 print 2014

Zhang B, Zhao Y, Li X, Li L, Xie F, Chen L. (2014) Supramolecular structural changes of waxy and high-amylose cornstarches heated in abundant water. *Food Hydrocolloids*, 35: 700-709 epub 2013 print 2014

Zhang J, Su H, Zhou J, Qian G, Xu Z, Xi Y, Xu Y, Theiss FL, Frost R. (2013) Mid- and near-infrared spectroscopic investigation of homogeneous cation distribution in MgxZnyAl(x+y)/2-layered double hydroxide (LDH). *Journal of Colloid and Interface Science* 411: 240-6

Zhang J, Xu Y, Liu J, Zhou J, Xu ZP, Qian G. (2013) Fe(CN)63−/Fe(CN)64− redox in the interlayer determined by the charge density of ZnnCr-layered double hydroxides. *Journal of Solid State Chemistry* 198: 506-10

Zhang J, Xu Y, Zhou J, Liang Y, Chen C, Liu Q, Qian G, Xu ZP. (2013) Magnetic nanomaterials recovered from co-treatment of CN-containing electroplating wastewaters and pickle acid liquor. *Separation and Purification Technology* 120: 186-90

Zhang J, Zhou JZ, Liu Q, Qian G, Xu ZP. (2013) Efficient removal of sulfur hexafluoride (SF6) through reacting with recycled electroplating sludge. *Environmental Science and Technology* 47: 6493-9

Zhang J, Zhou J, Xu Z, Li Y, Cao T, Zhao J, Ruan X, Liu Q, Qian G. (2014) Decomposition of potent greenhouse gas sulfur hexafluoride (SF6) by kirschsteinite-dominant stainless steel slag. *Environmental Science and Technology*, 48(1): 599-606 epub 2013 print 2014

Zhang L, Hu X, Yu C, Crawford R, Yu A. (2013) Preparation of sinapinaldehyde modified mesoporous silica materials and their application in selective extraction of trace Pb(II). *International Journal of Environmental Analytical Chemistry* 93: 1274-85

Zhang L, Tang R, Bai S, Connors NK, Lua LHL, Chuan YP, Middelberg APJ, Sun Y. (2013) Molecular Energetics in the Capsomere of Virus-Like Particle Revealed by Molecular Dynamics Simulations. *Journal of Physical Chemistry B* 117: 5411-21

Zhang X, Dou G, Wang Z, Li L, Wang Y, Wang H, Hao Z. (2013) Selective catalytic oxidation of H2S over iron oxide supported on alumina-intercalated laponite clay catalysts. *Journal of Hazardous Materials* 260: 104-11

Zhang X, Liu T, Sun W, Liu J. (2013) Mesoporous organosilica hollow microspheres with hierarchical structures on the shell. *Journal of Nanoscience and Nanotechnology* 13: 3046-53

Zhang X, Wan Y, Cooper-White J, Dimeski G, Atherton J, Punyadeera C. (2013) Quantification of D-dimer levels in human saliva. *Bioanalysis* 5: 2249-56

Zhao C-X. (2013) Multiphase flow microfluidics for the production of single or multiple emulsions for drug delivery. *Advanced Drug Delivery Reviews* 65: 1420-46

Zhao C-X, Middelberg APJ. (2013) One-step fabrication of titania hollow spheres by controlled interfacial reaction in a droplet-based microfluidic system. *Microfluidics and Nanofluidics* 14: 703-9

Zhao C-X, Middelberg APJ. (2013) Microfluidic synthesis of monodisperse hierarchical silica particles with raspberry-like morphology. *RSC Advances* 3: 21227-30

Zhao C-X, Yu L, Middelberg APJ. (2013) Magnetic mesoporous silica nanoparticles end-capped with hydroxyapatite for pH-responsive drug release. *Journal of Materials Chemistry B* 1: 4828-33

Zhao L, Seth A, Wibowo N, Zhao C, Mitter N, Yu C, Middelberg A. (2014) Nanoparticle vaccines. *Vaccine*, 32(3): 327-337. epub 2013 print 2014

Zhao ZY, Liu J, Hahn M, Qiao S, Middelberg APJ, He L. (2013) Encapsulation of lipase in mesoporous silica yolk-shell spheres with enhanced enzyme stability. *RSC Advances* 3: 22008-13

Zhen C, Wang L, Liu G, Lu GQ, Cheng H-M. (2013) Template-free synthesis of Ta3N5 nanorod arrays for efficient photoelectrochemical water splitting. *Chemical Communications* 49: 3019-21

Zhen C, Wang L, Liu L, Liu G, Lu GQ, Cheng H-M. (2013) Nonstoichiometric rutile TiO2 photoelectrodes for improved photoelectrochemical water splitting. *Chemical Communications* 49: 6191-3

Zheng Y, Jiao Y, Ge L, Jaroniec M, Qiao SZ. (2013) Two-step boron and nitrogen doping in graphene for enhanced synergistic catalysis. *Angewandte Chemie-International Edition* 52: 3110-6

Zhou G, Pei S, Li L, Wang D, Wang S, Huang K, Yin L-C, Li F, Cheng H-M. (2014) A graphene-pure-sulfur sandwich structure for ultrafast, long-life lithium-sulfur batteries. *Advanced Materials*, 26(4): 625-631. epub 2013 print 2014

Zhou G, Wang D-W, Li L, Li N, Li F, Cheng H-M. (2013) Nanosize SnO2 confined in the porous shells of carbon cages for kinetically efficient and long-term lithium storage. *Nanoscale* 5: 1576-82

Zhou G, Yin L-C, Wang D-W, Li L, Pei S, Gentle IR, Li F, Cheng H-M. (2013) Fibrous hybrid of graphene and sulfur nanocrystals for high-performance lithium-sulfur batteries. *ACS Nano* 7: 5367-75

Zhou L, Xu H, Zhang H, Yang J, Hartono SB, Qian K, Zou J, Yu C. (2013) Cheap and scalable synthesis of alpha-Fe2O3 multi-shelled hollow spheres as high-performance anode materials for lithium ion batteries. *Chemical Communications* 49: 8695-7

Zhou L, Zhou X, Huang X, Liu Z, Zhao D, Yao X, Yu C. (2013) Designed synthesis of LiMn2O4 microspheres with adjustable hollow structures for lithium-ion battery applications. *Journal of Materials Chemistry A* 1: 837-42

Zhou R, Zheng Y, Hulicova-Jurcakova D, Qiao SZ. (2013) Enhanced electrochemical catalytic activity by copper oxide grown on nitrogen-doped reduced graphene oxide. *Journal of Materials Chemistry A* 1: 13179-85

Zhu Q, Fu Y, Zhu S. (2013) Broad band focusing of photonic crystals with graded negative index. *Journal of Computational and Theoretical Nanoscience* 10: 177-80

Zhu Y, Hong H, Xu ZP, Li Z, Cai W. (2013) Quantum dot-based nanoprobes for in vivo targeted imaging. *Current Molecular Medicine* 13: 1549-67

Zhu Y, Li Z, Chen M, Cooper H, Lu GQ, Xu ZP. (2013) One-pot preparation of highly fluorescent cadmium telluride/cadmium sulfide quantum dots under neutral-pH condition for biological applications. *Journal of Colloid and Interface Science* 390: 3-10

Zhu Y, Li Z, Chen M, Cooper HM, Xu ZP. (2013) Tuning core-shell SiO2@CdTe@SiO2 fluorescent nanoparticles for cell labeling. *Journal of Materials Chemistry B* 1: 2315-23

Zhuang D-W, Kang Q, Muir SS, Yao X, Dai H-B, Ma G-L, Wang P. (2013) Evaluation of a cobalt-molybdenum-boron catalyst for hydrogen generation of alkaline sodium borohydride solution-aluminum powder system. *Journal of Power Sources* 224: 304-11

Zong X, Sun C, Yu H, Chen ZG, Xing Z, Ye D, Lu GQ, Li X, Wang L. (2013) Activation of photocatalytic water oxidation on N-doped ZnO bundle-like nanoparticles under visible light. *Journal of Physical Chemistry C* 117: 4937-42

Zong X, Thaweesak S, Xu H, Xing Z, Zou J, Lu G, Wang L. (2013) A scalable colloidal approach to prepare hematite films for efficient solar water splitting. *Physical Chemistry Chemical Physics* 15: 12314-21

Zong X, Wang L. (2014) Ion-exchangeable semiconductor materials for visible light-induced photocatalysis. *Journal of Photochemistry and Photobiology C: Photochemistry Reviews*, 18: 32-49 epub 2013 print 2014

Zong X, Xing Z, Yu H, Bai Y, Lu G, Wang L. (2014) Photocatalytic hydrogen production in a noble-metal-free system catalyzed by in situ grown molybdenum sulfide catalyst. *Journal of Catalysis*, 310: 51-56 epub 2013 print 2014

Patents granted in 2013

Peptide networks

Anton Middelberg and Annette Dexter (licensed to Pepfactants). European patent granted December 2013.

Method of producing a population of cells

Nicholas Timmins, Lars Nielsen and Emma Palfreyman. US patent granted October 2013. Australian patent granted November 2013.

Titanate photocatalyst

Gao Qing Lu and Lianzhou Wang. US patent granted October 2013.

VLP-based vaccine delivery system

Linda Lua and Anton Middelberg. US patent granted August 2013.

Preparation of suspensions

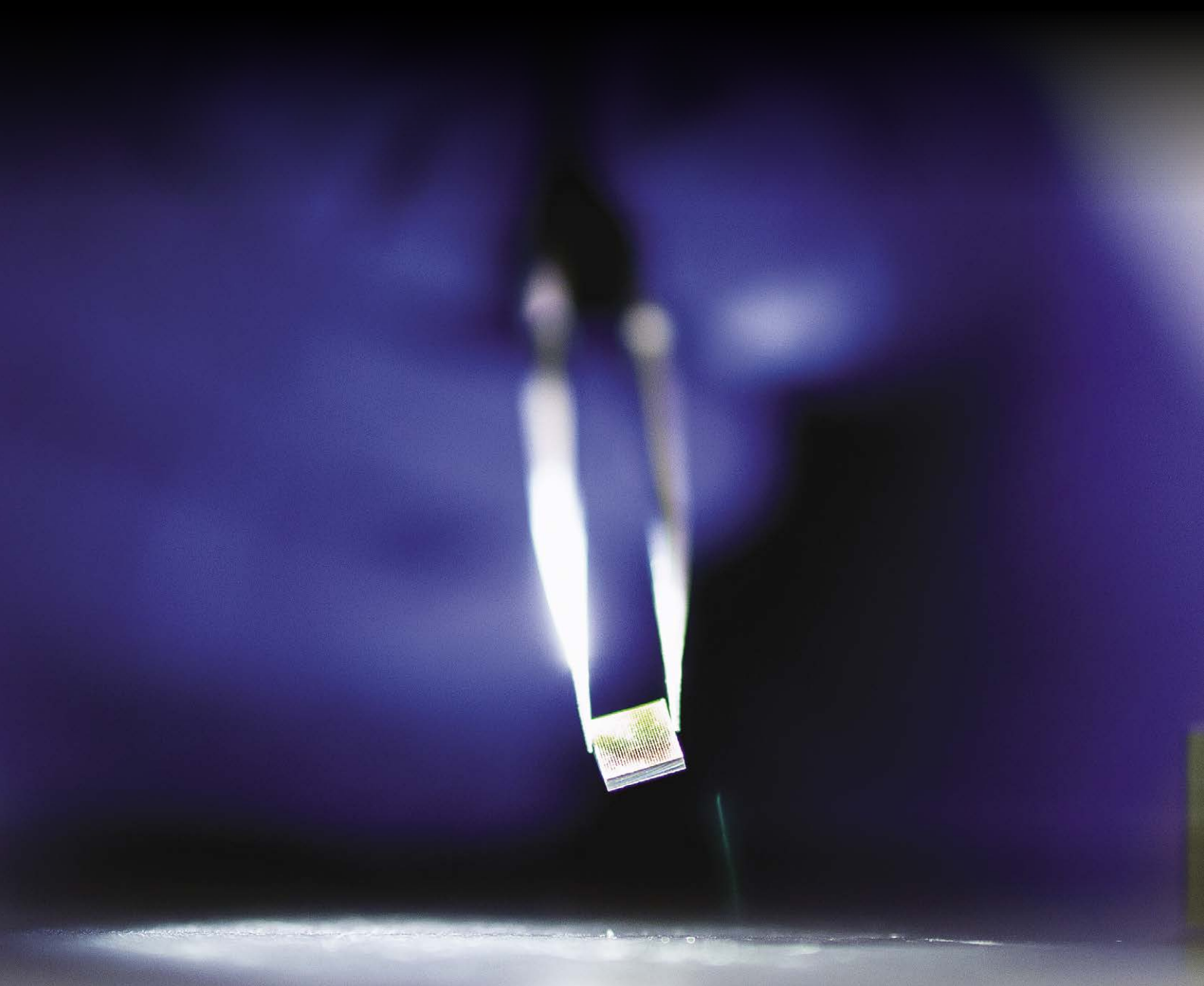
Gao Qing Lu and ZhipingXu. Canadian patent granted July 2013.

Patch production

Xianfeng Chen, Mark Kendall, Tarl Prow and Anthony Raphael. Chinese patent granted June 2013.

Porous polymer structures

Justin Cooper-White, Yang Cao and Andrew Rowlands. Australian patent granted January 2013.



Seminar Series 2013

4 February: **Professor Ryong Ryoo**, Center for Nanomaterials and Chemical Reactions, Institute for Basic Science and Department of Chemistry, Korea Advanced Institute of Science and Technology
Title: Surfactant molecules guiding multilevel nano-structures

8 February: **Professor Dayang Wang**, Ian Wark Research Institute, the University of South Australia
Title: Nanoparticles at interfaces

4 March: **Professor Jin-Ho Choy**, Executive Vice President, EWHA Woman's University, Seoul, Korea
Title: EWHA Womans University in Seoul, Korea

6 March: **Dr Mervyn Turner**, Advisor to Bay City Capital, San Francisco, US
Title: May you live in interesting times: the future of healthcare

14 March: **Professor Mark Kendall**, Group Leader, AIBN
Title: Improving the reach of vaccines to the developing world with Nanopatches

21 March: **Professor John Dorgan**, Site Director, Colorado Center for Biorefining and Biofuels, Colorado School of Mines, US
Title: Supramolecular EcoBioNanocomposites incorporating stereocomplexation

28 March: **Professor Jeffrey Gorman**, Leader, QIMR Protein Discovery Group; Convenor, Proteomics Australia
Title: Proteomic dissection of the battle between respiratory syncytial virus and epithelial cells during infection

11 April: **Professor Peter Halley**, Group Leader, AIBN
Title: Translational polymer research for sustainable polymers

18 April: **Professor Robert Booy**, National Centre for Immunisation Research and Surveillance
Title: Vaccine scares and successes

8 May: **Dr Gustavo Mostoslavsky**, Boston University School of Medicine, US
Title: Stem cells, disease modeling, regenerative medicine, gene correction and lentiviral vectors as tools for gene transfer

9 May: **Professor Hiroaki Kitano**, Director and President, Systems Biology Institute; Visiting Professor, the University of Tokyo and Keio University, Japan
Title: Systems biology in the context of systems and precision engineering

16 May: **Professor Gordon Southam**, School of Earth Sciences, UQ
Title: Bacteria: nature's nano-scale bioengineers

23 May: **Dr Chris Elvin**, CSIRO Animal, Food and Health Sciences
Title: Molecular biomimicry: nature's 4 billion years of research and development

30 May: **Professor J.D. Pettigrew**, Queensland Brain Institute, UQ
Title: The mystery of Bradshaw rock art

13 June: **Dr James (Jim) Aylward**, Owner, Oncolin
Title: Pioneering the early path to translation: one scientist-inventor's journey

17 June: **Professor Axel Müller**, Institute of Organic Chemistry, Johannes Gutenberg Universität Mainz, Germany; Makromolekulare Chemie II, Universität Bayreuth, Germany
Title: Self-organized multicompartment nanostructures from new triblock terpolymers

20 June: **Professor Magnus Nyden**, Director, Ian Wark Research Institute, the University of South Australia
Title: New methods for predicting diffusion in porous materials and new technologies for preventing biological growth at solid liquid interfaces

15 July: **Dr James W. Thackeray**, Research Fellow, Dow Electronic Materials
Title: Chemical amplification resists: their practical use and development in the semiconductor industry

16 July: **Professor Zhibing Zhang**, School of Chemical Engineering, the University of Birmingham, UK
Title: Encapsulation and micromanipulation: from fundamentals to industrial applications

1 August: **Professor Hynek Biederman**, Department of Macromolecular Physics, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic
Title: Nanocomposite and nanostructured films based on plasma polymers

8 August: **Professor Kirill Alexandrov**, ARC Future Fellow, AIBN, Institute for Molecular Bioscience, UQ
Title: Synthetic sensing and signal transduction cascades based on artificial autoinhibited proteases

9 August: **Professor Dongyuan Zhao**, Laboratory of Advanced Materials, Department of Chemistry, Fudan University, China
Title: Interfacial assembly and engineering for novel ordered mesoporous materials

15 August: **Dr Sue O'Brien**, Research Integrity Officer, UQ Research and Innovation
Title: Following the Australian Code for the Responsible Conduct of Research at UQ

22 August: **Dr Robert Robinson**, Bragg Institute, Australian Nuclear Science and Technology Organisation
Title: Opportunities for soft-matter and biological research using OPAL, the new Australian research reactor

29 August: **Dr Richard McQualter**, AIBN
Title: Production of a biodegradable plastic in a high biomass C4 crop

13 September: **Professor Enrico Traversa**, Physical Sciences and Engineering Division, King Abdullah University of Science and Technology, Saudia Arabia
Title: Next generation of solid oxide fuel cells operating at 600°C based on chemically stable proton conducting electrolytes

26 September: **Dr Pilar Blancafort**, Associate Professor, Cancer Epigenetics Group School of Anatomy, Physiology and Human Biology, the University of Western Australia
Title: Re-wiring the cancer genome: engineering of novel targeted therapies for breast and ovarian cancers

26 September: **Associate Professor Tadaharu Ueda**, Assistant Professor Shingo Hadano and Assistant Professor Kenji Matsumoto, Kochi University, Japan
Titles: Synthesis and characterization of novel polyoxometalates; Synthesis, nanostructures, and thermal properties of ABA-type amphiphilic triblock copolymers consisting of side-chain liquid crystalline polymethacrylate as a hydrophobic A-block and poly(ethylene oxide) as a hydrophilic B-block; and Functional metal complexes utilized non-covalent interactions–siderophores, catalysts, luminescent complexes

10 October: **Dr Nobuyoshi Joe Maeji**, Chief Scientific Officer, Anteo Diagnostics Ltd
Title: Nano-glues and surface modifications by use of coordination forces

17 October: **Dr Andy Mukherji**, Patent attorney, Griffith Hack; and Nicola Lake, Senior Associate, Engineering, Griffith Hack
Title: The hidden value of patent literature

18 October: **Professor Albin Sandelin**, The Bioinformatics Centre, Copenhagen University, Denmark
Title: Biogenesis and degradation of exotic RNAs from enhancers and gene promoters

24 October: **Kathy Hirschfeld**, Senate, UQ; Board member, AIBN
Title: Navigating the labyrinth of leadership

28 October: **Professor Alberto Gabizon**, Hebrew University-Faculty of Medicine, Jerusalem, Israel
Title: Liposomes as a nanomedicine platform in cancer therapy

31 October: **Professor Ruben Pio**, Division of Oncology, Center for Applied Medical Research, University of Navarra, Pamplona, Spain
Title: The role of complement proteins in lung cancer

7 November: **Professor Brian Yates**, Executive Director, Engineering, Mathematics and Information Sciences, Australian Research Council
Title: Australian Research Council: current developments and research opportunities

14 November: **Professor James Runt**, Materials Science and Engineering Department, Penn State University, US
Title: Nanostructure and molecular dynamics of polyurea copolymers

5 November: **Jason A. Roberts**, Senior Medical Scientist, National Enterovirus Reference Laboratory, Victorian Infectious Diseases Reference Laboratory, Melbourne
Title: Supercomputer simulation of newly discovered and novel enteroviruses

20 November: **Professor Dangsheng Su**, Catalysis and Materials Division, Institute of Metal Research, Chinese Academy of Sciences
Title: Nanocarbon: catalysis and energy

6 December: **Dr Chris Fellows**, Senior Lecturer, Chemistry Program, University of New England
Title: Why is it so? Mechanistic investigations of pervaporation, scale inhibition and monolayer evaporation suppression

13 December: **Dr Hiromasa Okayasu**, Medical Officer, Research, Policy and Product Development, Global Polio Eradication Initiative, World Health Organization
Title: Global Polio Eradication Initiative: progress updates and the role of innovation

Thank you

We thank our donors and benefactors for their continued generosity. AIBN's research success has been enriched through ongoing philanthropic support and we remain grateful for the opportunities this provides.

Front cover image:
a detailed chrome mask produced at the Australian National Fabrication Facility Queensland node (ANFF-Q) on their Heidleberg Direct Laser Writer, capable of achieving sub-micron print features.
These patterned masks are used as the first step in numerous fabrication techniques, all supported by the staff and facilities at ANFF-Q.

95472 1.5K JUN14 CS CRICOS PROVIDER NUMBER 00025B

Contact AIBN

Director
Professor Peter Gray
T: +61 7 3346 3888
E: aibn.director@uq.edu.au

Deputy Director (Operations)
Dr Zoe Cahill
T: +61 7 3346 3800
E: z.cahill@uq.edu.au

External Relations and Advancement Manager
Petrina Gilmore
T: +61 7 3346 3899
M: +61 413 619 642
E: p.gilmore@uq.edu.au

Deputy Director (Commercialisation)
Dr Ian Nisbet
T: +61 (0) 431 709 121
E: i.nisbet@uq.edu.au

Research Higher Degree Manager
Tony Miscamble
T: +61 7 3346 3989
E: t.miscamble@uq.edu.au

Australian Institute for Bioengineering and Nanotechnology
Building 75
Corner College and Cooper roads
The University of Queensland
Brisbane Qld 4072
Australia
T: +61 7 3346 3877

Our history

- AIBN was established by The University of Queensland Senate in December 2002.
- Construction of a custom-designed 15,689sq m AIBN research facility started in November 2004.
- First AIBN Group Leaders appointed in 2005.
- The $73.6 million AIBN research facility was completed in August 2006.
- Then Queensland Premier Peter Beattie opened the facility on October 23, 2006.


THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA
AIBN
Australian Institute for
Bioengineering and Nanotechnology