# AIBN

ANNUAL REPORT 2008

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

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VICE-CHANCELLOR'S

# MESSAGE

In just five years the Australian Institute for Bioengineering and Nanotechnology has emerged as a UQ flagship for engagement with global, national and local industry. Professor Peter Gray and his team speak the language of small, medium and large businesses, and work with them on practical solutions to scientific and technical problems.

The quality of AIBN output is reflected in the calibre of international organisations that choose to partner with the Institute. This relative new-comer to the research and development landscape has won the confidence of long-standing and globally renowned organisations, such as The Dow Chemical Company, the Chinese Academy of Sciences, the Korea Advanced Institute of Science and Technology, the Bill and Melinda Gates Foundation, Washington State University, the Fred Hutchinson Cancer Research Centre, Unilever and Intel – to list but a sample.

While satisfying overseas demand and attracting new income to Australia, AIBN scientists and engineers continue to serve local firms. In 2008 AIBN partnered with more than 30 businesses, whose products range from antibodies and metal oxides to homecare and personal products. The results include new processes and technologies that may reduce business costs and generate employment.

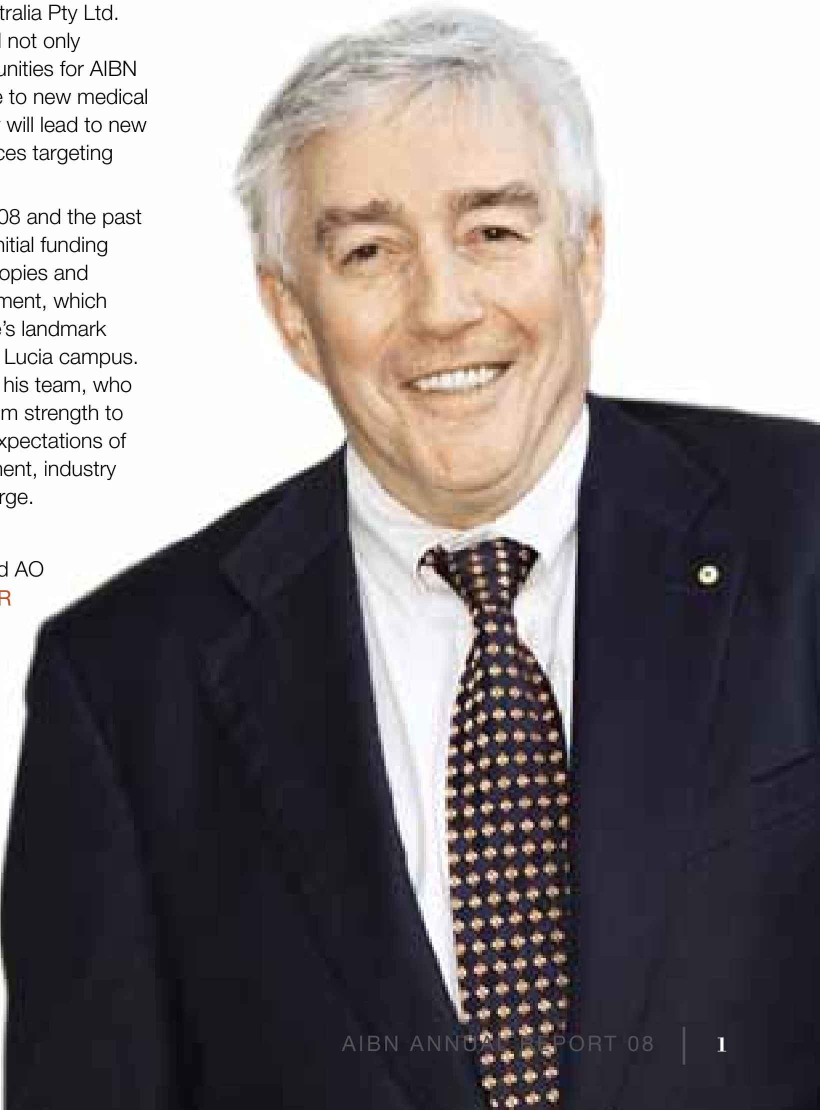
Entrepreneurism pervades the research projects of the AIBN. As well as aiming for improvements in human and environmental health, they strive to develop platform technologies and to support new industries.

Through liaison with UniQuest (UQ's main commercialisation company) outcomes that have commercial potential are placed on track to the market. For example, two start-ups from AIBN discoveries raised venture capital totalling $1.2 million in 2008, while a third attracted substantial funding to pursue low cost solar cells and water treatment materials.

Like students and staff, the AIBN executive is oriented to the future. This is evident in high-level involvement in negotiations to build the $342 million Translational Research Institute at the Princess Alexandra Hospital (a UQ teaching hospital), as well as the associated emergence of Biopharmaceuticals Australia Pty Ltd. These developments will not only create additional opportunities for AIBN researchers to add value to new medical research programs, they will lead to new drugs and clinical practices targeting major health concerns.

The achievements of 2008 and the past five years are rooted in initial funding by The Atlantic Philanthropies and the Queensland Government, which helped build the Institute's landmark headquarters at UQ's St Lucia campus. I congratulate Peter and his team, who I am confident will go from strength to strength in fulfilling the expectations of philanthropists, government, industry and the community at large.

Professor Paul Greenfield AO
VICE-CHANCELLOR
THE UNIVERSITY
OF QUEENSLAND



DIRECTOR'S
# MESSAGE

The year 2008 marked the first five-year milestone of the Australian Institute for Bioengineering and Nanotechnology (AIBN). In light of that significant development, a review of the Institute's achievements over the past five years was a major topic for discussion at the annual Queensland Government Review Committee meeting.

The past five years have seen AIBN grow to 17 research groups with more than 340 researchers, students and support staff; move into a new, state-of-the-art building; attract more than $A50 million in competitive grant funding; and form three spin-off companies.

As a result, I am very pleased to report that the Review Committee commended AIBN on its achievements to date and agreed that performance has more than exceeded expectations. The committee congratulated all AIBN staff and students on their impressive achievement in the first five years.

The support of the Review Committee, which is ably led by Euan Murdoch and comprises representatives from the Queensland Government and The University of Queensland, is greatly appreciated and reflects well on our successes. I look forward to working with the Review Committee and the AIBN Scientific and Commercialisation Committee to ensure the next five years maintain the high standard of excellence and continue the growth of AIBN.

The Institute's achievements in 2008 build on its previous accomplishments in the key areas of research excellence, industry focus and delivering a dynamic research environment. These three areas collectively distinguish AIBN, with its strong industry focus, from many other research institutes.

These achievements are demonstrated by AIBN's links with international companies, such as The Dow Chemical Company, Intel and Unilever, and Australian small-to-medium enterprises, such as BioProton and the Very Small Particle Company. AIBN has extensive international collaborations, some of which are supported by the Queensland Government's National and International Research Alliance Program. The program has enabled stronger partnerships with notable organisations, such as the Fred Hutchinson Cancer Research Centre, which is the largest cancer research centre in the world, and Sematech, a consortium of leading computing companies developing new technologies for the computing industry.

The 2008 Annual Report strongly reflects this industry focus and its influence on the Institute's research programs. However, there are some accomplishments and contributions without which this focus would not exist and they must be acknowledged.

AIBN again performed well in the 2008 competitive funding rounds of the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC), being awarded new grants totalling $A7.9 million over the next three years. The largest, an NHMRC grant worth $A1.8 million, was awarded to a six-person team that includes AIBN's Associate Professors Darren Martin and Michael Monteiro and investigates the impact nanomaterials may have on human health.

Additionally, AIBN received about $A5 million through the Queensland Government's National and International Research Alliance Program and an additional $A3.3 million in funding from the Australian Stem Cell Centre.

The Bill and Melinda Gates Foundation invested in AIBN's research into needle-free, nanopatch immunisation devices, led by Institute Group Leader Professor Mark Kendall.

I congratulate Professor Max Lu, who was awarded his second ARC Federation Fellowship in 2008. The fellowships are considered the most prestigious research awards in the country and are aimed at attracting and retaining world-class researchers.

In addition to welcoming the cohort of new staff and students who began in 2008, AIBN especially welcomes Professor Kirill Alexandrov. Professor Alexandrov is a joint appointment with UQ's Institute for Molecular Bioscience, whose research interests in new methods of protein expression and the isolation and handling of large protein complexes overlap with programs in AIBN.

This report is also the forum in which to officially acknowledge the contributions of AIBN's Group Leaders, research and support staff, and research higher degree students, more than 340 of whom now work in the AIBN building. These people are collectively responsible for the Institute's successes over the 12 months.

In particular, I thank members of the AIBN Executive Committee, Professors Julie Campbell, Max Lu, Anton Middelberg, Lars Nielsen and Matt Trau and Associate Professor Michael Monteiro, for their leadership and assistance. I also acknowledge the contributions of AIBN's Deputy Director Ms Donna Hannan, who is responsible for implementing the Institute's new operational initiatives and ensuring the smooth running of AIBN's operational support.

The contributions by members of AIBN's Scientific and Commercialisation Committee are also acknowledged. Professors Chunli Bai, Barry Buckland, Craig Hawker, Chris Lowe and Mihail Rocco and Doctors Peter Farrell AM, Susan Pond AM and Dan Syrdal all give freely and generously of their time so the Institute can hone and refine its scientific direction and make the most of potential commercial opportunities.

The University of Queensland provides a supportive and fertile environment in which AIBN can flourish and I thank the University's Senior Executives for their support. In particular, I welcome the ongoing cooperation of UQ's Vice Chancellor, Professor Paul Greenfield, and acknowledge the significant contributions of Deputy Vice Chancellor (Research) Professor David Siddle to the Institute's success.

**Professor Peter Gray**
AIBN DIRECTOR

AIBN SCIENTIFIC AND COMMERCIALISATION

# COMMITTEE

The AIBN Scientific and Commercialisation Committee (SACC) provides advice to the Institute Director on the strategic direction of research and commercialisation activities.

The SACC comprises the AIBN Director (Chair), four scientific experts in the fields of bioengineering and nanotechnology, and four business or industry experts from the nanotechnology, bioengineering or biotechnology disciplines.

The SACC's responsibilities include:

- providing advice on research direction, including current research program recommendations;
- identifying future strategic opportunities for fields of research, collaboration and cross-disciplinary foci of the Institute;
- identifying unique funding opportunities for the Institute's activities;
- assisting in providing global visibility for the Institute's activities;
- providing advice on matters such as raising the Institute's international profile to maximise benefits for Queensland and Australia;
- providing advice on commercialisation paths, activities and strategies for the Institute on a strategic and operational basis; and
- developing strategies for training and developing researchers and research students to build business acumen and a culture of entrepreneurship among members of the Institute.

Current SACC members are:

- Professor Chunli Bai, Senior Vice President, the Chinese Academy of Science, China;
- Professor Barry Buckland, Vice-President, Bioprocess R&D, Merck and Co, USA;
- Professor Craig Hawker, Director, Materials Research, University of California, Santa Barbara, USA;
- Professor Chris Lowe, Director, Institute of Biotechnology, University of Cambridge, UK;
- Professor Mihail Rocco, Chair, National Nanotechnology Initiative, National Science Foundation, USA;
- Dr Daniel Syrdal, previously with Heller Ehrmann Attorneys, Seattle, USA;
- Dr Susan Pond AM, former Managing Director, Johnson & Johnson Research Australia; and
- Dr Peter Farrell AM, Executive Chairman, ResMed.



INDUSTRY

# FOCUS

The key point of difference from most other research institutes, nationally and internationally, is the strong industry focus at the centre of AIBN's research. It is the Institute's engagement with external groups and the ability and willingness to undertake contract research for, and in partnership with, industry that enriches many of AIBN's research projects.

The industry focus is illustrated by the success of AIBN researchers in the Australian Research Council's Linkage Project grants scheme, which requires a substantial commitment from industry partners. In addition to these successful grants, the Institute has agreements with many organisations, including Intel and The Dow Chemical Company.

Not only does AIBN use existing funding schemes to build collaborations and links, the nature of its research programs makes it relevant to industry needs and AIBN researchers regularly undertake research contracts for companies.

The Institute is home to an unparalleled suite of infrastructure specialist capabilities, through the National Collaborative Research Infrastructure Strategy and the Queensland Government Building Innovation Fund. This infrastructure and expertise facilitates AIBN research and is available to the industrial research community. That availability facilitates linkages with industry that benefit the Queensland and Australian economies.

# AIBN
## WORKING WITH THE GLOBAL COMPUTING INDUSTRY

Polymer research by AIBN's Professor Andrew Whittaker is being applied by the global computing industry to increase the number of features printed on semi-conductors. That will improve processor speed and affect the price and performance of computing devices.

The basis of the global semi-conductor industry is Moore's Law, which, when initially proposed in 1965, held that the number of transistors incorporated on a chip would double every 18 months to two years. For the last 40 years, the industry has met that expectation, and Moore's Law is now widely acknowledged as a key driver of technological advances in the late 20th and early 21st centuries.

In this dynamic and intensely competitive area of development, size matters. Shrinking the size of semi-conductor features enables more features to be printed on a chip, which translates to improved processor performance and cheaper computers for consumers.

Professor Whittaker has collaboratively pursued this goal in four research projects spanning five years, with industry partner Sematech — the global semiconductor research and development consortium comprising companies such as Hewlett Packard, Panasonic and IBM — and the world's largest semiconductor producer, Intel.

According to Professor Whittaker, one solution to patterning smaller features onto a chip is the wavelength of the laser. The smaller the wavelength, the finer the beam, meaning more features can be printed in the same area.

In 30 years, decreases in laser wavelength, coupled with improved optics, have shrunk the size of features printed on silicon wafers about 100 times.

In 2004, Professor Whittaker and his team began a collaborative agreement with Sematech to investigate the possibility of using a 157 nm wavelength laser for printing features on computer chips. Based on results obtained from the Whittaker Group and other members of the collaborative partnership, it was determined by Sematech that 157 nm lithography was not an economically viable option for the computer industry.

"This research project capitalised on our recognised expertise in polymer degradation and, as a result, Sematech had no hesitation in signing up for another two-year grant to study the potential of immersion lithography as a way to cram more features onto a computer chip," Professor Whittaker said.

"Immersion lithography represented a potential alternative to 157 nm lithography because it used a 193 nm laser, coupled with optical tricks to create the smaller features not available at 157 nm.

"Our work contributed to redefining boundaries associated with immersion lithography as a viable tool for the fine lithography required by the computing industry.

"Collectively, we found immersion lithography is capable of printing 32 nm features onto computer chips. However progress beyond this point, to even smaller features, appears to be increasingly difficult, due to technical limitations and commercial considerations," he said.

Meanwhile, Intel had become interested in extreme ultraviolet lithography which uses 13.4 nm wavelength of radiation. That was a dramatic divergence from previous approaches and involved a completely new technology. Consequently, Intel directly funded a two-year research project to develop novel polymeric materials suitable for use with the new wavelength of radiation.

Materials developed by the Whittaker Group during the project have been sent to various laboratories around the world to test their ability to print at 32 nm and below.

Additionally, the team began looking to improve chip performance in other ways and, in 2008, successfully applied for an ARC Linkage Project grant with Sematech to explore non-chemically amplified resists.

That involves using laser light to directly change the structure of a photo-sensitive polymer, which can then be "developed", or washed away, to leave bare silicon onto which a metal circuit can be deposited.

The pattern created in the polymer by the laser is typically rougher than intended by design engineers, which has a deleterious effect on chip performance. The relative size of that effect is magnified when using low wavelength lasers to make smaller features.

"In response, the team successfully applied for a 2009 ARC Linkage Project grant, this time with Intel as the commercial partner, to develop a post-processing polymer treatment to smooth the sides of the features," Professor Whittaker said.

Professor Whittaker squarely attributed the success of the long-term association with Sematech and Intel to the expertise of his team, in particular Dr Idriss Blakey, and their ability to adapt to the different expectations and research demands of the global computing industry.

The enduring industry relationship is a fine example of AIBN's research focus and the proximity and applicability of the Institute's research to commercial outcomes.

# FOOD AND EATING

## FOR AN AGEING POPULATION

Australia's ageing population will benefit from two AIBN research projects aiming to improve texture-modified foods and better understand how we physically consume food.

Involving collaborations with Unilever, RSL Care and Two Small Giraffes, the projects are particularly important for Australia's aging population. The number of Australians aged between 65 and 84 is expected to almost double in the next 15 years, from 2.4 million in 2007 to four million in 2022.

The first project involves understanding the role of saliva in how food feels in a person's mouth, or the 'mouthfeel'. If people do not like the mouthfeel of a certain food, they are unlikely to buy it, making mouthfeel one of the most important properties driving consumer choice but also one of the least understood.

To remedy the knowledge gap, Professor Justin Cooper-White teamed with global nutrition, hygiene and personal care product company Unilever to design and develop a microfluidic device to characterise the properties of human saliva.

"Saliva plays a vital role in chewing and swallowing food, yet little is known about how saliva affects the taste and texture of what we eat," he said.

"We know subtle changes in a product's formulation can result in significant changes in taste and enjoyment, even when the measurable attributes of the product are the same.

"Therefore, if we understand how saliva interacts with food and the inside of our mouth, we will be in a better position to design foods with improved health features.

"This means we will be able to improve the taste of artificial sweeteners and fat replacements without compromising enjoyment," Professor Cooper-White said.

"Consequently, it is critical we study the relevant physical properties of saliva, such as viscosity, its composition and microstructure, and how it interacts with other biomolecules and surfaces.

"One current obstacle to this research is that each individual produces their own very specific saliva and accurately testing it is a difficult process."

Professor Cooper-White said the composition and physical properties of saliva altered dramatically, depending on the method of stimulation, time of day, medication and various other factors.

"Saliva also degrades rapidly, which means it cannot be stored without losing its physical characteristics.

"Our microdevice should overcome many of the problems associated with current testing procedures by enabling food manufacturers, such as our industry partner Unilever, to gather reliable data more quickly," he said.

Improved foods for elderly patients with swallowing difficulties are a potential outcome of an AIBN-led ARC Linkage Project grant with RSL Care, a leading not-for-profit provider of home and residential care, and Two Small Giraffes, Australia's first specialty practice offering services related to feeding and swallowing disorders.

Led by Professor Peter Halley, the multidisciplinary team brings a more scientific process to the design of texture-modified foods.

"For a variety of reasons, about 40 percent of elderly people have difficulty chewing and swallowing food and this has an obvious flow-on effect for their health in terms of nutrition, well being and general quality of life," he said.

"Current texture-modified foods have used trial and error to generate desired levels of texture, however most texture-modification processes generally make foods considerably less appealing, in terms of appearance, flavour and aroma.

"The food does not look, taste and smell as good as normal food," Professor Halley said.

"By applying rheology, which is the study of the flow of fluids, developing new texture models, looking at the nutrition of the foods and the swallowing behaviour of patients, this project aims to bring a more scientific approach to the formulation and design of novel texture-modified food.

"The outcome will hopefully be more appealing, safe-to-swallow foods that will improve the general well being of our elderly," he said.

# LIGHTANATE

## LEADING THE WAY

Low-cost solar cells and water treatment equipment are the potential outcomes of three new technologies emerging from Professor Max Lu's laboratory at AIBN.

The technologies highlight the industrial applications of AIBN research and offer step-change solutions to the linked challenges of energy production and the environment, through improved energy efficiency and decreased reliance on hazardous chemicals.

Professor Lu identified the technologies by their commercial names, Modified Titanate, Single Crystal and Microbelt, and said they incorporated different characteristics of titanium dioxide ($TiO_2$).

"Modified Titanate is a photocatalyst that is highly active in visible light. Single Crystal is a highly reactive $TiO_2$ for low-cost solar energy applications, while Microbelt is a fibrous form of $TiO_2$ for use in water treatment and air purification," he said.

"Modified Titanate involves delaminating $TiO_2$ into incredibly thin sheets that are particularly useful for self-cleaning, antibacterial coatings on glass, tiles and many other surfaces.

"Modified Titanate can be applied like paint and, due to its increased activity, uses considerably more of the energy available from natural light than currently available in other systems, thereby improving efficiency," Professor Lu said.

"In contrast, Single Crystal relies on our revolutionary discovery that increases the reactivity of $TiO_2$ crystals."

According to Professor Lu, the nano-crystals are promising materials for cost-effective solar cells, producing hydrogen from water and solar decontamination of pollutants.

"Typically, $TiO_2$ crystals prefer to grow in a highly stable but less reactive form. However, we discovered how to drastically increase the growth of crystals in the highly reactive form.

"This was previously thought to be impossible and opens exciting opportunities in the clean energy arena, due to increases in reactivity and efficiency," he said.

"The third technology, Microbelt, involves fibrous, cotton wool-like $TiO_2$, which it is hoped will be used like a purifying sieve in 'flow through' devices for water and air purification.

"Sunlight will activate the fibrous $TiO_2$, which then initiates a reaction that reduces pollutants to water and $CO_2$ gas," Professor Lu said.

Uniseed and Cleantech Ventures Pty Ltd recognised the commercial potential of the technologies when they provided substantial financial support to Lightanate, the start-up company formed to commercialise the technologies.

Professor Lu said the funds would be used to complete proof-of-concept studies and optimise the scalability.

"Dr Lianzhou Wang, who has been integral in Lightanate's research and technology development to date, is undertaking further tests to scale up production so manufacture is cheap, efficient and at the volume required for industrial applications," he said.

Professor Lu predicted it would take about five years for the water and air pollution applications to be commercially available, and five to 10 years for solar energy conversion using the crystals.

He said the breakthrough technology was a great example of the power of cross-disciplinary collaboration.

"AIBN's Professor Sean Smith's computational molecular science group was responsible for key computational studies that enabled experimental researchers to focus on specific surface modification elements to control $TiO_2$ crystal morphology."

Professor Lu said the work was also the result of a very fruitful and long-term international collaboration with Professor Huiming Cheng's group from the Chinese Academy of Sciences.

# DENDRIMED:

## A NEW DRUG DELIVERY TECHNOLOGY

DendriMed Pty Ltd, a recently formed start-up company based on the research of AIBN's Associate Professor Michael Monteiro, has at its disposal a novel platform technology with the potential ability to deliver drug payloads to precise sites in the body extremely effectively.

Rather than "carpet-bombing" every cell in the body to get a result like chemotherapy, the technology provides "surgical strike" capabilities to hit tissue-specific locations. The technology is highly adaptable, meaning it can be tailor made to solve a wide variety of drug delivery problems.

"We have combined polymer and dendrimer technologies to develop a macromolecule in which the drug or active component is encapsulated for delivery in the body. The features of the macromolecule can be tailored to suit the physiological characteristics at the site of action," Associate Professor Monteiro said.

Extra complexity can be built into the delivery devices using various techniques.

"This complexity extends to attaching antibodies to the surface of the macromolecule that are specific to proteins uniquely associated with a particular disease, ensuring the drug payload will be delivered to the exact site.

"Similarly, we can imbue the molecule with controlled release characteristics, so the drug payload is only released in very particular physiological conditions. Certain proteases, or protein-digesting enzymes, are specifically associated with certain disease states and these might be used to degrade the outer coating of the macromolecule and release the drug," Associate Professor Monteiro said.

"These examples demonstrate the flexibility of DendriMed's precise delivery capabilities and enable drug companies to concentrate their efforts on developing the active ingredient rather than having to focus on drug delivery.

"It has the potential to meet a company's needs faster and with greater certainty than delivery methods currently available," he said.

DendriMed is perfectly positioned to capitalise on the emergence of interference ribosomal nucleic acid (RNAi) as a new class of drugs, due to the bespoke capabilities of the DendriMed technology.

The drugs block cells from manufacturing disease-specific proteins, therefore preventing disease progression. Developing the relevant RNAi merely requires identifying the exact genetic sequence on which scientists can base the RNAi. Once that has been established, the RNAi can be made in just days.

However, delivery of the drugs to precise locations has been identified as a key problem with the technology. DendriMed has therefore enlisted the expertise of Associate Professor Nigel McMillan, from UQ's Diamantina Institute for Cancer, Immunology and Metabolic Medicine, to assess the potential of RNAi drugs.

The potential of DendriMed's technology was recognised when it attracted \$A630,000 of pre-seed venture capital investment to fund proof-of-concept studies to demonstrate the technology's effectiveness in delivering RNAi cancer therapies.

Associate Professor Monteiro says DendriMed technology is extremely attractive to pharmaceutical companies because it can potentially deliver a wider range of drugs more efficiently and to desired tissue areas.

AIBN INFRASTRUCTURE:

# BUILDING CAPABILITIES

Befitting the Institute's status as one of the leading research institutes working at the interface of bio and nanotechnologies, AIBN is the headquarters for a unique and comprehensive suite of facilities that dovetails with the Institute's research interests while contributing significantly to the Institute's industry focus.

The newest facilities are part of the National Collaborative Research Infrastructure Strategy (NCRIS) and service the Australian research community, including industry, by providing accessible infrastructure that meets long-term needs, enables the growth of transnational collaborative research projects and builds relationships with small-to-medium enterprises.

Courtesy of contributions from the Queensland and Australian governments and valued at more than $30 million, the NCRIS facilities at AIBN include the Biologics Facility, the Metabolomics Facility and, in conjunction with UQ's Centre for Organic Photonics and Electronics, the Queensland Node of the Australian National Nanofabrication Facility (ANFF-Q).

## THE NCRIS BIOLOGICS FACILITY

Established to enhance Australia's capacity to produce recombinant proteins in pre-clinical and clinical quantities, the NCRIS Biologics Facility specialises in mammalian cell expression technology for developing recombinant proteins with potential therapeutic and commercial uses.

The facility is already providing recombinant protein manufacturing capabilities to many Australian biotechnology companies, and working with several Australian academic institutes to develop potential therapeutics for various disease targets.

The Biologics Facility now employs 11 scientists and bioprocess engineers and has world-class expertise in molecular biology, antibody engineering, mammalian cell culture and protein chemistry. The facility commissioned the latest high throughput equipment, including Fluorescence Activated Cell Sorter and robotic high-expressing clonal selector (ClonePix). That infrastructure further strengthens the facility's capabilities in mammalian cell technology.

In 2008, the facility acquired the latest calorimetric and spectrometric instruments enabling the study of protein structure in liquid and solid formulations. This vital information is the key to understanding protein stability during storage, transport and use as therapeutic drugs.

## THE NCRIS METABOLOMICS FACILITY

Metabolomics is the detection and quantification of small molecules in biological samples and provides useful information about disease biomarkers, responses to genetic engineering and environmental factors.

The AIBN NCRIS Metabolomics Facility provides services and expertise in quantitative metabolomics and fluxomics as integral parts of systems biology. The facility's 13C fluxomics capabilities, which enable analysis of the dynamic changes of molecules in a system over time, is the most powerful fluxomics tool available and can be accessed on a collaborative basis.
The facility offers quantitative analytical services using sophisticated, high-performance liquid chromatography systems, gas chromatographs coupled with mass spectrometry and capillary electrophoresis coupled with tandem mass spectrometry.

In 2008, the facility commissioned new equipment, undertook method development and appointed highly qualified research staff. The first samples were analysed for external customers, including CSIRO and BSES Ltd.

## ANFF-Q

The ANFF-Q provides a dedicated facility for the synthesis, processing, characterisation and fabrication of new generation polymers, nanoparticles and nanomaterials, smart surfaces and microdevices.

The node's activities in 2008 included installing important items of instrumentation, appointing key research staff for polymer testing and characterisation, atomic force microscopy and microfluidic device development.

Researchers from academia or industry can now work in ANFF-Q's laboratories alongside the facility's nanofabrication and characterisation experts or can have their devices fabricated to specification.

# RESEARCH PROJECTS

AIBN has moved beyond traditional boundaries to focus its research in areas that will alleviate current problems in human health, manufacturing, information technology and the environment.

AIBN's unique capabilities come from merging the skills of engineers, chemists, biologists and computational scientists to conduct world-class research programs. The multidisciplinary teams work at the interface of the biological, chemical and physical sciences with research programs focusing on:

- delivering therapeutic agents using polymer chemistry, virus-like particles and needle-free transdermal technologies;
- using metabolic engineering to produce new bioproducts from cells;
- combining stem cell biology with novel scaffolds for regenerative medicine;
- developing nanomaterials for orthopaedic applications, enzyme encapsulation and biosensors; and
- developing high-performance hydrogen storage materials, photocatalysts for environmental remediation and novel membranes for water desalination and recycling.

The Institute's 17 Group Leaders are internationally acknowledged for their research excellence and have proven track records in attracting competitive grant funding and fellowships.

The following pages outline the research interests of AIBN's Group Leaders.

# Rapid selection of cells producing novel biopharmaceuticals

**GROUP LEADER:**
**Professor Peter Gray**

Biotechnology has led to the development of a new class of human therapeutic called biopharmaceuticals, which is the most rapidly growing class of therapeutic responsible for annual global sales of more than $US70 billion.

The most successful of these biopharmaceuticals are monoclonal antibodies, products based on the body's own proteins, which are finding increasing application as anti-cancer therapeutics.

Research by the Gray Group speeds the development of new monoclonal antibodies, enabling their clinical potential to be assessed sooner.

Monoclonal antibodies are large complex proteins, comprising two chains with a molecular weight of 150,000 Daltons. Combining genetic engineering with antibody sensitivity, it is now possible to target an almost infinite range of 'foreign' molecules (antigens). It is also possible to produce antibodies outside the body by using recombinant DNA techniques and inserting, or cloning, the gene coding for the antibody into a 'host' cell.

Because of the complex two-chain structure of antibodies, the production 'host' has to be a mammalian cell developed to grow in bioreactors. Normally, cloning the antibody genes and subsequent isolation of a cell producing sufficient amounts of the desired antibody is a long, drawn-out process that can take six to nine months.

Researchers from the Gray Group have linked two different fluorescent markers to the gene coding for the two chains making up the antibody. That enables the mixtures of cells obtained in the first stage of the production process to be sorted through a high-speed Fluorescence Activated Cell Sorter at speeds of up to 70,000 cells a second, and the few cells producing larger amounts of the antibody easily sorted away from the larger pool of cells.

The speed of the sorting process significantly reduces the time it takes to identify and develop an antibody producing cell line.

The research was presented at the key international conference on antibody production, the US Cell Culture Engineering Conference, and aroused considerable interest from delegates.

# Metabolic engineering of high molecular weight hyaluronic acid

**GROUP LEADER:**
**Professor Lars Nielsen**

Hyaluronic acid (HA) is a ubiquitous polysaccharide in vertebrates and the basis of a pharmaceutical and cosmetic market worth more than US$2 billion. It is used to lubricate arthritic joints, as a space filler during eye surgery, and in cosmetic procedures to remove wrinkles.

The market for HA obtained from bacteria has been revitalised in recent years due to a reluctance to use animal sources. However, the size or molecular weight of HA produced by microbes is currently inferior to that extracted from typical animal sources and therefore not as commercially attractive.

The molecular weight of the product realised in microbial fermentation is greatly affected by culture parameters, such as sugar source and oxygen availability, indicating that energy and carbon availability are major factors.

Over the past decade, the Nielsen Group has explored various process and strain engineering strategies to release more resources for HA production. Through systematic over expression of each gene in the HA pathway, combined with a comprehensive 'omics' analysis of the resultant strains, the team has increased the molecular weight of HA produced by bacteria from between one and two mega Daltons (MDa) up to more than five MDa.

The study highlights the power of systems biotechnology to tackle quality traits, such as molecular weight. Through the understanding gained via the systems approach, it was possible to identify strain and bioprocess engineering strategies that led to high molecular weight. As a result of this work, a patent application for the developed approach has been filed.





# Biologics

**Associate Professor**
**Steve Mahler**

The research activities of the Mahler team focus on the discovery and development of recombinant proteins as drugs, also called biologics or biopharmaceuticals. Many natural growth factors and hormones, for example, are able to treat diseases like cancer and heart disease and inflammatory diseases, such as rheumatoid arthritis.

With collaborators, the team has produced therapeutic grade recombinant proteins that have progressed through phase I and II clinical trials. Of particular interest are monoclonal antibodies, which are a major class of biopharmaceuticals, accounting for 30 percent of all new biologics in clinical development.

The research focuses on the isolation of monoclonal antibodies from large, immunoglobulin gene libraries against selected disease targets, using phage display technology. The antibodies are subsequently produced in mammalian cells on large scale for further testing and ultimately for human clinical trials.

The team has isolated antibodies against a dendritic cell antigen, and the antibodies are now undergoing further testing for their therapeutic potential.

Another approach to isolating new molecular entities (NME) involves looking beyond antibodies to new molecular scaffolds that can display multiple peptide loops. The molecular scaffolds present a new platform for developing new biologics and diagnostics.

One NME created by the researchers is a novel anticoagulant that binds with high affinity to Factor VIIa, the key clotting agent in blood. One potential application is as a substitute for warfarin, which is used after surgery to repair blood vessels and has applications for use post angioplasty. This 'beyond antibody' approach to creating a neutralising NME is one example of where molecular scaffolds could compete with monoclonal antibodies as neutralising entities.

# Production of baculovirus biopesticides – a systems biology approach

**GROUP LEADER:**
**Dr Steven Reid**

Increased resistance to chemical pesticides and concern over their use has renewed interest in the application of biological means to control pests affecting commercially important crops. Many wild type baculoviruses can specifically infect and kill key agricultural caterpillar pests and some virus strains can target mosquitoes.

The Reid laboratory has a process patent on a procedure for producing baculoviruses via fermentation. The lead product is a baculovirus targeting the *Helicoverpa* pest species, which is responsible for a US$3.2 billion annual market in traditional chemicals.

In 2008, a baculovirus product manufactured by the Reid Group and formulated by Agrichem was registered for use on Australian crops to combat heliothis caterpillars (more widely known as the cotton bollworm), under the trade name Heliocide.

The group is undertaking further research to increase current yields to enable manufacture and evaluation in the niche Australian market.

The research and collaboration with Agrichem has developed further with a project supported by an ARC Linkage Project grant to investigate and improve yields of the desired virus product. Researchers anticipate doubling the yield in the next 18 months.

The Reid Group is also collaborating with Professor Lars Nielsen to use transcriptomic and metabolomic techniques in an effort to understand how the virus interacts with host cells in culture. The extension of this research, through the collaboration with Agrichem and the expertise of the Nielsen Group, is targeted at increasing the yield to make it cost effective in broader markets, nationally and internationally.

Due to the agricultural benefits of the project, particularly in the developing world, the Reid Group has attracted substantial attention from potential collaborators in Vietnam. That has resulted in two Vietnamese students, both from agricultural institutes in Vietnam, working on the project.

# Magnetophoresis of flexible dumb-bell structures

**GROUP LEADER:**
**Dr Krassen Dimitrov**

Researchers in the Dimitrov laboratory are inventing new diagnostic technologies using single-molecule nanolabels that can be used for accurate and sensitive detection of any specific marker molecules associated with a disease, present in biological samples.

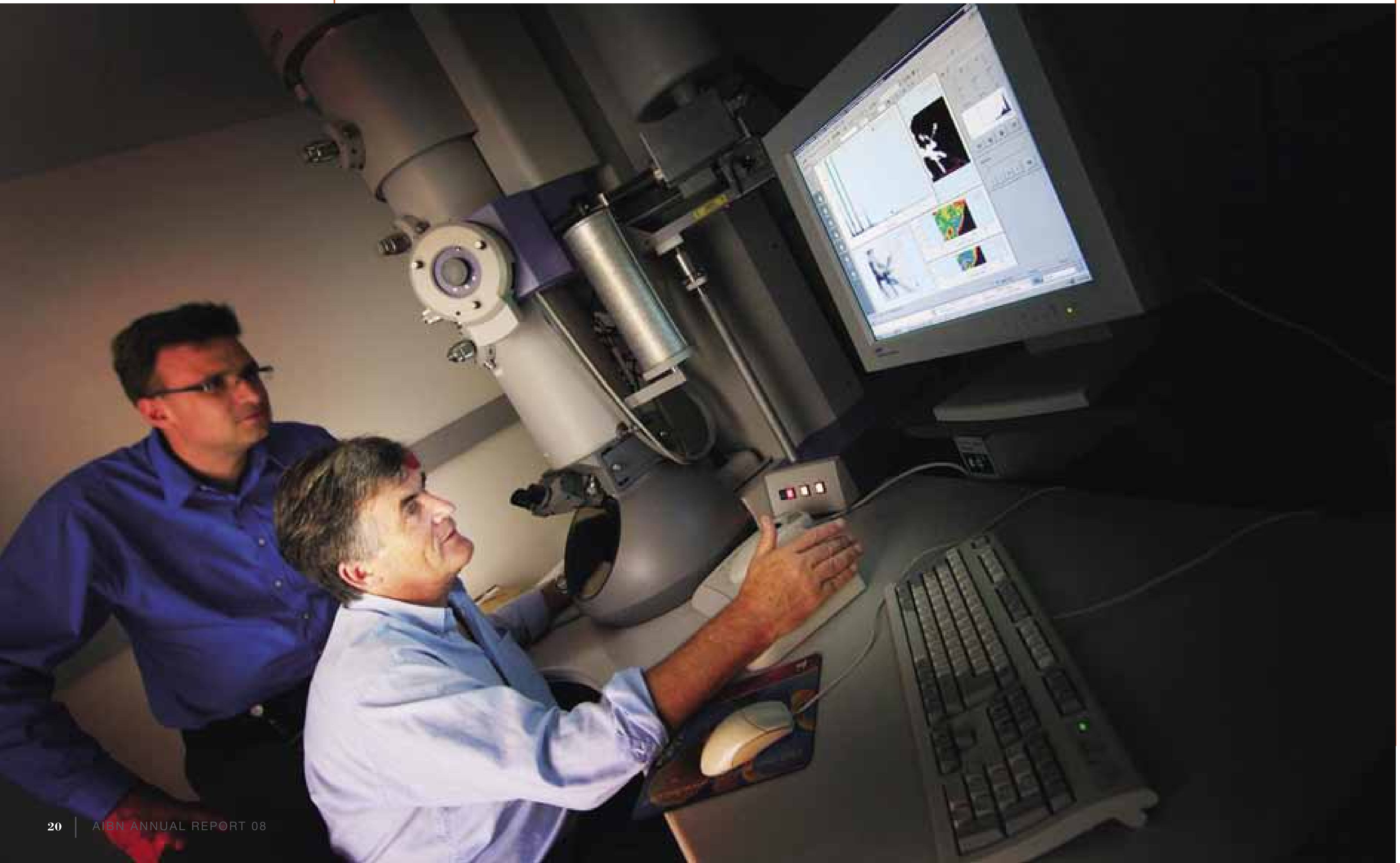
In 2008, the Dimitrov Group discovered and synthesised dumb-bell structures, consisting of a single magnetic and a single non-magnetic nanoparticle, connected via a flexible DNA linker.

The dumb-bells can be used as templates for labelling individual molecules.

The team also developed a technology for controlled translocation of the dumb-bells, using magnetic forces. The translocation technique, called magnetophoresis, enables researchers to precisely move and position the nanolabels near a nanometer-sized sensor or nanoelectrode for electronic detection.

The work will conceivably impact on early detection of human diseases, which has the potential to greatly improve treatment outcomes for patients.

More specifically, the research into dumb-bell structures will be used for the hypersensitive and specific detection of malaria and dengue fever. Malaria is the most widespread infectious disease in the world, while dengue fever is endemic in Queensland. By specifically labelling pathogen-related proteins with the nanobarcodes, the new technology will allow more sensitive and efficient diagnosis, early detection and disease management.







# Single molecule readouts using an elastic nanopore

**GROUP LEADER:**
**Professor Matt Trau**

An Australian and New Zealand partnership is developing a new molecular readout with potential diagnostic applications, which interrogates individual molecules as they pass through an adjustable molecular gate.

The project has been jointly funded to the tune of $500,000 by Izon Science Ltd and the Australia New Zealand Biotechnology Partnership Fund (ANZBPF), a groundbreaking fund specifically designed to foster trans-Tasman collaboration.

The Trau Group is applying its expertise in the colloid and diagnostic fields to exploit a unique elastic nanopore technology developed by Izon, with a view to creating the powerful diagnostic device.

Izon Science is a New Zealand-based nanotechnology company that has developed a method to muster and measure the properties of individual biological molecules and particles in solution.

The particles are pulled through a small adjustable hole, or nanopore, which is just a few millionths of a millimetre wide. As each particle passes through, it temporarily blocks the hole, causing a corresponding drop in the electrical current measured across the pore. By analysing the 'blockades', it is possible to profile each particle or molecule as it passes through the pore.

The adjustability of the pore makes the technology unique, and the researchers are exploiting that novel capability to make a system with potentially exciting new diagnostic applications.

# Origin of myofibroblasts in peritoneal tissue capsules

**GROUP LEADER:**
**Professor Julie Campbell**

Professor Campbell's research team uses the abdominal cavity as a 'bioreactor' to grow 'artificial' organs, such as blood vessels, bladders and vas deferens, by harnessing the body's normal inflammatory response to foreign material.

To improve the tissue production, the team is investigating the mechanisms that regulate the process of cell differentiation and tissue formation.

The researchers have demonstrated that macrophages are the cell type primarily responsible for producing the tissue best suited for replacing or repairing blood vessels and other smooth muscle organs, such as the bladder and vas deferens.

The group has shown that these cells are capable of trans-differentiating into cells called myofibroblasts, which are found in fibrotic or scar tissue. The research also suggests that, given appropriate conditions, the cells may be induced to differentiate further to smooth muscle cells.

Recent gene array studies reveal that, as the tissue develops, the constituent macrophages are 're-programmed' and there is a massive change in their gene expression profile from that of a macrophage to a mesenchymal cell.

Collectively, the results demonstrate that macrophages can differentiate to other cell types. They also indicate the process's potential for engineering new tissue for medical applications.

# Patient-specific stem cells for regenerative medicine

**GROUP LEADER:**
**Associate Professor Ernst Wolvetang**

Patient-specific stem cells hold great promise for treating a range of degenerative diseases. To deliver on their promise, pluripotent stem cells, the stem cells that can become any cell type of the body, must be generated in a safe, cost-effective manner, then efficiently turned into the desired cell type.

By using cutting-edge, inter-disciplinary approaches, researchers in the Wolvetang laboratory strive to understand and direct the complex molecular mechanisms governing the generation and differentiation of these patient-specific, pluripotent stem cells.

In 2008, the group discovered that one component of the culture medium used to grow pluripotent stem cells altered stem cell behaviour and was linked to the cells' genetic stability. They subsequently developed a culture medium that prevented those changes. That medium has been combined with newly identified factors that maintain human pluripotent stem cells, to develop a safer pluripotent stem cell culture method.

The group also started producing pluripotent stem cells from skin and other cell types, enabling the generation of patient-specific stem cells that can be transplanted without risk of rejection.

The next step involves developing stem cell reporter lines using lentiviral delivery technology, with the ability to indicate in real time whether stem cells develop into a desired cell type. The lines are being used to screen the 'smart' surfaces being developed in collaboration with researchers from Professor Justin Cooper-White's laboratory.

The group anticipates that the combination of those technologies will lead to the development of bioreactors enabling the controlled expansion and differentiation of patient-specific stem cells for use in regenerative medicine approaches.



# Tissue engineering the meniscus

**GROUP LEADER:**
**Professor Justin Cooper-White**

Tissue engineering is a rapidly developing, multidisciplinary research field in which the engineering and biological sciences interface to develop novel concepts and materials for tissue repair, regeneration and, ultimately, replacement.

The menisci, located in the knee joint between the femur and tibia bones, are the body's 'shock absorbers', taking on the majority of the load associated with normal physical activity, such as walking, running and jumping.

Unfortunately, meniscal tissue has poor inherent regenerative capacity, due to a lack of resident stem cells and low blood supply. The Cooper-White Group, in collaboration with Professor Julie Campbell, has in recent years worked to develop a stem-cell-based, tissue-engineered meniscus.

In 2008, the team developed a novel biomaterial that, when coupled with a new surface engineering strategy, allowed researchers to replicate the biochemical and biomechanical cues 'seen' and 'felt' by cells within meniscus tissue.

In a major advance, the team demonstrated that this strategy promoted the growth of fibrocartilage from human bone marrow derived mesenchymal stem cells, without relying on external growth factors or chemical inducements. Large animal trials of these novel cell-material constructs will start in 2009.

# Anatase $TiO_2$ single crystals with a large percentage of reactive facets

**Dr Shizhang Qiao**

The research of Dr Qiao and his colleagues aims to synthesise anatase titanium dioxide ($TiO_2$) single crystals with a large percentage of reactive surfaces. The highly active surfaces in the crystals will potentially improve the reactivity and efficiency of devices used for solar energy conversion, photocatalysis and hydrogen production.

Due to their scientific and technological importance, inorganic single crystals with highly reactive surfaces have long been studied and it is generally accepted that the minimisation of surface energy during crystal growth restricts the development of highly reactive surfaces.

In 2008, they published an article in the prestigious journal *Nature*, describing for the first time, synthesis of high-quality anatase $TiO_2$ single crystals with a large percentage of reactive surfaces.

Previously thought to be almost impossible, the work is an important step toward cost-effective solar energy cells.

It also has many applications in water and air purification, photonic crystals, smart surface coatings and sensors.

Theoretical studies indicate that the (001) surface of anatase $TiO_2$ is much more reactive than the thermodynamically more stable (101) surface and that the (001) surfaces may be the dominant source of active sites for various applications.

Unfortunately, most natural and synthetic anatase crystals are dominated by the less-reactive (101) surface. It also appears there has been no direct experimental evidence showing the reactivity of (001) surfaces, largely due to the difficulty of growing well-defined anatase single crystals rich in (001) facets.

The result provides a practical product to confirm the reactivity of (001) facets experimentally and test the various applications of this important semiconductor material.

## Nano-ionics

**GROUP LEADER:**
**Professor John Drennan**

By gaining an understanding of the microscopic structure of materials that conduct ions, Professor Drennan's team can design, using modern chemical techniques, materials optimised for ionic conduction. That will lead to more efficient fuel cell devices operating at lower temperatures.

Fuel cells are an extremely efficient means of converting natural gas directly into electricity and are finding increasing application in domestic heating and power generation systems.

Microstructural investigations, conducted by researchers from the Drennan laboratory, combined with careful conductivity measurements, have shown that it is critical to have homogeneous structures down to the atomic level. Any deviation from that leads to a reduction in the sought-after properties and a decrease in efficiency.

The team demonstrated that, by controlling the microstructure to minimise the formation of domains, it is possible to improve ionic motion in highly conducting systems. Analysis of those effects is difficult because the domains are coherent with the parent structure and extremely difficult to observe and characterise directly.

Recently published work in *Acta Materialia* described the team's combined electron-microscopy and high resolution X-ray photon spectroscopy studies showing that the dopant cations, which are the source of the pathway that increases conductivity, accumulate in domains of 20-30 nanometres in size.

It was the first time that phenomenon had been categorically identified and was the first quantitative evidence of the structure and composition of the domains. Professor Drennan and his colleagues also demonstrated that the domains can be controlled by suitable processing and are designing microstructures at the atomic level that influence the physical properties of the material.

# Simulation and visualisation of molecular systems

**GROUP LEADER:**
**Professor Sean Smith**

The Smith Group focuses on computational molecular modelling and applies it to health and environmental problems.

In particular, his team is interested in the rational design of materials for hydrogen storage, perfecting the process of liberating hydrogen from water using sunlight (photocatalysis) and understanding red and green fluorescent proteins, which are critically important as biological imaging agents.

In 2008, the group members collaborated with researchers from Professor Max Lu's laboratory to increase the reactive surfaces of titanium dioxide crystals; work which has the potential to revolutionise clean energy generation. It was published in the prestigious international journal *Nature*.

The group also made significant inroads in the qualitative understanding of green fluorescence protein (GFP). A key experimental strategy involves measuring the change in rates of proton transfer as deuterium is swapped for hydrogen in the protein. The effect, known as the kinetic isotope effect (KIE), was measured for GFP several years ago, although subsequent attempts to model the KIE for GFP were unsuccessful.

However, by employing various simulation techniques, the Smith Group was the first to successfully model KIE effects in the GFP.

They also investigated why some fluorescent proteins are bright at high pH. The team's modelling of that phenomenon provides a strategy by which to tune the fluorescence properties of proteins and has significant applications for molecular imaging in biological systems, the cornerstone of modern biological research.

## Functional nanomaterials research

**GROUP LEADER:**
**Professor Max Lu**

Photocatalysis is an important chemical process underpinning the development of renewable energy technologies critical to alleviating current environmental problems and improving industrial processes. Photocatalytic technologies include water and air purification, production of hydrogen from water, self-cleaning coatings and highly efficient solar cells.

Professor Lu and his team are questing after new photocatalysts with high light adsorption and activity. In 2008, they developed a novel technology that, when applied to the solar hydrogen production and air purification industries, will potentially deliver enormous economic and environmental benefits through lower costs, increased efficiency and reduced chemical usage.

The new technology involved developing novel modification techniques for titanium dioxide-based photocatalysts, understanding the nanostructure, charge generation and charge transfer mechanism, and understanding the fundamental relationships between synthesis and modification parameters, mesostructure and electronic structure, photoactivation process and photocatalytic activity.

Known as Lightanate, the new photocatalytic material can be manufactured in various forms. For example, granular particles can be dispersed in fluid or air, and it can be used as a thin layer over glass or ceramic. Perhaps more importantly, it is far more efficient at harvesting light and more effective as a photocatalyst than the current industrial benchmark.

The technology is the basis of a new start-up company, Lightanate Pty Ltd, which has secured investment to develop three titanium-based technologies with applications in solar energy.

The work sits well with the endeavours of Dr Shizhang Qiao, who focuses on the application of single crystals of titanium dioxide.

## Needle-free vaccine delivery

**GROUP LEADER:**
**Professor Mark Kendall**

Professor Kendall and his team conceived and are further developing the nanopatch, a revolutionary substitute for the traditional needle and syringe that delivers vaccines, genes and drugs more efficiently and cheaply.

In 2008, they demonstrated that when using the nanopatch in animal trials, a much smaller amount of a vaccine is required to produce the equivalent immune response generated by a traditional needle into the muscle.

Smaller doses mean many more people can potentially be vaccinated for the same cost. Additionally, the nanopatch is so easy to use that people may be able to administer the vaccine themselves.

The nanopatch delivers its vaccine payload to the outer layer of the skin, which is far more richly populated by immune cells than muscle tissue. Nanopatches remove the potential of contamination by needle-stick injury and are pain-free, because they contain thousands of tiny 'projections', or nanoneedles, dry-coated with the vaccine.

If the research is successful, it is easy to imagine a scenario where, in the case of pandemics such as bird flu, authorities might mail vaccinations for people to self-administer.

The potential of this technology attracted funding from the Bill and Melinda Gates Foundation which – in addition to Professor Kendall's new collaborative projects with the World Health Organisation, in Geneva, and the Program for Appropriate Technology in Health, in Seattle – enables the progression of nanopatches toward human clinical testing for vaccinations in the developing world.





## Engineering Gal2 as a potential treatment for immune-related diseases

**GROUP LEADER:**
**Professor Anton Middelberg**

Allergic reactions, graft-versus-host diseases and inflammatory diseases, such as ulcerative colitis, all involve the malfunction of an individual's immune system.

Human galectin-2 (Gal2) is a new therapeutic with potential to treat those conditions, due to its ability to regulate inflammatory and autoimmune responses.

However, the therapeutic potential of the native version of Gal2 is limited by its instability and its short use-by date in serum.

To overcome the limitations, Dr Lizhong He and other research team members have engineered an effective version of Gal2.

The potential therapeutic application of the engineered Gal2 includes treatment for immune-related diseases, such as rheumatoid arthritis and inflammatory bowel disease which is estimated to currently affect 61,000 Australians.

By engineering a single, specific, site-directed mutation, the team demonstrated that the adulterated Gal2 had reduced protein aggregation, an important result because protein aggregation in that context reduces efficacy.

The new version of Gal2 enables polymer modification of the protein at a selected site, which may significantly improve the pharmaceutical characteristics of proteins by increasing the length of time they remain circulating in the bloodstream.

The researchers demonstrated that neither mutation nor polymer modification altered the secondary structure of Gal2 and that the bioactivity of Gal2 was retained. That was augmented by producing the engineered Gal2 in a bacterial system, making it suitable for low-cost manufacture and therefore particularly attractive to commercial investors.

## Transformer nanostructures

**GROUP LEADER:**
**Associate Professor Michael Monteiro**

The Monteiro Group has discovered an innovative method of mimicking the human body's extracellular matrix using temperature-sensitive block copolymers.

Because the process is conducted in water and closely resembles conditions in the body, it has the potential to impact on a wide range of health and research issues, including tissue repair and engineering, and the multi-million dollar industry based on transport and long-term storage of highly unstable cell cultures.

Scientists have long attempted to assemble nanostructures with shape and functionality similar to that found naturally, to solve problems relating to drug delivery and tissue engineering.

Phase separation of amphiphilic block copolymers containing hydrophilic and hydrophobic segments are the best building blocks for creating the nanostructures because they can form a variety of assemblies in aqueous environments similar to that of biological systems.

The group has developed a paradigm-shifting method of initiating the metamorphosis of spherical nanostructures into loops, vesicles and rods, using a new mechanism of reassembly. The process can be conducted at polymer concentrations considerably higher than currently available.

The Monteiro Group is specifically interested in nanostructure reassembly into rod-like structures of nanoscale diameter. These long, flexible cylindrical micelles can potentially mimic naturally occurring rod-like fibrils, which form an integral part of the extra-cellular matrix.

In collaboration with other AIBN researchers, the team is investigating how the discovery might be applied as a scaffold upon which cells might grow and for treating burns and other wounds.

# Starch biopolymers

**GROUP LEADER:**
**Professor Peter Halley**

Professor Halley's research focuses on developing a starch-based biopolymer platform for industrial and biomedical applications, such as biodegradable agricultural films, biodegradable packaging, biopolymer drug delivery devices and biopolymer tissue scaffolds.

The technology enables the design of performance characteristics of starch polymers using novel formulation, processing and degradation knowledge. It will improve the control, performance and degradation properties of biopolymers in a range of environments, such as in agriculture, food packaging, general packaging and biomedical applications.

The team has a strong track record of commercial relevance, including involvement in two Cooperative Research Centres, various industrial grants with industry partners and spinning off a start up company, Plantic Technologies Ltd, in 2002. Plantic listed on the London Stock Exchange and generated more than £25 million when it floated in May 2007.

The team's links with Plantic Technologies remain strong and there are research collaborations investigating starch biopolymers while concurrently engaging with other companies interested in wider biopolymer platforms.

Future work is being planned to extend the biopolymer platform for biomedical applications and involves novel formulation development and processing technologies.

In 2008, the group made outstanding advances in the fundamentals of starch-based biopolymers, launched new commercial starch polymer products and opened the door to a wide range of biomedical applications for starch biopolymers.

Specifically, key research focused on understanding the fundamental structure-property-degradation relationships of starch biopolymers. The work resulted in the successful commercial launch of new injection-moulding resins for use by Queensland Health as mosquito traps for dengue fever control and weasand clips used in the meat processing industry. Because the mosquito traps are biodegradable they do not require collection and do not become dengue breeding containers after the insecticide is depleted.

Future work will focus on using starch biopolymer systems in drug delivery and biomedical devices, using novel biopolymer formulation work and green processing technologies.



# Fluorinated molecular imaging agents for disease detection

**GROUP LEADER:**
**Professor Andrew Whittaker**

The preliminary stages of Alzheimer's disease and the presence of tumour cells or other damaged tissues might be detected earlier because of new reporter molecules devised by the Whittaker Group.

Magnetic resonance imaging (MRI) is an important clinical tool for determining the location of abnormal tissue in the body and the new reporter molecules potentially promote the clinical power of MRI by offering greater sensitivity and accuracy with fewer side effects.

The research team has prepared partially fluorinated macromolecules which, when tested with nuclear magnetic resonance (NMR), provide a strong 19F signal. The testing is a good indicator of the macromolecules' potential when used in fluorine MRI and newly introduced clinical imaging techniques.

Consisting of flexible hydrophobic segments chemically attached to hydrophilic chains, the fluorinated segment is shielded from the body and provides a strong signal for detection when in the blood stream.

The macromolecules can be injected into the blood stream, where they circulate until directed by a targeting-moiety to diseased tissue or loaded into cells for immunotherapy.

Not only did developing these new, highly-sensitive structures significantly improved detection by NMR, it advanced researchers' understanding of how molecular characteristics influence imaging performance, which will improve the clinical application of MRI.



# Nanotoxicology, biomaterials and tissue engineering

**GROUP LEADER:**
**Associate Professor Darren Martin**

Associate Professor Martin's team is developing new polyurethane nanocomposite materials to be used in medical devices, such as cochlear implants, and in leisure and industrial applications, such as footwear, protective films and tough, flexible machinery components.

As part of the development of these new rubber-like materials, the team has begun exhaustive toxicology studies on the nanoparticles integral to the enhanced performance of the new nanocomposites.

The testing dovetails well with other interests of the Martin Group, which aims to understand the biological interactions and toxicology of a range of industrially important engineered nanomaterials…

…The work will ensure the materials' long-term biocompatibility and safety.

In 2008, the team successfully scaled up production of polyurethane nanocomposite materials with enhanced:

- tensile and tear strength;
- creep resistance, particularly at elevated service temperatures; and
- resistance to thermal degradation and yellowing.

The improvements, coupled with the ability to scale up the process, make the material more attractive for use in the mining, leisure and medical device industries. The ability to scale up the process is an important step in taking the material to market.

Start-up company TenasiTech, formed to commercialise the research, is working closely with several companies interested in the potential of the nanocomposites.

# INNOVATION
## AND COMMERCIAL DEVELOPMENT

AIBN is rich with ideas produced by its elite cadre of researchers, all of whom are focused on maximising the potential benefit of their intellectual pursuits. The Institute prides itself on its ability to solve industry problems crystalised by speculative inquiries.

Consequently, AIBN has an embedded team of innovation and commercialisation experts to ensure early identification and timely exploitation of commercial opportunities.

The Institute's Innovation and Commercial Development team is structured to be responsive to numerous industry needs and receptive to the many and varied opportunities generated by AIBN researchers. Collectively, the team has experience and expertise in intellectual property and the ability to foster and negotiate industry-led collaborations and contract research.

The benefit of AIBN's flexible approach to commercial opportunities is best demonstrated by two commercial agreements established in 2008. The first was a research contract with Brisbane company Bioproton Pty Ltd, which manufactures and supplies high-quality enzyme feed supplements for livestock to Australia, the Middle East, Asia and the United States. The second was an agreement with global computing giant Intel to develop smaller, faster, more energy-efficient microprocessors to satisfy global demand for cheaper, more reliable computing power.

Bioproton initially approached AIBN seeking assistance to develop a novel technology to fill a newly identified opportunity for a high-value product. So successful was the interaction that the parties are exploring the possibility of a multinational research project to fully capitalise on AIBN's research expertise and exploit the market opportunity.

In contrast, AIBN's relationship with Intel arose out of previous work investigating the potential of polymers for non-chemically amplified resists for extreme ultraviolet lithography. The success of that project resulted in a collaborative research project that will enable development of the next generation of silicon chips.

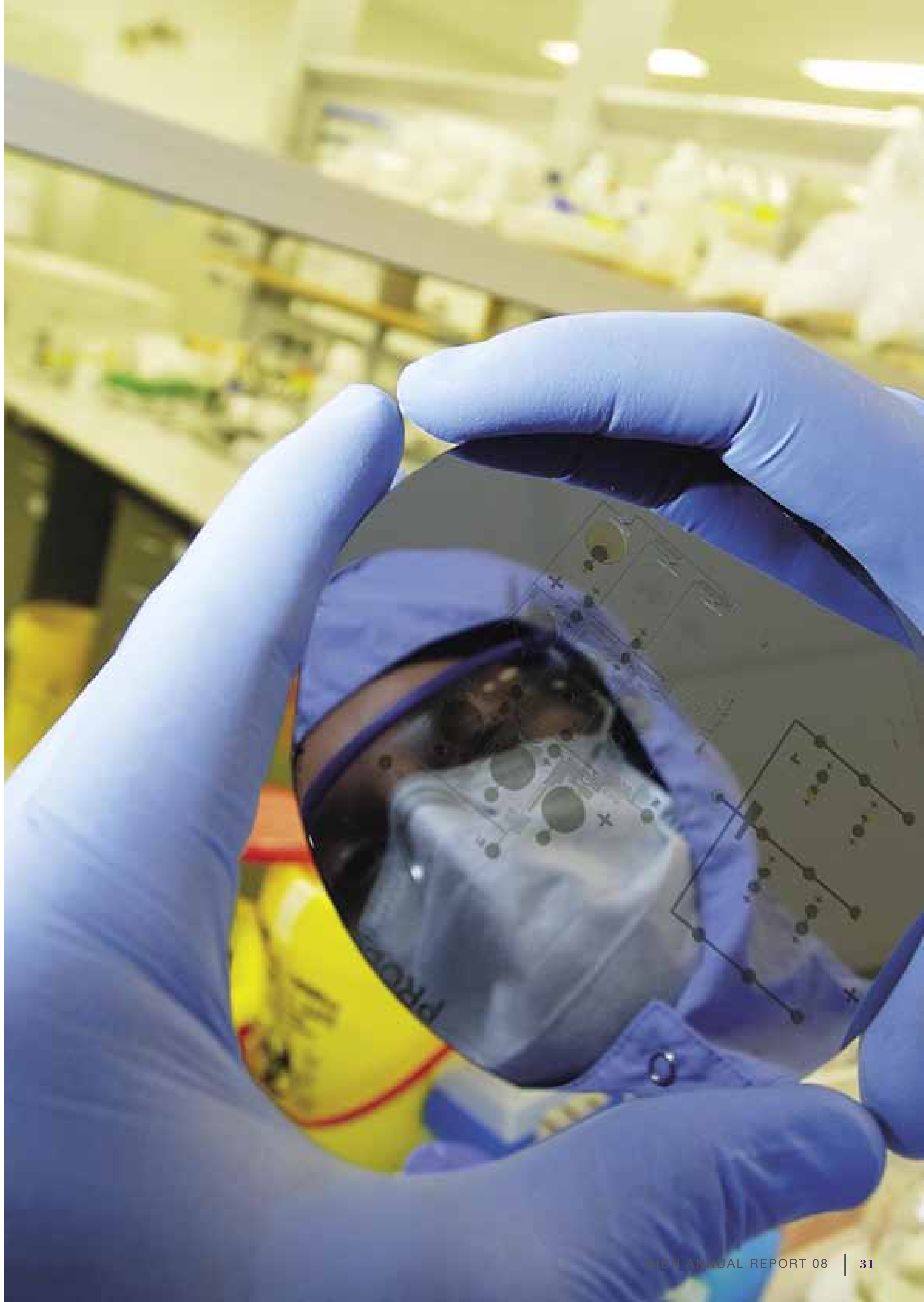
In short, researchers will develop materials with tailored properties to reduce defects in integrated circuit manufacture. That will potentially result in faster, more energy-efficient microprocessors.

Intel is a world leader in silicon innovation and combines advanced chip design with leading-edge manufacturing capabilities. The microprocessor industry had an annual revenue of US$220 billion and employed 1.5 million people globally in 2007. In light of those numbers and the possibility of contributing to such an important and lucrative industry, both parties were eager to enter into a collaboration aimed at developing the next generation of silicon chips.

These case studies demonstrate the leading role AIBN plays in developing and contributing to the knowledge economy, and epitomise the Institute's ability to nimbly and flexibly respond to industry needs.

They highlight the ability of AIBN researchers, in conjunction with the Innovation and Commercial Development team, to build meaningful, long-standing relationships with industry. That ability depends on AIBN's unique industry focus and spans the full gamut of industry, from small-to-medium enterprises, like Bioproton Pty Ltd, through to multinational organisations, such as Intel.

**Dr Craig Belcher**
INNOVATION AND COMMERCIAL DEVELOPMENT MANAGER



# AIBN
## GRADUATE PROGRAM AND CONTINUING PROFESSIONAL DEVELOPMENT

AIBN provides opportunities for research higher degree students and contributes to undergraduate training and continuing professional development.

By virtue of the applied nature of AIBN's research programs, its training and education have relevance to both industry and academia. The following demonstrate that relevance and highlight the Institute's successes.



# AIBN GRADUATE PROGRAM

The year 2008 was a milestone for AIBN's Graduate Program with two students graduating from research higher degree (RHD) programs. Akshat Tanksale and Sandy Budi Hartono successfully completed their respective PhD and M Phil studies and AIBN congratulates them on their achievements. A third student, Andrew Rowlands, submitted his thesis in 2008 and his PhD was awarded in early 2009.

With more students expected to complete their studies in the coming years, AIBN is now starting to reap the rewards of establishing a Graduate Program more than four years ago. The 19 new students that commenced in 2008 continue that investment and increase to 64, the number of RHD students enrolled through AIBN.

In response to the increase in student numbers and the growing complexity of student administration, AIBN appointed a new Postgraduate Administration Officer, Fiona McLeod, who has been charged with the responsibility of growing and administering the Graduate Program. The University has made significant changes to RHD student candidature and the seamless implementation of those changes will be a major focus of her time and energy.

Such is the quality of AIBN's student cohort that it is difficult not to become repetitive when acclaiming their achievements. However, it is important to celebrate student accomplishments and the Institute lauds the achievements of the following AIBN students:

**Wendy Chen** won the Opportunity Catcher Award at the Cooperative Research Centre for Sugar Industry Innovation through Biotechnology Symposium. The prize recognises Wendy's work identifying and developing new genes and methods for producing high molecular weight hyaluronic acid. The work has subsequently been patented.

**Mirjana Dimitrijev** was accepted into the 2008 Australian Nuclear Science and Technology Organisation, Australian Institute of Nuclear Science and Engineering (AINSE) Neutron School on Materials, at Lucas Heights, Sydney. She was also one of five Australian students chosen to participate in the 1st Asia-Oceania Neutron Scattering Summer School, in Daejeon, Korea, where she studied small-angle neutron scattering and neutron reflectometry.

**Geoff Johnston-Hall** was awarded the Treloar Prize at the 30th Australasian Polymer Symposium for his work on living radical polymerisation. The prize is awarded for the most outstanding oral presentation by a young polymer scientist given at the National Polymer Division Meeting and is regarded as a prestigious prize for young polymer scientists in Australia.

**Esteban Marcellin** was the Open Category prize winner in the UniQuest Trailblazer innovation competition for his work developing a system to efficiently mass-produce a form of hyaluronic acid for use in eye surgery.

**Daria Lonsdale** won a Royal Australian Chemical Institute Polymer Group Student Travel Award, worth $1,000, which supported her travel to the 48th Microsymposium on Macromolecules: Polymer Colloids, in July 2008. Daria was successful in her application for an ATSE Young Science Ambassador Award, which provided $1,200 plus travel expenses toward a series of presentations about nanotechnology for secondary school students in regional areas.

**Anthony Musumeci** was awarded an ATSE Young Science Ambassador Award, and travel grants from the University of Queensland, AINSE and the Australian Research Council Nanotechnology Network, which were used to fund a visit to the Centre for Nanoscale Materials at Argonne National Labs, in Chicago, USA, and conferences in The Netherlands and Switzerland. The work has resulted in several submitted papers that will significantly improve the quality of Anthony's thesis, and established a productive research collaboration between AIBN and the Argonne National Labs.

**Thomas Rufford** was appointed Secretary of the Joint Chemical Engineering Committee, Queensland Branch, of Engineers Australia and the Institute of Chemical Engineers (IChemE). He was also the student representative on the Management Committee of the ARC's Nanotechnology Network, and co-chaired the ARC Nanotechnology Network's Early Career Researcher and Postgraduate Student Symposium, in Melbourne. Thomas was on the Organising Committee for the International Conference on Nanoscience and Nanotechnology 2008.

**Carl Urbani** won the 2008 David Hill Thesis Award for the best thesis in the field of polymer chemistry. The RACI Queensland Polymer Group prize was awarded to Carl as part of the 30th Australasian Polymer Symposium. He was also successfully nominated by the Australian Academy of Science to attend the 59th Meeting of Nobel Laureates in Lindau, Germany, a meeting that attracts about 20,000 applications a year.

In light of these achievements it is important to acknowledge the excellent advice and mentoring provided to every RHD student by their advisory team and AIBN wholeheartedly thanks them for their efforts.

After four years, Professor Lars Nielsen surrendered the leadership of the AIBN Graduate Program, and his position as the Institute's Postgraduate Coordinator, to Associate Professor Michael Monteiro. Professor Nielsen's contributions to establishing the Graduate Program and his service to the University's Research Higher Degree Committee cannot be underestimated. He was responsible for the majority of AIBN's RHD policies and took a leading role in the Institute's implementation of the University's new Milestone and Progression policy. AIBN thanks Professor Nielsen for his service and welcomes Associate Professor Monteiro to this important responsibility.

AIBN
# SUMMER INTERNSHIPS

AIBN is acutely aware of the important contributions a vibrant, motivated student body makes to the Institute's ongoing success.

To enhance this energetic environment and expose budding researchers to the breadth and depth of the Institute's research programs, AIBN again held its Summer Internship Program.

Held over the December - January period, the eight-week internship is an opportunity for undergraduate students to supplement their studies with a supervised research project and obtain additional career mentoring from internationally acknowledged researchers. Because students are expected to fully participate in AIBN's activities, it provides insights into the life of a researcher and the chance to gain credit toward their degree program.

In 2008, nine AIBN Group Leaders offered 23 research projects for interested and motivated students to choose from. The Institute received almost 50 applications, more than double the previous year, with 14 students undertaking internships.

The quality of work produced by the interns was so high that several students have been offered part-time employment by their respective Group Leaders so they might continue their research project in parallel with their regular undergraduate studies.



AIBN
# BIOLOGICS EDUCATION AND TRAINING

A new education and training course developed by AIBN researchers provides opportunities for industry and university groups to learn more about the rapidly developing field of biologics and biopharmaceuticals.

Derived from living cells, biologics (also known as biopharmaceuticals) are a class of drugs accounting for one in three new drugs currently being approved by the United States Drug Enforcement Agency and have the potential to treat a variety of diseases, including cancer and heart disease. Monoclonal antibodies are a subclass of biologics and have the potential to treat various diseases, due to the ability to create antibodies for each specific disease indication. They are emerging as the wonder drugs of the new millennium.

Developed by Associate Professor Steve Mahler, the course outlines the science underpinning biologics, showcases the latest developments emerging from AIBN and discusses the technical and commercial considerations associated with this new generation of widely applicable drugs.

The course was originally designed as a professional development tool for researchers in large pharmaceutical companies, and has been presented to Pfizer Australia. However, interest from smaller pharmaceutical and biotechnology companies, government and private corporate entities stimulated further refinements to the content.

As a result, Associate Professor Mahler and AIBN's Dr David Chin conducted a three-day biologics course at the Universiti Sains Malaysia (USM), in Penang. The course was attended by more than 60 representatives from government, industry and universities and included delegates from the principal biologics manufacturing companies in Malaysia, Inno Biologics and Alpha Biologics.

The course was also delivered at the National Pharmaceutical Control Bureau, Ministry of Health, in Kuala Lumpur.

The course has strengthened links between AIBN and USM, and established AIBN and The University of Queensland as a provider of professional education and training to Malaysia and South East Asia in biologics discovery, production and licensing.

# APPENDICES

## AIBN RESEARCH FUNDING 2008

| Type | Scheme | AIBN Group Leader/ Investigator | Other Chief Investigators | Project Title | Duration | 2008 income $A |
|---|---|---|---|---|---|---|
| Commonwealth Competitive Grant Income | ARC Discovery Projects | A/Professor Darren Martin | Professor Paul Memmott, Dr Susanne Schmidt, Professor Richard Hyde, Dr Rod Fensham | Towards novel biomimetic building materials: Evaluating Aboriginal and western scientific knowledge of spinifex grass | 2008-2012 | 175,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Dr Idriss Blakey | Professor Traian Chirila, Dr David Hill, Dr Craig Hawker | Generation of peptidomimetic surfaces for biomaterials applications | 2008-2010 | 190,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Max Lu | Professor Perry Bartlett, Zhi Xu, Dr Helen Cooper, Professor Dongyuan Zhao | Novel hybrid inorganic nanoparticles for effective siRNA delivery to neurons | 2008-2011 | 319,963 |
| Commonwealth Competitive Grant Income | ARC Federation Fellowship | Professor Matt Trau | | Beyond microarrays: Nano-scaled devices for high throughput biological screening | 2004-2008 | 303,942 |
| Commonwealth Competitive Grant Income | ARC Linkage Infrastructure | Professor Max Lu | Professor Jin Zou, Professor John Drennan, Dr Rose Amal, Professor Hua Kun Liu, Professor Mark Kendall, Professor Ian Gentle, A/Professor Darren Martin, Dr Zhonghua Zhu, Dr Denisa Jurcakova, Dr Annette Dexter, Dr Xiangdong Yao | An integrated raman microscope and in situ TEM analysis system | 2008 | 690,250 |
| Commonwealth Competitive Grant Income | ARC Linkage Infrastructure | Professor Peter Halley | Dr Rowan Truss, Dr Peter Torley | Advanced processing and characterisation facility for functional polymers and polymer nanofibres | 2008 | 210,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Infrastructure | Professor Sean Smith | Dr Marlies Hankel, Professor Suresh Bhatia, Professor Max Lu, Professor Anton Middelberg, Professor Justin Cooper-White, Professor Alan Mark, Professor Bob Gilbert, A/Professor Paul Meredith, Dr Thomas Huber, Professor Aibing Yu, Professor Oleg Ostrovski, Dr Run Yu Yang, A/Professor Gang-Ding Peng, Dr Jie Bao, Dr Debra Bernhardt, Professor John Dobson, Dr Yuri Anissimov, A/Professor Peter Johnston | A computational facility for multi-scale modelling in bio and nanotechnology | 2008 | 1,920,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | A/Professor Stephen Mahler | Professor Maree Smith, Dr Bruce Wyse, Dr Trent Woodruff, Professor Paul Marie Gerard Curmi, Dr Dean Naylor, Dr Richard Brown | Development of chaperonin 10-based second generation biopharmaceuticals for treatment of inflammatory diseases | 2008-2010 | Grant awarded for 2008 funds not received until 2009 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Andrew Whittaker | Dr Idriss Blakey, Dr Heping Liu, Dr Paul Zimmerman | Double exposure photoresists for the 32 and 22 nm lithographic nodes | 2008-2011 | 496,817 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Peter Halley | Professor Bhesh Bhandari | A novel rheological and chewing and swallowing model for the smart design of texture-modified foods | 2008-2010 | Grant awarded for 2008 funds not received until 2009 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Max Lu | Dr John Zhu | Development of a novel one-step process for gas conversion to liquid | 2008-2011 | 296,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Max Lu | Dr Shizhang Qiao, Dr Brenton Peters, Dr Michael Kennedy | Porous silica-based nanocapsules for targeted and controlled release of biocides | 2008-2011 | 232,038 |



| Type | Scheme | AIBN Group Leader/ Investigator | Other Chief Investigators | Project Title | Duration | 2008 income $A |
|---|---|---|---|---|---|---|
| Commonwealth Competitive Grant Income | ARC QEII Fellowship | A/Professor Michael Monteiro | | Synthesis of nanocomposite polymers with targeted properties | 2004-2008 | 132,480 |
| Commonwealth Competitive Grant Income | Australian Nuclear Science and Technology Organisation | Dr Idriss Blakey | Dr Kevin Jack, Dr Zul Merican | Understanding the conformation of thermoresponsive polymer brushes on gold nanoparticles | 2008 | 12,000 |
| Commonwealth Competitive Grant Income | Australian Nuclear Science and Technology Organisation | Dr Lizhong He | | The physical states of pharmaceutical proteins and self-assembled peptides (AINSE Research Fellowship) | 2008-2011 | 194,449 |
| Commonwealth Competitive Grant Income | Australian Nuclear Science and Technology Organisation | Professor Anton Middelberg | | Interaction between Rubisco and SDOBS at an air-water interface | 2008 | 12,474 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | A/Professor Michael Monteiro | Dr Joanne Blanchfield, Professor Virgil Percec | Next generation polymer nanostructures | 2006-2008 | 200,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Anton Middelberg | Dr Annette Dexter | Microfluidic studies of stimuli-responsive emulsions | 2007-2009 | 170,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Anton Middelberg | Dr Samuel Peter Mickan, Dr Hwee-Lin Lua | Terahertz spectroscopy of mass-manufactured viral vaccines | 2007-2009 | 161,136 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Julie Campbell | Dr Tristan Croll, Dr Michael Doran | Tissue engineering the meniscus: Combining novel biomimetic hybrid scaffolds with adult stem cells | 2007-2010 | 140,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Mark Kendall | Professor Michael Roberts | Micro-nanoprojection patches for minimally-invasive and targeted delivery of genes and drugs to skin cells: from concept to technology platform | 2007-2009 | 245,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Max Lu | Dr Lianzhou Wang, A/Professor Jin Zou, Prof Serge Kaliaguine | Charge-driven self-assembly of nanocomposites of ionic polymers and oxide nanoparticles | 2006-2010 | 200,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Sean Smith | | Quantum unimolecular reaction dynamics: from isolated molecules to protein-embedded chromophores | 2007-2009 | 77,000 |
| Commonwealth Competitive Grant Income | ARC Discovery Projects | Professor Justin Cooper-White | A/Professor Malcolm R Davidson, Professor Gareth Huw McKinley | Micro process plants - Non-Newtonian flow and particle synthesis in confined geometries | 2005-2009 | 190,000 |
| Commonwealth Competitive Grant Income | ARC Linkage International | Professor Peter Halley | Professor Dr Luc Averous, A/Professor Darren Martin, A/Professor Bhesh Bhandari, Dr Peter Torley, A/Professor Eric Pollet | Functionable renewable plastics: developing novel polysaccharide, protein and natural polyester-based polymer nanocomposites | 2007-2009 | 10,000 |
| Commonwealth Competitive Grant Income | ARC Linkage International | Professor Andrew Whittaker | Dr Idriss Blakey, Professor Steven Melvyn Howdle, Dr Kristofer James Thurecht | Development of novel detergents for green solvent systems and their self-assembly into nanostructures | 2007-2009 | 10,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Andrew Whittaker | A/Professor Bhesh Bhandari, Professor Mike Gidley, Dr Hilton Deeth | The molecular mechanism of protein instability in dairy powder systems | 2007-2010 | 349,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Lars Nielsen | Yoke Fung, Dr Robyn Myra Minchinton | Ex vivo production of neutrophils | 2006-2008 | 35,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Andrew Whittaker | Professor Justin Cooper-White, Dr Edeline Wentrup-Byrne, Dr Jos Malda | Bioactive polymers for wound healing applications | 2005-2008 | 100,000 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Max Lu | Dr Zhonghua Zhu | Hydrogen production by non-thermal plasma assisted catalytic pyrolysis of natural gas | 2005-2009 | 40,737 |
| Commonwealth Competitive Grant Income | ARC Linkage Projects | Professor Max Lu | Dr Yinghe He, Xiangdong Yao | Nanostructured magnesium-base composites for high-density hydrogen storage | 2006-2009 | 105,000 |
| Commonwealth Competitive Grant Income | Australian Stem Cell Centre | Professor Peter Gray | Professor Lars Nielsen, Professor Justin Cooper-White | Australian Stem Cell Centre - Bioreactor Program | 2006-2008 | 709,392 |
| Commonwealth Competitive Grant Income | DEST International Science Linkages / French-Australian Science & Technology (FAST) Program | Professor Anton Middelberg | Dr Hwee-Lin Lua, Dr Waltraud Kaar | Bio-based functional materials from engineered self-assembling peptides (BASE) | 2005-2008 | 141,510 |
| Commonwealth Competitive Grant Income | NHMRC Equipment Grant | Professor Julie Campbell | | Microtome | 2008 | 11,379 |

| Type | Scheme | AIBN Group Leader/ Investigator | Other Chief Investigators | Project Title | Duration | 2008 income $A |
|---|---|---|---|---|---|---|
| Commonwealth Competitive Grant Income | NHMRC Fellowship Grant | Professor Julie Campbell | | Senior Principal Research Fellowship | 2006-2010 | 158,675 |
| Commonwealth Competitive Grant Income | NHMRC Project Grant (All Project Grants) | Professor Julie Campbell | Professor David Craik | Bioengineering of cyclotides with angiogenic properties | 2006-2008 | 175,175 |
| Commonwealth Competitive Grant Income | NHMRC Project Grant (All Project Grants) | Professor Julie Campbell | Dr Sharon Ricardo, Professor Melissa Little | Transplanted metanephroi as functional kidneys | 2008-2010 | 98,500 |
| Commonwealth Competitive Grant Income | NHMRC Project Grant (All Project Grants) | Professor Mark Kendall | Dr Sarah Waters, Professor Ian Frazer | MPM non-invasive imaging of biological interactions following drug delivery with micro-nanoprojection patches | 2007-2009 | 127,750 |
| Contract Research and other Industry Income | Bioproton | A/Professor Stephen Mahler | | Research project | 2008 | 29,268 |
| Contract Research and other Industry Income | CRC for Sugar Industry Innovation through Biotechnology | Professor Lars Nielsen | Dr Stevens Brumbley | Metabolix | 2008 | 51,807 |
| Contract Research and other Industry Income | CRC for Sugar Industry Innovation through Biotechnology | Professor Peter Halley | | Research project | 2008 | 9,034 |
| Contract Research and other Industry Income | DendriMed | A/Professor Michael Monteiro | | Dendrimed research | 2008 | 193,976 |
| Contract Research and other Industry Income | Pepfactants | Professor Anton Middelberg | Dr Annette Dexter | Pepfactants research | 2008 | 125,614 |
| Contract Research and other Industry Income | Reneuron | Professor Justin Cooper-White | | Research project | 2008 | 29,371 |
| Contract Research and other Industry Income | TenasiTech | A/Professor Darren Martin | | Tenasitech research | 2008 | 188,182 |
| National and International Grant Income | Australian Institute Nuclear Science & Engineering | A/Professor Darren Martin | Anthony Musumeci | Tailored nanoparticles for nanotoxicological studies | 2007-2009 | 21,450 |
| National and International Grant Income | Australian Stem Cell Centre | A/Professor Ernst Wolvetang | | Safe and efficient expansion of genetically stable hESC under defined conditions | 2008-2010 | 200,404 |
| National and International Grant Income | Australian Stem Cell Centre | Professor Lars Nielsen | Dr Nicholas Timmins, Dr Sia Athanasas-Platsis, Flavia Marturana, Penny Buntine | Ex vivo generated allogeneic neutrophils for anti-infective supportive care in acute leukaemia | 2008-2010 | 305,932 |
| National and International Grant Income | Australian Stem Cell Centre | Professor Melissa Little | | Australian Stem Cell Centre AIBN Node research activities | 2008 | 418,000 |
| National and International Grant Income | Cancer Australia | Professor Matt Trau | A/Professor Melissa Brown, Dr Glenn Francis, Dr Kymberley Vickery, Dr Bronwyn Battersby | Nanoscaled biosensors: Reading epigenetic signatures to improve breast cancer detection and treatment | 2008-2011 | 264,000 |
| National and International Grant Income | Centre for Low Emission Technology | Professor Max Lu | A/Professor Joao Diniz da Costa, Dr Mikel Duke, Dr Jorge Beltramini, Dr Michael Macrossan | Proof-of-concept engineering systems for membranes and catalytic membrane reactors (CMR) in coal gasification (cLET project) | 2005-2009 | 110,000 |
| National and International Grant Income | CRC for Sugar Industry Innovation through Biotechnology | Professor Lars Nielsen | Dr Stevens Brumbley | Production of PHB/PHAs in plants | 2006-2008 | 740,314 |
| National and International Grant Income | CRC for Sugar Industry Innovation through Biotechnology | Professor Lars Nielsen | | Use of endogenous bacteriocins to manipulate the rumen microbial ecology | 2006-2008 | 80,025 |
| National and International Grant Income | CRC for Sugar Industry Innovation through Biotechnology | Professor Lars Nielsen | Dr Jens Kroemer, Yiting Chen, Dr Claudia Vickers | High Mw hyaluronic acid | 2008-2009 | 44,000 |
| National and International Grant Income | CSIRO Flagships Collaboration Fund | Professor Max Lu | Dr Lianzhou Wang, A/Professor Joao Diniz da Costa | Flagship Collaboration Research Fund: Advanced membrane technologies for water treatment | 2007-2010 | 216,021 |
| National and International Grant Income | Department of Innovation, Industry, Science & Research | Professor Justin Cooper-White | | National Collaborative Research Infrastructure Strategy - capability area 5.4 fabrication | 2007-2011 | 2,800,000 |

| Type | Scheme | AIBN Group Leader/ Investigator | Other Chief Investigators | Project Title | Duration | 2008 income $A |
|---|---|---|---|---|---|---|
| National and International Grant Income | Department of Innovation, Industry, Science & Research | Professor Lars Nielsen | | National Collaborative Research Infrastructure Strategy - capability area 5.1 evolving biomolecular platforms | 2007-2011 | 634,500 |
| National and International Grant Income | Department of Innovation, Industry, Science & Research | Professor Peter Gray | | National Collaborative Research Infrastructure Strategy - capability area 5.5 biotechnology products | 2007-2011 | 1,400,000 |
| National and International Grant Income | Foundation Jerome Lejeune | A/Professor Ernst Wolvetang | | The generation of primary DS neurons from induced pluripotent cells | 2008-2009 | 25,335 |
| National and International Grant Income | National Breast Cancer Foundation | Professor Matt Trau | Professor John Forbes, A/Professor Susan Clark, A/Professor Melissa Brown, Dr Glenn Francis, A/Professor Alexander Dobrovic, Professor Rodney Scott, Dr Bronwyn Battersby, Dr Kymberley | Novel strategies for prediction and control of advanced breast cancer via nanoscaled epigenetic-based biosensors | 2008-2013 | 825,000 |
| National and International Grant Income | PATH - Program for Appropriate Technology in Health | Professor Mark Kendall | Dr David Koelle | Micro-nanoprojections (nanopatches) for HSV-2 DNA vaccine delivery to mice | 2008 | 28,917 |
| National and International Grant Income | Queensland Government - NCRIS Support | Professor Justin Cooper-White | | National Collaborative Research Infrastructure Strategy - capability area 5.4 fabrication | 2007-2011 | 3,300,000 |
| National and International Grant Income | Queensland Government - NCRIS Support | Professor Lars Nielsen | | National Collaborative Research Infrastructure Strategy - capability area 5.1 evolving biomolecular platforms | 2007-2011 | 220,000 |
| National and International Grant Income | Queensland Government - NCRIS Support | Professor Peter Gray | | National Collaborative Research Infrastructure Strategy - capability area 5.5 biotechnology products | 2007-2011 | 3,095,950 |
| National and International Grant Income | Queensland Government - Smart State Research Facilities Fund | Professor Peter Gray | Professor Lars Nielsen, Professor Justin Cooper-White, Professor Peter Halley, Professor Max Lu, Professor Anton Middelberg, A/Professor Michael Monteiro, Dr Steve Reid, Professor Matt Trau, Professor Andrew Whittaker, Professor Derek Hart, Professor Jonathon Golledge, Dr Stuart Hazell | BioNano development facility | 2008-2012 | 2,996,571 |
| National and International Grant Income | Queensland Government Smart State Fellowships | Professor Mark Kendall | | Micro-nanoprojection patches for targeted gene and drug delivery to the skin | 2007-2010 | 110,000 |
| National and International Grant Income | Queensland Government Smart State National and International Research Alliance Program | Dr Krassen Dimitrov | Professor Karl Bohringer, Dr Daniel Schwartz | Molecular diagnostics platform with electronic readout of nanobarcodes | 2008-2010 | Grant awarded for 2008 funds not received until 2009 |
| National and International Grant Income | Queensland Government Smart State National and International Research Alliances Program | Professor Andrew Whittaker | Dr Firas Rasoul, Dr Anne Symons, Dr Craig Jon Hawker, Professor Karen Lynn Wooley, Professor Julie Campbell, Professor Traian Chirila, Prof David M Haddleton, A/Professor Stephen Rose, Professor Steven Melvyn Howdle | International Biomaterials Research Alliance | 2007-2011 | 923,487 |
| National and International Grant Income | Queensland Government Smart State National and International Research Alliances Program | Professor Matt Trau | Professor Leland (Lee) Hartwell, Professor Kenneth D Stuart, Professor Nancy B Kiviat | Novel nanotechnology platforms for disease biomarker diagnostics | 2007-2010 | 687,500 |
| National and International Grant Income | The Cancer Council of Queensland | Professor Mark Kendall | Professor Michael Roberts, Professor Hans Soyer, Karsten Koenig, Dr Owen Jepps, Dr Glenn Francis, Dr Greg Siller, Dr John Auld, Mark Jones, Professor David Wilkinson | Assessment of topically treated non melanoma skin cancers by sequential optical biopsies using multiphoton microscope | 2008-2009 | 75,428 |

# AIBN PUBLICATIONS 2008

## JOURNAL ARTICLES


1. An, X. Z., Yang, R. Y., Zou, R. P. & Yu, A. B. (2008) Effect of vibration condition and inter-particle frictions on the packing of uniform spheres. *Powder Technology*, 188, 102-109.
2. Babic, B., Ghai, R. & Dimitrov, K. (2008) Magnetophoresis of flexible DNA-based dumbbell structures. *Applied Physics Letters*, 92.
3. Bargueno, P., Gonzalez-Lezana, T., Larregaray, P., Bonnet, L., Rayez, J. C., Hankel, M., Smith, S. C. & Meijer, A. (2008) Study of the H+O-2 reaction by means of quantum mechanical and statistical approaches: The dynamics on two different potential energy surfaces. *Journal of Chemical Physics*, 128.
4. Bell, C. A., Whittaker, M. R., Gahan, L. R. & Monteiro, M. J. (2008) Outer-sphere electron transfer metal-catalyzed polymerization of styrene using a macrobicyclic ligand. *Journal of Polymer Science Part a-Polymer Chemistry*, 46, 146-154.
5. Beltramini, J. N. & Tanksale, A. (2008) Improved performance of naphtha reforming process by the use of metal zeolite composite catalysts. *Studies in Surface Science and Catalysis*, 174, 1235-1238.
6. Blank, L. M., Hugenholtz, P. & Nielsen, L. K. (2008) Evolution of the hyaluronic acid synthesis (has) operon in Streptococcus zooepidemicus and other pathogenic streptococci. *Journal of Molecular Evolution*, 67, 13-22.
7. Cai, W. Y., Gentle, I. R., Lu, G. Q., Zhu, J. J. & Yu, A. M. (2008) Mesoporous silica templated biolabels with releasable fluorophores for immurroassays. *Analytical Chemistry*, 80, 5401-5406.
8. Campbell, G. R., Turnbull, G., Xiang, L., Haines, M., Armstrong, S., Rolfe, B. E. & Campbell, J. H. (2008) The peritoneal cavity as a bioreactor for tissue engineering visceral organs: bladder, uterus and vas deferens. *Journal of Tissue Engineering and Regenerative Medicine*, 2, 50-60.
9. Cao, Y., Zhang, B., Croll, T., Rolfe, B. E., Campbell, J. H., Campbell, G. R., Martin, D. & Cooper-White, J. J. (2008) Engineering tissue tubes using novel multilayered scaffolds in the rat peritoneal cavity. *Journal of Biomedical Materials Research A*, 87, 719-27.
10. Chaleat, C. M., Halley, P. J. & Truss, R. W. (2008) Properties of a plasticised starch blend. Part 1: Influence of moisture content on fracture properties. *Carbohydrate Polymers*, 71, 535-543.
11. Chaleat, C. M., Michel-Amadry, G., Halley, P. J. & Truss, R. W. (2008) Properties of a plasticised starch blend - Part 2: Influence of strain rate, temperature and moisture on the tensile yield behaviour. *Carbohydrate Polymers*, 74, 366-371.
12. Chaudhary, A. L., Miler, M., Torley, P. J., Sopade, P. A. & Halley, P. J. (2008) Amylose content and chemical modification effects on the extrusion of thermoplastic starch from maize. *Carbohydrate Polymers*, 74, 907-913.
13. Chen, A., Kozak, D., Battersby, B. J. & Trau, M. (2008) Particle-by-particle quantification of protein adsorption onto poly(ethylene glycol) grafted surfaces. *Biofouling*, 24, 267-273.
14. Chen, Z. G., Zou, J., Liu, G., Li, F., Wang, Y., Wang, L. Z., Yuan, X. L., Sekiguchi, T., Cheng, H. M. & Lu, G. Q. (2008) Novel Boron Nitride Hollow Nanoribbons. *ACS Nano*, 2, 2183-2191.
15. Chen, Z. G., Zou, J., Liu, G., Lu, H. F., Li, F., Lu, G. Q. & Cheng, H. M. (2008) Silicon-induced oriented ZnS nanobelts for hydrogen sensitivity. *Nanotechnology*, 19.
16. Chen, Z. G., Zou, J., Liu, G., Yao, X. D., Li, F., Yuan, X. L., Sekiguchi, T., Lu, G. Q. & Cheng, H. M. (2008) Growth, Cathodoluminescence and Field Emission of ZnS Tetrapod Tree-like Heterostructures. *Advanced Functional Materials*, 18, 3063-3069.
17. Chen, Z. G., Zou, J., Liu, Q. F., Sun, C. H., Liu, G., Yao, X. D., Li, F., Wu, B., Yuan, X. L., Sekiguchi, T., Cheng, H. M. & Lu, G. Q. (2008) Self-assembly and cathodoluminescence of microbelts from Cu-doped boron nitride nanotubes. *ACS Nano*, 2, 1523-1532.
18. Chen, Z. H., Wu, Z., Zhang, Q. Q., Bao, J. J., Wang, L. Z., Lu, G. Q. & Zhu, X. F. (2008) Preparation of Polymethyl Methacrylate(PMMA) Nanosphere and Technique of Coating Ag Layer. *Chemical Journal of Chinese Universities-Chinese*, 29, 2070-2073.
19. Chuan, Y. P., Fan, Y. Y., Lua, L. & Middelberg, A. P. (2008) Quantitative analysis of virus-like particle size and distribution by field-flow fractionation. *Biotechnology and Bioengineering*, 99, 1425-33.
20. Chuan, Y. P., Lua, L. H. & Middelberg, A. P. (2008) High-level expression of soluble viral structural protein in Escherichia coli. *Journal of Biotechnology*, 134, 64-71.
21. Corrie, S. R., Lawrie, G. A., Battersby, B. J., Ford, K., Ruhmann, A., Koehler, K., Sabath, D. E. & Trau, M. (2008) Quantitative data analysis methods for bead-based DNA hybridization assays using generic flow cytometry platforms. *Cytometry Part A*, 73A, 467-476.
22. Corrie, S. R., Vogel, R., Keen, I., Jack, K., Kozak, D., Lawrie, G. A., Battersby, B. J., Fredericks, P. & Trau, M. (2008) A structural study of hybrid organosilica materials for colloid-based DNA biosensors. *Journal of Materials Chemistry*, 18, 523-529.
23. Dai, H. B., Liang, Y., Wang, P., Yao, X. D., Rufford, T., Lu, M. & Cheng, H. M. (2008) High-performance cobalt-tungsten-boron catalyst supported on Ni foam for hydrogen generation from alkaline sodium borohydride solution. *International Journal of Hydrogen Energy*, 33, 4405-4412.
24. Dexter, A. F., Malcolm, A. S., Zeng, B., Kennedy, D. & Middelberg, A. P. (2008) Mixed system of Eudragit s-100 with a designed amphipathic peptide: control of interfacial elasticity by solution composition. *Langmuir*, 24, 3045-52.
25. Du, A. J., Chen, Y., Lu, G. Q. & Smith, S. C. (2008) Half metallicty in finite-length zigzag single walled carbon nanotube: A first-principle prediction. *Applied Physics Letters*, 93.
26. Du, A. J., Smith, S. C., Yao, X. D., Sun, C. H., Li, L. & Lu, G. Q. (2008) The role of V2O5 on the dehydrogenation and hydrogenation in magnesium hydride: An *ab initio* study. *Applied Physics Letters*, 92.
27. Duke, M. C., Lim, A., Da Luz, S. C. & Nielsen, L. (2008) Lactic acid enrichment with inorganic nanofiltration and molecular sieving membranes by pervaporation. *Food and Bioproducts Processing*, 86, 290-295.
28. Duxenneuner, M. R., Fischer, P., Windhab, E. J. & Cooper-White, J. J. (2008) Extensional properties of hydroxypropyl ether guar gum solutions. *Biomacromolecules*, 9, 2989-96.
29. Fang, Z. Z., Wang, P., Rufford, T. E., Kang, X. D., Lu, G. Q. & Cheng, H. M. (2008) Kinetic- and thermodynamic-based improvements of lithium borohydride incorporated into activated carbon. *Acta Materialia*, 56, 6257-6263.
30. Ge, L., Ran, R., Zhang, K., Liu, S. M. & Shao, Z. P. (2008) Oxygen selective membranes based on B-site cation-deficient (Ba0.5Sr0.5)(Co0.8Fe0.2)(y)O3-delta perovskite with improved operational stability. *Journal of Membrane Science*, 318, 182-190.
31. Ge, L., Zhou, W., Ran, R., Shao, Z. P. & Liu, S. M. (2008) Facile autocombustion synthesis of La0.6Sr0.4Co0.2Fe0.8O3-delta (LSCF) perovskite via a modified complexing sol-gel process with NH4NO3 as combustion aid. *Journal of Alloys and Compounds*, 450, 338-347.
32. Geiss, G. K., Bumgarner, R. E., Birditt, B., Dahl, T., Dowidar, N., Dunaway, D. L., Fell, H. P., Ferree, S., George, R. D., Grogan, T., James, J. J., Maysuria, M., Mitton, J. D., Oliveri, P., Osborn, J. L., Peng, T., Ratcliffe, A. L., Webster, P. J., Davidson, E. H., Hood, L. & Dimitrov, K. (2008) Direct multiplexed measurement of gene expression with color-coded probe pairs. *Nature Biotechnology*, 26, 317-325.
33. Glushenkov, A. M., Zhang, H., Zou, J., Lu, G. Q. & Chen, Y. (2008) Unusual corrugated nanowires of zinc oxide. *Journal of Crystal Growth*, 310, 3139-3143.
34. Gnanasambandam, A., Anderson, D. J., Purnell, M. P., Nielsen, L. K. & Brumbley, S. M. (2008) The N-terminal presequence from F1-ATPase beta-subunit of Nicotiana plumbaginifolia efficiently targets green fluorescent fusion protein to the mitochondria in diverse commercial crops. *Functional Plant Biology*, 35, 166-170.
35. Graf, A., Jack, K. S., Whittaker, A. K., Hook, S. M. & Rades, T. (2008) Protein delivery using nanoparticles based on microemulsions with different structure-types. *European Journal of Pharmaceutical Sciences*, 33, 434-444.
36. Gu, Z., Thomas, A. C., Xu, Z. P., Campbell, J. H. & Lu, G. Q. (2008) In vitro sustained release of LMWH from MgAl-layered double hydroxide nanohybrids. *Chemistry of Materials*, 20, 3715-3722.
37. Hankel, M., Smith, S. C., Gray, S. K. & Balint-Kurti, G. G. (2008) DIFFREALWAVE: A parallel real wavepacket code for the quantum mechanical calculation of reactive state-to-state differential cross sections in atom plus diatom collisions. *Computer Physics Communications*, 179, 569-578.
38. Hanslip, S. J., Zaccai, N. R., Middelberg, A. P. & Falconer, R. J. (2008) Intrinsic fluorescence as an analytical probe of virus-like particle assembly and maturation. *Biochem Biophys Res Commun*, 375, 351-5.
39. Hartmann, B. M., Kaar, W., Falconer, R. J., Zeng, B. & Middelberg, A. P. J. (2008) Expression and purification of a nanostructure-forming peptide. *Journal of Biotechnology*, 135, 85-91.
40. Harvie, D. J. E., Cooper-White, J. J. & Davidson, M. R. (2008) Deformation of a viscoelastic droplet passing through a microfluidic contraction. *Journal of Non-Newtonian Fluid Mechanics*, 155, 67-79.
41. Hines, M., Nielsen, L. & Cooper-White, J. (2008) The hematopoietic stem cell niche: what are we trying to replicate? *Journal of Chemical Technology and Biotechnology*, 83, 421-443.
42. Hong, J. S., Shin, S. J., Lee, S., Wong, E. & Cooper-White, J. (2007) Spherical and cylindrical microencapsulation of living cells using microfluidic devices. *Korea-Australia Rheology Journal*, 19, 157-164.
43. Huang, W. W., Wang, S. B., Zhu, Z. H., Li, L., Yao, X. D., Rudolph, V. & Haghseresht, F. (2008) Phosphate removal from wastewater using red mud. *Journal of Hazardous Materials*, 158, 35-42.
44. Hughes, G. L., Allsopp, P. G., Brumbley, S. M., Johnson, K. N. & O'Neill, S. L. (2008) In vitro rearing of Perkinsiella saccharicida and the use of leaf segments to assay Fiji disease virus transmission. *Phytopathology*, 98, 810-814.
45. Hulicova-Jurcakova, D., Li, X., Zhu, Z., De Marco, R. & Lu, G. Q. (2008) Graphitic Carbon Nanofibers Synthesized by the Chemical Vapor Deposition (CVD) Method and Their Electrochemical Performances in Supercapacitors. *Energy & Fuels*, 22, 4139-4145.
46. Jin, Y. G., Qiao, S. Z., Zhang, L., Xu, Z. P., Smart, S., Da Costa, J. C. D. & Lu, G. Q. (2008) Novel Nafion composite membranes with mesoporous silica nanospheres as inorganic fillers. *Journal of Power Sources*, 185, 664-669.
47. Johnston, A. P. R., Lawrie, G. A., Battersby, B. J., Corrie, S. R. & Trau, M. (2008) Toward colloid-based biosensors for SNP genotyping and personalised medicine applications. *International Journal of Nanotechnology*, 5, 299-317.
48. Johnston-Hall, G., Barner-Kowollik, C. & Monteiro, M. J. (2008) Design Criteria for Accurate Measurement of Bimolecular Radical Termination Rate Coefficients via the RAFT-CLD-T Method(a). *Macromolecular Theory and Simulations*, 17, 460-469.
49. Johnston-Hall, G. & Monteiro, M. J. (2008) Bimolecular radical termination: New perspectives and insights. *Journal of Polymer Science Part a-Polymer Chemistry*, 46, 3155-3173.
50. Johnston-Hall, G. & Monteiro, M. J. (2008) Diffusion controlled termination of linear polystyrene radicals in linear, 4-arm, and 6-arm star polymer matrices in dilute, semidilute, and concentrated solution conditions. *Macromolecules*, 41, 727-736.
51. Kang, X. D., Fang, Z. Z., Kong, L. Y., Cheng, H. M., Yao, X. D., Lu, G. Q. & Wang, P. (2008) Ammonia borane destabilized by lithium hydride: An advanced on-board hydrogen storage material. *Advanced Materials*, 20, 2756-2759.
52. Kealley, C. S., Rout, M. K., Dezfouli, M. R., Strounina, E., Whittaker, A. K., Appelqvist, I. A. M., Lillford, P. J., Gilbert, E. P. & Gidley, M. J. (2008) Structure and Molecular Mobility of Soy Glycinin in the Solid State. *Biomacromolecules*, 9, 2937-2946.
53. Knibbe, R., Drennan, J., Dicks, A. & Love, J. (2008) Effect of alumina additions on the anode vertical bar electrolyte interface in solid oxide fuel cells. *Journal of Power Sources*, 179, 511-519.
54. Koebmann, B., Blank, L. M., Solem, C., Petranovic, D., Nielsen, L. K. & Jensen, P. R. (2008) Increased biomass yield of *Lactococcus lactis* during energetically limited growth and respiratory conditions. *Biotechnology and Applied Biochemistry*, 50, 25-33.
55. Kozak, D., Chen, A. & Trau, M. (2008) Profiling protein-surface interactions of multicomponent suspensions via flow cytometry. *Langmuir*, 24, 1204-1211.
56. Kubler, D., Hung, C. W., Dam, T. K., Kopitz, J., Andre, S., Kaltner, H., Lohr, M., Manning, J. C., He, L. Z., Wang, H., Middelberg, A., Brewer, C. F., Reed, J., Lehmann, W. D. & Gabius, H. J. (2008) Phosphorylated human galectin-3: Facile large-scale preparation of active lectin and detection of structural changes by CD spectroscopy. *Biochimica Et Biophysica Acta-General Subjects*, 1780, 716-722.
57. Ladewig, B., Klaysom, C., Wang, L. Z. & Lu, M. (2008) Worth their salt. *TCE*, 38-39.
58. Lee, S. Y., Park, J. H., Jang, S. H., Nielsen, L. K., Kim, J. & Jung, K. S. (2008) Fermentative butanol production by clostridia. *Biotechnology and Bioengineering*, 101, 209-228.
59. Lee, Y. H., Clegg, J. K., Lindoy, L. F., Lu, G. Q. M., Park, Y. C. & Kim, Y. (2008) Co-3(PO4)(2)center dot 4H(2)O. *Acta Crystallographica Section E-Structure Reports Online*, 64, I67-U18.
60. Lee, Y. H., Clegg, J. K., Lindoy, L. F., Lu, G. Q. M., Park, Y. C. & Kim, Y. (2008) A second polymorph with composition Co-3(PO4)(2)center dot H2O. *Acta Crystallographica Section E-Structure Reports Online*, 64, I69-U29.
61. Lestari, S., Simakova, I., Tokarev, A., Maki-Arvela, P., Eranen, K. & Murzin, D. Y. (2008) Synthesis of biodiesel via deoxygenation of stearic acid over supported Pd/C catalyst. *Catalysis Letters*, 122, 247-251.
62. Leung, A., Lawrie, G., Nielsen, L. K. & Trau, M. (2008) Synthesis and characterization of alginate/poly-L-ornithine/alginate microcapsules for local immunosuppression. *Journal of Microencapsulation*, 25, 387-398.
63. Leung, A., Trau, M. & Nielsen, L. K. (2008) Assembly of multilayer PSS/PAH membrane on coherent alginate/PLO microcapsule for long-term graft transplantation. *Journal of Biomedical Materials Research A*, Epub ahead of print
64. Li, F., Zhu, Z. G., Yao, X. D., Lu, G. Q., Zhao, M. W., Xia, Y. Y. & Chen, Y. (2008) Fluorination-induced magnetism in boron nitride nanotubes from ab initio calculations. *Applied Physics Letters*, 92.
65. Li, J. J., Ma, C. Y., Xu, X. Y., Yu, J. J., Hao, Z. P. & Qiao, S. Z. (2008) Efficient elimination of trace ethylene over nano-gold catalyst under ambient conditions. *Environmental Science & Technology*, 42, 8947-8951.
66. Li, J. J., Mu, Z., Xu, X. Y., Tian, H., Duan, M. H., Li, L. D., Hao, Z. P., Qiao, S. Z. & Lu, G. Q. (2008) A new and generic preparation method of mesoporous clay composites containing dispersed metal oxide nanoparticles. *Microporous and Mesoporous Materials*, 114, 214-221.

67. Li, L., Wang, S. B., Zhu, Z. H., Yao, X. D. & Yan, Z. F. (2008) Catalytic decomposition of ammonia over fly ash supported Ru catalysts. *Fuel Processing Technology*, 89, 1106-1112.

68. Li, L., Yao, X., Sun, D. H., Du, A. J., Chen, L. N., Zhu, Z. H., Zou, J., Yu, C. Z., Smith, S. C., P., W., Cheng, H. M., Frost, R. L. & Lu, G. Q. (2008) Lithium-catalyzed dehydrogenation of ammonia borane within mesoporous carbon framework for chemical hydrogen storage. *Advanced Functional Materials*, 19, 265.

69. Li, L., Zhu, Z. H., Yao, X. D., Lu, G. Q. & Yan, Z. F. (2008) Synthesis and characterization of chromium oxide nanocrystals via solid thermal decomposition at low temperature. *Microporous and Mesoporous Materials*, 112, 621-626.

70. Li, L. D., Shen, Q., Li, J. J., Hao, Z. P., Xu, Z. P. & Lu, G. Q. M. (2008) Iron-exchanged FAU zeolites: Preparation, characterization and catalytic properties for N2O decomposition. *Applied Catalysis a-General*, 344, 131-141.

71. Li, L. D., Shen, Q., Yu, J. J., Li, J. J., Hao, Z. P. & Xu, Z. P. (2008) Wet ion exchanged Fe-USY catalyst for effective N2O decomposition. *Catalysis Communications*, 9, 1745-1748.

72. Li, M. Y., Zhou, C. H., Beltramini, J. N., Yu, W. H. & Fan, Y. X. (2008) Catalytically selective oxidation of glycerol. *Progress in Chemistry*, 20, 1474-1486.

73. Li, X., Zhu, Z. H., De Marco, R., Dicks, A., Bradley, J., Liu, S. M. & Lu, G. Q. (2008) Factors that determine the performance of carbon fuels in the direct carbon fuel cell. *Industrial & Engineering Chemistry Research*, 47, 9670-9677.

74. Lim, M., Rudolph, V., Anpo, M. & Lu, G. Q. (2008) Fluidized-bed photocatalytic degradation of airborne styrene. *Catalysis Today*, 131, 548-552.

75. Lim, M., Zhou, Y., Wood, B., Guo, Y. N., Wang, L. Z., Rudolph, V. & Lu, G. Q. (2008) Fluorine and carbon codoped macroporous titania microspheres: highly effective photocatalyst for the destruction of airborne styrene under visible light. *Journal of Physical Chemistry C*, 112, 19655-19661.

76. Lipin, D. I., Chuan, Y. P., Lua, L. H. L. & Middelberg, A. P. J. (2008) Encapsulation of DNA and non-viral protein changes the structure of murine polyomavirus virus-like particles. *Archives of Virology*, 153, 2027-2039.

77. Lipin, D. I., Lua, L. H. & Middelberg, A. P. (2008) Quaternary size distribution of soluble aggregates of glutathione-S-transferase-purified viral protein as determined by asymmetrical flow field flow fractionation and dynamic light scattering. *Journal of Chromatography A*, 1190, 204-14.

78. Liu, G., Li, F., Wang, D. W., Tang, D. M., Liu, C., Ma, X. L., Lu, G. Q. & Cheng, H. M. (2008) Electron field emission of a nitrogen-doped TiO2 nanotube array. *Nanotechnology*, 19.

79. Liu, G., Zhao, Y. N., Sun, C. H., Li, F., Lu, G. Q. & Cheng, H. M. (2008) Synergistic effects of B/N doping on the visible-light photocatalytic activity of mesoporous TiO2. *Angewandte Chemie-International Edition*, 47, 4516-4520.

80. Liu, H., Tan, X. Y., Pang, Z. B., Da Costa, J. C. D., Lu, G. Q. & Liu, S. M. (2008) Novel dual structured mixed conducting ceramic hollow fibre membranes. *Separation and Purification Technology*, 63, 243-247.

81. Liu, H. P., Blakey, I., Conley, W. E., George, G. A., Hill, D. J. T. & Whittaker, A. K. (2008) Application of quantitative structure property relationship to the design of high refractive index 193i resist. *Journal of Micro-Nanolithography Mems and Moems*, 7.

82. Lligadas, G., Rosen, B. M., Bell, C. A., Monteiro, M. J. & Percec, V. (2008) Effect of Cu(0) Particle Size on the Kinetics of SET-LRP in DMSO and Cu-Mediated Radical Polymerization in MeCN at 25 degrees C. *Macromolecules*, 41, 8365-8371.

83. Lligadas, G., Rosen, B. M., Monteiro, M. J. & Percec, V. (2008) Solvent Choice Differentiates SET-LRP and Cu-Mediated Radical Polymerization with Non-First-Order Kinetics. *Macromolecules*, 41, 8360-8364.

84. Lu, H. F., Li, F., Liu, G., Chen, Z. G., Wang, D. W., Fang, H. T., Lu, G. Q., Jiang, Z. H. & Cheng, H. M. (2008) Amorphous TiO2 nanotube arrays for low-temperature oxygen sensors. *Nanotechnology*, 19.

85. Lu, P. D., Wang, F., Zhao, L. J., Li, W. X., Li, X. H., Dong, J. L., Zhang, Y. H. & Lu, G. Q. (2008) Molecular events in deliquescence and efflorescence phase transitions of sodium nitrate particles studied by Fourier transform infrared attenuated total reflection spectroscopy. *Journal of Chemical Physics*, 129.

86. Lu, X., Sun, C. H., Li, F. & Cheng, H. M. (2008) Selected absorption behavior of sulfur on single-walled carbon nanotubes by DFT. *Chemical Physics Letters*, 454, 305-309.

87. Marcon, L., Kozak, D., Battersby, B. J., Chappell, K. J., Fairlie, D. P., Young, P. & Trau, M. (2008) A dual-purpose synthetic colloidal platform for protease mapping: substrate profiling for Dengue and West Nile virus proteases. *Analytical Biochemistry*, 376, 151-153.

88. Middelberg, A. P. J., He, L., Dexter, A. F., Shen, H. H., Holt, S. A. & Thomas, R. K. (2008) The interfacial structure and Young's modulus of peptide films having switchable mechanical properties. *Journal of the Royal Society Interface*, 5, 47-54.

89. Moghaddam, L., Martin, D. J., Halley, P. J. & Fredericks, P. M. (2008) Vibrational spectroscopic studies of laboratory scale polymer melt processing: Application to a thermoplastic polyurethane nanocomposite Vibrational Spectroscopy. Epub ahead of print.

90. Monteiro, M. J., Bazito, F. F. C., Siqueira, L. J. A., Ribeiro, M. C. C. & Torresi, R. M. (2008) Transport coefficients, Raman spectroscopy, and computer simulation of lithium salt solutions in an ionic liquid. *Journal of Physical Chemistry B*, 112, 2102-2109.

91. Moon, C. S., Kim, H. R., Auchterlonie, G., Drennan, J. & Lee, J. H. (2008) Highly sensitive and fast responding CO sensor using SnO2 nanosheets. *Sensors and Actuators B-Chemical*, 131, 556-564.

92. Moran, C. S., Cullen, B., Campbell, J. H. & Golledge, J. (2008) Interaction between Angiotensin II, Osteoprotegerin, and Peroxisome Proliferator-Activated Receptor-gamma in Abdominal Aortic Aneurysm. *Journal of Vascular Research*, Epub ahead of print.

93. Mori, T., Buchanan, R., Ou, D. R., Ye, F., Kobayashi, T., Kim, J. D., Zou, J. & Drennan, J. (2008) Design of nanostructured ceria-based solid electrolytes for development of IT-SOFC. *Journal of Solid State Electrochemistry*, 12, 841-849.

94. Morniroli, J. P., Auchterlonie, G. J., Drennan, J. & Zou, J. (2008) Contribution of electron precession to the study of perovskites displaying small symmetry departures from the ideal cubic ABO(3) perovskite: applications to the LaGaO3 and LSGM perovskites. *Journal of Microscopy-Oxford*, 232, 7-26.

95. Mu, Z., Li, J. J., Du, M. H., Hao, Z. P. & Qiao, S. Z. (2008) Catalytic combustion of benzene on Co/CeO2/SBA-15 and Co/SBA-15 catalysts. *Catalysis Communications*, 9, 1874-1877.

96. Mu, Z., Li, J. J., Hao, Z. P. & Qiao, S. Z. (2008) Direct synthesis of lanthanide-containing SBA-15 under weak acidic conditions and its catalytic study. *Microporous and Mesoporous Materials*, 113, 72-80.

97. Mu, Z., Li, J. J., Tian, H., Hao, Z. P. & Qiao, S. Z. (2008) Synthesis of mesoporous Co/Ce-SBA-15 materials and their catalytic performance in the catalytic oxidation of benzene. *Materials Research Bulletin*, 43, 2599-2606.

98. Mukherji, A., Wang, L. Z., Zou, J., Auchterlonie, G. J. & Lu, G. Q. M. (2008) Facile synthesis and characterization of potassium-doped MnO2 nanowires. *Journal of Nanoscience and Nanotechnology*, 8, 2011-2015.

99. Nielsen, K. L. C., Hill, D. J. T., Watson, K. A., Connell, J. W., Ikeda, S., Kudo, H. & Whittaker, A. K. (2008) The radiation degradation of a nanotube-polyimide nanocomposite. *Polymer Degradation and Stability*, 93, 169-175.

100. Nighswander-Rempel, S. P., Olsen, S., Mahadevan, I. B., Netchev, G., Wilson, B. C., Smith, S. C., Rubinsztein-Dunlop, H. & Meredith, P. (2008) Effect of dimerization on vibrational spectra of eumelanin precursors. *Photochemistry and Photobiology*, 84, 613-619.

101. Olsen, S. & Smith, S. C. (2008) Bond selection in the photoisomerization reaction of anionic green fluorescent protein and kindling fluorescent protein chromophore models. *Journal of the American Chemical Society*, 130, 8677-8689.

102. Ou, D. R., Mori, T., Ye, F., Zou, J., Auchterlonie, G. & Drennan, J. (2008) Oxygen-vacancy ordering in lanthanide-doped ceria: Dopant-type dependence and structure model. *Physical Review B*, 77.

103. Ou, D. R., Mori, T., Ye, F., Zou, J. & Drennan, J. (2008) Comparison between Y-doped ceria and Ho-doped ceria: Electrical conduction and microstructures. *Renewable Energy*, 33, 197-200.

104. Pang, Z. B., Tan, X. Y., Ding, R. G., Gu, Z. & Liu, S. M. (2008) Preparation, characterization and catalytic performance of SrTi0.9Li0.1O3 ultrafine powders. *Ceramics International*, 34, 1805-1810.

105. Park, Y., Doherty, W. & Halley, P. J. (2008) Developing lignin-based resin coatings and composites. *Industrial Crops and Products*, 27, 163-167.

106. Pittman, G. W., Brumbley, S. M., Allsopp, P. G. & O'Neill, S. L. (2008) Assessment of gut bacteria for a paratransgenic approach to control Dermolepida albohirtum larvae. *Applied and Environmental Microbiology*, 74, 4036-4043.

107. Pittman, G. W., Brumbley, S. M., Allsopp, P. G. & O'Neill, S. L. (2008) "Endomicrobia" and other bacteria associated with the hindgut of Dermolepida albohirtum larvae. *Applied and Environmental Microbiology*, 74, 762-767.

108. Quek, L. E. & Nielsen, L. K. (2008) On the Reconstruction of the Mus Musculus Genome-Scale Metabolic Network Model. *Genome Informatics* 2008, 21, 89-100.

109. Rai, B., Grondahl, L. & Trau, M. (2008) Combining chemistry and biology to create colloidally stable bionanohydroxyapatite particles: Toward load-bearing bone applications. *Langmuir*, 24, 7744-7749.

110. Rai, B., Noohom, W., Kithva, P. H., Grondahl, L. & Trau, M. (2008) Bionanohydroxyapatite/poly(3-hydroxybutyrate-co-3-hydroxyvalerate) composites with improved particle dispersion and superior mechanical properties. *Chemistry of Materials*, 20, 2802-2808.

111. Reddy, M. K. R., Xu, Z. P., Lu, G. Q. & Da Costa, J. C. D. (2008) Effect of SOx adsorption on layered double hydroxides for CO2 capture. *Industrial & Engineering Chemistry Research*, 47, 7357-7360.

112. Reddy, M. K. R., Xu, Z. P., Lu, G. Q. & Da Costa, J. C. D. (2008) Influence of water on high-temperature CO2 capture using layered double hydroxide derivatives. *Industrial & Engineering Chemistry Research*, 47, 2630-2635.

113. Renouf, M. A., Wegener, M. K. & Nielsen, L. K. (2008) An environmental life cycle assessment comparing Australian sugarcane with US corn and UK sugar beet as producers of sugars for fermentation. *Biomass & Bioenergy*, 32, 1144-1155.

114. Rintoul, L., Micallef, A. S. & Bottle, S. E. (2008) The vibrational group frequency of the N-O• stretching band of nitroxide stable free radicals. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 70, 713-7.

115. Rondeau, E. & Cooper-White, J. J. (2008) Biopolymer microparticle and nanoparticle formation within a microfluidic device. *Langmuir*, 24, 6937-45.

116. Rowlands, A. S. & Cooper-White, J. J. (2008) Directing phenotype of vascular smooth muscle cells using electrically stimulated conducting polymer. *Biomaterials*, 29, 4510-20.

117. Rowlands, A. S., George, P. A. & Cooper-White, J. J. (2008) Directing osteogenic and myogenic differentiation of MSCs: interplay of stiffness and adhesive ligand presentation. *American Journal of Physiology - Cell Physiology*, 295, C1037-44.

118. Rufford, T. E., Hulicova-Jurcakova, D., Zhu, Z. H. & Lu, G. Q. (2008) Nanoporous carbon electrode from waste coffee beans for high performance supercapacitors. *Electrochemistry Communications*, 10, 1594-1597.

119. Seredych, M., Hulicova-Jurcakova, D., Lu, G. Q. & Bandosz, T. J. (2008) Surface functional groups of carbons and the effects of their chemical character, density and accessibility to ions on electrochemical performance. *Carbon*, 46, 1475-1488.

120. Shen, Q., Li, L. D., Hao, Z. P. & Xu, Z. P. (2008) Highly active and stable bimetallic Ir/Fe-USY catalysts for direct and NO-assisted N2O decomposition. *Applied Catalysis B-Environmental*, 84, 734-741.

121. Si, F., Huang, W., Wang, S., Xu, Z. P., Zhu, Z. & Qiao, S. Z. (2008) Effects of calcination and composition of layered double hydroxide on phosphate adsorption. *International Journal of Chemical Engineering*, 1, 13-25.

122. Sleiman, R. J., Gray, P. P., Mccall, M. N., Codamo, J. & Sunstrom, N. A. S. (2008) Accelerated cell line development using two-color fluorescence activated cell sorting to select highly expressing anti body-producing clones. *Biotechnology and Bioengineering*, 99, 578-587.

123. Song, H., Kim, T. Y., Choi, B. K., Choi, S. J., Nielsen, L. K., Chang, H. N. & Lee, S. Y. (2008) Development of chemically defined medium for *Mannheimia succiniciproducens* based on its genome sequence. *Applied Microbiology and Biotechnology*, 79, 263-272.

124. Sopade, P. A., Halley, P. J., Cichero, J. A. Y., Ward, L. C., Hui, L. S. & Teo, K. H. (2008) Rheological characterisation of food thickeners marketed in Australia in various media for the management of dysphagia. II. Milk as a dispersing medium. *Journal of Food Engineering*, 84, 553-562.

125. Sopade, P. A., Halley, P. J., Cichero, J. A. Y., Ward, L. C., Liu, J. & Varliveli, S. (2008) Rheological characterization of food thickeners marketed in Australia in various media for the management of dysphagia. III. Fruit juice as a dispersing medium. *Journal of Food Engineering*, 86, 604-615.

126. Styan, K. E., Martin, D. J. & Poole-Warren, L. A. (2008) In vitro fibroblast response to polyurethane organosilicate nanocomposites. *Journal of Biomedical Materials Research Part A*, 86A, 571-582.

127. Sun, C. H., Lu, G. Q. & Cheng, H. M. (2008) Standard enthalpies of formation of finite-length (5,5) single-walled carbon nanotube. *Journal of Nanoparticle Research*, 10, 1037-1043.

128. Sun, C. H., Yao, X. D., Du, A. J., Li, L., Smith, S. & Lu, G. Q. (2008) Computational study of methyl derivatives of ammonia borane for hydrogen storage. *Physical Chemistry Chemical Physics*, 10, 6104-6106.

129. Sunarso, J., Chen, C. Y., Wang, L. Z., Costa, R. F. D., Lu, G. Q. & Da Costa, J. C. D. (2008) Characterization of hybrid organic and inorganic functionalised membranes for proton conduction. *Solid State Ionics*, 179, 477-482.

130. Surawski, P. P. T., Battersby, B. J., Lawrie, G. A., Ford, K., Ruhmann, A., Marcon, L., Kozak, D. & Trau, M. (2008) Flow cytometric detection of proteolysis in peptide libraries synthesised on optically encoded supports. *Molecular Biosystems*, 4, 774-778.

131. Suzuki, S., Whittaker, M. R., Wentrup-Byrne, E., Monteiro, M. J. & Grondahl, L. (2008) Adsorption of Well-Defined Fluorine-Containing Polymers onto Poly(tetrafluoroethylene). *Langmuir*, 24, 13075-13083.

132. Takahashi, M., Mori, T., Vinu, A., Ou, D. R., Kobayashi, H. & Drennan, J. (2008) Development of high quality Pt-CeO2 electrodes supported on carbon black for direct methanol fuel cell applications. *Advances in Applied Ceramics*, 107, 57-63.

133. Tan, I., Torley, P. J. & Halley, P. J. (2008) Combined rheological and optical investigation of maize, barley and wheat starch gelatinisation. *Carbohydrate Polymers*, 72, 272-286.

134. Tan, X. Y., Wang, Z. G., Liu, H. & Liu, S. M. (2008) Enhancement of oxygen permeation through La0.6Sr0.4Co0.2Fe0.8O3-delta hollow fibre membranes by surface modifications. *Journal of Membrane Science*, 324, 128-135.

135. Tanksale, A., Beltramini, J. N., Dumesic, J. A. & Lu, G. Q. (2008) Effect of Pt and Pd promoter on Ni supported catalysts - A TPR/TPO/TPD and microcalorimetry study. *Journal of Catalysis*, 258, 366-377.

136. Tran, N. H., Wilson, M. A., Milev, A. S., Bartlett, J. R., Lamb, R. N., Martin, D. & Kannangara, G. S. K. (2009) Photoemission and absorption spectroscopy of carbon nanotube interfacial interaction. *Advances in Colloid and Interface Science*, 145, 23-41.

137. Tran, P., Smith, S., Zhang, H., Xu, Z. P., Wong, Y. Y. & Lu, G. Q. (2008) Molecular dynamic simulations of interactions between LDH and NO3- intercalates in aqueous solution. *Journal of Physics and Chemistry of Solids*, 69, 1044-1047.

138. Tumes, D. J., Wong, A. C. H., Sewell, W. A., Mccoll, S. R., Connolly, A. & Dent, L. A. (2008) Differential rates of apoptosis and recruitment limit eosinophil accumulation in the lungs of asthma-resistant CBA/Ca mice. *Molecular Immunology*, 45, 3609-3617.

139. Urbani, C. N., Bell, C. A., Lonsdale, D., Whittaker, M. R. & Monteiro, M. J. (2008) Self-assembly of amphiphilic polymeric dendrimers synthesized with selective degradable linkages. *Macromolecules*, 41, 76-86.

140. Urbani, C. N., Bell, C. A., Whittaker, M. R. & Monteiro, M. J. (2008) Convergent synthesis of second generation AB-type miktoarm dendrimers using "Click" chemistry catalyzed by copper wire. *Macromolecules*, 41, 1057-1060.

141. Urbani, C. N., Lonsdale, D. E., Bell, C. A., Whittaker, M. R. & Monteiro, M. J. (2008) Divergent synthesis and self-assembly of amphiphilic polymeric dendrons with selective degradable linkages. *Journal of Polymer Science Part a-Polymer Chemistry*, 46, 1533-1547.

142. Vari, F., Munster, D. J., Hsu, J. L., Rossetti, T. R., Mahler, S. M., Gray, P. P., Turtle, C. J., Prue, R. L. & Hart, D. N. J. (2008) Practical blood dendritic cell vaccination for immunotherapy of multiple myeloma. *British Journal of Haematology*, 143, 374-377.

143. Vashi, A. V., Keramidaris, E., Abberton, K. M., Morrison, W. A., Wilson, J. L., O'Connor, A. J., Cooper-White, J. J. & Thompson, E. W. (2008) Adipose differentiation of bone marrow-derived mesenchymal stem cells using Pluronic F-127 hydrogel *in vitro*. *Biomaterials*, 29, 573-9.

144. Walewijk, A., Cooper-White, J. J. & Dunstan, D. E. (2008) Adhesion measurements between alginate gel surfaces via texture analysis. *Food Hydrocolloids*, 22, 91-96.

145. Wang, D. W., Fang, H. T., Li, F., Chen, Z. G., Zhong, Q. S., Lu, G. Q. & Cheng, H. M. (2008) Aligned titania nanotubes as an intercalation anode material for hybrid electrochemical energy storage. *Advanced Functional Materials*, 18, 3787-3793.

146. Wang, D. W., Li, F., Chen, Z. G., Lu, G. Q. & Cheng, H. M. (2008) Synthesis and electrochemical property of boron-doped mesoporous carbon in supercapacitor. *Chemistry of Materials*, 20, 7195-7200.

147. Wang, D. W., Li, F., Liu, M., Lu, G. Q. & Cheng, H. M. (2008) 3D aperiodic hierarchical porous graphitic carbon material for high-rate electrochemical capacitive energy storage. *Angewandte Chemie-International Edition*, 47, 373-376.

148. Wang, D. W., Li, F., Liu, M., Lu, G. Q. & Cheng, H. M. (2008) Mesopore-aspect-ratio dependence of ion transport in rodtype ordered mesoporous carbon. *Journal of Physical Chemistry C*, 112, 9950-9955.

149. Wang, D. W., Li, F., Lu, G. Q. & Cheng, H. M. (2008) Synthesis and dye separation performance of ferromagnetic hierarchical porous carbon. *Carbon*, 46, 1593-1599.

150. Wang, H., He, L., Lensch, M., Gabius, H. J., Fee, C. J. & Middelberg, A. P. (2008) Single-site Cys-substituting mutation of human lectin galectin-2: modulating solubility in recombinant production, reducing long-term aggregation, and enabling site-specific monoPEGylation. *Biomacromolecules*, 9, 3223-30.

151. Wang, X. P., Yu, J. J., Cheng, J., Hao, Z. P. & Xu, Z. P. (2008) High-temperature adsorption of carbon dioxide on mixed oxides derived from hydrotalcite-like compounds. *Environmental Science & Technology*, 42, 614-618.

152. Wang, Y., Qiao, S. & Wang, X. (2008) Electrochemical hydrogen storage properties of ball-milled NdMg12 alloy with Ni powders. *International Journal of Hydrogen Energy*, 33, 1023-1027.

153. Wang, Y., Qiao, S. Z. & Wang, X. (2008) Electrochemical hydrogen storage properties of the ball-milled PrNg(12-x)Ni(x)+150 wt% Ni (x=1 and 2) composites. *International Journal of Hydrogen Energy*, 33, 5066-5072.

154. Wei, H., Hou, G., Zheng, Q., Sun, X., Yao, X., H., G. & Hu, Z. (2008) Study on diffusion in the multicomponent -NiAl phase. *Journal of Physics. Conference Series*, 96.

155. Whittaker, M. R., Urbani, C. N. & Monteiro, M. J. (2008) Synthesis of linear and 4-arm star block copolymers of poly(methyl acrylate-b-solketal acrylate) by SET-LRP at 25 degrees C. *Journal of Polymer Science Part a-Polymer Chemistry*, 46, 6346-6357.

156. Wilson, M. A., Tran, N. H., Milev, A. S., Kannangara, G. S. K., Volk, H. & Lu, G. Q. M. (2008) Nanomaterials in soils. *Geoderma*, 146, 291-302.

157. Xiao, Y., Peng, H., Mao, X., Whittaker, A. & Rawford, R. C. (2008) Novel synthetic bio-mimic polymers for cell delivery. *Frontiers in Materials Science and Technology*, 32, 215-221.

158. Xu, Z. P., Jin, Y. G., Da Costa, J. C. D. & Lu, G. Q. (2008) Zr(HPO4)(2) based organic/inorganic nanohybrids as new proton conductors. *Solid State Ionics*, 178, 1654-1659.

159. Xu, Z. P., Jin, Y. G., Liu, S. M., Hao, Z. P. & Lu, G. Q. (2008) Surface charging of layered double hydroxides during dynamic interactions of anions at the interfaces. *Journal of Colloid and Interface Science*, 326, 522-529.

160. Xu, Z. P., Niebert, M., Porazik, K., Walker, T. L., Cooper, H. M., Middelberg, A. P. J., Gray, P. P., Bartlett, P. F. & Lu, G. Q. (2008) Subcellular compartment targeting of layered double hydroxide nanoparticles. *Journal of Controlled Release*, 130, 86-94.

161. Yan, M., Mori, T., Ye, F., Ou, D. R., Zou, J. & Drennan, J. (2008) Effects of dopant concentration and calcination temperature on the microstructure of Ca-doped ceria nanopowders. *Journal of the European Ceramic Society*, 28, 2709-2716.

162. Yang, H., Han, K. L., Nanbu, S., Nakamura, H., Balint-Kurti, G. G., Zhang, H., Smith, S. C. & Hankel, M. (2008) Quantum dynamical study of the O(D-1) plus HCl reaction employing three electronic state potential energy surfaces. *Journal of Chemical Physics*, 128.

163. Yang, H., Han, K. L., Nanbu, S., Nakamura, H., Balint-Kurti, G. G., Zhang, H., Smith, S. C. & Hankel, M. (2008) Quantum mechanical calculation of energy dependence of OCl/OH product branching ratio and product quantum state distributions for the O(D-1) plus HCl reaction on all three contributing electronic state potential energy surfaces. *Journal of Physical Chemistry A*, 112, 7947-7960.

164. Yang, H. G., Sun, C. H., Qiao, S. Z., Zou, J., Liu, G., Smith, S. C., Cheng, H. M. & Lu, G. Q. (2008) Anatase TiO2 single crystals with a large percentage of reactive facets. *Nature*, 453, 638-U4.

165. Yao, X., Zhu, Z. H., Cheng, H. M. & Lu, G. Q. (2008) Hydrogen diffusion and effect of grain size on hydrogenation kinetics in magnesium hydrides. *Journal of Materials Research*, 23, 336-340.

166. Yao, X. D. & Lu, G. Q. (2008) Magnesium-based materials for hydrogen storage: Recent advances and future perspectives. *Chinese Science Bulletin*, 53, 2421-2431.

167. Ye, F., Mori, T., Ou, D. R., Cormack, A. N., Lewis, R. J. & Drennan, J. (2008) Simulation of ordering in large defect clusters in gadolinium-doped ceria. *Solid State Ionics*, 179, 1962-1967.

168. Ye, F., Mori, T., Ou, D. R., Takahashi, M., Zou, J. & Drennan, J. (2008) Compositional dependence of electrical conductivity of Ce1-xTbxO2-delta (0 <= x <= 1). *Renewable Energy*, 33, 331-335.

169. Ye, F., Mori, T., Ou, D. R., Zou, J., Auchterlonie, G. & Drennan, J. (2008) Compositional and structural characteristics of nano-sized domains in gadolinium-doped ceria. *Solid State Ionics*, 179, 827-831.

170. Ye, F., Mori, T., Ou, D. R., Zou, J. & Drennan, J. (2008) Microstructural characterization of Ce1-xTbxO2-delta (0.60 <= x <= 0.90) sintered samples. *Materials Research Bulletin*, 43, 759-764.

171. Yuan, P., Liu, N., Zhao, L. Z., Zhou, X. F., Zhou, L., Auchterlonie, G. J., Yao, X. D., Drennan, J., Lu, G. Q., Zou, J. & Yu, C. Z. (2008) Solving complex concentric circular mesostructures by using electron tomography. *Angewandte Chemie-International Edition*, 47, 6670-6673.

172. Yuan, P., Yang, S., Wang, H. N., Yu, M. H., Zhou, X. F., Lu, G. Q., Zou, J. & Yu, C. Z. (2008) Structure transition from hexagonal mesostructured rodlike silica to multilamellar vesicles. *Langmuir*, 24, 5038-5043.

173. Zainuddin, Le, T. T., Park, Y., Chirila, T. V., Halley, P. J. & Whittaker, A. K. (2008) The behavior of aged regenerated Bombyx mori silk fibroin solutions studied by H-1 NMR and rheology. *Biomaterials*, 29, 4268-4274.

174. Zeng, P. Y., Ran, R., Zhihao, C. A. H., Zhou, W., Gu, H. X., Shao, Z. P. & Liu, S. M. (2008) Efficient stabilization of cubic perovskite SrCoO3-delta by B-site low concentration scandium doping combined with sol-gel synthesis. *Journal of Alloys and Compounds*, 455, 465-470.

175. Zeng, Q. H., Yu, A. B. & Lu, G. Q. (2008) Multiscale modeling and simulation of polymer nanocomposites. *Progress in Polymer Science*, 33, 191-269.

176. Zhang, H., Hankel, M., Smith, S. C., Nanbu, S. & Nakamura, H. (2008) Quantum calculation of ro-vibrational states: Methodology and DOCl application results. *Journal of Physical Chemistry A*, 112, 4141-4147.

177. Zhang, K., Ge, L., Ran, R., Shao, Z. P. & Liu, S. M. (2008) Synthesis, characterization and evaluation of cation-ordered LnBaCo(2)O(5+delta) as materials of oxygen permeation membranes and cathodes of SOFCs. *Acta Materialia*, 56, 4876-4889.

178. Zhang, L., Qiao, S. Z., Cheng, L. N., Yan, Z. F. & Lu, G. Q. (2008) Fabrication of a magnetic helical mesostructured silica rod. *Nanotechnology*, 19.

179. Zhang, L., Qiao, S. Z., F., Y. Z., Zheng, H. J., Li, L., Ding, R. G. & Lu, G. Q. (2008) CNT's/mesostructured silica core-shell nanowires via interafacial surfactant templating. *Chinese Science Bulletin*, 53, 2104-2108.

180. Zhang, L., Qiao, S. Z., Jin, Y. G., Chen, Z. G., Gu, H. C. & Lu, G. Q. (2008) Magnetic hollow spheres of periodic mesoporous organosilica and Fe3O4 nanocrystals: Fabrication and structure control. *Advanced Materials*, 20, 805-809.

181. Zhang, L., Qiao, S. Z., Jin, Y. G., Cheng, L. N., Yan, Z. F. & Lu, G. Q. (2008) Hydrophobic Functional Group Initiated Helical Mesostructured Silica for Controlled Drug Release. *Advanced Functional Materials*, 18, 3834-3842.

182. Zhang, L., Qiao, S. Z., Jin, Y. G., Yang, H. G., Budihartono, S., Stahr, F., Yan, Z. F., Wang, X. L., Hao, Z. P. & Lu, G. Q. (2008) Fabrication and size-selective bioseparation of magnetic silica nanospheres with highly ordered periodic mesostructure. *Advanced Functional Materials*, 18, 3203-3212.

183. Zhang, L., Yan, Z. F., Qiao, S. Z. & Lu, G. Q. (2008) Facile synthesis of stable mesoporous silica MCM-41 via a dual templating of CMC and CTAB. *Journal of Molecular Catalysis*, 22, 315-319.

184. Zhao, R. X., Torley, P. & Halley, P. J. (2008) Emerging biodegradable materials: starch- and protein-based bio-nanocomposites. *Journal of Materials Science*, 43, 3058-3071.

185. Zhou, C. H. C., Beltramini, J. N., Fan, Y. X. & Lu, G. Q. M. (2008) Chemoselective catalytic conversion of glycerol as a biorenewable source to valuable commodity chemicals. *Chemical Society Reviews*, 37, 527-549.


## BOOK CHAPTERS


1. Brumbley, S. M., Snyman, S. J., Gnanasambandam, A., Joyce, P., Hermann, S. M., Da Silva, J. A. G., Mcqualter, R., Wang, M. L., Egan, B., Patterson, S. M., Albert, H. H. & Moore, P. H. (2008) Sugarcane. in Kole, C. & Hall, T. C. (Eds.) *A Compendium of Transgenic Crop Plants: Sugar, tuber and Fiber Crops 1st ed.* Oxford, UK, Wiley-Blackwell Publishing. .

2. Ding, R. G., Yao, X., Zhu, H., Lu, G. Q. & Yan, F. Z. (2008) Effect of pore structure of activated carbon fibres on H2 adsorption. in Baranowski, B., Zaginaichenko, S., Schur, D., Skorokhod, V. & Veziroglu, A. (Eds.) *Carbon Nanomaterials for Clean Energy Hydrogen Systems*. y ed., Springer.

3. Halley, P. J., Truss, R. W., Markotsis, M. G., Chaleat, C. M., Russo, M., Sargent, A. L., Tan, I. & Sopade, P. A. (2008) A review of biodegradable thermoplastic starch polymers in Celina, M. C. & Assink, R. A. (Eds.) *Polymer Durability and Radiation Effects (ACS Symposium Series)* 978. Oxford University Press.

4. Kendall, M. A. F. (2008) Needle-free ballistic delivery of powdered immunotherapeutics to the skin using supersonic gas flow in Walters, K. A. & Roberts, M. S. (Eds.) *Dermatological and Cosmeceutical Development Absorption, Efficacy and Toxicology*. CRC Press Inc.

5. Kendall, M. A. F. (2008) Biolistic and other needle-free delivery systems in Templeton, N. S. (Ed.) *Gene and Cell Therapy: Therapeutic Mechanisms and Strategies* 3rd Edition ed., CRC press.

6. Kendall, M. A. F. (2008) Needle-free immunotherapeutics delivered to the skin in Atherton, M. A., Collins, M. W. & Dayer, M. J. (Eds.) *Repair and Design of Physiological Systems*. WIT Press.

7. Pattemore, J. A., Trau, M. & Henry, R. J. (2008) Nanotechnology: the future of cost-effective plant genotyping. In Henry R.J (Ed) *Plant genotyping II: SNP technology*, CABI

8. Smart, S. K., Edwards, G. A. & Martin, D. J. (2008) Thermoplastic Polyurethane Nanocomposites, in Thomas, S. & Stephen, R. (Eds.) *Rubber Nanocomposites: Preparation, Properties and Applications*. Wiley.

9. Yao, X., Wu, C. Z., Zhu, Z. H., Cheng, H. M., He, Y. & Lu, G. Q. (2008) Effect of Mn or Zr on hydrogen adsorption in Mg-based nanocomposites. in Baranowski, B. (Ed.) *Carbon Nanomaterials for Clean Energy Hydrogen Systems*. Springer.

10. Yu, A., Gentle, I. R. & Lu, G. Q. (2008) Biocompatible Nanocapsules for Biomacromolecule Encasing. in Wang, X. (Ed.) *Fabrication and bioapplication of functionalized nanomaterials*. Research Signpost.

11. Yu, A., Gentle, I. R. & Lu, G. Q. ( 2008) Preparation and Application of Bio-inspired Colloidal Systems. Nova Science Publishers.


## E1 REFEREED CONFERENCE PAPERS


1. Babic, B., Ghai, R. & Dimitrov, K. (2008) Induced movement of the magnetic beads and DNA-based Dumbbell in a micro fluidic channel. Biomems and Nanotechnology III, *Conference on BioMEMS and Nanotechnology III* Canberra, Australia.

2. Chen, X., Prow, T. W., Crichton, M., Fernando, G. J. & Kendall, M. A. F. (2008) Novel coating of Micro-nanoprojection patches for targeted vaccine delivery to skin. ICONN 2008, *International Conference on Nanoscience and Nanotechnology* Melbourne, Australia IEEE.

3. Jejurikar, A., Lawrie, G. A., Martin, D. J., Grondahl, L. & (2008) Improved Alignate Based Hydrogels for Articular Cartilage Replacement *8th World Biomaterials Conference*. Amsterdam, Netherlands

4. Musumeci, A., Broadhurst, G., Smith, S., Xu, Z. P., Minchin, R. & Martin, D. (2008) Radiolabelled Clay Nanoparticles for Toxicological Investigations *8th World Biomaterials Conference*. Amsterdam, Netherlands.

5. Noohom, W., Jack, K., Martin, D. & Trau, M. (2008) Understanding and Control of Mechanical Properties of HA/PHBV Nanocomposites for Bone Applications *8th World Biomaterials Conference*. Amsterdam, Netherlands.

6. Prow, T., Chen, X., Crichton, M., Tiwari, Y., Gradassi, F., Raphaelli, K., Mahony, D., Fernando, G. J., Roberts, M. S. & Kendall, M. A. F. (2008) Targeted Epidermal Delivery of Vaccines from Coated Micro-Nanoprojection Patches ICONN 2008, *International Conference of Nanoscience and Nanotechnology*. Melbourne, Australia.

7. Velayudhan, S., Riddle, K., Martin, D. J., Poole-Warren, L. A. & Cooper-White, J. J. (2008) Biomechanical Properties of Surgical Mesh Prosthesis Post Implantation: Evaluation by Hystersis Method *8th World Biomaterials Conference*. Amsterdam, The Netherlands


APPENDICES

# AIBN 2008 RESEARCH HIGHER DEGREE STUDENTS' PROJECTS

| Student Name | RHD | Project Title | Principal Advisor |
|---|---|---|---|
| Geety Nabi | PhD | Functional testing of bioengineering virus-inspired nanoparticles for gene therapy | Prof Andrew Whittaker |
| Hui Hui Lee-Wang | PhD | Novel hydrogelators for artificial vitreous | Dr Bronwin Dargaville |
| David Thomson | PhD | CMOS-based nanoelectrodes and serial biobarcodes for systems and proteomics biology | Dr Krassen Dimitrov |
| Li Pin Kao | PhD | The role of mitochondria and redox signalling in human embryonic stem cells | A/Prof Ernst Wolvetang |
| Amirali Popat | PhD | Porous silica-based nanocapsules for targeted and controlled research of biocides | Dr Shizhang Qiao |
| Ryan Harrison | PhD | Surface functionalisation of nanoparticles for siRNA delivery | Dr Zhiping (Gordon) Xu |
| Frances Stahr* | MPhil | Nanoparticle-based delivery of veterinary vaccines targeting bovine viral diarrhoea virus of cattle | Dr Shizhang Qiao |
| Mervyn Wing On Liew | PhD | Rapid response bioprocessing for avian influenza vaccination | Prof Anton Middelberg |
| Atikah Kadri | PhD | Synthesis and characterisation of Mg nanostructures by hard templating for hydrogen storage | Dr Xiangdong Yao |
| Ka-Tai (Terry) Law | PhD | The creation of new binding entities based on the Cpn10 molecular scaffold for therapeutic and diagnostic applications | A/Prof Stephen Mahler |
| Suriana Sabri | PhD | Molecular weight control in microbial hyaluronicacid production | Prof Lars Nielsen |
| Soo Lim | PhD | Phosphor-proteome of E Coli | Prof Lars Nielsen |
| Jenny Vo | PhD | Novel detection for banana viruses | Dr Bronwyn Battersby |
| Ajay Orpe* | MPhil | Mesoporous silica as nanohosts for enzymes | Prof Max Lu |
| Pamela Jaramillo Ferrada | PhD | Tissue engineering of the meniscus using mesenchymal stem cells and biodegradable scaffolds | Prof Justin Cooper-White |
| Holly Corbett | PhD | Micro and nano-patch needle-free vaccine delivery: achieving repeatable dry-coating methods suitable for large volume manufacture | Prof Mark Kendall |
| Nani Wibowo | PhD | The purification of virus-like particle precursor proteins, their self-assembly bioprocessing and application as novel siRNA delivery nanoparticles | Prof Anton Middelberg |
| Tania Rivera Hernandez | PhD | Bioengineering chimeric virus-like particles for mass vaccination | Prof Anton Middelberg |
| Anne Sandstrom | PhD | 3D polymer scaffolds for muscular tissue engineering | Prof Justin Cooper-White |
| Anthony Raphael | PhD | Dry-coating vaccines to micro-nanoprojections for needle-free vaccine delivery to skin | Prof Mark Kendall |
| Xiao Xia Yan | PhD | Mesoporous bioactive glass as composites for bone repair and treatment of bone tumour | Prof Max Lu |
| Kirsten Lawrie | PhD | Development of non-chemically amplified photoresists for EUV lithography | Prof Andrew Whittaker |
| Pearl Lee | PhD | Development of a novel DNA detection and amplification method to be applied in cancer diagnosis | Prof Matt Trau |
| Michael Crichton | PhD | Engineering micro-nanprojection array patches for needle-free vaccine delivery | Prof Mark Kendall |
| David Wang | PhD | Design and synthesis of injectable biodegradable scaffolds for the repair of dental bone | Dr Firas Rasoul |
| Jia (Jeff) Hou | PhD | Limits to expression levels in mammalian cell cultures expressing complex proteins | Prof Peter Gray |
| Stefanie Dietmair | PhD | Design of analytical platform to support metabolic engineering of mammalian cells | Prof Lars Nielsen |
| Kaiyin Hu*‡ | MPhil | Interfacially active and stimuli-responsive pepfactants - a new class of emulsifying agents for manufacturing biocompatible and stable emulsions for drug delivery | Prof Anton Middelberg |
| Hidayatul Zakaria | PhD | Terahertz spectroscopy of mass-manufactured viral vaccines | Prof Anton Middelberg |
| Tao (Michael) Ding | PhD | Computational prediction of biomolecular terahertz spectra | Prof Anton Middelberg |
| Paul Luckman | PhD | Non-cell based and cell-based epithelial membrane mimics | Prof Justin Cooper-White |
| Xuan Truong | PhD | Preparation and properties of controlled polymer hydrogel network | Dr Idriss Blakey |
| Guak-Kim Tan | PhD | Development of tissue-engineered 3D-scaffolds for the pancreatic islet's reconstruction | Prof Justin Cooper-White |
| Chalida Klaysom | PhD | Novel inorganic-organic nanocomposite membranes for electrodialysis application in water recovery | Prof Max Lu |
| Andrew Cameron | PhD | Development of a novel polymer scaffold to encourage differentiation and growth of progenitor cells for hernia repair applications | Prof Justin Cooper-White |
| Jennifer Turner | PhD | Investigation and development of new tissue culture methods that mimic the in vivo microenvironment to aid in research into hernia treatments | Prof Justin Cooper-White |
| Joshua Watts | PhD | Nanostructural semiconducting materials for a new generation of solar cells | Prof Max Lu |
| Anthony Musumeci | PhD | Tailored nanoparticles for nanotoxicologial studies | A/Prof Darren Martin |
| Drew Titmarsh | PhD | Microenvironmental control in coordinating cellular fate processes of stem cells | Prof Justin Cooper-White |
| James Hudson | PhD | The regeneration or restoration of heart muscle tissue using novel approaches | Prof Justin Cooper-White |
| Richard Mills | PhD | The investigation of geometric environment on cell migration, recruitment, differentiation and proliferation | Prof Justin Cooper-White |
| Colin Archer* | MPhil | Metabolic engineering of E Coli | Prof Lars Nielsen |
| Mirjana Dimitrijev | PhD | Microfluidic emulsions using designed peptide surfactants | Prof Anton Middelberg |
| Daisy Irawan† | PhD | Development of 3-dimensional biodegradable elastomer for tissue engineering | Prof Justin Cooper-White |
| Zi (Sophia) Gu | PhD | Control release and effective cellular delivery of anti-restinosis drugs via inorganic LDH nanoparticles | Prof Max Lu |
| Warren Pilbrough | PhD | Evolutionary engineering of improved mammalian host cells for biopharmaceutical production | Prof Peter Gray |
| Yalun Arifin | PhD | Metabolic engineering of peptide production in E coli | Prof Lars Nielsen |
| Lien Chau | PhD | Ex vivo tissue vascularisation | Prof Justin Cooper-White |
| Jane Mooney | PhD | Monocyte/macrophage involvement in the peritoneal foreign body response | Dr Barbara Rolfe |
| Giuseppe Codamo | PhD | Process development and characterisation of transient expression technology in CHO cells | Prof Peter Gray |
| Annie Chen | PhD | Nanotechnology based proteomic biosensors | Prof Matt Trau |
| Jessica Cameron | PhD | Bioactive polymers for wound healing applications | Prof Andrew Whittaker |
| Yunyi Wong | PhD | Layered double hydroxide (LDH) nanoparticle-based nuclei acid delivery carrier | Prof Max Lu |
| Sandy Budi Hartono* | MPhil | Functionalised mesoporous silica for T\trichodermareesei C\cellulase I\immobilisation confirmed | Prof Max Lu |
| Peter Stickler*‡ | MPhil | Factors affecting the differentiation of biotubes | Prof Julie Campbell |
| Oliver Squires | PhD | Production of novel fluorinated contrast agents for magnetic resonance imaging | Prof Andrew Whittaker |
| Daria Lonsdale | PhD | Synthesis of complex polymer architectures for vaccine delivery services | A/Prof Michael Monteiro |
| Wendy Chen | PhD | Effect of gene dose on hyaluronic acid metabolism | Prof Lars Nielsen |
| Esteban Marcellin | PhD | Understanding molecular weight control of hyaluronic acid production in Streptococcus zooepidemicus: a systems approach | Prof Lars Nielsen |
| Katharina Ladewig (nee Porazik) | PhD | Nanoparticles with application in the delivery of DNA to mammalian cell lines for production of recombinant proteins | Prof Max Lu |
| Natalie Connors | PhD | Identification of properties that affect in vitro virus-like particle assembly | Prof Anton Middelberg |
| Kwok Cheung | PhD | Fuel cell optimisation through data integration and model harmonisation | Prof John Drennan |
| Sani Jahnke | PhD | Origin of myofibroblast in cutaneous wound healing and the foreign body response | Dr Barbara Rolfe |
| Ian Aird | PhD | Cytokine immobilisation on microbeads. A novel approach to mimic signalling in the haematopoietic stem cell niche | Prof Lars Nielsen |
| Yap Chuan | PhD | Self-assembly of virus-like particles (VLPs) in cell-free reactor | Prof Anton Middelberg |
| Andrew Rowlands** | PhD | Conducting porous scaffolds for muscle engineering | Prof Justin Cooper-White |
| Wadcharawadee Noohom | PhD | Nano-hydroxyapatite composite scaffolds for tissue engineering | Dr Kevin Jack |
| Kylie Varcoe | PhD | The development of 129 Xenon NMR methods for the study of polymer structure and dynamics | Prof Andrew Whittaker |
| Akshat Tanksale** | PhD | Nanostructured catalysts for hydrogen production by aqueous phase reforming of biomass | Prof Max Lu |

* MPhil Student
** Completed in 2008
† Discontinued in 2008
‡ Changed program in 2008

# OFFICIAL 2008 AIBN SEMINAR SERIES

**Speaker:** Associate Professor Ernst Wolvetang, Australian Institute for Bioengineering and Nanotechnology, The University of Queensland
**Title:** Human embryonic stem cells at AIBN
**Date:** Thursday 28 February 2008

**Speaker:** Mr Sean Meehan, The Australian Stem Cell Centre
**Title:** The Australian Stem Cell Centre: Biotechnology Centre of Excellence
**Date:** Thursday 13 March 2008

**Speaker:** Professor Michael Good, The Queensland Institute of Medical Research, Australia
**Title:** Towards the development of a streptococcal vaccine
**Date:** Thursday 20 March 2008

**Speaker:** Professor Janis Matisons, School of Chemistry, Physics and Earth Sciences, Flinders University, Australia
**Title:** Nanotubes and nanoparticles: Making them work for you
**Date:** Thursday 27 March 2008

**Speaker:** Dr Pascal Silberzan, Physico-Chemistry Unit, Institut Curie, France
**Title:** Biology inspired physics at meso-scales
**Date:** Thursday 3 April 2008

**Speaker:** Professor Kenneth K Wu, National Health Research Institutes, Taiwan
**Title:** Protection of stem cells by COX-2 derived prostaglandins
**Date:** Monday 7 April 2008

**Speaker:** Professor Dietmar W Hutmacher, Institute of Health and Biomedical Innovation, Queensland University of Technology, Australia
**Title:** Using native and denatured collagen nanosurfaces to control the attachment and subsequent mineralisation of primary cells and cell lines
**Date:** Thursday 10 April 2008

**Speaker:** Dr Darren Martin, Australian Institute for Bioengineering and Nanotechnology, The University of Queensland
**Title:** Fifteen years of biomedical polyurethane development – From beaker to body
**Date:** Thursday 17 April 2008

**Speaker:** Dr Dana Andersen, Genentech Inc, USA
**Title:** Challenges in the production of recombinant proteins for therapeutic uses
**Date:** Friday 18 April 2008

**Speaker:** Professor Andrew C Newby, University of Bristol, UK
**Title:** Multiple new targets to inhibit neointima formation
**Date:** Thursday 29 May 2008

**Speaker:** Mr David Millhouse, Millhouse IAG, Australia
**Title:** Venture capital start-ups
**Date:** Thursday 24 July 2008

**Speaker:** Professor Garry Brown, Department of Mechanical and Aerospace Engineering, Princeton University, USA
**Title:** Physics-based engineering
**Date:** Thursday 31 July 2008

**Speaker:** Dr Didier Gigmes, Laboratoire Chimie Provence, Université de Provence, France
**Title:** Highly labile akoxyamines: From the synthesis to applications in nitroxide mediated polymerisation
**Date:** Friday 1 August 2008

**Speaker:** Professor Frank Caruso, Department of Chemical and Biomolecular Engineering, The University of Melbourne, Australia
**Title:** Designing advanced materials for nanomedicine
**Date:** Thursday 14 August 2008

**Speaker:** Professor Min Gu, FOSA, FSPIE, FAIP, FTSE, FAA, Faculty of Engineering and Industrial Science, Swinburne University of Technology, Australia
**Title:** Modern optical microscopy lights bio/nanophotonics
**Date:** Thursday 21 August 2008

**Speaker:** Professor Yoshihito Osada, Hokkaido University and RIKEN, Japan
**Title:** Intelligent gels - Artificial muscles as new bio-machine
**Date:** Thursday 28 August 2008

**Speaker:** Dr Carrie Hillyard, CM Capital, Australia
**Title:** Funding your inventions
**Date:** Thursday 28 August 2008

**Speaker:** Dr Amanda Barnard, School of Chemistry, University of Melbourne, Australia
**Title:** Towards nanoscale phase maps for predicting environmental stability
**Date:** Thursday 11 September 2008

**Speaker:** Professor Mark von Itzstein, Institute for Glycomics, Griffith University, Australia
**Title:** The world of sugars - New insight into disease processes
**Date:** Thursday 18 September 2008

**Speaker:** Professor Zee Upton, Institute of Health and Biomedical Innovation, Queensland University of Technology, Australia
**Title:** New approaches to tackling the "wound care challenge"
**Date:** Thursday 25 September 2008

**Speaker:** Professor Richard Day, University of New South Wales and St Vincent's Hospital, Sydney, Australia
**Title:** Development of novel biopharmaceuticals - Individualising drug therapy
**Date:** Thursday 9 October 2008

**Speaker:** Professor Halina Rubinsztein–Dunlop, School of Physical Sciences, The University of Queensland
**Title:** Engineering and applications of optically driven micro and nano-systems - Optical tweezers and optical micromanipulation at work
**Date:** Thursday 16 October 2008

**Speaker:** Dr Martin Svehla, Cochlear Ltd, Australia
**Title:** Cochlear implants - Challenges and innovation
**Date:** Thursday 23 October 2008

**Speaker:** Professor Istvan Toth, School of Molecular and Microbial Sciences, The University of Queensland, Australia
**Title:** Liposaccharide-based peptide, gene and vaccine delivery systems
**Date:** Thursday 30 October 2008

**Speaker:** Dr Eric J Devor, Integrated DNA Technologies, USA
**Title:** Genomic dark matter: The emergence of small RNAs
**Date:** Thursday 13 November 2008

**Speaker:** Professor Stuart Hazell, Pepfactants Pty Ltd, Australia
**Title:** Pepfactants - The challenge of commercialising a novel technology
**Date:** Thursday 20 November 2008

**Speaker:** Professor Kirill Alexandrov, Joint Appointment, Institute for Molecular Bioscience and Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, Australia
**Title:** Developing new approaches for *in vivo* and *in vitro* protein production
**Date:** Thursday 27 November 2008

**Speaker:** Dr Ute Roessner Australian Centre for Plant Functional Genomics and Metabolomics Australia, School of Botany, The University of Melbourne, Australia
**Title:** GC-MS and LC-MS based metabolomics tools in plant stress research
**Date:** Thursday 27 November 2008

**Speaker:** Professor Steven M Howdle School of Chemistry, University of Nottingham, UK
**Title:** Polymer synthesis and processing in supercritical fluids
**Date:** Thursday 11 December 2008

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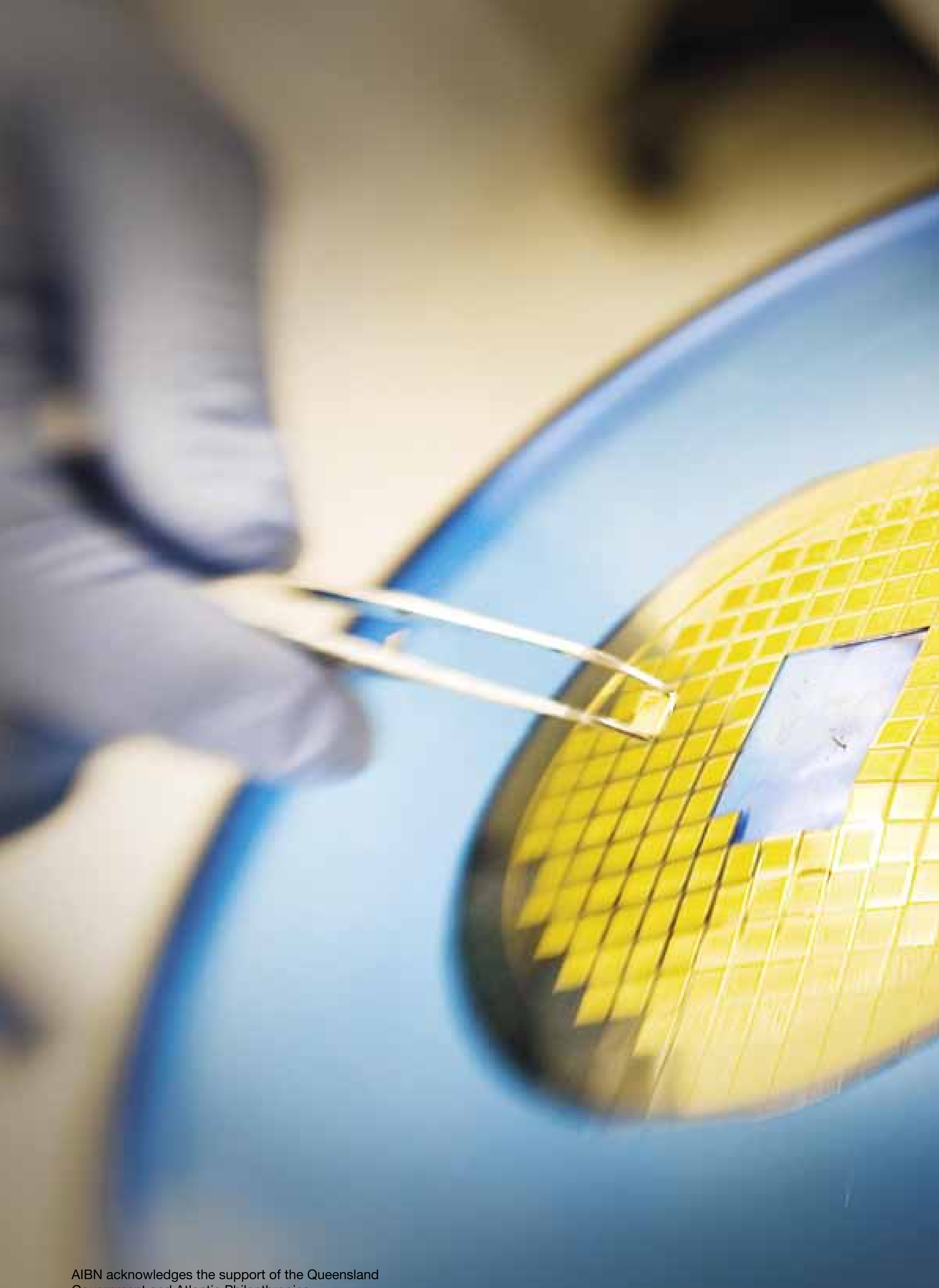

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