Australia’s only fully-integrated research institution bringing together scientists and engineers to solve problems at the nexus of the bio and nano fields.

OFFICIAL LAUNCH
OCTOBER 23, 2006
Overview from the AIBN Director

Successful scientific research in the 21st Century is characterised by three major features: state-of-the-art facilities, the ability to deploy diverse skill sets on scientific problems, and finally, the world’s best minds to understand and solve these problems.

I am pleased to report that not only does AIBN possess all three of these characteristics, but it also has an extra ingredient - a commitment to ensuring the Institute’s research does not remain at the laboratory bench, but is translated into positive outcomes for the whole Australian community.

It is widely accepted that bio and nano technologies will be two of the main drivers of economic growth for the 21st Century. The impact of these new technologies will be felt across a wide range of endeavours, from therapeutic and tissue regeneration products, through to bioinspired consumer products and environmental applications.

Bioengineering builds on our basic understanding of biosystems at the molecular, cellular and tissue levels to develop innovative products and processes. An example of the impact these new discoveries are having is that one out of every four new drugs currently introduced in Europe and the US is biopharmaceutical, a drug developed utilising the new recombinant DNA techniques.

Nanotechnology develops systems with defined structure and function, on the scale of 0.1 to 100 nanometers (about one thousandth of the diameter of a human hair). At the nanoscale, conventional rules governing the behaviour of materials and molecules change, enabling the development of exciting new products, such as membranes to separate carbon dioxide from air to minimise greenhouse gas accumulation.

Of particular interest at AIBN is nanotechnology research linking to the biological interface. Examples of such research include nanoparticles developed to detect early cancer markers in the blood, ‘smart surfaces’ mimicking conditions in the body and encouraging high rates of stem cell production, and the engineering of cells to produce the building blocks for plastics.

The ability to carry out such research has received a major boost with the completion of the AIBN building. It brings together many specialist facilities and provides a research environment that is only equaled at a few other locations internationally.

Of course the best infrastructure cannot solve scientific problems alone, and the AIBN has attracted a dynamic and cohesive group of extremely talented research group leaders, all recognised experts in their respective areas, who are committed to the Institute’s vision and underlying research philosophy.

Individually and collectively, they are attracting major research funding from national and international sources, including strong support from the industry sector, and are being joined by a growing group of highly-credentialed international post-doctoral researchers.

The high-quality, globally-competitive research being carried out in these groups is also attracting some of the brightest young minds in Australia to undertake research higher degree studies which will equip them with the skills and confidence necessary to take their place on the world stage.

At this time I must acknowledge the support and co-operation of our colleagues at The University of Queensland, particularly from the three faculties with which we have major interactions and who are responsible for science engineering and medical teaching and research. I also pay tribute to the vision and efforts of the University’s Vice-Chancellor Professor John Hay, AC, Senior Deputy Vice-Chancellor Professor Paul Greenfield, AO, and Deputy Vice-Chancellor (Research) Professor David Siddle.

Finally I thank the Queensland Government and The Atlantic Philanthropies for their generous financial contributions.

Dr Cooper-White said the project had two parts. The first was to produce viable structural and functional scaffolds capable of providing the growth of mesenchymal stem cells, and differentiate these cells into meniscal tissue using a specially designed bioreactor. Secondly, the team would investigate the way these structures, laden with mesenchymal stem cells, could be incorporated into the body. “The holy grail would be to harvest some recruiting cells from within the meniscus and capable of regenerating meniscus using tailored three-dimensional scaffolds and mesenchymal stem cells (precurors of the meniscus).”

“Elite athletes are not the only people who suffer meniscal damage,” Dr Cooper-White said. “The general wear and tear of normal life can cause damage requiring surgery. “In fact, in any gathering of people, about 50 percent of the group will have a damaged meniscus and some may not have any meniscus in one or both of their knees. “Unlike other body tissues, the meniscus does not repair itself because only a very small part receives blood, which is why surgery is often needed. “While most patients quickly recover from a meniscectomy, long-term issues such as early arthritis of the knee joint are common.”

The high quality, globally competitive, research being carried out in these groups is also attracting some of the brightest young minds in Australia to undertake research higher degree studies which will equip them with the skills and confidence necessary to take their place on the world stage. At this time I must acknowledge the support and co-operation of our colleagues at The University of Queensland, particularly from the three faculties with which we have major interactions and who are responsible for science engineering and medical teaching and research. I also pay tribute to the vision and efforts of the University’s Vice-Chancellor Professor John Hay, AC, Senior Deputy Vice-Chancellor Professor Paul Greenfield, AO, and Deputy Vice-Chancellor (Research) Professor David Siddle.

Finally I thank the Queensland Government and The Atlantic Philanthropies for their generous financial contributions.
Message from the Queensland Premier

The Australian Institute for Bioengineering and Nanotechnology is the latest addition to a research infrastructure being provided by the Queensland Government in partnership with Queensland’s universities to provide a major international biotechnology hub in the Smart State.

The Queensland Government and leading experts at The University of Queensland identified at an early stage the enormous potential of marrying bioengineering with nanotechnology.

The Institute is Australia’s only purpose-built facility for research combining the biological, chemical and physical sciences.

In addition to its research excellence, the Institute has a strong focus on translating and commercialising research outcomes, including a commitment to working with industry on problems.

The Queensland Government contributed $20 million towards the Institute’s $70 million building, which is the first project from the Smart State Research Facility Fund to be completed. It joins a growing number of Smart State initiatives supported at UQ.

We have also contributed $15 million in capital towards the Queensland Nuclear Magnetic Resonance Network, $20 million to the Queensland Brain Institute and $20 million to the Sustainable Minerals Institute, $5 million to the Queensland Institute for Medical Research and $127.5 million over 15 years to the Institute for Molecular and Materials Sciences.

The facility will be completed. It joins a growing number of Smart State initiatives supported at UQ.

I take this opportunity to thank the University for its investment in these projects, thus helping to turn Queensland into the Smart State. I also thank The Atlantic Philanthropies for contributing to the vast majority of these projects. This magnificent philanthropy has been integral to the success of our Smart State strategy.

Our investment in infrastructure and programs at the AIBN will help Queensland maintain its edge as a powerhouse of the knowledge economy and in creating a critical mass of researchers.

Institute researchers work in fields that will contribute significantly to the Australian economy. For example, the Institute has patented and is commercialising, a novel technology to grow neutrophils (a type of white blood cell) to help prevent chemotherapy patients from contracting life-threatening infections.

Institute researchers are also pursuing nanoscaled technologies for a variety of applications including the development of a needle-less syringe for the delivery of vaccines, discovery of biological markers for early cancer diagnosis, and molecules with detergent properties known as surfactants to improve recovery of crude oil from oilfields. They are also part of a team working to produce competitively-priced bio-plastics from sugarcane to provide a new market for the Queensland sugar industry.

Peter Beattie, MP

FOR KNEE CARTILAGE
cavity to differentiate these cells into the various types that make up a healthy meniscus.

“Both of these techniques require many years of research to be successful as we need a thorough understanding of how mesenchymal stem cells interact with scaffolds and how to optimise conditions promoting the cell growth around these scaffolds.”

“The scaffold, while encouraging cell growth, must also degrade at the correct rate so that all that remains is meniscal tissue.”

“We don’t know which approach will be the most effective clinically, and this is why we are investigating the possibility of the artificial environment as well as the insertion method.”

Dr Cooper-White said the research team also needed to be able to grow, or manufacture, the artificial meniscus reliably and quickly, suiting the circumstances of each patient.

Message from the UQ Vice-Chancellor

The Australian Institute for Bioengineering and Nanotechnology is the latest outcome of a highly-successful partnership between The University of Queensland, The Atlantic Philanthropies and the Queensland Government.

The AIBN is a pioneer in one of the most dynamic fields of modern science: research carried out at the intersection of the biological, chemical and physical sciences.

Located at UQ’s St Lucia campus, in a growth hot spot for the national knowledge economy, the AIBN is already attracting group leaders, post-doctoral researchers and students from around the world.

Many of these researchers are part of international collaborations of the highest calibre, with organisations including the Fred Hutchinson Cancer Research Centre in the US, the Chinese Academy of Science, and the European Union.

Research that is socially-relevant and bears practical outcomes will be a defining strength of the AIBN. It will set a standard in transnational research, which transforms laboratory work into products and processes. The presence at the University of UniQuest, a national leader in technology commercialisation, will ensure commercially-viable outcomes of AIBN research are available to industry and the community in an optimal timeframe.

The facility’s completion reasserts that UQ – substantially supported by the Queensland Government and The Atlantic Philanthropies – is building Australia’s finest cluster of new scientific research institutes.

Having opened in recent years the Institute for Molecular Bioscience and the Sustainable Minerals Institute, the University will next year commission the $64 million Queensland Brain Institute.

In coming years, a $60 million UQ Centre for Clinical Research and a $300 million translational medical research facility will also become Brisbane research landmarks. Their addition will mean that, by the end of this decade, more than 1500 scientists will be conducting bio-related research in new UQ facilities. Their output will reward the faith that our funding partners, collaborators and the national and international communities place in excellent research.

Professors John Hay, AC
World-leading nanotech to improve industry

A new process with the potential to revolutionise production methods in the US$1 billion pharmaceutical manufacturing industry has been invented by researchers at the AIBN.

It is also possible this nanotechnology could transform other industries including cosmetics, food processing, mining and oil, as well as waste water treatment.

Known as Pepfactants, the bio-friendly peptide (a small protein) technology can control the emulsions and foams used in a wide range of industrial processes.

Developed by Professor Anton Middelberg and Dr Annette Dexter, details of the technology were published in the prestigious Nature Materials journal.

According to Professor Middelberg, Pepfactants is a disruptive technology with the potential to be used in ways not yet foreseen.

“Emulsions, or mixtures of two immiscible liquids like oil and water, are found just about everywhere from mayonnaise to moisturising creams to products for delivering chemotherapy drugs,” said Professor Middelberg.

“Our process enables the reversible and controllable making and breaking of an emulsion or foam, in an environmentally friendly and sustainable manner. For example, Pepfactants allows for the very quick separation of oil and water as well as the reversible reformation of the emulsion.

“Another application of the technology may be in oil production where water is used to force oil to the surface of a well. Pepfactants would allow the easy separation of the oil/water emulsion on the surface. It would also change the viscosity of the oil to increase the amount of oil extracted from each underground oil reserve.”

Pepfactants has been acknowledged with awards at the TechConnect Summit 2006 in the US, as well as Australia’s leading commercialisation conference, the Commercialisation Expo 2006, and has attracted the interest of several large multinational corporations.

UQ’s main commercialisation arm, UniQuest Pty Ltd, plans to licence the technology into a start-up company and is seeking both investment and strategic product development partners in Australia, Europe and the US.

Managing Director of UniQuest, David Henderson, said the initial target for industry exploitation would be biacatalysis, surfactants and oil and gas cosmetics.

The AIBN is Australia’s first fully-integrated research institute to take a multidisciplinary approach to understanding and exploiting nanosciences, the genetic basis of cell activity and opportunities at the interface between bioengineering and nanotechnology.

UniQuest Pty Ltd is one of Australia’s most highly-regarded university technology transfer groups. The company’s charter is to identify, package and commercialise university technologies and expertise.

Outcome-driven technology

As a generator of new technologies and innovations, AIBN is committed to ensuring promising technologies are commercially developed in order to maximise the return to the Australian community.

In order to successfully achieve this, the AIBN has a strategic relationship with UniQuest Pty Ltd, the University’s major commercialisation organisation which has built an international reputation for research commercialisation excellence and is consistently ranked among the world’s best.

Critical to successful commercialisation, according to AIBN’s Manager of Innovation and Commercial Development Dr Craig Belcher, is a well-structured process to protect and exploit intellectual property through rigorous commercial assessment, patent protection and commercialisation via deal-making and capital raising.

“While all of this takes considerable time and statistically not all opportunities translate into successful outcomes, the AIBN is committed to commercialisation and it is integral to the Institute’s translational research environment,” Dr Belcher said.

“At the same time we want to work with industry to help meet their requirements.”

“The AIBN has expertise and ‘big ticket’ items of equipment to which industry currently lacks access, and through developing industrial relationships we can bring these capabilities to bear on specific industrial problems leading to collaborative or consultative arrangements,” he said.

In order to further build links with industry, the AIBN has established a Commercial Affiliates Program and started developing a network of invited individuals and commercial organisations.

The program aims to raise industry awareness of the AIBN – its intellectual property, capabilities assets and expertise – as well as to provide a commercial touchstone and industry perspective to its technology and market opportunities.

By strategically focussing on both basic research and the development of external ties with industry, the AIBN has both ‘inside-out’ and ‘outside-in’ commercialisation activities,” Dr Belcher said.

“AIBN research excellence coupled with its commercial focus has already resulted in promising opportunities and we are currently in discussions with potential business partners in Queensland, interstate and overseas.”

Challenge puts safety first

 Casting a critical eye over the environmental and human safety of nanotechnology to assist responsible product design is the aim of a new Challenge Project at UQ’s AIBN.

According to team leader Dr Darren Martin (pictured), toxicological evaluation of nanoparticles and nanostuctures does more than fulfil our social responsibility to be aware of the implications of our research. It also advances the field of nanomedicine by providing information about undesirable properties and how to avoid them, and ‘makes good business sense’ in terms of sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“By strategically focussing on both basic research and the development of external ties with industry, the AIBN has both ‘inside-out’ and ‘outside-in’ commercialisation activities,” Dr Belcher said.

“At the same time we want to work with industry to help meet their requirements.”

“The AIBN has expertise and ‘big ticket’ items of equipment to which industry currently lacks access, and through developing industrial relationships we can bring these capabilities to bear on specific industrial problems leading to collaborative or consultative arrangements,” he said.

In order to further build links with industry, the AIBN has established a Commercial Affiliates Program and started developing a network of invited individuals and commercial organisations.

The program aims to raise industry awareness of the AIBN – its intellectual property, capabilities assets and expertise – as well as to provide a commercial touchstone and industry perspective to its technology and market opportunities.

By strategically focussing on both basic research and the development of external ties with industry, the AIBN has both ‘inside-out’ and ‘outside-in’ commercialisation activities,” Dr Belcher said.

“AIBN research excellence coupled with its commercial focus has already resulted in promising opportunities and we are currently in discussions with potential business partners in Queensland, interstate and overseas.”

AIBN selects projects for second phase of challenge project

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

This collaborative project incorporates researchers at the AIBN.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.

The project will study the nanotoxicology of carbon nanotubes, layered double hydroxides and synthetic hectorites to identify potential safety issues, sustainability and safety.

“Research of this nature offers early identification of potential safety issues, providing safer products for the public, but also avoiding development of products that might not be marketable,” Dr Martin said.

“Establishing robust techniques to provide industry and regulators with scientifically valid data may also help to gain industry a competitive edge for bringing new nanoproducts to market,” he said.