New biomed research precinct

Research in the School of Biomedical Sciences has been given a boost, as scientists move into Monash University’s new $140 million biomedical research laboratories.

The laboratories will become part of Monash University’s MBio – one of the largest biomedical science hubs in Australia. The precinct encompasses many research programs, facilities and platforms. Its building provides over 17,000 square metres of space accommodating over 500 scientists. Equipped with the latest facilities, the new buildings position MBio scientists as leaders in biomedical research.

In November, developmental biologists, structural biologists and microbiologists, moved into the buildings leaving behind 1960s laboratories for new labs and the latest equipment fit-outs.

A principal feature of the buildings is its shared interactive core. Specially designed bridges link together three research buildings, which will encourage scientists to further develop interdisciplinary research programs.

The buildings are designed to be eco friendly. Among its ‘green’ features, the buildings will use natural gas instead of electricity where possible to reduce CO2 emissions, have rain water tanks, and materials that are suitable for recycling wherever possible.

“The internal environment has healthier air, low volatile organic compounds. The building is equivalent to a 5-star green rating building for offices. The laboratories are using techniques which are energy efficient,” Project Architect, Christon Batey-Smith, Director DesignInc said.

Last year, the CEO of the NHMRC and former Head of the School of Biomedical Sciences, Professor Warwick Anderson toured the new buildings.

“It’s great to see the commitment that Monash is making to fundamental biological research. It’s a really excellent research team here that’s been recruited over the last few years and these are the facilities they deserve,” Professor Anderson said.

Cancer and Molecular Biosciences researchers are currently occupying the second building. An official opening for the buildings will be held mid-year.
An international research team led by Dr Travis Beddoe and Professor Jamie Rossjohn have uncovered the first example of a bacterium-causing disease in humans by targeting a molecule that is incorporated into our bodies through what we eat.

The research, published in the international journal *Nature*, showed that a potent bacterial toxin, subtilase cytotoxin, specifically targets human cells that have incorporated a sugar called Neu5Gc on their surface.

Dr Travis Beddoe said the finding wasn’t predictable because it was thought that as humans can not make Neu5Gc, they should be resistant to the toxin.

“What we discovered was that the cells actually became vulnerable to attack by the toxin because humans consume foods that have high levels of Neu5Gc, such as red meat and dairy products and the human body ‘expressed’ the sugar on to the surface of cells lining the intestines and blood vessels,” Dr Beddoe said.

“Subtilase cytotoxin is produced by Shiga-toxigenic E. coli, a bacterium which, in humans, causes bloody diarrhoea and the potentially fatal disease haemolytic uraemic syndrome (HUS: Also known as “hamburger disease”). In HUS, toxin-induced damage to the delicate cells lining the blood vessels causes clots, damage to red blood cells and kidney failure.

Humans usually become infected after eating contaminated food.

“This research emphasises the need for people to eat only red meats that are well-cooked and pasteurised dairy products, as these processes destroy contaminating bacteria,” Dr Beddoe said.

Written by Penny Fannin

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**Babies could benefit from a newly discovered kidney gene**

**Stem-cell scientists have identified a gene that could help detect early kidney defects and save the lives of babies.**

Associate Professor Sharon Ricardo and her team have discovered that a gene called a colony stimulating factor 1 (CSF1) stimulates kidney growth in babies and later in life, it also helps to repair and recover kidney function.

“Having involvement in both the development and the repair of the kidney means that this gene has the potential to help unborn babies survive kidney defects or allow premature babies a better start in life,” said Dr Sharon Ricardo, Head of the Stem Cells and Renal Regeneration Group.

Her lab is also working on cell-based therapies, in combination with repair and growth factors, to develop a therapy which could offer alternatives to renal transplants for adults with kidney disease.

Dr Ricardo has been testing the growth and repair factors in mice. Results show that mouse kidney sizes increase by up to 40%.

These promising results have led to the Roslin Institute in Edinburgh to continue pre-clinical trials in both pigs and sheep.

Professor Nick Birrell, Director of the Monash Asia Pacific Centre for Science and Wealth Creation is helping the investors with the commercialisation of their discovery by a major pharmaceutical company.

“If the trials in Edinburgh prove successful then it’s a very good indication that it has the potential to work in humans,” she said.

“We hope that CSF1 can also be used in older people to repair damaged kidneys as a much-needed alternative to transplants.”

If successful, the therapy has major implications for fighting kidney disease – a health issue affecting millions of people world wide. It could mean that people with end-stage renal disease (ESRD) will no longer need to wait for a transplant or be on dialysis. ESRD costs the Australian health care system $670 million dollars a year. The number of Australians with end-stage kidney disease is projected to almost double in the next decade.*

Written by Penny Fannin

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*Kidney Health Australia
Scientists are researching a rare skin thickening condition which may provide a unique and unexpected insight into diseases of the heart and vascular system.

Dr Ian Smyth is part of a group who were awarded an NHMRC grant to study the causes of a genetic skin disease called Harlequin Ichthyosis (HI).

The primary cause of disease is a defect in the protein ABCA12. Together with collaborators Dr Benjamin Kile from WEHI and Dr Dimitri Sviridov from the Baker, the grant will allow Dr Smyth to work towards determining ABCA12’s function and purpose, with the aim of developing therapeutic treatments for HI.

Affected patients often die at birth from respiratory distress, bacterial infections or feeding difficulties. Babies are born with thick, dry ‘armour-like’ skin plaques which severely restrict their movements. With modern medicine, some patients live; however, they are susceptible to infection, dehydration and other long-term health difficulties.

“We hope that by studying this disease that we might develop drugs to help HI sufferers and that we might also gain insights into more common illnesses. Research of rare inherited diseases often provide insight into the fundamental biological processes which make our bodies tick,” said Dr Smyth.

The role of the normal ABCA12 protein is to transport lipids or fats within skin cells. People with a defect in the protein, cannot effectively transport lipids to their correct location, and consequently develop the thick, armour-like skin.

“ABCA12 also seems to play a critical role in regulating cholesterol transport within our cells. Consequently, we are now also investigating the effects ABCA12 may have on the development of cardiovascular disease.”

Dr Smyth is also aiming to establish links with The Wellcome Trust Sanger Institute (WTSI) in Cambridge, one of the worlds leading genome research organisations. He hopes this strategic alliance will allow Monash researchers to identify new models of diseases affecting the skin and other organs.

Dr Ian Smyth

Grant success

Last year the School of Biomedical Sciences was awarded an outstanding total of $17.5 million from the NHMRC for grants commencing in 2009.

The ARC awarded researchers a further $2.3 million. A total of 31 NHMRC and ARC grants were awarded. The total research income for the School was approximately $43 million.

Professors Patrick Sexton, Arthur Christopoulos and Roger Summers were awarded a $6.5 million program grant to investigate the most prominent class of drug targets – G protein-coupled receptors (GPCR), and how these can be used to understand how drugs work, and to develop new drugs.

Other projects included:

- how toxic genes cause gangrene;
- how low levels of oxygen affects the foetal brain; and
- developing novel strategies to combat cardiovascular disease.

Dr Reena Ghildyal

Grant to provide hope for asthma suffers

Funding will help researchers understand why a virus causes severe asthma in some people while others only catch a cold.

The infection of the Rhinovirus (RV) in airways of asthmatic patients is the major cause of virus induced asthma attacks and colds. Although the presence of the virus can cause asthmatics to have severe attacks, others with the infection will only show symptoms of the common cold.

Dr Reena Ghildyal’s grant from the NHMRC is investigating the difference between asthma sufferers and non-sufferers. She is working to understand why some people suffer severe shortness of breath, chest tightness and require hospitalisation, while others merely demonstrate cold symptoms.

In RV, the presence of a protein called 3C allows the virus to grow and spread, causing damage to the chest and airways.

Dr Ghildyal’s research group are focussing on the role of the 3C protein, to determine how it works, with the ultimate aim of reducing the severity of asthma attacks.

“We want to know what makes asthmatics behave so differently when exposed to RV than non asthma sufferers. If we can work out what underlies the difference, we can work on reducing the severity of the attacks,” Dr Ghildyal said.

Dr Ghildyal’s work could also shed light on the common cold.

“Although we are not working directly on the common cold, our research could have implications for it,” she said.

Sixteen people die of asthma related illnesses each week in Australia and over 30% of Australians suffer some form of asthma.

Dr Ghildyal is working in collaboration with Professor David Jans and Associate Professor Bardin (Monash Medical Centre).

Dr Reena Ghildyal
Professor Christina Mitchell was awarded the Sir John Monash Distinguished Professorship in 2008 for her research into how specialist enzymes regulate signalling processes to prevent diseases such as cancer and diabetes, and also for her leadership in biomedical research and research training at Monash University.

The Sir John Monash Distinguished Professorship is awarded to professors of exceptional distinction, who have made an outstanding contribution to their discipline and to Monash University.

Dr Natalie Borg was awarded a 2008 L’Oreal Australia For Women in Science Fellowship and the 2008 Tall Poppy Award for her work on analysing protein crystals with synchrotron light, to understand how our bodies mount a rapid defence when we are attacked by viruses.

“This basic research needs to take place before we can make better drugs and vaccines to treat and prevent viral infections,” she said. The Tall Poppy Award acknowledges her scientific achievements, highlights researchers as role models and encourages interest in their work among school students and the wider community.

Professor Michael Cowley received an Innovation Fellowship by the Victorian Endowment for Science, Knowledge and Innovation (VESKI) in 2008.

The VESKI Innovation Fellowships allow outstanding scientists to undertake research in Victoria for up to five years and receive up to AUD $50,000 per year against matched funding.

Dr Fleur Tynan was awarded the 2008 ASRP Synchrotron Thesis Medal. The award is presented annually to a PhD student who has completed the most outstanding thesis of the past two years in a specified area using any synchrotron light source facility.

Her synchrotron radiation techniques were a major contribution to her thesis.

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Editor and writer Amanda Hamilton
Over the last 10 years, the Monash Department of Biochemistry and Molecular Biology has emerged as one of the leading centres for structural biology in the country. Part of the reason for this has been the migration of talented scientists from throughout the world to the department. As an expert in NMR spectroscopy and X-ray crystallography, Dr Jackie Wilce is one researcher whose arrival at Monash in 2005 has helped build this reputation.

For the last four years, Dr Wilce has worked with her colleague and husband, Associate Professor Matthew Wilce, in building up a research team which examines protein-RNA interactions. Using a number of molecular imaging techniques such as NMR spectroscopy, X-ray crystallography and surface plasmon resonance, Dr Wilce’s lab looks at how specific proteins are precisely shaped to bind with particular RNA nucleotides. Understanding how this protein-RNA interaction functions is important in explaining how cells handle their own RNA and deal with foreign RNA, such as viruses.

After dedicating her first few years at Monash to establishing her research group as an ARC Research Fellow, Dr Wilce has recently taken up an academic appointment. In this new position Dr Wilce is convening the first year Biomedical Science subject “Biomedical Chemistry”. The unit is an introduction to biochemistry metabolism and deals with the chemistry which underlies how energy is generated from fats and carbohydrates in food.

“I love teaching and have long been passionate about molecules. I remember back to my own undergraduate days when I was inspired by the previous generation of lecturers – so it’s nice to have the opportunity to try and give to today’s students the best of what I enjoyed”, says Dr Wilce.

In addition to her teaching duties, Dr Wilce has recently been part of a successful infrastructure bid to the Australian Research Council delivering Monash its first NMR spectrometer. Costing 1.5 million dollars, the high field NMR spectrometer is particularly useful for structural biology as it can determine the structure and function of proteins. Dr Wilce has also recently been awarded an ARC grant to collaborate with cancer researchers in the US developing a new anti-cancer therapeutic.

“Some of the major attractions for coming back to Monash included the great developments in Structural Biology at Monash initiated by researchers like Jamie Rossjohn and James Whisstock, as well as the presence of the Australian Synchrotron just across the way,” says Dr Wilce.

Aside from her work, Dr Wilce is married with five- and eight-year-old boys. For Dr Wilce, however, it is often hard to distinguish between her home life and her work seeing as her husband Associate Professor Matthew Wilce is a close colleague.

“People say, ‘oh, do you ever leave work’, and I admit we’ll often be talking excitedly about our RNA-binding proteins or other projects over dinner, but it’s fantastic really because his expertise is really complementary to mine and two heads are better than one.”

Characterisation of the interaction between the Grb7 adapter protein and a cyclic inhibitor peptide.
In September of last year, Dr Peter Boag was recruited to the Department of Biochemistry and Molecular Biology as a Lecturer. Returning to Australia after seven years at the Harvard Medical School in America, Dr Boag is to head his own research group centred around the experimental model of the *C. elegans* roundworm. In addition to establishing his research lab Dr Boag will be lecturing in the second-year Biomedical Science course.

Dr Boag’s experience with the *C. elegans* experimental model is unique in Australia where the technique has not traditionally been used. Internationally renowned as a powerful research tool due to its simplicity, the *C. elegans* roundworm also has many similarities to more complex systems.

“I think of *C. elegans* as a Model T Ford, all the components and wiring are there and functioning, it just doesn’t look the same as today’s cars. Worms have about twenty thousand genes, humans have probably something like twenty-five to thirty thousand genes. So it’s small but most of the biological pathways in humans are also present in the worm.” Says Dr Boag.

Using *C. elegans*, Dr Boag’s lab focuses on how RNA pathways regulate the production of proteins. In the past RNA has been considered merely an intermediary stage between gene and protein synthesis. However, scientists are now discovering that RNA plays a significant role at multiple levels of gene regulation.

“We’re looking at conserved molecular machines that are involved in reproduction and also non-coding micro RNAs which are increasingly seen as essential for cell regulation and protein production. They’re involved in cancer and normal development, defects in micro RNA pathways can result in catastrophic outcomes.” Says Dr Boag.

In second semester this year, Dr Boag will also be lecturing in the third-year BMS subject, ‘Biomedical Basis of Human Diseases’. This will be Dr Boag’s introduction to undergraduate teaching and in order to prepare himself he will be completing a Dip Ed at Monash University Caulfield. Speaking of his teaching aspirations Dr Boag says;

“My aim is to provide a lecture environment that’s challenging to the students, but also a fun learning experience. An interactive process rather than just a person up the front talking away to themselves.”

Aside from his work, Dr Boag enjoys a working rapport with his partner who heads a research group at the Peter MacCallum Cancer Centre in the city. Having met at Monash University as undergraduates, Dr Boag and his partner have both completed PhD’s in Melbourne and worked together at Harvard Medical School. They have a two and a half year old boy and are expecting their second child mid-year.

“A 4 cell *C. elegans* embryo stained for DNA (white) and important proteins

“My aim is to provide a lecture environment that’s challenging to the students, but also a fun learning experience. An interactive process rather than just a person up the front talking away to themselves.”
First-, second- and third-year biomedical science students who achieved outstanding results (straight HDs) in 2008 were invited to an afternoon tea at Joe’s at the Campus Centre by the Head of School, Professor Christina Mitchell and the Course Convenor, Dr Yvonne Hodgson. Professor Mitchell congratulated the students on their performance, remarking that the school had been very fortunate in attracting such a high calibre of students.

VTAC selection of student for Biomedical Science and Radiography courses

The demand for places in the Biomedical Science course increased this year with 1822 prospective students applying through VTAC to enrol in the course. The clearly-in figure for the Biomedical Science course was 90.5. The clearly-in figures for the double degree programs were 98, 93.3 and 93.05 for the law, science and engineering. The biomedical science course has proved to be a good option for students who wish to work in medical research or those who are unsure about what they want to do but know that they are interested in health and disease.

Other teaching news

Teaching chit chat

Welcome back to Julia Choate. Julia Choate has returned to her position as Lecturer in the Department of Physiology after giving birth to her second son, Nicholas.

Julia will be convening BMS2031 and BND2011 in 2009, so biomedical science and nutrition students will be seeing a lot of Julia.
First paper: Seamus Crowe

For Seamus Crowe, his research efforts in the developing area of obesity research have paid off. The young honours student from the Department of Physiology has published his first paper.

“As an undergraduate student, it was a fantastic experience. I was also paid a wage so I could quit working as a waiter.”

The work behind the Endocrinology article originally began at the University of Melbourne, where Seamus was completing an Arts/Science degree. During the final year of his course, Seamus enrolled in the UROP program, an Undergraduate Research Opportunities Program which allowed him to complete a laboratory research project with working scientists. His supervisor for this project was Associate Professor Matthew Watt who headed a lipid metabolism group at St. Vincent’s Hospital.

“I’d go into St Vincent’s Institute once a week and work on this project,” says Seamus. “As an undergraduate student, it was a fantastic experience. I was also paid a wage so I could quit working as a waiter.”

The project focused on a molecule called CNTF, or ciliary neurotrophic factor, which is released by glial cells in the brain. Originally thought to be a protective agent against nerve cell degradation, CNTF was trialled in mouse models of Huntington’s disease. Here, CNTF was ineffective in neuro protection, but instead caused metabolic effects massive weight loss. Given CNTF’s potential as an anti-obesity drug, Seamus studied its affect in mice fed fatty diets, and compared their body weight with untreated animals.

“What we showed in our paper is that CNTF increases fat oxidation in fatty tissue – and hence weight loss,” he says.

“As a result of these promising findings, this molecule has subsequently been tested in humans. Unfortunately, our immune system neutralises CNTF, so a magical anti-obesity drug continues to elude scientists.”

Undeterred, Seamus persevered with studies in fat metabolism during his honours year, moving to Monash University with his supervisor Associate Professor Watt. Currently, Seamus is writing up his honours thesis.

“I wanted to see what doing research full time rather than just one day a week was like. It’s pretty good but I haven’t worked out whether I’ll do a PhD yet,” he says.

“I might try working for a year and see what that’s like—maybe not as a scientist – (and) get more involved in politics.”