MONASH University
Medicine, Nursing and Health Sciences

Newsletter – Issue 2, 2005

School of Biomedical Sciences

Structural biology

In the two years since its conception the Structural Biology facility in the Department of Biochemistry has become one of the most rapidly expanding centers for scientific research at Monash University. Consisting of three major research groups, under the direction of senior scientists James Whisstock, Jamie Rossjohn and Mathew Wilson the Monash center is currently awaiting the construction of a state of the art synchrotron which will further establish its research capabilities and international reputation.

Focused on the study of molecules at the atomic level Structural Biology is concerned with the three-dimensional arrangement of complex molecules such as proteins. In order to determine this 3D structure, structural biologists use a sophisticated experimental procedure called x-ray crystallography. In this process, a beam of x-rays is passed through a crystalline sample of the protein concerned, creating a diffraction pattern. Based on the spacing and intensity of the diffraction spots scientists can then work back to uncover the original structure of the protein. This is usually done in some sort of particle accelerator, such as a synchrotron, which the Monash structural biologists presently have to go to Chicago to use.

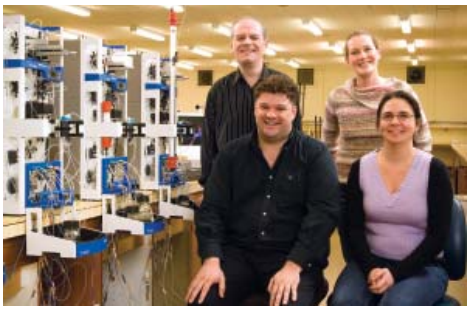
The relationship between protein structure and function is of primary importance to structural biology research. Many human diseases are the product of excessive protein function or dysfunction and one of the aims of structural biologists is to develop structural based therapeutics and drugs to control protein function. Scientists at the Monash Structural Biology facility have recently solved the crystal structure for a tumor suppressing protein called maspin which is involved in metastasis and breast cancer. Such developments are particularly encouraging given the success of a number of anti-cancer and HIV inhibitor drugs currently on the market which are the product of structural biology related findings.

In conjunction with its clinical potential, the fundamental scientific knowledge which structural biology provides is also of great importance. Originating from a physics background, structural biology in its early stages produced a number of Nobel Prize winning researchers. The pioneering structural biologist, William Brag, who was professor of physics at the University of Adelaide, and after whom Brag's Law was named, received the Nobel Prize for his work in x-ray crystallography. During this early stage of its development structural biology was without the aid of modern computing meaning scientists had to rely on the laborious methods of measuring angles and estimating photographic intensities manually. In light of such difficulties the first researchers to actually solve the structure of a protein were rewarded with the Nobel Prize for their ground breaking work. This was Max Perutz and John Kendrew who created models of myoglobin and hemoglobin back in the 1960s.

As a result of such restrictions early structural biology research was relatively isolated from other areas of biochemistry and biology. The heavy dependence on physical and mathematical understanding meant that most structural biologists of the 1960s and 70s were physicists, and not aware of how their research might relate to the field of biology. However, due to the vast development in computer technology over the last 50 years, structural biology in its current state is an accessible and integrated part of the biological sciences.

Today, entry into the field is primarily through an interest in biology and biochemistry, and there are a number of honors and PhD students currently completing theses in structural biology at the Monash center.

If you would like to know more about the structural biology program at Monash visit their web site at:
www.med.monash.edu.au/biochem/staff/rossjohn.html



Clockwise from top right: Mie Larsen, Vicky McCarl, James Whisstock and Nick Sotirells.

Inside this issue

Readers' contributions to this newsletter are welcomed. If you have news you'd like to share with your colleagues, forward a hard copy (marked newsletter) to:

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or email: *biomed@med.monash.edu.au*

Contributions should be no more than 200 words and should relate to the interests of the School of Biomedical Sciences, its students, graduates and staff.

Whilst every effort will be made to run readers' contributions, we reserve the right to evaluate content for suitability, and to edit content where necessary.

Editor: Dr. Yvonne Hodgson
Interviews: Thomas Dillane

My first paper: Dane Parker

In January of this year Dane Parker, a Ph.D. student in the Department of Microbiology, published his first paper in the *Journal of Bacteriology.* The article, which was produced under the supervision of Professor Julian Rood and in conjunction with fellow Monash scientist Ruth Kennan, represents the culmination of three years work in the area of iron regulation in bacteria. Specifically focusing on the bacteria *Dichelobacter nodosus* responsible for the disease footrot in sheep, Dane's research concentrated on a ferric uptake regulator (Fur) protein which is involved in various functions such as iron acquisition, oxidative stress, and virulence. Having devoted the majority of his honours and PhD years to the research Dane was extremely pleased with the publication, which he hopes will be the first of many.

The issue of footrot is a pressing agricultural problem in Australia and abroad as it causes sheep to become lame and lose body weight. The resulting deterioration in the quality of wool and meat is thus a significant economic concern for farmers and consumers alike. The bacteria responsible for the disease, *Dichelobacter nodosus*, infects the sheep hoof and proliferates in the anaerobic environment underneath the skin. It's ability to survive for limited amounts of time in the pasture, as an aero-tolerant anaerobe, and be passed on via carrier animals make it very difficult to isolate and control cases of infection.

Dane's field of research is classified as bacterial pathogenesis and is focused on the factors which enable bacteria to cause disease. The Fur protein which his research is based around was originally discovered while his lab was looking for regulatory proteins in bacteria. In order to work out what Fur's role was in *Dichelobacter nodosus* Dane created a mutant bacterium which lacked the Fur protein. Two-dimensional gels were used to determine whether there were any differences between the mutant and wild type strains of the bacteria, which would be represented by variations in protein levels on the gel. As Dane explains; "theoretically if Fur was doing anything and regulating any genes, differentially expressing proteins at different levels, we would be able to look at the two gels and compare the differing intensities in protein spots." Having observed a number of differences in the gels Dane and his lab used mass spectroscopy to identify what the individual proteins behind the various spots were. Upon comparison with a computer generated protein sequence of the entire genome of *Dichelobacter nodosus* the mass spectroscopy results for the mutant DNA sequence assigned various proteins as being responsible for the footrot condition.

On the subject of his article's publication Dane is very pleased. "I wouldn't say it was necessarily difficult to get the paper published but I suppose it depends on how high your standards are. *Journal of Bacteriology* is a very highly rated microbiology journal, one of the two best international journals in the field. It's sort of the backbone of microbiology I suppose you could say." Having completed the majority of the work for the paper during his PhD Dane is now nearing the completion of his thesis entitled "Regulation and Genomics of *Dichelobacter nodosus*". Once this is submitted he will be continuing for a short period of time at Monash as he oversees the completion of another paper also concentrating on regulation in the footrot bacteria. This will also be done in conjunction with The Institute for Genomic Research in the United States, who Dane collaborated with on the *Journal of Bacteriology* article. Looking towards the future Dane says that he would like to go overseas for a couple of years to work in a different area such as cell biology, but ultimately return to Melbourne and Monash Microbiology.

Our big paper: Tony Tiganis

Over the past two years, Tony Tiganis' research lab in the Department of Biochemistry has been investigating the various processes which control the biological response of inflammation. Attempting to identify the molecular basis by which inflammatory responses may be regulated, the group has been focusing on what they suspect are key proteins involved in inflammatory responses. Throughout the course of this research project Dr. Tiganis and his lab have made a number of findings, the most significant of which being the discovery of the protein **tyrosine phosphatase's** (TCPTP) direct role in regulating the intensity and duration of inflammation. The resulting publication in *Nature Immunology* was amongst the most significant papers the faculty has produced in recent years and a source of great satisfaction for all involved.

Clockwise from top right: Ben Shields, Patricia Bukczynska, Catherine Van Vilet, Christine Sadek and Tony Tiganis.

Research news

Although inflammation is a normal response to infection and injury it can, if left untreated, lead to a number of human diseases such as cancer, diabetes and arthritis. The Tiganis article, which was specifically interested in the molecular processes involved in inflammation, concentrated on the biochemical pathways in mice which were regulated by the **tryosine phosphatase** protein. Although previous studies from overseas laboratories had established a role for TCPTP in 'turning off' inflammation, it was not until the Tiganis lab's experiments that the protein's association with the **tumor necrosis factor** (TNF), which mediates inflammation, was understood. In uncovering this regulatory pathway, the group identified a central protein responsible for actually causing inflammation in response to the TNF. It was based on this knowledge that the Tiganis lab produced their *Nature Immunology* article, which they hope will pave the way for modulating TNF action (inflammation) in disease, in the future.

Despite the success of Dr. Tiganis' lab's experimental findings the actual process of publishing their work proved a significant hurdle. Having sent their initial paper to *Nature Immunology* in November 2004 the journal replied a month later with a review of the article stating that if it were to be published it required a number of major experiments to be conducted in a matter of weeks. Given the competitiveness of this particular journal, which was amongst the top four or five internationally, the Tiganis' lab was eager to secure the prestigious publication. Forced to work at a hectic and relentless pace for the subsequent two weeks the lab was ultimately successful in satisfying the journal's recommendations and obtaining the publication.

Accordingly, Tony Tiganis who was supervisor and last author on the paper is keen to acknowledge the unified and collaborative effort of his lab in producing the article: "My group rose to the challenge and performed as first class scientists to get the job done. It came down to the people who contributed to this study being committed and working around the clock." Considering the success of their research it is no surprise that the lab is presently continuing in this area of protein regulation in inflammation. Now looking at other cell types besides those of the original study, his lab is hopeful of reproducing some of the success of their *Nature Immunology* publication in the future.

Teaching news

Graduate coursework programs offered by the Department of Medical Imaging and Radiation Sciences

The Department of Medical Imaging and Radiation Sciences currently offers three graduate coursework programs. The Master of Radiation Therapy offers a direct pathway for graduates from the Bachelor of Biomedical Sciences, Bachelor of Science or Bachelor of Neuroscience into a clinically oriented profession. The program which commenced in July 2003, comprises six semesters completed over two calendar years. There are currently 32 students in each year of the program who study in Victoria, Tasmania, Queensland and Western Australia. The course has two components – an academic and a clinical element. The academic element enables students to study in a self-directed manner at home with additional support from the electronic study platform MUSO. The clinical element of the course is designed to expose students to practice early on in their studies, thus providing them with the opportunity to contextualise the underpinning principles and develop their technical and patient care skills in keeping with the novice to expert model of clinical skill development. Year 2 of the course is a paid work-based learning year where the students actively contribute to the workforce for a total of 43 weeks whilst completing their final academic units.

In May the program received full accreditation from the Australian Institute of Radiography (AIR). Upon the successful completion of the course graduates can be registered as radiation therapists without the need for additional clinical training.

The Master of Medical Ultrasound is an articulated program comprising a Graduate Certificate, a Graduate Diploma and a Masters in medical ultrasound. The overriding aim of the Graduate Diploma of Medical Ultrasound (GDMU) which commenced in 2001, is to facilitate the graduation of practitioners able to meet the Australian Sonographers Accreditation Registry (ASAR) expectations of an accredited medical sonographer (AMS). The workplace and profession require the GDMU to be accredited by ASAR and, last November the course was re-accredited for another five years. Applicants for the GDMU are generally radiography graduates. The program is offered part time and it is a requirement of the program that participants are actively engaged in clinical ultrasound.

The course is delivered via the 'flexible learning' mode at a national level with students supported by printed and interactive materials (including CDs). Each unit is supported by a one day seminar to bring students and staff together in small group tutorial style

The Graduate Certificate in Medical Ultrasound consists of two core units in physics and anatomy/embryology and two clinical units from the six currently on offer. The Masters requires the completion of the GDMU and two 12 credit point units which includes completion of a clinically oriented investigative project.

Additionally, the department convenes non-award programs in ultrasound training for specialist physicians. Training programs for emergency physicians, obstetricians and gynecologists and renal physicians have been conducted.

Finally, in July the department launched its articulated Master of Radiographic Practice. The program offers radiographers the opportunity to enroll in either a Graduate Certificate or Graduate Diploma and is designed to prepare them to engage in advanced practice in the fields of general radiography and computed tomography.

If you would like to know more about the above courses visit their website: *www.med.monash.edu.au/radiography/*

Teaching news

Open day

Open day was a very busy day for the staff in Biomedical Sciences. Our stall in the foyer of South 1 and the tables in the physiology building were busy giving course advice to prospective students and their parents. The three information sessions held in M3 throughout the day were full to capacity with many students and their parents enquiring about the course and its career outcomes.

New teaching programs in 2006

Next year will be an exciting year for teaching in the School of Biomedical Sciences. We will be starting three new double-degree programs with the Bachelor of Biomedical Science. These programs will add to our current double degree offering with economics and reflect the multidisciplinary interaction of biomedical science with industry. The growth of the biotechnology and health industry sector is providing new job opportunities for graduates with a background in biomedical science. The new double degree programs include law, engineering and science.

High achievers

Prizes and Awards Ceremony

The Prizes and Award Ceremony for academic excellence in 2004 was held on 27 April this year. The dean, Professor Edward Byrne, was in attendance to present the awards. The following students all achieved excellent results in their respective year levels and we congratulate them for their efforts.

Bachelor of Radiography and Medical Imaging

Year 1: **MIA and the Shimadzu Year 1 Highest Aggregate mark in first year** – Kristina Galang

Year 2: **AGFA Scholarship for Digital Imaging** – Heather Scoullar, **Tyco Healthcare Highest Aggregate Prize** – Lija Brutans, **Year 2 Faculty Prize** Lija Brutans

Year 3: **ATL Ultrasound Prize** – Lauren Shaw, **The Toshiba CT Prize** – Su Liew

Year 4: **The Seimens Prize** – Melissa Kindblad, **Mayne Health Prize** – Keith Vanhaltren, **Australian Institute of Radiography (Victoria Branch) Prize** – Melissa Kindblad, **The Royal Australian and New Zeland College of Radiologists Prize** – Jacqueline Barrett

Bachelor of Biomedical Science

Year 1: **Faculty Prize** – Peter Newton, Amy Barrett

Year 2: **Faculty Prize** – Chew-Li Soh, Ana Galevska-Dimitrovska , **Solly Faine Prize, highest mark in infectious diseases in BM2052** – Chew-Li Soh

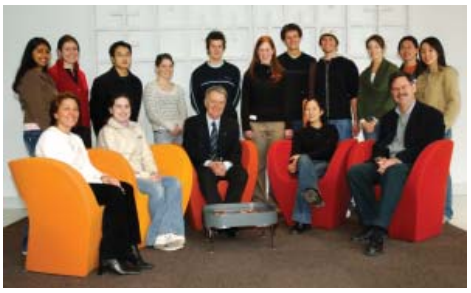
Year 3: **Faculty Prize** – Bree Buszard, Angela Keen

Bachelor of Biomedical Science Honours

Honours Faculty Prize awarded to the top Honours student – Ivan Poon

High Achieving Students in Biomedical Science

First and second year students who achieved outstanding results (straight HDs) in first semester were invited to a lunch held at the STRIP I building with the Head of School, Professor Warwick Anderson and members of staff. The photos show Prof Warwick Anderson with Year 1 and Year 2 students and staff from the lunch for high achievers. High achieveing Year 3 students attended an afternoon tea at Coco Red.



First year high achieving students

Second year high achieving students

Social news

Congratulations to Nigel Stepto – Lecturer in Exercise Physiology – Physiology Department, and his wife, on the birth of their daughter, Matilda Anne Stepto, born Thursday, 15 September 2005. Baby details: weight, 7.3 lbs, length, 51 cm. Mum and bub are doing very well. Photo shows Matilda at 7hrs old...dad's just showing her off.

Welcome back to Julia Choate. Julia returned to her position as lecturer in Physiology in September after taking 12 months maternity leave after the birth of her son, Nicholas. In 2006 Julia will be convening BMS2031, so biomedical science students will be seeing a lot of Julia.

Welcome back to Liz Hartland (convenor of BMS2052). Liz returned to her position as lecturer in Microbiology in July after taking six months maternity leave after the birth of her daughter Laura Elizabeth Hartland van Driel.

Physiology Ball

On 20 July, the Department of Physiology held its annual Ball at the Quatquatta Mansion in Ripponlea. Attended by over a hundred staff and students the event was a very enjoyable night for all involved. Kindly supported by donations from on campus shops; the Monash Bookshop, the Co-op Bookshop, the Monash Hairdressing salon, Cinque lire cafe, and the HQ coffee shop, the night had a number of door prizes and competitions. Head of Department Prof. Warwick Anderson made a speech and announced the King and Queen (James Peirson, Kerry Bowmar), Prince and Princess (Tom Forbes, Beth Allison), and best dressed awards (Jacquline Nathan, Ramesh Rajan) all of which were received in the good humor that surrounded the whole night.