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Science Matters

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Trainer Liliana Balaguera, left, gives some tips to researcher MJ Ong as part of the The Cycle Study.

Cycle study might stop diabetes cycle

A study to see if exercise can help prevent pregnant women from developing gestational diabetes has become very personal for research co-ordinator and PhD candidate MJ Ong.

On the day she turned up for her first session with her principal research supervisor, MJ had her own news for Assistant Professor Kym Guelfi.

She had just found out that she was pregnant and will give birth to her first child less than a year into her PhD.

Her research is part of The Cycle Study, an NHMRC/Telethon/Women and Infants Research Foundation-funded project led by Winthrop Professor John Newnham, Head of the School of Women's and Infants' Health. He and his colleague Adjunct Associate Professor Dorota Doherty are working with academics in the School of Sport Science, Exercise and Health to investigate whether regular exercise can beat the diabetes that some women develop during pregnancy and which can create serious problems for both mother and child into the future.

MJ is co-ordinating the exercise program which involves pregnant women using a stationary bike in their own homes for an hour, three times a week, supervised by a personal trainer.

MJ, an Honours graduate from Sport Science, Exercise and Health, has worked as a fitness instructor and is one of three personal trainers running the program.

"Initially, I was quite sedentary as I was battling morning sickness and extreme tiredness but now that I feel better I do a lot of exercise, which includes working out on a stationary bike," MJ says. "I also do much the same as the women in the study so, being pregnant myself, I have a better understanding of how they feel during the program. There is a difference in your breathing for a start.

"Having a baby and pursuing a doctorate degree is probably not two things you would think of doing together, but I think it helps with my understanding and appreciation of the research volunteers."

Sport Science academics Winthrop Professor Bob Grove, Professor Paul Fournier and Associate Professor Karen Wallman are all involved in the study. Graduates from the School, Liliana Balaguera and Louise Smargiassi, share the personal training with MJ.

Assistant Professor Guelfi explained that gestational diabetes appears in some women around the 26th week of their pregnancy, then disappears at delivery. "The mother then has an increased risk of developing type 2 diabetes and there is up to a 70 per cent chance that any subsequent pregnancies will result in the condition too," she says.

"The babies born to these women are often very big which can complicate the birth process and they too are at a higher risk of developing diabetes later in life, as well as obesity."

She said there was evidence that exercise was helpful for people with type 2 diabetes but the gestational form of the disease is not well-researched.

Women who have developed diabetes during one pregnancy and are now pregnant again are being recruited for the program and begin 14 weeks of training at week 14 of their pregnancies, after being tested for glucose intolerance. A further oral glucose intolerance test will be administered (as it is to all pregnant women) at 28 weeks.

The UWA team is hoping to have 200 women take part in the study over the next few years. Professor Newnham said that if the exercise program worked in preventing gestational diabetes, it would have profound benefits for women, their children and future generations.

Article courtesy of *UWAnews*.

In this issue

A new year, new courses and two new schools

Welcome to the first edition of Science Matters for 2012 and the first joint edition from the Faculty of Life and Physical Sciences and the Faculty of Natural and Agricultural Sciences.

Last year was a very productive year for the Faculties of Science as we geared up for the introduction of UWA's new courses. At the end of the month, we will welcome our first cohort into these courses with a record number of students expected to enrol in majors within the Bachelor of Science. This intake will involve contributions from the Faculties of Science; the Faculty of Engineering, Computing and Mathematics; and the Faculty of Medicine, Dentistry and Health Sciences.

After months of hard work by staff from across both science faculties, the Science Student Office officially opened in September. This one-stop, science shop presents a combined 'Faculties of Science' front and will help us provide better academic and administrative support to our students.

In December the Faculties' hosted the annual STAWA Future Science Conference with over 200 science teachers from around the state attending the one-day event featuring a program of workshops and presentations devoted to cutting edge science. The conference will be held at UWA for the next four years.

We begin 2012 with two new schools: the School of Biomedical, Biomolecular and Chemical Sciences has been disestablished to make way for the new schools of Chemistry and Biochemistry, and Anatomy, Physiology and Human Biology. The School of Chemistry and Biochemistry includes the disciplines of biochemistry and molecular biology, chemistry, and genetics. Neuroscience and physiology are now integrated into the School of Anatomy, Physiology and Human Biology. Microbiology and immunology and infectious diseases have transferred to the School of Pathology and Laboratory Medicine and pharmacy has joined the School of Medicine and Pharmacology (both in the Faculty of Medicine, Dentistry and Health Sciences).

All these changes indicate a busy year ahead. But what isn't likely to change is the quality research and achievements of our colleagues. In 2011 they received many awards and accolades, including **Professor Richard Hobbs** who was named WA Scientist of the Year.

The Faculties' reputation for research excellence was also further recognised with 14 prestigious Australian Research Council Future Fellowships awarded to our staff. The fellowships are awarded to outstanding researchers working in areas of national importance and help provide an incentive for them to conduct their research in Australia.

Several other colleagues have been acknowledged for the quality of their work. **Winthrop Professor Harvey Millar**, a Chief Investigator at the ARC Centre of Excellence in Plant Energy Biology, recently won the 2012 Fenner Medal for distinguished research in biology by a scientist under 40. The Fenner Medal is awarded by the Australian Academy of Science and recognises excellence in several categories including lifelong scientific achievement, outstanding early career researchers and research support.

Students in the Faculties of Science also achieved considerable success. **Nathanael Yates**, a PhD Neuroscience student in the School of Animal Biology, was awarded a United Kingdom Commonwealth Scholarship and Fellowship Plan Split-Site Scholarship, which will cover all fees and living expenses during 12 months' research at St Peter's College, Oxford.

Dean, Faculties of Science, Winthrop Professor Tony O'Donnell.

And in November, recent BSc graduate **Rachel Paterson** was named WA's 2012 Rhodes Scholar. Rachel – who completed majors in Genetics and Biochemistry – will study infection, immunology and translational medicine at Oxford University and hopes to use her research to eradicate killer diseases such as HIV.

We congratulate everyone on their achievements and wish them the best with their work and travels. And we look forward to continuing success in the year ahead.

Richard Hobbs named WA Scientist of the Year

Internationally renowned ecologist Professor Richard Hobbs has been named WA Scientist of the Year for his outstanding contributions in helping preserve key elements of unique West Australian ecosystems.

In a career spanning more than three decades, Professor Hobbs's research has laid the foundations for significant developments in our understanding of the management and conservation of ecosystems and landscapes, as well as managing invasive species and restoring degraded ecosystems.

Professor Hobbs, an Australian Laureate Fellow, completed his PhD on the post-fire dynamics of heathland communities in Scotland. He later undertook postdoctoral research in California investigating serpentine grassland dynamics.

He then joined the CSIRO in Western Australia to work on the dynamics of fragmented ecosystems in the Western Australian wheatbelt. He has continued his ecological research at Murdoch University and, since 2009, at UWA where he leads the Ecosystem Restoration and Intervention Ecology Research Group.

He has several long-term research projects, including a 29-year study of grassland dynamics in California. He and his research team have also recently set up a large-scale project at the UWA Future Farm at Ridgefield examining the effects of species diversity on carbon sequestration and other ecosystem processes.

Agricultural students shine at the Royal Show

Three students from the Faculty of Natural and Agricultural Sciences have made a clean sweep of the regional scholarships awarded by the Australian Council of Agricultural Societies (ACAS) and Coca-Cola.

WA Governor Malcolm McCusker and wife Tonya congratulate UWA's scholarship winners (l-r) Charissa White, Georgia Pugh and Joanna Lang at the Perth Royal Agricultural Show.

The scholarships were won by Charissa Wright, Joanna Lang and Georgia Pugh.

Charissa Wright, from Boyup Brook, has just completed her second year studying a Science degree in Natural Resource Management and has lived on a number of farms.

"My dad works as a farm manager and although our family has moved around a bit, I have always lived on farms and am loving it," she says.

For the past several years her father, Michael Wright, has been managing an 8,000-acre farm with livestock and mixed cropping, which reinforced Charissa's interest in resource management.

Charissa has been a regular volunteer at her local agricultural show – the Upper Blackwood Show – and, after her studies, hopes to commence a career in natural resource management in the region. She spent part of her $2,000 scholarship prize money to attend the WA Natural Resource Management conference last September, and the remainder will help with the costs of her studies.

Joanna Lang, who is about to complete her studies in Agricultural Science and Commerce, grew up on a 6,000-acre wheat and cattle farm near Gingin and although she moved to Claremont to be close to university during her studies, she is a frequent visitor back home to practise her equestrian skills and exercise her horse.

Joanna has been competing in show jumping and stock horse events both in regional agricultural shows and also at the Perth Royal Show for many years. "For as long as I can remember, I have been out and on horseback on the farm, chasing cattle and mucking around. I just love farm-life and being in the country," she says.

Besides pursuing her studies and horse riding, Joanna also works part-time for a grain marketing company, Emerald Group in Subiaco. The company has taken an interest in her studies at UWA and, with their encouragement, Joanna plans to do her honours project next year on the viability of on-farm grain storage in Western Australia.

Joanna plans to spend her scholarship money on a quality laptop, which will be a vital tool for her honours project, and plans to pursue a career as an agronomist.

Georgia Pugh is about to commence her third year studying Agricultural Science and Commerce.

"My family owns a cattle stud at Narrikup, 30km north of Albany, and I am an old hand helping out at the Royal Show where we show our cattle," she explains.

"In this day and age, I think you need to be business-savvy in most jobs, and my course at UWA will develop my business knowledge and at the same time allow me to follow my passion in agriculture," she says.

Georgia's dream job would be to work for a big agricultural company in South America – "they have lots of cattle there" is how she puts it. But for the moment, she is content that her scholarship money will enable her to cut back on her part-time work during semester as a hockey coach at her former high school, St Hilda's.

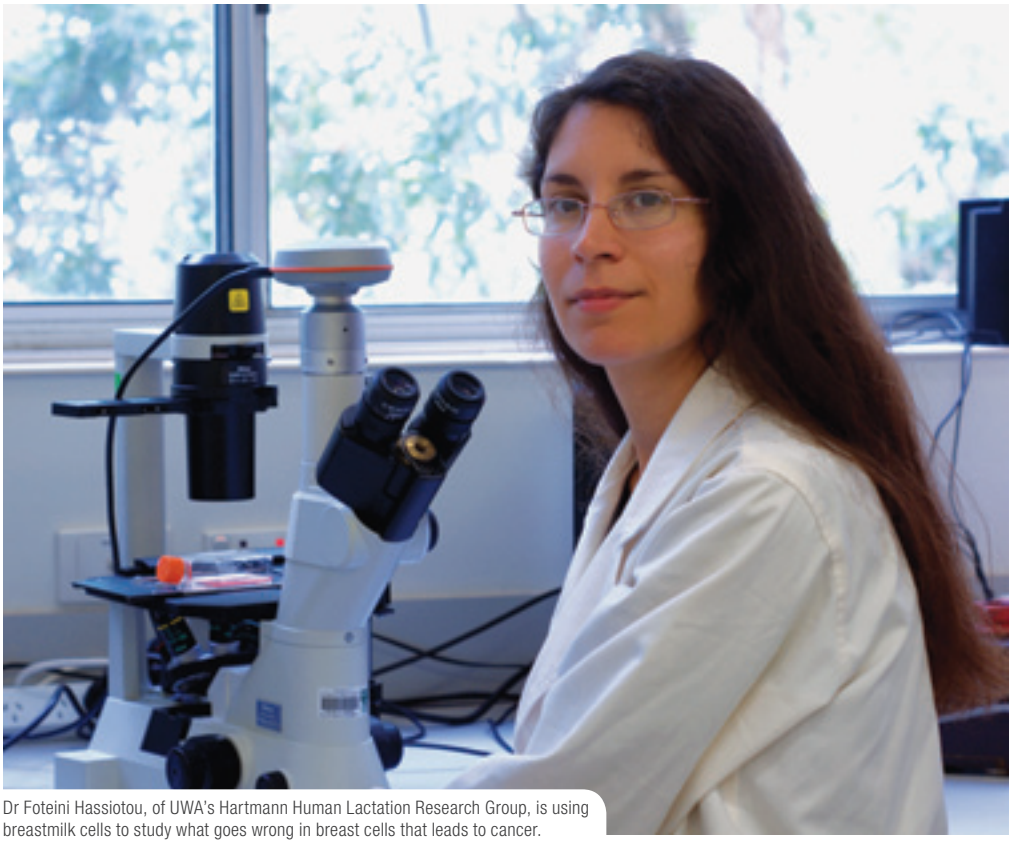
The purpose of the scholarships is to support rural youth to complete their tertiary studies in courses that will benefit regional Australia.

ACAS and Coca-Cola have been supporting Australian students studying in agriculture and related fields for the past five years. Since 2005, almost 200 scholarships to the value of $2,000 each have been given to some of Australia's most talented young people to help them develop careers in agriculture.

"One of the core aims of the Royal Agricultural Society (RAS) is education," says Martin Molony, the society's CEO, "and these scholarships help foster a passion for agriculture and encourage the next generation's ambitions and visions for agriculture – and this in turn will ensure that the industry will remain in capable hands."

Stem cells in breastmilk: new discoveries hold great promise

Breastmilk is well known for its unique biochemical components that provide nutritional, immunological and developmental benefits to the breastfed baby. What's not so well known is that in addition to biochemical factors, breastmilk contains maternal cells.

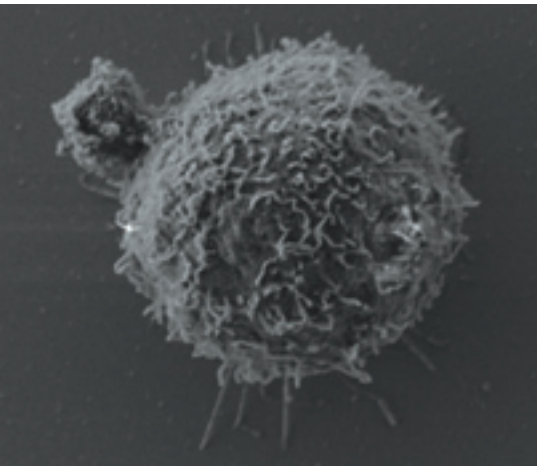


Dr Foteini Hassiotou, of UWA's Hartmann Human Lactation Research Group, is using breastmilk cells to study what goes wrong in breast cells that leads to cancer.

The UWA Hartmann Human Lactation Research Group (HHLR Group) revealed in 2007 that some of these cells display stem cell properties. More recent research by the group is now demonstrating that breastmilk stem cells display the two hallmarks of stemness: they can self-renew and differentiate towards various cell types.

HHLR Group member Dr Foteini Hassiotou has been characterising the different cell populations present in breastmilk obtained from breastfeeding women at various stages of lactation, from month one to the third year of lactation and beyond. She has identified distinct cell sub-populations in breastmilk, revealing an organised cellular hierarchy which reflects that of the human lactating breast.

Dr Hassiotou's goal has been to examine the properties of breastmilk stem cells in order to demonstrate their function in the lactating breast and in the breastfed baby. Initially, she showed that when breastmilk cells are grown in a breast-like microenvironment in the culture dish, they form alveolar and ductal structures similar to those of the lactating breast.



While the above was more or less expected since these cells originate from the breast, an exciting new discovery followed: breastmilk stem cells could also be turned into other cell types, such as bone cells, joint cells, liver and pancreatic beta cells, and neurons, in organ-specific microenvironments. The leader of the HHLR Group and Dr Hassiotou's advisor, Winthrop Professor Peter Hartmann, said: "We've always known that breastmilk is a very interesting fluid, but we had not really realised just how interesting it is."

These properties of breastmilk stem cells to turn into all these different cell types open new avenues for potential stem cell-based therapies. Since breastmilk is plentiful and can be obtained ethically using non-invasive methods, it may provide an innovative source of stem cells that could potentially be used to treat life-threatening diseases. For instance, Dr Hassiotou's advisor Professor Luis Filgueira says there is great promise for these cells to be used in therapies for diabetes.

In addition, breastmilk cells provide a new physiological model to study breast cancer. Dr Hassiotou, in collaboration with the Blancafort Breast Cancer Research Group of the University of North Carolina, has commenced experiments that use breastmilk cells as a model to study what goes wrong in breast cells that leads to cancer, hoping to identify potential causative factors that could lead to innovative medical interventions.

The presence of these cells in breastmilk has generated many questions. Among those is what the potential role of these cells is for the breastfed baby. Initially, it was believed that breastmilk cells would be digested in the baby's digestive tract. However, ground-breaking studies in 2000 showed that in animal models immune cells from breastmilk pass unharmed through the intestinal mucosa into the blood circulation. The stem cell team of the HHLR group has hypothesised that in a similar way stem cells from breastmilk can enter the baby's blood circulation, contributing to tissue regeneration and development early in life.

The scientists are now trying to understand what these cells do in the body and are conducting a series of animal transplantation experiments to further understand the regenerative capacity and differentiation potential of the breastmilk stem cells, and elucidate their role for breastfed babies.

UWA's DNA sequencer set to make its mark in fighting crop diseases

Imagine capturing the entire human genome in a single day, for a few thousand dollars.

Now, researchers at UWA will be able to do just that, with the launch of its first Hi-Seq Illumina Deep Sequencer, the most powerful platform worldwide for next-generation sequencing.

In a single day of use, this new technology will allow researchers to obtain the sequence equivalent of the entire human genome project which, a decade ago, took four billion dollars and 10 years to complete.

To put that in perspective, it would take a person typing 60 words per minute, eight hours a day, some 50 years to type the three billion letters, or base pairs, that make up the human genome.

Deep sequencers provide powerful information by reading every base pair of DNA that makes up an organism, and sorting this data into meaningful genetic maps. Using this information, researchers are making incredible breakthroughs as they discover the genes responsible for diseases in plants and animals, find new species and map our evolutionary past.

Hayden Walker and Dr Estelle Giraud with the new deep sequencer.

"A genome sequence is the ultimate genetic map," says Professor Jim Whelan.

"The availability of this technology opens up the sequencing field to ecologists, evolutionary biologists, environmental scientists and a variety of cellular and genetic disciplines.

"We are no longer tied to just studying model species such as mice or the model plant *Arabidopsis thaliana*. It develops our potential to cheaply sequence individuals in a population, varieties, mutants or clones in a variety of organisms, and study how they respond to the environment under WA conditions.

"This will greatly increase our ability to fight disease and to breed a variety of crop species for desired traits, such as increased drought, heat, pest or salinity tolerance, thus allowing producers to respond to environmental change or disease in a rapid manner."

Ostriches bed down for UWA sleep researchers. (Photo: gallofoto/Shutterstock.com)

Sleeping ostriches provide eye-opening insights for researchers

Academia is a small world and just how small was brought home to Professor Shane Maloney from the School of Anatomy, Physiology and Human Biology two years ago. He has always enjoyed working in South Africa, having spent three years as a post-doc at the University of the Witwatersrand in Johannesburg in the early 1990s, where he did some work on temperature regulation in ostriches.

In February 2008, his colleagues at Witwatersrand asked him if he would help a team from the Max Planck Institute for Ornithology undertake a study in South Africa on sleep in ostriches. At about the same time, he received an email from a Canadian named John Lesku wanting to do a post-doc in comparative physiology at UWA.

After two or three weeks and several emails going each way, it became clear that John was one of the researchers from Max Planck wanting to work on ostriches, but John wasn't aware that Shane was part of the Witwatersrand team. The outcome of those emails and a field trip to the African bush has been a paper in the prestigious online science journal PLoS One and a UWA Post-doctoral fellowship for Dr John Lesku, beginning in 2012. John will work with Shane, as well as Professor Peter Eastwood in the new Centre for Sleep Science, and Professor Don Robertson in the Neurophysiology lab.

John is interested in the evolution of sleep, a curious state in which every animal engages despite the inherent vulnerability of sleeping. There are lots of theories, but no consensus, on why we sleep. Since sleep states don't fossilise, John wants to use a comparative approach to look at sleep in different groups of living animals to see how it has changed in evolutionary time.

Most mammals engage in two types of sleep, slow wave sleep (SWS) and rapid eye movement (REM) sleep.

The most basal (or "ancient") group of living mammals – the egg-laying monotremes – engage in a REM sleep state that combines aspects of SWS (large, slow brainwaves) and REM sleep (rapid eye movements and reduced muscle tone). Whether this reflects an early stage in the evolution of mammalian sleep or a derived feature of monotreme biology is unclear.

Interestingly, birds are the only non-mammals to engage in SWS and REM sleep.

To determine the significance of the mixed state of monotremes, John and Shane conducted the first electrophysiologically-based study of sleep in the ostrich, a member of the most basal group of birds, the Palaeognathae.

They found that ostriches engage in unequivocal SWS; however, their REM sleep, reminiscent of monotremes, combined aspects of REM sleep and SWS. This observation suggests that the pattern of brain activity that characterises REM sleep in more derived mammals, including humans, is an evolutionary new feature of sleep that may support new sleep functions not found in more "ancient" animals.

John will use his post-doc to study sleep in the wild in other "old" mammals and birds, including monotremes and emus.

Timor-Leste to benefit from Marcal's crop research

(l-r) Emeritus Professor Alan Robson, former Vice-Chancellor, with crop researcher Dr Marcal Gusmao, principal supervisor Erik Veneklaas and Dean of the GRS Dean, Alan Dench.

A researcher working on a legume crop that is drought-tolerant and can cope with waterlogging is hoping his work will lead to better outcomes in his home country of Timor-Leste.

Dr Marcal Gusmao is UWA's first PhD graduate from Timor-Leste and will use the knowledge gained at UWA to continue working on improving crop yields and training agricultural science graduates in the tiny country located some 650 kilometres north-west of Darwin.

His doctorate in agricultural science will enable him to pass on methods of improving crop yields to his students at the National University of Timor-Leste, where he is also working for a United Nations development program on climate change.

Timor-Leste is among the world's 10 poorest countries. Almost half its population relies on subsistence agriculture and goes through a two- or three-month "hunger season" every year between one harvest and the next.

Dr Gusmao's research involved assessing grass pea which, unlike other legumes, produces a respectable seed yield under stress. He has presented his findings at international food legumes conferences in Turkey and Syria, thanks to funding from the Australian Centre of International Agricultural Research (ACIAR) and a UWA Postgraduate Research Travel Award.

Dr Gusmao enrolled at UWA after meeting UWA's Institute of Agriculture (IOA) Director, Winthrop Professor Kadambot Siddique, in Timor-Leste in 2006. Professor Siddique encouraged him to apply for a John Allwright Fellowship from the Australian Centre for International Agricultural Research (ACIAR).

UWA is also involved in a major program to alleviate hunger in Timor-Leste. The Seeds of Life III program – a collaboration between ACIAR, AusAID, UWA, and the Timor-Leste Ministry of Agriculture and Fisheries – aims to increase production of Timor-Leste's staple food crops.

"Dr Gusmao has every reason to be very proud of himself," says Professor Siddique.

"There is no doubt in my mind he will make a valuable contribution to achieving food security in Timor-Leste and will serve as an inspiration to other bright students in his country to choose agricultural studies as a career path which is rewarding on both a personal and national level."

Sport science stude at national conferenc

Prize winning postgrad … Angela Spence, left, prepares to put a sport science study participant through his paces on the treadmill.

Postgraduate students Angela Spence and Marcus Lee from the School of Sport Science, Exercise and Health received awards at the 2011 Australian Conference of Science and Medicine in Sport (ACSMS) held in Fremantle in October.

Angela, who is in the final year of her studies majoring in cardiovascular and exercise physiology, was awarded the Asics Best Paper in Exercise and Sports Science. She will use the award to travel overseas for conferences. Angela presented a study on how the heart adapts to different types of exercise training by applying state-of-the-art MRI technology to track changes in heart structure.

"It's thought that different types of exercise cause different patterns of growth of the heart muscle," Angela says.

"However, previous studies have used older technology (such as echo-cardiography) with limited resolution so we have attempted to overcome this limitation by using the best technology available, which is MRI.

"Also, the majority of past research has compared athletes to non-athletes, which often does not take other factors into consideration, such as differences in body size.

nts excel ce

"We trained normal, healthy young males for six months using either a running or weightlifting program and found that those in the running group had an increase in the myocardial mass and volume of the left ventricle, which is a normal physiological adaptation to exercise and makes the heart more efficient at pumping blood around the body.

"This type of adaptation is also seen in highly trained athletes, although to a greater extent as they have undergone years of intense training.

"What was very interesting is that we did not observe an adaptation in the subjects undergoing the weightlifting training. It was once thought that heavy weight training may cause a negative adaptation to the heart but our findings suggest that this negative adaptation doesn't seem to occur."

Marcus was awarded the prestigious NSW Sporting Injuries Award for Best New Investigator in Injury Prevention. As part of the award, Marcus is invited to attend and present at the annual American College of Sports Medicine conference in San Francisco in June.

"The aim of my PhD was to investigate sidestepping performed in a more 'game-realistic' visual environment to better understand the link between the visual-perceptual and motor components of sidestepping and how that may influence anterior cruciate ligament (ACL) injury risk," Marcus says.

Marcus presented his results and those of his co-authors, Asst/Professor Brendan Lay, Assoc/Professor Jacqueline Alderson, Research Assoc/Professor Paul Bourke and Winthrop Professor David Lloyd detailing the application of 3D integrated stereoscopic system during evasive sidestepping, which has ramifications for potentially reducing the occurrence of ACL injuries.

His findings suggest that visual-perceptual cueing and stimuli realism affect sidestepping mechanics, and highlight the importance for injury prevention interventions or investigations to consider both the visual-perceptual and motor components of sidestepping.

"It is a great privilege to win this award and I look forward to showcasing the great work we do here at UWA with a wider international audience," Marcus said.

Muza's movie-making skills bring science to life

Lights, camera, science! … students from Malawi demonstrate their camera skills as part of Muza Gondwe's research combining science and cinema.

Basketball, fireworks, kung fu, Batman, coffee and Aboriginal culture have all helped to give Year 7 students at Maylands Peninsula Primary School a new insight to science.

The students worked with Science Communication PhD student, Muza Gondwe, to learn how to film, edit, and share stories about their cultures and their understanding of science.

> 'He really enjoyed this. [He] could not stop talking about this project when he came home. It's his first time to make a film. He has never used a camera or thought about science in this way.'
>
> Student's mother during the screening of a film produced as part of Muza's project

Through her project, Muza is raising awareness of the multicultural roots of science and engaging a wide range of students in science through filmmaking.

Her filmmaking program runs over three weeks during which students learn camera skills, editing and storyboarding. At the end of the program, students are awarded certificates at a screening of their films.

Muza's research with three groups of students from Port Hedland, Malawi and Maylands suggests that filmmaking offers an enjoyable opportunity for students to showcase their culture as well as enable them to research and explore science.

The project is one of three being conducted by PhD students involved in the Science Education Enrichment (SEE) Project, an ARC Linkage Project that involves partners from UWA, Curtin University, the Gravity Discovery Centre (GDC) and the Graham "Polly" Farmer Foundation.

Researchers in the SEE Project are investigating the effectiveness of specialised science enrichment programs delivered through the GDC in influencing students' attitudes to science, learning and engagement. They are also surveying teachers about their confidence and self-efficacy before and after excursions to the GDC.

The GDC is located 80 km north of Perth in Gingin. It is an informal science learning centre that focuses on modern physics, astronomy and biodiversity.

The GDC's cosmology gallery offers a unique space in which students can engage in discussions about science and culture. The gallery houses multicultural artwork that depicts the beliefs of Hindu, Christian, Indigenous and Islamic faiths; astronomical photographs; and a timeline presenting the scientific story of the creation of the universe.

Researchers brush up on moon dust data

Photo: NASA SS16-114-18423

Apollo moon dust gives up its secrets … Honours student Monique Hollick is working on the moon dust data collected by Adjunct Professor Brian O'Brien.

Researchers in the School of Physics have been gaining new insights into lunar exploration, thanks to data collected during the Apollo Moon voyages more than 40 years ago.

Honours student and champion athlete Monique Hollick has been working with Adjunct Professor Brian J. O'Brien examining data on the potentially hazardous dust and radiation effects of the Moon.

A new era began in 1969 when Neil Armstrong and Buzz Aldrin on Apollo 11 became the first humans to set foot on another celestial body. The six manned Apollo missions to and from the Moon between July 1969 and December 1972 gave the world new insights to our nearest neighbour but also raised many questions.

During those voyages, astronauts deployed self-powered active scientific observatories, whose experiments measured the lunar environment until 1977, transmitting digital data to Earth for recording and analyses.

The UWA team's data came from matchbox-sized Dust Detector Experiments (DDEs) invented by Professor O'Brien on 12 January, 1966 and deployed by Apollo 11, 12, 14 and 15. Even now, those dust experiments are still the only direct active measurements of the number one environmental problem for Apollo astronauts on the Moon: the sticky, abrasive, powdery dust which is easily disturbed but then inescapable.

Monique has been fascinated by space from a young age and began research on the dust experiments this year for her Physics Honours thesis, in collaboration with Prof. O'Brien and UWA Senior Lecturer Ron Burman. Their studies of digital data from the solar cells of the DDEs are the most comprehensive analyses of the combined long-term effects of dust and radiation on solar cells on the Moon to date, and provide the groundwork for more future investigations into dust itself.

The research requires frequent communication with international scientists to piece together information and findings, both historical and recent, from various projects in space and in laboratories.

"As a Science and Engineering student, the research has been invaluable," says Monique. "It required and helped me develop a wide range of professional skills in data analyses, report writing and communication, and provides opportunities to be involved in a stimulating, unique project requiring research in many disciplines."

Monique is planning to complete her degree in 2012 while continuing the analysis of DDE and related data with Professor O'Brien.

Thoroughly investigating the 40-year-old data is seen as necessary because no such direct experiments of the lunar surface have been performed since the Apollo flights.

Astronomers eye SKA opportunities

Top astronomers and engineers from nine countries met in Perth in early September to plan for pre-construction of the Square Kilometre Array (SKA) at *The Path to SKA-low* workshop.

Hosted by the International Centre for Radio Astronomy Research (ICRAR), the workshop attracted more than 75 researchers from Australia, India, Italy, Malta, New Zealand, the Netherlands, South Africa, the UK and the US.

ICRAR Deputy Director and workshop organiser, Professor Peter Hall, said the workshop looked at the design and construction of antennas to allow the SKA to detect low-frequency radio waves from objects throughout the universe (SKA-low).

Professor Hall said with new technology and signal processing techniques, flashing radio sources – called pulsars – and other fast, "transient" radio sources could be better detected using lower frequency radio telescopes.

"This makes SKA-low an even more essential part of the SKA as a whole," he said.

"A major goal of SKA-low is to observe the first structures in the very distant universe as they formed. ICRAR researchers have also recently shown the importance of SKA-low in observations of the changing, or dynamic, radio sky."

Australia, together with New Zealand, is bidding to host the SKA, which requires an extremely radio-quiet location.

"SKA-low will be particularly sensitive to radio interference and a location such as Australia's candidate core site, in WA's Murchison, will allow a high-performance, cost-effective SKA-low," adds Professor Hall.

The General Director of ASTRON in the Netherlands and the chairman of the SKA Science and Engineering Committee, Professor Michael Garrett, said he hoped ICRAR would play a leading role in the SKA-low pre-construction phase.

"It is essential that the knowledge and expertise built up via the Murchison Widefield Array finds its way back into the international SKA project," Professor Garrett said.

"SKA-low will address Nobel-prize winning science questions about the early universe, and I'm convinced it will emerge as one of the dominant areas of astrophysical research over the next few decades. It's great to see ICRAR, and indeed the Australian community as a whole, getting behind these efforts and becoming so heavily involved."

Eye on the sky … Professors Michael Garratt (ASTRON), Peter Hall (ICRAR), Professor Jeanette Hacket (Curtin University), Peter Quinn (ICRAR) and Phil Diamond (CSIRO) at the Path to SKA-low conference.

The sky's the limit for users of theSkyNet

Lord Mayor Lisa Scaffidi; Science Minister John Day and Chief Scientist Lyn Beazley (on couch, l-r) join students from Ardross Primary School and others at the launch of theSkyNet.

Thanks to a new initiative called theSkyNet, you don't need a supercomputer to help collect data for the next generation of radio telescopes.

This ambitious citizen science project uses a global network of privately owned computers to process astronomical data arriving from galaxies, stars and other distant objects located across the universe.

WA's Science and Innovation Minister, John Day, launched theSkyNet in September 2011.

The project soon attracted almost 20,000 hits to theSkyNet.org website, and nearly 3,000 members in the first day. A few weeks later, the website surpassed 100,000 hits and 5,000 members.

Members sign up and donate their spare computing power to theSkyNet, an activity which is not only rewarding, it's also fun. Members receive "credits" for processing data and donating time on their computer, which earns them trophies they can share with their networks through Facebook. Users participate in the project as individuals but can also form or join alliances to help process data as a group.

There are also some very real-world rewards on offer, with the most attractive being the opportunity to visit the Murchison Radio-astronomy Observatory in the Mid-West of Western Australia. This remote and radio-quiet site is home to several next generation radio telescopes and is earmarked as the potential site for the proposed Square Kilometre Array.

With support from the WA State Government, theSkyNet is an initiative of the International Centre for Radio Astronomy Research (ICRAR), a joint venture of Curtin University and The University of Western Australia.

According to ICRAR's Outreach and Education Manager, Pete Wheeler, the project aims to involve people in the discovery process while also raising awareness of radio astronomy and providing a real resource that astronomers can use to advance our understanding of the universe.

"This is a very exciting project for us as it's a unique opportunity to bring our research and public outreach activities together and get the public involved in science," he said.

"We were hopeful that the name of the project would generate interest, but the level of interest and uptake we experienced so soon after launch was beyond our wildest expectations."

So far, theSkyNet has been using data collected by the Parkes radio telescope in New South Wales to refine the system and demonstrate that the results produced by theSkyNet are scientifically useful and accurate.

Next, theSkyNet will use a reprocessed version of this data to create a new catalogue of radio galaxies before moving on to larger data sets in preparation for the enormous volumes of information that will flow once telescopes such as the CSIRO's Australian SKA Pathfinder come online in the next couple of years.

ICRAR Director, Professor Peter Quinn, said: "Radio astronomy is a data intensive activity and as we design, develop and switch on the next generation of radio telescopes, the supercomputing resources processing this deluge of data will be in increasingly high demand."

At any one time, around 4,000 machines around the world are online and contributing to theSkyNet. On average, the network is performing one million processing tasks per day, placing theSkyNet on par with a supercomputer with between 15 and 20 TFlops of computing power. The cost to build a single supercomputer with this sort of capacity is currently around $1.5 million.

Rather than the cost and years of planning needed to build and run such a machine, theSkyNet runs with only minimal cost and has appeared virtually overnight. Using the power of the Internet to connect people to the excitement of scientific discovery makes cost effective, efficient and environmentally sensible use of readily available computing resources that might otherwise be wasted.

This type of community computing is especially useful when the time taken to process the data is not an issue. Rather than using valuable supercomputing time in facilities such as the iVEC Pawsey Centre in Perth, data that can be processed in "slow time" can be off-loaded to a distributed network like theSkyNet.

"The key to theSkyNet is having lots of computers connected, with each contributing only a little, but the sum of those computers can achieve a lot," Professor Quinn said.

For further information and to sign up, visit theSkyNet website at **theSkyNet.org**

Ryan takes shark science to remote WA high schools

Lots of teenagers dream of a career in science – doctor, vet and marine biologist are often high on the list – but many consider it out of their reach.

Ryan Kempster just might be able to help them realise those dreams.

Ryan has been invited to join UWA's Travelling Scientist Program, which takes inspiring young PhD students to remote and regional WA high schools, to encourage the students to consider a career in science.

Travelling scientists explain their research in a fun and engaging way, talk about how they became a scientist, and essentially open up new study and career options that students may never have considered.

"We'll be talking about what we do as scientists but also how we got there in the first place," says Ryan, who studies marine neurobiology — in particular, the sensory system of sharks — at UWA's Oceans Institute and the School of Animal Biology.

"It's good for kids to know that it doesn't always have to be a linear path into a career – you can change your mind and explore lots of different areas along the way."

Ryan originally wanted to be a vet, he says, but now loves his work as a shark biologist and has even set up a popular shark conservation group, Support Our Sharks.

The Travelling Scientist Program was established by UWA's SPICE program and Science Futures Foundation in late 2009.

Associate Professor Jan Dook, who coordinates the program, says it's about inspiring kids to think about their options.

Shark show and tell … Oceans Institute researcher Ryan Kempster, holding a young Port Jackson shark, will be visiting schools as part of UWA's Travelling Scientist Program.

"Kids in the metropolitan area have easy access to events at the university, listening to talks and career advice," she says. "Kids in remote and regional areas don't have that.

"So we ask young, dynamic scientists to tell their own story, to get kids to consider something they probably have never thought about before."

Ryan proved his skills as a science communicator in 2011 when he claimed both top prize ($3,000) and the people's choice award ($500) in UWA's Three Minute Thesis competition.

Ryan went on to compete in the international 3MT in late September, held at UWA's Octagon Theatre. He won his way into the final round, finishing in the Top 11 out of 42 speakers from Australia, New Zealand and Fiji.

Ryan will make his first trip to WA high schools as a Travelling Scientist early this year.

Slimy trick … the hagfish or 'snot eel' emits noxious slime to ward off predators.

Slime proves to be a lifesaver for hagfish

A new study has found the primitive hagfish, also known as a "snot eel", can defend itself by releasing a noxious slime that chokes would-be predators.

The long, thin hagfish are almost blind and have no jaws but use tooth-like rasps to prey on dead and dying fish. Fossil records suggest hagfish have evolved for some 500 million years.

Researchers from The University of Western Australia, New Zealand's national museum Te Papa and Massey University in Auckland recorded underwater footage which reveals – for the first time – the hagfish repelling sharks and bony fish using its gooey defence mechanism. The study was published in *Scientific Reports*.

"As soon as it is attacked, the hagfish releases a mucus-like substance from a battery of slime glands, which makes predators gag before quickly retreating," says Associate Professor Euan Harvey from the UWA Oceans Institute and the School of Plant Biology.

Year 7 students tackle the time warp that's trapped science education

Eminent physicists ranging from Euclid to Einstein and from Alexander Ross to Stephen Hawking made appearances at the School of Physics recently, thanks to the acting abilities of Year 7 students from Rosalie Primary School.

The 11- and 12-year-olds performed a play, *Free Float*, which reinforced the ideas of time and space that they had been learning about from Winthrop Professor David Blair over the preceding six weeks.

The performance was hugely enjoyed by Physics staff and other guests. The play was the culmination of a pilot study by the Science Education Enrichment (SEE) Project, the ARC-funded project examining the effectiveness of science education enrichment programs, in partnership with the Gravity Discovery Centre and the Graham "Polly" Farmer Foundation.

Professor Blair believes that science education is caught in a time warp.

"It has its origins in the ancient Greek mathematician Euclid, whose writings became the most influential book in the history of science," he said. "It has been in print for more than 2,000 years and was a basic school text for Galileo, Newton, Einstein and for most people of my generation.

"Newtonian physics is founded on Euclidean geometry. But Einstein's theory of gravity suggests that Euclid's geometry was fundamentally flawed. Space is not flat as Euclid assumed and his geometry is simply wrong.

"Today's physicists and astronomers deal with 'curved' space every day – even our GPS navigators must allow for the warped space time around the Earth.

"The general belief is that Einstein's physics is too difficult to teach in school. Most people who go on to be teachers maintain the Newtonian mindset – and so we remain in a Euclidean time warp."

So Professor Blair – whose son Julian is in the Rosalie class – and his SEE partners, Winthrop Professor Grady Venville and Associate Professor Nancy Longnecker, set out to discover whether primary school students could come to grips with modern physics.

"I asked them if they thought they were too young to understand this stuff and they said 'no'," Professor Blair said.

Professor Venville said the students easily grasped some of the ideas. "They learnt to think about space time, and they learnt to appreciate that falling from a tower and floating in a space station are really the same thing," she said. "The astonishing thing was that the students were not very surprised."

Free Float covered the history of notions of gravity from Euclid to Newton to Einstein. More recent physicists who featured included Professor Alexander Ross, who founded UWA's School of Physics and who led the historic Wallal Downs expedition in 1922 that confirmed the curvature of space around the Sun. The children asked and answered questions about space, time and gravity with humour and even included a short rap performance by "Einstein".

Professor Venville praised Professor Blair for his contributions.

"I can't speak highly enough of David," she said. "He worked closely with the children, using lots of analogies to which they related. He is a fabulous interpreter of science."

Food and fibre shortages provide food for thought

Helena Stoakley, of Great Southern Grammar, and Jeff Medcalf, of North Albany SHS, taking part in the PICSE session.

Twenty seven teachers from around Western Australia and a scholarship teacher from South Australia attended the annual Primary Industry Centre for Science Education (PICSE) Teacher Professional Development event last November with the theme being "The Science of Food and Fibre Security".

Winthrop Professor Wallace Cowling opened the session and stressed the importance of educating young people to ensure that future generations can solve the problems of food and fibre shortages given the world's rapidly growing population.

PICSE is the largest outreach program within the Faculty of Natural and Agricultural Sciences at UWA. Each year, it works with more than 3,000 teachers and students to promote primary industries through science education.

The main goal of PICSE is to fill the growing labour shortages in primary industries by providing students and teachers with up-to-date knowledge, cutting-edge research and the promotion of career opportunities in these fields.

This year's PD was a jam-packed, two-day event with activities and presentations from UWA researchers and industry organisations such as the Department of Agriculture and Food WA and CBH Grains. Each session was designed to provide teachers with interesting information that could be taken back to the classroom.

Following the first day's sessions, the teachers went to Mosmans Restaurant for a night of networking and a fantastic locally-grown menu. The teachers were joined by Rob Delane, DAFWA's Director General, who spoke of the great work PICSE is doing regarding food and fibre security as well as the important role that teachers play.

PICSE is a national program that started in Tasmania in 2001. The UWA activity centre was formed two years later and the number of students and teachers participating is growing each year.

Global soil project for schools takes root

A global school science project is helping students not only become better scientists but also making them more aware of how the ground beneath their feet can be affected by climate change.

The Monitoring Soil Science Project is a soil science teaching resource which aims to increase awareness of the importance of soil among students, teachers and other interest groups and create an international network of soil science enthusiasts.

Participating teachers study samples as part of the global Monitoring Soil Science Project.

The project was initiated by WA's Chief Scientist Professor Lyn Beazley, staff of the SPICE Program at The University of Western Australia and the Vice Dean of UWA's Faculty of Natural and Agricultural Sciences, Winthrop Professor Lyn Abbott.

One of the aims of the project is to illustrate the importance of soils in the environment and in the climate change debate.

"The Monitoring Soil Science Project has been designed to become an ongoing global soil science project for schools, with the same or different students participating from year to year," says Professor Abbott.

"With time, comparative information will become available and schools may communicate with each other about their findings. They could, for example, compare the biodiversity of soil fauna in different parts of the globe or in relation to climate, soil type and land use and in this process develop an understanding how their soils differ."

While it was designed primarily for high school students, it has information suitable for students of all ages. The project brings soil scientists into the classroom as mentors to science teachers.

On-going partnerships between schools and local farming organisations (such as grower groups) can also be based around this soil science project for school students.

Each school can monitor their soil research site for such things as:

- the abundance and ratio of mites and springtails;
- soil pH and electrical conductivity (soil salinity); and
- soil bulk density, soil moisture content and organic matter content.

Students can then upload their data to the Monitoring Soil Science project website (at **soils.duit.uwa.edu.au/index.php**) which will connect students, scientists and soil science enthusiasts across the world.

The project was piloted with the help of students and staff at Duncraig Senior High School, Gilmore College, Newman Senior High School, Perth Modern School, Shenton College, Newton Moore Senior High School in Bunbury, and Rossmoyne Senior High School.

The website was developed with financial assistance from the International Union of Soil Sciences.

The SPICE team within the Centre for Learning Technology at the University has been instrumental in developing the Monitoring Soil Science Project, in particular: Bob Fitzpatrick, Dr Jan Dook, Jenny Gull and Dr Helen Billiald. Deborah Lin, a PhD student in soil science at The University of Western Australia, assisted with developing the website and as the soil science mentor for the pilot with Rossmoyne Senior High School.

Many others contributed to the development of the project including Associate Professor Adrianne Kinnear, and Peter McCafferty of the Natural Resources Chemistry Laboratory at the ChemCentre. As well as those contributions, the Australian Society for Soil Science (WA) provided a start-up kit and soil science books to the schools participating in the pilot of the project.

Where are they now?

Patrick Hollingworth

Manager, RPS Group (Environmental Consulting)

BSc (majoring in Geography) Hons (Ocean and Coastal Management), UWA

I am currently working for RPS Environmental Consulting, a London-based multinational company which specialises in the fields of energy, planning and the environment. I manage a team of marine scientists and we focus on gaining environmental and planning approvals for marine and coastal infrastructure projects in Western Australia.

After I graduated from UWA I moved to Sydney, where I gained experience working as a consultant in the construction waste industry. Upon returning to Perth I worked in the Environmental Unit of the Department for Planning and Infrastructure, before commencing my employment at RPS, where I have worked for the past 10 years.

My most satisfying moment to date was summiting Mount Everest in 2010. Although not related to my career as an environmental consultant, it has subsequently enabled me to focus on new avenues for my career, focusing on running a business examining leadership and teamwork skills and how they can be best used within the workplace.

If you would like to be featured in an upcoming Science Matters please contact jenni.wallis@uwa.edu.au or chris.hale@uwa.edu.au

Contact us

We welcome contributions, photos, feedback and anecdotes. Please send to jenni.wallis@uwa.edu.au or chris.hale@uwa.edu.au

An online version of Science Matters is available at **science.uwa.edu.au/news/science-matters**

Science in the community
To keep up to date with the latest science events happening at UWA visit **science.uwa.edu.au/calendar-2012**

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