



BIOLOGY News



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ECOLOGIST WINS NSW SCIENTIST OF THE YEAR FOR BIOLOGY

Professor Chris Dickman has been named NSW Scientist of the Year in “Plant and Animal Sciences” for dedicated investigation into threats faced by NSW wildlife and achieving practical conservation outcomes.

Professor Dickman is the second scientist from the School of Biological Sciences to win the “Plant and Animal Sciences” category of the NSW Scientist of the Year Award in the competition’s three-year history. Professor Steve Simpson won the category in 2009 for his research into locust swarming and nutrition.

The prestigious title is awarded by the NSW Office of Science and Medical Research to recognise “high calibre research that brings benefits to the state’s economy, environment and people,” said Jodi McKay, NSW Minister for Science and Research, who named the winners at an award ceremony on 15 September.

Professor Dickman said he was humbled and proud to win the award. “I was stunned to get the news about this award. There are many outstanding life scientists working in New South Wales, so even being considered for an award of this kind is a great honour.”

Professor Dickman, who holds a personal Chair in Terrestrial Ecology and is Director of the Institute of Wildlife Research, has conducted long-term research into the factors influencing the distribution and abundance of land animals. Using this understanding of ecology, he has taken a holistic approach in developing environmental management plans to protect threatened species and maintain biodiversity in NSW.

For example, with colleagues, he is pioneering novel methods to

recover native species using competitive replacement (using native rats to reduce populations of introduced rats around Sydney Harbour) and top predators (using dingoes to mitigate the damaging effect of feral animals on native populations in western NSW).

He was instrumental in completing the first baseline survey of the status of vertebrate animals and other biota in NSW, and in listing the key threats that they face. In seeking to combat these threats and recover biodiversity, he showed that restricting land clearing would conserve 1.4 million native mammals a year and developed innovative tools to identify native species and places where they risk depredation by red foxes and feral cats.

Professor Dickman said that while NSW wildlife faced many threats, there is still hope for achieving conservation goals. “Like many parts of Australia, the terrestrial environment of NSW has been changed and degraded over the last two centuries, and this has had dramatic and negative effects on the native biota. But many pockets of biodiversity remain, and one of the great things about being an ecologist is that you get the opportunity to investigate the factors that promote biodiversity and explore ways that we can best protect it.

“I am indebted to my friends and colleagues in the School and elsewhere for their support over many years, and for providing an environment in which stimulating research can be carried out. The award is really one that we all share.”

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WEDNESDAY 20 OCTOBER 2010

LIZARDS IN AN EVOLUTIONARY TREE PRESENTED BY MURRAY LECTURER PROFESSOR JONATHAN LOSOS

Celebrate the International Year of Biodiversity, with a lecture that showcases the extraordinary variety of lizards on earth.

FRIDAY 29 OCTOBER 2010

BIOLOGY ALUMNI COCKTAIL PARTY

Join us to meet and network with alumni, revisit staff members of the School and enjoy drinks and canapés on the much-loved Botany Lawn.



HEADSPACE

I look forward to welcoming you to our 3rd Biology Alumni Cocktail Party, 29 October on the Botany Lawn.

It is a great chance to catch up with old friends and make new ones with a shared interest in biology. This year we will honour and celebrate the achievements of Professor Charles Birch who passed away at the end of last year. Professor Birch, Challis Professor of Biology for 25 years, has left a lasting legacy in the field of ecology. As part of this celebration, we invite you to contribute to our online tribute at sydney.edu.au/science/biology/alumni/back_to_birch with your reflections or images of Professor Birch.

You are also welcome to join us on 20 October for the free public Murray lecture by the Harvard evolutionary biologist, Professor Jonathan Losos. His lecture, "Lizards in an Evolutionary Tree", marks the International Year of Biodiversity. Please visit our website for more details and to register for both of these events.

The School has recently welcomed Professor Mats Olsson who joined us from the University Wollongong on an ARC Professorial Fellowship. Professor Olsson uses reptilian and amphibian model systems to address questions in evolutionary ecology and genetics. Coupled with our existing strengths, this appointment gives us formidable expertise in herpetology. I am also delighted that Assoc Professor Peter Banks, a conservation biologist who has a number of research projects on wildlife within Sydney metropolitan area, has accepted an offer to join our staff early in 2011.

Members of the School have received a number of accolades in the past months. As Professor Chris Dickman and his colleagues marked 20 years of continuous research in the Simpson Desert, he was named the 2010 NSW Plant and Animal Scientist of the Year. Dr Min Chen and colleagues generated substantial interest worldwide following their *Science* paper describing their discovery of a new chlorophyll, the first in 67 years. Finally, Professor Lord Robert May, Baron of Oxford, at the request of the Vice Chancellor conducted a review of the School of Biological Sciences. His report was glowing about the research strengths of our school.

Regular readers will be aware that over the past couple of years that the School has been part of bids to obtain government funding for a major development on Science Rd at the Ross St entrance to house Biology and Agriculture. Unfortunately, these bids have not been successful. However, the first step in development of this site is about to take place – demolition of the Ross St Building is underway to make way for a green space!

Enjoy this newsletter and don't forget our two October Alumni events– the Murray lecture by Jonathan Losos followed by drinks on 20th and the Cocktail Party on 29th.

With warm regards



Robyn Overall

Head, School of Biological Sciences

RESEARCH SPOTLIGHT: DR CHARLOTTE TAYLOR

Dr Charlotte Taylor is on a mission: to improve biological literacy in the community.



A trained tropical forest ecologist, Dr Taylor is also a passionate educator. She has dedicated 20 years at the University of Sydney to working on course design, staff training, assessment and online learning for large classes of 1000-1500 students, for which she was awarded a Vice Chancellor's Excellence in Teaching Award for the First Year Experience. She is currently the Associate Dean for Learning and Teaching in the Faculty of Science. Her research is focused on an integration of urban ecology, scientific literacy and biodiversity education. For the past 12 years she has been involved in the Birds Australia Birds in Backyards project which in 2008 was awarded the national Alan Strom Eureka Prize for Environmental Sustainability Education.

Biology News spoke with Dr Taylor to hear about her latest research.....

Why are you so passionate about improving biological literacy in the public?

There is no doubt that we are living in an era of rapid change – especially to our environment, medicine and technology. On a daily basis we are hit with news about climate change, stem cell research or feral animals. An understanding of the principles of biology, and science in general, is critical for people to cope with this new information and to behave as responsible citizens.

Of course in an ideal world, community members would all be involved with conserving their local environment. But having people blindly planting trees, with no understanding about why, simply won't work in the long run. If people have the biological knowledge to understand why conservation of their local area is important, they are much more likely to be involved.

You are involved with the award-winning project, Birds in Backyards. Can you describe this project and how it achieves its aims?

20% of Australian bird species under threat of extinction. Birds in Backyards has created a website enlisting backyard bird enthusiasts to combat the decline. It helps visitors get involved by taking part in online surveys, learning how to create bird-friendly spaces in gardens and local communities and encouraging them to find out more about Australian birds and their habitats. This project is an exemplar of using people's enthusiasm for bird-watching to introduce concepts of biodiversity and sustainability, thus improving their biological literacy.

There are a number of environmental workshops being run in local areas, but are they working in improving biological literacy?

I am very interested in answering this question, which is the basis of one of my projects with funding from the Environmental Trust. I am evaluating the effect of environmental workshops on people's biological literacy and attitudes to conservation and the environment. We are currently creating a survey, which we will use to measure the behaviour and literacy of people who have and who haven't attended an

environmental education workshop. The interesting thing will be to see if there is any significant change resulting from the education activity over time.

Is there any flow-on from your work with members of the public into your education projects within the University?

The same questions arise when thinking of university students and their attitudes to the biological content they are learning and also how their scientific literacy is changing over the course of their education.

A big issue with First Year Biology teaching at the University of Sydney is the huge variation present in the cohort, which comprises almost 2000 students.

We are particularly interested in how this variation translates to the understanding and teaching of difficult concepts – how do students understand difficult concepts? How do lecturers recognise and communicate them?

In order to manage this variation, we are trialling a project in which we create surveys to diagnose students' understanding – both as an individual and also as a cohort – of difficult concepts. We are profiling students based on their particular misconception and understanding, and tailoring the teaching method accordingly.

What are the difficult concepts?

The concepts we are currently looking at are hypotheses and hypothesis testing. Also the concept of scale – as in the connection between molecular to cellular to whole organism to system to ecosystem. Many students see these as discrete topics, rather than levels that are connected, and it is my hope that students can come out of first year with this understanding.

VISITING LIZARD ECOLOGIST SHEDS LIGHT ON EVOLUTION

This semester, the School is privileged to welcome Jonathan Losos, Professor in the Department of Organismic and Evolutionary Biology at Harvard University, as the visiting Murray Lecturer for 2010.

Professor Losos is the third person to hold the Murray Lecture position, which aims to bring an internationally noted academic to the School to present a public talk and participate in mentoring activities for postgraduate students.

A world leader in evolutionary ecology, Professor Losos' research primarily concerns the evolutionary diversification of lizards. An enduring area of his research has been to understand the radiation of the Anolis lizards, which are the most diverse lizard group on earth comprising 400 living species.

Professor Losos says that a childhood fascination with reptiles was the starting point for his scientific career. "Like most boys, I was obsessed with dinosaurs," he remembers. "Then I started keeping caymans and lizards at home, and my interest grew from there."

The start of his research on the colourful and diverse group of Anolis lizards came from a university research project. Whilst an undergraduate student at Harvard University, he made an important discovery about the functional significance of the dewlap - a colourful collar, which is flared out for communication purposes, that is characteristic of the Anoline lizards.

"People had observed that different species of Anolis, living together, always had different coloured dewlaps," Professor Losos says. "For my project I looked at two species that were identical, except for the colour of their dewlap. After doing tests in which I modified the colours of the dewlap using paint, I was able to show for the first time that the lizards do use the colour of the dewlap to recognise their own species."

Today, Professor Losos continues to work on Anolis lizards, which he says are excellent study organisms to use for unravelling some of the evolutionary processes that have occurred during speciation. "Lizards live in almost all parts of the world and show myriad different adaptations for surviving in different environments. They are also usually easy to observe in the wild and study in the laboratory, making them ideal organisms for investigating the origin and maintenance of biological diversity. The Anolis in particular have shown a spectacular radiation throughout the landscape, and offer a model for studying evolution that parallels the classic system of Darwin's finches."

Professor Losos will reveal more about his work on Anolis lizards at his public talk, Lizards in an Evolutionary Tree, held on October 20 in the Eastern Ave Auditorium.

His Murray Lectureship also means that postgraduate students will be hearing from him at a retreat to be held at Warrah field station in mid October.

What advice does he give budding biologists?

"Try to find questions that are both interesting to you and provide a new perspective to the field. With the competitive nature of science, asking the same question but on a different species won't get you very far. If you really want to make your mark, you need to develop your own ideas."

Professor Losos says that a broad knowledge base is key to helping researchers carve out new intellectual territory. "Read a lot, and learn as much as you can because the more you learn the more you will see connections and come up with new approaches."



Photo credit: Jonathan Losos

NEW CHLOROPHYLL DISCOVERED IN ANCIENT STROMATOLITES

Dr Min Chen has discovered the first new chlorophyll in over 60 years. Found in stromatolites from Western Australia's Shark Bay, the new pigment, named chlorophyll *f*, harvests part of the light spectrum that other forms of chlorophyll don't absorb.

The history-making discovery of chlorophyll *f* extends the known range of light that is usable by most photosynthetic organisms and challenges our understanding of the physical limits of photosynthesis - revealing that tiny changes to the structure of chlorophyll allows photosynthetic organisms to scavenge for light and survive in almost any environment on Earth.

Dr Chen, who found the new chlorophyll deep within stromatolites - rock-like structures built by photosynthetic bacteria, called cyanobacteria - says the discovery happened by accident.

"Finding the new chlorophyll was totally unexpected - it was one of those serendipitous moments of scientific discovery. I was actually looking for another chlorophyll, which we knew could be found in cyanobacteria living in low light conditions. I thought that stromatolites would be a good place to look, since the bacteria in the middle of the structures don't get as much light as those on the edge."

After finding the new pigment, Dr Chen worked with a team of interdisciplinary scientists from Australia and Germany to characterise the absorption properties and chemical structure of chlorophyll *f*, making it the fifth known type of chlorophyll molecule on Earth.

The team found that chlorophyll *f* absorbs infrared light of 720 nm, which is the lowest light energy utilised by any known chlorophyll. Dr Chen says the result has rewritten the rules of photosynthesis, which was thought previously to only occur in visible light in the range 400nm to 700nm.

"Discovering this new chlorophyll has completely overturned the traditional notion that photosynthesis needs high energy light. It is amazing that this new molecule, with a simple change to its chemical structure, can absorb extremely low energy light. This means that photosynthetic organisms can utilise a much larger portion of the solar spectrum than we previously thought and that the efficiency of photosynthesis is much greater than we ever imagined."

In ecological terms, chlorophyll *f* allows cyanobacteria living deep within stromatolites to photosynthesise using low-energy infrared light, which is the only light able to penetrate into the structure. This gives the chlorophyll *f*-containing cyanobacteria a competitive advantage over other algae, enabling them to exploit a totally new niche.

Dr Chen says harnessing this pigment's power could lead to biofuel-generating algae that are super-efficient, using a greater spread of sunlight than thought possible.

"Chlorophyll *f*, and its ability to absorb infrared light, can have numerous applications to industries like plant biotechnology and bioenergy. Potentially, it could lead to the development of new strains of algae that can use a larger part of the light spectrum to produce biofuel oils, which in turn would help to make renew-



*Stromatolites from Hamelin Pool in Shark Bay, WA, where Dr Chen discovered the new chlorophyll *f*. Photo by R. Abramovich.*

able biofuel production cheaper and more competitive with fossil fuels. Another exciting possibility is to use the chlorophyll in solar cells to trap light more efficiently."

Dr Chen's study, published in the international journal *Science*, has captured the attention of the scientific community and the broader public. The work has been featured in numerous media outlets around the world - including *Scientific American*, *New Scientist* and the prestigious journal *Nature* - and has been identified as one of the most important articles in biology by the world's leading scientists in the *Faculty of 1000*.

Dr Chen says she is excited by the attention her work has received. "I am so happy that people are interested in this new pigment and are excited about its applications. I hope that our discovery of a cyanobacterium, which exploits a tiny modification in its chlorophyll molecule to photosynthesise in light that we cannot see, will open people's minds to the seemingly limitless ways that organisms adapt to survive in their environment."

NEW ARC SUPER SCIENCE FELLOWSHIPS FOR MARINE BIOLOGY

BY KATYNNA GILL

Professor Maria Byrne and Dr Will Figueira have been awarded one of the first Super Science Fellowships from the Australian Research Council

Dr Byrne and Dr Figueira's Fellowship - for research into using robots to collect data on marine communities - is one of three to be awarded to the Faculty of Science at the University of Sydney. Combined, the three Fellowships are worth \$1.67 million - a considerable slice of the \$27.2 million that will be spent over four years across Australia on the Super Science Fellowships.

Announced by Senator Kim Carr, federal Minister for Innovation, Industry, Science and Research, the new Super Science Fellowships have been established to attract and retain the best and brightest early-career researchers from within Australia and around the world.

Across Australia, 50 Super Science Fellowships will begin in 2010 and 50 in 2011.

"Our aim is to support exceptional domestic and international researchers to establish and maintain careers in Australia. Providing opportunities for our most promising early-career researchers to work in areas of importance to all Australians is critical, especially as we move through the global recession," said Senator Kim Carr.

Professor Byrne and Dr Figueira, together with Dr Stefan Williams, from the Faculty of Engineering and

Information Technologies, and Dr Neville Barrett, from the University of Tasmania, will receive \$278 400 over four years starting in 2010 for their project 'Machine Assisted, Multi-scale Spatial and Temporal Observation and Modeling of Marine Benthic Habitats'.

"The Integrated Marine Observing System science plan includes sampling campaigns reliant on the Autonomous Underwater Vehicle (AUV) Facility operated by the Australian Centre for Field Robotics in the Faculty of Engineering", explained Dr Stefan Williams.

"The AUV generated data is designed to address the issues of quantification of marine biodiversity. The proposed research will directly enhance the effectiveness of these data by speeding labour-intensive analyses, aggregating the results, and searching for ecological patterns that would be difficult, if not impossible, to identify using traditional approaches," explained Dr Will Figueira.

"We are pleased to tie in with the major national initiative funded through the Integrated Marine Observing System to generate new approaches to survey marine benthic communities at a time when significant alterations in marine diversity are being driven by climate change," said Professor Maria Byrne.



"The Next Wave voyage has been a great experience and excellent introduction to what is involved in marine research at sea."

PALOMA MATIS
THIRD YEAR OF B. SC.
MAJORING IN BIOLOGY

MY WEEK AS A MARINE BIOLOGIST

BY PALOMA MATIS

On September 16, third year biology student Paloma Matis set sail on a six-day voyage from Hobart to Sydney to work as a scientist on board Australia's Marine National Facility Research Vessel, Southern Surveyor. Paloma is part of the Next Wave program that provides a unique opportunity for early career researchers and students of marine science to experience working on a blue water research vessel.

Excerpts from Paloma's voyage journal.....

Day 1: Today we all arrived in Hobart and boarded the Southern Surveyor. We were allocated our cabins and had a tour around the different areas of the ship including the wet lab, fish lab, mess, bridge and the operations room.

Day 2: Sea sickness got hold of a few of us and unfortunately conditions meant that we could only deploy an Argo Float, which sends up information about temperature, depth, salinity, pressure and currents.

Day 3: Conditions worsened as we passed through the Bass Strait today so it wasn't safe enough to do any sampling.

Day 4: Today we let out the N70 net three times to a depth of 50m and brought it back in at 1m/second to collect samples of organisms present in the water column. Within the samples we found salps, krill, copepods and other zooplankton.

Day 5: We gathered to hear some talks by the post-grad students about their research projects - discovering a new virus spreading among copepods, the effects of water masses on salps and krill, and the distribution of top predator fish in the East Australian Current.

Ruchira Somaweera with fresh water crocodile, *Crocodylus johnstoni*, in Lake Argyle.

POSTCARD



Dear SoBS,

For the last two years I have been studying freshwater crocs at Lake Argyle in the rugged Eastern Kimberley outback. My work is aimed at not only studying determinants of the cane toad impact, but also natural history aspects of crocs such as parental care, prey electivity, predation, nest-site selection (and in the process) the relationship between jaw power and pain from a bite etc.

The work is giving new insight to the biology of these magnificent creatures in a large, permanent, stagnant water body.

Thanks to all the co-workers in the Shine Lab, supporters (including many volunteers from the University of Sydney) and the scenic wilderness, I am living my dream!

RUCHIRA SOMAWEERA

PHD CANDIDATE

PROTEINS AND PLANT CELLS GET STUDENTS AHEAD

Two Biology post-graduate students succeeded in reaching the finals of the inaugural University of Sydney Three-Minute Thesis competition.

Bridget Murphy and Will Armour were two of the 12 finalists selected out of 50 entrants to compete in the final round of the competition.

The Three-Minute Thesis competition is a skills development activity, initiated by the University of Queensland in 2008, which challenges research higher degree students to explain their research project to a non-specialist audience in just three minutes.

The Sydney final competition, held in late July, was an impressive showcase of the diverse research being undertaken by graduate students around the University, which included the science of wine tasting, magnetic fields in galaxies, beatboxing on the flute and sex with robots.

PhD student and Fresh Science winner Bridget Murphy took out third prize for her discovery of a powerful cancer protein in the uterus of a lizard, which sheds light on the evolution of cancer in animals.

Bridget, who is supervised by Professor Mike Thompson and Dr Kathy Belov, says: "It was a fantastic and useful experience to engage the audience in less than three minutes and using only one slide. Now if I ever get stuck in a lift with my dream employer for a few minutes, I might actually have a chance of being hired!"

PhD student Will Armour, supervised by Professor Robyn Overall and Dr Debbie Barton, came highly commended for his research which seeks to understand how plant epidermal cells form an undulating jigsaw puzzle like pattern from their original cuboidal shape.

Will says: "I highly recommend this competition to other postgraduate students. Good verbal communication is such an important part of being a researcher, that I see great potential for more biology postgrads to excel at this event next year so we can place in the top three again."



Above: Bridget Murphy. Photo credit: Fresh Science
Below: Will Armour.





LECTURE PRESENTED BY 2010 MURRAY LECTURER,
PROFESSOR JONATHAN LOSOS

LIZARDS IN AN EVOLUTIONARY TREE

Did you know that Australia is home to more lizard species than anywhere on earth, and that lizards are one of the most successful animal groups to have evolved on this planet?

From the three metre long Komodo Dragon to an animal that can fit on a five cent coin, lizards have evolved into myriad shapes and sizes to survive in almost every part of the world. But how have they evolved? And what can their success tell us about the evolution of life on earth?

Find out at a public lecture on October 20, where you will climb the lizard tree of life to see the spectacular diversity of animals that have evolved over 200 million years.

Internationally renowned evolutionary biologist from Harvard University, Professor Jonathan Losos, will present the free lecture as part of the Sydney Science Forum.

In *Lizards in an Evolutionary Tree*, Professor Losos will reveal how the study of lizards can help solve one of science's greatest mysteries: what are the processes that have led to the evolution of life on earth?

He will introduce the specific group of lizards – the Anolines that have evolved into 400 different species, the most of any lizard on earth – which are helping scientists unravel the mysterious processes of evolution.

Professor Losos, a world authority on Caribbean anoles who has spent years collecting data on their habitat use, behaviour, function, genetics and enormous array of body types found in different environments, will present a synthesis of this research to demonstrate what these attractive lizards can tell us about the origin and maintenance of biological diversity.

So celebrate the International Year of Biodiversity, and see a showcase of the extraordinary variety of lizards on earth – including video footage of their bizarre behaviours and images of rare and cryptic species, such as the mysterious horned lizard from Ecuador.

Rick Shine, Professor in Evolutionary Biology at the School of Biological Sciences, will introduce Professor Losos and host the question session following the lecture.

Afterwards, enjoy an exciting display of reptiles - including live animals, museum specimens and skeletons - over a glass of wine in the Eastern Ave Foyer.

This spring, rediscover your roots on the Botany Lawn ...

The School of Biological Sciences invites you to join fellow alumni, friends and staff for the 2010 Biological Sciences Alumni Cocktail Party.

Join us to meet and network with alumni, revisit staff members of the School and enjoy drinks and canapés on the much-loved Botany Lawn. As usual, the function is family friendly, so little ones are welcome to join in the fun.

2010 BIOLOGY ALUMNI COCKTAIL RECEPTION

FRIDAY 29 OCTOBER 6:00 PM - 8:00 PM
MACLEAY FOYER (A12) AND BOTANY LAWN
CAMPERDOWN CAMPUS, THE UNIVERSITY OF SYDNEY

REGISTER ONLINE NOW

sydney.edu.au/science/biology/forms/alumni-rsvp.php

RSVP Friday 22 October

ENQUIRIES Carla Avolio
E biorsvp@sydney.edu.au
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LIZARDS IN AN EVOLUTIONARY TREE

WEDNESDAY 20 OCTOBER 5:45 PM - 6:45 PM
EASTERN AVENUE AUDITORIUM, THE UNIVERSITY OF SYDNEY

Bookings required for catering purposes

Register online: sydney.edu.au/science/biology
Email: science.forum@sydney.edu.au
Phone: 02 9351 3021

BIOLOGICAL
SCIENCES

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