Australian National University

Research School of Biology Newsletter

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ANU COLLEGE OF SCIENCE

NEWS

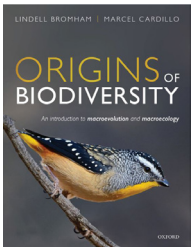
Chris Fulton appointed to marine park advisory committee

Chris Fulton (E&E) has been appointed to the Commonwealth Temperate East Marine Park Advisory Committee by the Australian Government to provide expert advice on the management plan and monitoring of this large offshore marine park network.

Barry Pogson elected next Head of Plant Sciences Division

Staff from the RSB Division of Plant Sciences elected **Barry Pogson** (PS) to be the next Head of Division, beginning 1 July 2019. He takes over from **Owen Atkin** (PS), who will focus on his new role as 2019 Vice-Chancellor's Entrepreneurial Fellow.

New book by Lindell Bromham and Marcel Cardillo



Congratulations to **Lindell Bromham** and **Marcel Cardillo** (both E&E), whose book 'Origins of Biodiversity' was published this month by Oxford University Press.

Biology Olympiad medallists now ANU undergrads

Deputy Director of the Biology Olympiad Program Juliey Beckman (BTLC) with former Biology Olympiad medallists, now ANU students Jess Law, Luke Hemmingsen and Sai Campbell. (Image: Sharyn Wragg)

Three of the four Biology Olympiad 2018 international competition medallists started their undergraduate degrees at ANU this year. Two moved here from Melbourne as a consequence of their experience and training here at ANU in summer and April in 2018. All three have also helped with mentoring the new 2019 National Biology Olympiad Team. Two are PhB students majoring in Biology and one has commenced a double degree: engineering/science. - **Juliey Beckman**, BTLC

Teachers and students of BIOL8702 taking a break during their mini-conference this month. Standing, from left: Matthew Johnson (Leyton group, BSB) , Course Co-ordinator Tony Millar (PS), Jamila Jamila, Hsueh Pan, Yatong Zhang, Congqi Lou, Yuechi Zhang, Yabing Zhao, Vijay Bhoopalan, Saishyam Ramesh, Xinran Cui, Shujia Zhang. Seated, from left: Yuting Zhan, Fangrui Guo, Parul Saini, Ke Lu, Yilin Hao, Zhiyu Hu and Dantong Lei. (Image: Sharyn Wragg) (See: News Item)

World Bee Day

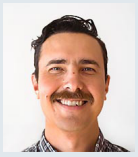
Ryzsard Maleszka, Anton Pemmer (Rotarian), Steve Hill (Past District Governor Rotarian) and Mick Gentleman (ACT Minister for Planning), at the World Bee Day event at Government House.

Ryszard Maleszka (BSB) was a guest at a reception hosted by the Governor General Sir Peter Cosgrove and Lady Cosgrove in the Government House to celebrate World Bee Day. This international event was proclaimed in 2017 after the UN approved Slovenia's proposal to observe it on May 20 in honour of Anton Janša, a pioneer of modern apiculture who was born on this day in 1734. The key aim of this initiative is to raise awareness of how human activities impact beneficial insects. Members of the ACT Government, ambassadors, inventors and scientists were in attendance. - **Ryszard Maleszka** (BSB)

Master of Biotech course taught by EMCRs

The main photo on this page shows participants and teachers from the Master of Biotechnology course 'Advanced Research Techniques', on a break during their mini-conference held at RSB on 21 May. This mini-conference was part of the 12-unit BIOL8702 course which is led and delivered by five Early and Mid-Career Researchers (EMCR) of the RSB; **Arun Yadav** (Pogson group, PS), **Jason Ng** (Mathesius group, PS), **Matthew Johnson** (Leyton group, BSB), **Angela McGaughran** (Moritz group, E&E) and **Darren Wong** (Peakall group, E&E) under the broader guidance of the Course Convenor, **Tony Millar** (PS). For the last two years, these EMCRs have jointly undertaken the teaching responsibilities of this course, including curriculum development, lecture delivery, and assignment and practical development and implementation. To further expand the scope of the students' learning outcomes, novel topics such as use of genomic tools in crop breeding, personalised medicine and insertional mutagenesis have been introduced. For details please refer to this weblink.- **Arun Yadav** (Pogson group, PS).

Group leader profile: Joe Brock (BSB)



Group research focus
My group focuses on understanding the function of integral membrane transporters and receptors from a structural perspective. The recent breakthroughs in Electron Microscopy that were the subject of the 2017 Nobel Prize in Chemistry have completely revolutionised my field. High-resolution structures that were once unimaginable are now being published every month. Structural information by itself rarely explains how proteins work however, so we will collaborate extensively with the excellent array of other membrane research groups at RSB to understand the whole picture. We will also combine structures with synthetic biology to try and solve some of society's problems.

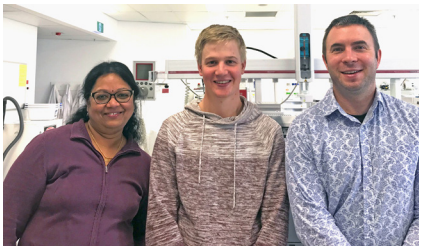
Teaching and research achievements
During my time in David Drew's group at Stockholm University, I feel very lucky to have been involved with the structural determination and characterisation of the malarial sugar transporter that will soon be published in Science. I am also very proud for surviving my first component of lecturing for the BIOL2161 genetics course at ANU!

What do you enjoy most about teaching?
Helping others catch the "science bug". Giving the tools to others to understand the world around them through a critical and scientific lens is a wonderful feeling. It changed my life and I hope it can for them also.

Who is your science hero?
Richard Feynman is a personal favourite of mine. His combined brilliance, lust for life and irreverence for all things bureaucratic, traditional and conservative is something I try to strive towards. He also had an excellent teaching philosophy – despising jargon – he could explain the most complicated physical phenomenon with plain English and a wry smile.

This newsletter is archived at biology.anu.edu.au/news-events/newsletter.
Layout: Mel Norris
Editing: Scott Keogh & Mel Norris

Mass spectrometry at the RSB/RSC JMSF: MASSive development in a SPECtrum of areas



Anitha Jeyasingham, Joe Boileau and Adam Carroll, three quarters of the JMSF staff (Thy Truong was away).

There have been so many exciting developments in the RSB/RSC Joint Mass Spectrometry Facility (JMSF) recently that it warrants a special RSB newsletter article. Firstly, in mid-2018, a new MS Technical Officer, **Joseph Boileau** (Joe), an Honours graduate with proteomics expertise from the Djordjevic group at RSB, joined the team, now four people strong. Over the summer, Joe completed a challenging university unit 'Electricity and Electronics' to build capacity in the JMSF for development of custom electronic and mechatronic hardware to save capital costs and enable new lines of research. With this training, Joe has already saved us ~$9k by making an accurately temperature-controlled nanoflow column oven worth ~$10k commercially for <$1k using open-source electronics, CAD design, 3D-printing and some CNC metal fabrication work by **Link Williams** at the RSC/RSB Workshop. Joe is now working on a new approach to make high-performance nano UHPLC columns based on a 3D-printed fused silica grinding apparatus. Excitingly, the JMSF is also growing in terms of MS instruments this year. Due to success of an ARC LIEF (LE19) proposal, 'High resolution gas chromatography-mass spectrometry for metabolic research', designed and written by **Adam Carroll** and formally led by **Rod Peakall** (E&E) with CIs from RSB, RSC, UNSW, CSU, U. Sydney and CSIRO, the JMSF will soon install what will be one of the world's most powerful and versatile gas chromatography/mass spectrometry platforms valued at $812k – an Agilent 7250 GCxGC Q/TOF equipped with a powerful Gerstel preparative robotic autosampler with automated sample preparation and thermal desorption – particularly useful for metabolomics and volatiles analysis. The JMSF was also successful with a MEC grant this year. The grant, 'High-performance mass spectrometer for chemistry, biology and drug discovery', designed and written by **Adam Carroll** and formally led by RSC's Malcolm McLeod with CIs from RSB, RSC and JCSMR, provides a total of $500k for the purchase of a new high-resolution Waters Synapt G2-Si HDMS LC-Q/TOF instrument with ion mobility spectrometry capability. In addition to metabolomics, proteomics and high throughput screening, this instrument will be particularly powerful for the analysis of intact proteins, large protein complexes and studying changes in biomacromolecule folding states through

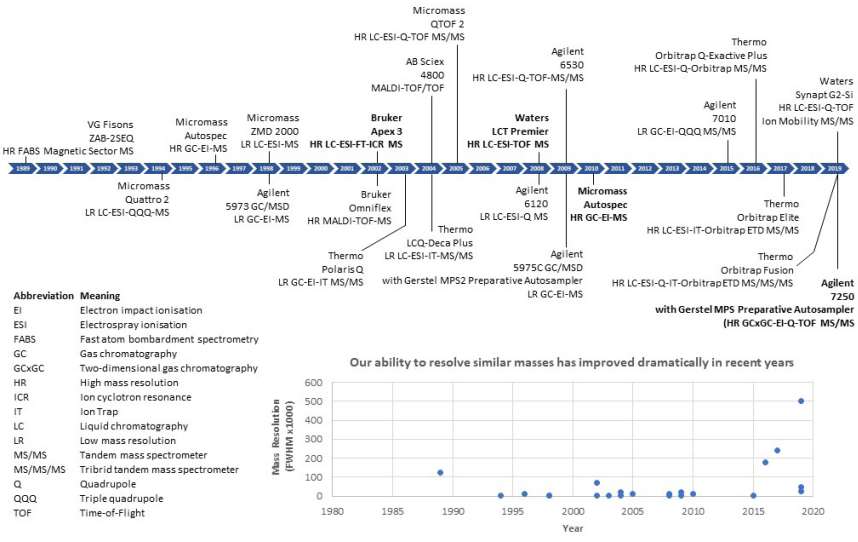


Figure 1. Timeline of mass spectrometer acquisitions at RSB, RSC and JCSMR over the past 30 years. Mass spectrometers acquired by RSB, RSC and JCSMR are mapped onto a 30-year timeline. The mass resolving power (ability to discriminate between similar masses – a key performance parameter of mass spectrometers) of MS instruments in the precinct has improved dramatically since establishment of the RSB/RSC Joint Mass Spectrometry Facility and is on an upward trajectory. The variety of available analytical techniques is also improving in 2019 with the introduction of Ion Mobility Spectrometry (IMS, the capacity to separate ions of equal mass according to their cross-sectional areas), two-dimensional gas chromatography (providing unparalleled chromatographic separation of complex mixtures), thermal desorption and advanced robotic sample prep automation and tribrid quadrupole / ion-trap / orbitrap MS (enabling intricate dissection of complex biomolecules inside the mass spectrometer). Instruments in bold are known to have been supported by ARC LIEF. However, funding information could not be found for most instruments acquired before 2008.

its ion mobility functionality which allows ions of equal mass to be separated based on their cross-sectional areas. After lengthy negotiations, the JMSF is also anticipating the likely replacement of its faulty Thermo Orbitrap Elite instrument with one of the most powerful instruments on the market – a Thermo Orbitrap Fusion tribrid instrument worth ~$1M. Moreover, to process the new torrents of large proteomic and metabolomic datasets, the JMSF is currently setting up a powerful new 48-core/96-thread 384 GB RAM Dell PowerEdge data analysis server, funded through the RSB Small Equipment Scheme. RSB's mass spectrometry capabilities are growing rapidly (see Figure 1) and further growth is expected in coming years. With these developments, the JMSF will help RSB researchers push the boundaries of world-class biological research. - **Adam Carroll**, Manager, JMSF.

Giant Pumpkin competition

Alex Skeels' entry won the Peoples' Choice Award for Most Beautiful Pumpkin. Image Sharyn Wragg.

The RSB Giant pumpkin weigh-in was held on Friday May 3rd. As expected, it was an evening of high excitement with over 100 people in attendance. Standing in for Allen, who was swanning around the world, **Owen Atkin** (PS) gave a welcome speech and presided over the prize-giving, as well as awarding the "Director's Choice" Prize. The drought and heatwave took its toll this year and so we didn't see the monsters we saw last year, but 23 pumpkins were entered for judging. The results were:
1st Prize: Luke and Thea O'Loughlin (Fenner) 27kg
2nd Prize: **Kelli Gowland** (Nicotra group, E&E)11.5kg
3rd Prize: **Alyssa Weinstein** (Peakall and Linde groups, E&E)11.2kg
The peoples' vote for the most beautiful pumpkin went to **Alex Skeels** (Cardillo group, E&E), and **Alyssa Weinstein** (Peakall and Linde groups, E&E) produced the pumpkin judged to be the most like Clive Palmer. The Director's Choice went to Thea and Luke O'Loughlin (Fenner). Thanks to **Owen Atkin**, and to **Tim Butler** (RSB compliance), **Felix Smits** (Langmore group, E&E) and **Kevin Yang** (ANU biology undergrad) for working behind the scenes to make this a successful and enjoyable evening. - **Dave Rowell**, E&E.

Outreach News

Chris Fulton (E&E) discussed the role of spiny crayfish in keeping high country streams healthy with the Canberra Anglers Association (see image above), who are keen to get involved in a citizen science partnership to track the occurrence of this threatened species throughout the ACT and NSW.

Megan Head (E&E) and **Maider Iglesias-Carrasco** (Head group, E&E) have been awarded €1500 from the European Society for Evolutionary Biology (ESEB) Outreach Fund, for an outreach project called 'Life in Eucalypts'. The project includes a talk for familes about the importance of eucalypts in shaping Australian biodiversity, an article in Australasian Science magazine and a photography competition that aims to get people to document the invertebrate life in the Eucalypts around them.

Congratulations

Jenny Graves (E&E) has been elected a Foreign Associate of the US National Academy of Sciences.

Barry Pogson (PS) received the ANU Vice-Chancellor's Award for Excellence in Supervision at a ceremony at Kambri this month.

Awards

Angela McGaughran (Moritz group, E&E) won a Young Investigator Award to attend the 2019 Society for Molecular Biology and Evolution conference in Manchester, England.

Alicia Grealy (Langmore group, E&E), Clare Holleley (CSIRO) and **Naomi Langmore** (E&E) have received a CBA Ignition Grant ($10,000) for their research on 'Barcoding and capture-based approaches for eggshell genomics to improve biodiversity assessment in Australian birds'.

Chris Fulton (E&E) and Peter Unmack (UC) won a CBA Ignition grant to study 'Can environmental selection on physiological phenotypes help explain the success of invasive species in Australian rainbowfishes?'

Three RSB student projects also received CBA Ignition grants. They are:
'The role of honey bee microbiome evolution in adaptation to environmental stress', **Sasha Mikheyev** (E&E), **Kiera O'Halloran** (Mikheyev group, E&E) and colleagues at CSIRO and OIST.
'What do humans and insects have in common? Using advances in human genetics to understand insecticide resistance in the cotton bollworm, *Helicoverpa armigera*', **Angela McGaughran** (Moritz group, E&E) and colleagues at CSIRO and JCSMR.
'Building a reference genome for a non-model species: *Wahlenbergia ceracea*', **Rocco Notarnicola** (Kruuk group, E&E), **Loeske Kruuk** (E&E), **Benjamin Schwessinger** (PS), **Diep Ganguly** (Pogson group, PS) and Alexander Schmidt-Lebuhn (CSIRO).

Two RSB CBA Synthesis Group bids were also funded - 'Using expert elicitation to identify impacts of climate change on Australian species' (app development), **Adrienne Nicotra** (E&E), **Rachel Slatyer**, **Sonya Geange** (both Nicotra group, E&E) and partners in other institutions and agencies, and 'Genomic empowerment of Australian bee systematics, taxonomy, conservation and diversity' (workshop), **Sasha Mikheyev** (E&E), Saul Cunningham and Julian Brown (Fenner) and many others.

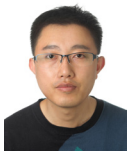
IN THE MEDIA

Research by **Lindell Bromham** (E&E), **Marcel Cardillo** (E&E), **Xia Hua** (Bromham group, E&E) and colleagues that shows a link between climate and language diversity was reported by SBS News and other outlets including Phys.org and The Tribune India.

Chris Fulton (E&E) discussed why we need to control the invasive common carp as part of the many actions needed to restore native fishes of the Murray-Darling Basin during primetime on ABC Radio Drive.

WELCOME

We welcome **Yansheng Li**, who started a one-year post-doctoral fellowship in the Mathesius group (PS), awarded by the Chinese Academy of Science. Yansheng is an Assistant Professor from the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Harbin, China. He will work on the connection between root exudates, soil microbiome changes and nodulation in *Medicago*.



Welcome **Steven Worthington**, who joins RSB IT as a casual for the next four months. He will be working in client services, helping with Windows 10 upgrades and anti-virus rollout. Steve has a background in electronics and arts, and you can see some of his work here.

FAREWELL

Farewell to **Joy McDermid** (BTLC Team) who is retiring from the University to enjoy a life of leisure. Joy has provided enormous help to staff/UG/Hons students. She will be sorely missed and we wish her all the best for her retirement. **Helen Wong** will take over Joy's role as Coursework Senior Student Admin Officer. We also like to welcome **Jay Prentice** to the team. Jay will take over Helen's role as HDR Senior Student Admin Officer. He will start on 11 June.

We also wish to farewell **Isabelle Ferru** (BTLC), who will be moving back to France in July. Isabelle has played a key role in the biomedical curriculum, with significant convening and/or teaching responsibilities in three courses as well as an online masters course. She will still teach the latter, BIOL8021 Health & Disease in a Changing World, from France so remains a member of RSB. She will also be sorely missed by both staff and students and we wish her well. - **Susan Howitt** (Head, Biology Teaching & Learning Centre).

Lou Gaffey (RSB Technical Services) has taken a six-month secondment at ANU Facilities and Services.

PHDS SUBMITTED

Ross Dennis (Furbank group, PS) 'The role of primary carbohydrate metabolism in wheat grain dormancy and germination'.

Damien Esquerré Gheur (Keogh group, E&E) 'Old World Serpents and New World Dragons : The Evolutionary Dynamics of Pythons and Liolaemid Lizards'.

Meng Zhang (Maier group, BSB) 'Trafficking and function of Maurer's clefts proteins and Maurer's clefts biogenesis'.

Yicheng Zhu (Huttley group, E&E) 'Novel techniques for measuring the effect of neighbouring bases on mutation and its application'.

PHDS AWARDED

Kevin Murray (Borevitz group, PS) 'New computational methods and plant models for evolutionary genomics'.

Stefanie Oberprieler (Moritz group, E&E) 'Incorporating terrestrial invertebrates in conservation planning: diversity, distribution and cross-taxon congruence in an Australian tropical savanna landscape'.

Angelin Samuel (Gordon group, E&E) 'Genotypic and survival characteristics of *Escherichia coli* phylogroup B2 from water'.

PAPERS ACCEPTED

Bonnet T, Morrissey M, Kruuk L, Estimation of genetic variance in fitness, and inference of adaptation, when fitness follows a log-normal distribution, *Journal of Heredity*.

Bush A, Catullo R, Mokany K, Harwood T, Hoskins AJ, Ferrier S, Incorporating existing thermal tolerance into projections of compositional turnover under climate change, *Global Ecology and Biogeography.*

Darma R, Lutz A, Elliott CE, Idnurm A, Identification of a gene cluster for the synthesis of the plant hormone abscisic acid in the plant pathogen *Leptosphaeria maculans, Fungal Genetics and Biology*.

Fox RJ, Donelson JM, Schunter C, Ravasi T, Gaitan-Espitia J-D, Beyond buying time: the role of plasticity in phenotypic adaptation to rapid environmental change, *Philosophical Transactions of the Royal Society, Series B.*

Hsiao Y, Tsai C-L, *Cephalomalthinus simplicicornis* (Wittmer, 1993) rev. stat. et comb. n.: a resurrected soldier beetle (Coleoptera, Cantharidae) from Taiwan based on morphological and molecular data, *Zootaxa.*

Morrissey M, Bonnet T, Analogues of the fundamental and secondary theorems of selection, assuming a log-normal distribution of expected fitness, *Journal of Heredity*.

Perez DM, Backwell PRY, Selection for conspicuous visual signals in a fiddler crab, *Behavioral Ecology & Sociobiology.*

Piatti L, Rosauer D, Nogueira C, Ferreira V, Strüssmann C, Martins M, Snake diversity in floodplains of central South America: Is flood pulse the principal driver?, *Acta Oecologica.*

Posch BC, Kariyawasam BC, Bramley H, Coast O, Richards RA, Reynolds MP, Trethowan R, Atkin OK, High temperature responses and acclimation of net carbon balance in wheat, *Journal of Experimental Botany.*

Reiter N, Freestone M, Brown G, Peakall R, Pollination by sexual deception of fungus gnats (Keroplatidae and Mycetophilidae) in two clades of *Pterostylis* (Orchidaceae), *Botanical Journal of the Linnean Society.*

Schrempf D, Minh BQ, von Haeseler A, Kosiol C, Polymorphism-aware species trees with advanced mutation models, bootstrap, and rate heterogeneity, *Molecular Biology and Evolution.*

Skeels A, Cardillo M, Equilibrium and non-equilibrium phases in the radiation of Hakea and the drivers of diversity in Mediterranean-Type Ecosystems, *Evolution*.

Somasiri P, Behm CA, Adamski M, Wen J, Verma NK, Transcriptional response of *Caenorhabditis elegans* when exposed to *Shigella flexneri*, *Genomics*.

Szabo B, Whiting MJ, Noble D, Sex-dependent discrimination learning in lizards: a meta-analysis, *Behavioural Processes.*

Urbarova I, Forêt S, Dahl M, Emblem A, Milazzo M, Hall-Spencer J, Johansen SD, Ocean acidification at a coastal CO_2 vent induces expression of stress-related transcripts and transposable elements in the sea anemone *Anemonia viridis, PLOS ONE.*

Wang J-WD, Gross GL, Andrew ER, Padovan A, Fahrer AM, A predicted novel protein isoform of HoxA9, *Leukemia Research*.

Yadav AK, Carroll AJ, Rebetzke GR, Estavillo GM, Pogson BJ, Wheat drought tolerance in the field is predicted by amino acid responses to glasshouse imposed drought, *Journal of Experimental Botany.*