Australian National University

Research School of Biology Newsletter

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From the Director

Dear Colleagues

Welcome to our last newsletter for 2024. Whilst 2024 has been a challenging year, it is great to see the many achievements listed in this issue. In particular I note several promotions of academics, these reflecting sustained excellence in teaching, research and service.

RSB has a strong record of outstanding fundamental research. This year our researchers continued this with a high success rate (60%) for full proposals for ARC Discovery Grants, along with several near-misses. And I note that the inexhaustible Graham Farquhar was on an externally led grant. Of the six new grants led from RSB, four are led by EMCRs, which bodes well for the future. On top of this, the Gate Foundation C4 Rice project, which builds on decades of fundamental plant science at ANU, is set to continue for another 18 months and perhaps realise the goals of this incredibly ambitious project. The RSB Spotlight this month focusses on several major achievements (and papers) in solving protein structures. Then, the list of publications highlights the breadth and quality of outputs from our research. The sum across research grants and outcomes is rather impressive!

On the 27th and 28th of November, we held our annual Faculty Retreat, with day one focussed on research and day two on teaching and PhD training. This is our one chance each year to take a deep dive into our core business of research and education. As important, it just gives faculty a chance to mingle and reconnect. As we face the challenges and opportunities ahead, this and other such collegial events become all-the-more important to shaping how we respond.

I am also pleased to announce that the 2025 Ralph Slatyer Prize, ANU's premier award in biological sciences, will be awarded to Madeleine Van Oppen from Univ. Melbourne and the Australian Institute of Marine Science. This award recognises her ground-breaking research in applying evolutionary principles to increase the resilience of corals (including their symbiotic algae and microbiomes) to increasing sea temperatures. In sum, her research demonstrates how fundamental science can be translated to help solve major environmental issues. Stay tuned for information on the award ceremony next year.

We ended the year with the annual RSB party which brings us all together to celebrate a job well done. Thanks to Vienna, Michelle and Steve for all they did to bring this about.

I hope you have a real refresh with family and friends over the new year break. I'm intending just that.

Craig

Grants Awarded

Australian Research Council Discovery Project 2025 outcomes announcement saw several successful RSB applicants:

Ben Corry (BSB) project awarded $1,025,000

Damien Farine (E&E) project awarded $730,968

Andrew Scafaro (PS) project awarded $729,225

Joanna Melonek (PS) project awarded $828,790

John Rathjen (PS) project awarded $666,818

Kai Chan (PS) project awarded $677,657

Welcome

Welcome to **Asma Zia Muhammad Hanif** (Chan group, PS) who has joined the Chan group and the ARC Training Centre for Future Crops Centre to undertake her PhD on Nanotechnology Enabled CRISPR Gene Editing in Crops, including industrial collaboration with Grain Research and Development Corporation (GRDC).

We welcome **Hyewon Jun** (Farine Group, E&E) to the Farine Group. Hyewon is an MSc student at the University of Zurich, and she will spend the next 12 months developing a pipeline using deep learning to quantify foraging rates in superb fairywrens, and use the data to evaluate how foraging rates vary across different microhabitats.

The Farine Group also welcomes **Antonia Huerlimann** (Farine Group, E&E), who is a visiting MSc graduate from the University of Zurich. Antonia studied memory and collective movements in vulturine guineafowl for her MSc, and is visiting the Group at ANU to write up her results (and collaborate on other projects).

Welcome to **Grace Mani** (Solomon Group, PS) who has joined RSB as the Centre Administrator for the ARC Training Centre in Plant Biosecurity. She's based next to Sarah Adam's office, ground floor Linnaeus Building, and has moved across from the CoS Research Office. Come and say hello!

Farewell

Late last month the Future Crops Training Centre bid farewell to **Neelam Gogoi** (Pogson Group, PS), the Centre's first Innovation Fellow who is moving to France to take up a position nearer to family. Neelam has established Visiting Fellow status already, and will continue to be on the panel of one of our Centre PhD students, support some teaching on nanotechnology mediated gene-editing, co-publishing collaborative research and perhaps host a student in

future! Neelam has been a much-loved personality within the Centre and will be missed. Neelam departs just following her publication in "Trends in Plant Science" Developing frameworks for nanotechnology-driven DNA-free plant genome-editing - ScienceDirect. We wish Neelam all the very best for her next role (in the grapevine industry!).

Congratulations

Congratulations to our newly promoted academics:

Level A to B
Deyun Qiu (Lehane Group, BSB)
Mareike Moeller (Schwessinger Group, PS)

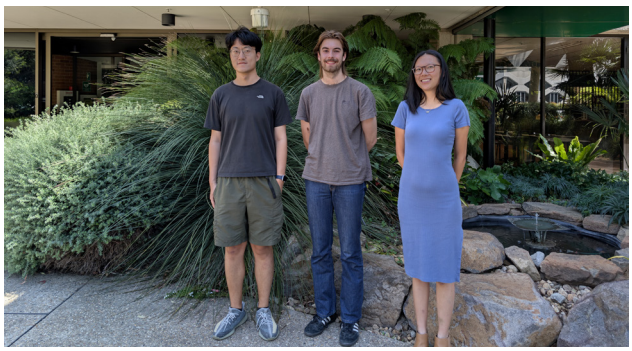
Level C to D
Adele Lehane (BSB)
Juliey Beckman (BTLC)

Level D to E
Benjamin Schwessinger (PS)

Congratulations to **Emily Roycroft** (Moritz Group, E&E) who received a L'Oréal-UNESCO For Women In Science Fellowship for her research into endangered Australian mammals. Listen to the interview in ABC Listen's Illawarra Drive program at the 44:02 mark or read the following articles Meet five trailblazing female scientists being honoured for their work in STEMM published by Women's Agenda and The world needs science and science needs more women – fast published by the Guardian. The award ceremony was held in the State Library of Victoria.

Congratulations to **Rob Lanfear** (E&E) who was named as a field leader in evolutionary biology in The Australian's report on Australia's research field leaders published on the 27th of November 2024.

Congratulations to **Danielle Way** (PS) and **Yong-Ling Ruan** (PS) who have been named in the top one per cent in the world in their fields on Clarivate's Highly Cited Researchers 2024 list.



Zirui Zhang (Schwessinger Group, PS), **Riley Furbank** (Chan Group, PS), **Yie Chang** (YC) **Lin** (Corry Group, BSB)

Congratulations to **Zirui Zhang** (Schwessinger Group, PS) who was awarded the Postgraduate Medal for Academic Excellence. Zirui also received the highest grade for a student completing the Master of Science (Advanced) in Quantitative Biology and Bioinformatics.

Congratulations to **Riley Furbank** (Chan Group, PS) who was awarded the University Medal for recognition of outstanding academic excellence and obtaining First Class Honours.

Congratulations to **Yie Chang** (YC) Lin (Corry Group, BSB) who was awarded Janet Elspeth Crawford Postgraduate Leadership Prize for 2024. This prize is awarded by the College of Science to a postgraduate student who has demonstrated significant leadership and outstanding academic achievement.

Congratulations to **Alison Bentley** (PS) who has been recognised as one of four STEM SuperSTARs at the ANU for promoting gender diversity in Science. Read more about her efforts on her profile on the Science & Technology Australia website or the ANU reporter article STEM Superstars step into the spotlight.

Congratulations to **Spencer Whitney** (PS) who was awarded a Individual service contribution award from the ANU College of Science for his longstanding leadership as the HDR convenor for the division of Plant Sciences. The College of Science Service Awards recognise and celebrate staff and students from the College who have gone above and beyond expectations in serving the CoS community.

Congratulations to **Haoran Li** (Danila Group, PS) who won a poster prize on his work on "Elucidating the role of plasmodesmata in wheat stripe rust infection" at the ASPS2024 held at Western Sydney University on the 28th of November.

PhDs awarded

Vanessa Howieson (Saliba Group, BSB) *The Coenzyme A biosynthesis pathway of the human malaria parasite Plasmodium falciparum and Toxoplasma gondii*

Audrey Prasetya (Moritz Group, E&E) *Historical Biogeography and Avian Speciation in the Indo-Australian Region*

Salome Wilson (Schwessinger Group, PS) *Identifying and characterising effector molecules corresponding to disease outcomes in wheat stripe rust disease*

Murraya Lane (Marsh Group, E&E) *The effects of the 2019-2020 megafires on koalas and the nutritional quality of their habitat*

Caitlin Cherryh (Lanfear Group, E&E) *Systematic bias in phylogenetic methods: investigating the adequacy of the treelikeness assumption*

In the Media

Yun (Living) Li (Previously Moritz Group, E&E) had an article published by Australian Geographic on how darkling beetles rose to 'global ecological dominance'.

Dave Rowell (E&E) spoke to Riotact about white tailed spiders, read the full article Are we looking at the wrong culprit in white-tailed spider-bite horror stories?

Kate O'Hara (Moritz Group, E&E) had an article published by ANU Reporter which has since been republished by Australian Geographic, read the full article These lizards gave up on sex in favour of cloning themselves, and you're still scrolling on a dating app.

Caitlin Byrt (PS) spoke with various media channels about growing plants on the moon, tune in to ABC Radio's Victorian Afternoons program Science takes

on small step towards plant life on the moon or read the Riotact article Can plants grow on the moon? ANU scientists are poised to find out.

Lucy Aplin (E&E) spoke to Cosmos Magazine about research led into the social learning of the great tit (Parus Major) from other birds in the environment.

Wolfram Buss (Borevitz Group, PS) wrote an article for the Conversation titled Spreading crushed rock over farmland can remove CO2 from the atmosphere if we do it right.

Sasha Mikheyev (E&E) spoke to Yahoo! News about golden orb weavers found near an Australian beach, read the full article Incredible discovery during Aussie man's beach walk: 'Dangerous business'.

News

C4 Rice Project Extended

In 2009 the Bill and Melinda Gates Foundation invested US$12M to fund a consortium of 16 researchers in 11 countries to boost rice yield by 50%. The plan was to install the highly efficient C4 pathway of photosynthesis (discovered in 1966 in Australia by Hatch and Slack) from maize, into the C3 crop rice. At the time, Bill Gates called this his Apollo Project, a real moon-shot. High risk but high payoff. This year, after 15 years of investment, a slimmed down version of the project was extended for another 18 months. ANU has been a key player in this consortium since day one with the von Caemmerer and Furbank labs in charge of building the metabolic prototype in rice. With field trials in Taiwan this year, the race to the finish line is now on.

The C4 Rice ANU team is shown here celebrating 15 years of achievements in Susanne's garden (from left to right: **Bob Furbank** (PS), **Fahim Nawaz** (Furbank Group, PS), **Susanne von Caemmerer** (PS), **Kelly Chapman** (Furbank Group, PS), **Florence Danila** (PS), **Jing Zhang** (Furbank Group, PS), **Ding Yuan** (Whitney Group, PS) and **Kavya Yalamanchili** (Furbank Group, PS))

On Tuesday 26th of November the Centre for Biodiversity Analysis hosted the Australian Biodiversity Discovery Facility open day in-person and streamed the day online. Talks were given by ANU researchers **Megan Head** (E&E), **Rod Peakall** (E&E), and **Justin Borevitz** (PS), and collaborators from Karlsruhe Institute of Technology (Germany). Rachel Mapperson and Lorenz Wührl gave detailed tours of the facility for all our attendees.

This novel DiversityScanner technology developed by Rudolf Meier (Museum fur Naturkunde) and Lorenz Wührl (both speakers on the day) and Christian Pylatiuk (Karlsruher Institut für Technologie) combines robotics, machine learning and high-throughput genomic sequencing to scan, classify and quantify invertebrate taxa from bulk environmental samples.

Attendees with wide-ranging interests attended from UC, CSIRO, ANU, Federal Gov, NT gov, ACT Gov, AIMS, QLD gov, Greening Aus, JCU, Latrobe Uni, Uni Adelaide, SA museum, Ausvet, NRM, Uni of Agriculture Multan Pakistan, NRCA Australian National Fish Collection, and more. Event recordings and slides are available on the ABDR Open Day event page.

The DiversityScanner was also on display the following day at the ANU Research Infrastructure expo on Wednesday 27th.

HDR-EMCR conference 22nd of November

Congratulations to all presenters at the HDR-EMCR conference – it was an AWESOME event. As always, the quality of the talks was outstanding, but there could only be 3 HDR prizes. Special congratulations to **Ciara Wallis** (Corry Group, BSB), **Lisa Fontana** (Aplin Group, E&E) and **Suyan Yee** (Chan Group, PS) who won the Hirota Naora best student presentation award.

These events would not have been possible without the organisational help of many. In particular the HDR representative committee (**Arslan Mahmood** (Millar Group, PS), **Nils Kreuter** (Sequeira Group, E&E), **Brendah Nyagah** (Farine Group, E&E), **Alex Williams** (Brock Group, BSB), **Capella MaGuire** (van Dooren Group, BSB), and **Hafiz Sabah Ud-Din Mazhar** (Danila Group,PS)), the EMCRs (**Mitzy Pepper** (Keogh Group, E&E), **Kai Chan** (PS), **Pieter Arnold** (Nicotra Group, E&E), **Erick Tjhin** (Spry Group, BSB), **Richard Poire** (Way Group, PS), **Deyun Qiu** (Lehane Group, BSB), with help from **Peisong Tian** (Head Group, E&E), **Dinithi Rajapaksha** (Adamska Group), **Kushini Kalupahana** (Langmore Group, E&E) as well as **Sam Jahromi** and **Dani Maas** from Student Admin BTLC. A big thank you to the session chairs and the HDR convenors, **Giel van Dooren** (BSB), **Spencer Whitney** (PS) and **Scott Keogh** (E&E).

HDR Scholarships

After much uncertainty and at a late hour, RSB has been awarded 5 international student scholarships. These have been allocated to students ranked by the HDR convenors and involving an interview process. Having allocated 5 scholarships, it does mean though that we will have NO international scholarships for the April 2025 round as we have allocated our yearly quota in this round.

In further good news, ALL 13 domestic PhD applicants will be awarded an ANU scholarship. IMPORTANT: If you have a new domestic applicant who would like to apply for a scholarship in the current round, they should do so asap as they may qualify for "leftover" domestic PhD scholarships – these must be awarded before the 16th of January 2025 though. If they miss this date, they could always apply in the April round.

Confirmation of Candidature

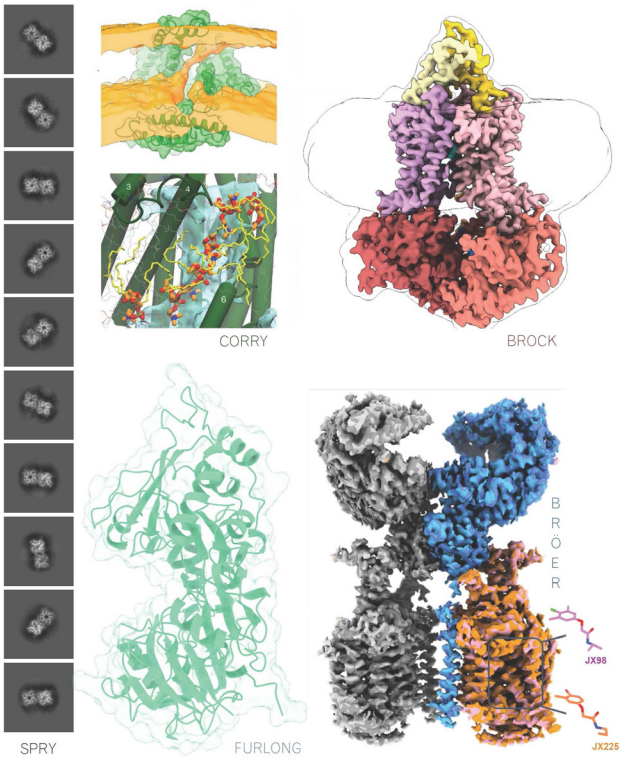
Well done to all 22 students who have participated in our inaugural CoC process. It has been an incredibly valuable process for all (students, supervisors, HDR Board members, and HDR convenors!). The standard of talks were outstanding. A special thank you to our HDR board members (**Joanna Melonek** (PS), **Simon Williams** (PS), **Kai Chan** (PS), **Megan Head** (E&E), **Dan Noble** (E&E), **Naomi Langmore** (E&E), **Emily Furlong** (BSB), **Alex Maier** (BSB), and **Adele Lehane** (BSB)), volunteer Board members, and of course, our HDR convenors who took on a tremendous workload as Chairs of the CoC panels.

Outreach

RSB hosted two outreach events in the month of October. The Junior Biology Olympiad was held in the Biology Teaching Lab from the 8th to 11th of October. The 24 high achieving, Year 7 to 10 students, participated in pipetting, microscopy, gram staining and DNA profiling practicals. The second event was for twenty Year 9 and 10 students from Crossways Lutheran School in South Australia, who attended ANU on the 31st October for a lecture, "From single cell to human body" delivered by **Maja Adamska** (BSB).

RSB Spotlight- Biomedical Science and Biochemistry

Protein Structure, especially structures derived by cryo-electron microscopy (cryo-EM), was considered a key priority area for growth by the Division of Biomedical Science and Biochemistry (BSB). This month's Newsletter Spotlight highlights some protein structures that have recently been solved, or are in the process of being solved, by BSB groups.



Images, clockwise from top left:

1. The Mycobacterium tuberculosis PanD protein, which is implicated in the mechanism of action of the tuberculosis drug pyrazinamide, is best characterised as a tetramer, however, the Spry Group have observed that it also forms higher order oligomers and are attempting to determine their structure by cryo-EM. Unpublished Credit: Jobichen Chacko (CAM) and **Xiaojun (Holly) Yuan** (Spry Group, BSB).

2. Mechanical stimulation opens a lipid-lined pore in the OSCA protein, responsible for sensing osmotic changes in plants. Lipids (yellow surface in top cryo-EM map, orange molecules in bottom simulation image) form a belt between membrane leaflets that lines a water and ion conducting pore, used to convert mechanical forces into cellular responses. (Han et al., Nature 628: 910, 2024) Credit: **Ruitao Jin** (Corry Group, BSB, **Sitong He** (Corry Group, BSB) and Yaoyao Han (Chinese Academy of Science).

3. Cryo-EM structure of the Candida albicans Cdr1 multidrug transporter in the inward-open state, in complex with ADP/ATP in the two nucleotide binding domains and Rhodamine 6G bound within the substrate binding pocket. Although, many ABC transporters are dimeric, Cdr1 is encoded on a single gene created by an ancestral gene duplication. This has allowed this family to evolve an "asymmetric" structure, with one nucleotide binding site unable to hydrolyse ATP and instead performs an allosteric regulatory role. The structure generated by the Brock Group allowed a better understanding of the mechanism of this allosteric regulation, by which a flexible linker domain transfers conformational change associated with nucleotide binding to the rest of the transporter. (BioRxiv: doi: https://doi.org/10.1101/2024.10.28.620768, 2024) Credit: **Alice (Jeeeun) Shin** (Brock Group, BSB).

4. The complex of membrane transporter B0AT1 (pink and yellow) and the coronavirus receptor ACE2 (blue) forming a large dimer in the membrane with another B0AT1/ACE2 (grey) complex. The transporter can be blocked by specific inhibitors (JX98/JX225), which were developed in collaboration with RSC. (Xu et al. Nature Communications 15: 7224, 2024) Credit: Aditya Yadav, Yashan Jiang, **Angelika Bröer** (Bröer Group, BSB).

5. X-ray crystal structure of the YntA nickel binding protein from the urinary tract pathogen Proteus mirabilis. This protein is part of the nickel import system and is important for P. mirabilis virulence. Unpublished Credit: **Sarah Mueller** (Furlong Group, BSB) and **Scarlett Cox** (Furlong Group, BSB).

Papers

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Thank you to all the contributors to the RSB Newsletters in 2024!