



PROFESSOR STEFAN BROER (BSB) TALKS ABOUT HIS RESEARCH



How has your research improved our understanding of the Corona virus?

It is well established that angiotensin-converting-enzyme 2 (ACE2), a peptidase

that is located at the surface of many cells, is hijacked by the current coronavirus to enter cells. While hanging on to ACE2, a membrane fusion protein is released that initiates the endocytosis of the virus. What we have established is that ACE2 is not alone in the membrane, but rather forms a bigger complex with an amino acid transporter. Whether this complex facilitates entry or hinders it remains unclear.

What are the implications of your research?

We just wrote a grant proposal to investigate the complex in the lung and whether expression levels of ACE2 and of the amino acid transporter could underlie the large differences in clinical outcomes of coronavirus infection that we currently observe. It appears that the strength of the immune system has relatively little impact on clinical outcomes. The abundance of the receptor-transporter complex might be a relevant factor. If true we could predict who might become a severe case of coronavirus infection or only a mild one.

What would you like to do in the future in this research space?

NHMRC permitting, we hope that we can investigate the complex in lung and investigate whether the larger ACE2-transporter complex influences binding of the coronavirus. We are working with RSC (Malcolm McLeod and Megan O'Mara) to understand the dynamics of this complex in more detail.



Photo: Tom Semple from his PhD study of "A 3D-perspective on the reproductive evolution of Australian thynnine wasps".

PHDS APPROVED

Congratulations to Tom (Thomas) Semple (E&E, formerly in the Peakall group), now based in Canada with his partner Marta (formerly Keogh group). Tom has had his PhD thesis approved for the award of Doctor of Philosophy. His thesis is entitled: "A 3D-perspective on the reproductive evolution of Australian thynnine wasps". Rod Peakall explains how "this was a highly innovative, and one might say intimate look at the reproductive biology of thynnine wasps."

"The best part about being a research biologist is the fieldwork, no question. I went to beautiful parts of the country that I might never have otherwise been, all in the search of interesting wasps! What did I learn? A



whole lot, and not much - or just enough to realise how little I/we know about thynnine wasps. I also learnt that Canberra is a beautiful place to live and study. I miss it! Thanks Rod and the rest of the Peakall lab for an excellent 4 years!" Tom Semple.

PHDS SUBMITTED

Congratulations to Fitria Oktalira (Linde group) on her PhD submission: "Diversity of Serendipitaceae Mycorrhizal Associations of

Australian Terrestrial Orchids." Fitria explains: "As I always have a strong interest in mycology, through this PhD I was given the opportunity to gain understanding and experience in the area



of mycology such as fungal biology, fungal diversity and fungal taxonomy. Besides, I also learned the biodiversity of Australian orchids where I obtained my studied fungal from. The most favourite part of my PhD is I was able to learn and strengthen the necessary skills in both field and laboratory experiments. I am so grateful for this privilege and I am looking forward to share the immense experience and knowledge I have got here to my community in Indonesia."

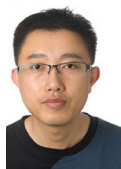
Congratulations to Arild Ranlym Arifin (E&E, Linde group) who submitted his PhD this month on the "Diversity of Tulasnellaceae mycorrhizal associations of Australian terrestrial orchids."



Arild explains how he uncovered a remarkable diversity of Tulasnella fungi to associate with these taxonomic groups, which were found to have different degrees of phylogenetic congruency.

GOODBYE

We need to say goodbye and good luck to Alicia Grealy, who is completing her post-doc in the Langmore group. Alicia will be taking up a new post-doc in Alexander Schmidt-Lebuhn's lab at CSIRO, where she will be part of the Environomics project "Accelerating discovery: a collection genomics pipeline for high-throughput target enrichment". "She has been a wonderful and hugely productive member of our group and she will be very much missed!" Naomi Langmore.



We also wish Dr Yansheng Li well. He is leaving the Mathesius group at the end of May to return to his home in Harbin, China. Yansheng has been at RSB

for the last 12 months on a Fellowship from the Chinese Scholarship Council as a post-doctoral fellow. Yansheng will return to the Northeast Institute of Geography and Agroecology, part of the Chinese Academy of Sciences. Ulrike Mathesius explains: "Yansheng has been working on the metabolomic responses of legumes to elevated CO₂ and found a strong link between atmospheric CO₂ concentration and the exudation of flavonoids into the soil, which were linked with increased nitrogen fixation. We will continue to collaborate and wish Yansheng all the best. It has been a productive time and we will miss Yansheng!"

GRANTS

ARC Linkage success! Congratulations to Susanna Venn (formerly E&E) and Adrienne Nicotra (E&E) who are part of a team who have been awarded ARC Linkage grant "Building resilient alpine environments with less snow". LP190100844. This research aims to build resilience into Alpine National Parks and Alpine Resorts to counter the effects of ongoing declines in snow.

Congratulations to Justin Borevitz (PS, E&E) who is a joint recipient of an ARC Linkage grant focusing on "Integrated Farm Modelling to Improve Resilience and Sustainable Prosperity." LP190101060. This project aims to improve farm resilience, farm management, and

economic decision-making in Australia and internationally.

Congratulations to Tony Millar (PS) who was awarded a Herman Slade grant on "Developing broad-spectrum pathogen resistance in the Solanaceae". Tony explains: "We have discovered that the suppression of a miRNA triggers strong expression of a broad spectrum of disease resistant genes that confer immunity to the pathogen *Phytophthora* in tobacco. Our grant aims to determine the spectrum of pathogens that it confers immunity, how conserved this miRNA response pathway is in plants, and whether we can manipulate it to generate novel disease-resistant transgenes. This collaboration is between the Millar lab and Leila Blackman, David Jones and John Rathgen labs."

AWARDS

Congratulations to Stephan Fairweather (RSB & RSC), who with his PI Megan O'Mara and colleague Katie Wilson from RSC has been awarded a National Computational Infrastructure (NCI) Australasian Leadership Computing Grant. The grant was awarded to three research groups Australia-wide and was a special call for computational research specifically related to the current COVID-19 pandemic.



The project entitled 'Using large-scale molecular dynamics for rational drug design against the SARS-CoV-2 Receptor ACE2-B0AT1' will use atomistic simulations on the NCI's new Gadi supercomputer to examine how the SARS-CoV-2 virus binds to the human receptor ACE2-B0AT1 to enter human cells and how this might be prevented.

The project is the continuation of many years collaborative work with Stefan Broer's group here at RSB, which has been foundational in discovery and understanding of the ACE2-B0AT1 complex. Using 48 processors running for 19 days for each of 64 molecular simulations, this research will spend around 13 million hours of computing time in the coming months. The funding period runs from April 30th 2020 for one year!

Congratulations to Eloise Tredenick (Farquhar Group) who has won two awards: The AustMS WIMSIG Cheryl E. Praeger Travel Award for women in mathematics,

as an invited speaker at the Forum "Math-for-Industry" 2019 - Mathematics for the Primary Industries and the Environment, Albany, New Zealand in November 2019.



Eloise also received the Queensland University of Technology (QUT) Executive Dean's Commendation for Outstanding Doctoral Thesis. The PhD was awarded at QUT in March 2019 and the commendation was received in May. Her thesis is titled: Mathematical modelling of ionic agrochemical diffusion in plant cuticles: A mechanistic approach.

Jana Sperschneider (PS, a DECRA fellow, Rathjen and Stone groups) won the Tansley Medal in Plant Science from the New Phytologist. The New Phytologist Tansley Medal is awarded annually in recognition of an outstanding contribution to research in plant science by an individual in the early stages of their career.



NOTABLE PAPERS

Two recent publications (PS) were in the 10% most cited publications (Top downloaded articles) for The Plant Journal and the New Phytologist:

Ermakova, M., F.R. Danila, R.T. Furbank and S. Von Caemmerer. 2020. On the road to C₄ rice: advances and perspectives. The Plant Journal 101: 940-950.

Furbank, R.T., J.A. Jimenez-Berni, B. George-Jaeggli, A.B. Potgieter and D.M. Deery. 2019. Field crop phenomics: enabling breeding for radiation use efficiency and biomass in cereal crops. New Phytologist 223: 1714-1727.

Barua and Mikhayev's recent 2020 paper (below) was highlighted in the PNAS journal club: "Snake venom evolved in fits and spurts". The blog can be found [here](#).



Photo: Alexander Mikhayev

MEETINGS AND WORKSHOPS

Tony Millar and Lauren duFall ran a great meeting in May on how we might partner with a few others around the country to build our plant transformation capabilities.

Jennie Mallela ran two online sessions for the Women in STEM workshop for educators. This was a free online workshop for educators to increase girls' participation in STEM, hosted by Australia's Women in STEM Ambassador, Professor Lisa Harvey-Smith, and Questacon.

COMPETITIONS



DIVISION OF PLANT SCIENCES

Congratulations to Naomi Hawley and Andrew Bowerman who won the PS logo competition. Their logo will be used for PS marketing and online. The

logo: the four leaf colours represent the 4 different research groups, but they stem from the same plant, not only because they are part of the one division of science but because one plant needs all four factors to successfully develop. The plant stem merges into the genetic helix representing the science and molecular foundations which all plants have and a scientific component which we are striving to understand in this Division. The Helix continues to wrap towards the leaves in a circular pattern, symbolising the working relationship between the four research groups and adding a continuity to the logo.

Congratulations to Florian Busch who won one of the two #ANUZoomPrize from @EcoEvo_ANU for the most creative Zoom background. [Click here](#) to see his entry.

H2O Hack: an exciting hackathon (with cash prizes!) being run in mid June that will focus on finding solutions to improve water use efficiency in the agri-food sector. We are looking for entrants from a wide range of areas, including many areas of the areas covered by RSB.

IN THE MEDIA

Plant Sciences has made the news recently in several media outlets including The land,

the Weekly Times and EurekAlert:



ANU researchers look to lift crop production through photosynthesis research.

No time to waste to avoid future food shortages.

Peter Solomon (PS) authored an *opinion piece* in the Times Higher Education on student feedback: "Is student course evaluation actually useful?" In his article Peter concludes: "I strongly encourage students to share their honest experiences of the course, both positive and negative. However, I do also remind them that we are human and that we try. So if they have something to be critical about, that is absolutely fine, but they should be constructive and consider the impact of what they say."

ONLINE

Lecture: So you're graduating your PhD in a Pandemic... what next? June 9th 2020 12pm-1pm.

The HDR COVID-19 Frequently Asked Questions (FAQ) webpage is *now live*.

Teaching resources: Have you ever wondered how to make a gender inclusive learning environment? *Top tips at the GIST.*

TEACHING & MENTORING

Rob Lanfear (E&E) has been jointly awarded HDR supervisor of the month. Congratulations Rob!

SOCIAL MEDIA

Have you got an interesting image of you in the field or laboratory? Can you provide a sentence about your research? Please email them to rsb.newsletter@anu.edu.au. We'll tweet your images and information. Please include your twitter handle and your

divisional/institutional twitter handles.

Don't forget to share your good news and research stories with us via the RSB newsletter. Email us on: rsb.newsletter@anu.edu.au

PAPERS ACCEPTED

Alves, F., N.E. Langmore, R. Heinsohn and D. Stojanovic. 2020. 'Self fumigation' of nests by an endangered avian host using insecticide-treated feathers increases reproductive success more than tenfold. . Animal Conservation.

Asao, S., L. Hayes, M.J. Aspinwall, P.D. Rymer, C. Blackman, C.J. Bryant, et al. 2020. Intra-specific trait variation arises similarly among genotypes of *Eucalyptus camaldulensis* in response to seasonal change in environment rather than water availability or climate of genotype provenance. *New Phytologist*.

Bailey, L.D., L.E.B. Kruuk, R. Allen, M. Clayton, J. Stein and J.L. Gardner. 2020. Using different body size measures can lead to different conclusions about the effects of climate change. *Journal of Biogeography*.

Barua, A. and A.S. Mikheyev. 2020. Toxin expression in snake venom evolves rapidly with constant shifts in evolutionary rates. *Proceedings of the Royal Society B: Biological Sciences* 287: 20200613.

Braby, M.F., E.D. Edwards and A.A.E. Williams. 2020. A new species of Sun-Moth, synemon *kimberleyensis* sp. nov. (Lepidoptera: Castniidae), from the Kimberley in Western Australia. *The Journal of the Lepidopterists' Society* 74: 31-42.

Chai, A.B., G.K.F. Leung, R. Callaghan and I.C. Gelissen. 2019. P-glycoprotein: a role in the export of amyloid- β in Alzheimer's disease? *The FEBS journal*.

Chapman, K., A. Ivanovici, M. Taleski, C.J. Sturrock, J.L. Ng, N.A. Mohd-Radzman, et al. 2020. CEP receptor signalling controls root system architecture in *Arabidopsis* and *Medicago*. *New Phytologist* 226: 1809-1821.

Chung, M.H.J., R. Fox and J. M.D. 2020. Fine-scale genital morphology affects male ejaculation success: an experimental test. *Biology Letters*.

Dinnage, R., A. Skeels and M. Cardillo. 2020.

Spatio-phylogenetic modelling of extinction risk reveals evolutionary distinctiveness and brief flowering period as threats in a hotspot plant genus. *Proceedings of the Royal Society B* 287: 20192817.

Ermakova, M., F.R. Danila, R.T. Furbank and S. Von Caemmerer. 2020. On the road to C4 rice: advances and perspectives. *The Plant Journal* 101: 940-950.

Furbank, R.T., J.A. Jimenez-Berni, B. George-Jaeggli, A.B. Potgieter and D.M. Deery. 2019. Field crop phenomics: enabling breeding for radiation use efficiency and biomass in cereal crops. *New Phytologist* 223: 1714-1727.

Gray, L.N., A.J. Barley, D.M. Hillis, C.J. Pavón-Vázquez, S. Poe and B.A. White. 2020. Does breeding season variation affect evolution of a sexual signaling trait in a tropical lizard clade? *Ecology and Evolution* 10: 3738-3746.

Green, K.A., D. Berry, K. Feussner, C.J. Eaton, A. Ram, C.H. Mesarich, et al. 2020. *Lolium perenne* apoplast metabolomics for identification of novel metabolites produced by the symbiotic fungus *Epichloë festucae*. *New Phytologist*.

Harris, J.M., K. Pawlowski and U. Mathesius. 2020. Editorial: Evolution of signaling in plant symbioses. *Frontiers in Plant Science* 11: 456.

Houston, K., J. Qiu, S. Wege, M. Hrmova, H. Oakey, Y. Qu, et al. 2020. Barley sodium content is regulated by natural variants of the Na⁺ transporter HvHKT1;5. *Communications Biology* 3: 258. doi:10.1038/s42003-020-0990-5.

Hsiao, Y. 2020. A taxonomic study of *Cucujus Fabricius*, 1775 from Asia (Coleoptera: Cucujidae), with descriptions of new species and notes on morphological classification. *Insect Systematics & Evolution*.

Hulyer, A.R.C., D.A. Briggs, M.L. O'Mara, I.D. Kerr, J.R. Harmer and R. Callaghan. 2020. Cross-linking, DEER-spectroscopy and molecular dynamics confirm the inward

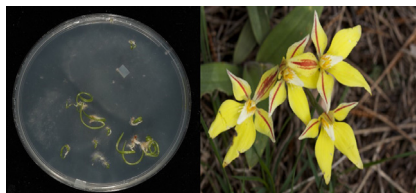


Photo: *Fitria Oktalira* from her PhD study species.

facing state of P-glycoprotein in a lipid membrane. *Journal of Structural Biology*: 107513.

Jigisha, M. Iglesias-Carrasco, A. Vincent and M.L. Head. Disentangling the costs of mating and harassment across different environments. *Animal Behaviour*.

Kachuei, V., Talebi B.A.A, F. Rahimi and M. Forootan. 2020. Colonization by *Pseudomonas aeruginosa* and *Staphylococcus aureus* of antral biopsy specimens from gastritis patients uninfected with *Helicobacter pylori*. *Infection and Drug Resistance* 13: 1411-1417.

Kenthirapalan, S., P.N. Tran, T.W.A. Kooij, M.C. Ridgway, M. Rauch, S.H.J. Brown, et al. 2020. Distinct adaptations of a gametocyte ABC transporter to murine and human *Plasmodium* parasites and its incompatibility in cross-species complementation. *International Journal for Parasitology*.

Khan, H., M.C. McDonald, S.J. Williams and P.S. Solomon. 2020. Assessing the efficacy of CRISPR/Cas9 genome editing in the wheat pathogen *Parastagonospora nodorum*. *Fungal biology and biotechnology* 7: 1-8.

Kidsley, A.K., M. O'Dea, E. Ebrahimie, M. Mohammadi-Dehcheshmeh, S. Saputra, D. Jordan, et al. 2020. Genomic analysis of fluoroquinolone-susceptible phylogenetic group B2 extraintestinal pathogenic *Escherichia coli* causing infections in cats. *Veterinary Microbiology*: 108685.

Langmore, N.E. 2020. Song in female birds. *Current Biology*.

Minh, B.Q., M. Hahn and R. Lanfear. 2020. New methods to calculate concordance factors for phylogenomic datasets. *BioRxiv*: 487801.

Minh, B.Q., H.A. Schmidt, O. Chernomor, D. Schrempf, M.D. Woodhams, A. Von Haeseler, et al. 2020. IQ-TREE 2: New models and efficient methods for phylogenetic inference in the genomic era. *Molecular Biology and Evolution* 37: 1530-1534.

Muria-Gonzalez, M.J., Y. Yeng, S. Breen, et al. 2020. Volatile molecules secreted by the wheat pathogen *Parastagonospora nodorum* are involved in development and phytotoxicity. *Frontiers in microbiology*. 4

Phillips, R.D., R. Peakall, T. van der Niet and S.D. Johnson. 2020. Niche perspectives on plant-pollinator interactions. *Trends in Plant Science*.

Rahimi, F. and A.T.B. Abadi. 2020. Tackling the COVID-19 Pandemic. *Archives of Medical Research*.

Rashid, F.A.A., A.P. Scafaro, S. Asao, R. Fenske, R.C. Dewar, J. Masle, et al. 2020. Diel and temperature driven variation of leaf dark respiration rates and metabolite levels in rice. *New Phytologist*.

Roberts, S.G., A. Killin, A. Deb, C. Sheard, S.J. Greenhill, Sinnemäki, et al. 2020. CHIELD: the causal hypotheses in evolutionary linguistics database. *Journal of Language Evolution* Izaa001.

Rottet, S., S. Iqbal, P.A. Beales, A. Lin, J. Lee, M. Rug, et al. 2020. Characterisation of Hybrid Polymersome Vesicles Containing the Efflux Pumps NaAtm1 or P-Glycoprotein. *Polymers* 12: 1049.

Schwessinger, B., Y. Chen, R. Tien, J. Vogt, J. Sperschneider, R. Nagar, et al. 2019. Distinct life histories impact dikaryotic genome evolution in the rust fungus *Puccinia striiformis* causing stripe rust in wheat. *Genome Biology and evolution* 12: 597-617.

Spry, C., L. Barnard, M. Kok, A.K. Powell, D. Mahesh, E.T. Tjhin, et al. 2020. Towards a stable and potent coenzyme A-targeting antiplasmodial agent: structure-activity relationship studies of N-phenethyl- -methyl-pantothenamide. *ACS Infectious Diseases*.

Taylor, C.J. and N.E. Langmore. 2020. Feeling the pressure: How do brood parasitic cuckoos reconcile conflicting environmental and host selection pressures on egg size investment? *Animal Behaviour*.

Wanelik, K.M., J.S. Griffin, M. Head, F.C. Ingleby and Z. Lewis. 2020. Breaking barriers? Ethnicity and socioeconomic background impact on early career progression in the fields of ecology and evolution. *Ecology and Evolution*..

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