

BIOLOGY Honours and Masters (Advanced) Programs

BIOL4001/BIOL8701

Biology Honours is an exciting, challenging and rewarding year. By working on a research project under the guidance of a supervisor, and through training courses and workshops, you will develop valuable skills in research planning, laboratory, field, or computational techniques, data analysis and inductive inference. You will develop an advanced understanding of a particular field of biology and an enthusiasm for the process of scientific discovery.

Admission Requirements

- Satisfactory completion of an undergraduate degree with an average score of at least 70%, calculated from six 2000 and 3000 level courses relevant to the proposed field of research.
- The availability of a research supervisor.

How to apply

For information on how to apply: [Honours | ANU Research School of Biology](#)

Application deadline

The application deadline is 15 December (late January start) or 31 May (July start).

How do you find a project and supervisor?

Before you apply, you should have a topic of research and the agreement of a Lab Leader in RSB to supervise your project. Well before applications close, get in touch with potential supervisors to discuss your research interests. Supervisors may offer “off the shelf” projects to choose from, or be willing to tailor a project to your interests. You might consider talking to honours or PhD students from RSB to get an idea of the research environments in different labs. Many RSB academics co-supervise projects with CSIRO, so a project based at CSIRO is also a possibility.

What type of research is being done in RSB? Find out here: <http://biology.anu.edu.au/research/divisions>.

What projects are available? See list below

Are there any scholarships available?

Yes there are, see p4.

What does an Honours research year entail?

The Honours year is entirely based on independent research. Most of your year will be spent working on **your research project**, under the guidance of a supervisor and typically with staff or/and students in their group.

- The year begins with a few weeks of **training courses and workshops** to equip you with important research skills.
- Early in the year you will present a 15 min **Introductory Seminar** to outline your project to RSB staff and students.
- A few weeks later you will submit a **Research Proposal** outlining the background, aims and methods for your project and then meet with your *panel of examiners* to discuss your project plan. The Research proposal is worth 15% for Honours students. For Masters students it is compulsory, but does not contribute to your final score.
- You will meet with your *panel of examiners* mid-way through the year to review your progress and then near the end of the year present your findings and conclusions in a 15 min **Final Seminar**. This is a good chance to organize your thoughts and get feedback before writing your thesis.
- The major piece of assessment is your ~10,000 word **Thesis**. This is worth 85% of your final score for Honours students and 100% for Masters students. The thesis presents the background and literature review relevant to your project, your project aims, a description of the methods and results, a discussion of your findings and their implications, and your conclusions. Plenty of support and guidance is provided to help you prepare your thesis.
- After your thesis is submitted, you will meet again with your examiners for a discussion of your thesis.

As a member of a research group you will be expected to participate in your group’s regular activities such as lab meetings are encouraged to actively participate activities at the School or Division level, such as journal clubs, workshops, weekly seminars, and various social events.

Available Research Projects:

Below are projects on offer for 2022. You can also contact academic staff directly and tell them what your general interests are.

[Kara Youngentob](#) and [Karen Ford](#) – *Nutritional ecology*

- How plant nutrients and toxins affect animals

[Simon Williams](#) – *Plant Structural Immunology*

- How do effector proteins from necrotrophic fungi cause disease in wheat?
- The molecular basis for plant susceptibility and immunity to Fusarium wilt disease
- Understanding the molecular basis of fungal rust diseases in plants

[Spencer Whitney](#) - *Synthetic Photosynthesis - bioengineering enzymes to adjust carbon fixation*

- The use of synthetic biology to supercharge plant CO₂ fixation by directed (laboratory) evolution
- Trialing new chloroplasts transformation capabilities in tobacco and canola for protein bioengineering

[Giel van Dooren](#) - *Cell biology and metabolism of apicomplexan parasites*

- Uncovering connections between nutrient uptake and mitochondrial metabolism in Toxoplasma parasites

[Peter Solomon](#) - *Plant-pathogen interactions*

- Protein interaction studies to understand how pathogen proteins cause disease
- Confocal analysis to study the interaction and localisation of plant-pathogen protein interactions
- Gene expression analysis in model plants upon treatment of a novel resistance chemical
- CRISPR analysis of pathogen genes to understand gene expression and protein folding

[Benjamin Schwessinger](#) – *Plants fungi, evolution*

- Enhancing agricultural and environmental biosecurity using cutting edge genomics & bioinformatics.

[John Rathjen](#) – *Plant immunity and pathogen genomics*

- Plant immunity and primary metabolism
- Diurnal expression of host and pathogen genes during rust pathogenesis
- Directed evolution of plant disease resistance proteins

[Barry Pogson](#) - *Intracellular communication in plant stress tolerance*

- Linking intracellular communication to molecular mechanisms that promote plant stress tolerance.
- Synthetic biology and cellular signaling.
- Energy use efficiency in wheat.

[Rod Peakall and Darren Wong](#) - *Molecular biology of novel flower colour evolution*

- Molecular biology of novel flower colour evolution
- Computer modelling and simulation of semiochemical-based pollinator driven speciation
- The ecology, molecular biology and evolution of nectar production in sexually deceptive orchids

[Daniel Noble](#) – *Climate change, development plasticity and lizard ecophysiology*

- How do early thermal environments impact thermal behaviour in lizards?
- How do early thermal environments affect metabolic thermal acclimation responses in lizards?
- How do early thermal environments affect growth across different lizard species?

[Adrienne Nicotra](#) – *Plant physiological ecology, evolutionary biology*

- Thermal tolerance and response to climate change in plants and soil invertebrates from extreme environments (desert/mountain)
- Field studies of response to simulated climate change in the high country
- Understanding drivers of tree dieback in the high country
- Characterising the diversity, species richness, and functional groups of soil invertebrates in changing alpine ecosystems using environmental DNA and morphology

[Craig Moritz](#) – *Understanding and protecting Australia's unique biodiversity*

- Modeling spatial patterns of genetic and phylogenetic diversity to identify refugia for conservation across Australia's tropical north
- Comparing speciation and range-shifting of species under past climate change
- Identifying genes under selection for desiccation resistance in geckos
- Understanding divergence and genetic erosion in island mammals

- Molecular evolution and phylogenetics of Australian marsupials

[Rob Magrath](#) – *Bird behaviour and acoustic communication*

- Acoustic communication
- Learning to recognize alarm calls

[Anthony Millar](#) – *Plant RNA biology*

- Using plant miRNAs to trigger disease resistance in plants

[Sasha Mikheyev](#) – *Evolutionary genomics*

- How animals adapt to rapid changes in their environments

[Ulrike Mathesius](#) - *Root-microbe interactions – symbionts to parasites*

- Improving nitrogen-fixing symbioses by modification of plant signals
- Investigating trade-offs between symbiosis and parasitism in legumes
- Improving translation of nitrogen fixation to yield

[Alex Maier](#) – *Malaria/Parasitology*

- Incommunicado - Impact of cellular signalling on the survival and development of the malaria parasite
- Fighting malaria with fat – analysis of the lipid metabolism of the malaria parasite
- Power unseen – in-situ visualisation of parasites of medical and veterinary importance
- Public Perception of Parasitology

[Adele Lehane](#) – *Antimalarial drug action and resistance*

- The role of the malaria parasite's SulP transporter in ion regulation
- Transporters associated with resistance to antimalarial clinical candidates – investigating their natural functions and roles in resistance

[Robert Lanfear](#) – *Molecular evolution and phylogenetics*

- The causes and consequences of mutation in plant genomes
- New methods to build better phylogenies
- Predicting recombination from genome sequences
- Analysing millions of SARS-CoV-2 genomes in real time for public health
- Software engineering for phylogenetics
- Benchmarking phylogenetic tools and algorithms

[Gavin Huttley](#) - *Computational genomics, Bioinformatics*

- Machine learning techniques for identifying the origin of genetic variants
- Non-stationary Markov processes and their application to understanding genetic divergence
- GPU programming for probabilistic molecular evolutionary models

[Graham Farquhar](#)

- Mapping isolated pools of liquid water within the leaf using stable isotope techniques
- Identifying sources of evaporated water through the leaf surfaces using the isotopic signatures carried by water vapors
- Development of an infra-red spectroscopy technique to measure live water content variations of a leaf subjected to vapor pressure deficit

CSIRO [Dr Lydia Guja](#) - *Seed biology, seed ecology, and plant conservation*

- Understanding germination drivers for seeds of endangered communities such as grasslands and alpine peatlands, and the impacts of changed climate or stress
- Laboratory investigations of the responses of native seeds to fire cues
- Drivers of seed longevity in conservation storage
- How seed functional traits affect early life history processes and community composition

[Maria Ermokova](#) (*Furbank Group*) – *Improving C4 photosynthesis and crop yield*

- *Distinguishing the roles of two cyclic electron flow routes in C4 photosynthesis using gene-edited plants*

[Michael Djordjevic, Michael Taleski and Sara Shafik](#) – *Plant Molecular and Developmental Biology; Transporter Function, Peptide Hormone Function*

- New Strategies to Improve Nitrogen Fixation in Legumes
- Engineering Plants with Fit-For-Purpose Root Systems
- Characterising Transporters Crucial for Establishing the Symbiotic Handshake

[Manny Delhaize](#) and *Richard Poire*

- Characterising root mutants of wheat for improved water use efficiency
- Understanding the gravity-defying roots of the *Twisted Sister* mutants of wheat

[Ben Corry](#) - *Membrane channels, transporters and computational biophysics*

- Designing new sodium channel inhibitors for treating chronic pain
- Understanding the Piezo channel proteins responsible for our sense of touch
- New methods for water filtration using biologically inspired membranes and temperature gradients
- Simulating the structure and function of malaria parasite membrane transporters
- Computationally predicting the danger of new SARS-Cov-2 variants and circulating animal coronaviruses

[Caitlin Byrt](#) – *Engineering plant membrane proteins and solute transport to increase yield security*

- Applying synthetic biology approaches to building novel membrane proteins for food and water security applications
- Characterising key metabolite transporters in the C₄ photosynthetic pathway
- Deciphering the role of aquaporins in C₄ photosynthesis
- Deciphering functional roles of aquaporins in salt-secreting mangroves
- Elucidating determinants for hydrogen peroxide and water permeation through target aquaporins

[Lindell Bromham](#) - *Molecular Evolution, Macroevolution, Language and Cultural Evolution*

- Adapting to extremes: modelling evolution of tolerance to extreme conditions in Australian flora
- Rates of molecular evolution in eusocial species and their social parasites
- Patterns and processes of language evolution in Australia and New Guinea
- Evolutionary pressures shaping variation in mutation rates between species
- Australian biodiversity and the development of indigenous agriculture

[Joseph Brock](#) – *Membrane structural biology, biochemistry and biophysics*

- [SynBio enabled biosensors](#)
- [Engineering the secretory pathway of Yeast](#)
- [Structural basis of edometriosis](#)
- [Structural basis of drug resistance in the Malaria parasite](#)

[Marcel Cardillo](#) – *Biodiversity, biogeography, conservation*

- Global patterns of extinction risk in vertebrates
- Phylogenetics, macroevolution, and conservation the plant family Proteaceae

CSIRO [Christine Cargill](#) – *Bryophyte Systematics*

- Systematics of Australian liverworts and hornworts
- Soil crusts

CSIRO [Francisco Encinas-Viso](#) - *Pollination ecology and population genetics*

- The role of flower scents in alpine plant-pollinator interaction networks.
- Population genetics of the alpine reed bee (*Exoneura* sp.).
- Modelling climate change effects in Australian alpine plant-pollinator communities.

[Celeste Linde](#) – *Fungal-plant interactions*

- Endophyte microbiomes associated with *Eucalyptus* dieback
- Can we use mycorrhizal fungi to help establish *E. viminalis* on the Monaro plains?
- Mycorrhizal turnover (arbuscular vs ectomycorrhizal fungi) in *Eucalyptus* associated with dieback.

Paul Cooper - *Invertebrate physiological ecology*

Effect of rehydration in a reclaimed agricultural catchment on aquatic invertebrates

Interaction between grapevine cultivars and scale insects under climate change

CSIRO [Alexander Schmidt-Lebuhn](#) – *Plant Systematics and Biogeography*

- Phylogenomics, taxonomy and biogeography, especially of the daisy family Asteraceae
- Machine learning in species identification and collection science
- Polyploidy and genome size

CSIRO [Heidi Zimmer](#) – *Plant Conservation*

- Threatened flora conservation
- Orchids

Are there any scholarships available?

Applications for the following scholarships are available for Biology Honours students:

- [ANU Honours Scholarship](#) (\$5000)
- Centre for Biodiversity Analysis Honours Awards (\$10,000). Information can be found at <http://cba.anu.edu.au/opportunities/cba-grants-funding/honours-awards>
- Miscellaneous Scholarships (\$1000-\$5000). Occasionally supervisors may be in a position to offer a scholarship from their research funds. This should be discussed with your supervisor.
- External or Industry Scholarships: Your supervisor may know of other scholarships offered by industries, government agencies, Grains Research and Development Corporation (GRDC), CSIRO, or Australian Biological Resources Study (ABRS). Please discussed with your supervisor directly.