SCHOOL OF BIOLOGICAL SCIENCES
Department of Ecology and Evolutionary Biology

Honours in Ecology and Environmental Science

Honours in Evolution and Palaeobiology

Honours Project Booklet 2019
Overview of Honours Degree of Bachelor of Science
Department of Ecology and Evolutionary Biology

From 2019 the Department of Ecology and Evolutionary Biology will offer two Honours courses: Honours in Ecology and Environmental Science and Honours in Evolution and Palaeobiology. The courses have the same structure but have been given different names in order to cover the broad range of research areas undertaken within the Department.

An Honours degree provides you with the opportunity to develop and improve important scientific skills and knowledge that will increase job opportunities and lead to a broader range of careers. You will develop specialised research expertise, but will also gain broader skills in critical thinking, data analysis and interpretation, project management, and scientific communication. Our teaching and research staff are international leaders in the fields of ecology, evolution, environmental science and palaeobiology, so you will be exposed to cutting edge research and a network of national and international academic, government and industry partners.

This booklet includes many research projects that are available to Honours students in the Department of Ecology and Evolutionary Biology. However, we encourage you to talk with staff to discuss these or alternative projects. You may also want to talk with current Honours students to find out what Honours is like from a student perspective.

What is Honours like?
As an Honours student you become a member of the school and a valued colleague. You will spend most of your time as part of a research group sharing goals, triumphs, disappointments and all of the other things that are part of the adventure of scientific research. For the first time, you will be responsible for the outcome of your own scientific work. You will form friendships and professional associations that could last a lifetime.

The Honours degree will give you a thorough training in scientific methods and a detailed insight into ecological, evolutionary and environmental problems in the area of research that you pursue. The scientific approach to problem solving, communicating science, and the self-confidence gained during the Honours year will equip you for a wide variety of careers. Many of our students elect to continue in the research domain by enrolling in the school's PhD programs. However, the analytical and communication skills that our students acquire have led other Honours graduates into a range of careers in many different fields.

José M. (Jope) Facelli and Jeremy Austin
Honours Co-ordinators

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or

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University of Adelaide, School of Biological Sciences
Introduction
As an undergraduate you have learned about many facts, ideas and resources, and you have demonstrated your ability to recall, organise and interpret that information. These are skills that you will call upon many times in the future. So far, however, you may not have had many chances to develop and apply your own ideas. This is one of the great attractions of the year ahead! Completing an Honours year is a very worthwhile extension to your B.Sc. degree. It is not just a bridge to a postgraduate degree, nor simply a chance to explore an area of biology that especially interests you. It is also an opportunity for personal development: a test of your imagination, self-reliance and self-discipline. It will help to develop your confidence and prowess in clear thinking, constructive criticism, communication and a variety of technical skills. These "advanced" skills are likely to enhance your prospects for employment.

Honours in Ecology and Environmental Science/Evolution and Palaeobiology is the recommended option if you are enthusiastic about a career that includes knowledge and understanding of evolution, taxonomy, ecology, animal behaviour, physiology, landscape science, global change and the conservation and management of wildlife and plants. The Honours degree is the usual stepping-stone to a higher degree but all possibilities for future employment remain open to you and are improved with an Honours degree. Indeed, employers see an Honours degree as a demonstration of advanced skills in problem solving and project management. Further, the area of research does not limit you to a specific type of work for the rest of your professional life but is a way to obtain and develop those skills.

Entry qualifications are normally credits in 9 - 12 points of level 3 courses for your major or relevant to your Honours research project, or equivalent. Students from outside the University and from allied departments within the University may have equivalent courses and are encouraged to apply. The Honours course runs from early February until November. It is also possible to begin in second semester, commencing in mid-late July and completing in late May – commencement time must be discussed with prospective supervisors as some projects can only be feasible at some times of the year.

Under exceptional circumstances, the Honours degree can be done on a half-time basis, over two years. For further information, contact one of the Honours Coordinators.

During the Honours year you will need to commit yourself to a series of challenging assignments, and you will be responsible for most decision-making and management of your time. This information booklet tells you about the content of the Honours program and offers suggestions about the various options, particularly the research project. If you need more information about a project you are encouraged to contact individual supervisors.

Toward a higher degree
Completing Honours is a pathway towards postgraduate research – a Masters or PhD. If you are considering postgraduate study you will need to obtain a high mark overall - students with a first class Honours are competitive in the scholarship rankings for postgraduate research.

Eligibility
To be offered an Honours placement you need to (1) have completed your Science degree; (2) hold credits (65%) or better in the Level III subjects for your major and/or relevant to your research project; and (3) have approval from a staff member with whom you have discussed a possible project, and who has indicated that they would be willing to be your supervisor.
If you are in any doubt over your eligibility, please ask one of the Honours Coordinators. Please note that some supervisors may not be able to accept you because there is a limit on the number they are allowed to supervise. You should investigate several alternative supervisors and projects and submit at least 2 preferences when you submit your application.

If you come from another university, you may be eligible for Honours, depending on the courses you have taken and your results. Please contact one of the Honours Coordinators in the first instance with your transcripts and scholastic desires and they will advise you.

How to apply
If you are interested in studying Honours you need to contact a prospective supervisor to discuss potential honours projects and submit an Expression of Interest form to the Faculty of Sciences and await an offer of a place. You are then free to accept or reject the offer; your application is not binding.

To find out how to submit your Expression of Interest and key dates go to the Faculty of Sciences Honours website at: sciences.adelaide.edu.au/study/honours

For those intending to start in first semester, you need to apply before December. Later applications are possible, but there may be delays in processing. Those wanting to begin in second semester may apply in December, if they wish, or postpone their application until, at the latest, the end of May. If you are sure that you wish to make a mid-year start, you should apply in December, as potential supervisors may no longer be available by the May selection period. In some years certain kinds of projects are more popular than others, and it may not always be possible to give you your first choice of research project and supervisor. In case complications do arise, we ask you to nominate a reserve choice.

Scholarships for Honours
Consult the web-site: sciences.adelaide.edu.au/study/student-support/scholarships#honours to find details of currently available Honours scholarships

Some staff have research grants that may include a scholarship for a project that falls within the grant's umbrella. There are also a few 6-8 week summer scholarships available before Honours, but not for Honours projects. Talk to potential supervisors about these.

Structure of the Honours Program
The Honours program consist of two separate year-long courses that collectively equate to 24 units (equivalent to 8 undergraduate courses).

For Honours in Ecology and Environmental Science the two courses are:
- Advanced Ecology and Environmental Science (Hons) worth 9 units
- Honours Ecology and Environmental Science Project worth 15 units

For Honours in Evolution and Palaeobiology the two courses are:
- Advanced Evolution and Palaeobiology (Hons) worth 9 units
- Honours Evolution and Palaeobiology Project worth 15 units

The “Advanced….“ course contains three tasks that are completed across the full academic year and focus on building research and (written) communication skills. The three components are:
- a literature review and research proposal,
- a broadening essay,
The "Honours…Project" course covers the major research project. The research project consists of about 18 weeks of full-time research and is presented as a thesis written in the form of a research paper (hopefully with the intention of publication) with a substantially expanded discussion to cover relevant literature and to explore project issues more fully.

In addition to the assessed tasks, students will also undertake an Occupation Health and Safety induction course and complete a Senior First Aid certificate. They should also attend regular or special seminars and interact with the postgraduate students and staff. Honours students should also become involved in some of the other activities that are part of University life, like assisting in an undergraduate camp, or accompanying an academic or postgraduate student in the field if you have the time. There will also be meetings between the class and the Honours Coordinators and between individual students and their supervisor. Other meetings during the year will be devoted to discussions about the progress of your research, about ways to prepare essays, talks and posters, and the use of school resources (e.g. computer software and statistical methods).

Assessment
The Honours grading system is not like the one used for undergraduate courses. It ranges from First Class (I) through Second Class Division A (IIA), Second Class Division B (IIB) and Third Class (III), each with a numerical value. The greatest rewards in assessment are for originality, insight, clear thinking, scientific writing and technical competence. These things will come through hard work and dedication.

Be aware that for the purpose of scholarship competition, all students will be ranked. However, the ranking within the classes is confidential.

Research supervisors
Most staff should be available as supervisors, but some may be unavailable, either because they have their quota of students or they are on leave for part of the year. In addition, some of the staff employed at the South Australian Museum, State Herbarium, Dept of Environment, Water & Natural Resources, CSIRO and SARDI (Aquatic Sciences) are affiliated with the School of Biological Sciences and can offer projects and act as supervisors or co-supervisors. Some of these external supervisors are included below in the list of potential supervisors. Other external researchers not listed here could also provide supervision but may need to work with a staff member as an "internal" supervisor. If you have ideas in this direction, discuss them with the appropriate staff member and one of the Honours Coordinators well in advance.

Role of the supervisor
Your research supervisor is someone with enough expertise in your field of interest to be able to advise you about techniques, literature and so on. S/he should not direct your research, but offer support, counsel and constructive criticism, particularly in the planning stages. In consultation with your supervisor, you need to refine the original idea (which may be only vaguely defined) and develop a work plan. It may be a month before you have a clear set of goals. In this process you are expected to play the major role: your supervisor will look to you for bright ideas and initiative. Supervisors know from experience that student's inclinations and abilities differ, and they adjust their contribution accordingly. Of course, you may need to make comparable adjustments in the demands you make on your supervisor! Your relationship with your supervisor therefore is
important. S/he should be someone you find easy to talk with and, most importantly, someone you feel you could work with and learn from.

Finally, it is your responsibility to maintain close contact with your supervisor and work out problems immediately when they arise. There will be problems, and they tend to get worse if not dealt with quickly. Make sure you have regular meetings, but also organise meetings as problems/opportunities arise.

Role of the Honours Coordinators
The Coordinators will want to keep in touch with the progress of each student and, in particular, to offer advice and support if needed. The Coordinators are there to direct the course as a whole, to oversee assessment of components, to organise and sit on marking committees, and to assemble final reports so that the academic staff can decide on final marks and rankings.
## Supervisors and Projects – Summary

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Arthropods are the dominant animal life form on the planet and they are responsible for key ecological processes as well as causing major problems as pests and vectors of disease to plants and other animals. We are a closely knit group of researchers from the School of Biological Sciences and the South Australian Museum who undertake a range of research projects on the systematics, phylogenetics and biogeography of terrestrial and groundwater associated arthropods. Our research involves field work to locations across the continent, complemented by laboratory-based molecular and morphological studies using the latest techniques.

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours Projects

- Systematics and evolution of parasitic wasps
- Evolution and phylogeography of subterranean beetles and crustaceans
- Using eDNA for monitoring the diversity of groundwater invertebrates
- Systematics and host plant relationships of lerp insects
- Systematics and biology of spiders

For an insight into our day-to-day activities see our twitter page: @DNAthropods
FRONTIERS OF RESTORATION ECOLOGY

Dr Martin BREED

martin.breed@adelaide.edu.au

The Frontiers of Restoration Ecology group is a multidisciplinary team with a common goal - harnessing innovative approaches to improve restoration success, for the benefit of the natural world and society alike. We recognise that our planet is rapidly changing and believe that to respond, we need solutions based on cutting-edge science.

The group draws together expertise that ranges from evolutionary biology to population genetics, ecology to plant physiology, to public health and biotechnology. Having such a diverse team allows us to tackle problems from multiple angles, with collaboration at the epicentre of everything we do. The collaborative nature of the team enables us to work across several fields and we combine this expertise with modern genomics, bioinformatics and statistics.

Research highlights so far include pioneering the integration of genomics into restoration science, leading the development of the Microbiome Rewilding Hypothesis, enhancing the benefits to society from biodiverse urban green spaces, and contributing to the global revision of seed sourcing strategies under global change.

Find out more here
Researcher Profile: https://researchers.adelaide.edu.au/profile/martin.breed
Twitter: @_MBreed

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours projects
- **Urban rewilding** - Optimising the rewilding of urban green space microbiomes
- **Population genomics** - Using population genomics to inform restoration seed sourcing of Australian plants
- **Evolutionary ecology** - Exploring microgeographic variation in adaptive traits in Australian plants
- **Plant-microbe feedbacks** - Do local soil microbiomes impact on Australian plant fitness?
- **Smart cities** - Optimising the management of Adelaide’s street trees
FRESHWATER ECOLOGY

Prof Justin BROOKES

Co-supervisors: Dr Virginie Gaget, Dr Deb Furst,

Our group conducts research in two main areas: water quality for human consumptions and water for the environment. Change to land-use and modified hydrology has changed nutrient loading and biodiversity in aquatic ecosystems, including estuaries, lakes, rivers and wetlands. We study how plant and animal physiology, populations and community assemblages respond to changes in flow and biogeochemistry. We are particularly interested in productivity and the transfer of material from one trophic level to another. We conduct a lot of research in partnership with the water industry. This is particularly focussed on cyanobacteria and water quality in drinking water reservoirs.

You can find out more about our research here:

Researcher Profile: https://researchers.adelaide.edu.au/profile/justin.brookes
Webpage: https://www.freshwaterecologylab.com

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours projects

- **Coorong water quality** - Does wave activity increase sediment resuspension and nutrient concentrations in the Coorong?

- **Arid aquatic refugia** - Are waterholes within the Flinders Ranges an important refugia for aquatic microinvertebrates and how might these be impacted by a changing climate?

- **Climate change and lakes** - How is climate changing temperature and ice cover in the world’s lakes; with a particular focus on the high altitude lakes of the Himalaya?

- **Water quality** - Does the disinfection of water with chlorine produce compounds that impact upon the gut microbiome?

- **Water quality** - Does denitrification reduce the nutrient load from Hahndorf waste water treatment plant
The **Invasion Science & Wildlife Ecology Group** brings critical analytical techniques to the study of applied ecology, wildlife conservation, and biosecurity risk management; areas characterised by complexity and uncertainty.

Human actions have contributed to pervasive changes in biodiversity at a variety of scales. Many of our projects use vertebrate populations as models for studying the flexibility in behavioural and physiological traits during the invasion (or extinction) process. In all of our research we endeavour to present and translate our results in exciting and innovative ways.

We collaborate extensively with local and national government environment and biosecurity agencies, non-government conservation organisations, and international wildlife enforcement agencies. All of our projects will be well-supported logistically, and the development of individual research projects, to match a students' interests, will be particularly encouraged. Suitable candidates should be prepared to undertake a project with both intensive field and quantitative desktop components.

A number of Honours projects are available in: (i) global change biology; (ii) invasive species pest management; (iii) illegal wildlife trade; and (iv) the prioritisation of evidence-based biosecurity decision making.

*Recommended Honours Enrolment: Honours in Ecology and Environmental Science*
Co-supervisors: I’ve worked extensively with a number of co-supervisors, most frequently Professor Megan Lewis. The supervisory panel needs to be appropriate for the student and the project, so I’ll work with you to ensure you get a supportive, appropriate panel of supervisors.

My work focuses on making remote sensing and spatial science relevant. I and my team take existing research and convert it into useful information, using it to solve real-world problems. Or, if existing research is inadequate we do the research ourselves, and then solve the management problem.

We’ve got a long track record of working with government and industry and we frequently work across disciplines. Our experience covers a host of areas, including rangeland condition assessment; mapping seagrass meadows, and looking at how they’ve changed over time; developing ways to understand wetland inundation regimes, so we can manage them better; improving monitoring methods to help protect our arid mound springs; developing new ways of detecting and mapping bush-fire scars; and many others!

Our approach includes a strong logical basis for our work, with firm roots in relevant theory (ecological, geological, remote sensing, etc. as appropriate). Sound literacy in critical thinking, computers and a specialist field (e.g., ecology, geology, computer science, agriculture, astronomy, physics, robotics, or other) are essential. Some programming or scripting experience (e.g., R or python) is ideal, but not necessary (you can pick it up as you go, it’ll be fun!).

The listed honours projects (below) are just some current ideas. I’m more than happy to talk about other potential projects.

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

- Spatial variation of chlorophyll-a inside freshwater reservoirs – bloom dynamics
- Characterising historical variation in suspended sediment in Gulf St. Vincent (with remote sensing), and linking with measured and modelled estimates of suspended sediments
- Relative impact of chronic discharges (wastewater) and pulsed events (rivers) on seagrass meadows
- Measuring the effect of 10-years de-stocking on rangeland condition (Project with Ramesh Raja Segaran), by comparison with neighbouring properties with continuous grazing/pastoralism, or with alternative conservation management (e.g., de-stocking and removal of feral predators, and then reintroduction of native animals)
- Developing useable rangeland-condition assessment tools
- Measurement and characterisation of arid wetland vegetation dynamics
- Remote sensing with high/moderate resolution satellite imagery for the characterisation of river plume extent (focusing on one or more of the worlds more significant, heavily regulated rivers).
SAVE OUR OCEANS: WILDLIFE & RESTORATION ECOLOGY

Prof Sean CONNELL  sean.connell@adelaide.edu.au

Great science leaves people engaged, admiring, and wanting more. Help us restore native oysters reef that once rivalled coral reefs or figure out how to we can adapt marine life to ocean change. We are starting with 20 hectares here in South Australia! Your honours would figure out how marine life best responds by experimenting in tanks or making observations on snorkel or SCUBA dives.

You’ll work with employers from private industry and government. You’ll be supported by international NGOs and large private donors. Some must travel. We watch how marine life responds to ocean acidification and marine heatwaves around South Pacific Islands and our Gulfs. You’ll use creativity not only to bring accurate information that is lucid in its meaning, but also creates an interesting experience as student and value for its funder.

You can find out more about my research here:
Researcher Profile: https://researchers.adelaide.edu.au/profile/sean.connell

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

- Restore oyster reef by trailing techniques to boost reproduction and survival
- Test how ocean warming & acidification (or nuclear winter) changes wildlife
- Compare responses of land plants with marine plants to future carbon emissions
- Unlock cognitive science (the human mind) in creative science (great thinkers)
- Save the plight of our Giant Australian Cuttlefish or Little Penguins
PLANT SYSTEMATICS AND POPULATION GENETICS, EVOLUTIONARY ECOLOGY AND PLANT MACROFOSSILS

Prof Michelle WAYCOTT  michelle.waycott@adelaide.edu.au  
Dr John CONRAN     john.conran@adelaide.edu.au

Websites  
http://waycott.seagrassonline.org/research/  
https://researchers.adelaide.edu.au/profile/john.conran

Co-supervisors: Dr Juergen Kellermann, Dr Ed Biffin, Dr Kor-jent Van Dijk.

Our research program aims to investigate the diversity, history and origins of living and fossil plant communities. We apply molecular genetic, morphological, cytological and fossil analyses to our research. Currently we work on diverse groups including marine, desert, carnivorous, parasitic and other specialised groups of native Australian, New Zealand, New Caledonia and other Pacific Island plant groups. We study not only the plants but co-evolution of plants and animals that they are associated with. Many of our projects aim to improve the conservation of plant species in the landscape today.

Our research has adopted the use of up to date next generation sequencing tools to generate data and will lead to students having highly valued skills.

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours Project Topics  
[for discussion with students to define the project]  
- Endemic, rare or threatened native plant species systematics and taxonomy  
- Phenology and evolution of the South Australian flora  
- Systematics, molecular phylogenetics and cytological studies of native plants  
- Pollen diversity of New Caledonian podocarps  
- Evolution of fossil angiosperms (see Bob Hill section)  
- Population genetics of marine angiosperms (seagrasses)  
- Developing an exemplar database for Australian weeds and/or native plants (morphology, anatomy, pollen form, leaf venation patterns, DNA sequences)  
- Unravelling species complexes and hybridisation in Australian native plant groups  
- How do we detect if something is a weed?  
- Research supporting the revised taxonomy of the Rhamnaceae  
- Seed dispersal by sleepy lizards (jointly with Phill Cassey)  
- Impacts of coastal management activities on carbon storage in mangrove and saltmarsh (with Bronwyn Gillanders)

Special project offer 2019

In partnership with Dr Jason Tanner from SARDI we have funding for a project to support the restoration of coastal seagrasses off Adelaide. The project may include the study of how seagrass species produce fruits and/or seedlings, how far the move in water column, the genetic diversity of donor beds and the effective size of seagrass populations.

Contacts Michelle Waycott or Kor-jent van Dijk.
Resolving the taxonomic status of bandicoots and gliders for conservation management

Honours projects are available applying molecular techniques to study the population genetic structure and phylogeography of either bandicoots (genus *Isoodon*) or marsupial glider species (genus *Petaurus*). The results will have important implications for assessing the taxonomic status of different populations in southern and northern Australia and hence inform future conservation management of these species, many of which have suffered serious declines in population size. An honours project here would involve wet lab procedures (e.g. DNA extractions, PCR amplification and DNA sequencing) and may also involve the application of next generation sequencing analyses/ bioinformatics. Potential applicants should preferably have a background in molecular genetics, population genetics and phylogenetics, be self-motivated and capable of working relatively independently.
I study the evolutionary genetics of fundamental problems: the evolution of sex and recombination, sexes (anisogamy), senescence (ageing) and altruism (kin selection). These questions are approached using comparative data analysis and mathematical modelling. As such, my work is purely computational, relying on statistical analysis and computer programming.

I have been modelling the coevolution of hosts and pathogens to test the idea that such antagonistic coevolution selects for recombination. I have also been using data from the volvocene algae (Volvox, Chlamydomonas, etc.) to test theories about the evolution of anisogamy (sexes). Another area of focus is using lifetable data from honeybees to determine whether the large differences in lifespan between queens and workers are due to the different hazards of their lifestyles or whether they are due to the adaptive plastic regulation of somatic maintenance.

Recommended Honours Enrolment: Honours in Molecular and Biomedical Science

Honours Projects

- Hill-Robertson interference, the Red Queen and the evolution of sex
- Testing the gamete competition theory of the evolution of anisogamy
- Plasticity of lifespan in the honeybee and the disposable soma theory

For details, please see my web pages:

https://biological.adelaide.edu.au/research/cmel/
The genomic age allows us to explore issues of adaptation and population history in non-model organisms. Many issues around conservation approaches can utilise population history and genetic diversity to focus management options in innovative ways. Data at the genomic scale also allows dissection of recent speciation events and understanding of the micro-evolutionary basis of speciation can also lead to the identification of landscape features that promote diversity. Projects focus on a range of iconic marine and terrestrial animal species with the potential to inform conservation approaches or understand organismal responses to environmental gradients.

In addition to genetics-based projects, there are opportunities with Dr Armstrong that will provide skills in 3D geometric morphometrics and bioacoustics analysis. In situations of closely-related bat species, the analysis of 3D models of skull anatomy derived from micro-CT x-ray scans can help quantify differences in shape in the context of both ecological speciation and the constraints imposed by the need to maintain the integrity of echolocation signals. In biodiversity surveys, there is an increasing reliance on large-scale acoustic recordings that allow investigators to recognise more species of frogs, birds, and bats more efficiently and with less cost. But off-the-shelf software falls well short of providing reliable outputs. Together with Professor Langford White of the School of Electrical and Electronic Engineering and Professor Ian Reid of the university’s Institute for Machine Learning, there is opportunity to explore the efficacy of alternative ways of signal processing, feature extraction and signal classification for expedient, robust, non-invasive and broad-scale acoustics-based biodiversity surveys.

**Recommended Honours Enrolment: Honours in Evolution and Palaeobiology**

**Honours projects**

- Giant Australian Cuttlefish - detecting genomic signals of diversifying ecological selection as a pretext to speciation.
- Do western Pygmy possums show genetic evidence of selection for enhanced survival in arid environments that may be useful for predictive translocations ahead of climate change impacts?
- New approaches for expedient processing of ultrasonic recordings for better bat surveys.
- Do shape differences between closely-related bat species indicate ecological speciation?
Our research focuses on applying ecological knowledge to address management and restoration of natural vegetation. We focus our work on arid lands and Mediterranean-type environments; the last including woodlands, grasslands and wetlands in the Fleurieu Peninsula. Our approach always includes a strong conceptual framework and rigorous experimental design to investigate ecological issues ranging from the theoretical to the applied.

**Recommended Honours Enrolment: Honours in Ecology and Environmental Science**

**Honours Projects**

- **Ecology of the Koonamore Reserve** - The Koonamore Vegetation Reserve has been protected from grazing and monitored for nearly 100 years. In addition to the accumulated information, several projects require fieldwork including differences in spatial heterogeneity between grazed and ungrazed areas.

- **Interactions between microbes and plants** - Plants modify the soil microbial community in ways that may favour or hinder them. Invasive species may be able to obtain an advantage over native plants through this mechanism. Research in this area can be particularly important to understand the success of invasive species and to increase our ability restore native vegetation.

- **Restoring grassy woodlands: interaction between native and invasive grasses** - We are investigating various strategies to restore grassy woodland. This project includes experimental assessment of the performance of native grasses and seedlings of native trees when introduced to former farmland sites. The approaches can range from molecular (to investigate microbial assemblages) through field based (investigating species interactions).

- **Interactions between plant parasites and their hosts** - We investigate the interactions between *Cassytha pubescens* (a native coiling hemi-parasite) and their host, particularly invasive species: it infects weeds such as Scotch broom, gorse, and blackberry, on which it has much stronger negative effects than on native hosts. Currently we are investigating the possibility of using this parasite as a biological control agent.

- **Mighty macrophytes: Ecology and management of common reed and bulrush** - Common reed (*Phragmites australis*) and bulrush (*Typha domingensis*) inhabit freshwater and brackish ecosystems across southern Australia. While native, their abundance has increased greatly encroaching into the habitat of other species. We research the drivers and the consequences of their expansion to help improve management strategies.

- **Emu-wrens and other threatened fauna of the Fleurieu Peninsula wetlands** - The shrinking Fleurieu Peninsula Swamps are dynamic systems. We research the effects of disturbances on swamp succession, and their effects on native fauna that rely on them. We focus particularly on the endangered southern emu-wren, and on invertebrate communities. Ultimately, we aim to improve management for emu-wrens and other swamp dwellers.
Global extinction rates have soared over the past century, due predominantly to the resource demands of a burgeoning human population. Shifting land-use and wildlife exploitation, and elevated rates of competition and predation by invasive organisms, have reduced the range and abundance of many species, directly causing severe biodiversity loss at local scales, and indirectly limiting the scope for sufficient ecological and evolutionary adaptation to future environmental change. Understanding how biodiversity will respond to future human impacts requires innovative new approaches which explicitly couple ecological and climatic-geophysical processes. Research in my group is focused on:

- Delivering the predictive tools required to anticipate ecological responses to climate change in the context of other human-driven threatening processes.
- Identifying the mechanisms that drive range contractions. This is important for the conservation and management of biodiversity, because the contraction of a species’ distribution generally precedes its extinction.
- Determining why some species are present in some locations, but not others? This is a simple, fundamental ecological question, yet surprisingly, our answers on this point remain far from complete.

Our research utilizes the latest developments in quantitative ecology, paleoclimatology, geochronology and genomics. Interested candidates should refer to our website for further information: https://www.fordhamlab.com/

A number of honours projects are available in the areas of climate change ecology, global change impacts on biodiversity, species range dynamics and extinction processes. Examples of some of these are listed below.

**Recommended Honours Enrolment: Honours in Ecology and Environmental Science**

**Honours Projects**

- Management strategies for mitigating climate change impacts on frogs.
- Modelling the effects of climate change on the range dynamics of plants and animals
- Mapping the pace and stability of past and future climate change
- Assessing the effects of climate change on the diversity of marine life on the Great Barrier Reef
EARLY ANIMAL EVOLUTION: EVIDENCE FROM THE EDIACARAN AND CAMBRIAN

Assoc Prof Diego GARCÍA-BELLIDO  
diego.garcia-bellido@adelaide.edu.au

Co-Supervisor: Dr Jim Gehling (SA Museum)  
jim.gehling@samuseum.sa.gov.au

The broad focus of our group is the evolution of the earliest animals on Earth. The oldest macroorganisms known in Earth, are the Ediacara Biota (575–545 Ma), named after the Ediacaran Hills in the Flinders Ranges (South Australia). Most of these organisms show no mineralization and they reveal very diverse morphologies, making their phylogenetic relationships controversial. Shortly afterwards came the Cambrian ‘explosion’, the event that gave rise to most phyla –highest-rank groups within animals– some 540 Ma. Some exceptional outcrops preserve not only shells or bones but also complete soft-bodied organisms and even their internal organs (digestive tubes, blood vessels, nervous system) and other delicate structures (such as eyes or gills). One of the few such localities in the Cambrian, and the only one known in the Southern Hemisphere, is the Emu Bay Shale (515 Ma) in Kangaroo Island, which contains fossils of more than 50 different species: sponges, worms, brachiopods, molluscs, arthropods... The study of the fossils found in these South Australian localities is shedding light into the taxonomical diversity, phylogenetic relationships, functional morphology and palaeoecology of the earliest metazoans.

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours project

- Palaeobiology of Beltanelliformis, the most enigmatic aggregating organism from the Ediacara Biota
- Behavioural and palaeoecological analysis of the trace fossils from the Marsden Sandstone (Kangaroo Island) and its bearing on the overlying Emu Bay Shale Lagerstätte.
MARINE/FRESHWATER ECOLOGY AND FISH BIOLOGY

Prof Bronwyn GILLANDERS  bronwyn.gillanders@adelaide.edu.au

Co-supervisors:
Dr Alice Jones: alice.jones01@adelaide.edu.au, Twitter: @Alice_R_Jones,
Dr Samantha Munroe: samantha.munroe@adelaide.edu.au, Twitter: @SEM_Munroe

A number of my projects also involve collaboration with researchers from SARDI Aquatic Sciences, Department of Environment and Water and the Environment Protection Agency.

The Gillanders aquatic ecology group (www.gillanderslab.org) researches freshwater, estuarine and marine waters focusing on fish, cephalopods and environmental issues. Our main research areas are 1) ecological and environmental change; 2) integrated marine management with a focus on Spencer Gulf; 3) population structure and connectivity; 4) cephalopod biology, ecology and fisheries and 5) carbon storage and other ecosystem services provided by coastal wetland ecosystems (seagrass, mangrove and saltmarsh) - for background info on this research theme see: https://coastalcarbonsa.wordpress.com and follow @CoastalCarbonSA on Twitter.

You can find out more about our/my research here:
Researcher Profile: https://researchers.adelaide.edu.au/profile/bronwyn.gillanders
Webpage: http://www.gillanderslab.org
Social media: @BronGillanders

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

- Plastics in marine and terrestrial environments
- Cumulative impacts in marine and freshwater systems
- Ecological and environmental change using calcified structures of organisms
- Population structure and connectivity of fish populations
- Cephalopod biology, ecology and fisheries
- Impacts of coastal management activities on carbon storage in mangrove and saltmarsh (with Michelle Waycott)
MONOTREME GENOMICS, EVOLUTION AND CONSERVATION

Prof Frank GRÜTZNER

frank.grutzner@adelaide.edu.au

Recommended Honours Enrolment: Honours in Molecular and Biomedical Science

EchidnaCSI (Conservation Science Initiative)

EchidnaCSI is a citizen science project that combines field ecology and molecular biology for echidna conservation.

The project aims to:

• establish the first Australia wide detailed echidna distribution map. Integration of historic data and in-depth analysis in specific areas (e.g. revegetated, agricultural and urbanised) will provide valuable information about variation in echidna numbers and how they are affected by our changing environment.

• utilise the collection and molecular analysis of echidna scat samples from captive and wild populations to provide novel insight into fundamental aspects of echidna biology (e.g. diet, stress, breeding) and their role in natural or cultivated environments.

• use EchidnaCSI as an outreach and engagement platform via traditional (media, seminars, flyers, videos) and social (e.g. phone app, Facebook, Twitter, email) media to educate and enthuse the community about biodiversity, environmental awareness and the value of interdisciplinary research for application in conservation and animal biology, and to foster change in behaviour to help protect and preserve biodiversity.

The project has now been running for a year and we have more than 5000 users with over 2800 sightings recorded and 200 scats sent in. This provides interested students to do projects on the data and molecular analysis of these unique samples.

Please contact Tahlia Perry (tahlia.perry@adelaide.edu.au) or Prof Frank Grützner (frank.grutzner@adelaide.edu.au) for more information.

The echidna genome project

The platypus genome was published in 2008 and provided fundamental new information about monotreme biology and mammalian evolution. The echidna genome has been sequenced and we are part of a small international team helping with the assembly and carrying out analysis on the genome for the Echidna genome publication (which will also feature a much improved Platypus genome). This is a great opportunity for students to take part in an international collaboration that will provide the first echidna genome assembly and carries out analysis of the echidna genome to better understand the fascinating biology of these animals.

Please contact Dr Linda Shearwin (linda.shearwin@adelaide.edu.au) or Prof Frank Grützner (frank.grutzner@adelaide.edu.au) for more information.
Our overall interest is in the evolution of the living Australian vegetation, using the plant macrofossil record as a basis for determining how the vegetation has changed, along with living plant morphology and ecophysiology to predict how species have evolved and how they may adapt to environmental change in the future.

We are interested in a broad range of ages of fossils, from the time Australia was beginning to separate from Antarctica, about 50 million years ago, through to the most recent fossil evidence. Australia is one of the great living laboratories in which to discover the long term impacts of major climate change and we have a large number of potential projects. Those listed below are a subset of the projects we have. If you are interested, please come along and talk to us, we are happy to plan a project that suits your particular interests.

**Recommended Honours Enrolment: Honours in Evolution and Palaeobiology**

**Honours projects:**

- Stomatal protection mechanisms in Casuarinaceae: How did this iconic family manage to evolve to the point where it is one of the last trees standing in arid Australia?
- Evolution of photosynthetic organs in *Acacia*: How and why did most species in this genus give up on true leaves and instead rely on flattened leaf petioles to deliver carbohydrates to the plant? (Led by Kathryn Hill)
- Tropical Rainforest in Antarctic latitudes – 45 million years ago South Australia was connected to Antarctica and the landscape was dominated by complex rainforests. We still don’t fully understand the makeup of these forests or how complex rainforests could survive through winter darkness. Several fossil floras holds the answers to important questions like these. (potential collaboration with John Conran)
- A detailed examination of the fossil history of selected plant taxa. Two obvious families of angiosperms that require more work on the known fossils that we have are the Elaeocarpaceae and Cunoniaceae. (potential collaboration with John Conran)
- Leaf morphology in *Nothofagus menziesii*: This key New Zealand species may hold important clues to the way in which trees coped with the major climate changes that occurred during the glacial cycles over the last several hundred thousand years. (Led by Kathryn Hill)
- Re-vegetating South Australia: How can we use the fossil record to assist us in determining what species to use to re-vegetate parts of South Australia that have had their native vegetation removed since European colonization?
- An assessment of the environmental ranges of key fossil plant taxa from southeastern Australia and the capacity to reconstruct the fossil palaeoenvironments.
SPATIAL INFORMATION, ENVIRONMENTAL REMOTE SENSING AND GIS

Prof Megan LEWIS  
megan.lewis@adelaide.edu.au
Assoc Prof Bertram OSTENDORF  
bertram.ostendorf@adelaide.edu.au

Co-supervisors: Dr David Taggart, Dr Ken Clarke, Dr Dorothy Turner

You can find out more about our research here:

We offer Honours projects that use spatial information tools and data (remote sensing, geographic information systems, spatial analysis and modelling) for students in science, natural resource management, environmental science, geography, geoscience and agriculture. Projects cover a wide range of applications and settings, including terrestrial, wetland and marine ecology, wildlife and habitats, land assessment and management and earth science.

Students should have completed level 3 courses in GIS and/or Remote Sensing, but specific projects can be defined to suit different interests and skill levels. These projects provide opportunities for students to develop and apply their skills in spatial sciences and to network with potential employers.

Many of our projects conducted in collaboration with government agencies and outside partners such as the Department of Environment & Natural Resources and regional Natural Resource Management groups. In addition, there is scope for projects that involve supervisors from other research areas.

Software and equipment available for use in projects includes:

- ERDAS Imagine, ENVI, IDL, ArcGIS and other image analysis software
- ASD FieldSpec Pro Visible-shortwave infrared spectroradiometer
- Unmanned aerial vehicles and a range of sensors: visible, infra-red and thermal cameras and video through collaboration with the Unmanned Research Aircraft Facility
- GIS & image data: access to national and international archives of many forms of satellite and airborne imagery & spatial data from broad to ultra-fine scales.

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

- Using spatial information to improve wildlife and habitat monitoring and management
- Monitoring environmental change over time using long-term satellite image time-series
- Assessing land, habitat, vegetation, soil and water condition with new spatial tools and data
ECOLOGICAL AND EVOLUTIONARY GENETICS OF PLANTS, WILDLIFE FORENSIC BIOLOGY

Prof Andrew LOWE andrew.lowe@adelaide.edu.au

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours projects

- Developing DNA timber tracking methods for Indonesian meranti; supervisors: Prof Andrew Lowe, Dr Elly Dormontt

- Continental biogeography and monitoring - Macro-ecological patterns; supervisors - Prof Andrew Lowe, Dr Greg Guerin & the Terrestrial Ecosystem Research Network

- Functional mechanisms involved in community co-existence; supervisors: Prof Andrew Lowe, Dr Greg Guerin & the Terrestrial Ecosystem Research Network

- Can seed banks predict community response to climate change? Observational and experimental approaches.
MARINE ECOLOGY – CLIMATE CHANGE EFFECTS ON FISHES

Prof Ivan NAGELKERKEN  ivan.nagelkerken@adelaide.edu.au

My research focuses on the effects of global change and human impacts on aquatic species and ecosystems. The studies are highly relevant for management purposes and to understand how climate change will affect productivity and resilience of coastal ecosystems and their associated animal populations.

You can find out more about my research here:
Researcher Profile: http://researchers.adelaide.edu.au/profile/ivan.nagelkerken

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours projects

Climate change stressors such as warming and acidification of the oceans are predicted to have dramatic impacts on the diversity, abundance, and distribution of fish species worldwide. The degree to which fishes adapt to or tolerate changing conditions will determine their persistence in their original habitats as well as their ability to extend their ranges to novel habitats or higher latitudes.

Available projects focus on providing an understanding of how ocean acidification will affect the behaviour and physiology of fish species, how this could modify their population dynamics, and what the implications are for biodiversity. Natural volcanic CO$_2$ vents at New Zealand are the primary area from which fish samples are obtained for analysis.

A second project focuses on understanding how coral reef fishes are extending their ranges to higher latitudes along the east coast of Australia and what the consequences are for temperate fishes and ecosystems.
WILDLIFE CONSERVATION, PLANT-ANIMAL INTERACTIONS; RESTORATION ECOLOGY

Assoc Prof David PATON  
david.paton@adelaide.edu.au

Co-supervisors: Dr Daniel Rogers, Dr Katherine Moseby

We have broad interests in terrestrial ecology and behaviour that are all aimed at providing research outcomes that facilitate the management, conservation and restoration of biodiversity. Much of our research investigates spatial and temporal variation in resources, and how these, and perturbations like fire and drought, and changes in herbivory and predation influence the distribution, abundance, behaviour and population demography of flora and fauna. We have a range of on-going research and long-term monitoring programs being conducted in different areas of the State (Mt Lofty region, Coorong, Arid Recovery, Monarto, Ngarkat). Opportunities exist for honours students to work on aspects of these long-term projects and extend them in various ways – from assessing the adequacy of pollination, the fate of any seeds produced, documenting plant recruitment (and mortality), collecting baseline data on pollinator communities and networks, and relating these to grazing pressure. Other areas where students can engage in this research include: assessing the perturbations caused by inadequate water management in the Coorong; investigating the consequences of changed predator regime; detailed autecological studies on threatened fauna and their habitats; and by assessing novel habitats and testing how these could be enhanced for wildlife conservation.

Recommended Honours Enrolment: Honours in Ecology and Environmental Science
ENVIRONMENTAL MONITORING WITH DRONES AT THE UNMANNED RESEARCH AIRCRAFT FACILITY

Dr Ramesh RAJA SEGARAN  
ramesh.rajasegaran@adelaide.edu.au

Co-supervisors: Dr Ken Clarke, Dr Alice Jones, Dr Graeme Findlayson, James Trezise, Jarrod Hodgson

Drones are becoming commonplace tools for environmental monitoring. Coupled with the right sensor (RGB, multisupeptral, hyperspectral, thermal), they offer a unique view of the landscape. With this new perspective the scale of traditional field survey techniques can be extended, satellite remote sensing techniques can be enhanced, or the gap between the two can be bridged. The technologies are rapidly maturing but making sense of the large volumes of data is still at an exciting stage of infancy, leaving a lot of room to explore and make your mark.

To better understand environmental dynamics for better decisions the data must be translated to information using methods that range from basic visual interpretation to advanced computation which will draw from remote sensing and/or GIS techniques.

I work with closely with government, industry and conservation NGOs in Australia and the Asia-Pacific region to develop methods that they can use in the field to monitor vegetation and wildlife population dynamics. Projects at URAF include environmental monitoring research with partners such as Conservation International, DEW, PIRSA / SARDI, Bush Heritage Australia.

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours projects:

Fire
- Modelling fire break design to manage fire while minimising ecological disturbance in Cambodia
- Spatial regrowth dynamics of mallee after a fire

Detecting mammals and modelling their distributions
- Thermal sensing of kangaroos
- RGB mapping of fur seals

Vegetation
- Measuring vegetation biomass from dense point clouds
- Detection and discrimination of seagrasses

Remote sensing
- Integrating/calibrating moderate resolution Landsat spectral data with extremely high resolution imaging
The broad focus of our group is plant physiology, with specific interests in plant nutrition, plant stresses caused by hostile soils, mistletoes and adaption to low water supply and variations in available light. Physiological aspects of aquatic plants are also included. Most projects are lab or glasshouse-based, but can involve some aspect of fieldwork.

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

- Aquatic plant photosynthesis as a driver of large pH changes in wetlands
- Do plants need to sleep? There is evidence in some plants that lack of a dark period can inhibit growth, and that this is linked to the need to close stomata to increase cell turgor, the main driver of expansion growth.

Feel free to propose any topic in the area plant physiology that you think might make an interesting honours project.
EVOLUTION AND CONSERVATION OF REPTILES

Dr Kate SANDERS  kate.sanders@adelaide.edu.au

Kate’s group focuses on speciation, trait evolution and biodiversity discovery/conservation, especially in aquatic snakes. Current projects involve: 1) sequencing sea snake genomes to uncover population history and genomic patterns of speciation; 2) reconstructing morphological evolution in sea snakes, especially the remarkably frequent origin of ‘microcephalic’ burrowing-prey specialists and possible role in promoting reproductive isolation and rapid species diversification; 3) molecular evolution of sensory systems in the transition to aquatic habitats in snakes, including vision, skin photoreception and chemoreception; 4) sea snake conservation genetics and management in partnership with Western Australian trawl fisheries. Our research has a substantial fieldwork component focused primarily in Indonesia and Western Australia.

You can find out more about my research here:

And in a blog and video by 2017 Honours student Charlotte Nitschke:

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours projects

- Visual (or chemosensory) evolution in the transition from land to sea in elapid snakes, using sequence and expression analyses of sensory genes and spectrophotometry. Co-Supervisor: Dr Bruno Simoes (bruno.simoes@adelaide.edu.au)

- What are the genomic consequences of major ecological transitions in evolution? Using comparative analysis of whole genome sequences for terrestrial and marine snakes. Co-Supervisors: Dr Vicki Thomson (vicki.thomson@adelaide.edu.au); Alastair Ludington (alastair.ludington@adelaide.edu.au); Dr Jimmy Breen (jimmy.breen@adelaide.edu.au)

- Morphological evolution and diversification of the elapid snake radiation, using macroevolutionary analyses of 3D morphometric and ecological data. Co-Supervisor: Dr Emma Sherratt (emma.sherratt@gmail.com)

- Conservation genetics and biodiversity of Western Australian sea snakes. Lab and field components, with links to natural resource agencies and industry. Co-Supervisor: Dr Mathew Hourston (mathew.hourston@dpird.wa.gov.au)

- Mating systems in elapid snakes, using captive husbandry, reproductive anatomy and genetic analyses of parentage. Co-Supervisors: Luke Allen (Venom Supplies, luke@venomsupplies.com); Dr Vicki Thomson (vicki.thomson@adelaide.edu.au)
The research in this lab involves how whole animals and plants interact with their environments and have evolved adaptations to survive, often in severe conditions. We focus mainly on the effects of body size on energy requirements, temperature regulation, exchange of respiratory gases and the structure and function of the circulatory system. We study mammals, birds, reptiles, amphibians, fish, insects and even heat-producing flowers and dinosaurs. Recently the focus has been on the relationships between the metabolic rate of certain tissues (brains and bone) and the rate of blood flow to them. We can measure this flow from the holes in skulls and limb bones where blood vessels pass through. Remarkably, this technique can be applied to museum specimens of recent and extinct vertebrates, including human ancestors and dinosaurs. Most recent Honours student projects from my lab have concerned this project and have been published in reputable journals. An Honours student would be working with existing PhD and Honours students on this project, which is funded by the ARC. A $5000 Honours Scholarship and travel to overseas museums is available for an especially motivated student working under this umbrella (first project). There are other potential projects available, as listed below.

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

- Correlation of brain blood flow and brain size with behaviour in primates
- Buoyancy and aquatic stability of sauropod dinosaurs
- Pollination biology of endothermic insects and heat-producing flowers
- Underwater environments of Coorong aquatic spiders
MORPHOLOGICAL EVOLUTION OF ANIMALS

Dr Emma SHERRATT  
emma.sherratt@adelaide.edu.au

Emma’s research group broadly encompasses research on morphological evolution of animals. Research projects in this group are focussed on using sophisticated methods to quantify and capture complex morphological variation of particular structures or whole organisms, to answer questions about the tempo and mode of evolution. Topics previously covered include deep-time evolution of Anolis lizards, cuckoo egg mimicry, skull shape of various mammals, reptiles and amphibians relating to diet and locomotion, tempo and mode of shell shape in bivalved molluscs, and macroevolution frogs and their tadpoles.

You can find out more about her research here:
Researcher Profile: https://researchers.adelaide.edu.au/profile/emma.sherratt
Webpage: http://www.emmasherratt.com
Social media: Twitter: @DrEmmaSherratt

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours projects

Emma welcomes students interested in morphological evolution of any structures or organisms. Examples of potential research projects:

- Evolution of dietary specialisation and its effect on snake skull shape. Co-Supervisors: Dr Kate Sanders (kate.sanders@adelaide.edu.au)
- Evolution of the head shape in burrowing lizards and snakes: more than one way to make a shovel. Co-Supervisors: Dr Mark Hutchinson (Mark.Hutchinson@samuseum.sa.gov.au)
- Morphological Evolution and adaptation of Australia’s rabbits
EVOLUTION AND ADAPTATION OF TIGER SNAKES

Dr Vicki THOMSON  
vicki.thomson@adelaide.edu.au

Vicki's research focuses on the evolution and adaptation of Tiger Snakes, with special emphasis on how island populations have diverged from the mainland over both long and short timeframes. Current research involves: population genomic approaches to understanding the spatial genetic diversity of tiger snakes; evolution of venom to different suites of prey species; development of gigantism and dwarfism in body size on islands; head size and shape differences at the population level; evolution and adaptation of skin pigment between populations and in response to UV light exposure; and epigenetic regulation of phenotypic plasticity.

You can find out more about my research here:
Researcher Profile: https://researchers.adelaide.edu.au/profile/vicki.thomson
Webpage: vicki-thomson.com
Social media: @Vicki_Thomson

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours projects

- Morphological project quantifying skin pigment differences between populations (striped vs. completely black) and in response to UV exposure over a season.
- Morphological project examining evolution of skull shape in response to different prey type/size between island and mainland populations.
- Bioinformatics project investigating adaptation of venom in island populations of tiger snake using venom gland transcriptome data.
- Bioinformatics project identifying potential functional genes involved in body size gigantism/dwarfism using whole genome data.
- Bioinformatics project investigating population-level epigenetic differences involved in adaptation to island environments.
AUSTRALIAN CENTRE FOR ANCIENT DNA (ACAD)
The Australian Centre for Ancient DNA is a leading research centre at the University of Adelaide. Our research focuses on the use of DNA, increasingly genomes, from ancient humans, microbes, animals, and plants to study evolution and environmental change. Our research includes both lab-based and bioinformatics approaches. Potential Honours projects and supervisors are listed below.

Please visit our website for full details of our staff, students and current research.

https://www.adelaide.edu.au/acad/
My research uses "ancient" DNA techniques in two very different fields of genetics and evolution. The first focuses on using DNA sampled through space and time to understand the evolutionary history of living and extinct animals and birds, to assess the impacts of past environmental change on animal and bird populations, and to provide valuable genetic data for conservation and management of threatened species.

The second utilises ancient DNA techniques to allow forensic identification of highly degraded human remains - murder victims, missing persons and war dead. In this area Jeremy's group is developing new "genomics" techniques for human identification as well as providing a service to the Australian Defence Force, Australian Police and humanitarian agencies to assist with the identification of human remains.

You can find out more about my research here:
Webpage: www.adelaide.edu.au/acad
Social media: @dnatimelord (Twitter & Instagram)

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours Projects

- Phylogeography and conservation genetics of Australian birds and mammals, including night parrots, wombats and quolls
- Developing a forensic mitochondrial DNA database for human identification
- Molecular diet analysis of introduced and native species
- Molecular diet analysis of bent-winged bats (co-supervised with Dr Thomas Prowse)
Using the ancient DNA to explore human adaptation and evolutionary medicine

Humans are hugely successful organisms, having spread from Africa to occupy most parts of the planet. This journey had a big impact on human genetic diversity and health, as it involved massive population size changes, and lead to several new adaptations following our exposure to a variety of new environmental challenges and pathogens.

Notably, we still know very little about the genetic origins and environmental drivers of many modern human traits and diseases, since studies of modern populations do not tell us when and where these events first took place. However, with the recent explosion of ancient human genetic datasets, it is now possible to investigate such questions directly. To make such analyses possible, researchers at (ACAD) have built the Online Ancient Genome Repository (OAGR) https://www.oagr.org.au/, which is the first and only repository to collate all available ancient human genome data.

The ACAD team is currently pursuing a number of projects that apply state-of-the-art methods to investigate the role of adaptation in generating modern human genetic and phenotypic diversity, and the genetic origins and environmental drivers of common diseases. We are looking for students that would like to get involved in research into human adaptation and evolutionary medicine, who would ideally be familiar with either the R or Python programming language, and have some previous experience working in a Linux environment and shell scripting.

*Recommended Honours Enrolment: Honours in Evolution and Palaeobiology*
ACAD - MEGAFANAL EVOLUTION AND EXTINCTION

Dr Kieren MITCHELL
kieren.mitchell@adelaide.edu.au

Over the last 50 thousand years the majority of megafauna (animal species larger than around 44 kg) from around the world have become extinct. This lost diversity includes: giant ground sloths from South America; dire wolves, mammoths, and sabre-toothed cats from North America; giant kangaroos, marsupial lions, and thylacines from Australia; and many more. At ACAD, we use DNA preserved in bones and teeth to reconstruct the genomes of these extinct species, allowing us to better understand their evolution and roles in past ecosystems. In addition, this ancient DNA allows us to learn about past population sizes, migrations, and inter-species hybridisation. By combining ancient DNA data with radiocarbon dating, stable isotope analysis, and palaeontological data we can also infer the responses of animal populations to climate and environmental change in the past, and potentially determine what ultimately caused the extinction of the megafauna.

Honours projects available in this area will be predominantly analytical/bioinformatics-based, with the option of a limited wet-lab component.

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology
ACAD - ANCIENT DNA, EPIGENETICS AND BIOINFORMATICS

Dr Bastien LLAMAS  
bastien.llamas@adelaide.edu.au

Bastien’s research focuses on early human migrations and processes of rapid adaptation to changing cultural and natural environments. He uses ancient DNA extracted from past human populations to observe molecular changes as it happens, and in the process reconstruct human population history.

You can find out more about Bastien’s research here:  
Researcher Profile: https://researchers.adelaide.edu.au/profile/bastien.llamas  
Twitter: @DNATimeMachine

Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Honours projects

- **Chromosome Y analysis of the descendants and potential ancestors of the Inca rulers**
  This project will leverage a recently published study (Sandoval et al. 2018) that reports Chromosome Y lineages from descendants of the Inca nobility. The aim will be to generate genetic information from the chromosome Y of pre-Columbian and present-day individuals and test ancestral relationships along paternal lineages. The work will be both experimental and computer-based.

- **Mutation rate estimates in early European farmers**
  This project will consist in sequencing the whole genome of pairs of related early European farmers (parent-child), estimate the genomic mutation rate, and compare it to the mutation rate reported from the analysis of modern pedigrees. The work will be both experimental and computer-based.

- **Characterisation of ancient DNA damage in a new type of high throughput sequencing data**
  This project will make use of a novel DNA library methodology recently developed at ACAD. The goal is to characterise ancient DNA damage using high throughput sequencing of the new type of DNA libraries. In addition, sequencing error rates and other experimental biases will also be estimated. The project will involve both experimental and computer-based work.

- **Method development to repair ancient DNA damage**
  This project will explore the use of a new enzymatic treatment to repair ancient DNA damage before high throughput sequencing. The work will be both experimental and computer-based.
Recommended Honours Enrolment: Honours in Evolution and Palaeobiology

Evolutionary history of oral microorganisms in Neandertals
This Honours project will use novel methods to reconstruct ancient genomes from both Neandertals and our ancestors. We recently published the oldest microbial genome to date at 48,000 years old, and we are interested in an Honours student to continue to mine these data sets using a novel approach. This project is largely bioinformatics based.

The effects of DNA damage and degradation on ancient human microbiomes
In humans, DNA degradation is tightly linked to the environment and time of degradation. Microorganisms are incredibly diverse, and the rates at which they decay are currently unknown. This Honours project will center on examining different genomic rates of decay in different microbial populations over the past 50,000 years. This study is also largely bioinformatics based.

Unlocking past diets through the analysis of ancient dental calculus (led by Dr Raphael Eisenhofer).
Dental calculus (calcified dental plaque) on our teeth may trap food during its formation. Therefore, the study of ancient dental calculus may offer unprecedented insights into past human cultures around the world. However, as dietary DNA makes up a small proportion of the total DNA in dental calculus, its analysis is computationally challenging. This project will seek to enhance our ability to infer the diets of past humans through optimising existing and developing new approaches for analysing the DNA preserved in ancient dental calculus. This project is largely bioinformatics based.
INVERTEBRATE PHYSIOLOGY AND ECOLOGY

Prof Phil Weinstein
Co-supervisor: Prof Andy Austin

philip.weinstein@adelaide.edu.au

Recommended Honours Enrolment: Honours in Ecology and Environmental Science

Honours Projects

Chironomids in extreme environments - Non-biting midges (Chironomidae) are very similar to mosquitoes, and are masters at survival: their larvae live in waters that can be surprisingly hot (hot springs), cold (Antarctica), deep (2 km!), acidic, saline, ephemeral, or otherwise challenging. We are interested in comparing larval habitats in South Australia to what is known from the international literature: are the larvae in our Dalhousie hot springs tougher than their counterparts overseas? How acid and salt tolerant are larvae in the Coorong compared to elsewhere? Can our larvae survive desiccation in ephemeral water bodies, like the ones in Africa? The exact focus and hypothesis to be tested will be developed under this umbrella, depending on the interests and skills of the student – it could include aspects of vulnerability to climate change, molecular approaches to cryptic species identification, and biodiversity conservation.