STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

We are passionate about animals and study how they live, work, have sex and sense the world around them. We study animals in the natural and managed environments including below and on the ground and in the air as well as in fresh and marine waters. We are also passionate about the communication of science to the public and external stakeholders and work towards sustainable and ethical food supplies, help to protect threatened environments, and provide clues to advance medical sciences and treatments.

We undertake research projects not only in Australia but also globally.

The School's research expertise is far-reaching and diverse, spanning five major Disciplines: Evolutionary Biology, Ecology & Conservation Biology, Livestock Science, Neuroscience, and Science Communication. As such, we place great value not only in research but also in research-led teaching and external engagement. The School focuses on an integrative approach to fundamental problems that can make a significant contribution to the solution of outstanding scientific and societal problems in the following discipline areas;

Ecology & Conservation

We research how animals interact with other species and with their physical environment. This fundamental ecological understanding is required to conserve endangered species and protect their habitats with effective, evidence-based methods. Our research takes us to habitats from suburban backyards to deserts and the depths of the sea.

Evolutionary Biology

Our research explores evolutionary responses to selection at the phenotypic and genomic level, with the broad aim of discovering how organisms adapt to their changing environment. CEB takes a multidisciplinary approach to explore selective processes acting on the morphological and life-history traits of whole organisms and their gametes. We have particular expertise in acoustic signalling, predator-prey interactions, visual ecology, sperm competition, chemical ecology, and the genetic mapping of complex traits.

Science Communication

Our research explores evolutionary responses to selection at the phenotypic and genomic level, with the broad aim of discovering how organisms adapt to their changing environment. CEB takes a multidisciplinary approach to explore selective processes acting on the morphological and life-history traits of whole organisms and their gametes. We have particular expertise in acoustic signalling, predator-prey interactions, visual ecology, sperm competition, chemical ecology, and the genetic mapping of complex traits.

Neuroscience

Neurological conditions make up one third of global disease burden, yet there are few effective treatments. We aim to understand brain structure and function with the goal of promoting functional recovery in various neurological conditions including developmental brain disorders, traumatic injury and neurodegenerative diseases. Our research covers key areas including abnormal brain development; clinical trials for spinal cord injury and neurotrauma.

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Neuroecology

By researching the nervous and sensory systems of animals we are discovering how animals detect light, chemicals, sound and other environmental cues, as well as finding ways to explain abnormal brain development and treat traumatic neural injury in humans. Our work extends from animal behaviour and neuroecology, via fundamental neuroscience, to clinical trials, and encompasses animals from insects and crabs, to mammals and sharks.

Students are encouraged to contact prospective supervisors directly to discuss the project and find out about additional projects not currently listed in this booklet.

TOPIC	LEVEL	SUPERVISORS
Male dimorphism and sexual conflict Male dimorphism usually reflects alternative reproductive tactics among males: the large male morphs typically guard females or reproductive territories and have more elaborate weaponry; the small male morphs sneak copulations and have reduced weaponry. In the bulb mite Rhizoglyphus echinopus, fighters have a thick and sharp pair of legs and kill rival males, whereas scramblers search for unguarded females. We have colonies of bulb mites in the lab that have been under artificial selection on the thickness of fighter legs for several generations. The aim of this honours project will be to assess whether selection for thicker legs in fighters generated any response in females. If so, then a sexual conflict should arise and constrain the evolution of sexual dimorphism and male dimorphism, which would be a very significant finding in evolutionary biology. The work will involve manipulating mites under the microscope and measuring their legs with image software.	Honours	Dr Bruno Buzatto, bruno.buzatto@uwa.edu.au A/Prof Joseph Tomkins joseph.tomkins@uwa.edu.au

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School of Animal Biology

Reaction of fish to sound Sound travels well underwater and underwater sound is increasingly recognised as a form of pollution that has significant impact on many fish. This project will investigate the reaction of fish to sound in field and lab conditions. Experiments will include the analyses of in situ natural sounds recorded with hydrophones in the Swan River and/or in coastal marine environments, and observations of fish behaviours in reaction to these sounds, and to sounds in play-back experiments. Fish will be monitored with stereo underwater cameras so that their movements can be tracked and quantified.	Honours Masters PhD	Prof Shaun Collin, shaun.collin@uwa.edu.au A/Prof Julian Partridge julian.partridge@uwa.edu.au Dr Jan Hemmi, jan.hemmi@uwa.edu.au Dr Di McLean dianne.mclean@uwa.edu.au
Modelling the conservation of wide-ranging species – University of Western Australia An exciting opportunity has arisen to undertake a PhD that will contribute towards the conservation of wide-ranging species in one of the world's biodiversity hotspots. This PhD is part of a larger project involving staff from the University of Western Australia, Alcoa of Australia, Department of Parks and Wildlife and the Western Australian Museum. The project, funded by the Australia Research Council, Alcoa World Alumina Australia and Department of Parks and Wildlife, aims to develop methods to better integrate conservation with anthropogenic activities across the whole landscape in a drying climate. We are seeking a motivated candidate to undertake a PhD that will use data on the spatial distribution of critical resources for Red-tailed Black-Cockatoos to model the best trade-offs between conservation outcomes and a range of anthropogenic land uses. Critically, this will include modelling of how the location of cockatoo drink sites might influence these trade-offs. While most of the data have already been collected, we would envisage that the candidate would undertake, or assist with, some fieldwork to better understand the cockatoo ecology, the landscapes and land uses modelled. The fieldwork would be conducted in a variety of landscapes in the northern jarrah forest ranging from 35km SE to 120km SSE of Perth.	PhD	Dr Michael Craig michael.craig@uwa.edu.au
Limiting damage following mild traumatic brain injury Traumatic injury to the central nervous system has serious and long-term functional consequences. We have demonstrated that oxidative stress in the cells that make the myelin required for efficient functioning of the nervous system is associated with disruptions to myelin structure and chronic functional loss. Here we will use a model of repeated mild traumatic brain injury/concussion and assess whether the changes to myelin and oxidative stress feature following this highly clinically relevant injury. We will assess therapeutic strategies designed to limit myelin changes, including combinations of calcium channel inhibitors.	Honours Masters PhD	A/Professor Lindy Fitzgerald melinda.fitzgerald@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Targeted nanoparticles to deliver novel combinatorial treatments for secondary degeneration following neurotrauma Injury to the central nervous system is exacerbated by the progressive secondary degeneration of residual tissue beyond the original injury site. We have demonstrated that three Ca2+channel inhibitors in combination prevent structural changes to myelin and successfully restore function in an in vivo model of secondary degeneration in rat optic nerve. However, two of the inhibitors must be administered directly to the site of injury by osmotic mini-pump, significantly reducing the clinical translation potential of the combination. In this project, the student will generate nanoparticle based therapies to deliver combinations of Ca2+ channel inhibitors directly to damaged cells following neurotrauma.	Honours Masters PhD	A/Professor Lindy Fitzgerald melinda.fitzgerald@uwa.edu.au
Gamifying science 'Serious games' and game-based learning have grown in popularity in recent years, used both in the home and in school to enrich children's learning and engagement with issues such as biodiversity conservation. But what do children really think about these games and do they learn from them, or simply enjoy playing them? Do computer games have a place in the classroom?	Masters Honours	Dr Ann Grand ann.grand@uwa.edu.au
I use Twitter for this but LinkedIn for that Researchers are encouraged to engage a wide range of publics with their research, and a growing number turn to social media as a route for engagement. But how do they decide what tools to use? Why do they choose the tools they do? Do they use different tools to engage with other researchers than they use when engaging with the wider community? And how do they develop the skills they need to use social media effectively?	Honours Masters PhD	Dr Ann Grand ann.grand@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Cooperation and communication in humpback dolphins* The Australian humpback dolphin (Sousa sahulensis) is a newly designated species that may be more socially complex than previously assumed, forming temporary, cooperative male alliances and performing socio-sexual displays during consortships. This project will involve two months fieldwork in the Dampier Archipelago, Pilbara, using focal sampling methods combined with an array of underwater microphones to document complex behaviour and the vocal strategies these males may employ in negotiating these social relationships. The student would assist in the fieldwork component, and would be responsible for analysing the acoustic recordings collected. The student will be trained in the use of specialized sound analysis software and computing environments, such as R and MATLAB. There is potential for this project to result in a peer-reviewed publication in an international journal. *This project is dependent upon Dr King and collaborators securing funding from the Sea World Research and Rescue Foundation, the outcome of which will be known in December 2016.	Honours Masters PhD	Dr Stephanie King stephanie.king@uwa.edu.au
Synchronous vocal displays in allied male bottlenose dolphins Interestingly, synchronous behaviour may have evolved as a coalition signalling system in humans to indicate the quality of the cooperative relationship. Synchronous behaviour in allied male dolphins may therefore represent convergence in the use of synchrony as an alliance signal. The male dolphins in Shark Bay commonly exhibit synchronous physical behavioural displays, but we have recently discovered the production of synchronous vocalisations – namely 'pops', a threat vocalisation they use to herd females. The student would quantify the differences between single pop trains, asynchronous pop trains and synchronous pop trains to fully describe these vocal behaviours. He/she will explore whether synchronous popping occurs between all males, or whether the strength or quality of the alliance relationship influences synchronous pop production. This project will use data already collected from the male dolphins in Shark Bay. The student will be trained in the use of specialized sound analysis software and computing environments, such as R and MATLAB. Although this project is primarily desk-based, the student may have the opportunity to join Dr King in the field in Shark Bay to help collect further acoustic data. The aim would be for this project to lead to a peer-reviewed publication in an international journal.	Honours Masters PhD	Dr Stephanie King stephanie.king@uwa.edu.au

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How fiddler crabs see the world This project aims to understand how animals, in particular fiddler crabs, see their world. Using a mix of behavioural, physiological and anatomical experiments, we seek to understand how these animals see colours, patterns and polarisation, and how these visual capabilities influence how these crabs interact with their environment, their predators and conspecifics. Experiments will be conducted using our resident UWA fiddler crab colony, housed in a 4 m^2 fully-functional artificial mudflat. You will discover how sensory information underpins animal behaviour, learn how to probe the visual capabilities of animals and, depending on your interests and abilities, learn different combinations of behavioural and physiological and possibly genetic techniques.	Honours Masters PhD	Dr. Jan Hemmi jan.hemmi@uwa.edu.au A/Prof Julian Partridge julian.partridge@uwa.edu.au
Escape responses in fiddler crabs How do animals decide when to escape from an approaching predator? We are trying to understand the sensory information animals underlying this decision. The results will tell us how animals measure risk and how they manage to avoid being eaten while still being able to feed and find mates. Fiddler crabs are highly visual animals that live under constant threat of predation from birds. Field experiments have shown that the crabs are not able to measure a predator's distance or their direction of movement – a problem they share with many other small animals. You will bring fiddler crabs into the laboratory and their escape decisions will be tested in our artificial mudflat (at UWA) and/or on a custom made treadmill controlled conditions. Depending on your interests, you can use a combination of behavioural and physiological measurements to understand the mechanisms underlying the crab's escape behaviour.	Honours Masters PhD	Dr. Jan Hemmi jan.hemmi@uwa.edu.au A/Prof Julian Partridge julian.partridge@uwa.edu.au
Comparative colour vision and spatial vision in ants Ants have some of the smallest brains in the animal kingdom, yet they show a wide range of interesting behaviours, many of them visually driven. Their small size and limited head and eye space has forced them to optimise their visual system in very distinct ways. We have recently shown that one of the Australian bull ants, a species exclusively active in the dark of the night, has trichromatic colour vision like humans. As this is the first ant that has been shown to have more than two spectral photoreceptor types, this project will compare ants from different phylogenetic branches in order to understand the evolution of colour vision and spatial vision in ants in general. This project runs in collaboration with researchers from Macquarie University and will use a range of complementary techniques (physiology, behaviour and possibly molecular biology).	Honours Masters PhD	Dr. Jan Hemmi jan.hemmi@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Eye movements for high resolution in fiddler crabs The compound eyes of arthropods such insects and crustaceans are well known for their low spatial resolution. By our visual standards, almost all these animals seem to have a hopelessly blurry view of the world. This low spatial resolution is due to the optical design of their eyes: in particular the relatively broad angular sensitivity of the ommatidia – the individual photoreceptor elements of the eye – and the interommatidial angle – the way in which each ommatidia's line of sight differs from that of its neighbour. If each ommatidium looks in a very different direction, it is inevitable that the whole eye's view will lack spatial detail. Unless, that is, arthropods have evolved a way to overcome this problem. In machine vision, a technique of subpixel interpolation is used to increase the resolution of an imaging system or camera. This is done by taking several images of a scene but shifting the image sensor slightly for each image. You will use macro high speed video to investigate whether fiddler crabs move their eyes in a way that would enable them to employ such sub-ommatidial interpolation.	Honours Masters PhD	Dr. Jan Hemmi jan.hemmi@uwa.edu.au A/Prof Julian Partridge julian.partridge@uwa.edu.au
Comparative eye anatomy We have recently developed an exciting new tool to measure the visual field of animals with compound eyes, such as ants and bees. MicroCT is a technique that uses x-rays to image eyes on a very fine spatial scale. We have now developed unique new software to analyse these 3D images and reconstruct how the eyes sample the world. This has never been done before. The output will be a much improved understanding of how animals see their world and much detail they can see. The speed and accuracy of this technique will allow you to compare numerous eyes and can form the basesused for a comparative study of fiddler crab eyes, or to compare the eyes of a range of other animals groups such as ants. For a PhD project, this could involve developing a new staining technique to investigate neural connections in the intact eye, to see how neurons are	Honours Masters PhD	Dr. Jan Hemmi jan.hemmi@uwa.edu.au A/Prof Julian Partridge julian.partridge@uwa.edu.au

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eDNA a) Developing and applying eDNA protocols so we can identify locations where trout have established self-reproducing populations b) Developing and applying eDNA protocols for freshwater native fish biodiversity surveys and to determine the existence of feral fish populations Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au
Trout Reproduction Research: a) Evaluating and comparing sperm and egg quality between brown trout and rainbow trout Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au

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Native Fish Research: a) Evaluating trap design and bait type to identify the optimum protocol for catching native fish b) Developing a non destructive technique for determining sex and spawning condition of native freshwater fish species c) Developing and evaluating techniques to improve wound healing after surgical implantation of PIT tags in freshwater fish d) What is the distribution of Galaxias occidentalis in the Swan Avon river e) Evaluating non-invasive tests for stress and welfare of freshwater fish Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au
Freshwater Crayfish Research: a) Genetic variation among marron in the Harvey River catchment b) Why are the the critically endangered Margaret River marron hairy? c) Where did the redclaw strain(s) in WA originate from? d) Distribution of Gilgies & Koonacs on the swan coastal plain Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au

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Feral Fish Research: a) Can trout be used to control feral Gambusia populations in artificial lakes? b) Comparing and evaluating traps (design, light, temperature, baits) for selectively removing feral Gambusia from waterbodies c) What is the best bait attractant for use in traps to catch feral carp? Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au
Mosquito-borne disease control a) Developing and validating a new technique for counting mosquito larvae Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

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Aquaculture a) Developing and evaluating diets for marron production b) Developing and evaluating diets for silver perch production Facilities & funding support - Funding will be provided by the Department of Fisheries for travel expenses and equipment - Students will be provided with facilities, tanks and aquariums at the UWA Aquaculture & Native Fish Breeding Laboratory - UWA Shenton Park Field Station and/or Dept Fisheries Field Station & Hatchery in Pemberton. - Student supervision will be provided by staff from both UWA and Department of Fisheries	Honours Masters PhD	Dr Craig Lawrence clawrence@fish.wa.gov.au
Are the "KNDy cells" really the holy grail of reproductive biology? The brain switches reproduction on and off by altering the pulsatile secretion of the brain hormone gonadotrophin releasing hormone (GnRH). However, what controls the release of these pulses has remained a mystery. Recently, three brain hormones (kisspeptin, neurokinin B and dynorphin) produced by the same cells (KNDy cells) may be the answer. In this project you will explore the role of KNDy cells in sheep, a species that is reproductively highly responsive to external stimuli (e.g. nutrition, prospective mate). Results will be relevant to fertility issues in humans, farm animals and wildlife. Projects are laboratory based. Animal work is occurring in late 2016, and further animal work may be available for longer-term projects. You will develop skills in radio-immunoassay of hormones, immunohistochemistry and microscopy.	Honours Masters PhD	Prof Graeme Martin graeme.martin@uwa.edu.au Dr Stacey Rietema stacey.rietema@uwa.edu.au Dr Jeremy Smith (APHB - UWA) jeremy.smith@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

UV light and biofouling Growth of bio-fouling organisms (plants and animals) on structures in marine and estuarine waters presents significant problems including the need to remove fouling with water jets, physical and chemical cleaning, and replacement of equipment early in their design lives. This project will determine the capacity of different levels and wavelengths of ultraviolet (UV) irradiation to reduce biofouling accumulation rates on in-water settlement plates deployed in marine and estuarine environments. UV irradiation has long been recognised as having biocidal efficacy, including an ability to reduce unwanted marine growth. UV light emitting diodes (LEDs) have recently become cheap and high power, renewing interest in their use for preventing biofouling underwater. The project will involve the construction of UV-LED irradiators and their deployment in marine and estuarine locations in the Perth metropolitan area.	Honours Masters PhD	A/Prof Julian Partridge julian.partridge@uwa.edu.au Dr Jan Hemmi jan.hemmi@uwa.edu.au
Reaction of marine invertebrates to sound Sound travels well underwater and underwater sounds is increasingly recognised as a form of pollution that has impacts on a wide range of animals. Little is known, however, about the affect of sound on marine and estuarine invertebrates. This project will investigate the reaction of marine invertebrates such as crustaceans and aquatic insect larvae to sound. Experiments will include analyses of in situ natural sound recorded with hydrophones in the Swan River, observations of invertebrate behaviours in reaction to these sounds, and sound play-back experiments.	Honours Masters PhD	A/Prof Julian Partridge julian.partridge@uwa.edu.au Dr Jan Hemmi jan.hemmi@uwa.edu.au Prof Shaun Collin shaun.collin@uwa.edu.au
Heart rate monitoring of aquatic invertebrates Heart rate is well known as an indicator of physiological 'state', activity and stress in animals such as mammals, including humans. Heart rate varies similarly in invertebrates such as crabs and molluscs, providing a method to monitor the animals to determine their state of physiological stress (e.g. in response to pollutants), to optimise husbandry for welfare reasons, or to maximise growth rates in aquaculture. We have constructed a small electronic package comprising an infrared (IR) light emitting diode (LED) and IR detector that can be mounted on the shell of a mollusc or carapace of a crab and used to monitor heart rate with minimal impact on the animal. We will use this to measure the affect of physico-chemical environmental conditions such as dissolved oxygen tension, temperature, and pH on aquatic invertebrates including farmed animals such as abalone and marron. We will also investigate heart rate in the context of marine invertebrates with complex behavioural repertoires and/or that live in environmentally highly varying conditions (e.g. fiddler	Honours Masters PhD	A/Prof Julian Partridge julian.partridge@uwa.edu.au Dr Jan Hemmi jan.hemmi@uwa.edu.au Dr Craig Lawrence (DoF) clawrence@fish.wa.gov.au

crabs).		
Changes in scale of coral bleaching in the British Indian Ocean Territory. The 2016 El Nino swept the world's oceans causing unprecedented rates of coral bleaching globally. Reports in October 2016 suggest that 80% of corals in the northern Great Barrier Reef are dead as a result of this warming event. Some evidence suggests that corals recover from bleaching faster when in fully protected marine protected areas (MPA). As part of a fish survey using baited remote underwater video systems (BRUVS) we have habitat data from the British Indian Ocean Territory MPA pre and post the 2016 bleaching event. This project would examine (1) whether BRUVS be used to detect bleaching and (2) the chance in incidence rate of bleaching pre event and at two points post bleaching.	Honours	Prof Jessica Meeuwig jessica.meeuwig@uwa.edu.au
Cross-shelf patterns in fish biodiversity at Bremer Basin. The Bremer Basin has been identified as a "hotspot" of diversity, supporting an iconic aggregation of orcas. The degree to which this area also is a hotspot for area is a fish hotspot is however unknown. Towed video imagery has been collected at numerous locations in the area and this project will focus on (1) assessing the information generated by towed video an d (2) interpreting this in terms of regional diversity.	Honours	Prof Jessica Meeuwig jessica.meeuwig@uwa.edu.au Prof Christine Erbe (Curtin)

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School of Animal Biology

Light within tissues and in sediments We are well aware of the importance of light in context such as animal vision or plant photosynthesis. Less well understood is the way in which light penetrates tissue for non-visual photodetection. For example, most animals have non-visual light detectors distributed throughout their bodies. What light is available to these detectors. Similarly, light penetrates environmental substrates such as soils and sediments where it is used by microorganisms for photosynthesis, phototaxes, and by plants for root phototropism. What light is available to these detectors. This project will involve the construction of novel fibre optic micro-irradiance probes to measure the specral irradiance of light in tissue, as well as in soils and sediments.	Honours Masters PhD	A/Prof Julian Partridge julian.partridge@uwa.edu.au Dr Jan Hemmi jan.hemmi@uwa.edu.au
Heart rate monitoring of aquatic invertebrates Heart rate is well known as an indicator of physiological 'state', activity and stress in animals such as mammals, including humans. Heart rate varies similarly in invertebrates such as crabs and molluscs, providing a method to monitor the animals to determine their state of physiological stress (e.g. in response to pollutants), to optimise husbandry for welfare reasons, or to maximise growth rates in aquaculture. We have constructed a small electronic package comprising an infrared (IR) light emitting diode (LED) and IR detector that can be mounted on the shell of a mollusc or carapace of a crab and used to monitor heart rate with minimal impact on the animal. We will use this to measure the affect of physico-chemical environmental conditions such as dissolved oxygen tension, temperature, and pH on aquatic invertebrates including farmed animals such as abalone and marron. We will also investigate heart rate in the context of marine invertebrates with complex behavioural repertoires and/or that live in environmentally highly varying conditions (e.g. fiddler crabs).	Honours Masters PhD	A/Prof Julian Partridge julian.partridge@uwa.edu.au Dr Jan Hemmi jan.hemmi@uwa.edu.au Dr Craig Lawrence (DoF) clawrence@fish.wa.gov.au
Karajarri Inter-Tidal Reef Project A unique opportunity to engage with the indigenous custodians of the shore between Roebuck Bay and 80 mile beach. This project is not the typical honours project, incorporating aspects of citizen science and science communication. Its main objectives are: 1. Initiate activities to gain baseline biodiversity data on karajarri sea country – initially intertidal reefs (but also interested in mangroves, seagrass and intertidal creek systems). 2. Build capacity of rangers and community members to undertake these activities 3. Establish an ongoing monitoring program	Masters Honours	Dr Jane Prince jane.prince@uwa.edu.au

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Cygnet Bay This project aims to understand competitive interactions between rock oysters and other sessile/sedentary intertidal species with the objective of promoting successful rock oyster settlement and recruitment into the rocky shores. This project will require a long stay at the Cygnet Bay Research station, interactions with traditional owners and volunteer interns.	Masters Honours	Dr Jane Prince jane.prince@uwa.edu.au
The effectiveness of small marine protected areas for the protection of a) Herring and b) King George Whiting Two years of census data taken over summer at Rottnest Islan show that the numbers of both herring and King George Whiting appear greater inside the marine sanctuary zones than outside. This result was unexpected, especially for herring which is a migratory pelagic fish and the aim of this project is to examine the population structure and movements of both species inside and outside the reserves, before during and after the main fishing season. Applicants must be strong swimmers and prepared to spend significant time in the field.	Masters Honours	Dr Jane Prince jane.prince@uwa.edu.au Dr Jordan Goetze
Conflict and cooperation in group-living species Western Australian magpies live together in cooperative groups in which they help one another to raise young, defend resources and repel predators. They interact regularly and as a result, not only do they cooperate, but they also come into conflict. The Magpie Project based here at UWA is a long-term research project that studies the behaviour of ringed, habituated magpies in 12 different groups. We use these groups to ask a number of questions regarding cooperation, conflict, communication and cognition. Because this is a long-term study, students are expected to join a collaborative research team, and to work in the field with the magpies. There are many questions that can be asked of the magpies (becasue of the amount of data we can collect on them), but most questions will be based around the themes of: the causes and consequences of cooperation, the complexity of vocal communication, parental care and offsrping development, parent-offspring conflict, population dynamics and viability. Students are encouraged to contact me for the the specific research areas they are interested in among those listed and I will give furhter details of the projects avaialble	Honours Masters PhD	Dr Amanda Ridley amanda.ridley@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Sexual selection and sperm competition Research opportunities are available to explore the role of pre-copulatory and post-copulatory sexual selection in the evolution of male and female reproductive behaviour and morphology. We seek to understand how life-history trade-offs affect male allocation of resources to the weapons and ornaments of mating competition and sperm production for competitive fertilization success. These questions can be addressed in a variety of taxa from insects to humans, and using a variety of approaches, from comparative morphology to genetics.	Honours Masters PhD	Professor Leigh Simmons leigh.simmons@uwa.edu.au
Paternal effects on offspring performance. Although offspring are known to resemble their parents through the action of genes, there is now a growing awareness of non-genetic mechanisms by which parents can affect the growth and health of their offspring. This project aims to quantify the putative role of the social environment on so-called non-genetic inheritance. Using an insect model, the research aims are to identify proteins in the seminal fluid that promote early embryo development, explore how males allocate these proteins to their mates, and how females adjust their own reproduction in response to seminal fluid proteins.	Honours	Professor Leigh Simmons leigh.simmons@uwa.edu.au
Traumatic insemination in plant bugs In traumatic insemination (TI), males use hypodermic genitalia to inject sperm into the female through the side of her abdomen, bypassing her genitalia. This project will use plant bugs in the genus Coridromius to examine sexual conflict arising from TI. Experiments might include but are not limited to: determining the costs of TI to females; measuring the immune response of females to TI; studies of mating behaviour/mate choice; identifying the sperm pathway through the female bloodstream. The project will involve collaboration with researchers at the WA Museum.	Honours Masters PhD	Professor Leigh Simmons leigh.simmons@uwa.edu.au
The evolution of mating spurs in trapdoor spiders Many male trapdoor spiders use their front legs to move females into a suitable position during mating, by locking highly specialised mating spurs located on their anterior legs under the female's fangs during copulation. Using landmark geometric analyses, the project will quantify and map shape variation onto a pre-existing molecular phylogeny of the spiders, and test evolutionary hypotheses for the divergence of these male mating structures. The project will involve collaboration with the WA Museum.	Honours	Professor Leigh Simmons leigh.simmons@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

The costs of male weaponry: are males with enlarged weapons visually impaired Male dung beetles invest in horns which are used in battles over access to tunnels and the females breeding within. However, some males do not develop horns or fight for access to females, but rather sneak copulations guarded by horned males. Males that develop horns compromise the development of their eyes. This project will compare the visual capabilities of minor and major males using a combination of anatomical, physiological and behavioural methods. You will learn how to make electroretinogram measurements to assess the beetles' visual acuity and light sensitivity and correlate these findings with anatomical predictions based on 3D microCT measurements of the beetles' eyes.	Honours	Professor Leigh Simmons leigh.simmons@uwa.edu.au Dr. Jan Hemmi jan.hemmi@uwa.edu.au
How private is the public domain? Most universities consider that all posts made to public online discussion boards are in the public domain. Therefore, people's posts on the internet are able to be used as research data without needing specific consent from the poster.While researchers are sensitive to the potential ethical issues involved and have suggested guidelines for use of public posts, we do not know if people understand the implications of posting in the public domain or if they would consent to their data being used if they did know. In this project, you will explore people attitudes and emotional responses to the use of their social media posts for research purposes.	Masters Honours	Dr Miriam Sullivan miriam.sullivan@uwa.edu.au
Employment outcomes for science communication students Employers specifically look for good communication skills when hiring science students. However, we don't know specifically which communication skills or theoretical knowledge is important for employers who are specifically looking to hire science communication specialists. In this project, you will explore what science communication employers (eg. museums, science centres, zoos, government, etc) view as desirable graduate outcomes for potential employees.	Masters Honours	Dr Miriam Sullivan miriam.sullivan@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Gas exchange in aestivating garden snails Aestivating garden snails (*Helix aspersa*) are able to metabolically depress and reduce their evaporative water loss by forming a single or multiple epiphragms across the shell aperture. Gas exchange is maintained across the kalkfleck (lime spot) in the epiphragm, allowing oxygen uptake and carbon dioxide and water loss via their diffusion lung. Little is known regarding the pattern of diffusion ventilation controlled by the opening/closing of the pneumostome. This project will measure the instantaneous rates of oxygen uptake, carbon dioxide excretion, and evaporative water loss for aestivating snails, to determine the pattern of exchange (continuous or discontinuous) and the relationship s between the rates of diffusional exchange for these three gases.The dynamics of diffusive gas exchange can be manipulated by using artificial atmospheres (oxygen in helium, helox).	Masters Honours	Professor Philip Withers philip.withers@uwa.edu.au
Discontinuous gas exchange in a large insect Discontinuous gas exchange (DGE) is a well-documented respiratory exchange pattern of many large insects, based on the periodic closure, fluttering then opening of the spiracles. Although the selection pressures leading to the evolution of DGE are unclear, the physiological patterns and consequences are clear. This project will examine DGE patterns in a large insect, to partition cuticular and tracheal pathways; cuticular water loss will be primarily convective whereas tracheal water loss will be primarily diffusive. The project will then examine DGE patterns in modified atmospheres (oxygen in helium or argon) to determine how the altered diffusive/convective properties modify cuticular (convective) and tracheal (diffusive) gas exchange.	Masters Honours	Professor Philip Withers philip.withers@uwa.edu.au Dr Theo Evans theo.evans@uwa.edu.au
How do numbats find their termite food? This project aims to determine numbat foraging methods and preferred prey species. Numbats lack strong claws and muscular forelegs, so they are unable to break into termite mounds, which are easy to find and where termites are most concentrated. Instead numbats search for foraging termites. These are often in tunnels underground. How do numbats locate termites hidden underground? Likely by smell, and possibly by sound, or a combination. Smells linger and so do not indicate termite presence, the opposite is true for sound. This project will be in collaboration with Chris Cooper (Curtin Univ).	Honours	Dr Theodore Evans theodore.evans@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Echidna foraging and feeding preferences Echidnas are insectivorous, eating mostly ants and termites, but also targeting large moth pupae and other insects found in the soil. Diet preferences are poorly known; are echidnas fundamentally ant eaters with a broad palate? This project aims to ascertain echidna food preferences and their effects on foraging behaviour, using existing and novel data on echidna activity from Dryandra woodlands. As most ant and termite nests are long lived, food targets may be by determining insect diversity and abundance at known feeding locations. This project will be in collaboration with Chris Cooper (Curtin Univ).	Honours	Dr Theodore Evans theodore.evans@uwa.edu.au
Ants as biocontrol agents of weed seeds There are many seed eating ants in Australia, many disperse seeds of native plants. Some seed eating ants have adapted to agricultural lands, and live on crop and weed seeds. A suite of seed-eating ants do reduce rolly-polly weeds in wheat paddocks by eating their seeds. This project aims to determine whether seed eating ants reduce other weed species, and if so, whether particular ant species target different weed species, and the factors that may influence their choices, such as seed size relative to ant size, seed composition, or availability.	Honours	Dr Theodore Evans theodore.evans@uwa.edu.au
The effect of urbanisation on termite population structure? *Coptotermes* is the most important termite pest genus in the world, as it adapts to urban ecosystems well. Indeed it is an "urban exploiter". The centre of *Coptotermes* diversity is SE Asia and Australia, and several species from this region are invasive elsewhere. Despite considerable research into population genetics in invaded regions, little is known about natural populations. This project aims to compare the effect of urbanisation on *Coptotermes* across Perth, sampling long urbanised, recently urbanised and natural habitats.	Honours	Dr Theodore Evans theodore.evans@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Little rulers Edward O. Wilson considers ants and termites to be "the little rulers of the world", because they influence most ecosystem functions and because they are so ubiquitous. Australia has been called the "land of ants" because of their high diversity and abundance. This project aims to test baiting methods targeted to remove ants and termites from natural habitats, in order to test their influence on those ecosystems. Different baiting methods will be tested, and effects on non-target species will be ascertained.	Honours	Dr Theodore Evans theodore.evans@uwa.edu.au
Can environmental effects on sperm distort patterns of genetic variation in offspring fitness? Over the last decade or so we have come to realise that sperm can be highly sensitive to environmental variables, and that these effects can have profound influences on offspring fitness. In this project, you will have the opportunity of designing an experiment that explores these effects in *M. galloprovincialis*. By incorporating an experimental approach (where sperm are exposed to different environmental treatments) within a quantitative genetic breeding design (paternal half sib), you will determine how much variance in offspring fitness can be attributable to environmental effects (i.e. due to changes in the sperm environment prior to fertilization) and additive genetic effects (i.e. due to the sire's intrinsic genetic 'quality'). The results from this project could have profound implications for studies that use quantitative genetic approaches to estimate genetic variation in offspring traits without considering the possible role of sperm-moderated paternal effects.	Honours (mid year intake)	Jon Evans & jonathan.evans@uwa.edu.au Rowan Lymbery rowan.lymbery@research.uwa.edu.au
Environmental modifiers of multivariate selection on sperm phenotype? Mussels have proved to be superb models for understanding the role that egg chemoattractants (chemical cues realised by eggs to attract sperm) play in moderating gamete interactions. Evidence from our lab has shown that in *M. galloprovincialis* egg chemoattractants selectively attract sperm from genetically compatible males, a process we term 'differential sperm chemotaxis'. We have also developed a highly innovative method for visualising the outcome of sperm competition in mussels, using fluorescent markers to 'tag' sperm and then watch their progress as they compete to fertilize eggs. This project will make use of these fluorescent dyes to explore whether outcomes of sperm competition, and therefore patterns of selection on ejaculates, depend on the presence or absence of egg chemoattractants	Honours (mid year intake)	Jon Evans & jonathan.evans@uwa.edu.au Rowan Lymbery rowan.lymbery@research.uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Personality & sexual behaviour: study on behavioural plasticity over time Although the concept of personality is rooted in the idea that individuals consistently differ in their behaviour, rec have challenged the stability of personality types over the lifetime of an individual. The idea is that natural selec favour high plasticity in the behaviour of young individuals compared to older individuals. The guppy (Poecilia offers an excellent opportunity to test this hypothesis in the framework of ARTs (alternative reproductive tacti project you will test whether social environment impacts the development of sexual behaviour personality a behavioural plasticity declines over time by conducting observations on male sexual behaviour at different life different social environments.	Honours	Supervisors: Clelia Gasparini clelia.gasparini@uwa.edu.au Jon Evans jonathan.evans@uwa.edu.au
Understanding patterns of coral reef fish biodiversity Understanding patterns of coral reef fish biodiversity is challenging and highly dependent on data availability. This project will use existing fish species richness and abundance available for Ningaloo Reef, Western Australia, to develop predictive models of biodiversity patterns at the reef scale. Detailed hyperspectral bathymetric and habitat information will be incorporated in the models as well as other predictors commonly available (e.g., sea surface temperature). The project will involve collaboration with CSIRO and Murdoch University. Skills needed/developed: geographical information systems, programming in R, species distribution models.	Honours	Dr Ana Sequeira (UWA) ana.sequeira@uwa.edu.au Dr. Hector Lozano-Montes (CSIRO)
Colourful signalling in Drosophila? Quite unbenkownst to the human observer the humble fruitfly has wings that shimmer and shine in rainbow hughes as they compete for the the sexual attention of females. What do female fruitflies see? How should males make the best of their display? Are these colours and patterns in male drosophila condition-dependent like other displays of sexual prowess like those of the peacock? This project incorporates studies of the light environment preferred by males and females, and the condition-dependence of the male colour patterns.	Masters Honours	Joe Tomkins, Rob Dugand Jan Hemmi, Jason Kennington. Joseph.tomkins@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

The experimental evolution of anisogamy. An ARC funded project requiring expertise in sterile tissue culture.	PhD	JoeTomkins Joseph.tomkins@uwa.edu.au
The experimental evolution of insular (island) dwarfism ? Insular dwarfism is a repeated evolutionary pattern where species isolated on islands evolve to become smaller than their relatives on the mainland (like the dwarf elephant of Borneo). Insular gigantism occurs where island species grow larger than their mainland relatives (like the Komodo dragon). Understanding evolved size changes on islands has been hypothesised to be greatly dependent on the ratio of nutrient supply to nutrient demand. Where supply exceeds demand animals are thought to evolve to a larger size (gigantism) whereas where demand exceeds supply dwarfism is favoured. These predictions are muddied by phylogenetic history, ecology and island biogeography. However we can cleanly alter supply and demand in an experimental setting?	Masters Honours	JoeTomkins Joseph.tomkins@uwa.edu.au
Sexual conflict: Adaptive harm or collateral damage? Callosobruchus maculatus are small seed-eating beetles that are easily cultured in the laboratory. Male beetles have spines on their penis which damage the reproductive tract of females. Most studies of this phenomenon suggest that the damage is collateral, i.e. arising as a by-product of male adaptations to sperm competition, rather than directly increasing male fitness. However, almost all studies in this species are conducted using virgin males. Non virgin males have much smaller ejaculates than virgins and it may be that it is among these males that harming females is adaptive. This projects tests this hypothesis by examining female egg laying rates and remating propensity following matings with males of different duration and with males with different mating histories.	Masters Honours	JoeTomkins Joseph.tomkins@uwa.edu.au

STUDENT RESEARCH PROJECTS AVAILABLE IN 2017

School of Animal Biology

Climate change adaptation: Does heat-shock release cryptic genetic variation available to adaptation? One feature of our changing climate is spikes in temperature. Temperature spikes during development can cause organisms to express a heat shock response in which heat-shock proteins (Hsp) are produced. These Hsp's chaperone the production of proteins and maintain developmental stability under stress. Nevertheless heat shock is also known to release 'cryptic' genetic variation, but no studies have yet investigated whether the genetic variation that is released is available to selection. Clearly this is an important question for understanding evolution in thermally sensitive organisms under climate change. This project investigates whether heat-shock increases levels of additive and dominance genetic variation in a pedigreed population of beetles mites or fruit flies.	Masters Honours	Joe Tomkins and Jason Kennington. Joseph.tomkins@uwa.edu.au