# Master of Science by Research (MScRes) in the Biological Sciences – Current opportunities

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# Introduction

In this booklet you can find out more about current opportunities to undertake **a self-funded Master of Science by Research (MScRes) in Biological Sciences** degree (<https://www.bangor.ac.uk/courses/postgraduate-research/biological-sciences-mscres>) at the School of Environmental and Natural Scieces of Bangor University.

The MSc by Research (MScRes) is a **one-year full-time research programme (or 2 years part-time)** that differs from a taught Masters programme by placing more emphasis on research (there are no taught modules), and by being examined much more like a PhD, by an internal and an external examiner, rather than by grading of coursework and dissertation. This degree will equip you with confidence and competence in the latest research skills (including generic skills such as literature searching, legal and ethical aspects, project planning, grant proposal writing, and statistical analysis of data) and allow you to apply for further research training (PhD) programmes, or to directly apply for research positions in universities or research institutes.

The variety of advertised projects in this booklet reflects the diversity of research that is conducted by the staff in our School. The list is not exhaustive; please feel free to contact individual members of staff whose research aligns with your own interests to discuss additional possibilities.

In addition to working on your research projects, as postgraduate researchers at Bangor you will have access to a range of research skills and professional development training opportunities as well as the chance to develop your teaching skills by undertaking paid demonstrating opportunities for modules on our undergraduate curriculum.

You will also present your work at the annual School and College Postgraduate Conferences and become part of the vibrant research community of the College of Science and Engineering. There are multiple research seminarsthat run in the College, and you’d be able to join any that relate to your research interests.

Successful applicants typically have a good first degree in a relevant subject (2:1 or above). While the minimum qualification that would allow you to apply for this programme of study at Bangor University is a 2:2, if that is the case we strongly encourage that you discuss your academic background with a potential supervisor before applying. If you have valuable non-academic experience that is relevant to your research plans, you may be in a good position to secure a place on this course, even if you do not have a First or a 2:1 degree from your undergraduate studies.

You would also need to have identified a way to fund your studies (tuition fees, bench fees, living expenses). Some projects may also involve additional costs which you’d have to meet (e.g., overseas fieldwork) so make sure you discuss all the details with your potential supervisor before applying.

**How to apply:** The first step is to identify a project you are interested in then and contact the member of staff who is advertising it. They will then advise you if and how you should make a formal application to the University. When contacting potential supervisors, you should briefly outline your academic background and explain your interest in the project you are contacting them about, as well as attach a CV.

**Do not submit a direct application for a postgraduate research degree to Bangor University without first identifying a potential supervisor and discussing your research interests with them first.**

In addition to contacting the individual members of staff who have advertised specific projects here, you may also contact the following staff with general inquiries:

School Director of Postgraduate Research Studies (School of Environmental and Natural Sciences): Dr Aaron Comeault (a.comeault@bangor.ac.uk)

College Director of Postgraduate Research Studies (College of Science and Engineering): Dr Alexander Georgiev (a.georgiev@bangor.ac.uk)

## Animal Behaviour, Ecology and Evolution: General

### The early fish does not catch the worm: the role of chronobiology in spatial cognition

**Subject area:** Animal Behaviour, Chronobiology, cognition

**Supervisor(s):** **Professor Richard Holland** <https://www.bangor.ac.uk/staff/sens/richard-holland-113845/en>) Dr Amy Ellison (<https://www.bangor.ac.uk/staff/sens/amy-ellison-495358/en>)

**Contact:** r.holland@bangor.ac.uk

**Project description:**

Animals need to be able to learn about the spatial relationships of their surroundings to navigate around them. The mechanism that they have been extensively studied, but to fully understand how they do this, we need to look at external factors that influence their learning ability. Recent evidence suggests that female Siamese fighting fish (*Betta splendens*) trained in a spatial memory task were unable to reach the learning criterion when trained in the morning, only being able to do this when trained in the afternoon. This project will therefore explore further the role of the time of day in learning and memory and investigate whether chronotype plays a role in how fast fish are able to learn a task.

### Nesting ecology of red squirrels on Anglesey

**Subject area:** Mammalian reproduction; nests

**Supervisor(s): Dr Mark C. Mainwaring** (<https://www.bangor.ac.uk/staff/sens/mark-mainwaring-023874/en>), Dr Craig Shuttleworth (<https://www.bangor.ac.uk/staff/sens/craig-shuttleworth-082156/en>)

**Contact:** m.mainwaring@bangor.ac.uk

**Project description:**

Red squirrels (*Sciurus vulgaris*) are an iconic mammal that has undergone dramatic population declines in Great Britian due to the degradation of their forest homes and threats from introduced grey squirrels (*Sciurus carolinensis*) in the form of a disease, the squirrel parapoxvirus, that does not appear to affect the grey squirrels but often kills red squirrels. The island of Anglesey is a stronghold of British red squirrels and as part of efforts to help conserve them, we need to acquire a better understanding of their reproductive biology. This project will examine the selection of sites in which red squirrel dreys are located, both in terms of dreys built in tree branches and in terms of nest boxes provided for the squirrels. The project will also help quantify which nest boxes are occupied and which are left unoccupied to help direct future conservation efforts. Meanwhile, old dreys will be dissected so that the material used to construct the nests can be quantified so that the nesting material of nests can be linked to the breeding success of the squirrels. This project will be co-supervised by Dr Craig Shuttleworth, who spearheads the conservation efforts relating to red squirrels on Anglesey, and he will provide practical knowledge of the location of breeding red squirrels and of the knowledge needed to locate squirrel dreys in woodlands on the island. This project is important because it will help to improve our understanding of the reproductive biology of red squirrels, which are an endangered yet highly charismatic mammal species of local concern here in northwest Wales.

### Foraging of carrion by vertebrate scavengers

**Subject area:** Ecology, ecosystem functioning

**Supervisor(s): Dr Mark C. Mainwaring** (<https://www.bangor.ac.uk/staff/sens/mark-mainwaring-023874/en>), Dr Craig Shuttleworth (<https://www.bangor.ac.uk/staff/sens/craig-shuttleworth-082156/en>)

**Contact:** m.mainwaring@bangor.ac.uk

**Project description:**

The foraging of carrion by scavengers is a crucial ecosystem service that improves the health of ecosystems and helps prevent human illness, yet the ‘cleaning’ services provided by scavengers is often disregarded as being unimportant. A few studies have examined the consumers of carrion within agricultural landscapes and found that carrion crows (*Corvus corone*) are important consumers of carrion, yet our understanding of the foraging of carrion in marine and urban environments remains poor. Pertinently, it may be that gulls, which are often viewed as being a nuisance by many people, may perform a valuable ecosystem service by consuming carrion in marine and urban environments. This project will entail the placement of commercially bought dead rats along an urban-rural gradient in a marine environment in northwest Wales throughout the course of an entire year and use camera traps to establish the species that consume the rats. Rats will be secured to boards with nails so that scavengers cannot rapidly remove them, meaning that the cameras are more likely to identify the scavenger. Rat carcasses will be left in the field for seven days and rats remaining on the boards will be removed, and safely and clinically disposed of, via Bangor University. All photos from the camera traps will be checked to identify the scavengers and the time taken to find and scavenge the carcasses will also be recorded. This study will therefore help establish the identity of the foragers of carrion in marine and urban environments and may help establish that gulls, which are abundant in the study area, consume carrion and thus perform a valuable ecosystem service.

### Molecular dietary analysis of red squirrel, *Sciurus vulgaris*

**Subject area:** Metabarcoding / Mammal Ecology

**Supervisor(s): Dr. Amy Ellison** (<https://www.bangor.ac.uk/staff/sens/amy-ellison-495358/en>), Dr. Craig Shuttleworth (<https://www.bangor.ac.uk/staff/sens/craig-shuttleworth-082156/en>), Dr. Peter M. Haswell (<https://www.bangor.ac.uk/staff/sens/pete-haswell-097853/en>)

**Contact:** a.ellison@bangor.ac.uk

**Project description:**

A highly motivated and capable student is sought to apply metabarcoding approaches to squirrel stomach contents for dietary analysis. Potential exists to explore and contribute broadly, but with a predominant focus on species ecology and trophic interactions. Understanding dietary composition (plants, fungi, invertebrates & vertebrates), and the impact of variables such as age class, sex, geographic or temporal context, and cause of death (road traffic casualties, sudden deaths, vs those found in woods/gardens, natural causes), are variables of interest and relevance.

Additional research funding has been raised by Dr. Shuttleworth to help cover laboratory costs. Samples are already collected. Access to necessary equipment through Dr. Ellison. Students may need to fundraise for any beyond scope costs.

### Upstairs – Downstairs: Bat behaviour and movement when transitioning between maternity and hibernation roosts

**Subject area:** Ecology

**Supervisor(s): Lucinda Kirkpatrick** (<https://www.bangor.ac.uk/staff/sens/lucinda-kirkpatrick-672983/en>), Sam Dyer (NRW)

**Contact:** l.kirkpatrick@bangor.ac.uk

**Project description:**

Explore the fascinating ecology of Lesser Horseshoe bats (*Rhinolophus hipposideros*) in the Conwy Valley. This protected species moves between maternity and hibernation roosts, with some staying local and others traveling to more distant mines. This project will investigate what drives these movements and how climatic variables influence roost selection. Using advanced remote monitoring tools (camera, acoustic, environmental) and GIS, you will study the bats’ movement, behaviour, and demography. Working closely with Natural Resources Wales and local bat groups, your research will contribute valuable insights into bat conservation. The role involves independent, physically demanding fieldwork in a dynamic setting. Access to a car is desirable but not essential for this unique opportunity to make a meaningful scientific impact for bat conservation.

### The long-term responses of a trout fishery and its populations to environment, fishing pressures and management in an Anglesey reservoir and feeder streams

**Subject area:** Freshwater Fishery Ecology

**Supervisor(s):** **Dr Nigel Milner,** Honorary Research Fellow (<https://www.bangor.ac.uk/staff/sens/nigel-milner-013535/en> and APEM Ltd), Dr Natalie Fenner, Senior Lecturer (<https://www.bangor.ac.uk/staff/sens/nathalie-fenner-015344/en>).

**Contact:** n.fenner@bangor.ac.uk

**Project description:**

Fisheries are reliant on sustainable fish populations which in turn are dependent on the state of their environments. This project will (i) explore a unique 60-year data set on a reservoir trout fishery performance and (ii) to generate contemporary new data on recruitment, to understand its response to environment and management.

The Llyn Cefni (Anglesey) fishery (Fig 1) is based on wild brown trout (*Salmo trutta*) and stocked rainbow trout (*Salmo gairdneri*). The Cefni Angling Association has kept records of catches and stocking since 1965. These data have been only partly reviewed (Fig 1) and await detailed analysis.

The brown trout population is sustained naturally by breeding in inflowing streams, the ecology of these has never been investigated. Therefore, part of the study will be to survey and assess habitat and, by electrofishing, the abundance, population structure and dynamics of the trout in relation to stream habitats and environments and to attempt estimation of the breeding stock that derives from the lake population.

The lake experiences annual algal blooms and intense aquatic macrophyte growth that constrain fishing. An aspect of the analysis will be to explore their effects on the fishery and their associations with factors controlling primary production

### The diversity and ecology of Florida mangrove fish communities

**Subject area:** Mangrove fish communities

**Supervisor(s):** **Dr Nigel Milner, Honorary Research Fellow** (<https://www.bangor.ac.uk/staff/sens/nigel-milner-013535/en> and APEMLtd), Dr Natalie Fenner, Senior Lecturer (<https://www.bangor.ac.uk/staff/sens/nathalie-fenner-015344/en>)

**Contact:** n.fenner@bangor.ac.uk

**Project description:**

Mangrove channels support high diversity fish communities and dominate ecosystem processes where they occur, but they are increasingly pressured by coastal development and climate change. The project aims to use data collected via sampling by seine net surveys underwater video recording (UWV) to (i) test for spatial variation within and between sites (multiple samplings within each geographical site) and the role of habitat and environment factors such as salinity and temperature, (ii) similarly, test for temporal variation between wet and dry seasons, (iii) compare species diversity between methods and seasons, (iv) describe the population ecology of key species using data from netting surveys on abundance and size distributions, (v) offer a critique of UWV as a fish sampling method.

In the context of mangrove ecosystem function and environmental threats, the project will set and test hypotheses regarding assemblage composition, diversity and ecological responses to habitats, inter-specific interactions across spatial and temporal gradients. and make comparison with literature on such habitats. Finally, the effectiveness of this UWV method will be critiqued.

### Describing new cichlid fishes from Lake Malawi

**Supervisor(s):** **Prof George Turner** (<https://www.bangor.ac.uk/staff/sens/george-turner-016522/en>).

**Contact:** george.turner@bangor.ac.uk

**Project description:**

Monitoring and assessing threats to species is greatly hindered if they cannot be recorded or even identified: freshwater tropical vertebrates are particularly badly impacted. Lake Malawi is home to at least 800 cichlid fish species, of which around 400 are estimated to lack formal description. You would compare our preserved specimens at Bangor and Cambridge Universities with previously known species at the Natural History Museum in London. You would be provided with guidance in taxonomic methods, data analysis and presentation and the formal process of species naming and description, ultimately leading to publication. If you are interested, you might also use geometric morphometrics or bioinformatic analysis of genome sequences, with additional collaborative supervision.

### How to build a cave bear: identifying genetic adaptations in an extinct Pleistocene megafaunal species

**Subject area:** Evolutionary genetics, ancient DNA, mammals

**Supervisor(s): Axel Barlow** (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>), Johanna Paijmans (<https://www.bangor.ac.uk/staff/sens/johanna-paijmans-682198/en>)

**Contact:** a.barlow@bangor.ac.uk

**Project description:**

A tremendous diversity of mammalian megafauna was lost during the Pleistocene mass extinction. However, we know relatively little about the genetic underpinnings of the unique phenotypes of these extinct species. Among these are the cave bears: giant herbivorous bears that differed from their nearest relatives, brown bears and polar bears, in a range of morphological and ecological traits. You will investigate the genetic basis of these unique adaptations by carrying out genome scans for selection against their extant relatives. This work will for the first time help us to understand, genetically, what makes a cave bear a cave bear. More broadly, this work will help quantify the loss of adaptive genetic diversity associated with the Pleistocene extinction.

### Pleistocene population dynamics of large felids in Europe

**Subject area:** Evolutionary genetics, ancient DNA, mammals

**Supervisor(s): Johanna Paijmans** ( <https://www.bangor.ac.uk/staff/sens/johanna-paijmans-682198/en>, Axel Barlow (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>)

**Contact:** j.paijmans@bangor.ac.uk

**Project description:**

During the past 100,000 years, large cat species such as lions, leopards and lynx roamed large parts of Europe. All these species were impacted by the severe climate fluctuations associated with the Last Glacial Maximum around 25,000 years ago, and many went extinct in Europe during this period. How these past populations relate to modern individuals is crucial to understand how these populations arrived in, and disappeared from, Europe. In this project, we will investigate this for one of these felids: we will use climatic reconstructions to infer their range over the past 100,000 years, as well as recover palaeogenomic data from ancient samples, and combine the results to gain a deeper understanding of these ancient populations and how they responded to past climate changes.

### Shark evolution and development

**Subject area:** Evolutionary developmental biology

**Supervisor(s): John Mulley** (<https://www.bangor.ac.uk/staff/sens/john-mulley-067365/en>)

**Contact:** j.mulley@bangor.ac.uk

**Project description:**

The cartilaginous fish (sharks, skates, and their relatives) occupy an important phylogenetic position as the oldest extant group of jawed vertebrates. They can provide insights into key events in vertebrate evolution, and can inform our understanding of general vertebrate anatomy, development, and physiology.

In this project, students will study the development of one of a number of shark organ systems in the lesser spotted catshark (*Scyliorhinus canicula*), a model chondrichthyan, with a view to informing our understanding of processes associated with human health issues. Techniques will involve bioinformatic identification of candidate genes from genomic and transcriptomic resources, and determination of temporal and spatial distributions of mRNA and proteins using RNA-Seq, immunohistochemistry, *in situ* hybridisation and hybridisation chain reaction.

## Conservation

### Spatial interactions between global poverty and protected area coverage

**Subject area:** Conservation Science

**Supervisor(s): Leejiah Dorward** (<https://www.bangor.ac.uk/staff/sens/leejiah-dorward-476984/en>)

**Contact:** l.dorward@bangor.ac.uk

**Project description:**

Protected areas (PAs) are among the most widely used conservation tools. Considering the overlap between high biodiversity and regions of severe human poverty, understanding the relationship between poverty and PAs is critical for creating conservation strategies that balance ecological goals with social equity. Using existing global datasets this project will investigate the spatial relationship between PAs and the socioeconomic status of adjacent populations, estimating the number of people living near PAs who experience different levels of poverty and exploring how poverty varies by factors such as region, national economic status, and PA type. Results will contribute to discussions on the socio-economic impacts of conservation, particularly in light of international goals to expand PA coverage to 30% of the planet’s surface.

### Mammal conservation & research, Croatia

**Subject area:** Interspecific interactions / Human-wildlife coexistence / Mammal conservation

**Supervisor(s): Dr. Peter M. Haswell** (<https://www.bangor.ac.uk/staff/sens/pete-haswell-097853/en>), Prof. Josip Kusak; (Zagreb University, Croatia),

Potential co-supervisors / advisors: Dr Simon Valle (<https://www.bangor.ac.uk/staff/sens/simon-valle-452728/en>)

**Contact:** p.m.haswell@bangor.ac.uk

**Project description:**

Highly motivated and capable students are sought to analyse camera trap datasets and/or conduct mammal research in Croatia. Potential exists to explore topics such as interspecific interactions e.g. carnivore or herbivore communities, or predator-prey dynamics, risk/fear ecology, interference competition, drivers of community richness and structure, alongside the impacts of human activity. Free roaming dog interactions with carnivores, particularly wolves & jackal, are of topical interest. Potential exists for students to conduct additional field data collection e.g. foraging experiments, or small mammal survey, pending financial, ethical and legal logistics. Efforts aimed at fostering coexistence and resolving conflicts between herders of free roaming horse/cattle and carnivores is also of high interest. Students will need to meet any beyond scope costs.

### Socio-ecological feasibility of mountain hare restoration in North Wales

**Subject area:** Species restoration / Mammal Conservation / Social sciences / Ecology

**Supervisor(s): Dr. Peter M. Haswell** (<https://www.bangor.ac.uk/staff/sens/pete-haswell-097853/en>)

Additional potential co-supervisors / advisors: Dr. Craig Shuttleworth(<https://www.bangor.ac.uk/staff/sens/craig-shuttleworth-082156/en>), Dr Simon Valle (<https://www.bangor.ac.uk/staff/sens/simon-valle-452728/en>), Dr Anthony Caravaggi (University of South Wales), Jonathan Hulson (North Wales Wildlife Trust), Dr. Leejiah Dorward (<https://www.bangor.ac.uk/staff/sens/leejiah-dorward-476984/en>), Dr Tyler Hallman: (<https://www.bangor.ac.uk/staff/sens/tyler-hallman-659106/en>)

**Contact:** p.m.haswell@bangor.ac.uk

**Project description:**

Highly motivated and capable students are sought to explore the socio-ecological feasibility of restoring mountain hare to Wales.

Widespread in post glacial Britain, the population in North Wales is deemed extinct. UK status is generally considered unfavourable with populations deteriorating. Re-establishment of the species in the Welsh uplands could provide an additional safety net, while restoring a species of ecological and cultural significance. Return of mountain hare may, of course, also be deemed undesirable to some. The proposition requires ecological and social evaluation, alongside careful planning.

Potential exists to explore a range of issues, evaluating human dimensions, participatory management planning or co-design, habitat suitability modelling, population viability, translocation methodologies, policy evaluation, baseline data, assessment of potential source populations, etc.

## Herpetology: Evolution, Conservation, Ecology

### Beyond the “Big Four”: Species Distribution Modelling of Indian venomous snakes for designing effective snakebite treatment

**Subject area:** Herpetology

**Supervisor(s): Anita Malhotra** (<https://www.bangor.ac.uk/staff/sens/anita-malhotra-009176/en>), Isabelle Winder (<https://www.bangor.ac.uk/staff/sens/isabelle-winder-113705/en>)

**Contact:** a.malhotra@bangor.ac.uk

**Project description:**

The World Health Organisation aims to halve global mortality from snakebite (a “Neglected Tropical Disease”) by 2030. Known as the snakebite capital of the world, India produces a large amount of pan-India antivenom for the “Big Four” species (common krait, spectacled cobra, saw-scaled viper and Russell’s viper) yet still has over 60,000 deaths annually. The Big Four are widely distributed and considerable geographic venom variation is present within apparently well-defined species. However, recently acquired genetic data suggests that all show marked phylogeographic structure. This project will integrate phylogeographic information with occurrence and climatic information for the Big Four and related species to obtain co-distribution maps to help define boundaries and species coverage for new regional antivenoms.

### Carryover effects of hibernation conditions on lizard behaviour

**Subject area:** behavioural ecology, climate change

**Supervisor(s):** **Dr Kirsty MacLeod** (<https://www.bangor.ac.uk/staff/sens/kirsty-macleod-571963/en>),

**Contact:** k.macleod@bangor.ac.uk

**Project description:**

An under-recognised aspect of global warming is increasing overwinter temperatures, which have been rising at a faster rate than summer temperatures over the last century. Ectothermic species such as reptiles are especially vulnerable to projected thermal shifts given their physiological reliance on ambient temperatures. Evidence suggests that milder winters could disrupt hibernation, with lasting effects on growth, breeding success, and tolerance to stressors. Changes in behaviour (e.g. foraging and thermoregulatory behaviour) may drive some of these effects, but very little is known about the effects of winter conditions on subsequent behaviour post-hibernation (ie. carryover effects) or how behavioural plasticity may mitigate the consequences of climate change, particularly in reptiles.

This project will run alongside an existing PhD project including laboratory-based experiments using an invasive lizard found in the UK, the wall lizard (Podarcis muralis). The student will investigate how winter warming affects lizard behaviour in the post-hibernation period. The project will primarily consist of designing, running, and analysing behavioural assays, but there may be opportunity to investigate other traits of interest depending on the student.

### Conservation venomics: does inbreeding affect adder venom variation?

**Subject area:** Conservation genetics, molecular ecology, herpetology

**Supervisor(s): Axel Barlow** (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>), Wolfgang Wüster (<https://www.bangor.ac.uk/staff/sens/wolfgang-wuster-007198/en>)

**Contact:** a.barlow@bangor.ac.uk

**Project description:**

Venomous snakes can be locked in an “evolutionary arms race” with their prey, which responds to predation by evolving venom resistance. Recent genomics studies have shown that snake venom genes are under balancing selection, which maintains multiple gene variants in the population, allowing the venom phenotype to rapidly adapt if and when prey resistance evolves. A consequence of this evolutionary system is that, if the snake population loses genetic diversity through genetic drift and inbreeding, it may lose the capacity to adapt and lose the arms race. You will investigate this question using the European adder (*Vipera berus*) as a model system. Our ongoing adder research has revealed severe inbreeding in many UK adder populations which is rapidly reducing levels of genetic variation. You will assess whether venom gene regions are more or less likely to lose diversity, showing whether balancing selection can overcome the effects of severe inbreeding, or not. We will potentially be able to identify at risk populations with depleted venom gene diversity, and guide future population reconnection or translocation effort to restore it. This study improves our understanding of how genetic diversity loss and inbreeding in small and isolated populations may reduce their ability to adapt to future environmental and ecological change.

### Genetic time machines: tracking adder genetic diversity declines using museomics

**Subject area:** Conservation genetics, ancient DNA, herpetology

**Supervisor(s): Axel Barlow** (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>), Wolfgang Wüster (<https://www.bangor.ac.uk/staff/sens/wolfgang-wuster-007198/en>)

**Contact:** a.barlow@bangor.ac.uk

**Project description:**

Populations lose genetic diversity as they become smaller and more isolated. Although conservation genetics methods allow us to detect these events, pinpointing exactly when and how fast the loss of diversity occurred is challenging as standard methods lack statistical accuracy. An alternative is to examine the genetics of very old specimens, which provide a “time machine” to accurately measure past diversity. You will apply this exciting approach to measure genetic diversity loss in the European adder. Our ongoing adder research has revealed high levels of inbreeding and genetic diversity loss in many UK adder populations. In this project you will analyse whole genome data from century-old museum specimens to precisely quantify the diversity loss over the past ~100 years. This research will help inform conservation management of the adder in the UK. It will also showcase the potential for natural history collections for the future genetic management and conservation of threatened species.

### Ecomorphological and microhabitat adaptation in *Zootoca vivipara* in the UK

**Subject area:** Herpetology, Morphology, Adaptation

**Supervisor(s): Dr. James Hicks** (<https://www.bangor.ac.uk/staff/sens/james-hicks-069306/en>), Dr Axel Barlow (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>)

**Contact:** j.hicks@bangor.ac.uk

**Project description:**

Research into lizard morphology usually finds changes in functional traits between species occupying different niches, often strongly correlated to maximising performance on differing substrate types. In the UK, the viviparous lizard (*Zootoca vivipara*) occupies superficially distinct habitat types which presumably impose different selection pressures on e.g., locomotion.

This project will build on existing datasets for lizard ecomorphology in North Wales, in addition to utilising genomic data to examine evidence of adaptation in UK populations of this species in contrasting habitats. This will shed light on the mechanisms underlying adaptation in *Z. vivipara*, as well as contributing to our understanding of lizard genetic health in the UK, guiding future conservation policy.

### Assessing the genetic diversity of adders in the Somerset Levels

**Subject area:** Conservation genetics; genomics; herpetology; bioinformatics

**Supervisor(s): Prof. Wolfgang Wüster** (<https://www.bangor.ac.uk/staff/sens/wolfgang-wuster-007198/en>), Dr Axel Barlow (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>)

**Contact:** w.wuster@bangor.ac.uk

**Project description:**

Population fragmentation is a key factor imperilling many species: small, isolated populations are liable to inbreeding, leading lead to loss of fitness and population extinction. The adder (*Vipera berus*) is widespread but declining in the UK, and we have demonstrated inbreeding in many UK populations (<https://doi.org/10.1101/2023.09.19.557540>). In this project, you will investigate the genetic health and connectivity between isolated populations of adders in Somerset. You will carry out whole genome sequencing of a series of adder samples and then use advanced bioinformatic tools to assess levels of heterozygosity, inbreeding, and population genetic structure. Through this project, you will receive training and acquire extensive expertise in modern population genomic analyses, phylogenomics and population genetics.

More info: <https://tinyurl.com/5uxs3s2e>

### Using genomics to solve the mystery of the Walser Viper

**Subject area:** Herpetology, Population Genomics, Bioinformatics

**Supervisor(s): Prof. Wolfgang Wüster** (<https://www.bangor.ac.uk/staff/sens/wolfgang-wuster-007198/en>), Dr Axel Barlow (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>)

**Contact:** w.wuster@bangor.ac.uk

**Project description:**

The Walser viper (*Vipera walser*), described as a brand new species from northwestern Italy only in 2016, is notable for looking like an adder (*Vipera berus*), but its mtDNA places it with a group of Caucasus vipers. Preliminary research showed that the genome of the species has been swamped with genes from neighbouring adder populations. But how did the Caucasus-clade mtDNA get to northern Italy?

Here, you will sequence the genome of a Walser viper and determine what proportion of its genome reflects its Caucasus ancestry. Scanning our extensive portfolio of adder genome sequences to test for genetic traces of the Caucasus lineage will indicate its origins and former distribution. You will receive training and acquire extensive expertise in population genomic analyses, phylogenomics and population genetics. More info: <https://tinyurl.com/5uxs3s2e>.

### Using Whole Genome Sequencing to understand hybrid zones between snake species

**Subject area:** Herpetology, Genomics, Bioinformatics, Taxonomy

**Supervisor(s): Prof. Wolfgang Wüster** (<https://www.bangor.ac.uk/staff/sens/wolfgang-wuster-007198/en>), Dr Axel Barlow (<https://www.bangor.ac.uk/staff/sens/axel-barlow-036245/en>)

**Contact:** w.wuster@bangor.ac.uk

**Project description:**

Hybrid zones constitute "natural laboratories" for studying speciation and evolutionary processes, and can resolve taxonomic questions, e.g., whether two populations constitute different species. In venomous snakes, hybridisation has been suggested to explain the phylogenetically incongruous distribution of toxin genes among species.

There are multiple work possibilities in this project, e.g., rattlesnakes, saw-scaled vipers, or European vipers .

You will carry out Illumina genome sequencing. You will then use your data to test for the extent of genetic exchanges across the hybrid zone, and whether genes of particular interest (e.g., toxins) are more likely to cross hybrid zones than others. As part of this work, you will will receive training and acquire extensive expertise in population genomic analyses, phylogenomics and population genetics. More info: <https://tinyurl.com/5uxs3s2e.>

### Admixture effects on thermal performance traits in the invasive Common wall lizard

**Subject area:** thermal biology, behavioural ecology, genomics, herpetology

**Supervisor(s): Dr Kirsty MacLeod** (<https://www.bangor.ac.uk/staff/sens/kirsty-macleod-571963/en>), Dr Aaron Comeault (<https://www.bangor.ac.uk/staff/sens/aaron-comeault-485161/en>)

**Contact:** k.macleod@bangor.ac.uk

**Project description:**

Invasive species have profound consequences on ecosystems, but what makes a species a “successful invader”? Thermal performance traits (i.e., thermoregulatory behaviour and thermal preference/tolerance) could be key to invasion success, with populations able to tolerate a wider range of temperatures more likely to survive in new niches. Broader thermal tolerance in invaders may go hand in hand with genetic traits associated with invasion, such as high levels of admixture (genetic mixing of previously isolated lineages) in invasive populations. The invasive common wall lizard (*Podarcis muralis*) is ideally suited to investigate links between thermal performance traits, genetics, and invasion success: UK populations were founded by individuals from multiple isolated lineages from mainland Europe, providing a unique opportunity to test how admixture, which is likely to vary across UK populations, has affected traits important for an organism’s survival across different climates.

This project will integrate behavioural and genomic data to test whether genetic mixing of previously isolated populations is linked to thermal performance traits in the common wall lizard, *Podarcis muralis,* an invasive species in the UK. Results will increase our ability to predict species’ responses to climatic change and better understand how populations of *P. muralis* might spread within the UK.

### Who’s your daddy? Tracing the origin of parthenogenetic hybrid rock lizards (*Darevskia* spp).

**Subject area:** Phylogenetics, hybridisation, evolution, herpetology

**Supervisor(s): Darren Parker** (https://genestobehaviour.co.uk/news) and Susana Freitas (<https://genestobehaviour.co.uk/people>)

**Contact:** d.parker@bangor.ac.uk

**Project description:**

In vertebrates, parthenogenesis (asexual reproduction) is typically a rare outcome of frequent hybridisation. What influences why new parthenogenetic species arise is unknown, however, one important factor is the genetic make-up of the parental species. Often it is easy to identify the maternal parent but a challenge to identify the paternal parent. This project will address this gap by on identifying the paternal species’ responsible for producing six species of parthenogenetic lizard in the genus *Darevskia*. This will be done by using sequenced markers from 120 individual sexual and parthenogenetic lizards to construct phylogenies to determine the paternal contributions. This work is entirely computer-based, however, there is potential for the successful student to amplify and sequence additional markers in the lab.

### The eco-evolutionary dynamics of amphibian-microbe interactions

**Subject area:** microbial ecology, co-evolution, bioinformatics, herpetology

**Supervisor(s): Owen Osborne** <https://www.bangor.ac.uk/staff/sens/owen-osborne-493757/en>), Amy Ellison (<https://www.bangor.ac.uk/staff/sens/amy-ellison-495358/en>)

**Contact:** o.osborne@bangor.ac.uk

**Project description:**

The fungal pathogen *Batrachochytrium dendrobatidis* (Bd) is a leading cause of global amphibian biodiversity loss. The amphibian skin microbiome influences Bd infection outcomes, sparking interest in probiotic control strategies. While some Bd-inhibitory bacteria colonise many species, whereas others are extremely host-specific, potentially contributing to differences in Bd-susceptibility and probiotic success between amphibian species. The project will involve mining amphibian microbiome data to analyse host-microbe interactions across the entire amphibian phylogeny. The results will answer fundamental questions – which factors determine the specificity of host-microbe interactions? – while directly contributing to the development of next-generation rationally-designed probiotic treatments for Bd, with potentially important conservation impacts. Additionally, there is potential for students to contribute to other ongoing amphibian Bd work in our research groups.

## Ornithology: Behaviour, Ecology, Conservation

### Effects of Artificial Light at Night (ALAN) on the UK’s colony-nesting birds

**Subject area:** Ecology, Ornithology, Anthropogenic Effects, Artificial Light at Night (ALAN)

**Supervisor(s): Tyler Hallman** (<https://www.bangor.ac.uk/staff/sens/tyler-hallman-659106/en>), Svenja Tidau (<https://www.bangor.ac.uk/staff/sens/svenja-tidau-497222/en>)

**Contact:** t.hallman@bangor.ac.uk

**Project description:**

While some threats to wildlife, such as harvest and persecution, have clear and direct effects, the effects of other pervasive environmental change can be much more nuanced. Artificial light at night (ALAN) has caused a major shift in nighttime light intensity and timing around the world. ALAN affects wildlife by altering activity timing, migration and development. In seabirds, the effects of ALAN range from increased nighttime foraging in lit areas to disorientation, grounding, and mortality. The population level effects of ALAN in seabirds are poorly understood. In this study you will use data from the British Trust for Ornithology’s (BTO), Seabird Monitoring Programme for colonies across the UK (e.g., common tern, Manx shearwater, etc.) and freely available GIS data to investigate the population level effects of ALAN, including trends in population size, breeding success, and additional endpoints. If you have any questions, please do not hesitate to ask.

Blue tit nests as bioindicators of plastic pollution

**Subject area:** Ornithology; environmental pollution; bioindicators

**Supervisor(s): Dr Mark C. Mainwaring** (<https://www.bangor.ac.uk/staff/sens/mark-mainwaring-023874/en>), Prof Christian Dunn (<https://www.bangor.ac.uk/staff/sens/christian-dunn-011539/en>)

**Contact:** m.mainwaring@bangor.ac.uk

**Project description:**

Plastics are commonly discarded by humans in the environment, both in the form of large fragments (macro plastics) and small fragments (micro plastics). Micro plastics are too small to be seen by humans and so their presence and abundance in the environment is under-recorded. Nesting material collected by birds contains micro plastics and so birds’ nests may be bioindicators of plastic pollution, therefore this project will examine if the nests of blue tits (*Cyanistes caeruleus*) provide a non-invasive method of quantifying micro plastics in agricultural environments at Henfaes Research Centre and in woodlands at Treborth Botanic Gardens. After the reproductive parameters of the blue tits are qualified during the spring, the nests will be collected at the end of the breeding season and assessed for the presence and/or abundance of microplastics using micro-Fourier Transform Infrared Spectroscopy (μ-FTIR) analysis. The nests will then be dissected to quantify the presence of macro plastics so that the abundance of macro and macro plastics can be quantified and correlated with the reproductive success of the birds. This project will therefore establish whether blue tit nests represent a cost-effective and non-invasive method of assessing micro and macro plastics in the wider environment.

Environmental pollution and avian nest predation rates

**Subject area:** Ornithology; environmental pollution

**Supervisor(s): Dr Mark C. Mainwaring** (<https://www.bangor.ac.uk/staff/sens/mark-mainwaring-023874/en>)

**Contact:** m.mainwaring@bangor.ac.uk

**Project description:**

Natural selection favours traits that minimise the risk of predation, including the selection of safe nesting sites. However, nest predation rates may become altered after being exposed to environmental pollution. Pollution is widespread in the Anthropocene, primarily in the form of artificial light at night and the presence of discarded plastic in nests. A better understanding anthropogenic impacts on breeding birds, particularly in urban areas is required. Part 1 will use the nests of Eurasian blackbirds (*Turdus merula*) to examine whether artificial light at night and plastic materials impacts nest predation rates. Part 2 will use artificial nests containing common quail (*Coturnix coturnix*) eggs to test these factors in a controlled manner. Both studies will test the hypothesis that lit areas help predators find nests and thus increase nest predation rates, whilst lit nests containing anthropogenic material will be predated even more frequently because they shine more brightly under artificial light at night. Daily nest checks will determine nest survival rates and camera traps will identify nest predators and to establish the timing of predation events. This project is important as it will help establish the link between artificial light at night, plastic pollution, and nest predation rates of urban birds.

Barn owl pellets as bioindicators of plastic pollution

**Subject area:** Ornithology; environmental pollution; bioindicators

**Supervisor(s): Dr Mark C. Mainwaring** (<https://www.bangor.ac.uk/staff/sens/mark-mainwaring-023874/en>), Prof Christian Dunn (<https://www.bangor.ac.uk/staff/sens/christian-dunn-011539/en>), Dr Tyler Hallman: (<https://www.bangor.ac.uk/staff/sens/tyler-hallman-659106/en>)

**Contact:** m.mainwaring@bangor.ac.uk

**Project description:**

Plastics and heavy metals are commonly found in the environment, and we need to find ways in which their presence and abundance can be monitored. This is particularly true in highly modified terrestrial environments such as farmland. This project will examine if the pellets of barn owls (*Tyto alba*) provide a non-invasive method of quantifying macro and micro plastics and heavy metals in agricultural environments. Barn owl pellets will be provided by a combination of the supervisor’s own field sites, and any other sources of pellets available. The pellets will be assessed for the presence and/or abundance of microplastics using micro-Fourier Transform Infrared Spectroscopy (μ-FTIR) analysis in Prof Christian Dunn’s laboratory and for the presence of heavy metals in Tyler Hallman’s laboratory. The pellets will later be dissected to quantify the presence of macro plastics, whilst the prey of the barn owls will also be assessed by examining the bone fragments of rodents remaining in the pellets. This project will therefore establish whether barn owl pellets represent a non-invasive and cost-effective method of assessing macro / micro plastics and heavy metals in highly modified agricultural environments.

### The influence of species familiarity on human wellbeing benefits

**Subject area:** Ornithology, Environmental Psychology

**Supervisor(s): Whitney Fleming** (<https://www.bangor.ac.uk/staff/sens/whitney-fleming-659105/en>), Tyler Hallman (<https://www.bangor.ac.uk/staff/sens/tyler-hallman-659106/en>)

**Contact:** t.hallman@bangor.ac.uk

**Project description:**

Perceived biodiversity, from visual and auditory cues, has positive effects on human wellbeing. Experiencing nature can have physiological and psychological benefits, including increased cognitive function, decreased stress, and improved mood. Habitat loss, biodiversity declines, and an increasing proportion of the world’s population living in urban environments contribute to an extinction of experience in which people lose the ability to gain wellbeing benefits from nature. Understanding the connection between nature interactions and wellbeing benefits is essential for urban and conservation planning. Here you will investigate the connection between familiarity with a species and the wellbeing benefits received from auditory cues. In this study, controlled laboratory experiments with before and after questionnaires will be used to assess wellbeing benefits while familiarity will be either directly tested or assumed based on local and foreign auditory treatments. If you have any questions, please do not hesitate to ask.

### Making community science count: the abundance calibration index

**Subject area:** Community (Citizen) Science, Ecology, & Statistics

**Supervisor(s): Tyler Hallman** (<https://www.bangor.ac.uk/staff/sens/tyler-hallman-659106/en>)

**Contact:** t.hallman@bangor.ac.uk

**Project description:**

Community (citizen) science data are collected at a spatial and temporal scale that cannot be matched by professional surveys. These data, however, are not without challenges. Large community science platforms such as eBird (ebird.org) encourage users of all skill levels to participate and guidelines for survey protocols are flexible. Developing methods to address the noise in community science data is essential. While indices that account for an observer’s ability to detect and identify a species improve species distribution models, they do not address an observer’s skill or experience at counting individuals. Even in observers who are skilled at identification, abundance information from their counts may be unreliable. This study will use community science data to compare the reported abundances of birds at frequently visited sites to create a new observer and species specific abundance calibration index. If you have any questions, please do not hesitate to ask.

### Preference-based observer bias in wildlife surveys

**Subject area:** Community (Citizen) Science, Ecology, & Environmental Psychology

**Supervisor(s): Tyler Hallman** (<https://www.bangor.ac.uk/staff/sens/tyler-hallman-659106/en>), Whitney Fleming (<https://www.bangor.ac.uk/staff/sens/whitney-fleming-659105/en>)

**Contact:** t.hallman@bangor.ac.uk

**Project description:**

Community (citizen) science data are collected at a spatial and temporal scale that cannot be matched by professional surveys. These data, however, are not without challenges. Large community science platforms such as eBird (ebird.org) encourage users of all skill levels to participate and guidelines for survey protocols are flexible. These databases may be highly biased as community scientists may be far less likely to start checklists in locations where they detect either 1) no birds or 2) no birds of interest. This study will explore biases associated with when and why observers decide to begin a checklist. Depending on the interest of the student, this can either be from the statistical side of comparing the prevalence of species and habitats in community science v. standardized surveys, or from the social/psychological side of participant decision making and behaviour. If you have any questions, please do not hesitate to ask.

### Heart rate as a measure of avian behaviour and/or flight performance

**Subject area:** Zoology, Ornithology, Animal Behaviour.

**Supervisor(s):** **Dr Charles Bishop** (<https://www.bangor.ac.uk/staff/sens/charles-bishop-008127/en>), Professor Richard Holland (<https://www.bangor.ac.uk/staff/sens/richard-holland-113845/en>)

**Contact:** c.bishop@bangor.ac.uk

**Project description:**

This research will use multi-function data loggers and GPS tracking devices to look at the behaviour and body movements of birds, e.g. during rest, when performing various modes of flight or following specific manipulations of their wings and body. The focus of the study will be homing pigeons kept at Bangor University but could potentially be supplemented by other species of birds.

Homing pigeon studies could involve studying their circadian rhythms of heart rate and physical activity while within the loft and/or involve measurements taken when they are flying along a 18 m long horizontal and 5m high vertical flight tunnel or conducting flights around the home loft or short homing flights back to the loft.

Possible project experimental or observational conditions may include: whether birds are flying singly, in pairs, or in larger flocks; the effect of headwinds and tailwinds on flight performance; the effect of carrying additional weights, or dummy transmitters, and where the weights are attached; the relationship between heart rate and 3D body acceleration recordings, their repeatability within individuals, and their correlation between resting and flight data; the effects of anthropogenic pollution (e.g. light conditions and noise) on measures of heart rate and body motion.

### Spatial cognition in birds: how do age and experience interact?

**Subject area:** Zoology, animal behaviour, experimental psychology, neuroethology.

**Supervisor(s): Professor Richard Holland** (<https://www.bangor.ac.uk/staff/sens/richard-holland-113845/en>), Dr Charles Bishop (<https://www.bangor.ac.uk/staff/sens/charles-bishop-008127/en>)

**Contact:** r.holland@bangor.ac.uk

**Project description:**

Homing pigeons develop highly repeatable routes when released multiple times from the same location and will return to these when later released off these routes. Work at our facility in Bangor suggests that this may change with age, with younger birds having less repeatable routes and being less tied to them. However, it is difficult to know whether this is the result of ageing in of itself, or because older birds tend to have more experience. Using the pigeon facility at Treborth, we will investigate the role of age and experience in the spatial cognition of homing pigeons. This will involve tracking the birds with GPS from release sites to compare birds of different age groups but with the same experience.

## Primatology: Behaviour, Ecology, Conservation

### The function of long-distance calling in the Zanzibar red colobus monkey

**Subject area:** Primatology, Animal Behaviour

**Supervisor(s):** **Alex Georgiev** (https://www.bangor.ac.uk/staff/sens/alexander-georgiev-125564/en)

**Contact:** a.georgiev@bangor.ac.uk

**Project description:** The long-distance vocalisations made by many primates can have multiple, non-mutually exclusive functions related, for example, to resource defence, mate defence, signalling social status, and maintaining contact with other individuals. This project will examine the function of long-distance calls in the Zanzibar red colobus, an endemic and endangered primate, which is non-territorial but engages in frequent intergroup confrontations. You will collect data on the rate of long-distance call by males in different groups and across contexts to test several hypotheses regarding the function of these vocalisations. Costs for three months of field work in Zanzibar with the Zanzibar Red Colobus Project (<https://www.zanzibarredcolobusproject.org>), would need to be partially self-funded.

### Male social relationship in the Zanzibar red colobus monkey

**Subject area:** Primatology, Animal Behaviour

**Supervisor(s):** **Alex Georgiev** (https://www.bangor.ac.uk/staff/sens/alexander-georgiev-125564/en)

**Contact:** a.georgiev@bangor.ac.uk

**Project description:** The nature of social relationships within primate groups are often underpinned by the pattern of dispersal by the two sexes. Red colobus species (*Piliocolobus sp.),* have been typically described as male-philopatric (i.e., males remain in their natal group, while females disperse), however, evidence from some sites suggests that males can also move between groups, creating a complex pattern of relatedness and sociality within some groups. In the Zanzibar red colobus (*P. kirkii*), in particular, previous studies have shown such male dispersal. In this study you will investigate the nature and pattern of male social relations (including, affiliative and competitive interactions) to examine if and how these differ from what we would expect based on a regime of male philopatry in this species. Comparisons between different groups will help identify if this species can be characterised by typical pattern of male sociality or if there is considerable variation between groups in male relations, depending on the number of males present and the level of habitat disturbance. Costs for three months of field work in Zanzibar with the Zanzibar Red Colobus Project (<https://www.zanzibarredcolobusproject.org>), would need to be partially self-funded.

### The ecology of Zanzibar red colobus in heavily degraded coastal forest fragments

**Subject area:** Primatology, Conservation

**Supervisor:** Alex Georgiev <https://www.bangor.ac.uk/staff/sens/alexander-georgiev-125564/en>

**Contact:** **a.georgiev@bangor.ac.uk**

**Project description:**

While most members of the red colobus (*Piliocolobus*) genus tend to be dependent on relatively undisturbed rainforest, the Zanzibar red colobus (*P. kirkii*) has shown considerable ecological plasticity in its habitat requirement and the ability to persist even in heavily modified anthropic landscapes. In this project you will study several groups of Zanzibar red colobus along the southeast coast of Unguja Island, Zanzibar that live in very ‘marginal’ habitat. Resulting from deforestation coupled with intense tourist development, these coastal habitats present novel conditions for what is typically a forest-specialised primate. You will first establish the presence and distribution of these groups along an approximately 10-km stretch of coast via ecological surveys and interviews. Then you will also collect baseline data on the feeding ecology, ranging, and interactions with people in the local area for a subset of the groups identified. This project will provide an important insight into the status of Zanzibar red colobus living outside protected areas. Field research will take place along the southeast coast of Unguja, Zanzibar, in the area of Paje and Jambiani villages. Costs for three months of field work in Zanzibar with the Zanzibar Red Colobus Project (<https://www.zanzibarredcolobusproject.org>), would need to be partially self-funded.

## Entomology: Ecology and Evolution

### Morphological trade-offs between fighting and flight traits in an insect

**Subject area:** entomology, plant-insect interactions, quantitative genetics, morphology, sexual selection

**Supervisor(s): Dr Benjamin Jarrett** (<https://www.bangor.ac.uk/staff/sens/benjamin-jarrett-602764/en>)

**Contact:** b.jarrett@bangor.ac.uk

**Project description:**

Organisms often experience conflicting selection pressures that manifest as trade-offs (e.g., survival or offspring production): how do organisms cope with such conflicts? Animal weapons have evolved as a consequence of sexual selection, but some weapons can be large and cumbersome, potentially hindering movement and flight. Male alydid broad-headed bugs, *Hyalymenus longispinus*, have large hind legs they use as weapons: this project will investigate the relationship between weapon shape and size and wing shape variation, and assess the genetic contribution to this trade-off. This study will advance out understanding of how the development of important fitness-related traits impact one another, which will aid predictions about adaptive evolution.

### What’s eating invasive species? Community composition changes on *Rhododendron ponticum* in the last 30 years.

**Subject area:** entomology, plant-insect interactions, invasive species, community ecology

**Supervisor(s): Dr Benjamin Jarrett** (<https://www.bangor.ac.uk/staff/sens/benjamin-jarrett-602764/en>), Dr Farnon Ellwood (https://www.bangor.ac.uk/staff/sens/farnon-ellwood-573335/en)

**Contact:** b.jarrett@bangor.ac.uk

**Project description:**

Freed from coevolved natural enemies in their native ranges, invasive species flourish and dramatically restructure the trophic links within communities. Invasive species, however, present an ecological opportunity for native species; a novel interaction to which a species can adapt). *Rhododendron ponticum* is a non-native shrub that dominates woodlands and outcompetes many native woodland species. This project will measure herbivory and quantify the herbivore community found on *R. ponticum* a non-native shrub that dominates woodlands and outcompetes many native woodland species at two local sites in North Wales. This project will show how the native herbivore community has changed in the last 30 years, and provide insight in the taxa that can adapt to utilise an invasive plant as a new host.

### The genetic basis of cold tolerance in *Drosophila*

**Subject area:** Genetics, entomology

**Supervisor(s): Darren Parker** (<https://www.bangor.ac.uk/staff/sens/darren-parker-571328/en>)

**Contact:** d.parker@bangor.ac.uk

**Project description:**

For many organisms the ability to tolerate the onset of winter has major implications for their fitness, however, little work has been done to understand their underlying genetic basis. We have generated a list of candidate genes for cold tolerance (from gene expression data) and the next step is to experimentally test these genes’ role in cold tolerance. To do this we will use the genetic tools available in *Drosophila melanogaster* to manipulate the gene expression of these genes. These experiments will provide valuable insights into the genetic mechanisms that underlie cold tolerance in insects. Training in *Drosophila* husbandry, phenotyping, microscopy, genetic crossing, and data analysis will be given.

### Assessing current and historical levels of genetic diversity in North Wales moths

**Subject area:** Entomology, genetics

**Supervisor(s): John Mulley** (<https://www.bangor.ac.uk/staff/sens/john-mulley-067365/en>)

**Contact:** j.mulley@bangor.ac.uk

**Project description:**

There are two species of moth in North-West Wales which are found nowhere else in the UK, Weaver’s Wave (*Idaea contiguaria)* and Ashworth’s Rustic (*Xestia ashworthii*). These populations are likely relics of a wider distribution, and may be cold-adapted. Such populations are extremely susceptible to climate change, as they cannot easily shift their range to more hospitable areas, and small isolated populations typically have low levels of genetic diversity.

The project will include field sampling across the current range of these species; identification of historical samples in UK and European museums; and lab-based determination of current and historical levels of genetic diversity to shed light on what is going on with these species, and what pressures they might be under as our climate changes.

## Plant Science

### The consequences of hydration status on cactus robusticity

**Subject area:** Biomechanics, Botany, Engineering, Bioinspiration

**Supervisor(s): Dr Kris Crandell** (<https://www.bangor.ac.uk/staff/sens/kristen-crandell-454344/en>), Dr Katherine Steele (https://www.bangor.ac.uk/staff/sens/katherine-steele-008458/en)

**Contact:** k.crandell@bangor.ac.uk

**Project description:**

Cacti have a rigid epidermis and thick waxy cuticle to help retain moisture and spines to defend against herbivory. Many species directly respond to environmental conditions by losing 30% of their water while retaining functions. Such changes in hydration can change flesh texture and could affect the epidermis’s resistance to herbivory. In this self-funded project, the student will investigate whether changes in plant turgidity can affect resistance to herbivory in living cacti. The student will gain skills in plant husbandry, biomechanics and engineering techniques, including use of a materials tester to quantify strength. Please note that the primary supervisor is on maternity leave during 2025, and the ideal candidate (self-funded) would start in Oct 2025 or January 2026.

### The ecological effects of rapid adaptation in plants

**Subject area:** adaptation, evolutionary ecology, plant science

**Supervisor(s): Owen Osborne (**<https://www.bangor.ac.uk/staff/sens/owen-osborne-493757/en>), Alex Papadopulos (<https://www.bangor.ac.uk/staff/sens/alexander-papadopulos-128237/en>)

**Contact:** o.osborne@bangor.ac.uk

**Project description:**

Environmental changes, such as pollution, can trigger rapid evolution and ecosystem shifts. While numerous examples of rapid evolution are known, their ecological consequences remain unclear. This project will examine how plant adaptation to metal-contaminated environments affects interactions with mycorrhizal fungi and soil bacteria. Former metal mine sites, which host locally adapted metal-tolerant plant populations, provide ideal study systems. Mycorrhizal fungi enhance plant metal tolerance, but plant adaptation may reshape these relationships. The project involves fieldwork at former Welsh metal mines, fungal culturing, and DNA sequencing. Recent evidence that adaptation can occur within a few generations has sparked interest in how it interacts with ecological dynamics. This research will advance this emerging field, with implications for agricultural productivity and biodiversity conservation.

## Microbial Ecology

### Diversity of microorganisms in natural acidic environments

**Subject area:** Environmental Microbiology

**Supervisor(s): Olga Golyshina** (<https://www.bangor.ac.uk/staff/sens/olga-golyshina-014830/en>)

**Contact:** o.golyshina@bangor.ac.uk

**Project description:**

The project is designed to assess the diversity of microorganisms in natural acidic environments, specifically focusing on Parys Mt in Anglesey, UK. The methodology might involve a hybrid approach, combining culture-based methods with molecular and bioinformatic analyses. Initially, enrichment cultures will be established under various conditions, followed by DNA isolation, PCR amplification, and DNA barcoding methods. Alternatively, metagenomic DNA can be directly extracted from environmental samples, and the subsequent steps involve PCR amplification and DNA barcoding methods. Comprehensive analysis of the sequencing data generated from both approaches will be undertaken to augment the findings. The list of objectives and research questions encompasses key inquiries such as:

1. What is the ratio of cultivated bacterial and archaeal iron-oxidizers to cultivated bacterial and archaeal organoheterotrophs under specific conditions?
2. Which acidophilic bacteria and archaea can coexist with acidophilic algae in cultivation?
3. What is the diversity of unexplored sites within Parys Mt?
4. The project's outcomes will furnish insights into the microbial species participating in element cycling within naturally extremely acidic environments, shedding light on their potential applications in biotechnology.

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## Neurobiology

### Using a fly model to investigate nerve cell vulnerability in Alzheimer’s Disease

**Subject area:** Neurobiology, human disease, animal models

**Supervisor(s): Dr Lovesha Sivanantharajah** (<https://www.bangor.ac.uk/staff/sens/lovesha-sivanantharajah-113861/en>)

**Contact:** l.sivanantharajah@bangor.ac.uk

**Project description:**

Uncovering why some brain regions are more susceptible than others to toxic tangle formation is key for a better understanding of Alzheimer’s Disease (AD) onset and progression. Using a genetic toolset for targeting gene expression to single neuron types in the *Drosophila melanogaster* central nervous system (CNS), we observed that the tangle-forming protein tau affects different neuron types in varied ways. Rather than a uniform response, neurons display a spectrum of vulnerabilities, with some more susceptible to tau than others. To investigate the mechanisms behind this differential vulnerability or resilience, the MRes student will expand on these findings to identify the regions of the tau protein important for mediating this neuronal response. The student will gain a variety of multi-disciplinary skills used in neurobiology, including behavioural assays, genetics (e.g., RNA-interference), immunohistochemistry, and molecular techniques, while working in a highly relevant area of dementia research. Although a framework for the project will be provided, students are invited to add their own stamp reflecting their research interests.