

BIOLOGICAL SCIENCES

# BIOLOGICAL BREAKTHROUGHS

“ What can be more important than the science of life to any intelligent being who has the good fortune to be alive? ”

Isaac Asimov  
Biochemist & Author

[www.reading.ac.uk/  
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“ The importance of biology has never been more apparent than now. The Covid pandemic highlighted how important it is that we understand how diseases spread and are able to develop new medicines quickly. The climate crisis is putting unprecedented pressure on our natural world, causing rapid changes to habitats and loss of biodiversity across the planet. Here at Reading we are at the forefront of these important topics and our goal is to better understand how life works and to use this knowledge to educate and inspire future generations of biologists so that we will be better placed to tackle the critical issues that are facing us. Our academics are experts in the full range of biological sciences subjects, from biomedical science researchers advancing knowledge that underpins human health and disease to evolutionary biologists and ecologists who enable better understanding of the natural world and how it can be conserved. We are proud that this excellence in research informs our teaching and that all students are taught by experts in their fields. ”



**Professor Philip Dash**

Head of the School of  
Biological Sciences

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# VULTURE CULTURE

**Dr Campbell Murn is Head of Conservation and Research at The Hawk Conservancy Trust. He is also a lecturer at the University of Reading in the School of Biological Sciences, where he uses his hands on conservation skills to inspire our students and better understand the world of conservation.**

Campbell's most recent research has focused on African vultures, which are rapidly becoming the world's most threatened group of birds. He assessed the vultures' populations, breeding rates and threats, both locally and across the entire African continent. He found that one of the main causes of the vultures' catastrophic decline was feeding on toxic elephant carcasses – laced with poison by poachers to prevent the circling birds from drawing attention to their crimes.

Campbell was able to show how poison response practices can effectively tackle the problem: neutralising the poisoned site, helping the wildlife and collecting forensic samples in order to prosecute those responsible. Working with conservation charities in the UK and South Africa, Campbell's recommendations have been incorporated into both international policy and national level action plans and used to train over 2,500 rangers, field guides, police and government staff across nine African countries.

The experience of working with many stakeholders, often with conflicting priorities, to find a solution that has the ability to solve major conservation issues, has influenced Campbell's module "Nature Conservation in Practice". The module helps you gain the skills needed in stakeholder management and

conservation decision making frameworks, which are so fundamental to conservation success. "People often get into conservation because they love animals - I love animals - and that's really important to be a good conservationist, but what's essential is recognising the other 'animal' in the equation, which is people. Being able to understand and work with different stakeholders is a key skill for a successful career in conservation"

The module focuses on real world examples, including Campbell's work on vulture conservation, and those from other working conservationists in the School. The module puts you into the mindset of a working conservationist, helping you to gain the skills and outlook that is so essential for a career in conservation.

“ I really enjoyed the session that focused on role playing stakeholders. We were given an example of a conservation issue and we had to take into account who the stakeholders were, who was most affected, who was least affected and why. This was a really good way of getting into the heads of the different people who are involved. ”

**Daisy**

BSc Ecology and Wildlife Conservation





# CRACKING AN EEG

**Biomedical engineering applies engineering methods and designs to some of the greatest challenges we face as a society in terms of our health and well-being.** The University of Reading is training future biomedical engineers who will develop the next generation of technologies to diagnose diseases earlier, restore lost bodily functions and improve quality of life for patients and older adults.

One such technology is Brain Computer Interfaces (BCI). These allow for direct communication of user intentions based solely on their brain electroencephalogram (EEG). In normal circumstances we communicate using a combination of voice, gestures and facial expressions, but in some conditions the ability to use these communication channels is severely disrupted.

Decoding what a user wants directly from tiny brain electrical signals picked up non-invasively allows BCI to be used in a wide variety of applications, ranging from opening communication for locked-in patients and assessment of disorders of

consciousness to rehabilitation of stroke patients and amelioration of affective disorders such as depression.

More recently, BCI technologies have begun to be explored outside the health domain, for example in gaming or as a means of artistic expression. Interestingly, these applications are finding their way back into healthcare too.

BCI is a truly interdisciplinary technology, built on foundations of engineering, computer science, neuroscience and cognition. As a Reading Biomedical Engineering undergraduate, you will be given an excellent introduction to these foundations early in your degree programme. You will learn the fundamentals of coding in the Programming module, allowing you to understand how to read, process and route EEG data from the EEG hardware towards the application controlled by the BCI.

In the Physical Essentials for Medicine, and Biomedical Sensors and Wearable Technology modules, you will learn the fundamentals of sensors and circuits,

which are the key ingredients of the EEG system. The Biomedical Signal Processing and Feedback Systems module will give you a good foundation to process signals such as EEG time series, and the Neuroscience module will provide you with an understanding of the brain and the nervous system and their disorders.

With this background you will be able to take the dedicated Brain Computer Interfaces and Assistive Technology module, which will systematically introduce the core components of BCI, covering specific details of the hardware and the principles underpinning generation of the EEG signals. Methods to make sense of EEG signals utilised specifically in BCI applications will give you a good understanding of how to use such signals to uncover user intentions. A range of BCI applications and case studies will also provide you with a good overview of the state of the art of this technology and specifically will show how it can be integrated with other technologies offering extra benefits to the patients. In addition, the Brain Computer Interfaces and

Assistive Technology module has, at its core, practical hands-on experience – after all there is no better way to understand the technology than to experience its use first hand.

The module will be taught by Dr Yoshi Hayashi and Prof Slawek Nasuto, both of whom focus their research on developing solutions using technologies such as BCI in healthcare. They believe the best way to teach is to base the material on their own research, as students can in this way have access to the latest information and developments. As such, Yoshi will be able to share his experience of collaborating with doctors and physical therapists in using Virtual Reality to aid rehabilitation of stroke patients at the Royal Berkshire Hospital and will tell students how this can be used to encourage patients to perform movement exercises. Slawek will share details of his work on using BCI to guide functional Electrical Stimulation in therapy aimed at improving wrist mobility of stroke patients, which not only enhances their hand mobility but also leaves a lasting impression on their brain activity.



**AFTER  
DARWIN**

# TO THE GALAPAGOS AND BEYOND

**Following in the footsteps of Darwin, swimming with sea lions and seeing some of the world's rarest species is truly a once-in-a-lifetime experience.** Memories of the tropical biology field course, where our students journeyed to the Galapagos Islands have stayed with them long after they have graduated. Described by UNESCO as a unique 'living museum and showcase of evolution', the Galapagos Islands are brimming with marine, animal and bird species. The tropical biology field course allows students to appreciate how people are completely transforming the planet. "It's difficult to explain just how lucky we are to be able to see species as iconic as anacondas, sloths, river dolphins, marine iguanas, giant tortoises and Darwin's finches in the space of a couple of weeks," says Mark Fellowes who runs the field course. The arid Galapagos volcanic islands are laboratories for evolution, with the majority of species found nowhere else on earth, and many differing from island to island. One year, whilst snorkelling in the ocean, students came across 50 or 60 giant mantra rays.

A recent addition to our portfolio of field courses is a Marine Biology field course to South Africa. Running for the first time in 2022, students undertook marine diving surveys, presenting their research findings to the local community. They were lucky enough to see fur seals, otters, jackass penguins, bottlenose dolphins, shy sharks, lots of colourful sea slugs (nudibranchs), comb jellies, anemones and other marine invertebrates. Students were diving in the kelp forests, which are an important nursery for fish and to support the marine ecosystem.

Back in Reading, teaching involves using the biodiverse campus as a field site and outdoor laboratory, with students learning to identify and survey birds, mammals and invertebrates. The campus has prestigious Green Flag status and is home to a large lake, woodlands, meadows and the Harris Garden with foxes, deer, hedgehogs and owls among its inhabitants.



## WHERE ELSE COULD YOU GO

Learning within the field provides essential knowledge and experience, in addition to the fieldwork we do on campus, we offer varied global field work opportunities.

Previous destinations for our field courses have been:

- UK Biodiversity Field Skills - Devon, UK
- Palaeontology Research Field Course - Dinosaur Provincial Park; Alberta, Canada
- Marine Biology and Conservation Field Course - Cape Town, South Africa
- Biodiversity field course - Spain
- Tropical Biology Field Courses: Borneo, Java, Madagascar, Ecuador, Tanzania



“ If we want to make a difference, to protect what remains of our biodiversity, the first step is to get hands-on and look at things. The lessons learned at Reading set the stage for understanding how to help protect what's left, it's that important. ”

# THE CLOT THICKENS

**At the beginning of 2020 life as we knew it changed dramatically – and the cause – a devastating new virus.** As the world entered a period of lockdown, doctors and scientists came together to work out what was going on. Why did some SARS CoV2 (the COVID 19 virus) infected people become so ill while others escaped with just a sniffle? In the period between then and now remarkable things have happened. We now have protective treatments and tests, and effective and widely available vaccines.

Scientists at Reading have been at the forefront of the response to COVID 19, working out why some patients become so sick, advising doctors on treatments to use, and providing expertise to vaccine manufacturers during periods when problems arose.

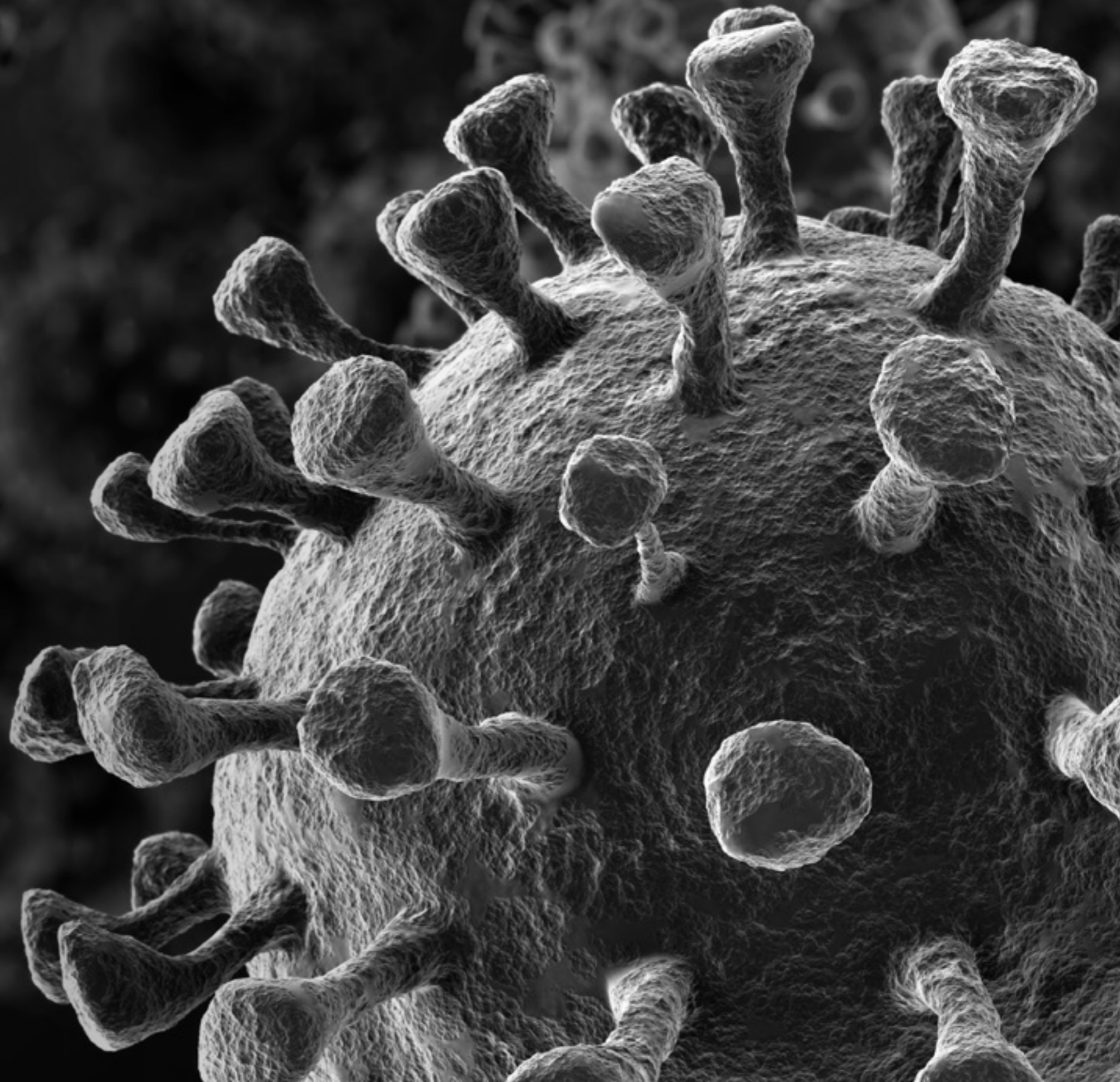
Severe SARs CoV2 infection symptoms include blood clots in the lungs, which compromise lung function and cause death. We set out to understand why this happens, and to find ways to prevent it. It became rapidly clear that the serious symptoms of the infection were in part self inflicted – by an over active immune response. Curiously, clotting symptoms began a few days after the peak of infection and as virus levels were dropping in most patients. This also coincided with the emergence of antibodies in the blood, designed to target and destroy the virus. All antibody proteins in our blood have sugars attached to them, but the combinations of sugars were found to be abnormal in severely ill patients. We therefore asked whether these abnormal antibodies could explain the clotting

problem. We discovered that they activate blood cells known as platelets to trigger excessive clotting reactions. Importantly, from our previous research we know how antibodies activate platelet functions, and this allowed us to identify 3 existing drugs that reversed these effects – an important breakthrough.

So how might this help? Clinical trials of these drugs are underway to see if they help combat COVID 19 and prevent serious life threatening symptoms.

You might ask – why worry about this now? Well, some individuals will continue to have bad reactions to SARS CoV2 and we need to be able to treat them effectively. Research will also continue into why specific patients fair so poorly. Importantly, there are many viruses that affect blood clotting, and scientists at the University of Reading are now an important step closer to understanding why.

How can you get involved? The ongoing research into the effects of COVID 19 and the prevention of this devastating virus have influenced our teaching. You will have the opportunity to be part of a scientific community looking into these issues for future generations. In modules such as Viral Pathogens and Cardiovascular Disease you will learn about the disease mechanisms, and those of related conditions, and how this knowledge can be used to develop sophisticated ways to treat sick patients and respond quickly to prevent outbreaks of future new viruses from developing into global pandemics.



**ONCE  
BITTEN...**







**Snakebites are a major clinical problem, with around 5 million people across the world bitten by snakes each year, resulting in 130,000 deaths as well as extensive injury and disability.**

Professor Ketan Patel and Professor Sakthi Vaiyapuri are investigating the effects of snake venom, and in particular viper bites, on muscles, in order to understand how molecules in snake venom cause these injuries. Currently used anti-snake venoms are largely ineffective in treating snakebite-induced muscle damage and the subsequent permanent disabilities, so there is a crucial need to find ways to treat snakebites more effectively. Ketan and Sakthi's research will help to develop better treatment methods, and to help people make a full recovery.

Both Ketan and Sakthi are passionate about their research making a difference to people's lives having seen the devastating effects of snakebites first hand. The University of Reading are also supporting projects in India to help protect children from snakebites, as part of our commitment to the global community. We have provided snake awareness kits and hand-powered torches to schools in rural communities to help children identify snake species and avoid being bitten by these dangerous predators.

While everyone is familiar with venomous snakes, the use of venoms across the animal kingdom is much more expansive. From the obvious examples like spiders, and jellyfish, to less well known such as cone snails (which can hunt fish with

harpoons!), molluscs (such as octopuses), insects (such as ants, bees and wasps) and even mammals (such as shrews, the platypus and the slow loris).

At Reading we teach a unique, discipline-spanning module called Venoms and Poisons that takes a deep dive into this fascinating aspect of the natural world. Almost all plants and fungi contain poisons to deter herbivores from eating them, and similar chemical defences are used by many animal species such as sponges, pufferfish, poison dart frogs and bombardier beetles. Some animals deploy these chemical weapons in a more active way by injecting them into their prey. These animals are venomous - rather than poisonous - and the active delivery of venom through a wound inflicted by fangs,

stingers, spines or other means, helps these animals hunt their food and defend themselves from predators.

The diversity of species that use venoms and poisons hints at the breadth of the topic. It's an incredibly rich and diverse subject that touches on many aspects of biology, including ecology evolutionary biology, zoology, biochemistry and toxicology, as well as drug development and medical applications, and like most of our teaching, the venoms and poisons module is informed by our research – so you will hear directly from Ketan and Sakthi about the science behind their research – which is why it's one of our most popular modules, taken by students across all programmes in the School of Biological Sciences.



# CATCHING THE BUG

**Tamara unearthed a passion for conservation while studying Zoology. She enjoyed her time at Reading so much, she decided to stay on at Reading and further her research studying for a MSc by Research in Entomology.**

Tamara made her decision to study at Reading, after a rainy open day visit, seeing the Cole Museum along with the campus. She knew this was the ideal place for any Zoology student to study.

"When I visited the University, just walking around, I fell in love with it. Seeing the size of the campus, and the Cole Museum. I knew the campus was perfect for a Zoologist"

One of the most important decision makers for Tamara was the modules on offer at the University. She loved that at Reading you study Zoology from day one, so she could focus on her area of interest straight away.

Tamara originally intended to study the three year BSc. As her interests grew throughout her studies, and with the support and guidance from the School's

academics, she decided to apply for a Placement after her second year. She was interested in the practical/ field work aspect of Zoology, so focused her search for a placement on a role centred around field based conservation.

Conservation is a highly competitive industry, and it can be hard to find placements that offer extensive field work. Tamara was well supported by the School, from the key skills module where she was given feedback on improving her applications and offered practice interviews, to the dedicated careers support from the school, where academics would seek out and share exclusive placement opportunities with students – where Tamara found her placement with the Game and Wildlife Conservation Trust (GWCT).

Tamara's placement was a fantastic opportunity where she was able to take part in field work in Scotland, based outside of Edinburgh for the year.

"A lot of ecology placements are voluntary, I managed to secure a paid placement at the GWCT, where I got accommodation and bills all paid for, along with a weekly stipend – It was brilliant."

Her placement gave her the opportunity to take part in real world ongoing research. Tamara's first project was to look at ways that Grey Partridges were managed by farmers, with the goal of increasing biodiversity on the land by 30% through the implementation of high quality partridge habitats and farmer education. Tamara was based at the Scottish sites and involved in the monitoring surveys necessary for the project – surveying farmland birds, hares, insects, vegetation cover and grey partridge amongst other things.

The second project she was involved in was a way to investigate insect biodiversity in potato crops. Wildflower strips were planted up the centre of tramlines and pitfall traps used to assess the abundance of insect species at different distances along both the tramlines and into the potato crops.

The aim was to see how far insects could travel from the grass margin/field edge, up the wildflower strips and into the potato crops. Tamara's focus was on ground beetles which act as natural pest and weed control.

Through Tamara's work GWCT are now able to show farmers that well planted wildflower strips have a positive effect on the abundance and diversity of ground beetles in potato crops reducing the need for pesticides and herbicides. Tamara was able to apply this newfound interest into her third year research project where she expanded on the research she had undertaken on her placement.

Tamara had such a positive experience at Reading throughout her Zoology degree, she has decided to stay on at Reading to study MSc by Research – Entomology. This will allow her to expand even further on her experience and research into ground beetles focusing on education within farming communities and the benefits of biodiversity in potato crops, to produce better yields.



# ALL SKIN AND BONES

**Dinosaur Provincial Park – a UNESCO World Heritage Site in the Badlands of Alberta, Canada – is one of the world's richest locations for dinosaur fossils.** The park is unmatched in terms of the number and variety of high-quality fossil specimens which, to date, represent more than 44 species, 34 genera and 10 families of dinosaurs, dating back 75-77 million years.

The University of Reading is privileged to be one of only two universities in the world to have permission to run field courses for students inside the park, supported by The Royal Tyrrell Museum, our field course allows our students to study Late Cretaceous biodiversity in multi-taxic bonebeds in this amazing location.

It was on a scouting trip for this field course, led by Dr Brian Pickles, Associate Professor of Ecology, that volunteer crew member Teri Kaskie discovered what could be one of the best-preserved dinosaur fossils ever found in the park.

The fossil has been identified as a juvenile Hadrosaur, a large-bodied, herbivorous, duck-billed dinosaur. What makes their find so unique is the fact that large areas

of the exposed skeleton are covered in fossilised skin. Although adult duck-billed dinosaurs are well represented in the fossil record, younger animals are far less common. This means the find could help palaeontologists to understand how hadrosaurs grew and developed.

Brian explained, "It's so well preserved you can see the individual scales; we can see some tendons and it looks like there's going to be skin over the entire animal. Which means, if we're really lucky, then some of the other internal organs might have preserved as well."

As a student with the School of Biological Sciences you could choose to take our Palaeontology Research Field Course, and have the once in a lifetime experience of working on the excavation over the next two field seasons. Possibly uncovering new specimens to collect or to excavate in future years.

# CAREERS

**Developing the employability and career prospects of our students is our top priority.**

Our carefully curated programmes and hands on approach to teaching and learning will provide you with the knowledge and transferable skills that can be applied to a wide range of careers after you graduate. We employ a dedicated Careers Team who can help you navigate your career journey and encourage participation in a range of career development activities ranging from job application essentials to subject specific careers fairs.

From making the transition to university life to your final year of study - we will support and encourage you to develop your confidence, skill sets and to explore the various job markets that are related to biology and beyond.

\*Based on our analysis of HESA data © HESA 2022, Graduate Outcomes Survey 2019/20; includes all School of Biological Sciences responders

Our reputation and strong industry relationships make our graduates highly sought after in the workplace. **Overall, 93% of graduates from the School of Biological Sciences are in work or further study within 15 months of graduation\*.**

Our recent graduates have gone on to work in a range of different careers in organisations which include GlaxoSmithKline, AstraZeneca, Pfizer, the Defence Science and Technology Laboratory (DSTL), the National Health Service (NHS), Natural England, UK Health Security Agency (UKHSA), Forestry England and the Animal and Plant Health Agency (APHA). Others have chosen to enhance their career opportunities by studying for MSc, MRes or PhD degrees.

# PLACEMENTS

**Many companies use internships or placement schemes to identify and nurture candidates for their graduate recruitment schemes. You can be ahead of the competition by taking time out from your studies for a professional placement.**

The School of Biological Sciences places a lot of emphasis on career training, especially placements. Our successful placement programme provides you with the opportunity to gain hands on experience in a relevant sector. Work experience will give you greater confidence and enhance your employment prospects in a competitive recruitment marketplace.

All students are given the opportunity to undertake a placement as part of their degree programme. This is not a choice that you will have to make before you enrol. You will have the option to add a placement year to your studies during the second year of your

course, providing you with a lot of flexibility in your decision making.

We will provide you with full training and support throughout your placement journey, this includes workshops, sorting CVs and covering letters, searching for a placement, interviews and assessment centres. We will also continue to support you whilst you are on placement and ensure that you have a rewarding experience all around.

The diversity of employers that we work with means that we can find relevant placements for a large number of career paths. Our students have completed their placements in Pfizer, Cancer Research UK (CRUK), Woburn Safari Park, Bristol Zoo, UK Health Security Agency, and UK Health Security Agency, to name a few.

#### Disclaimer

This brochure was issued in 2022 and is aimed at prospective undergraduate students wishing to apply for a place at the University of Reading (the University) and start a course in autumn 2023. The brochure describes in outline the courses and services offered by the School of Biological Sciences at the University. The University makes every effort to ensure that the information provided in the brochure is accurate and up to date at the time of going to press (Sep 2022). However, it may be necessary for the University to make some changes to the information presented in the brochure following publication – for example, where it is necessary to reflect changes in practice or theory in an academic subject as a result of emerging research; or if an accrediting body requires certain course content to be added or removed. To make an informed and up to date decision, we recommend that you check [www.reading.ac.uk/Ready to Study.aspx](http://www.reading.ac.uk/Ready%20to%20Study.aspx) for up to date information.

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#### Modules disclaimer

Sample modules are provided as a taster of some of the modules that may be available on this course. The sample modules listed may be compulsory (core) or optional modules. Information is correct at the time of going to press (Sep 2022) but the University cannot guarantee that a module appearing in this list will definitely run.

For optional modules, the University cannot guarantee that all optional modules will be available to all students who may wish to take them, although the University will try to ensure that students are able to take optional modules in which they have expressed interest at the appropriate time during their course. Optional modules vary from year to year and entry to them will be at the discretion of the Programme Director.

Some modules are available on more than one course; if you see a sample module under one course and want to know if it is available on another course, contact the relevant department.

#### Year abroad and placement fees

Some courses include an optional or compulsory year abroad or placement year. During this year you will only pay a partial fee which is currently set at 15% of the normal tuition fee.

Check the website for the latest information: [www.reading.ac.uk/fees](http://www.reading.ac.uk/fees) and funding



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