Royal Veterinary College
University of London

Study Abroad Academic Programme

General Information

Module selection

Information about the available modules can be found in the following pages. When making your selection please pay attention to where & when the modules take place, and ensure that you don't select modules that clash (i.e. students should not choose modules taught on the same day).

Please note that the College will not cover the cost of travel expenses for students selecting modules based at Hawkshead.

Due to current COVID-19 social distancing regulations, all Term 1 modules will be delivered remotely.

Term dates 2020-21

Term 1: 5 October – 11 December 2020
Term 1 module exams will be held in w/c 11th January 2021

Term 2: 18 January – 26 March 2021
Term 2 module exams will be held in the Summer Exam period (26 April to 4 June)

Campuses

We have two campuses: Camden, and Hawkshead. Please refer to the module information to see where teaching will take place.

Camden Campus:
Royal College Street, London, NW1 0TU

Our Camden campus is about a 10 minute walk from Kings Cross/St Pancras, Mornington Crescent and Camden Town tube stations. More details can be found here.

Hawkshead Campus:
Hawkshead Lane, North Mymms, Hertfordshire, AL9 7TA

Our Hawkshead campus is located in Potters Bar, Herts. The RVC runs a free shuttle bus service from Potters Bar train station to the campus. There are regular trains to Potters Bar from Kings Cross, Finsbury Park and Moorgate stations – the journey takes about 20 minutes from Kings Cross. More details can be found here.

Contact

If you have any questions, please contact Hannah Croall, the Sciences Course Support Manager (hcroall@rvc.ac.uk).

Modules available

All of the modules listed are Level 6. Please note that some modules may be subject to minor changes**.**

MODULE	WEIGHTING	CAMPUS	MODULE LEADER	TERM	DAY	Page
Advanced Concepts in Biobusiness (ACBB)	15 credits	Camden	Mehroosh Tak	2	F	3
Advanced Concepts in Reproduction (ACIR)	15 credits	Camden	Ali Fouladi	1	Th	4
Advanced Skeletal Pathobiology (ASP)	15 credits	Camden	Scott Roberts	1	Th	5
Animal Behaviour & Cognition (ABC)	15 credits	Hawkshead	María Díez León	1	Th	6
Applied Animal Welfare (AWW)	15 credits	Hawkshead	Troy Gibson	2	Th	8
Applied Molecular Microbiology (AMM)	15 credits	Camden	Rob Noad	1	Th	9
Comparative Animal Locomotion (CAL)	30 credits	Hawkshead	Richard Bomphrey	1	M/F	10
Comparative Models of Disease (CMoD)	15 credits	Camden	Rachel Lawrence	2	Th	12
Development & Disease (D&D)	15 credits	Camden	Imelda McGonnell	1	Tu	14
EMS (Endocrine & Metabolic Syndromes)	15 credits	Camden	Rob Fowkes	1	F	15
Epidemiology: The Bigger Picture (E:TBP)	15 credits	Camden	Julian Drewe	2	F	16
Infection & Immunity (I&I)	30 credits	Camden	Sharon Kendall	2	M/Tu	18
Parasitology of Human & Veterinary Tropical Diseases (PHTVD)	15 credits	Camden	Rachel Lawrence	1	M	19
Science of Animal Welfare (SAW) *	15 credits	Hawkshead	Siobhan Abeyesinghe	1	Tu	21

* ABC is strongly recommended as a co-requisite of SAW

Advanced Concepts in Biobusiness (15 Credits)

Module Leader: Dr Mehroosh Tak (mtak@rvc.ac.uk)

Module date: The module will run on Fridays in Term 2, at the Camden campus.

Overview
The objective of this module is to enable students to develop a work-relevant theoretical and practical understanding of commercial innovation, within the context of human and veterinary bio-medical sciences. Put simply, to learn and experiment with the knowledge, skills and attitudes scientists need to assemble in order to play a more effective and integrated role during the development of innovative life-saving and life-enhancing products and services including new medicines, diagnostics and healthcare provision.

A supportive, highly-practical learning environment will be provided to enable students to exchange views, develop novel thinking and facilitate peer-to-peer learning.

Students will be required to use the taught theory, and reflection on their own technical and transferable skills, to solve commercial problems in small groups and further develop their understanding of bioscience business, management and enterprise. The key learning outcomes will be a set of practical employability skills and enhanced commercial awareness that will allow students to link their scientific expertise with their new found understanding of commercial innovation and enterprise. These outcomes are crucial as numerous surveys of graduate employers in high technology disciplines state that science graduates lack important business and management competencies.

Likely Learning Outcomes:
By the end of this module, students will be able to:

1. Demonstrate an understanding of innovation: innovation as a concept, commercial risk, markets and competition and, scenario planning to anticipate change.
2. Critique the key theories of managing innovation: business creativity, objective assessment of bioscience technologies, intellectual property management, business models in bioscience, introduction to strategy, deploying key management models, introduction to management and, ethical business.
3. Evaluate enterprising behaviours: enterprising mind sets, overview of bioscience company creation and, dealing with change and failure.

The learning will culminate in the student being able to apply critical thinking and implement practical solutions to common challenges in commercial bioscience innovation.

Teaching & Learning Methods
Typically, there will then be four 45 minute interactive lectures drawing on contemporary business management thinking and theoretical frameworks. These lectures will often involve external expert speakers. The lectures will be segmented by a hands-on experiential session using workplace management models as a framework.

Assessment
The module will be assessed by:

- In-course assessment (previously this has comprised of a presentation and a written report)
- One summative exam paper in Summer exam period

Advanced Concepts in Reproduction (15 Credits)

Module Leader: Dr Ali Fouladi-Nashta (afouladi@rvc.ac.uk)

Deputy Module Leader: Dr Mandy De Mestre (ademestre@rvc.ac.uk)

Module date: The module will run on Thursdays in Term 1, at the Camden campus.

Overview
This advanced module concentrates on the latest developments and applications of research in this exciting field, and highlights how they make a real impact on health and welfare.

Module Aims
To learn cellular and molecular aspects of reproductive biology from gonadal development and function to ovulation, fertilization and embryo and germ cells development, and establishment and maintenance of pregnancy and placental immunology in animals.

Topics likely to be covered:

- Prenatal and Postnatal Gonads Development
- Germ Cell Niche
- Folliculogenesis and Reproductive Cycles
- The Corpus Luteum
- Puberty
- Sperm Development, Sperm Assessment & Sex Determination
- Oocyte Maturation & Fertilisation
- Embryogenesis & Molecular Mechanism of Blastocyst Formation
- Embryo Metabolism & Embryo Implantation
- Placenta Biology
- Pregnancy and Pregnancy Loss
- Immunology of Pregnancy
- Maternal Recognition of Pregnancy
- Parturition
- Nutrition and Reproduction

Teaching & Learning Methods
A variety of complementary teaching and learning formats are to be used throughout the module. They include: Lectures, laboratory-based practical classes and journal clubs. For most of the topics the teaching format will be two lectures in the morning with a practical or journal club in the afternoon.
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Assessment
The module will be assessed by:

- Individual journal club presentation (10%)
- In-Course Assessment (25%)
  (Writing 1000 word critical review of the research topic being presented for the Journal Club)
- One summative exam paper in January exam period (65%)

Advanced Skeletal Pathobiology (15 Credits)

Module Leader: Dr Scott Roberts (sjroberts@rvc.ac.uk)

Module date: The module will run on Thursdays in Term 1, at the Camden campus

Overview
The aim of the course is to introduce students to a broad range of skeletal tissues including bone, cartilage and tendons. Topics will incorporate anatomy, physiology, cell biology and pathology to give a broad understanding of skeletal development, ageing and adaptation.

Bone and joint pathologies such as osteoporosis, osteoarthritis and cancer are highly prevalent and represent a major challenge to human and animal welfare. Consequently, research activities often focus on improving our understanding of these conditions and how they develop. This module will also integrate basic biology, physiology and pathology to provide an overview of the skeletal system in health and disease.

Module Aims
The course will be based around the research and teaching expertise of the unique range of musculoskeletal biologists at the Royal Veterinary College. It also incorporates new insights into bone and joint pathology and physiology. The course aims to:

- Introduce the principles of bone, cartilage, tendon, and joint biology.
- Examine development, adaptation and on occasion the ageing of skeletal tissues.
- Provide an overview of a broad range of skeletal disorders and the treatments available.
- Introduce the experimental techniques in use in skeletal research.
- Enable the critical analysis and discussion of cutting-edge skeletal research and drug development.

Teaching & Learning Methods
The course will be taught using a combination of lectures, seminars, tutorials, computer-based practicals and journal clubs. These will be run by RVC-based lecturers or post-doctoral staff. Teaching will incorporate both basic and clinical science. Students will be introduced to some of the most recent developments in skeletal research.

Assessment
The course will be assessed in two ways:

- In-course assessment (an extended essay).
- One summative exam paper in January exam period

Animal Behaviour and Cognition (15 Credits)

Module Leaders:

Maria Díez León (mdiezleon@rvc.ac.uk) & Charlotte Burn (cburn@rvc.ac.uk)

Module date: The module will run on Thursdays in Term 1, at the Hawkshead campus

Overview

The way animals behave represents an adaptive response to the environment that integrates both physiological and ecological aspects of the individual. The scientific study of Animal Behaviour aims to understand the mechanisms that underpin behaviour and is thus fundamental to interpret animal research and to establish ecological relationships between members of the same or other species. It has also direct application to areas such as welfare, training, conservation breeding or population management.

This course will provide theoretical and methodological training in the science of Animal Behaviour and Cognition. It will cover theoretical frameworks and a critical evidence-based approach to the scientific study of behaviour and cognition, covering areas such as social and parental behaviour, and learning and memory.

This module will develop you as a scientist, communicator and critical thinker.

This module will introduce theoretical and methodological training in Animal Behaviour and Cognition. Each topic will normally comprise a 45-minute lecture followed by an interactive directed learning session. Practicals, 'hands on' skills development and demonstrations will include:

- Quantitative behaviour recording
- Writing a journalistic soundbyte about animal behaviour
- Dog training practical
- Behavioural observation of animals in the wild (e.g. seals)

Module Aims

- To convey the importance and methodology of animal behaviour as a scientific discipline;
- To cover the influences of evolution, genetics and individual experience on behaviour and cognition;
- To introduce a critical and evidence based approach to the study of animal behaviour and cognition and the underpinning frameworks.

Likely Learning Outcomes

At the end of this module, students should be able to:

1. Suggest and explain the contributions and limitations of animal behaviour science in advancing understanding and progress in important relevant issues
2. Objectively and quantitatively measure, hypothesise and communicate about animal behaviour, distinguishing between evidence, theory, and speculation
3. Compare Tinbergen's four questions, and apply them to help explain novel examples of animal behaviour
4. Interpret major concepts in sensory perception, cognition, learning and memory, and evaluate how species differences in them might influence animal behaviour
5. Compare and assess social, reproductive and parental behaviours for a range of species, and explain why differences may evolve

6. Analyse how animal learning processes can be used to develop effective training regimes for animals and consider some of the main influences on training success
7. Measure and debate animal ‘personalities’ and test hypotheses about them
8. Explain major concepts in behavioural ecology and animal signalling and apply them to novel animal behaviour scenarios

Teaching & Learning Methods
A combination of lectures, directed learning sessions, visits and practical interactive teaching. The module comprises 50 hours of contact time. You are expected to read course material outside contact hours.
Directed learning sessions follow most lectures, and are frequently interactive and practical, but also serve to underpin the ability to critique concepts and approaches. They are designed to develop specific relevant learning outcomes given.

Assessment
The module will be assessed by:

- One in-course assignment
- One Summative exam paper in January exam period

Applied Animal Welfare (15 Credits)

Module Leader: Troy Gibson (tgibson@rvc.ac.uk)

Module date: The module will run on Thursdays in Term 2, at the Hawkshead campus

Overview
The module will examine important animal welfare issues from a UK and global perspective. Investigating and critically evaluating the demands of current and future practices on the welfare of animals under the domain of humans.
This course will use the principles you developed in previous modules to allow you to critically examine real world welfare issues.

Module Aims
- Discuss animal welfare issues from both a UK and global perspective.
- Examine the important animal welfare issues associated with farming, research, pets and wildlife.

Likely Learning Outcomes:
At the end of this module, students should be able to:
1. Critically examine animal welfare issues associated with animal-based production systems.
2. Objectively examine issues relating to the welfare of: companion animals, wild captive animals, wildlife and animals in science.
3. Discuss how animal welfare science can investigate and influence the welfare of animals under our care.
4. Determine the potential conflicts and barriers to improving the welfare of animals under the domain of humans.
5. Analyse the influence of economics and societal values on the perception of animal welfare issues.

Units likely to be covered:
1. Applied animal welfare
2. Production and working animal welfare
3. Companion and lab animal welfare
4. Wild and captive animal welfare
5. Welfare and slaughter

Teaching & Learning Methods
A combination of lectures, seminars, group tutorials, and practical interactive teaching. The module comprises 50 hours of contact time, consisting of 32.5 hours interactive and formal teaching, and 17.5 hours of practical sessions and visits.
Each topic will normally comprise a 45-minute lecture followed by an interactive directed learning or practical session. Practicals will include: sessions on animal welfare and livestock production, shelter animal welfare, lab animal welfare, animal welfare in zoological collections and stunning and slaughter.

Assessment
The module will be assessed by:
- One in-course assignment (in previous years this has taken the format of a written summative report on an animal welfare topic)
- One summative exam paper in Summer exam period

Applied Molecular Microbiology (15 Credits)

Module Leader: Dr Rob Noad (rnoad@rvc.ac.uk)

Module date: The module will run on Thursdays in Term 1, at the Camden campus

Overview
In addition to their importance as pathogens, microbes have many beneficial uses. This module will give students the opportunity to explore the beneficial biotechnological use of microbes in the food industry, and in human and animal health. The module will be organised into four core units: Microbes as factories, Microbes and food, Microbes in research, and Microbes and health.

The module will highlight the historical and state-of-the-art applications as useful organisms, and focusses on giving students hands-on opportunities to explore how microbes can be used for the production of biopharmaceuticals.

It is available to all third year students and is particularly suitable for students who have chosen Practical Investigative Biology or Infection and Immunity as other modules, as many of the themes discussed on these modules are complementary to those explored on Applied Molecular Microbiology.

Module Aims
On completion of the module students will be expected to:

1. Describe beneficial uses of microbes in food production, health and research.
2. Interpret data relating to the application of microbes to answer research questions.
3. Explain how the use of genetically engineered microbes is regulated.
4. Compare applications for different microbes and explain why microbes are particularly suited to solve specific problems.

Teaching & Learning Methods

- Lectures
- Seminars
- Laboratory Practicals
- Group Exercises
- Presentations

Assessment
The module will be assessed by:

- One in-course assessment (which has previously taken the format of a practical write-up of laboratory work).
- One summative exam paper in January exam period

Comparative Animal Locomotion (30 Credits)

Module Leader: Prof Richard Bomphrey (rbomphrey@rvc.ac.uk)

Module date: The module will run on Mondays and Fridays in Term 1, at the Hawkshead campus

Overview

Locomotion is the signature behaviour of the kingdom Animalia. All animals are motile at some stage of their life history. Locomotion is thought to be the selective pressure that gave rise to the nervous system. If we can understand how brains, muscles, and skeletons work together to produce locomotion, in the full context of other animals and the natural environment, then we will not only have solved one of the great mysteries of the natural world, but we stand to improve the lives of all animals, including humans, through treatment of neurological and musculoskeletal disease.

Animal locomotion is an integrative, dynamic field of study. It relies on understanding at every level: genes, molecules, cells, tissues, organisms, collective behaviour and the environment. And it is currently at an extraordinary juncture. The field has seen several revolutions in understanding, from the first biomechanical treatise in Borelli's Die Motu Animalum in the 1600s, to the reflex arc theories of Sherrington in the early 1900s, to the neuromechanical perspectives of the 1990s and 2000s. Many of these advances have been made possible by new technologies, for example, precise and accurate mechanical testing, or position tracking using high speed cameras and motion capture systems. Often, these technologies have been developed in the realm of engineering but we now apply them to animals in order to acquire a deeper understanding of their movement.

This module will provide an exciting, hands-on introduction to the field of comparative animal locomotion at all levels. It does not rely on a background in maths or physics, but instead requires a willingness to think conceptually about how animals move.

Locomotion is one of the main design criteria of animals and the design challenges vary with animal size and mode of locomotion. By studying biomechanics in a comparative perspective we can learn not only how different animals move, but also gain a better understanding about the costs and benefits that our own musculo-skeletal system must sustain in order to achieve our particular style of locomotion. This course will introduce students to comparative aspects of the musculo-skeletal system, and modes of locomotion. Throughout the course, examples will be drawn across the animal kingdom, so students will gain an appreciation for the breathtaking diversity of movement strategies.

The course also has three uniting vertical themes, which are:

1. How animals move: musculoskeletal anatomy, introductory mechanics, the energetic cost of moving, and evolutionary perspectives.
2. Scaling of animal locomotion: how does size affect the way animals move?
3. Clinical biomechanics: how can measuring and understanding locomotion improve animal welfare?

Learning Outcomes

At the end of the module, you should be able to:

1. Think and write like a research scientist.
2. Describe, using simple Newtonian mechanics, how a range of animal move and how that changes with size.

3. Understand how movement is controlled by the musculo-skeletal system and neuronal architecture.
4. Apply biomechanical principles to closely related fields such as ecology, bio-inspired design or clinical treatments.

Teaching & Learning Methods
An important goal of this module is development of skills required to become a scientist. Sessions are directed at developing and improving analysis of information, experimental design, interpretation of evidence, group based discussions, independent learning and presentation of analyses. Lecture content will be reinforced with hands-on experience, group-based learning, and private reflective study. The module is arranged around a series of themes each taught by lecturers and researchers based at the renowned Structure and Motion Laboratory. Each unit will be explored by:

1. Lectures introducing main themes and fundamental principles.
2. Practical sessions to provide experience with anatomy, research methods, data handling and analysis.
3. Discussion sessions revolving around important papers in the field.

Assessment
The module will be assessed by written examination and in-course assessment.
There will be two exam papers in the January exam period, and the in-course assessment is likely to comprise of three components: a CAL lab notebook, a critical paper review, and a presentation.

Comparative Models of Disease (15 Credits)

Module Leader: Dr Rachel Lawrence (rlawrence@rvc.ac.uk)

Module date: The module will run on Thursdays in Term 2, at the Camden campus

Overview
To cure diseases we need to identify the underlying pathological processes so that we can develop different strategies to moderate or nullify this pathology and/or treat the symptoms. The identification of pathogenic or virulence factors is essential and historically this has been investigated by observation of diseased individuals in natural hosts. Typically patients are compared with healthy subjects, or comparisons are made between patients with mild and severe forms of diseases. However, these comparisons cannot differentiate between cause and effect. Scientists have developed animal models of many diseases in order to test the cause and effect of different pathogens and the development of disease or immunity as well as the efficacy of "intervention strategies". The development of transgenic animals has led to greatly increased knowledge of the pathological processes involved in disease and the potential methods of combatting them.

However, the role of animal models in the understanding of human and animal physiology and in the treatment of infectious diseases is controversial. Modern society is increasingly re-evaluating the value of animal life and as a consequence questioning the use of animal disease models. In this module students will be introduced to the rationale behind use of animal models and the increasing number of alternatives, including cells, isolated tissues, zebrafish and drosophila. Students will be introduced to the key aspects that need to be considered when developing/analysing models of disease. The uses and limitations of comparative models of disease will be discussed. This module analyses the use of comparative models of infectious diseases, genetic diseases, neurodegenerative diseases and neoplasia. The course will also examine models of lifestyle diseases including obesity, cardiovascular and metabolic diseases. The use of animal models in the development of new therapies and the production of research tools will be discussed.

Module Aims
The course will allow students to develop an understanding of the following:

- How research goes about examining human and animal diseases.
- How animal models of disease are developed/engineered (including basic genetic, basic biology, breeding strategies, transgenesis) and how animal models are validated (phenotyping, imaging)
- How the goals of comparative models are designed
- The range of "natural animal models"
- The alternatives to animal models (cell and tissue models) – the advantages and limitations of these models.
- How animal models are used to understand physiology/immunology/pharmacology
- How animal models help our understanding of specific diseases
- How animal models provide tools for discovery (monoclonal antibodies)
- The societal/scientific influences of comparative models.

Teaching & Learning Methods

- Lectures
- Group exercises - directed learning
- Tutorials
- Laboratory practicals

Assessment

The module will be assessed by examination and in-course assessment.
There will be one exam paper in the Summer exam period. The in-course assessment will likely be an essay and oral presentation

Development & Disease (15 Credits)

Module Leader: Dr Imelda McGonnell (imcgonnell@rvc.ac.uk)

Module date: The module will run on Tuesdays in Term 1, at the Camden campus

Overview
The nervous system is by far the most complex tissue in any animal. By understanding the molecular and cellular basis of nervous system development, we aim to understand how changes in these processes result in developmental defects – both morphological and functional. For example, significant change in the morphology of the brain can be seen in conditions such as holoprosencephaly whereas functional changes are seen in autism and schizophrenia. This module will give insight into the latest research in nervous system development, will give you the opportunity to develop your understanding of how scientists employ animal models in this research and inform you of the latest applications of developmental biology research, including the use of stem cells and molecular editing techniques.

Module Aims
At the end of the module you should be able to:

1. Hypothesise how specific nervous system defects occur, using knowledge of mechanisms of normal development.
2. Discuss how you would design an experiment to test such a hypothesis, including which animal model you would use and why.
3. Debate the merits of different therapeutic strategies to correct abnormal development.

Teaching & Learning Methods
An important goal of this module is development of skills required for independent analysis of information, experimental design, interpretation of evidence, group based discussions and critical thinking. Lecture content will be reinforced with hands-on experience, group-based learning, and private reflective study. Private reflective study will involve reading of primary research papers to supplement and extend taught content. The module is arranged around a series of themes, and these will be explored by:

1. Lectures introducing main themes and fundamental principles.
2. Exploration and reflection guided by private study activities, group-based directed learning sessions and journal clubs and assignments.
3. Practical sessions to provide experience with anatomy, research methods, data handling and analysis.

Assessment
The course will be assessed in two ways:

- One in-course assessment
- One summative exam paper in January exam period

Endocrine & Metabolic Syndromes (15 Credits)

Module Leader: Dr Abir Mukherjee (amukherjee@rvc.ac.uk)

Module date: The module will run on Fridays in Term 1, at the Camden campus.

Overview
Disorders associated with impaired endocrine function or metabolic defects are common in companion animals and mammals in general. The increasing problem of obesity in the human and pet population has resulted in a dramatic increase in research efforts to understand and influence metabolism, and treat associated side effects. This module provides a firm basis in the components of the mammalian endocrine system, and the mechanisms of action of different types of hormones.

We will seek to integrate the basic science of endocrinology into more translational topics relating to the diseases and syndromes associated with disorders of endocrinology and metabolism. Having taught the concepts of endocrine signalling, the following units of study will focus specifically on clinical abnormalities affecting blood glucose regulation and feeding, growth and metabolism, endocrine-related cancers, and reproductive disorders including those affecting sex differentiation and intersex. In every unit, we will stress the importance of endocrine research in establishing the molecular and physiological basis of these conditions.

Module Aims
To introduce the endocrine system as the major controller of homeostasis in mammals, to underline the importance of endocrine signalling in disease establishment and progression, and to illustrate the consequence of these clinical disorders on multiple body functions.

Teaching & Learning Methods
Each unit will be taught as a combination of didactic plenaries, followed by directed learning and directed study sessions, and relevant practicals.

Assessment
The course will be assessed in two ways:
- In-course assessment
- One summative exam paper in January exam period

Epidemiology: The Bigger Picture (15 Credits)

Module Leader: Dr Julian Drewe (jdrewe@rvc.ac.uk)

Deputy Leader: Dr Martin Walker (mwalker@rvc.ac.uk)

Module date: The module will run on Fridays in Term 2, at the Camden campus.

Overview
If you want to discover more about how diseases affect animal (and human!) populations, and how to select the best ways to try to control diseases, then this module is for you! The sorts of questions that you will know the answers to if you undertake this module include:

- How do you investigate a disease outbreak?
- Can we work to prevent the next pandemic?
- What's a simple way to understand mathematical models of disease spread without being a maths expert?
- How can I learn all this and have fun at the same time?

What is this module all about?

- Discovering the patterns, causes, and effects of diseases in animal populations.
- The key concepts of epidemiology taught in a structured way.
- A broad range of examples are used to help you understand the subject.
- Topics include research methods, economics, One Health, strategies for disease control, and more!
- Case studies of pets, livestock, horses and wildlife will show you how to apply what you learn in the real world.
- A wide range of experts will teach you.
- Classroom-based (seminars, group work, discussions, interactive tasks).

What skills will you gain?

- Training in research methods.
- Awareness of a wide range of topical diseases around the world.
- Understanding of how disease control policies are made.
- Tips for fieldwork.
- By the end of this module you will know answers to the questions at the top of this page!

Module Aims
The aim of this module is to give students an insight into the broad range of subjects that epidemiology covers. Epidemiology is at the centre of disease investigation and control, and this module will introduce students to some of the key skills involved using examples from a wide range of species and countries.

At the end of this module you will not expected to be an expert in epidemiology (that would take a lot longer!) but you should have an appreciation of what the subject involves and some ideas as to the sorts of applications to which it can be put.

After undertaking this course, you should have a good understanding of some of the research skills relevant to a broad range of career options. As an example, you might choose to apply to undertake the MSc in Veterinary Epidemiology, MSc in One Health, or

MSc in Wild Animal Biology. Previous students from these MSc courses have gone on to do exciting PhDs.

Teaching & Learning Methods
The course consists of 10 days' of teaching.

The first day will be an interactive introduction, to set the scene and get you oriented.

The following eight sessions will each be taught by a different expert. These sessions will introduce you to case studies of exciting projects involving research in diseases of wildlife, livestock, companion animals and human health. You will also learn some key concepts of epidemiology such as study design and surveillance for diseases

The last day will concentrate on integrating the concepts that you will have learnt throughout the course.

You can expect the following types of teaching:

- Key information provided in seminars
- Teaching by a wide range of lecturers and researchers
- Case studies
- Guest speakers
- Problem-solving scenarios
- Fun quizzes
- Small group discussions facilitated by the lecturer
- NB This is not a lab-based module!

Assessment
The course will be assessed in two ways:

- In-course assessment (a group presentation [20%] and an individual written assignment [30%])
- One summative exam paper in Summer exam period [50%]

Infection & Immunity (30 Credits)

Module Leader: Dr Sharon Kendall (skendall@rvc.ac.uk)

Module date: The module will run on Mondays and Tuesdays in Term 2, at the Camden campus.

Overview
Infectious diseases continue to be one of the major challenges to animal and human health worldwide. While several infectious diseases have been controlled in some countries – and one human and one animal infectious disease eliminated globally – others still remain challenging. In addition, new pathogens continue to emerge and spread to new geographical ranges. An understanding of the biology of the pathogen(s) involved, how they behave in the host animal and animal populations, and an understanding of how the host combats infection are all requirements of modern and successful control strategies. The 'ideal' would be to prevent disease outbreaks from occurring, but this is more challenging – especially of new and emerging disease threats.

During the module students will have the opportunity to study the mechanisms by which the host combats infection, and how these are overcome by different types of pathogen. General principles of disease pathogenesis in individual animals will be discussed and spread of pathogens within populations, and the complexities of control of exotic diseases considered.

Thus, the overall purpose of the course is to introduce students to key aspects that need to be considered when defining and controlling infectious diseases in individual animals and populations, using examples from virology, bacteriology and parasitology. Students should then be able to apply similar principles to additional pathogens of both animals and man.

Module Aims
During the course students will have the opportunity to:

- Study, in depth, some key characteristics of pathogenic bacteria, viruses and parasites relevant to the way in which they cause disease.
- Discuss the host responses to pathogens, how they are overcome in disease, and how host responses can be manipulated.
- Provide an overview of the approaches used to control infectious diseases at the local, national and international levels.
- Rationally discuss issues relating to infectious disease control and highlight some of the current international issues in infectious diseases.

Teaching & Learning Methods

- Lectures
- Seminars
- Laboratory Practicals
- Group Exercises
- Presentations

Assessment
The module will be assessed by written examination and in-course assessment. There will be two exam papers in the Summer, and in previous years the ICA has comprised of an essay and a presentation.

Parasitology of Human & Veterinary Tropical Diseases (15 Credits)

Module Leader: Dr Rachel Lawrence (rlawrence@rvc.ac.uk)

Module date: The module will run on Mondays in Term 1, at the Camden campus.

Overview
Parasitic infections cause some of the most prevalent and pathological diseases world-wide and have a major effect on the socio-economic status of affected countries. This module will build on the information received in year 2 and will provide an understanding of the complex co-evolutionary relationships between parasites and their hosts. In addition it will illustrate, by experimental research examples, the ways in which the study of parasitic organisms have provided fundamental insight into the fields of molecular biology, immunology, pathology, cell biology and epidemiology.

The module will cover major human tropical diseases caused by protozoan and helminth parasites. Major veterinary tropical parasitic diseases that cause significant production losses and/or are significant zoonoses will be covered. For each disease interesting aspects of research conducted on these organisms will be highlighted. For example, immune evasion by malaria using *var* genes, granuloma pathology of schistosomes is necessary to protect the host but also allows egg release into the gut, intestinal parasitic helminths downregulate host immune responses and this is beneficial for the treatment of a number of inflammatory disorders such as Crohn's and ulcerative colitis.

Module Aims
To study major human and veterinary parasitic tropical diseases from the viewpoints of immunology, epidemiology, pathology, treatment and control. As well as provide the student with a well-focused understanding of the major protozoal and helminth parasitic diseases mainly found in the tropics.

Special emphasis will be placed upon:
The biology of the causative organisms, disease aetiology, disease epidemiology, host immunological responses and pathogenesis, anti-parasitic chemotherapy, vaccination and other control strategies such as vector control.

Learning Outcomes:

1. The student will have a detailed understanding of several protozoal and helminthic diseases and in some cases will have developed an integration of the complex principles and considerations for disease treatment, prevention and control.
2. Students will gain an appreciation of the ways in which parasites have evolved to survive within the host. They will acquire a sound knowledge of the complex mechanisms used by parasites to avoid the host immune response.
3. Students will gain an understanding of the use of parasites as experimental tools to answer fundamental biological questions. More specifically an understanding in how to acquire new information and interpret recent developments in the field will be gained.

Teaching & Learning Methods
The Module will be taught by a combination of lectures, seminars, group journal clubs and practical interactive teaching. A particular goal of this module is the development of skills required for analysis of information, interpretation of evidence from current research, group

based discussions and independent learning. Lecture content will be reinforced with group-based learning, and private reflective study.
The module is arranged around weekly disease themes, and these will be explored by:

- Lectures introducing main themes and fundamental principles.
- Exploration and reflection guided by private study activities, group-based directed learning sessions and assignments.
- A practical session providing consolidation of form and function of parasites.

Assessment
The course will be assessed in two ways:

- In-course assessment
- One summative exam paper in January exam period

Science of Animal Welfare (15 Credits)

Module Leader: Siobhan Abeyesinghe (sabeyesinghe@rvc.ac.uk)

Module date: The module will run on Tuesdays in Term 1, at the Hawkshead campus

Co-requisites: Students are strongly recommended to take Animal Behaviour and Cognition (Y3 module) alongside this module

Overview
The Module will provide theoretical and methodological training in Animal Welfare Science, which is broadly equivalent to the biology of sensations, motivation and emotions, using examples across a range of species and animal sectors and introducing some of the latest exciting approaches. It will cover theoretical underpinning frameworks and a critical evidence-based approach to use of quantifiable indicators, including behavioural, physiological, cognitive and pathological signs, of diverse welfare states including pain, anxiety, boredom and positive states.

This module will develop you as a scientist, communicator and critical thinker.

Each topic will normally comprise a 45 min lecture followed by an interactive directed learning session.
Practicals, 'hands on' skills development and demonstrations will include:

- Recording of behaviour and preference used as welfare indicators
- Salivary cortisol collection and analysis
- Heart-rate recording
- Collecting EEG and Evoked potential data
- Applying a horse welfare assessment protocol

Module Aims

- To convey the importance and methodology of animal welfare as a scientific discipline
- To cover the main scientific means for assessing animal welfare
- To introduce a critical and evidence-based approach to evaluating animal welfare issues and the underpinning frameworks

Likely Learning Outcomes:
At the end of this module, students should be able to:

1. Apply, reframe and develop concepts in animal welfare
2. Defend and criticise how animal welfare can be quantitatively measured using both objective and subjective techniques
3. Scientifically measure basic animal behaviour and physiology that is relevant to animal welfare, and evaluate the methodology
4. Critique how animal welfare indicators are scientifically validated
5. Recommend and criticise the use and value of different physiological, neurological, behavioural, and cognitive welfare indicators for purposes covered in the course
6. Recommend and compare objective indicators of welfare states covered by the course (e.g. fear, pain, sickness, boredom and positive welfare)
7. Design, and evaluate the efficacy of, novel environmental enrichments to benefit captive animal welfare or suitability for release into the wild

Teaching & Learning Methods
A combination of lectures, seminars, group tutorials, and practical interactive teaching. The module comprises around 50 hours of contact time, including 12 hours of practical and demonstration sessions. You are expected to read course material outside contact hours.

Directed learning sessions follow most lectures, and are frequently interactive and practical, but also serve to underpin the ability to critique concepts and approaches. They are designed to develop specific relevant learning outcomes given.

Assessment
The module will be assessed in two ways:

- One in-course assignment worth 40% of module marks (in previous years this has involved creating a recorded powerpoint presentation)
- One summative exam paper worth 60% of module marks in the January exam period