



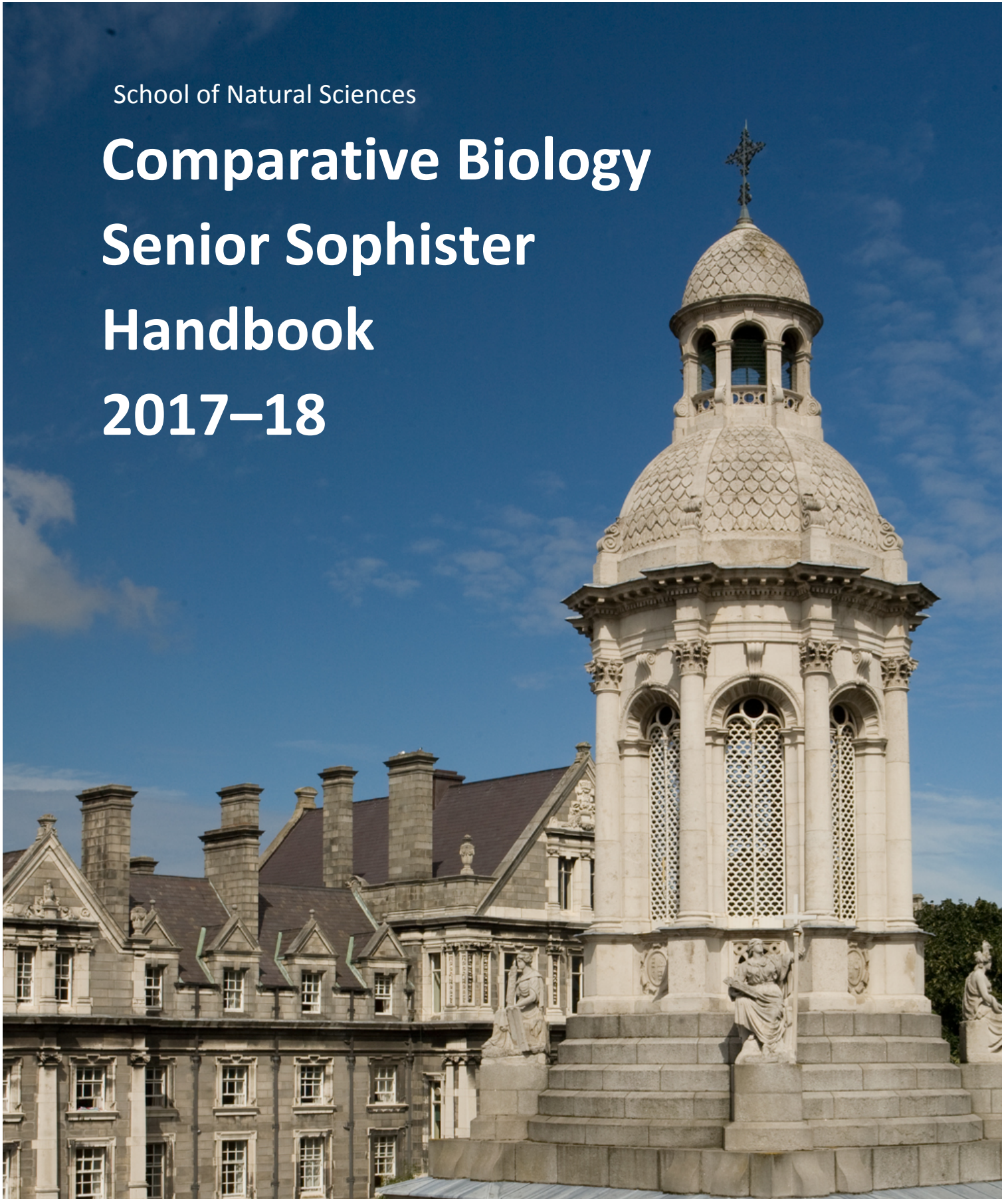
Trinity College Dublin

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

School of Natural Sciences

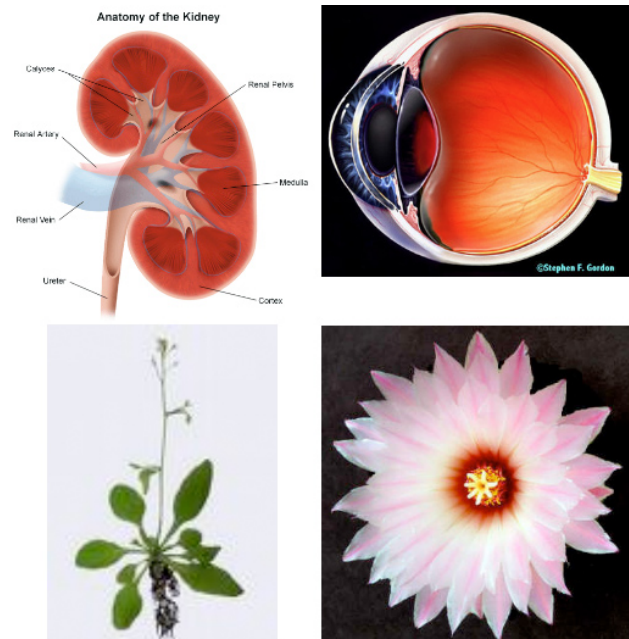
Comparative Biology Senior Sophister Handbook 2017–18



School of Natural Sciences

Comparative Biology

The Comparative Physiology of Organisms



<http://www.naturalscience.tcd.ie/undergraduate/functional-biology.php>

A Note on this Handbook

This handbook applies to all students taking the **Comparative Biology Programme** run by the School of Natural Sciences. It provides a guide to what is expected of you on this programme, and the academic and personal support available to you. Please retain it for future reference.

The information provided in this handbook is accurate at time of preparation. Any necessary revisions will be notified to students via email. Please note that, in the event of any conflict or inconsistency between the General Regulations published in the University Calendar and information contained in course handbooks, the provisions of the General Regulations will prevail.

Introduction

Welcome back to the Comparative Biology Moderatorship

Comparative Biology encompasses the comparative physiology of organisms.

- Comparative Biology describes the discovery of important physiological phenomena conserved across species, revealing key principles, which cannot be revealed by study of individual model organisms alone.
- Comparative Biology has a unifying significance for evolutionary biology in that the physiological processes plants and animals employ are best understood in the context of their evolutionary history.
- Comparative Biology is at the core of biological as well as macro-evolutionary explanations for the history of life.
- Comparative Biology is important in elucidating the effects of gene mutations/ablations affecting protein function or the environment on gene expression, development and physiology and is therefore relevant to current biomedical research

The Comparative Biology moderatorship is designed to also encourage critical thinking, the development of numeracy and literacy, and the exploitation of sources of scientific data. The combination of scientific study with such skills provides an excellent background for a wide range of careers. The Comparative Biology moderatorship acts as a springboard for undergraduate students to go on to post-graduate degrees; e.g. Masters and PhDs in biological and/or physiological disciplines. Graduates are ideally placed to contribute to the knowledge economy and society through careers with biotechnology companies and/or industry. For example, it provides an excellent background for students who want to pursue a career in teaching biology. Other graduates will have the transferable skills to move into broader areas of education and the media, computer software development, management and business for example.

In the Senior Sophister year, the emphasis is placed on the development of research, analytical and communication skills. Along with specific modules, the student has the chance to select a topic for a research project and specific areas of interest for tutorials.

This guide provides descriptions of the practical work and the lecture modules which Comparative Biology Senior Sophister students follow.

We look forward to working with you during this and trust that you will find the programme interesting and rewarding.

Trevor Hodkinson, Comparative Biology Course Coordinator
Trevor.Hodkinson@tcd.ie
Botany Building, TCD

Staff Contacts

Email (@tcd.ie)	Phone (896-)
--------------------	-----------------

ZOOLOGY

Prof. Yvonne BUCKLEY	Professor of Zoology Head of Discipline (Zoology)	buckleyy	3172
Dr Colleen FARMER	Assistant Professor	cfarmer	1036
Prof. Celia HOLLAND	Professor	cholland	1096
Dr Andrew JACKSON	Assistant Professor	a.jackson	2728
Prof Nicola MARPLES	Associate Professor	nmarples	1063
Prof. Paula MURPHY	Professor	paula.murphy	3780
Dr Nessa O'CONNOR	Assistant Professor	n.oconner	1926
Dr Jay PIGGOTT	Assistant Professor	jeremy.piggott	2364
Ms Alison BOYCE	Senior Technical Officer School Safety Officer	aboyce zoosafe	3506
Ms Sarah-Louise HASSETT	Technical Officer	shassett	3506
Dr Martyn LINNIE	Chief Technical Officer 1	mlinnie	1679
Ms Fiona MOLONEY	Executive Officer	fimolony	1366

BOTANY

Prof. Trevor HODKINSON	Professor Head of Discipline (Botany)	trevor.hodkinson	1128
Dr Matthew SAUNDERS	Assistant Professor	saundem	4870
Prof. Jane STOUT	Professor	jane.stout	3761
Dr Michael WILLIAMS	Assistant Professor	michael.williams	2421
Ms Siobhan McNAMEE	Chief Technical Officer	siobhan.mcnamee	1309
Ms Aisling O'MAHONY	Executive Officer	botany	1274
Ms Jacqueline STONE	Senior Technical Officer	jacqueline.stone	1275
Mr Mark KAVANAGH	Senior Technical Officer	kavanamg	1017
Ms Patricia COUGHLAN	Technical Officer	coughlp	1275

GENETICS

Prof. Tony KAVANAGH	Professor	tkvanagh	1035
Dr Juan-Pablo LABRADOR	Assistant Professor	labradoj	1966
Prof. Mani RAMASWAMI	Professor	mani.ramaswami	8400
Dr Frank WELLMER	Associate Professor	wellmerf	3729

OTHERS

Dr Susanne BARTH	Research Officer (Teagasc)	Susanne.Barth @teagasc.ie	
-------------------------	-------------------------------	------------------------------	--

The Programme

Objectives of the Comparative Biology Moderatorship

The overall objective of the Comparative Biology moderatorship is to provide a broad training in **Comparative Biology - The Comparative Physiology of Organisms**. The course integrates both animal and plant physiology, development and genetics and explores the diversity of the functional characteristics of organisms in the context of their evolutionary histories. The course is run by the School of Natural Sciences with significant input from staff in the School of Genetics and Microbiology. It meshes, in particular, with the Molecular and Comparative Physiology interdisciplinary research activity in the School of Natural Sciences and builds on a long-standing tradition of teaching Comparative Physiology of organisms in both Zoology and Botany Disciplines.

Programme Learning outcomes

Upon successful completion of this programme, students will be able to:

- Demonstrate social awareness, particularly in relation to the contributions that comparative biology makes to society, such as broadening the scientific base of biological science, medical research, animal and plant biotechnology
- Articulate the fundamental concepts in comparative biology
- Discuss current research developments in comparative biology
- Critically review published scientific articles in comparative biology
- Carry out research with technical competence and work accurately, efficiently and safely in the laboratory using modern research facilities
- Demonstrate numerical competency and the ability to analyze quantitative data by appropriate statistical tests, using spreadsheets and other software
- Produce reports using word processing and graphics
- Collaborate effectively in teams and work independently
- Communicate accurately, clearly, persuasively and imaginatively, in both oral and written form

Bologna and the European Credit Transfer System

Under the Bologna Process, to which Ireland is a party, and which is designed to encourage student mobility and the international recognition of qualifications, the European Credit Transfer and Accumulation System (ECTS) has been introduced in Trinity College Dublin, and applies to all undergraduate and taught postgraduate programmes.

ECTS credits represent the student workload required to achieve the desired outcomes of modules and programmes, where 60 credits is the norm for full-time study over one full academic year. It should be noted that as one ECTS credit is considered to account for between 20 and 25 hours of student participation in a course, 60 credits, therefore, amounts to between 1,200 and 1,500 hours - that is an average of 40 to 50 hours per week over the 30 weeks of the University year. In Science and Technology, approximately 30-40% of that total may involve 'contact hours'.

The ECTS credit weighting for a given module or elective is a measure of the student input or workload required for that module, based on factors such as the number of contact hours, the number and length of written or verbally presented assessment exercises, class preparation and private study time, laboratory classes, examinations, and so on as appropriate. There is no intrinsic relationship between the credit weighting of a module and its level of difficulty.

Credits are obtained by individual students upon successful completion of the academic year or programme. However, one-year and part-year visiting students are awarded credit for all individual modules successfully completed.

Senior Sophister students in Comparative Biology take 60 credits of 'Core' Modules (see below).

Summary of the Senior Sophister Programme

Mandatory modules

Module Code	Module Title	CA	EX	ECTS Credits
FB4000	Research Project	100%		15
FB4020	Genetics for Comparative Biology <i>School of Genetics and Microbiology modules:</i> <i>GE4031 Plant Molecular Genetics II</i> <i>GE4053 Genetics of Neural Development</i> <i>GE4057 Plant Developmental Genetics</i>		100%	10
ZO4060	Research Comprehension	40%	60%	5
ZO4012 ZO4015	Tutorials in Zoology	20%	80% 100%	10
FB4050	Tutorials in Plant Sciences (<i>see below</i>)	20%	80%	5
ZO4030	Data Handling	100%		5

TUTORIALS IN ZOOLOGY (each worth 5 credits)

BLOCK A – Semester 1

ZO4015	Evolution	Dr Nicola Marples
--------	-----------	-------------------

BLOCK B – Semester 2

ZO4012	Advances in Parasitology	Prof. Celia Holland
--------	--------------------------	---------------------

TUTORIALS IN PLANT SCIENCES (students take the following 2 Plant Sciences topics, worth a combined 5 credits)

Semesters 1 and 2

FB4050	Part 1: Plant Molecular Biology	Dr Trevor Hodkinson
	Part 2: Plant Physiology	Dr Mike Williams

Optional modules (choose two modules from the three listed below)

ZO4017	Tropical Ecology Field Course	50%	50%	5
FB4060	Plant Breeding and Biotechnology	50%	50%	5
BO4108	Plant Environment Interactions	50%	50%	5
BO4107	Plant-Animal Interactions	50%	50%	5

Brief Description of Senior Sophister Modules

FB4000 Research Project

(15 credits – Michaelmas and Hilary Terms)

Module Personnel:

Prof. Yvonne Buckley, All Zoology & Botany Staff

Module Content

Students will carry out a piece of independent research work and present their results in the form of a thesis. They will be assigned to a member of staff who will support an appropriate topic and will supervise the work. They will submit a research proposal before the practical work begins as part of the Junior Sophister ZO3070 Experimental Design & Analysis module and present a poster on the results after submission of the thesis. For the project, they will be expected to outline clearly a scientific problem, review the associated literature, design and execute an appropriate research programme, analyse and present the results and draw clear conclusions, **all the time recording progress in a laboratory and/or field notebook**. The thesis will not exceed 8,000 words (excluding references). Words over this limit will be taken to indicate lack of a concise writing style. Detailed guidance notes on writing and submitting the thesis and poster may be found on the FB4000 Blackboard site.

Learning Outcomes:

On successful completion of this module, students will be able to:

1. Formulation of scientific questions, application of a scientific approach to problem solving
2. Planning an investigation and utilization of the principles of good experimental, observational or computational design
3. In-depth scientific review of a subject
4. Organisation of desktop, computational, field or laboratory based research including: logistics, recording, archiving, appropriate quantitative and/or qualitative analysis and presentation and interpretation of results
5. Project management expertise through continuous assessment of progress and improvement of skills
6. Effective team work with supervisor and other members of the research team
7. Demonstrate technical competence in the handling of modern research facilities and operate safely in a laboratory, office and/or field environment, both individually and as part of a team
8. Presentation and communication of results in the form of a dissertation and presentation

Assessment Details:

Continuous assessment: Thesis (14 ECTS credits), poster presentation (1 ECTS credit)

FB4020 Genetics for Comparative Biology

(10 credits – Semesters 1 and 2)

Module Personnel:

Genetics Staff

GE4031 Plant Molecular Genetics II

Prof. Tony Kavanagh

Module Content:

This module provides an advanced overview of plant molecular genetics.

Learning Outcomes:

On successful completion of this module, students will be able to:

- Show how light acts as a major determinant of plant development.
- Outline the role of the COP-DET-FUS class of negative regulators in mediating photomorphogenesis.
- Outline the role of HY5 and its homologs as positive regulators of photomorphogenesis.
- Outline the role of abscisic acid (ABA) in the responses of plants to environmental challenges such as drought and low temperatures.
- Describe the ABA response pathway and demonstrate the role of genetic analysis in its elucidation (receptors, signalling pathway and target gene activation).
- Describe the gene silencing pathways and mechanisms that act post-transcriptionally to regulate gene expression in plants.
- Describe the transcriptional gene silencing pathway in plants which employs DNA and histone methylation to negatively regulate transcription.

GE4053 Genetics of Neural Development

Dr Juan-Pablo Labrador

Module Content:

This module is intended for Senior Sophister students who have previously taken GE3M13 (Neurogenetics/Drosophila) as a prerequisite.

The goal of this module is to provide a concise and stimulating investigation of the field of Developmental Neurogenetics. Course lectures will explain different developmental processes of the nervous system, discuss the current issues and questions, and provide a framework for reading scientific literature. Each topic will be covered by one or more reviews and its study will be required for a successful completion of the course. Upon completion of this course students will not only understand the basic concepts but will understand the current challenges within each field of study. Students will gain an appreciation for the complexity of neural development at the cellular, molecular and genetic level. Upon completion, students should be able to approach any scientific literature related to this course.

The module covers different aspects of nervous system development from neural induction to early steps of circuitry assembly. There is a focus on different genetic experimental methods employed to identify central mechanisms of nervous system development. We will use different models to explain processes and provide examples of networks and

concepts. The emphasis will be on the conservation of signaling pathways in development of very diverse organisms. This will include *Drosophila melanogaster* and vertebrates *Xenopus laevis*, Chick and Mouse.

Different subjects covered include:

- Neural Induction
- Neurogenesis
- Neural stem cells
- Temporal control of neuronal specification in *Drosophila*
- Neuronal specification in vertebrates
- Axon guidance genetics
- Gradients in retinotectal mapping
- Topographic mapping in the olfactory system

Learning Outcomes:

On successful completion of this module, students will be able to:

- Compare and contrast similarities and differences during neural induction between vertebrates and Invertebrates.
- Point out commonalities during neurogenesis in different organisms.
- Identify common mechanisms of neuronal specification between vertebrates and invertebrates.
- Outline the basis of symmetric and asymmetric division of neural stem cells.
- Distinguish the different mechanisms and molecules involved in Axon guidance.
- Contrast the different mechanisms required to generate discrete and continuous neural maps.

GE4057 Plant Developmental Genetics

Dr. Frank Wellmer

Module Content:

This module provides an overview of plant development and the molecular mechanisms by which plant development is controlled. It especially focuses on work that has been done using genetic analyses in the model plant *Arabidopsis thaliana*. Modern experimental approaches and fundamental concepts underlying the development of plants and other multicellular organisms are discussed.

Learning Outcomes:

On successful completion of this module, students will be able to:

- State why the study of plant development is important.
- Discuss plant life-cycles.
- Say why *Arabidopsis* is used as a good model system for plant development.
- Describe and discuss embryogenesis, root development, apical meristem development and stem cell maintenance, leaf development, induction of flowering and flower development.

Assessment Details:

100% exam: Students have the choice of 2 of 3, 1.5 hour exams, each examines one of the modules listed

FB4050 Tutorials in Plant Sciences

(5 credits – Semesters 1 and 2)

Module Personnel:

Dr Trevor Hodkinson, Dr Mike Williams

Module Content:

Students take 2 electives from Plant Science: Plant Molecular Biology and Plant Physiology.

Within each tutorial there will generally be four topics covered, each in a set of two, one hour-long tutorials. In the first session introductory information will be presented in the form of a lecture and a task set for the tutorial class for the next session. This will involve studying some current literature and student participation in presentations, debates or critiques as appropriate.

The aim of this module is for students to research a number of topics key to the evolution and metabolism of higher plants and to present their information to the class over a series of tutorial sessions. Eight separate topics have been chosen that reflect the breadth and diversity of current research into fundamental aspects of plant molecular biology, anatomy and metabolism. Following introductory lectures on each topic provided by Drs Trevor Hodkinson and Michael Williams, students will be given a week to prepare an in depth review using primary scientific literature to be presented in front of the class. The topics will be chosen from topics similar to those listed below:

Dr Trevor Hodkinson: Plant Molecular Biology (Semester 2, Part 1)

1. Plant Molecular Phylogenetics
2. Molecular Dating
3. Evolution and Development of Flowering
4. Genetic Engineering

Dr Mike Williams: Plant Physiology (Semester 2, Part 2)

1. Chloroplast Symbiosis – Physiology of Chloroplast Autonomy and Assimilate Flow
2. Evolution of the Stele – Mechanical and Physiological Aspects to the Development of Early Stele Architecture
3. Halophytes and Glycophytes – Defense Systems to Increasing Salinity
4. Electrical Signalling in Plants – Plant Memory and Intelligence

Learning Outcomes:

On successful completion of this module, students will be able to:

- Discuss a wide range of research issues in plant science and critically assess the available information.
- Work effectively and equitably in groups.
- Develop key literature research criteria
- Improve presentation skills
- Prepare and present work in an appropriate written and oral format.

FB4060 Plant Breeding and Biotechnology

(5 credits – Semester 2)

Module Personnel:

Dr Trevor Hodkinson

Module Content:

The module covers the principles and practice of plant breeding and biotechnology. Lectures cover key topics such as the origins of agriculture, genetic resources, disease resistance, conventional breeding, modern breeding, genetic engineering, and case studies in breeding and biotechnology. Practicals cover crop diversity, polyploid estimation and at least one site visit to a Teagasc Research Centre (Oak Park, Carlow and/or Ashtown Dublin).

Learning Outcomes:

On successful completion of this module, the student will be able to:

- Discuss core elements within the field of plant breeding and biotechnology
- Show laboratory skills in plant breeding
- Demonstrate knowledge of plant breeding techniques

Assessment Details:

50% continuous assessment (practical write-up and an essay): 50% annual written examination.

Tutorials in Zoology

(10 credits – Semester 2)

Module Personnel:

Zoology Staff

Students will select two five-credit electives from the following Zoology options: Evolution and Advances in Parasitology.

Within each tutorial there will generally be four topics covered, each in a set of two, one hour-long tutorials. In the first session introductory information will be presented in the form of a lecture and a task set for the tutorial class for the next session. This will involve studying some current literature and student participation in presentations, debates or critiques as appropriate.

ZO4012 *Advances in Parasitology*

(5 credits – Semester 2)

Module Personnel:

Prof. Celia Holland

Module Content:

This module consists of two parts.

The first part (A) explores the significance and impact of parasitism upon humans. Some of the topics discussed during the module illuminate the practical challenges of designing and undertaking parasitological research in human subjects. In contrast, other topics highlight the relative merits of using animal model systems under experimental conditions as compared to field-based studies in human subjects. The topics are as follows - the impact of parasitism upon cognitive development in growing children; co-infection: challenges and solutions; epidemiology of helminths: aggregation and predisposition; the ultimate challenge - parasite control.

The second part (B) focuses upon more ecological aspects of Parasitology with a particular emphasis upon the impact of parasites at the level of the ecosystem and within wild animal hosts. The topics include parasites as ecosystem engineers, parasites and introduced species and the use of wild mammal host-parasite systems to model human parasitism.

Learning Outcomes:

On successful completion of this elective, the student will be able to:

- demonstrate familiarity with the conduct of human studies under field conditions in developing countries
- describe the impact of parasitism upon human hosts
- explore the pros and cons of using animal models in parasitological studies
- delineate the mechanisms of interaction between co-infections
- define parasite aggregation and predisposition
- identify the challenges associated with anti-parasite chemotherapy and vaccination
- evaluate the use of wild rodent parasite communities as models of human infection
- demonstrate understanding of the role of parasites in an ecosystem
- assess the role of introduced host species in parasite transmission
- demonstrate the skills to critique a scientific paper
- discuss and debate various contributions to a particular topic

Assessment Details:

This module is assessed by 20% continuous assessment and by 80% questions on an annual examination paper.

ZO4015 Evolution

(5 credits – Michaelmas Term)

Module Personnel:

Dr Nicola Marples

Module Content:

This module covers a number of different topics of current importance in evolutionary thinking. Most of the work is done outside of the weekly meeting times, in a series of worksheets completed online, which are designed to help you learn about the topic. There is a verbal discussion each week to allow you to air your thoughts and raise questions – these sessions are neither tutorials nor lectures; their content is largely up to you. The module is designed to give you a good contemporary insight into the processes underlying evolution and the controversies still hotly debated. The topics to be covered include Units of selection, Individuals vs genes, Replicators and Vehicles, Sociality and altruism, Imperfection of adaptation, Evolution of complex organs, Evolution of sex, and Speciation.

Learning Outcomes:

On successful completion of this elective, the student will be able to:

1. demonstrate a thorough grounding in most important aspects of evolutionary theory.
2. show familiarity with the most influential writers in evolutionary thinking in recent years.
3. confidently discuss evolutionary topics with a group of interested academics.
4. show discernment to recognise a spurious argument, and expose its weaknesses.
5. investigate any topic using a web-based resource.

Assessment Details:

This module is assessed 100% by questions on an annual examination paper.

ZO4017 Tropical Ecology

(5 credits – Michaelmas Term)

Module Personnel:

Dr Ian Donohue, Prof. Yvonne Buckley, Dr John Rochford

Module Content:

This module comprises a short series of lectures and an eleven-day residential field course in East Africa that will run during the study week in the first semester. The course will focus on the ecology and biodiversity of a range of ecosystems and habitats (including tropical montane forest, aquatic ecosystems [freshwater rivers and lakes, wetlands and saline lakes] and grasslands) and the connectivities among them. Issues and problems to do with human impacts and the conservation and management of these diverse habitats will also comprise an important element of the course.

Learning Outcomes:

On successful completion of this elective, the student will be able to:

1. demonstrate holistic knowledge of East African geology, landscapes and ecosystems and the extent and nature of human interactions within them.
2. appreciate the principles underpinning the ecology of tropical ecosystems.
3. evaluate the importance of natural background environmental fluctuations compared to those caused by human impact.
4. synthesise and reconcile the conflicting arguments for the future of the ecosystems studied and integrate these arguments into sustainable management plans incorporating indigenous livelihoods.
5. design and conduct a group research project and analyse and synthesis the results for presentation orally (supported by a written synthesis).

Assessment Details:

This module is assessed 50% by continuous assessment and 50% by questions on an annual examination paper.

Module Website:

<http://www.tcd.ie/Zoology/undergraduate/tropicalfieldcourse.php>

ZO4030 Data Handling

(5 credits – Michaelmas Term)

Module Personnel:

Dr Andrew Jackson, Prof. Yvonne Buckley

Module Content:

Being able to form research questions and challenge our hypotheses by collecting and analysing data forms the basis of scientific inquiry. An understanding of data analysis is an essential skill-set for all scientists. This module will consist of 2 tutorial sessions per week spanning all of semester 1 and the first half of semester 2. One of the tutorials each week will be used to develop class-directed questions relevant to current scientific thinking. As a class, we will form hypotheses, collect data and develop appropriate analytical techniques to answer our research questions. Concurrently, online material including video podcasts will be used to develop hands-on skills in the use of the very powerful and flexible statistics package R for data analysis. In the first half of the 2nd semester, these tutorial sessions will also be used to support the Research Project ZO4050. The module will start with basic probability theory, introduce different statistical distributions and culminate in learning how General Linear Models form a common framework for conceptualizing and analyzing your data. At the end of the module you will have analysed a wide variety of data types and will have used the transferable and widely applicable statistics package R to analyse your data.

Learning Outcomes:

On successful completion of this module, students will be able to:

1. Summarise and communicate quantitative results graphically and textually to scientific standards.
2. Apply appropriate statistical analyses of commonly encountered data types.
3. Explain the context of the analyses within a hypothesis driven framework of scientific logic.
4. Use the R statistical computing language for data analysis.
5. Write a short document in the format and style of a peer reviewed science publication and self-assess each classmates' documents.

Assessment Details:

100% continuous assessment.

ZO4060 Research Comprehension

(5 credits – Michaelmas and Hilary Terms)

Module Personnel:

Dr Matt Saunders, Dr Ian Donohue

Module structure:

Research Comprehension will be made up of tutorials and weekly research seminars in the Evolutionary Biology and Ecology Seminar Series. In general, there will be a seminar on Friday followed by a tutorial about the seminar on Monday led by a member of academic staff. Tutorials will involve a discussion of the seminar and where it fits into the wider research area, and will be supplemented each week with assigned reading of papers mentioned during the seminar. There are also a few *special* tutorials throughout the year designed to introduce you to the module, provide help with thesis writing, and to prepare you for the Research Comprehension paper. Note that this module will take place during the final weeks leading up to your research project submission in order to give you extra time to write your thesis. Use this time wisely!

Aims:

No matter what you do when you graduate, in most jobs you will be expected to read, understand and interpret data. Often this will be in a subject you are unfamiliar with, or use unfamiliar methods or study organisms. The aim of this module is to help you to develop the ability to understand and interpret research from a broad range of scientific areas, and then to develop opinions about this research and how it fits into the “big picture”. This module also aims to improve your ability to communicate all kinds of scientific research to a general audience, a skill that is currently in great demand.

Learning Outcomes:

On successful completion of this module, the student will be able to:

1. Comprehend and report on scientific studies presented both orally and in primary literature.
2. Identify the aims and/or hypotheses in scientific studies and analyse the research methods employed to address them.
3. Interpret and generalise the results of the studies in the context of the wider subject area.
4. Assess and evaluate the conclusions of the scientific study.
5. Interpret graphical, tabular and pictorial representations of data and infer results in the context of the subject matter.
6. Summarise scientific studies in language and style suitable for consumption by a wide audience in an online form.

Assessment & Feedback:

This module will have three main assessment components:

1. Attendance of seminars. This is mandatory and a role call will be taken. No marks are assigned for this but anyone with poor attendance will not be permitted to take the exam. If you have a legitimate reason for missing a seminar please explain your reasons to Fiona.

2. Blog posts (40%). You are required to submit three blog posts over the course of the first semester. Everyone must write a blog post for the **first seminar** which needs to be submitted to Blackboard and will be returned to you with feedback from academic staff. You will also be asked to peer review the blog posts of three of your colleagues. This means you will get around four pieces of feedback on that first blog post to help you improve your writing. You will then choose two additional seminars you would like to write about. These two blog posts will be assessed and with each being worth equal marks (20% of the module grade). The **first** of these assessed blogposts will be submitted via Blackboard at the midway point of the seminar series **approximately early December**. The **second** (which can be on any of the seminar topics except the first one, and your previously submitted choice) will be submitted via Blackboard **after the end of the seminar series in approximately March**.
3. Written exam (60%). This exam will be a research comprehension exam. You will be given unseen data in tables, figures and diagrams and be expected to interpret this data. The data will be linked to one or more of the seminars in the seminar series. We will give more details during tutorials.

Provisional Timetable:

There will be approximately 12 research seminars on Friday afternoons spread across Semester 1 and 2 which you will attend. The specific dates for the seminars will be finalised before the start of the academic year. A tutorial will be held early the following week in order to provide a discussion forum for the seminar. This tutorial will be led by an academic or research member of staff whose research interests overlap with the seminar topic. This tutorial will provide you a venue to consolidate what you have learned from the seminar.

Note that because seminar speakers are coming from other institutions we can't guarantee that they'll actually make their flights etc. In such cases the seminar and the subsequent tutorial will be cancelled.

BO4107 Plant-Animal Interactions

(5 Credits – Semester 2)

Module Personnel:

Prof. Jane Stout, Prof. Yvonne Buckley

Module Content:

Plant-animal interactions have increasingly become recognized as drivers of evolutionary change and important components of ecological communities. This module will focus on herbivory (the consumption of plants by animals) and pollination (the transfer of pollen between male and female reproductive structures in flowers).

Learning Outcomes:

- On successful completion of this module students should be able to:

- Synthesise and summarise aspects of the ecology and evolution of mutualistic and antagonistic plant-animal interactions, from individuals to communities, interactions between native and alien species, and applied issues.
- Carry out laboratory work investigating pollination syndromes, plant-pollinator interaction networks and plant and animal adaptations to herbivory, and analyse and interpret data collected.
- Work as a team to obtain, organise and present material on current topics in the field.

Assessment Details:

50% continuous assessment: 50% annual written examination

BO4108 Plant Environment Interactions

(5 credits – Semester 1)

Module Personnel:

Dr Matthew Saunders

Module Content:

Plant growth is significantly influenced by the surrounding physical, chemical and biological environment. This module will address the key inter-related concepts of carbon assimilation and sequestration, plant water relations and energy balance components across the soil-plant-atmosphere continuum. The physiological response of plants to respond to a broad range of environmental conditions including abiotic and biotic extreme events will be explored, and the implications for natural and production based systems will be assessed.

Learning Outcomes:

On successful completion of this module, the student will be able to:

- Demonstrate an understanding of how environmental factors influence the physiological performance of plants at various stages of growth and across multiple spatial scales (leaf, whole plant and ecosystem scale).
- Identify suitable methodological approaches to monitor and quantify the impacts of key environmental drivers on physiological processes observed at the leaf, plant and ecosystem scale.
- Understand how plant systems respond to external drivers such as future climatic variability and land-use pressures.
- Show an understanding of how these concepts can be utilised in the development of sustainable land management practices.

Assessment Details:

50% continuous assessment: 50% annual written examination.

Programme Regulations

Assessment

The assessment value is based on the ECTS credit value of the modules concerned. Your performance will be assessed from a range of assignments encompassing independent research, research analysis and communication, as well as from the end of year examinations. In addition you must be available for an interview (*Viva voce*) following examinations which may be requested by the external examiner.

Copies of past papers are available from the College website. Further information about the form of the examination papers will be provided as part of the tutorial modules.

Access to scripts (Freedom of Information Act)

Students may have access to examination scripts upon written application to the Head of Discipline (Botany or Zoology).

Plagiarism

Plagiarism is **academic fraud** and, as such, is an offence against University discipline. The University considers plagiarism to be a **major** offence, and subject to the disciplinary procedures of the University.

In order to support students in understanding what plagiarism is and how they can avoid it, an **online central repository**, to consolidate all information and resources on plagiarism, has been set up and can be accessed at <http://tcd-ie.libguides.com/plagiarism> .

Grading Guidelines

The following guidelines are used when awarding grades for essays and examination answers in the Sophister years

Class	Mark Range	Criteria
I	90-100	EXCEPTIONAL ANSWER; This answer will show original thought and a sophisticated insight into the subject, and mastery of the available information on the subject. It should make compelling arguments for any case it is putting forward, and show a rounded view of all sides of the argument. In exam questions, important examples will be supported by attribution to relevant authors, and while not necessarily giving the exact date, should show an awareness of the approximate period. In essays, the referencing will be comprehensive and accurate.
	80-89	OUTSTANDING ANSWER; This answer will show frequent originality of thought and make new connections between pieces of evidence beyond those presented in lectures. There will be evidence of awareness of the background behind the subject area discussed, with evidence of deep understanding of more than one view on any debatable points. It will be written clearly in a style which is easy to follow. In exams, authors of important examples may be provided. In essays all important examples will be referenced accurately.
	70-79	INSIGHTFUL ANSWER; showing a grasp of the full relevance of all module material discussed, and will include one or two examples from wider reading to extend the arguments presented. It should show some original connections of concepts. There will be only minor errors in examples given. All arguments will be entirely logical, and well written. Referencing in exams will be sporadic but referencing should be present and accurate in essays.

II-1	65-69	VERY COMPREHENSIVE ANSWER; good understanding of concepts supported by broad knowledge of subject. Notable for independent synthesis of information rather than originality. Evidence of relevant reading outside lecture notes and module work. Mostly accurate and logical with appropriate examples. Occasionally a lapse in detail.
	60-64	LESS COMPREHENSIVE ANSWER; mostly confined to good recall of module work. Some independent synthesis of information or ideas. Accurate and logical within a limited scope. Some lapses in detail tolerated. Evidence of reading assigned module literature.
II-2	55-59	SOUND BUT INCOMPLETE ANSWER; based on module work alone but suffers from a significant omission, error or misunderstanding. Usually lacks synthesis of information or ideas. Mainly logical and accurate within its limited scope and with lapses in detail. The content is sensible and relates a reasonable narrative, if limited in synthesis and sophistication. There is reasonably good citation practice and a well presented reference list in essays.
	50-54	INCOMPLETE ANSWER; suffers from significant omissions, errors and misunderstandings, but still with understanding of main concepts and showing sound knowledge. Several lapses in detail. Content may be disjointed and lacking good structure. Poor citation practice and reference list in essays.
III	45-49	WEAK ANSWER; limited understanding and knowledge of subject. Serious omissions, errors and misunderstandings, so that answer is no more than adequate.
	40-44	VERY WEAK ANSWER; a poor answer, lacking substance but giving some relevant information. Information given may not be in context or well explained, but will contain passages and words, which indicate a marginally adequate understanding.
F-1	30-39	MARGINAL FAIL; inadequate answer, with no substance or understanding, but with a vague knowledge relevant to the question.
F-2	0-29	UTTER FAILURE; with little hint of knowledge. Errors serious and absurd. Could also be a trivial response to the misinterpretation of a question.
U.G		Ungraded

The following guidelines are used Project/Dissertation Assessment.

Class	Mark Range	Criteria
I	85-100	An exceptional project report showing broad understanding of the project area and excellent knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight and originality.
	70-84	A very good project report showing evidence of wide reading, with clear presentation and thorough analysis of results and an ability to critically evaluate and discuss research findings. Clear indication of some insight and originality. A very competent and well presented report overall but falling short of excellence in each and every aspect.
II-1	60-69	A good project report which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organisation adequate to good.
II-2	50-59	A moderately good project report which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature. Presentation, analysis and interpretation of the results at a basic level and showing little or no originality or critical evaluation. Insufficient attention to organisation and presentation of the report.
III	40-49	A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any originality or critical evaluation. General standard of presentation poor.

Fail	20-39	An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation.
------	-------	--

	0-19	A very poor project report containing every conceivable error and fault. Showing virtually no real understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions.
--	------	---

Prize

A prize will be awarded to the graduate with the best overall performance in the moderatorship if they reach a first class grade.

Candidates who show exceptional merit at the degree examination may be awarded a **Gold Medal** by the Board of College on the nomination of the examiners.

General Information

Health and Safety

The **Safety, Health and Welfare at Work Act 2005** places legal responsibility on students to take care of their own safety and that of others around them. The Medical Declaration forms signed in Junior Freshman year stated your agreement to abide by College's safety policies. These policies cover work in the laboratory, the field and all activities on campus. You must read the Faculty of Engineering, Mathematics and Science Health and Safety Guidance Manual to inform yourself of these procedures, which can be found on the Faculty local home page at: <https://ems.tcd.ie/local/>

Specific safety issues relating to the research laboratories will be explained to you before you commence any practical work. These will include information on chemical, biological, mechanical and fieldwork hazards. If you are unsure of any aspect of safety, it is your duty to ask questions until you fully understand the risks and the protections in place to mitigate them.

Fire drills are held regularly. On hearing a fire alarm you must listen to all instruction given and gather at the Assembly Point until you are permitted to return to the building. Do not bring your belongings or ignore the alarm. This may delay your exit from the building.

If you have any questions regarding Safety, Health or Welfare please contact the School Safety Officer, Ms Alison Boyce, at Zoosafe@tcd.ie

Illness/Disability

Issues regarding welfare and wellbeing are best brought to your tutor's attention or to the College Health Service. Students with a medical condition or disability that is likely to impair their performance in courses or examinations (e.g. asthma, dyslexia, etc.) are encouraged to inform the Comparative Biology Moderatorship Coordinator, in confidence. Please be aware of, and use where necessary, the various student support services in College.

Information relating to all support services is available at:

<http://www.tcd.ie/students/supports-services/> Medical certificates, LENS reports, etc. should be lodged, at the time of issue, with your Tutor, and copies submitted to the Executive Officer in the Zoology Department Office as appropriate.

Information on Discipline Procedures, Safety and Security

A copy of the review of the disciplines procedures will be given to you at the start of Semester 1. Detailed information about access and security, and the use of Zoology's facilities is provided in the document.

Also, please review the **Introduction to Zoology** presentation at:

<https://www.tcd.ie/Zoology/local/>

You must read the **General Information on Procedures, Safety and Security** document (also at: <https://www.tcd.ie/Zoology/local/>) and pay particular attention to the sections on Lone or Out of Hours working. Undergraduates must vacate the building before 9pm and are not permitted to use any laboratory facilities after 6pm, unsupervised. All projects must be risk assessed. In particular the possibility of afterhours work should be assessed and signed by your supervisor. You will find the Out of Hours Risk Assessment form on the local webpage.

Procedures are also in place for booking, cold rooms, incubators and histological equipment. Certain labs need to be reserved well in advance. Please look for booking forms on lab doors, equipment or ask your supervisor or a technical officer.

Ethics

In line with Trinity College Dublin's [Policy on Good Research Practice](#), all research in the School of Natural Sciences (SNS) should be conducted according to the overarching ethical principles of "respect for the individual subject or population, beneficence and the absence of maleficence (research should have the maximum benefit with minimal harm) and justice (all research subjects and populations should be treated fairly and equally)."

All individuals involved in research should facilitate and ensure research is conducted ethically. Ethical conduct in research is a shared responsibility. Primary responsibility rests with the Principal Investigator(s). Ethical responsibilities and legal obligations may overlap. All staff and students conducting research are required to ensure that their research is carried out in compliance with this policy. Ethical review is required before any studies involving human subjects, other living organisms and natural or man-made habitats commence. This requirement applies to staff, postgraduate and undergraduate students and volunteers/interns. Field- and laboratory work cannot commence until review has been completed and/or approval has been gained. STUDENTS PLANNING TO UNDERTAKE RESEARCH SHOULD COMPLETE THE [SNS Research Ethics Application](#).

For further details please follow this link: www.naturalscience.tcd.ie/research/ethics

TCD Science Societies

A number of societies run by students, and affiliated to the Central Societies Committee, cover interests relevant to students in Comparative Biology. These include the Zoological Society, the Environmental Society, the Genetical Society and the Biochemical Society. The Comparative Biology Programme is relatively new, inaugurated in 2010-2011, so no dedicated society exists. Students are encouraged to consider establishing a Comparative Biology Society.

Seminars

Attendance at the seminar series on Ecology and Evolution by visiting speakers is an obligatory part of the Research Comprehension Module (ZO4060). In addition you should watch noticeboards and emails for relevant seminars in Genetics and Neuroscience or other related Disciplines. Attendance at seminars is an excellent way to keep up-to-date with the latest research in the field of Comparative Biology

The Careers Service and Postgraduate Opportunities

You will need to spend some time this year planning your future. You will be reminded of the facilities offered by the Careers Service in the Introductory Week. Most staff members keep informed about careers in Comparative Biology and also may be able to help you.

The Zoology and Botany Discipline websites, <http://www.tcd.ie/Zoology> and <http://www.tcd.ie/Botany/> outline possibilities for postgraduate work in each area, while some information about postgraduate work elsewhere is to be found from the notices posted on the general notice board outside the Discipline offices and in the Careers Office.

Other information is available from the Graduate Studies Office
http://www.tcd.ie/Graduate_Studies/

In addition to TCD sites, there are possibilities further afield in the EU and the USA.

Look for example at www.cordis.lu for EU opportunities, and www.sciencecareers.org (general on jobs)

<http://educationusa.state.gov/faq.htm> (graduate education in the USA)

<http://www.erf.org/jobs/jobs.html> (specific lists of current jobs available in estuarine science) as examples of what's on offer in the USA. Note that for the latter, all graduate applicants have to take the Graduate Record Examination (www.greguide.com) and that this has to be done as early as November for some applications.

Some Important Dates in 2017-18

Semester 1 (Michaelmas Term) begins 25.09.17

Induction Week 25.09.16 – 29.09.17

Semester 1, Part 1

Lectures and Tutorials begin..... 02.10.17

Study Week - no lectures..... 06.11.16 – 10.11.17

Semester 1, Part 2 13.11.17

Semester 1 (Michaelmas Term) ends 15.12.17

2017

Semester 2 (Hilary Term) begins 15.01.18

Semester 2, Part 1

Lectures and Tutorials begin 15.01.18

Study Weeks - no lectures 26.02.17 – 02.03.18

Semester 2, Part 2 05.03.18

Semester 2 (Hilary Term) ends 06.04.18

Revision Period 09.04.17 – 27.04.18

Moderatorship Examinations begin to be announced



© School of Natural Sciences 2017