Science at Trinity

Faculty of Engineering, Mathematics and Science

TR060

Biological & Biomedical Sciences Junior Freshman Programme 2019 - 2020
This handbook applies to all students taking TR060 Science. It provides a guide to what is expected of you on this programme, and the academic and personal support available to you. Please retain 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 and the Science Course Office website (http://www.tcd.ie/Science). 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.

Produced by: The Science Course Office
Trinity College Dublin 2
Tel: +353 1 896 1970
Web Address: http://www.tcd.ie/Science/
Welcome to Science at Trinity

TR060: Biological and Biomedical Sciences introduction

Welcome to the Biological and Biomedical Sciences Stream at Trinity College Dublin.

In the Biological and Biomedical Stream students will study the core concepts that are fundamental to all biological systems. These will be presented in core modules during the first two years and will include: cell structure and composition, genetics, heredity and biological information, evolution, molecular biology, metabolism, anatomy and physiology of bacteria, fungi, plants and animals, ecosystems and environmental biology. Students will also study core concepts in chemistry with a focus on aspects that are essential for an understanding of how biological systems function and those that underpin biomedical science. Students will also acquire mathematical, statistical and computational skills that are relevant for the analysis of biological systems.

In addition, students have the opportunity both to expand their scientific knowledge and to pursue their individual interests by choosing from a cohort of approved modules on topics such as foundation physics, geoscience, history, philosophy and ethics of science, science education and communication, agriculture and biotechnology, infection and immunity, and behavior.

In the third year, students specialize in one of the 11 moderatorships offered in this stream: Biochemistry; Botany; Environmental Science; Genetics; Human Genetics; Immunology; Microbiology; Molecular Medicine; Neuroscience; Physiology; Zoology. The fundamental concepts of that discipline will be presented in core modules while students will also select from a cohort of approved modules from allied disciplines that enhance understanding of their chosen discipline and encourage interdisciplinary thinking and research. Students can also experience the wide range of knowledge and investigation available throughout the university by choosing an elective module from a cohort that highlights major research themes from across all faculties.

In the fourth year students choose from a selection of modules on advanced topics within their discipline. They will also undertake a Capstone project in Trinity College or in a research laboratory in another university, research institute or hospital. Throughout this program, students will also acquire skills in problem solving and data handling and in oral and written communication.

This program of science education is designed to foster and develop a student’s capability for independent thought and effective communication, an ability to continue their education independently and to act in a responsible manner. These attributes are a preparation for a career in science and medicine (e.g. in research, biotechnology, pharmaceutical industry, further medical training); for a career in related areas where a scientific education is beneficial (e.g. patent law, forensic science, journalism) and for careers in areas such as education, management, business, industry, communication and policy making.

Professor Kevin Devine
Director, TR060 Biological and Biomedical Sciences Course
TR060 Biological and Biomedical Sciences overview and module selection

Students entering Science must attend orientation presentations and module registration on Monday 2nd September 2019. The following presentations will take place in the MacNeil Theatre Hamilton Building on Monday 2nd September 2019:

13.30 - 13.40    Prof. Aine Kelly, Associate Dean of Undergraduate Science Education (ADUSE)
13.40 - 13.50    Prof Kevin Devine, Director TR060: Biological and Biomedical Sciences

Students should return to the Hamilton atrium where they will meet with an academic who will advise on module choices.
At the module registration session, students will be provided with:
• The TR060 Junior Freshman Programme 2019/20 (first year);
• A module choice form to complete, following advice from an academic adviser.

On completion of the module choice, students will meet their S2S (Student to Student) Mentor Groups who will assist with your integration into college and address any queries you may have.

MODULE SELECTION

Students must take 40 core credit modules (20 per semester) as follows:

BYU11101    From Molecules to Cells
BYU11102    From Organisms to Ecosystems
CHU11B01    Chemistry for Life Sciences
MAU11002    Mathematics, Statistics, and Computation 2

Students will choose approved modules to the value of 20 credits (10 per semester) from the following:

GSU11004    Spaceship Earth: An Introduction to Earth Systems Science
GSU11005    Introduction to Geology: A Beginners Guide to Planet Earth
* PYU11F10  Foundation Physics for Life and Earth Sciences 1
* PYU11F20  Foundation Physics for Life and Earth Sciences 2
* SEU10001  Science Education and Communication 1
* SEU10002  Science Education and Communication 2

* Foundation Physics and Science Education modules may be taken in either semester one or semester two but cannot be taken in both
Semester structure

TR060: BIOLOGICAL AND BIOMEDICAL SCIENCES

CORE MODULES (mandatory) – 20 credits per semester

<table>
<thead>
<tr>
<th>SEMESTER 1 – Michaelmas term (9th September – 29th November)</th>
<th>SEMESTER 2 – Hilary Term (20th January – 10th April)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYU11101: From Molecules to Cells (10 credits)</td>
<td>BYU11102: From Organisms to Ecosystems (10 credits)</td>
</tr>
<tr>
<td>CHU11B01: Chemistry for Life Sciences (10 credits)</td>
<td>MAU11002: Mathematics, Statistics and Computation (10 credits)</td>
</tr>
</tbody>
</table>

APPROVED MODULES (optional): Students choose 10 credits from each semester

<table>
<thead>
<tr>
<th>BYU11104: Spaceship Earth: An introduction to Earth System Science (10 credits)</th>
<th>GSU11005: Introduction to Intro to Geology: A beginners guide to Planet Earth (10 credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PYU11F10: Foundation Physics for Life and Earth Scientists 1 (10 credits)</td>
<td>PYU11F20: Foundation Physics for Life and Earth Scientists 2 (10 credits)</td>
</tr>
<tr>
<td>SEU10001: Science Education and Communication 1 (10 credits)</td>
<td>SEU10002: Science Education and Communication 2 (10 credits)</td>
</tr>
</tbody>
</table>

Moderatorships

In the Junior and Senior Freshman years TR060 students complete a course of study which will qualify them to compete for a places in one of the following Moderatorships after the Senior Freshman year:

- Biochemistry
- Botany
- Environmental Sciences
- Genetics
- Human Genetics,
- Immunology
- Microbiology
- Molecular Medicine
- Neuroscience
- Physiology
- Zoology
Faculty of Engineering Mathematics and Science
TR060: Biological and Biomedical Sciences
Junior Freshman module choice form – September 2019

Following the introductory session in the MACNEIL lecture theatre, Hamilton on Monday 3rd September 2019, students will be required to submit this module choice form to the Science Course Office by 12.00 noon on Tuesday 3rd September 2019.

BLOCK CAPITALS PLEASE

Name: ____________________________  CAO No: ____________________________

Date: ____________________________  Student No: ____________________________

LEAVING CERTIFICATE/A LEVEL

Please enter below the grades obtained for subjects taken

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>LC (H)</th>
<th>LC (O)</th>
<th>A Level</th>
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<tbody>
<tr>
<td>Biology</td>
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<tr>
<td>Chemistry</td>
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<tr>
<td>Physics</td>
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<tr>
<td>Physics/Chemistry</td>
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<tr>
<td>Mathematics</td>
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<tr>
<td>Applied Maths</td>
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<tr>
<td>Geology</td>
<td></td>
<td></td>
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<tr>
<td>Agricultural Sc.</td>
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</table>

PTO
SECTION C: JUNIOR FRESHMAN MODULES FOR 2019/20

(To be completed with help of Adviser)

Please tick appropriate box

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Title</th>
<th>Semester</th>
<th>Credits</th>
<th>Tick Box</th>
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<tbody>
<tr>
<td>BYU11101</td>
<td>From Molecules to Cells</td>
<td>1</td>
<td>10</td>
<td>MANDATORY</td>
</tr>
<tr>
<td>BYU11102</td>
<td>From Organisms to Ecosystems</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>CHU11B01</td>
<td>Chemistry for Life Sciences</td>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>MAU11002</td>
<td>Mathematics, Statistics and Computation</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**Core modules – 20 credits per semester**

**Approved modules – 10 credits per semester**

Availability of approved modules is subject to student numbers

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Title</th>
<th>Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSU11001A</td>
<td>Spaceship Earth: An Introduction to Earth Systems Science</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>GSU11002A</td>
<td>Introduction to Geology: A Beginners Guide to Planet Earth</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>* PYU11F10</td>
<td>Foundation Physics for Life and Earth Sciences 1</td>
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<tr>
<td>* PYU11F20</td>
<td>Foundation Physics for Life and Earth Sciences 2</td>
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<tr>
<td>* SEU10001</td>
<td>Science Education and Communication 1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>* SEU10002</td>
<td>Science Education and Communication 2</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

*PYU11F10/20 may be taken in either semester one OR semester two - cannot be taken in both

*SEU10001/2 may be taken in either semester one OR semester two - cannot be taken in both

Total Credits: 30 per semester (20 core and 10 approved)

Signature of advisor: ____________________________________________

Signature of student: ____________________________________________

Date: __________________________________________________________
Change of Approved Modules

If you feel that you have perhaps made the wrong choice of approved module, please seek advice immediately from your Tutor, Course Director or the Science Course Office. It may be possible for you to change from one module to another within Science, subject to permission from the Associate Dean of Undergraduate Science Education. If you do decide to change modules, then do so quickly - it can be difficult to try to catch up with work in a new module if you have missed more than two or three weeks of lectures. You should call into the Science Course Office if you wish to change modules.

College registration

You will complete College registration online via the website my.tcd.ie. Registration will open in August on a course by course basis. A communication will be sent to the e-mail address you supplied during the application process inviting you to log in to the Academic Registry website to register. Please check your TCD email address regularly. We will only send e-mails to a valid TCD e-mail address.

All information regarding College registration is available at the following link: http://www.tcd.ie/academicregistry/registration/

Please Note: Students who have already accessed the my.tcd.ie website should continue to access it using your current username and password as this will not change. For those who have not previously logged on, a username and password has been created to give you immediate access.
Module learning aim:
This module aims to provide an introduction to molecular and cellular biology, and will therefore include key topics in Cell Biology, Biochemistry, Genetics, and Microbiology. A description of the possible origin of life, from the abiotic world to single-celled and multicellular organisms will be given, and the ultrastructure of the prokaryotic and eukaryotic cells will be covered in detail. The properties and functions of the major classes of biochemicals found in living systems (carbohydrates, lipids, proteins and nucleic acids) will be described, the structure and function of membranes and organelles, and the chemical basis of metabolism and energy transfer in the cell. Students will then be introduced to basic concepts in Genetics, how the information contained in DNA (genes) is expressed, replicated and inherited. Finally, the sheer diversity of life forms, from viruses to prokaryotic and eukaryotic microorganisms, to more complex plant and animal life forms will be described. Students will also study cell and virus structure, cell growth and viral replication, agents of infectious diseases, and host immunity.

Learning outcomes:
On successful completion of the module, students will be able to:
1. Provide an account of the cellular basis of life: from its origins in the abiotic world, to the evolution of unicellular and multicellular organisms.
2. Describe the diversity of life forms: including viruses, Prokaryotes (bacteria), Archaea, and Eukaryotes (unicellular organisms, animals and plants).
3. Provide an account of the chemical basis of life and the biochemistry on which living systems depend: the properties and functions of the major classes of biomolecules, the structure and function of membranes and organelles, and the chemical basis of metabolism and energy transfer.
4. Describe how the information contained in DNA (genes) directs the construction and growth of an organism, and how this information is replicated and transmitted from one generation to the next (inheritance; genetics).
5. Employ a range of laboratory techniques, demonstrating the development of practical scientific skills, knowledge of experimental design and the interpretation of results.
6. Apply the scientific method as a fundamental approach to experiment-based investigations, critical analysis of data, and problem solving.
Module content:

Lectures | Topic and Content
---|---
**Lecture 1** | Lecture 1: Module: Introduction, objectives and overview.  
**Module Coordinator** (Professor Tony Kavanagh)

**Lectures** | Section 1: Origin of Life - Cellular basis of life - Diversity of Life Forms:
---|---
**Lecture 2 and 3**: Origin of Life (Professor Luke O’Neill)  
- What is Life? How did it arise?  
- The Origin of Life from a chemical and cellular perspective. The abiotic world  
- The prebiotic world. Miller-Urey experiment. The first cell  
- Photosynthesis and oxygen – mass extinction. Origin of first eukaryotic cell  
- Multicellular life. Cell specialization

**Lecture 4 – 6**: Cellular basis of life (Professor Fred Sheedy)  
- Cell structure – Prokaryotes, Archaea, Eukaryotes - Animal and Plant  
- Organelles & their prokaryotic origin – Mitochondria, Chloroplasts  
- Mitosis and Meiosis – Cell division – Regulation of cell division (introduction)

**Lecture 7 – 12**: Diversity of Microbial Life (Professor Alastair Fleming)  
**Lecture 7- The Tree of Life** (Professor Alastair Fleming)  
**Lecture 8 - Bacteria** (Professor Alastair Fleming)  
- Cell structure, morphology, function and habitat.

**Lecture 9- Fungi & Protists** (Professor Alastair Fleming)  
- Fungal cell structure, morphology, function and habitat.

**Lecture 10- The Archaea** (Professor Alastair Fleming)  
- A third way of life; features of both prokaryotes and eukaryotes: cell structure, morphology and function. Extremophiles

**Lecture 11-Viruses** (Professor Alastair Fleming)  
- Alive? Structure, function and habitat

**Lecture 12 – Relationship between life forms**: (Professor Alastair Fleming)  
- The good, the bad and the ugly. Concepts of Symbiosis and Parasites. Plant and animal diseases

**Lectures** | Lecture 13: Summary of key concepts: Q&A Profs. LO’N, FS, AF  
---|---
**13** | ONLINE ASSESSMENT via MCQ

**Section 2**: Chemistry of Life:

**Lectures** | Structural principles for small molecules (Professor Luke O’Neill)  
---|---
- Elements and chemical groups commonly found in Nature  
- Bonds, bond energies, bond lengths in Nature  
- Asymmetry: right and left-handed molecules etc.  
- Typical forces between molecules and chemical groups in nature  
- Four basic classes of Biomolecules: Amino acids, Nucleotides, Carbohydrates & Lipids

**Lecture 15: Nucleotides, Amino acids and peptides** (Professor Luke O’Neill)  
- Classes of nucleic acids (DNA, RNA), Chromatin and chromosome structure, Properties of amino acids: chemical features and physical properties of the R-groups  
- The peptide unit and peptide bond  
- Introduction to polypeptides & concept of folding

**Lecture 16: Proteins and protein structure** (Professor Luke O’Neill)  
- Concept that shape dictates function  
- Hierarchical organization of protein structure: concept of primary, secondary, tertiary and quaternary structure.
- Introduction to forces that stabilize protein structure

**Lecture 17: Protein function** (Professor Luke O’Neill)
- Major functional classes of protein
- Introduction to bioinformatics: Proteins and evolution; relationships between proteins: similarity and identity.

**Lecture 18 and 19: Enzymes: the catalysts of life** (Professor Vincent Kelly)
- Enzyme structure & function
- Enzyme reaction mechanism (co-factors and vitamins)
- Enzyme kinetics
- Regulation of enzyme activity

**Lecture 20: Lipids and membranes** (Professor Vincent Kelly)
- Lipid structures: fatty acids, phospholipids etc
- Membranes: chemical and physical properties
- Membrane proteins
- Transport across membranes
- Concept of compartmentation and membrane traffic

**Lecture 21 and 22: Metabolism & major metabolic pathways** (Professor Vincent Kelly)
- The starting point: introduction to carbohydrates and fatty acids
- Organization, energetic principles, key steps and links between the main metabolic pathways.
- Glycolysis, TCA cycle, beta oxidation
- Outline of the reversing catabolic pathways: gluconeogenesis and fatty acids synthesis.

**Lecture 23: Mitochondria & Respiration** (Professor Vincent Kelly)
- Mitochondria, redox reactions and energy transduction
- Electron transport and the electron transport chain
- Oxidative phosphorylation
- Coupling of oxidation to phosphorylation: chemiosmotic view of energy transduction (in brief).

**Lecture 24: Chloroplasts and Photosynthesis** (Professor Vincent Kelly)
- Chloroplasts: architecture and function
- Overview of the light and dark reactions of photosynthesis

**Lecture 25: Summary of key concepts: Q&A Profs. LO’N, VK**

ONLINE ASSESSMENT via MCQ

**Lecture 26: Introduction to Genetics** (Professor Jane Farrar)
- Introduction to the course content: An outline of some core concepts from classical genetics to the present will be presented. A whistle stop tour of key discoveries in the history of genetics.

**Lecture 27: Mendelian Genetics** (Professor Jane Farrar)
- Mendel’s laws: the 1st law of segregation and the 2nd law of independent assortment using monohybrid and dihybrid crosses; concepts relating to genetic analysis and the use of model systems will be described. Inheritance patterns for single gene disorders will be presented - pedigree analysis.

**Lecture 28 and 29: Linkage and recombination** (Professor Jane Farrar)
- Meiosis and the role of ‘crossing over’ in gene mapping (meiosis covered in detail elsewhere). A brief recap regarding Mendelian genetics – for example, highlighting that genetic linkage breaks Mendel’s 2nd law of independent assortment (refer back to L27)
- Outline of key concepts underlying the generation of genetic maps. Reference will be made to some classical work by Sturtevant / Morgan.
Lecture 30: Identification of DNA as hereditary material  (Professor Jane Farrar)
- Key experiments establishing DNA as the genetic material; bacterial transformation and its significance (Griffith / Avery, McLeod & McCarthy / Hershey-Chase); the concept of horizontal gene transfer (mechanisms transformation, conjugation, transduction).
- Differences in vertical and horizontal gene transfer.

Lecture 31: Quantitative Genetics  (Professor Jane Farrar)
- An overview of some concepts relating to discrete variation versus continuous variation.
- Experiments demonstrating that quantitative traits are inherited.
- Examples of some quantitative traits in humans. Concepts regarding the use of GWAS to elucidate the genetics architecture of complex traits using an example of one or more disorders.

Lecture 32: DNA, Structure and Function  (Professor Tony Kavanagh)
- The double helix - discovery of the structure of DNA – DNA composition - DNA replication – semi-conservative replication, replication forks, leading and lagging strand synthesis, DNA polymerases
- DNA replication in prokaryotes and eukaryotes.

Lecture 33 - 35: Information flow in the cell - The Central Dogma  (Professor -Tony Kavanagh).
- Transcription, RNA Polymerases in prokaryotes and eukaryotes.
- Promoters, repressors, terminators – the lac operon; transcription factors, enhancers.
- Decoding the information in mRNA:
- Translation (Protein synthesis).
- Ribosomes in prokaryotes and eukaryotes, tRNAs and aminoacyl tRNA synthetases, the genetic code; translation;
- Introduction to the regulation of gene expression – positive and negative regulation

Lecture 36: DNA –Mutation and its consequences  (Professor Tony Kavanagh)
- Mechanisms by which mutations are generated - including errors in DNA replication; the action of chemical and physical mutagens; and errors in chromosome construction and distribution.
- An outline of the different types of mutation (missense, nonsense, frameshift mutations) and their molecular consequences in relation to gene expression and protein function. Mutations causing inherited diseases and cancer.
- DNA repair – mechanisms of DNA repair; repair deficiency and disease.

Lecture 37: Summary of key concepts: Q&A Profs. JF, KD
Lecture 38: Module: overview and objectives.

Module Coordinator  (Professor Tony Kavanagh)

Recommended reading lists:

(1) Campbell Biology, 11th Edition By Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece (Published by Pearson (2019))

Contact Hours/Methods of Teaching and Student Learning.

65 hours consisting of a mixture of lectures, tutorials and hands-on laboratory practicals. The practical sessions are formatted in order to further clarify concepts thus reinforcing learning. A tutorial problem solving activities provides an additional opportunity for the lecturer to assess understanding and gauge the knowledge level of the students.
Method of assessment

**Continuous assessment 50%**
- Laboratory practical assessment: 35%
- Online Assessment via multiple choice questions (MCQ) 15%: there will be three MCQ online assessments, each worth 5%

**Written Examination 50%**
One written examination paper of 1.5 hour duration.
There will be three sections on the examination paper:
- Section 1 will have 2 questions on Pod 1 (Origin of Life) you are required to answer 1 question from this section
- Section 2 will have 2 questions on Pod 2 (Chemistry of Life) you are required to answer 1 question from this section
- Section 3 will have 2 questions on Pod 3 (Biological Information) you are required to answer 1 question from this section
- All questions carry equal marks
Module learning aim:
The Organisms to Ecosystems module aims to introduce students to the biology of individuals, species, populations and ecosystems, and explore how humans interact with other living organisms. It will cover the developmental biology of organisms, their physiology, brain function and the evolutionary and ecological responses of organisms to their environment. Topics incorporate the diversity of life and its biological development, interactions between organisms and their environment, the biological context of climate change, human impacts on the environment, future food sustainability, urban ecology, ecosystem services and the value and conservation of biodiversity. Topics are arranged in three sections: 1) Multicellularity and Development, Physiology, Behaviour and Neuroscience, 2) Evolution: Adaptation, Populations and Biodiversity, and 3) Ecology and Environment.

A mixture of lectures, tutorials and hands-on laboratory practicals are used in the delivery of this module. There will be one - ecology practical - on a field site outside of campus. Essay writing skills are developed through tutorial sessions.

Learning outcomes
On successful completion of this course, the student will be able to:
1. Outline the major steps involved in how complex animal and plants are formed and be able to relate the morphological changes that occur to the molecular and cellular changes that underlie and drive embryo and organ development
2. Describe the concept of homeostasis at the cell, organ and organism level; give examples of the functional interrelationships that exist between cells, organs and systems; provide an account of how organisms can sense change in the environment
3. Describe the basic principles by which the brain functions and outline key experimental steps and informative clinical cases that have elucidated our current understanding of brain function.
4. Recognise the diversity of life on earth and describe how it evolved over geological time scales
5. Describe the ecological relationships between individuals, populations, communities and ecosystems, and between organisms and their environment
6. Recognise how humans can positively and negatively influence other living organisms and their environment and understand the value of other living organisms for humans
7. Demonstrate practical, numerical and analytical skills
8. Collate, synthesise, organise and present information in written reports
## Module content:

### Lectures

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Topic and Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Module: Introduction, objectives and overview.</td>
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**Module Coordinator Professor Trevor Hodkinson**

### Section 1A: Multicellularity and Development (Professor Rebecca Rolfe)

<table>
<thead>
<tr>
<th>Lecture</th>
<th>5 lectures</th>
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<tbody>
<tr>
<td>2</td>
<td>Introduction to development</td>
</tr>
<tr>
<td>3</td>
<td>Embryogenesis and morphogenesis</td>
</tr>
<tr>
<td>4</td>
<td>Intercellular communication, determination, potency, axis formation</td>
</tr>
<tr>
<td>5</td>
<td>Pattern formation</td>
</tr>
<tr>
<td>6</td>
<td>Differential gene expression</td>
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### Section 1B: Physiology (Professor Áine Kelly)

<table>
<thead>
<tr>
<th>Lecture</th>
<th>6 lectures</th>
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<tbody>
<tr>
<td>7</td>
<td>Form and Function</td>
</tr>
<tr>
<td>8</td>
<td>Homeostasis.</td>
</tr>
<tr>
<td>9</td>
<td>Physiological regulation of function.</td>
</tr>
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</table>

### Section 1C: Physiology (Professor Tomas Ryan)

<table>
<thead>
<tr>
<th>Lecture</th>
<th>6 lectures</th>
</tr>
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<tbody>
<tr>
<td>10</td>
<td>Pre-neuroscience history of mind/brain ideas</td>
</tr>
<tr>
<td>11</td>
<td>Fundamentals of nervous system structure and function</td>
</tr>
<tr>
<td>12</td>
<td>Introduction to the biology of memory storage</td>
</tr>
</tbody>
</table>

### Lecture 13

| Lecture  | Summary of key concepts: Q&A Profs. Rolfe, Kelly and Ryan |

**ONLINE ASSESSMENT via MCQ**

### Section 2: Evolution: adaptation, populations, biodiversity (Professor Trevor Hodkinson)

<table>
<thead>
<tr>
<th>Lecture</th>
<th>2 lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Short history of life</td>
</tr>
</tbody>
</table>

- timeline, major groups, diversity.
Lecture 15 - Selection/modern synthesis
- adaptation

Lecture 16 - Species
- Definitions, taxonomy, diversity, species rich groups

Lecture 17 - Speciation
- allopatric, sympatric, adaptation, radiations, key innovations

Lecture 18 – Extinction
- fossils, global change (climate, atmosphere, tectonic)

Lecture 19 - Phylogeny, homology, convergence, reversals, methods

Lecture 20 - Genetic basis of selection (Professor Aoife McLysaght)

Lecture 21 - Genetic basis of evolution
- Molecular variation, neutral theory, drift

Lecture 22 - Genetic basis of evolution
- Molecular evolution of population genetic variation

Lecture 23 - Genetic basis of evolution
- Population genetic variations

Lecture 24 - Human evolution

Lecture 25 - Summary of key concepts: Q&A Prof. Hodkinson & McLysaght

ONLINE ASSESSMENT via MCQ

Section 3: Ecology and Environment (Professor Jennifer McElwain & Professor Yvonne Buckley)

Global ecology (Professor Jennifer McElwain)

Lecture 26 - Global ecology and climate change
- Future climate change – global challenges – projections
- Pest diseases, human physiology, how to predict
- Need to understand fundamentals of ecology to address these global challenges

Lecture 27 - Biomes, niches
- Introduction to biomes, what shapes biome distribution? climate change
- concepts – climate niches / fundamental versus realized niche
- challenge of predicting future ecological responses to climate change

Populations to communities: challenges & solutions (Professor Yvonne Buckley)

Lecture 28 - Commonness, rarity and population processes (Professor Yvonne Buckley)
- Extinction or persistence are processes that operate at the population level.
- Introduction to concepts of abundance and rarity, competition, dispersal, demography and its application to conservation (incl. endemism and invasions)

Lecture 29 - Conservation
- applications of population biology at the species level, including prioritizing species for conservation management, assessing threat and red listing

Lecture 30 - Trophic cascades and rewilding
- What is a community, energy flow, applications of community ecology to conservation and rewilding challenges. Consumption, facilitation & predation

Lecture 31 - Constructing ecosystems and conservation
- In the Anthropocene humans have constructed new ecosystems, what are they, where do we find them and what are their values? Contrast with “natural” ecosystems

Lecture 32 - Urban ecology
- how have organisms adapted to living in urban environments? How can we better design our cities and buildings to gain more value from nature and support biodiversity?
Lecture 33 - Ecosystem services and natural capital
- Nature provides many valuable ecosystem services supported by natural capital
- Introduction to the concepts and controversies surrounding the ecosystem services and natural capital concepts

Food and feedbacks (Professor Jennifer McElwain)

Lecture 34 - Food: environmental impacts and ecological process
- Food security- ecological concepts- productivity- energy flows through ecological systems/basic concepts of biogeochemical cycles.

Lecture 35 - Future food and a changing planet
- Food security
- Ecological concepts, human population increase, projections for future productivity.

Lecture 36 - Biosphere feedbacks on climate system
- Introduction to biological feedbacks on the climate system: at global level
- Carbon sequestration/ transpiration/ water budget, within biomes
- Fire feedbacks/rain seeding. Nature based solutions to climate mitigation and adaptation
- Green and blue solutions – cities etc., ‘The Martian’ closed systems

Lecture 37 - Summary of key concepts: Q&A

Lecture 38 - Module: Overview and integration of all concepts

Module Coordinator - Trevor Hodkinson

Recommended reading lists:
(1) Campbell Biology, 11th Edition By Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece (Published by Pearson (2019))

Contact Hours/Methods of Teaching and Student learning.
65 hours consisting of a mixture of lectures, tutorials and hands-on laboratory practicals. The practical sessions are formatted in order to further clarify concepts thus reinforcing learning. A tutorial problem solving activities provides an additional opportunity for the lecturer to assess understanding and gauge the knowledge level of the students.

Method of assessment
Continuous assessment 50%
- Laboratory practical assessment: 35%
- Online Assessment via multiple choice questions (MCQ) 15%: there will be three MCQ online assessments, each worth 5%

Written Examination 50%
One written examination paper of 1.5 hour duration
There will be three sections on the examination paper:
- Section 1 will have 2 questions on Section 1 (Multicellularity and Development; and Physiology) you are required to answer 1 question from this section
- Section 2 will have 2 questions on Section 2 (Evolution: adaptation, populations, biodiversity) you are required to answer 1 question from this section
- Section 3 will have 2 questions on Section 3 (Ecology and Environment) you are required to answer 1 question from this section
- All questions carry equal marks
Contacts:

**Course Director TR060: Biological and Biomedical Sciences:**  
Professor Kevin Devine  
E-mail: kdevine@tcd.ie  
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**Freshman Biology Teaching Coordinator:**  
Dr. Glynis Robinson  
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**Executive Officer:**  
E-mail: BTC.Administrator@tcd.ie  
Phone: 01 896 1117
CHU11B01: Chemistry for Life Sciences

Semester 1, 10 credits

Module learning aim:
To provide an introduction to aspects of chemistry which are essential to an understanding of the operation of living systems and the chemical technology of medicine.

Learning Outcomes:
On successful completion of the module, students will be able to:
1. Explain, using appropriate terminology and physical units, basic concepts in chemistry, including precipitation and redox reactions.
2. Analyse bonding and molecular structure, hybridisation and mechanisms.
3. Explain the concepts of entropy and free energy and the control of chemical and biochemical reactions by free energy changes.
4. Explain the concept of equilibrium and factors affecting the position of equilibrium;
5. Demonstrate understanding of acid-base, buffers and electrochemistry.
6. Explain the factors which influence the rate of a reaction and the concepts of order of reaction.
7. Describe and explain the chemistry of oxygen based functional groups.
8. Recall the structure and properties of the major types of biological organic molecules, and be able to describe the relationships between structure, properties and functions.
9. Describe organic reaction mechanisms that impact on biochemical processes.

Module content:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic and description</th>
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<tbody>
<tr>
<td>1-3</td>
<td><strong>Introduction to chemistry: The atom, chemical bonding and chemical reactions</strong></td>
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<tr>
<td>9 Lectures</td>
<td>Structure and building principles of atoms; element symbols; masses and the mole; introduction to the periodic table; brief introduction into the structure of the electron shell</td>
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<tr>
<td></td>
<td>Atoms, Molecules, and Ions.</td>
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<td>Isotopes and radionuclides in medicinal chemistry.</td>
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<td>Bonding in chemical substances – lengths, angles and rotation</td>
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<td>Ionic bonding; covalent bonding; weak bonding; molecules and solid state structures; electronegativity; the periodic table.</td>
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<td>Hybridization</td>
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<td>Chemical reactions; symbolizing reactions; balancing equations;</td>
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<td>Solutions, concentrations and dilutions</td>
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<td>limiting reagents and yields; role of water in chemical reactions; important classes of chemical reactions</td>
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<tr>
<td></td>
<td>Oxidation and reduction reactions, electron transfer; oxidizing and reducing agents; half-equations.</td>
</tr>
</tbody>
</table>
4-9
(14 Lectures)
- Chemical energetics, thermodynamics and chemical equilibria (8 L)
- Ionic equilibria (1 L)
- Acids, bases buffers (2 L)

Week 7 – study week
- Kinetics (1 L) and 1st order law
- Electrochemistry (2 L)

10-12
(10 Lectures)
- Nomenclature of carbon chains, simple hydrocarbons and aromatics
- Oxygen based functional groups; hydroxyls, aldehydes, ketones, carboxylic acids, esters
- Sugars, aminoacids and peptides.
- Lipids and nucleic acids
- Introduction to substitution, addition, elimination, condensation and hydrolysis reactions.

13
Student Revision/Study week – tutorials only

14
Student Assessments

Reading list/ Indicative Resources
- Organic Chemistry, by Jonathan Clayden and Nick Greeves; Publisher: OUP Oxford; 2 ed.
- Chemistry & Chemical Reactivity Hardcover by Paul Treichel, John Kotz, John Townsend, David Treichel; Publisher: Brooks Cole; 9 ed.

Methods of Teaching and Student Learning
A mixture of lectures, tutorials and hands-on laboratory practicals are used in the delivery of this module. The practical sessions are formatted in order to further clarify concepts thus reinforcing learning.

Methods of Assessment CHU11B01
- Laboratory and in course assessment: 25% of Final Grade
- Examination: 75% of Final Grade

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Phone: 01 896 1726
MAU11002: Mathematics, Statistics and Computation

Semester 2, 10 credits

Module learning aim:
This module provides an introduction to the application of computers to mathematical calculation. Exercises could include ideas from calculus (graphing, Newton's method, numerical integration via trapezoidal rule and Simpson's rule) and linear algebra. We will make use for the computational software Mathematica which is used in many scientific applications.

- Numbers. An introduction to numbers and number systems e.g. binary, octal and hexadecimal numbers and algorithms for converting between them.

Module learning outcome
On successful completion of this module students will be able to
- Manipulate vectors to perform algebraic operations on them such as dot products and orthogonal projections and apply vector concepts to manipulate lines and planes in space $\mathbb{R}^3$ or in $\mathbb{R}^n$ with $n \geq 4$.
- Use Gaussian elimination techniques to solve systems of linear equations, find inverses of matrices and solve problems which can be reduced to such systems of linear equations.
- Manipulate matrices algebraically and use concepts related to matrices such as invertibility, symmetry, triangularity, nilpotence.
- Manipulate numbers in different bases and explain the usefulness of the ideas in computing.
- Use computer algebra and spreadsheets for elementary applications.
- Explain basic ideas relating to functions of a single variable and their graphs such as limits, continuity, invertibility, even/odd, differentiability and solve basic problems involving these concepts.
- Give basic properties and compute with a range of rational and standard transcendental functions, for instance to find derivatives, antiderivatives, critical points and to identify key features of their graphs.
- Use a range of basic techniques of integration to find definite and indefinite integrals.
- Apply techniques from calculus to a variety of applied problems.

Module content
The module is divided into a maths and a statistics part, with maths further divided into calculus and linear algebra/discrete mathematics.

**Mathematics:**
a) Calculus:
3 lectures plus one tutorial per week. The syllabus is largely based on the text book [Stewart-Day], and will cover most of Chapters 1-6 along with the beginning of Chapter 7 on differential equations:
- Functions and graphs. Lines, polynomials, rational functions, exponential and logarithmic functions, trigonometric functions and the unit circle.
- Limits, continuity, average rate of change, first principles definition of derivative, basic rules for differentiation
- Graphical interpretation of derivatives, optimization problems
- Exponential and log functions. Growth and decay applications, semilog and log-log plots.
- Integration (definite and indefinite). Techniques of substitution and integration by parts. Applications.
• Differential equations and initial value problems, solving first order linear equations. 
Applications in biology or ecology.
b) Linear algebra/discrete mathematics:
1 lecture and 1 tutorial per week. The syllabus will cover parts of chapter 1 on sequences, limits of 
sequences and difference equations and then chapter 8 of [Stewart-Day] on linear algebra.
The syllabus is approximately:
• Sequences, limits of sequences, difference equations, discrete time models
• Vectors and matrices, matrix algebra
• Inverse matrices, determinants
• Systems of difference equations, systems of linear equations, eigenvalues and eigenvectors.
  Leslie matrices, matrix models

Statistics:
There will be 1 lecture per week and 1 computer practical. The syllabus will cover much of chapters 
11-13 of [Stewart-Day] and use [Bekerman-et-al] as main reference for R in the computer practicals.
The syllabus is approximately:
• Numerical and Graphical Descriptions of Data
• Relationships and linear regression
• Populations, Samples and Inference
• Probability, Conditional Probability and Bayes’ Rule
• Discrete and Continuous Random Variables
• The Sampling Distribution
• Confidence Intervals
• Hypothesis Testing

Recommended reading lists:
  Stewart and Troy Davis, Cengage Learning (2016)
• [Beckerman-et-al] Getting Started with R: An Introduction for Biologists (2nd Ed). Beckerman, 
  Childs and Petchy, Oxford University Press.

Methods of Teaching and Student Learning
11 weeks; 8 hours per week, including 5 lectures, 2 tutorials and 1 computer practical.
• 1 or 2 lecturers from the school of mathematics
• 1 lecturer from the department of statistic
• teaching assistants/demonstrators for tutorial groups and practicals
4 lectures + 2 tutorials per week will be covered by the school of maths;
1 lecture + 1 computer practical per week will be covered by the department of statistics
Methods of Assessment

- 70 percent of the mark will come from the maths component with 50 percent from a 2 hour end of semester exam and 20 percent based on continuous assessment (tutorials)
- 30 percent of the mark will come from the statistics component, consisting of group assessment (1-3 students working together on a data analysis project during the last weeks of teaching term)
- Supplementals, if required, will consist of a 2 hour exam for the maths component which contributes 70 percent of the mark and another data analysis project (of the same format as during teaching term) for the statistics component

Mathematics Course Director:
Professor Stefan Sint
E-mail: sint@maths.tcd.ie
Phone: 01 896 8559

General enquiries:
E-mail: mathdep@maths.tcd.ie
Phone: 01 896 1949
TR060 Biological and Biomedical Sciences - Approved Modules

GSU11004: Spaceship Earth: An introduction to Earth System Science
Semester 1, 10 credits

More than 7 billion people now inhabit the Earth and no corner of the planet is unaffected by human activity. The rise of our species has been fuelled by our ability to access planetary storehouses of energy and employ this to manipulate the environments around us. The global-scale of human impacts has led some to suggest we are entering a new era of Earth history - the Anthropocene. Dealing with the effects of environmental and climate change is one of the most significant challenge that our species faces in the 21st century.

This module provides a foundation for understanding global environmental issues by considering the Earth as an interconnected system in which matter and energy are exchanged between the Geosphere, Biosphere, Atmosphere, Hydrosphere and the Anthroposphere. It considers the life-support systems of ‘spaceship Earth’ and aims to provide a theoretical basis for evaluating the role of humans as agents of climate and environmental change.

Module learning aims
To provide foundation-level knowledge of:
- Fundamental concepts of Earth systems science and the theoretical basis of the ‘systems approach’ in Geography and Geoscience
- Character and scope of Earth’s principal sub-systems: Geosphere, Hydrosphere, Atmosphere, Biosphere and Anthroposphere
- Composition / structure of the solid Earth (Geosphere) and the principal processes / drivers responsible for its formation and evolution
- Composition / structure of atmosphere and ocean, the physical processes / drivers of their circulation, and the nature of coupling between them
- Weather and climate at a global scale including climate change past, present and future
- Biogeochemical cycling and the role of interconnected biotic and abiotic systems in the maintenance of life on Earth
- Ecological and historical biogeography including fundamentals of ecology, evolution and extinction
- Nature and scope of human impacts on the Earth system including the ‘Anthropocene’ concept

To develop the following skills & graduate attributes
- Digital skills to manipulate and analyse geographical data, including use of Google Earth and Excel
- Self-motivated and reflective approach to independent learning, including completion of assigned reading, activities and formative assessment
- Make connections between a student’s core subject areas and the field of geography & geoscience
<table>
<thead>
<tr>
<th>Week 1</th>
<th>Topic and Description</th>
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<tbody>
<tr>
<td>Lecture 1:</td>
<td><strong>Introduction to Earth System Science: What is Earth System Science?</strong> Prof Robin Edwards</td>
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<tr>
<td>(3 webcast presentations; 1 classroom lecture)</td>
<td>- The scientific method; scientific reductionism</td>
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<td>- The systems approach; isolated, open, closed systems; models, fluxes, reservoirs</td>
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<td>- Major subsystems: Geosphere, hydrosphere, atmosphere, biosphere, anthroposphere.</td>
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<td>- Characteristics of natural systems. Feedback processes.</td>
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<td>- Chaos theory, complex systems, emergent properties.</td>
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<td></td>
<td>- Module outline &amp; scope.</td>
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<tr>
<td>Lecture 2</td>
<td><strong>Spaceship Earth: Life support on planet Earth</strong> – Prof Carlos Rocha</td>
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<td></td>
<td>- systems, energy and matter; biogeochemistry – quantitative study of life and chemistry</td>
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<td>- species and environment</td>
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<td>- Box models; the hydrological cycle, fluxes &amp; rates</td>
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<td>- homeostasis</td>
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<tr>
<td>Student Activity 1</td>
<td><strong>Daisyworld modelling exercise: Practical model application</strong> – Prof Carlos Rocha</td>
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<td>- albedo, feedback</td>
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<tr>
<td>Assigned Reading</td>
<td>Blue Planet: Chapters 1 and 2</td>
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<td>Holden: Chapter 1</td>
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<td>Teaching week 2</td>
<td><strong>Our habitable planet</strong></td>
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<tr>
<td>Lecture 3</td>
<td><strong>Third Rock from the Sun: Introducing the Geosphere</strong> – Prof Robin Edwards</td>
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<td></td>
<td>- Matter &amp; the finite nature of resources</td>
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<td>- composition of the Earth, principal chemical elements, minerals, rocks and rock types</td>
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<td>- Earth structure; rock cycle; the tectonic cycle</td>
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<td>- plate tectonics as a unifying theory</td>
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<tr>
<td>Lecture 4</td>
<td><strong>Making Earth Habitable: The Atmosphere &amp; Climate Control. Atmosphere – source and composition</strong> – Prof Robin Edwards</td>
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<td></td>
<td>- insolation and the global heat budget</td>
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<td>- the greenhouse effect links between atmosphere and geosphere; the goldilocks zone; evidence for a long-term thermostat – feedback cycles, Venus &amp; the runaway greenhouse, Snowball earth; tipping points, recent global warming, atmospheric CO2 in context</td>
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<tr>
<td>Student Activity 2</td>
<td><strong>Plate tectonics in Google Earth: familiarisation with Google Earth</strong> – Prof Robin Edwards</td>
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<td></td>
<td>- Plate boundaries, types, location and associate geomorphic/geological features</td>
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<tr>
<td>Assigned Reading</td>
<td>Blue Planet: Chapters 3, 5, 7, 11</td>
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<tr>
<td>Teaching week 3</td>
<td><strong>Understanding and modelling cycles</strong></td>
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<td>Lecture 5</td>
<td><strong>Into the Hydrosphere</strong> The hydrological cycle – Prof Carlos Rocha</td>
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<td>- sources, sinks, reservoirs and fluxes, residence time (ocean)</td>
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<tr>
<td>Lecture 6</td>
<td><strong>The air that we breathe</strong> Thermoregulation, equations for life, oxygen and photosynthesis – Prof Carlos Rocha</td>
</tr>
</tbody>
</table>
- carbon cycling; life as a rechargeable battery; carbon storage and atmospheric oxygen; biological carbon pump

Student Activity 3  
Hydrological Cycle Box Model - Prof Carlos Rocha

Assigned Reading  
Blue Planet: Chapters 8

Teaching week 4  
Ocean circulation - Professor Robin Edwards

Lecture 7  
A brief introduction to Planet Ocean: Ocean heat budget, sea surface temperature; atmosphere – ocean interaction; wind-driven ocean circulation; geostrophy, ocean gyres, westward intensification; garbage patches; ENSO, upwelling and marine fisheries

Lecture 8  
Into the Abyss: The oceanic interior: Ocean stratification, temperature, salinity, density; water masses; convective overturning; thermohaline circulation; atmosphere – ocean interaction 2 – gas exchange, oxygen and life, CO2 and marine sequestration

Contact hours: 22 hours

Recommended Reading List:

Assessment Details: 100% continuous assessment via in-course tests and assignments.

Module Website: Blackboard
GSU11005: Introduction to Geology: A beginners Guide to Planet Earth

Semester 2, 10 credits

From the vastness of space, to the microscopic crystal structure of minerals; from events which take billions of years, like galaxy formation, to volcanic eruptions which may last only minutes or seconds. Geology, or Earth Science, is the all-encompassing study of Planet Earth. Geology sets out to investigate the origin and development of the planet, the natural principles that govern it, the processes that act in it, on it, and around it, and finally the life that has evolved with it. Many sciences are conducted in the laboratory, but to a geologist, the Earth itself is the laboratory.

The module is organised into two main themes. Firstly, we will look at ‘Earth in Space’. We live on a dynamic and ever-changing planet, where the surface is constantly being destroyed and renewed. This theme looks at the origin of the Earth, what it’s made of and the processes at work, inside and out, which drive this change. The second theme, ‘Earth in Time’, then focuses on the evolution of the planet over time, and the life that has evolved with it. Earth has been around for just over 4,500,000,000 years, and remarkably, we have evidence that life has existed for at least 3,800,000,000 of those years. There are times in Earth’s history when geological events have changed the course of biological evolution. And, perhaps more intriguingly, there are times when life has changed the way the planet operates. So, this theme of Earth and Life evolving together through geological time is illustrated by looking at eight key episodes in Earth’s history, without which, we simply wouldn’t be here.

Module learning aims
To provide foundation-level knowledge of:
- Fundamental concepts and principal methods employed in the science of geology
- Planetary origins and evolution of planet Earth
- Rock types, composition, classification and transformation
- Structure of planet Earth and plate tectonic theory
- The distribution and causes of geohazards (volcanoes, earthquakes, tsunamis)
- Fossil evidence of the origins and evolution of life on Earth
- Geological evidence of past environments and climatic conditions
- Economic geology and the nature of geological resources

To develop the following skills & graduate attributes
- Written and digital / analytical skills
- Critical thinking
- Make connections between a student’s core subject areas and the science of Geology

Module learning outcomes
On successful completion of this module students will be able to:
- Outline the origin and evolution of planet Earth
- Describe and illustrate the dynamic nature of planet Earth with reference to specific geological processes
- Describe the origins of life on Earth and list the major evolutionary episodes evident in the fossil record
- Explain the links between the evolution of life and environmental conditions on planet Earth
- Outline the geological history of the island of Ireland
- Make basic geological observations, measurements and interpretations in the field and laboratory
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic and Description</th>
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<tbody>
<tr>
<td>Week 1</td>
<td><strong>The Earth In Space (1)</strong></td>
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<tr>
<td>Lecture 1</td>
<td><strong>Introduction #1: A Dynamic Planet: The Great Neptunist</strong></td>
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<td></td>
<td>- Plutonist Controversy</td>
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<td>- The Rock Cycle</td>
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<td>- A Brief Introduction to your Home Planet</td>
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<td>Lecture 2</td>
<td><strong>Introduction #2: Rocks &amp; Time: Rock Classification</strong></td>
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<td>- Minerals &amp; Crystals</td>
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<td>- Geological Time</td>
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<td>- Catastrophism or Uniformitarianism?</td>
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<tr>
<td>Lecture 3</td>
<td><strong>The Small Matter of Our Universe: Origins</strong></td>
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<td>- What’s in Space?</td>
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<td>- Star Birth</td>
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<td>- The Stellar Engine: The Proton-Proton Chain Reaction</td>
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<td>- Death Star</td>
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<td>Week 2</td>
<td><strong>The Earth In Space (2)</strong></td>
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<td>Lecture 4</td>
<td><strong>Birth of the Solar System: Early Formation of the Solar System</strong></td>
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<td>- Planetary Accretion</td>
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<td>- Emergence of the Solar System</td>
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<td>- A Rough Guide to Our Solar System</td>
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<td>- Meet the Neighbours: The Terrestrial Planets</td>
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<td>- Ice Worlds</td>
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<td>- And What About Earth?</td>
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<td>Lecture 5</td>
<td><strong>At the Earth’s Core: What’s in the Inner Core?</strong></td>
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<td>- The Great Melting Pot</td>
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<td>- The Outer Core: How do we Know its Liquid?</td>
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<td>- Where Does Earth’s Magnetic Field Come From?</td>
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<td>Lecture 6</td>
<td><strong>Mantle, Moho and Melt: Mr. Mohorovičić</strong></td>
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<td>- Ophiolites - Mafic Igneous Rocks</td>
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<td>- Down Below the Moho</td>
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<td>- Asthenosphere and Lithosphere</td>
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<td>- Heat Loss From the Core: Driving the Lithospheric Plates</td>
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<td>- Mantle Plumes and ‘Hot Spots’</td>
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<td>Week 3</td>
<td><strong>The Earth In Space (3)</strong></td>
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<tr>
<td>Lecture 7</td>
<td><strong>Forming a Crust: Two Types of Crust</strong></td>
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<td>- Continents and Ocean Basins</td>
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<td>- Exposing the Crust to the Atmosphere: Earth Surface Processes</td>
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<td>- How and When Did Continental Crust and Plates Evolve?</td>
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<td>- Continental Drift</td>
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<td>- Types of Plate Boundary</td>
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<td>Lecture 8</td>
<td><strong>A Filling on the Crust: Sedimentary Basins</strong></td>
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<td>- Clastic Sediments</td>
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<td>- Energy of Transport</td>
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<td>- Depositional Environments – Burial and Lithification</td>
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<td>- Chemical Precipitates - Carbonates (Inorganic and Organic)</td>
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<td>- Evaporites</td>
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</tbody>
</table>
Lecture 9  Causing a Rift: Origins of the Plate Tectonic Theory
- Magnetism in Basalt - Sea-Floor Spreading - Continental Rifting - What Happens if Continental Rifting Goes ‘All the Way’? - Ireland’s Own Continental Rift

Week 4  The Earth In Space (4)
Lecture 10  Earth Story: Ring of Fire (DVD)
Lecture 11  Subduction! Subduction Zones I: Oceanic
- Oceanic Collision
- Subduction Zones II: Oceanic
- Continental Collision
- Melting and Intrusion at Subduction Zones
- Melting and Extrusion at Subduction Zones
- Metamorphism at Subduction Zones

Lecture 12  Collision Course! How Do Continent
- Continent Collisions Happen?
- Features of Continent
- Continent Collisions
- Deformation in Rocks: Stress and Strain
- Squashing and Heating During Collision: Metamorphism
- Isostasy During Collision
- Conservative Plate Boundaries

Week 5  The Earth In Space (5)
Lecture 13  Earth Story: Journey to the Centre of the Earth (DVD)
Lecture 14  Volcanoes: Viscosity and Explosivity
- What Do Volcanoes Produce?
- Different Types of Volcano
- What Are the Plate Tectonic Settings for Different Types of Volcano?

Lecture 15  Volcanoes: Hazards and History: Basaltic Shield Volcano Hazards
- Andesitic Stratovolcano Hazards
- Rhyolitic Lava Dome Hazards
- Secondary Volcanic Hazards

Week 6  Earthquakes and Tsunamis: The Birth of Seismology
Lecture 16  How to be a Fossil: What is a Fossil?
- What Happens When Organisms Die?
- How Can We Preserve Signs of Life in Rocks?
- What is a Species?
- How Do Species Evolve?
- Zoological vs Fossil Species
- What Do Fossils Tell Us?

Lecture 17  Life and Death on Ancient Earth: An Introduction to the Main Invertebrate Fossil Phyla
- Taphonomic Processes and Preservational Bias
- Functional Morphology
- Examples of Adaptation to Specific Palaeo-environments
Week 7
Study Week – No lectures

Week 8
The Earth in Time – Key Episodes in Earth’s History 1-2

Lecture 19
Continents Adrift: Telling the Time Accurately: Biostratigraphy
- Telling the Time Accurately: Radiometric Age Dating
- Palaeo-Latitudes and Palaeo-Wander
- Palaeo-Environments

Lecture 20
Episode 1: Slimeworld Natural Selection and Genetic Mutation
- The Origin of Life
- Advent of Photosynthesis
- Consequences of Photosynthesis
- What Was Happening in Ireland During the Early – Mid Precambrian?

Lecture 21
Episode 2: Snowball Earth and Slugworld Slimeworld Gradually Changes
‘Snowball Earth’ - Steps Towards a ‘Snowball Earth’
- Back From the Brink - So What Was Happening in Ireland During the Late Precambrian?
- After the Snowball: The ‘Cambrian Explosion’ (~600 – 520 Ma)
- The Burgess Shale

Week 9
Key Episodes in Earth’s History 3-5

Lecture 22
Episode 3: How Green is the Valley? What Were the First Vertebrates?
- Evolution of Jaws - What about Life on Land?
- What Was Ireland Doing in the Early Paleozoic?

Lecture 23
Episode 4: Tetrapods and Tropics How Did we Get the First Vertebrates on Land?
- How Do You Get a Fish out of Water?
- Tetrapods: The First Land Vertebrates - Amphibians to Reptiles
- Ireland’s Lazy Wander Through the Tropics

Lecture 24
Episode 5: A Farewell to Familiar Families Mass Extinction Events: The ‘Big Five’ (or Six!)
- How Can We Cause a Mass Extinction?
- Volcanism: Flood Basalts - Volcanism: Super-eruptions
- Sea Level Change: Glaciations
- Sea Level Change: Sea-Floor Spreading Rate
- Extra-terrestrial - So What Caused the ‘Big Five’?

Week 10
Key Episodes in Earth’s History 6-8

Lecture 25
Episode 6: Reptiles Rule! Pangaea: The Reptiles Take Over
- Origin of the First Mammal-like Reptiles
- The Mesozoic Era - Reptile World Domination
- Mammals Await Their Chance
- The Mesozoic in Ireland

Lecture 26
Episode 7: It Came from Outta Space! ‘Terrible Lizards’
- Dinosaurs Rule!
- Ornithischians – Saurischians
- Upsetting the Evolutionary Apple-Cart
- The Smoking Gun… So Why Might Chicxulub Have Caused a Mass Extinction?

Lecture 27
Episode 8: Greenhouse – Icehouse What is Characteristic of the Cenozoic?
- How Can Palaeo-Temperatures be recorded?
- The Magic of Planktonic and Benthic Foraminifera
- Cenozoic Radiation
- How and Why Did Humans Evolve?
- Ireland in the Cenozoic
Week 11
Lecture 28  Economic Geology
Economic Geology 1 - What is Economic Geology? Facts & Misconceptions:
What is Economic Geology?
- What are Mineral Deposits?
- Where are Mineral Deposits Found?
- Do We Really Need Mines Anymore? - Mining History?

Lecture 29  Economic Geology 2 - What are Resources? Mining & Exploration 1: Fossil Fuel Resources:
- Peat - Coal - Oil & Gas
- Types of Non-Fuel Mineral Resources
- Focus on Metallic Minerals - What Constitutes Ore?
- What is the Minerals Cycle? - Ore Minerals and Metal Extraction

Lecture 30  Economic Geology 1 - What are Resources? Mining & Exploration 2: Where are Mineral Deposits Found?
- Metal Sources
- Modern Seafloor Zn-Pb Deposits
- Seafloor Sulphide Deposits
- Hydrothermal Deposits - Deposit Types

Week 12
Lecture 31  Module Summary
Earth Story: The Big Freeze (DVD)
Lecture 32  Module Close-Out Summary of Module Learning Outcomes:
- Key Concepts That You Should Now Know About
- Coping With the Theory Exam: Exam Structure and Content
- Worked Examples and Past Papers

Recommended Reading List:

Assessment Details: 50% examination; 50% continuous assessment via in-course tests and assignments.

Module Website: https://www.tcd.ie/Geology/undergraduate/modules/year1/

Course Director TR062 Geography and Geosciences
Professor Robin Edwards  E-mail: Robin.Edwards@tcd.ie
Phone: 01 896 1713

Executive Officers:
E-mail: geog@tcd.ie
Geography Department  Ph: 01 0896 1576

Ms Sarah Guerin  E-mail: earth@tcd.ie
Geology Department  Ph: 01 896 1074
PYU11F10/PYU11F20: Foundation Physics for Life and Earth Sciences

Semester 1 or Semester 2, 10 credits

Foundation Physics for the Life and Earth Sciences is a foundation module (10 credits) in physics. It is available as an approved 10 credit module for TR060 and TR062 students, all of whom are taking Maths, Stats, & Computation (10 credits); as well as for TR061 students (if not taking Physics 1 or Physics 2) who take both Mathematics 1 (10 credits) and Mathematics 2 (10 credits). It is available in both semesters for TR060 and TR062 students, (but cannot be taken twice); it is only available in semester 2 for TR061 students.

**Module Content:** This foundation module comprises lectures, practical work and tutorials, providing an introduction to: physics of motion, biomechanics, physics of hearing and seeing, electricity, magnetism and bioelectricity, radioactivity, nuclear physics and related medical applications, heat, pressure, as well as fluids and their biological, geological and medical applications.

**Module Learning Outcomes:**
On successful completion of this module, students should be able to:

- Demonstrate the application of Classical Physics within the biomedical and earth sciences
- Connect the study of wave phenomena and electromagnetism with ultrasound diagnostics and vision
- Relate basic knowledge of atomic and nuclear physics to radiation diagnostics and therapy, and to geological applications
- Prepare a brief report, including error analysis, on a simple physical experiment
- Through homework: (i) identify the appropriate concepts, principles, and relations that apply to the problem; (ii) provide a reasonable and appropriate explanation of why they apply; and (iii) solve physics problems at a foundation level.

**Module Structure:**

**Contact Hours:** 42 lectures/tutorials, three-hour practical laboratories, online homework.

**Module Personnel:** Lecturers: Prof. Lewys Jones; Prof. Martin Hegner; Prof. Matthias Möbius

**Summary of Laboratory Practicals:** In the Foundation Physics for Earth and Life Sciences students complete a minimum of three of the available bench experiments in the semester. The emphasis in the laboratory practical is on learning to make physical measurements, record keeping in laboratory notebooks and estimating uncertainties in measurements, while using these estimates in analysing data in order to make a quantitative measurement of a physics property. Differing students will attempt a differing set of experiments from those available. There may also be differing availability of experiments on the bench in both semesters. Students are required to record all data and information related to experiments in a hardback practical laboratory notebook which is assessed.

**Laboratory Practicals:** Experiments are selected from among but are not limited to: Pendulum, Thin Lenses, Density and the Principle of Archimedes, Surface Tension, Electrical Resistance, Collisions and Momentum Transfer, Resonance Tube, Leslie’s Cube, Geiger Counter, and Photoelectric Effect among others.

**Assessment of the laboratory:** Student’s experiments are assessed through both at-the-bench laboratory notebook assessment and through submission of written experimental reports. These must include and require a complete data analysis, description and concise report of the outcomes of the experiment, and any inferences or conclusions that can be drawn from the outcome.
**Reading List:** Required reading: "Physics for the Life Sciences" - Authors: M. Zinke-Allmang et al - It is a requirement that students purchase the mandatory e-textbook which includes student access to online homework assignments.


**Online Assignments:** Online assignments are submitted through the Cengage system where electronic access is associated with the required text book.

https://www.cengagebrain.co.uk/shop/index.html

**Methods of Teaching and Student Learning:**
A mixture of lectures, hands-on laboratory practicals, lecture demonstrations and weekly on-line assignments based on both numerical and conceptual questions from the textbook are used in the delivery of this module. The lecture course follows the material in the textbook very closely with reading assignments clearly indicated to students as the lecture course progresses.

The practical sessions are structured to provide a firm introduction to the process of physical measurements, as well as an introduction to estimations of uncertainty (error) and propagation of errors as applied to physics experiments. Each experiment has its own specific learning outcomes and is structured in order to further clarify concepts met in the textbook and lectures thus reinforcing learning.

Weekly homework assignments, typically alternating between topics, are submitted by students through an online system and corrected, with some limited feedback to the student available through the online system post deadline. The lecturer has oversight of the scores and responses to each assignment and can address these in subsequent lectures and tutorials. Finally, a number of lecturers use class based polling of student responses to questions using the available “clicker” technologies.

**Methods of Assessment:**
Assessment is by a combination of examination and continuous assessment and will include multiple choice tests (MCQs) examination paper; laboratory practical work; and online tutorial homework assignments.

**Module website:** See links at: http://www.tcd.ie/Physics/study/current/undergraduate/

**Foundation Physics Course Coordinator:**
Prof. Lewys Jones  
E-mail: Lewys.Jones@tcd.ie  
Phone: 01 896 4171

**Junior Freshman Physics Coordinator:**
Prof. Matthias Möbius

**General Enquiries:**
E-mail: mobiusm@tcd.ie  
E-mail: Physics@tcd.ie  
Phone: 01 896 1675

**Senior Executive Officer:**
Ms Una Dowling  
E-mail: dowlingu@tcd.ie
SEU10001/SEU10002: Science Education and Communication

Semester 1 OR semester 2, 10 credits

Introduction
Communication and collaboration are essential skills for researchers. This module explores the relationship between science and society through the theory and practice of communication and education.

This module will provide a practical and theoretical foundation that will enable students to develop their own communication and presentation skills as well as critical thinking skills. Students will gain an understanding of how science is communicated, an awareness of how research policy and public perception is crafted, and a familiarity with interdisciplinary opportunities and issues arising at the interface of science, society, and education.

The course will equip students with key communication skills as well as a knowledge of science education (both formal and non-formal), policymaking, funding and ethics that will serve as a platform to examine the historical impact that science has had on society. It will enable students to identify responsible research and to propose models of science education that promote cultures of sustainability and participation. Students will be equipped to communicate their own work and critically reflect on the social context, ethics, and public understanding of their field of study.

Module learning aims:
The module aims to support the development of a range of graduate attributes, including:

1. To think independently
   - The module will give students a deep knowledge of science education and communication and an appreciation of knowledge beyond their chosen field
   - Independent research will be encouraged as well as the analysis and synthesis of evidence
   - By learning how to critique how science is learned and communicated it will nurture the students’ capacity for critical thinking
2. To act responsibly
   - The module will offer global perspectives on societal challenges
   - The module will give students a familiarity with contemporary ethical issues arising at the interface of research, culture and society
   - The roles of open science, sustainability and equality in research will be explored
3. To develop continuously
   - The module will foster self-motivated learning, career skills and confidence
   - Reflective practice and personal development appraisal will be incorporated into classes
   - Career pathways will be considered in terms of adaptability, flexibility and coping with setbacks
4. To communicate effectively
   - The module will challenge students to present work coherently through all mediums
   - Students will gain an understanding how science is communicated, an awareness of effective communication methods both for public, research and policy settings.
   - Opportunities will be provided for students to develop their listening, speaking and writing skills
   - Digital engagement during classes will enable students to contribute, connect, and collaborate
Module content

- An introduction to Science Education, Communication and Society
- Brief history of Science and the Scientific Method (Overview of early science education from ancient Greek academies to Alexandria and medieval universities)
- Theories of Learning (Contemporary theories in science education such as Cognitive Constructivism and Social Constructivism)
- Paradigms of Science in Society and Science Communication (Evolving concepts such as scientific literacy, public understanding of science, and the deficit-dialogue-participatory models of communication)
- Ethics & Responsible Research (Historical development of ethics and the role of Reflective Practice)
- Controversies, scandals, and conflict in science
- Science Governance & Policymaking (Funding, politics and sustainability)
- Public Engagement in Science (Theoretical models, outreach benefits, and evaluation research)
- Citizen Science (Historical developments of citizen science — Theory & Practice)
- Is science culture? (Interdisciplinary theory, practice, and what can be gained from cross-disciplinary pursuits)
- Engaging the Media (Mass Media & Social Media, public perception)
- Writing Science (The basics of good writing practices and publishing)
- Speaking Science (Presenting and professional communication)
- Careers in Science, Education and Communication (Tips, advice and troubleshooting for early-career researchers)
- Module Review (Review, feedback and assignment support)

Recommended reading list


Assessment details

This module consists of 100% continuous assessment with both summative and formative components.

The teaching strategy combines a blend of lectures and discussion groups. The lectures will utilise interactive methods to incorporate whole class input, while the discussion groups will be led by the teaching assistants and will facilitate teamwork and problem-based, cooperative/collaborative learning. This will offer students a flexible approach to learning with a special emphasis on peer-assessment. College guidelines on universal accessibility will be followed.

The summative assessment consists of two 1,000-word written assignments that will assess the key concepts of the course. These assignments will be designed with the help of CAPSL (http://www.tcd.ie/CAPSL/) to ensure that they adhere to the best practice as set out by the Trinity Education Project (https://www.tcd.ie/CAPSL/trinity-education-project/). A group project will be carried out in the second half of the term which will culminate in and end of term presentation.
The project and presentation will carry 50% of the marks for the course, while the written assignments will contribute to the remaining 40%. Attendance and participation in Discussion groups, which is essential, will constitute 10% of the marks.

Formative assessment will take place regularly during the course, predominantly in the discussion groups. The discussion groups will be led by PhD and Postdoctoral researchers, with the guidance of the course lecturers, and will provide a more informal working space for students to engage in the course content. Students will be invited to share ideas and will be taught how to critically review each other’s work. This focus on self-assessment and peer-assessment will build confidence and critical skills. It will provide students with information based on their performance and monitor their learning to aid instruction and their comprehension of teaching at regular intervals. Detailed feedback will also be provided by the teaching team on non-graded student work, which will assist students in preparing their summative assessment.

Formative assessment will aid students and teaching staff to identify strengths, weaknesses and challenges. Student feedback will be collected at the end of the module to help assess the effectiveness of the teaching strategies.

Contact hours
2 hours lectures and 1 hour discussion/lab = 3 hours per week
X11 weeks = 33 hours per term

Module Coordinators
Professor Joseph Roche  E-mail: joseph.roche@tcd.ie
School of Education/Science Gallery  Phone: 01 896 4851
Graduate Attributes

The Trinity Graduate Attributes represent the qualities, skills and behaviours that you will have the opportunity to develop as a Trinity student over your entire university experience, in other words, not only in the classroom, but also through engagement in co- and extra-curricular activities (such as summer work placements, internships, or volunteering).

The four Trinity Graduate Attributes are:

- To Think Independently
- To Act Responsibly
- To Develop Continuously
- To Communicate Effectively

Why are the Graduate Attributes important?

The Trinity Graduate Attributes will enhance your personal, professional and intellectual development. They will also help to prepare you for lifelong learning and for the challenges of living and working in an increasingly complex and changing world.

The Graduate Attributes will enhance your employability. Whilst your degree remains fundamental, also being able to demonstrate these Graduate Attributes will help you to differentiate yourself as they encapsulate the kinds of transversal skills and abilities, which employers are looking for.

How will I develop these Graduate Attributes?

Many of the Graduate Attributes are ‘slow learned’, in other words, you will develop them over the four or five years of your programme of study.

They are embedded in the curriculum and in assessments, for example, through undertaking independent research for your final year project, giving presentations and engaging in group work.

You will also develop them through the co-curricular and extra-curricular activities. If you help to run a club or society you will be improving your leadership skills, or if you play a sport you are building your communication and team-work skills.
Dates to Note:

Freshers Orientation Week: 2nd September 2019 – 6th September 2019
Introductory Lecture, MACNEIL lecture theatre, 2nd September 2019 @ 15.30
Hamilton Building

Academic Year Structure 2019/20

Key Dates:

Freshers/Orientation Week: Monday 2nd September to Friday 6th September 2019
Study/Review Week: Monday 21st October to Friday 25th October 2019
Revision Week Semester 1: Monday 2nd December to Friday 6th December 2019
Study/Review Week: Monday 2nd March to Friday 6th March 2020
Revision Week Semester 2: Monday 13th April to Friday 17th April 2020
Trinity week: Monday 20th April to Friday 24th April 2020

Formal Assessment weeks
*Semester 1 examinations Monday 9th December to Friday 13th December 2019
*Semester 2 examinations Monday 27th April to Friday 1st May 2020
*Extra contingency days may be required outside of the formal assessment / reassessment weeks.
Closing Dates for Course Transfer

If you decide to transfer out of your course altogether, you must submit an application for transfer of course to the Academic Registry, following discussion with your tutor. Decisions are based on a) the availability of places, and b) the entry qualifications of the transfer applicant. It may not be possible to permit transfers to subjects which already have a full complement of students. Further details are available on the following link:

http://www.tcd.ie/study/apply/making-an-application/undergraduate/index.php

Students may not register or attend a course until their application to transfer has been formally approved by the Senior Lecturer

Progression and Awards

Information on progression and awards can be found via the following webpage:
https://www.tcd.ie/TEP/assets/Docs/factsheet_students_progression_awards.pdf

Attendance

All students should enter into residence in or near Dublin and must begin attendance at the College not later than the first day of teaching term, and may not go out of residence before the last day of teaching term, unless they have previously obtained permission from the Senior Lecturer through their tutor.

Students must attend College during the teaching term. They must take part fully in the academic work of their class throughout the period of their course. Lecture timetables are published through my.tcd.ie and on school or department notice-boards before the beginning of Michaelmas teaching term. The onus lies on students to inform themselves of the dates, times and venues of their lectures and other forms of teaching by consulting these timetables.

The requirements for attendance at lectures and tutorials vary between the different faculties, schools and departments. Attendance is compulsory for Junior Freshman in all subjects. The school, department or course office, whichever is relevant, publishes its requirements for attendance at lectures and tutorials on notice-boards, and/or in handbooks and elsewhere, as appropriate.
Absence from College – Medical and Absence Certificates

MEDICAL CERTIFICATES
Where a student misses an assigned laboratory practical class through illness, they should (a) submit a Medical Certificate to the Science Course office on the day of their return to College and (b) inform the laboratory practical supervisor of their absence at the next session.

- Science Medical Certificate Form (use with med cert from doctor) – Available from Science Course Office

For periods of illness of three days or less (but no more than seven days in any year) a student may ‘self-certify’ their illness on the forms supplied, again to the Science Course Office on the day of their return to College.

- Science Medical Self Certification Form (use for 3 days med not covered by doctor) – Available from the Science Course Office

OTHER ABSENCES
Students who require to be absent from a laboratory practical classes (with or without an associated assessment) for any other reason, such as a sporting or social event, should inform the appropriate module coordinator well in advance of the event (preferably a week beforehand).

- Science Absence from College Form, Sport or Other – Available from the Science Course Office

Where possible they will be assigned to an alternative laboratory practical session, but if that is not possible, and the justification for the absence is considered legitimate, they may be treated in the same manner as students submitting medical certificates (i.e. assigned an alternative assessment for one missed or awarded a pro-rata/pass mark). This is decided by the individual Disciplines concerned (i.e. Biology, Chemistry, Physics etc.) not the Science Course Office.

Excuses for absence, presented after the event, will not be entertained. Students who anticipate that their sporting commitments may necessitate more than the occasional absence from College (e.g. Sport Scholars, etc.) should discuss their situation with their tutor and the Associate Dean of Undergraduate Science Education (ADUSE).

Non-satisfactory attendance and course work
All students must fulfil the requirements of the school or department, as appropriate, with regard to attendance and course work. Where specific requirements are not stated, students may be deemed non-satisfactory if they miss more than a third of their course of study or fail to submit a third of the required course work in any term. Further information on non-satisfactory attendance and course work may be found via the following webpage:

https://www.tcd.ie/undergraduate-studies/academic-progress/attendance-course-work.php
Plagiarism- 2019/20

It is important to emphasise that all students, i.e., undergraduate, postgraduate, new entrants and existing students, will be required to complete the online tutorial ‘Ready, Steady, Write’. Students must ensure that the cover sheets they complete when submitting assessed work, contain the following declaration:

I have read and I understand the plagiarism provisions in the General Regulations of the University Calendar for the current year, found at: http://www.tcd.ie/calendar

I have also completed the Online Tutorial on avoiding plagiarism ‘Ready, Steady, Write’, located at http://tcd-ie.libguides.com/plagiarism/ready-steady-write

Students should read the items listed below to ensure that they understand plagiarism.

2. The 2019-19 Calendar entry on plagiarism; Plagiarism
3. Guidelines on the appropriate methodology for the kind of work that students will be expected to undertake. Providing discipline specific examples of good academic practice for referencing is very helpful for students. We would like to draw your attention to the 2019-20 Calendar entry on plagiarism which states that “all Schools and departments must include in their handbooks or other literature given to students, guidelines on the appropriate methodology for the kind of work that students will be expected to undertake”;  
4. A statement informing all students that they must complete the online tutorial on avoiding plagiarism ‘Ready, Steady, Write’, located at http://tcd-ie.libguides.com/plagiarism/ready-steady-write
5. The template of the coversheet/s which students must complete and attach to work submitted in hard or soft copy or via Blackboard. NB. The coversheet must include the declaration noted above.

The Tutorial Service is unique, confidential and available to all undergraduate students offering student support in all aspects of College life. The Tutorial Service is supported and co-ordinated by the Senior Tutor’s Office which is located on the ground floor in House 27.

Opening Hours
The Senior Tutors Office is open Monday - Friday from 9am - 5.30pm. Closed for lunch from 1-2pm.

Appointments
If you require specific advice or would like a confidential meeting with the Senior Tutor, you can make an appointment by telephoning +353 1 896 2551 or by emailing stosec@tcd.ie

What is a Tutor?
A Tutor is a member of the academic staff who is appointed to look after the general welfare and development of the students in his/her care. Whilst the Tutor may be one of your lecturers, this is not always the case as the role of the College Tutor is quite separate from the teaching role.

When should I go to see my Tutor?
Whenever you are worried or concerned about any aspect of College life or your personal life, in particular if it is affecting your academic work. Everything you say to your Tutor is in strict confidence. Unless you give him/her permission to do so, s/he will not give any information to anybody else, whether inside College or outside (to your parents/family for example). Your Tutor can only help you if s/he knows you are facing difficulties, so if you are worried about anything go and see your Tutor before things get out of hand.

Further information on the Senior Tutors Office and College Tutors may be found via the following webpage: Senior Tutor’s Office - https://www.tcd.ie/seniortutor/students/undergraduate/

Disability Services
The Disability Service aims to provide appropriate advice, support and information to help students and staff with disabilities. The Disability Service has in place a range of supports to ensure that students with disabilities have full access to the same facilities for study and recreation as their peers. Most students registering with the Disability Service request access to a range of supports that help the student reach their full potential while studying. Most students’ needs are accommodated through these supports. The student decides what level of support they require.

For contact information or to make an appointment, please contact the Disability Service – contact details are available via their webpage:

https://www.tcd.ie/disability/contact/
The Student Counselling Service is here to help you to manage any difficulties you are experiencing so you can enjoy and fully participate in your time here at College.

If you wish to make an appointment with the Student Counselling Service, please consider one of the options below. If you have any other queries you can call into reception on the 3rd floor of 7-9 South Leinster Street or contact us on:

Phone: (01) 8961407
Email: student-counselling@tcd.ie

For further information visit the following webpage:
https://www.tcd.ie/Student_Counselling/

Helpful College Websites:
In the first few weeks at College, you will hear an array of abbreviations, titles and place names. So visit the jargon buster page: https://www.tcd.ie/students/jargon-buster/

Student life offers information on Supports and Services, Clubs and Societies, Student Unions etc.,
https://www.tcd.ie/students/

For information on Registration, Fees, Grants, ID Cards etc. visit the Academic Registry (AR) in the Watts Building or the visit the AR website: https://www.tcd.ie/academicregistry/
Sample timetables

Please note that the following SAMPLE timetables may change before term commences on 9 September 2019. Once registered students can view their timetable via my.tcd.ie in real time. Do not take and save snapshots as they will not reflect the most up-to-date information.

SAMPLE semester one timetable
SAMPLE Semester two timetable
TR060: Biological and Biomedical Sciences

Contact details:

Course Director TR060: Biological and Biomedical Sciences
Professor Kevin Devine  E-mail: kdevine@tcd.ie
Phone: 01 896 1872

Executive Officer: E-mail: BTC.Administrator@tcd.ie
Ph: 01 896 1117

Science Course Office

Professor Áine Kelly  Ph: 01 896 2025
Associate Dean of Undergraduate Science Education

Ms Anne O’Reilly  E-mail: science@tcd.ie
Science Course Administrator  Ph: 01 896 2023

Ms Ann Marie Brady  E-mail: sfsco@tcd.ie
Senior Executive Officer  Ph: 01 896 2829

Ms Lucy Martin  E-mail: martinl3@tcd.ie
Senior Executive Officer  Ph: 01 0896 1970

Ms Eva Page  E-mail: eva.page@tcd.ie
Global Officer, Life and Geosciences  Ph: 01 896 2799
# Teaching Term Dates 2019-20

## Michaelmas Term
**Monday 09 Sept 2019 - Friday 29 Nov 2019**

<table>
<thead>
<tr>
<th>Teaching wk</th>
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<td>14 Oct - 18 Oct</td>
<td>Teaching wk 6</td>
<td>Week 27</td>
<td>24 Feb - 28 Feb</td>
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**Study week**

| Week 09 | 21 Oct - 25 Oct |

**Teaching wk 8**

| Week 10 | * 28 Oct - 01 Nov |

**Teaching wk 9**

| Week 11 | 04 Nov - 08 Nov |

**Teaching wk 10**

| Week 12 | 11 Nov - 15 Nov |

**Teaching wk 11**

| Week 13 | 18 Nov - 22 Nov |

**Teaching wk 12**

| Week 14 | 25 Nov - 29 Nov |

## Hilary Term
**Monday 20 January 2020 - Friday 10 April 2020**

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<tr>
<td>Teaching wk 1</td>
<td>Week 22</td>
<td>20 Jan - 24 Jan</td>
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<td>Teaching wk 2</td>
<td>Week 23</td>
<td>27 Jan - 31 Jan</td>
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<td>Teaching wk 3</td>
<td>Week 24</td>
<td>03 Feb - 07 Feb</td>
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<td>Teaching wk 4</td>
<td>Week 25</td>
<td>10 Feb - 14 Feb</td>
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<td>Teaching wk 5</td>
<td>Week 26</td>
<td>17 Feb - 21 Feb</td>
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<td>Teaching wk 6</td>
<td>Week 27</td>
<td>24 Feb - 28 Feb</td>
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**Study week**

| Week 28 | 02 Mar - 06 Mar |

**Teaching wk 8**

| Week 29 | 09 Mar - 13 Mar |

**Teaching wk 9**

| Week 30 | * 16 Mar - 20 Mar |

**Teaching wk 10**

| Week 31 | 23 Mar - 27 Mar |

**Teaching wk 11**

| Week 32 | 30 Mar - 03 Apr |

**Teaching wk 12**

| Week 33 | 06 Apr - 10 Apr |

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* Monday 28th October 2019 Bank Holiday - College closed
* Tuesday 17th March 2020 St Patricks Day - College closed

Updated: 11/07/19
### Appendix 1: General Information

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<th>ITEM</th>
<th>REFERENCE/Source</th>
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</table>
| **General Regulations** | Calendar, Part II - General Regulations and Information, Section II, Item 12:  
Calendar, Part III, General Regulations, Section 1.20  
https://www.tcd.ie/calendar/graduate-studies-higher-degrees/complete-part-III.pdf  
**Attendance Requirements:**  
Calendar, Part II, General Regulations and Information, Section II, Items 17-23  
Calendar, Part III, General Regulations and Information, Sections 1.23; 2.11; and 3.2  
**Absence from Examinations**  
Calendar, Part II, General Regulations and Information, Section II, Item 35  
Calendar, Part III, Section 3.5  
**Calendar – General Regulations:**  
**Plagiarism Policy and information:**  
https://www.tcd.ie/teaching-learning/UG_regulations/Plagiarism.php  
https://libguides.tcd.ie/friendly.php?s=plagiarism |
| **General Information** | Timetable are available via my.tcd.ie portal:  
https://my.tcd.ie/urd/sits.urd/run/siw_lgn  
Blackboard:  
https://tcd.blackboard.com/webapps/login/  
**Academic Registry:**  
https://www.tcd.ie/academicregistry/  
**Data Protection:**  
**Dignity & Respect Policy**  
https://www.tcd.ie/equality/policy/dignity-respect-policy/ |
| **Foundation Scholarship** | Foundation and Non Foundation Scholarship: Calendar, Part II  
Science Foundation Scholarship information sheet:  
https://www.tcd.ie/Science/assets/documents/PDF/Foundation-Scholarship-
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<td><strong>Information on TCDSU and GSU, Including</strong></td>
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### Appendix 1: General Information

| student representative structures | TCDSU Student Representation Overview  
| | https://www.tcdsu.org/aboutus |
| | TCD GSU  
| | https://www.tcdgsu.ie/ |
| | GSU - Student Representation Overview  
| | https://www.tcdgsu.ie/becomearep/ |

<table>
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<tr>
<th>Emergency Procedure</th>
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| In the event of an emergency, **dial Security Services on extension 1999**  
| Security Services provide a 24-hour service to the college community, 365 days a year. They are the liaison to the Fire, Garda and Ambulance services and all staff and students are advised to always telephone extension 1999 (+353 1 896 1999) in case of an emergency.  
| Should you require any emergency or rescue services on campus, you must contact Security Services. This includes chemical spills, personal injury or first aid assistance.  
| It is recommended that all students save at least one emergency contact in their phone under ICE (In Case of Emergency). |

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**NOTE:** All of the information contained in this booklet is accurate at time of publication. However, the Science Course Office reserves the right to modify information, dates and times as necessary. Students will be notified of any changes via e-mail and the Science webpage.