Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Science at Trinity

Faculty of Engineering, Mathematics and Science

TR060
Biological & Biomedical Science
Junior Fresh Programme 2018 - 2019

tcd.ie/science

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
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TR060: Biological and Biomedical Sciences

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TR060: Biological and Biomedical Sciences introduction

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

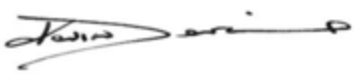
In the Biological and Biomedical Stream, students will study the core concepts that are fundamental to all biological systems. These will be presented in core modules during the first two years and will include: cell structure and composition, genetics, heredity and biological information, evolution, molecular biology, metabolism, structure, physiology and development 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 behaviour.

In the third year, students specialise in one of the 11 moderatorships offered in this stream: Biochemistry; Botany; Environmental Science; Genetics; Human Genetics; Immunology; Microbiology; Molecular Medicine; Neuroscience; Physiology and 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 3rd September 2018. The following presentations will take place in the MacNeil Theatre Hamilton Building on Monday 3rd September 2018:

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

These will be followed by a reception in the Hamilton Building concourse where students will discuss module choices with an academic advisor and will be provided with the following:

- The TR060 Junior Fresh Programme 2018/19 (first year);
- A module choice form to complete, following advice from an academic adviser.

Students will meet their S2S (Student to Student) Mentor Groups on Wednesday 5th September from 10.15 onwards and they will assist with student integration into college life and address any queries that may arise.

MODULE SELECTION

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

BYU11101	From Molecules to Cells	Semester 1	10
BYU11102	From Organisms to Ecosystems	Semester 2	10
CHU11B01	Chemistry for Life Sciences	Semester 1	10
MAU11002	Mathematics, Statistics, and Computation 2	Semester 2	10

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	Semester 1	10
GSU11005	Introduction to Geology: A Beginners Guide to Planet Earth	Semester 2	10
* PYU11F10	Foundation Physics for Life and Earth Sciences 1	Semester 1	10
* PYU11F20	Foundation Physics for Life and Earth Sciences 2	Semester 2	10
* ET1030	Science Education, Communication and Society 1	Semester 1	10
* ET1031	Science Education, Communication and Society 2	Semester 2	10

***** Foundation Physics for Life and Earth Scientists and Science Education, Communication and Society modules may be taken in **either** semester one or semester two but cannot be taken in both.

TR060: BIOLOGICAL AND BIOMEDICAL SCIENCES

CORE MODULES (mandatory) – 20 credits per semester

SEMESTER 1 – Michaelmas term 10 September 2018 – 30 November 2018	SEMESTER 2 – Hilary Term 21 January 2019-12 April 2019
BYU11101: From Molecules to Cells (10 credits)	BYU11102: From Organisms to Ecosystems (10 credits)
CHU11B01: Chemistry for Life Sciences (10 credits)	MAU11002: Mathematics, Statistics and Computation (10 credits)

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

GSU11004: Spaceship Earth: An introduction to Earth System Science (10 credits)	GSU11005: Introduction to Intro to Geology: A beginners guide to Planet Earth (10 credits)
PYU11F10: Foundation Physics for Life and Earth Scientists 1 (10 credits)	PYU11F20: Foundation Physics for Life and Earth Scientists 2 (10 credits)
SEU10001: Science Education and Communication 1 (10 credits)	SEU10002: Science Education and Communication 2 (10 credits)

Moderatorships

In the Junior and Senior Fresh years TR060 students complete a course of study which will qualify them to compete for a place in one of the following Moderatorships after the Senior Fresh 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 Fresh module choice form – September 2018

Following the introductory session in the **MACNEIL lecture theatre, Hamilton on Monday 3rd September 2018,** students will be required to submit this module choice form to the Science Course Office by 12.00 noon on Tuesday 4th September 2018.

BLOCK CAPITALS PLEASE

Name: _____ CAO No: _____

Date: _____ Student No: _____

SECOND LEVEL QUALIFICATIONS

Please enter below the grades obtained for subjects taken

SUBJECT	**Leaving Certificate**		**A Level**	**Other** (please indicate)
	H	O		
Biology				
Chemistry				
Physics				
Physics/Chemistry				
Mathematics				
Applied Maths				
Geography				
Geology				
Agricultural Sc.				
Other Science Subject (please indicate)				

PTO

SECTION C: JUNIOR FRESH MODULES FOR 2018/19
(To be completed with help of Adviser)

Please tick appropriate box

Module Code	Module Title	Semester	Credits	Tick Box
Core modules – 20 credits per semester				
BYU11101	From Molecules to Cells	1	10	MANDATORY
BYU11102	From Organisms to Ecosystems	2	10	
CHU11B01	Chemistry for Life Sciences	1	10	
MAU11002	Mathematics, Statistics and Computation 2	2	10	
Approved modules – 10 credits per semester Availability of approved modules is subject to student numbers				
GSU11004	Spaceship Earth: An Introduction to Earth Systems Science	1	10	
GSU11005	Introduction to Geology: A Beginners Guide to Planet Earth	2	10	
* PYU11F10	Foundation Physics for Earth and Life Sciences 1	1	10	
* PYU11F20	Foundation Physics for Earth and Life Sciences 2	2	10	
*ET1030	Science Education, Communication and Society 1	1	10	
*ET1031	Science Education, Communication and Society 2	2	10	
* PYU11F10/20 may be taken in either semester one OR semester two - cannot be taken in both * ET1030/1031 may be taken in either semester on 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, after a couple of weeks, a student feels that they have perhaps made the wrong choice of approved module, they should seek **advice immediately** from a Tutor, Course Director or the Science Course Office. It may be possible to change from one module to another within your course, subject to permission from the Associate Dean of Undergraduate Science Education. Once a decision has been made to change modules, it should be done **quickly** - it can be difficult to try to catch up with work in a new module when more than two or three weeks of lectures have been missed. Change of module forms are available from the Science Course Office. These are also available on the Science website: http://www.tcd.ie/Science/TR060/tr060-module-choice-form.php

College registration

The Academic Registry issue an **'Invite to Register'** email to all new entrants and continuing students eligible to register for the forthcoming academic year. This communication is issued via the my.tcd.ie portal and your institutional (TCD issued) email address.

On receipt of the emailed invitation, you should log in to the my.tcd.ie to complete the registration steps.

All information regarding College registration is available at the following links:
https://www.tcd.ie/academicregistry/registration/how-to-register/
http://www.tcd.ie/academicregistry/registration/

TR060 Biological and Biomedical Sciences - CORE MODULES

BYU11101: From Molecules to Cells

Semester 1, 10 credits

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 ultrastucture 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 **Module: Introduction, objectives and overview.**
Module Coordinator (Professor Tony Kavanagh)

SECTION 1 **Origin of Life - Cellular basis of life - Diversity of Life Forms** (11 lectures)

Lecture 2 & 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)
- 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.
- Protist cell structure, morphology, habitat and life-cycles: extreme cell diversity.

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.

Lecture 13 **Summary of key concepts: Q&A Profs. LO'N, FS, AF**

ONLINE ASSESSMENT OF SECTION 1 via MCQ

SECTION 2 **Chemistry of Life** (11 lectures)

Lecture 14: Introduction to biochemistry:
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, 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, 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 OF SECTION 2 via MCQ

SECTION 3 Biological Information: Genetics, Heredity and DNA (11 lectures)

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 and 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.
- 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. GJF, TK**

ONLINE ASSESSMENT OF SECTION 3 via MCQ

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 (2018))

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 of the module (Origin of Life) you are required to answer 1 question from this section
- Section 2 will have 2 questions on Section 2 of the module (Chemistry of Life) you are required to answer 1 question from this section
- Section 3 will have 2 questions on Section 3 of the module (Biological Information) you are required to answer 1 question from this section
- All questions carry equal marks

Module coordinator - BYU11101 From Molecules to Cells

Professor Tony Kavanagh
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E-mail: Tony.Kavanagh@tcd.ie

Executive Officer

Ms Diane Touzel
E-mail: BTC.Administrator@tcd.ie
Phone: 01 896 1117

BYU11102: From Organisms to Ecosystems
Semester 2, 10 credits

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	Topic and Content
Lecture 1	**Lecture 1 Module: Introduction, objectives and overview.** Module Coordinator Professor Trevor Hodkinson
SECTION 1A	**Multicellularity and Development** (Professor Rebecca Rolfe) (5 Lectures) **Lecture 2 - Introduction to development** - core concepts / model organisms / analysis of development (morphology, genetic, biochemical) **Lecture 3 - Embryogenesis and morphogenesis** - germ layers **Lecture 4 - Intercellular communication, determination, potency, axis formation** - anterior-posterior, dorsal-ventral. **Lecture 5 Pattern formation** - morphogens, gradients and thresholds. **Lecture 6 Differential gene expression** - temporal and spatial, master regulators
SECTION 1B	**Physiology and Neuroscience** (Professor Áine Kelly and Professor Tomas Ryan) (6 Lectures) **Lecture 7 - Form and Function** (Professor Áine Kelly) - Functional characteristics of living things - Specialisation of cells/tissues/organs to fulfill specific functions **Lecture 8 – Homeostasis** (Professor Áine Kelly) - The concept of the internal environment. Composition, temperature, pH etc. of body fluids. Maintenance of homeostasis by cooperation of different physiological systems. Feedback and feed-forward **Lecture 9 - Physiological regulation of function** (Professor Áine Kelly) - Fundamentals of nervous and endocrine control of function and comparison of speed and modes of action**.** How an individual organism senses and responds to changes in the external and internal environments. **Behaviour and Neuroscience** (Professor Tomas Ryan) **Lecture 10 - Pre-neuroscience history of mind/brain ideas** - Cartesian dualism and materialist and non-materialist explanations of mind. The brain as the substrate of mind. The effects of head trauma on behaviour and memory, anatomy of the human/mammalian brain, functions in behaviour and in homeostasis, overview of human brain regions and attribution of various regions to broad functions (evidence from lesions, imaging). **Lecture 11 - Fundamentals of nervous system structure and function** - Reticular vs. neuron theory, nervous system as electrically active, Helmholtz and excitable neurons, action potentials & synaptic transmission. **Lecture 12 - Introduction to the biology of memory storage** - Challenges of integrating neurobiology and brain function at multiple levels. Reductionism and correlation vs. causation. The biology of memory storage.
Lecture 13	**Summary of key concepts: Q&A Profs. Rolfe, Kelly and Ryan**
	ONLINE ASSESSMENT ON SECTIONS 1A and 1B via MCQ
SECTION 2	**Evolution: adaptation, populations, biodiversity** (Professor Trevor Hodkinson) (11 Lectures) **Lecture 14 - Short history of life** - 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 **Lecture 25 - Summary of key concepts: Q&A Profs. Hodkinson & McLysaght**

ONLINE ASSESSMENT ON SECTION 2 via MCQ

SECTION 3 **Ecology and Environment** (Professor Jennifer McElwain & Professor Yvonne Buckley) (11 Lectures)

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 **Lecture 37 - Summary of key concepts: Q&A Profs. Buckley & McElwain**

ONLINE ASSESSMENT ON SECTION 3 via MCQ

Lecture 38

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 (2018))

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.

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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 Sections 1A and 1B of the module (Multicellularity and Development; **and** Physiology and Neuroscience) you are required to answer 1 question from this section
- Section 2 will have 2 questions on Section 2 of the module (Evolution: adaptation, populations, biodiversity) you are required to answer 1 question from this section

- Section 3 will have 2 questions on Section 3 of the module (Ecology and Environment) you are required to answer 1 question from this section
- All questions carry equal marks

Contacts:

Module coordinator - BYU11102 From Organisms to Ecosystems

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Executive Officer

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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:

Week	Topic and description
1-3 9 Lectures	**Introduction to chemistry: The atom, chemical bonding and chemical reactions** • 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 • Atoms, Molecules, and Ions. • Isotopes and radionuclides in medicinal chemistry. • Bonding in chemical substances – lengths, angles and rotation • Ionic bonding; covalent bonding; weak bonding; molecules and solid state structures; electronegativity; the periodic table. • Hybridization • Chemical reactions; symbolizing reactions; balancing equations; • Solutions, concentrations and dilutions • limiting reagents and yields; role of water in chemical reactions; important classes of chemical reactions • Oxidation and reduction reactions, electron transfer; oxidizing and reducing agents; half-equations.

4-9 (14 Lectures) Week 7 – study week	• Chemical energetics, thermodynamics and chemical equilibria (8 L) • ionic equilibria (1L) • acids, bases buffers (2 L) • 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.
- Atkins, P.W. & de Paula, J. (2011) Physical Chemistry for the Life Sciences , 2nd Edition, W H Freeman & Co

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: 30% of Final Grade
- Examination: 70% of Final Grade

CHU11B01 Chemistry for Biologists - Module Coordinator

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MAU11002: Mathematics, Statistics and Computation
Semester 2, 10 credits

Module learning aim:

The students should be enabled to use maths and statistics as tools to solve problems in their scientific discipline, like finding maxima or minima of functions, solving (matrix) difference equations and performing a basic statistical analysis of a data set, aided by the computer language R. When using R and predefined R-functions, students should be in the position to understand the underlying principles, for example how confidence intervals are obtained from integrals of probability density functions, or how linear regression relies on solving systems of linear equations. The relevant sciences will help these aims by emphasising the role of mathematical and statistical methods in the context of their respective disciplines.

Module learning outcome

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

- use graphs of functions in the context of derivatives and integrals
- compute derivatives and equations of tangent lines for graphs of standard functions including rational functions, roots, trigonometric, exponential and logs and compositions of them;
- find indefinite and definite integrals including the use of substitution and integration by parts;
- solve simple maximisation/minimisation problems using the first derivative test and other applications including problems based on population dynamics and radioactive decay;
- select the correct method from those covered in the module to solve wordy calculus problems, including problems based on population dynamics and radioactive decay;
- algebracially manipulate matrices by addition and multiplication and use Leslie matrices to determine population growth;
- solve systems of linear equations by Gauss-Jordan elimination;
- calculate the determinant of a matrix and understand its connection to the existence of a matrix inverse; use Gauss-Jordan elimination to determine a matrix inverse;
- determine the eigenvalues and eigenvectors of a matrix
- determine the eigenvalues and eigenvectors of a matrix and link these quantities to population dynamics;
- Understand the basic ideas of descriptive statistics, types of variables and measures of central tendency and spread.
- Appreciate basic principles of counting to motivate an intuitive definition of probability and appreciate its axioms in a life science context.
- Understand common discrete and continuous distributions and how these naturally arise in life science examples.
- Understand how to take information from a data set in order to make inference about the population, appreciating the core ideas of sampling distributions, confidence intervals and the logic of hypothesis testing.
- Have a basic understanding of the statistical software R including importing and exporting data, basic manipulation, analysing and graphing (visualisation) of data, loading and installing package extensions, and how to use help files and on-line resources to solve error queries or to achieve more niche capabilities.

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-Day] "Biocalculus: Calculus, Probability and Statistics for the Life Sciences", James 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:

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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

Module Learning Outcomes

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

- Outline the fundamental concepts of Earth Systems Science with reference to its major subsystems: Geosphere, Biosphere, Atmosphere, Hydrosphere and Anthroposphere
- Illustrate how material and energy are cycled through the Earth system
- Describe the links between biotic and abiotic systems and their role in maintaining a habitable planet
- Apply an Earth Systems approach to describe the phenomena of environmental and climate change
- Discriminate between 'weather' and 'climate' and situate concerns about current climate change in a longer-term (geological) context
- Identify how human activities modify Earth System function
- Make links between Earth Systems Science and topics covered in their chosen field of study

Module content

Week	**Topic and Description**
Week 1	**Introduction to Earth System Science: What is Earth System Science?**
Lecture 1: (3 webcast presentations; 1 classroom lecture)	**Prof Robin Edwards** - The scientific method; scientific reductionism - The systems approach; isolated, open, closed systems; models, fluxes, reservoirs - Major subsystems: Geosphere, hydrosphere, atmosphere, biosphere, anthroposphere. - Characteristics of natural systems. Feedback processes. - Chaos theory, complex systems, emergent properties. - Module outline & scope. - Learning outcomes. Assessment methods. Timetable & curriculum.
Lecture 2	**Spaceship Earth: Life support on planet Earth – Prof Carlos Rocha** - systems, energy and matter; biogeochemistry – quantitative study of life and chemistry - species and environment - Box models; the hydrological cycle, fluxes & rates - homeostasis
Student Activity 1	**Daisyworld modelling exercise: Practical model application – Prof Carlos Rocha** - albedo, feedback
Assigned Reading	Blue Planet: Chapters 1 and 2 Holden: Chapter 1
Week 2	**Our habitable planet**
Lecture 3	**Third Rock from the Sun: Introducing the Geosphere – Prof Robin Edwards** - Matter & the finite nature of resources - composition of the Earth, principal chemical elements, minerals, rocks and rock types - Earth structure; rock cycle; the tectonic cycle - plate tectonics as a unifying theory
Lecture 4	**Making Earth Habitable: The Atmosphere & Climate Control. Atmosphere – source and composition – Prof Robin Edwards** - insolation and the global heat budget - the greenhouse effect links between atmosphere and geosphere; the

	goldilocks zone; evidence for a long-term thermostat – feedback cycles, Venus & the runaway greenhouse, Snowball earth; tipping points, recent global warming, atmospheric CO2 in context
Student Activity 2	**Plate tectonics in Google Earth: familiarisation with Google Earth – Prof Robin Edwards** - Plate boundaries, types, location and associate geomorphic/ geological features
Assigned Reading	Blue Planet: Chapters 3, 5, 7, 11
Week 3	**Understanding and modelling cycles**
Lecture 5	**Into the Hydrosphere The hydrological cycle – Prof Carlos Rocha** - sources, sinks, reservoirs and fluxes, residence time (ocean)
Lecture 6	**The air that we breathe Thermoregulation, equations for life, oxygen and photosynthesis – Prof Carlos Rocha** - 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
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
Assigned reading	Blue Planet – Chapter 10 Holden: Chapter 3 Pinet: Chapters 6, 7, 8
Student Activity 4	**Argo floats in Google Earth: Professor Robin Edwards** - surface ocean circulation patterns - exploring current systems and gyres - marine technology
Week 5	**Weather – The atmosphere in motion**
Lecture 9	**Introduction to the Atmosphere: Professor Gayle McGlynn** - weather vs climate - climate forcing - atmospheric composition and structure - movement of heat and moisture - adiabatic lapse rates, clouds - driving atmospheric circulation
Lecture 10	**Global Atmospheric Circulation: Professor Gayle McGlynn** - 3 cell model - low, middle and high latitude circulation - jet streams; monsoons - ENSO; cyclones and hurricanes
Assigned reading	Blue Planet – Chapter 12 Holden: Chapters 6, 8, 9
Student Activity 5	**Exploring Hurricanes – Professor Gayle McGlynn**
Week 6	**The Earth' Climate System – Professor Pete Coxon**

Lectures 11 and 12	- temperature anomalies - extreme weather events - NAO; weather vs climate - change in natural systems - global temperature: instrumental and proxy data - Milankovitch and astronomical theory of climate - CLIMAP; Biostratigraphy; oxygen isotopes; ocean and ice core records - glacial – interglacial transition; abrupt climate change - Greenhouse gases and future change
Assigned Reading	Blue Planet – Chapter 13 Holden Chapters 4, 5
Student Activity 6	**Reconstructing past climate: Professors Pete Coxon and Robin Edwards** Excel-based exercise using oxygen isotope data to explore glacial-interglacial climate cycles
Week 8	**Geomorphology: Shaping the Earth's surface**
Lecture 13	**Shaping the Surface: Professor Robin Edwards** - Controls on landscape development - timescale of change - inheritance - physical processes: erosion, transport and deposition - sediment type, description and classification - particle size and grain size distributions - Hjulström diagram; settling lag; depositional environments – coastal illustration - bedforms and morphodynamics – an introduction
Lecture 14	**Coastal Geomorphology: Professor Mary Bourke** - coasts – definition & significance - coastal morphodynamics, feedbacks, timescales - geomorphic systems approach; tides & waves, inc. storms and tsunamis - sedimentary systems - depositional coasts & landforms; erosion & rocky coasts
Assigned reading	Holden – Chapters 16, 22
Student Activity 7	**Coastal Geomorphology: Professor Mary Bourke** Google Earth to measure: 1) dynamic coastal change in a coastal barrier island system; 2) identify coastal landforms in satellite images
Week 9	**Making a Living on Earth**
Lecture 15	**Structuring the Biosphere – Energy: Professor Carlos Rocha** - insolation as the power source - energy distribution and climate regions; ecosystem components – biotic & abiotic - Illustration: aquatic/marine biomes - energy exchange in ecosystems - photosynthesis - pyramids and trophic levels - hydrothermal vents and autotrophic chains;

Lecture 16 **Structuring the Biosphere – Biogeochemistry - Carlos Rocha**

- nutrient cycles and life
- fundamental concepts in biogeochemistry
- carbon cycle
- nitrogen cycle
- phosphorus cycle
- human impacts on biogeochemical cycles

Week 10 **Biogeography**

Lecture 17 **Introduction – Explaining the Patterns of Life: - Professor Robin Edwards**

- Biomes & Ecozones
- Biogeography – history and ecology
- fundamental units of life – individual, population, species
- habitat; ecological optima/tolerance; carrying capacity and population growth (human); planetary boundaries
- species interactions; niche – partitioning space; generalist vs specialist
- biodiversity – definition and threats; resilience

Lecture 18 **Biogeographic Change - Evolution & Extinction: Professor Robin Edwards**

- Biogeographic engines – plate tectonics & evolution. Zoogeographic maps, disjunct populations, isolation & endemism
- illustration – Australia. Fundamentals of evolution – competition, variation, reproduction, inheritance; response to environmental change – move, adapt, die
- vicariance & connectivity; ecological succession; r- and k- selected species
- range expansion/contraction/fragmentation, refugia
- speciation and evolutionary geography; extinction (including the 6th extinction)

Assigned Reading Blue Planet: Chapters 14,16
Holden; Chapters 10, 11

Student Activity 9 **Planetary Boundaries exercise – Professor Robin Edwards**

Week 11 **Terraforming Spaceship Earth - Professor Mary Bourke**

Lecture 19 **The Anthropocene**

- rise and spread of humans; technology and agriculture
- humans as geomorphic agents
- population growth, energy consumption
- human impact on the geosphere, hydrosphere, atmosphere & biosphere
- The Anthropocene – a new geological epoch?

Lecture 20 **Resource types and uses: Professor Mary Bourke**

- natural resources – historical overview of uses
- renewable/non-renewable; the resource cycle
- Illustration – forests; mineral resources, mining, hydrocarbon industry
- renewable energy

Student Activity 10 **Google Earth Engine: Professor Mary Bourke**
Monitoring of earth system change using remote sensing platforms

Assigned Reading Blue Planet; Chapters 17, 18, 19
Holden: Chapters 25, 26

Week 12	**The end of the beginning**
Lecture 21	**The future of climate: Professor Gayle McGlynn** - earth's climate system; carbon cycle and climate - human activities and atmospheric change - measuring human impact on climate; the IPCC - scientific consensus on climate change; how to predict the future – approaches and limitations - Climate modelling and projection; climate as a policy issue; A +2°C future?
Lecture 22	**Summary & Synthesis - Professor Robin Edwards**
Student Activity 11	**Modelling future climate**
Assigned Reading	Blue Planet; Chapter 19 Holden: Chapter 7 IPCC AR 5

Contact hours: 22 hours

Recommended Reading List:

Holden, J. (2018) An Introduction to Physical Geography and the Environment. 4th Edition. Pearson: Harlow, UK. 876 pages. Skinner, B.J., Murck, B. (2011) The Blue Planet: An Introduction to Earth System Science. 3rd Edition. J. Wiley & Sons: Hoboken, USA. 656 pages.

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

Module content

Week	Topic and Description
Week 1	**The Earth In Space (1)**
Lecture 1	**Introduction #1: A Dynamic Planet: The Great Neptunist** - Plutonist Controversy - The Rock Cycle - A Brief Introduction to your Home Planet
Lecture 2	**Introduction #2: Rocks & Time: Rock Classification** - Minerals & Crystals - Geological Time - Catastrophism or Uniformitarianism?
Lecture 3	**The Small Matter of Our Universe: Origins** - What's in Space? - Star Birth - The Stellar Engine: The Proton-Proton Chain Reaction - Death Star
Week 2	**The Earth In Space (2)**
Lecture 4	**Birth of the Solar System: Early Formation of the Solar System** - Planetary Accretion - Emergence of the Solar System - A Rough Guide to Our Solar System - Meet the Neighbours: The Terrestrial Planets - Ice Worlds - And What About Earth?
Lecture 5	**At the Earth's Core: What's in the Inner Core?** - The Great Melting Pot - The Outer Core: How do we Know its Liquid? - Where Does Earth's Magnetic Field Come From?
Lecture 6	**Mantle, Moho and Melt: Mr. Mohorovičić** – Ophiolites - Mafic Igneous Rocks - Down Below the Moho - Asthenosphere and Lithosphere - Heat Loss From the Core: Driving the Lithospheric Plates - Mantle Plumes and 'Hot Spots'
Week 3	**The Earth In Space (3)**
Lecture 7	**Forming a Crust: Two Types of Crust** - Continents and Ocean Basins - Exposing the Crust to the Atmosphere: Earth Surface Processes - How and When Did Continental Crust and Plates Evolve? - Continental Drift - Types of Plate Boundary
Lecture 8	**A Filling on the Crust: Sedimentary Basins** - Clastic Sediments - Energy of Transport - Depositional Environments – Burial and Lithification - Chemical Precipitates - Carbonates (Inorganic and Organic) - Evaporites

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

Lecture 16 **Earthquakes and Tsunamis: The Birth of Seismology**

- What Causes an Earthquake?
- Earthquake Hazards
- Neotectonics: Tectonics Happening Right Now
- Earthquake Generated Tsunamis
- Tsunamiites: Preserving Tsunamis in the Rock Record
- Alternative Ways to Generate Tsunamis

Lecture 17 **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 18 **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! - Ornithiscians – 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	**Economic Geology**
Lecture 28	**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	**Module Summary**
Lecture 31	**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:

Nicholas, C. J., 2018. A Beginner's Guide to Planet Earth: Introductory Lectures in Geology. C.J. Nicholas (ISBN 978-1-911180-33-3)

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 Geoscience

Professor Robin Edwards
E-mail: Robin.Edwards@tcd.ie
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Executive Officers:

Ms
Geography Department
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PYU11F10/PYU11F20: Foundation Physics for Earth and Life 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.
http://www.nelson.com/catalogue/productOverview.do?N=197+4294967212+4294961008&Ntk=P_EPI&Ntt=171810329217138545478672127298457286 4&Ntx=mode%2Bmatchallpartial

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 Fresh Physics Coordinator:
Prof. Matthias Möbius
E-mail: mobiusm@tcd.ie

General Enquiries:
E-mail: Physics@tcd.ie
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Senior Executive Officer:
Ms Una Dowling
E-mail: dowlingu@tcd.ie

ET1030/ET1031: Science Education, Communication and Society

ET1030 Semester 1, 10 credits or ET1031 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
- Theories of Learning
- Paradigms of Science in Society, and Science Communication
- Ethics & Responsible Research
- Controversies, scandals, and conflict in science
- Science Governance & Policymaking
- Public Engagement in Science
- Citizen Science
- Is science culture?
- Engaging the Media
- Writing Science
- Careers in Science, Education and Communication
- Module Review

Recommended reading list

- Trench, B. et al. (2016). Little Country, Big Talk: Science Communication in Ireland. Dublin: The Pantaneto Press.
- Jensen, E., & Laurie, C. (2016). Doing real research: A practical guide to social research. London: Sage. Sagan, C., & Druyan, A. (1996).
- The demon-haunted world: Science as a candle in the dark. New York: Random House

Assessment details

This module consists of 100% continuous assessment through assignments with both summative and formative components. The teaching strategy combines a blend of lectures and discussion groups. The discussion groups will be led by the teaching assistants and will facilitate teamwork and problem-based, cooperative/collaborative learning.

Contact hours

3 hours per week (2 hours of lectures and 1 hour of discussion/lab).

Module coordinators

Professor Joseph Roche
School of Education and Science Gallery
E-mail: joseph.roche@tcd.ie
Phone: 01 896 4851

Mr Ian Brunswick
Science Gallery
E-mail: ian.burnswick@dublin.sciencegallery.com
Ph: 01 896 4090

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: 3rd September 2018 – 7th September 2018

The following presentations will take place in the MacNeil Theatre Hamilton Building on Monday 3rd September 2018:

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

Academic Year Structure 2018/19

Key Dates:

Freshers/Orientation Week:	Monday 3 September to Friday 7 September 2018
Study/Review Week:	Monday 22 October to Friday 26 October 2018
Revision Week Semester 1:	Monday 3 December to Friday 7 December 2018
Study/Review Week:	Monday 4 March to Friday 8 March 2019
Revision Week Semester 2:	Monday 15 April to Friday 19 April 2019
Trinity week:	Monday 29 April to Friday 3 May 2019

Formal Assessment weeks

Semester 1 examinations	Saturday 8 December to Friday 14 December 2018
Semester 2 examinations	Tuesday 23 April to Saturday 27 April 2019 (and Tuesday 30 April and Thursday 2 May 2019 if required)

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 Fresh 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- 2018/19

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.

1. The weblink to the Library Repository, http://tcd-ie.libguides.com/plagiarism
2. The 2018-19 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 2018-19 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.

[1] UG: Calendar Part II, General Regulations, Academic Progress, Paragraphs 82 and following; PG Calendar Part III, General Regulations, Paragraphs 1.32 and following.

Trinity Tutorial Service

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.

Further information on the support available may be found via the following link: https://www.tcd.ie/disability/services/

For contact information or to make an appointment please contact the Disability Services – contact details are available via the following webpage:

https://www.tcd.ie/disability/contact/

Student Counselling

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/

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.

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Science Course Office

Faculty of Engineering, Mathematics and Science Trinity College Dublin 2, Ireland.

Oifig na gCúrsaí Éolaíochta Dámh na hinne-altóireachta, na Matamaitce agus na hÉolaíochta Ollscoil Átha Clíath, Coláiste na Tríonóide Baile Átha Cliath 2. Éire.

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