

This handbook applies to all students taking TR060: Biological and Biomedical Sciences. It provides a guide to what is expected of you on this programme, and the academic and personal support available to you. Please retain 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.

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Welcome to Science at Trinity

TR060: Biological and Biomedical Sciences introduction

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

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

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

In the third year, students specialise in one of the 11 moderatorships offered in this stream: Biochemistry; Botany; Environmental Science; Genetics; Human Genetics; Immunology; Microbiology; Molecular Medicine; Neuroscience; Physiology; Zoology. The fundamental concepts of that discipline will be presented in core modules while students will also select from a cohort of open 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, students will acquire skills in problem solving and data handling and in oral and written communication.

This programme 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 Andrew Jackson](#)

[Director, TR060 Biological and Biomedical Sciences Course](#)

TR060 Biological and Biomedical Sciences overview and module selection

Module choices will be made online. Prior to selecting modules, you should read the TR060

TR060: BIOLOGICAL AND BIOMEDICAL SCIENCES

handbook available here. **Please note that choices you make in Junior Freshman year may influence your choices in the second semester of Junior Freshman year and Senior Freshman year.**

Please read the following information on pages 2,3, and 4 and then go to the [TR060 Module Choice Form](#) to select your modules. If you feel that you need assistance with your choices, please contact us at jfsco@tcd.ie and we will be happy to help.

Students considering a career in teaching at second level (Junior and Senior Certificate) are reminded of the need to fulfil the requirements of the Teaching Council for each subject they intend to teach. The requirements for each subject are listed at:

<https://www.teachingcouncil.ie/en/Publications/Registration/Documents/Curricular-Subject-Requirements-after-January-2017.pdf>

MODULE SELECTION

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

BYU11101	From Molecules to Cells	Semester 1	10
BYU11102	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
* SEU10001	Science Education and Communication 1	Semester 1	10
* SEU10002	Science Education and Communication 2	Semester 2	10

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

Students considering a career in teaching at second level (Junior and Senior Certificate) are reminded of the need to fulfil the requirements of the Teaching Council for each subject they intend to teach. The requirements for each subject are listed at

<https://www.teachingcouncil.ie/en/Publications/Registration/Documents/Curricular-Subject-Requirements-after-January-2017.pdf>

CORE MODULES (mandatory) – 20 credits per semester

SEMESTER 1 – Michaelmas term (27th September to 17 December 2021)	SEMESTER 2 – Hilary Term (24th January to 15th April 2022)
BYU11101: From Molecules to Cells (10 credits)	BYU11102: Organisms to Ecosystems (10 credits)
CHU11B01: Chemistry for Life Sciences (10 credits)	MAU11002: Mathematics, Statistics and Computation (10 credits)

OPEN 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 beginner’s 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)

Semester structure

Moderatorships

In the Junior and Senior Freshman 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 Freshman year:

- Biochemistry
- Botany
- Environmental Sciences
- Genetics
- Human Genetics,
- Immunology
- Microbiology
- Molecular Medicine
- Neuroscience
- Physiology
- Zoology

[Change of Open Modules](#)

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

College registration

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

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

Please Note: Students who have already accessed the my.tcd.ie website should continue to access it using your current username and password as this will not change. For those who have not previously logged on, a username and password has been created to give you immediate access.

TR060 Biological and Biomedical Sciences – Core Modules

BYU11101: From Molecules to Cells I

Semester 1, 10 credits

Module Coordinator: Tony Kavanagh tkvanagh@tcd.ie

Module Learning Aims

This module aims to introduce students to molecular and cellular biology, including 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 is given, and the ultrastructure of the prokaryotic and eukaryotic cells is covered in detail. The properties and functions of the major classes of biochemicals found in living systems (carbohydrates, lipids, proteins and nucleic acids) are described, the structure and function of membranes and organelles, and the chemical basis of metabolism and energy transfer in the cell. Students are 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 is described. Students 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:

Provide an account of the cellular basis of life: from its origins in the abiotic world, to the evolution of unicellular and multicellular organisms.

Describe the diversity of life forms: including viruses, prokaryotes (bacteria), archaea, and eukaryotes (unicellular organisms, animals and plants).

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.

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).

Employ a range of laboratory techniques, demonstrating the development of practical scientific skills, knowledge of experimental design and the interpretation of results.

Apply the scientific method as a fundamental approach to experiment-based investigations, critical analysis of data, and problem solving.

Contact Hours/Methods of Teaching and Learning

Lectures and practicals will be supplemented with information sessions, tutorials and activities that provide guidance in the use of library resources, laboratory health and safety, help with avoiding plagiarism and examination techniques. Sixty-five hours contact time.

Module Content

Lecture Topic	Lecturer	Practicals
Introduction and overview	Glynis Robinson	
Section 1 Origin of Life - Cellular basis of life - Diversity of Life Forms		
1. Origins of Life	Luke O'Neill	The Diversity of Life Forms
2. Origins of Life	Luke O'Neill	
3. Cellular Basis of Life	Fred Sheedy	Liquid Handling
4. Cellular Basis of Life	Fred Sheedy	
5. Cellular Basis of Life	Fred Sheedy	Bacterial Growth & Survival
6. The Tree of Life	Alastair Fleming	
7. Bacteria	Alastair Fleming	
8. The Archaea	Alastair Fleming	
9. Fungi & Protists	Alastair Fleming	
10. Viruses	Kim Roberts	
11. Relationship Between Life Forms	Alastair Fleming	
Section 2 The Chemistry of Life		
12. Introduction to Biochemistry	Luke O'Neill	
13. Nucleotides, Amino Acids & Peptides	Luke O'Neill	Enzyme Purification (Chromatography)
14. Protein Structure	Ken Mok	
15. Protein Function	Ken Mok	Enzyme Characterisation (Electrophoresis)
16. Enzymes	Vincent Kelly	
17. Enzymes	Vincent Kelly	Enzyme Characterisation (Kinetics)
18. Lipids & Membranes	Vincent Kelly	
19. Metabolism	Vincent Kelly	
20. Metabolism	Vincent Kelly	
21. Mitochondria & Respiration	Vincent Kelly	
22. Chloroplasts & Photosynthesis	Vincent Kelly	
Section 3 Biological Information – Genetics, Heredity & DNA		
23. Introduction to Genetics	Jane Farrar	Mendelian Genetics
24. Mendelian Genetics	Jane Farrar	
25. Linkage & recombination 1	Jane Farrar	
26. Linkage & Recombination 2	Jane Farrar	

27. Identification of DNA as Hereditary Material	Jane Farrar	
28. Quantitative Genetics	Jane Farrar	
29. DNA - Structure & Function	Tony Kavanagh	
30. Information Flow - The Central Dogma	Tony Kavanagh	
31. Information Flow - The Central Dogma	Tony Kavanagh	
32. Information Flow - The Central Dogma	Tony Kavanagh	
33. Mutation & the Consequences	Tony Kavanagh	

Lecture Content:

- **Origin of Life:** 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.
- **Cellular basis of life:** Cell structure – prokaryotes, archaea, eukaryotes - animal and plant organelles & their prokaryotic origin – mitochondria, chloroplasts, mitosis and meiosis – cell division – regulation of cell division.
- **Diversity of Microbial Life:** the tree of life; bacteria, archaea, fungi & protists, cell structure, morphology, function and habitat; extremophiles; viruses
- **Relationship between life forms:** the good, the bad and the ugly; concepts of symbiosis and parasites; plant and animal diseases.
- **Structural principles for small molecules:** elements and chemical groups in life, bonds, bond energies, bond lengths; forces between biological molecules and chemical groups; asymmetry; four classes of biomolecules: amino acids, nucleotides, carbohydrates & lipids
- **Nucleotides, Amino acids and peptides:** 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
- **Proteins and protein structure:** the 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.
- **Protein function:** functional classes of protein; introduction to bioinformatics; proteins and evolution; relationships between proteins; similarity and identity.
- **Enzymes:** structure & function; reaction mechanisms; co-factors and vitamins; kinetics; regulation of enzyme activity
- **Lipids and membranes:** lipid structures, fatty acids, phospholipids; membranes, chemical and physical properties, membrane proteins; transport across membranes; concept of compartmentation and membrane traffic.
- **Metabolism & major metabolic pathways:** 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.

- **Mitochondria & Respiration:** 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).
- **Chloroplasts and Photosynthesis:** chloroplast, architecture and function, overview of the light and dark reactions of photosynthesis.
- **Introduction to Genetics:** an outline of some core concepts from classical genetics to the present; a whistle stop tour of key discoveries in the history of genetics.
- **Mendelian Genetics:** 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; inheritance patterns for single gene disorders - pedigree analysis.
- **Linkage and recombination:** Meiosis and the role of 'crossing over' in gene mapping ; a brief recap regarding Mendelian genetics – for example, highlighting that genetic linkage breaks Mendel's 2nd law of independent assortment; outline of key concepts underlying the generation of genetic maps; classical work by Sturtevant / Morgan.
- **Identification of DNA as hereditary material;** 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.
- **Quantitative Genetics:** an overview of concepts relating to discrete variation versus continuous variation; experiments demonstrating that quantitative traits are inherited, examples of 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.
- **DNA, Structure and Function:** 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.
- **Information flow in the cell - The Central Dogma:** transcription, RNA polymerases in prokaryotes and eukaryotes; promoters, repressors, terminators – the *lac* operon; transcription factors, enhancers; decoding the information in mRNA, translation; ribosomes in prokaryotes and eukaryotes, tRNAs and aminoacyl tRNA synthetases, the genetic code; introduction to the regulation of gene expression – positive and negative regulation
- **DNA –Mutation and its consequences:** mechanisms by which mutations are generated - including errors in DNA replication; the action of chemical and physical mutagens; errors in chromosome construction and distribution; an outline of the different types of mutation (missense, nonsense, frameshift mutations) and their molecular consequences in relation to gene expression and protein function; mutations causing inherited diseases and cancer; DNA repair – mechanisms of DNA repair, repair deficiency and disease.

Recommended Text Book

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

Assessment Details:

(A) End of semester written examination: 50% of module mark

Two questions from each of the three sections of the lecture course. Students must answer one question from each section.

(B) Three in-term MCQ tests: one on each section of the lecture course, each worth 5% of module mark

(C) Practical write-ups/assessments: 35% of module mark. Attendance at practicals and submission of the associated exercises is compulsory.

Students must obtain an overall module mark of 40% to pass the module.

A student who fails to attend more than one-third (1/3) of the practical sessions cannot pass the module without completion of a supplementary practical session, or an alternative exercise in the event that a practical is not possible.

Contacts:

Module Coordinator: Tony Kavanagh tkvanagh@tcd.ie

Biology Course Coordinator: Glynis Robinson, robinsog@tcd.ie, Phone: 01 8962895

Laboratory Manager: Siobhan McBennett, smcbrntt@tcd.ie, Phone: 01 8961049

Executive Officer: Helen Sherwin-Murray btcadmin@tcd.ie, Phone: 01 8961117

BYU11102: Organisms to Ecosystems I

Semester 2, 10 credits

Module Coordinator: Trevor Hodkinson hodkinst@tcd.ie

Module learning aims

Organisms to Ecosystems I aims to introduce students to the biology of individuals, species, populations and ecosystems, and explore how humans interact with other living organisms. It covers 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.

Learning outcomes

On successful completion of this module, 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

Contact Hours/Methods of Teaching and Learning

Lectures and practicals will be supported by discussion sessions and tutorials. Sixty-five hours contact time.

Module Content

Lecture Topic	Lecturer	Practicals
Introduction and overview	Trevor Hodkinson	
Section 1 Multicellularity and Development, Physiology, Behaviour and Neuroscience		
1. Multicellularity and Development	Rebecca Rolfe	
2. Introduction to Development	Rebecca Rolfe	Development and Floral Morphology
3. Embryogenesis and Morphogenesis	Rebecca Rolfe	
4. Intercellular Communication,	Rebecca Rolfe	
5. Pattern Formation	Rebecca Rolfe	Physiology
6. Differential Gene Expression	Rebecca Rolfe	
7. Form and Function	Áine Kelly	
8. Homeostasis	Áine Kelly	
9. Physiological Regulation	Áine Kelly	
10. Pre-neuroscience History of Ideas of Mind & Brain	Tomas Ryan	
11. Fundamentals of Nervous System Structure and Function	Tomas Ryan	
12. Introduction to the Biology of Memory Storage	Tomas Ryan	
Section 2 Evolution: Adaptation, Populations and Biodiversity		
13. History of life	Trevor Hodkinson	First Life
14. Selection/modern synthesis	Trevor Hodkinson	
15. Species	Trevor Hodkinson	Diversity of Life
16. Speciation	Trevor Hodkinson	
17. Extinction	Trevor Hodkinson	Evolution
18. Phylogeny	Trevor Hodkinson	
19. Genetic Basis of Selection	Aoife McLysaght	Species Diversity Evolution & Modularity
20. Genetic Basis of Evolution 1	Aoife McLysaght	
21. Genetic basis of Evolution 2	Aoife McLysaght	
22. Human Evolution	Aoife McLysaght	
Section 3 Ecology and Environment		
23. Species	Yvonne Buckley	
24. Species - Conservation	Yvonne Buckley	Biodiversity & Ecosystems Services
25. Trophic Cascades and Rewilding	Yvonne Buckley	
26. Constructing Ecosystems and Conservation	Yvonne Buckley	
27. Urban ecology	Yvonne Buckley	
28. Ecosystem Services and Natural Capital	Yvonne Buckley	Biological Environmental Systems
29. Global Ecology and Climate Change	Jennifer McElwain	
30. Biomes, Niches	Jennifer McElwain	
31. Biomes and Global Productivity	Jennifer McElwain	
32. Biomes and Biogeochemical Cycles	Jennifer McElwain	
33. Desiccation Resistance and Space Travel	Jennifer McElwain	

Lecture Content:

- **Introduction to development:** core concepts, model organisms, analysis of development; morphology, genetic, biochemical.
- **Embryogenesis and morphogenesis:** germ layers
- **Intercellular communication:** determination, potency, axis formation – anterior-posterior, dorsal-ventral.
- **Pattern formation:** morphogens, gradients and thresholds.
- **Differential gene expression:** temporal and spatial, master regulators.
- **Form and Function:** functional characteristics of living things; specialisation of cells/tissues/organs to fulfill specific functions.
- **Homeostasis:** 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.
- **Physiological Regulation of Function:** 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.
- **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).
- **Fundamentals of nervous system structure and function:** reticular vs. neuron theory, nervous system as electrically active, Helmholtz and excitable neurons, action potentials & synaptic transmission.
- **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.
- **Short history of life:** timeline, major groups, diversity.
- **Selection/modern synthesis:** adaptation
- **Species:** definitions, taxonomy, diversity, species rich groups.
- **Speciation:** allopatric, sympatric, adaptation, radiations, key innovations.
- **Extinction:** fossils, global change (climate, atmosphere, tectonic).
- **Phylogeny:** homology, convergence, reversals, methods.
- **Genetic basis of selection**
- **Genetic basis of evolution:** molecular variation, neutral theory, drift; molecular evolution of population genetic variation.
- **Human evolution**
- **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.
- **Biomes, niches:** introduction to biomes, what shapes biome distribution? climate change, climate niches / fundamental versus realized niche; challenge of predicting future ecological responses to climate change
- **Commonness, rarity and population processes:** 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 (endemism and invasions).

- **Conservation:** applications of population biology at the species level, including prioritizing species for conservation management, assessing threat and red listing.
- **Trophic cascades and rewilding:** what is a community, energy flow, applications of community ecology to conservation and rewilding challenges; consumption, facilitation & predation.
- **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.
- **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?
- **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: environmental impacts and ecological process:** food security- ecological concepts- productivity- energy flows through ecological systems/basic concepts of biogeochemical cycles.
- **Future food and a changing planet:** food security; ecological concepts, human population increase, projections for future productivity.
- **Biosphere feedbacks on climate system:** introduction to biological feedbacks on the climate system; 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 system.

Recommended Textbook

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

Assessment Details:

(A) **End of semester written examination: 50% of module mark**

Two questions from each of the three sections of the lecture course. Students must answer one question from each section.

(B) **Three in-term MCQ tests: one on each section of the lecture course, each worth 5% of module mark**

(C) **Practical write-ups/assessments: 35% of module mark. Attendance at practicals and submission of the associated exercises is compulsory.**

Students must obtain an overall module mark of 40% to pass the module.

A student who fails to attend more than one-third (1/3) of the practical sessions cannot pass the module without completion of a supplementary practical session, or an alternative exercise in the event that a practical is not possible.

Contacts

Module Coordinator: Professor Trevor Hodkinson, email: hodkinst@tcd.ie

Biology Course Coordinator: Glynis Robinson, robinsog@tcd.ie, Phone: 01 8962895

Laboratory Manager: Siobhan McBennett, smcbnntt@tcd.ie, Phone: 01 8961049

Executive Officer: Helen Sherwin-Murray btcadmin@tcd.ie, Phone: 01 8961117

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 an understanding of acid-base, buffers and electrochemistry.
6. Explain the factors that 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 <ul style="list-style-type: none">• Structure and building principles of atoms; element symbols; masses and the mole; introduction to the periodic table; brief introduction to 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)	<ul style="list-style-type: none"> • Chemical energetics, thermodynamics and chemical equilibria (8L) • Ionic equilibria (1L) • Acids, bases and buffers (2L) • Kinetics (1L) and 1st order rate law • Electrochemistry (2L)
10-12 (10 Lectures)	<ul style="list-style-type: none"> • 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.

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

Module Coordinator

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MAU11002: Mathematics, Statistics and Computation

Semester 2, 10 credits

Module learning aim:

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

- Spreadsheets. A brief overview of what spreadsheets do. Assignments based on Google docs.
- Numbers. An introduction to numbers and number systems e.g. binary, octal and hexadecimal numbers and algorithms for converting between them.

Module learning outcome

On successful completion of this module students will be able to

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

Module content

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

Mathematics:

a) Calculus:

3 lectures plus one tutorial per week. The syllabus is largely based on the text book [Stewart-Day], and will cover most of Chapters 1-6 along with the beginning of Chapter 7 on differential equations:

- Functions and graphs. Lines, polynomials, rational functions, exponential and logarithmic functions, trigonometric functions and the unit circle.
- Limits, continuity, average rate of change, first principles definition of derivative, basic rules for differentiation
- Graphical interpretation of derivatives, optimization problems
- Exponential and log functions. Growth and decay applications. semilog and log-log plots.

- Integration (definite and indefinite). Techniques of substitution and integration by parts. Applications.
- Differential equations and initial value problems, solving first order linear equations. Applications in biology or ecology.

b) Linear algebra/discrete mathematics:

1 lecture and 1 tutorial per week. The syllabus will cover parts of chapter 1 on sequences, limits of sequences and difference equations and then chapter 8 of [Stewart-Day] on linear algebra.

The syllabus is approximately:

- Sequences, limits of sequences, difference equations, discrete time models
- Vectors and matrices , matrix algebra
- Inverse matrices, determinants
- Systems of difference equations, systems of linear equations, eigenvalues and eigenvectors. Leslie matrices, matrix models

Statistics:

There will be 1 lecture per week and 1 computer practical. The syllabus will cover much of chapters 11-13 of [Stewart-Day] and use [Bekerman-et-al] as main reference for R in the computer practicals.

The syllabus is approximately:

- Numerical and Graphical Descriptions of Data
- Relationships and linear regression
- Populations, Samples and Inference
- Probability, Conditional Probability and Bayes' Rule
- Discrete and Continuous Random Variables
- The Sampling Distribution
- Confidence Intervals
- Hypothesis Testing

Recommended reading lists:

- [Stewart-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 - Open 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

Recommended Reading List:

Holden, J. (2019) 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

Course Director TR062 Geography and Geosciences

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Executive Officers:

Ms Helen O'Halloran E-mail: geog@tcd.ie
Geography Department Ph: 01 0896 1576

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Geology Department Ph: 01 896 1074

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

Recommended Reading List:

Nicholas, C. J., 2019. 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 Geosciences

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PYU11F10/PYU11F20: Foundation Physics for Life and Earth Sciences

Semester 1 or Semester 2, 10 credits

Foundation Physics for the Life and Earth Sciences is a foundation module (10 credits) in physics. It is available as an approved 10 credit module for TR060 and TR062 students, all of whom are taking Maths, Stats, & Computation (10 credits); as well as for TR061 students (if not taking Physics 1 or Physics 2) who take both Mathematics 1 (10 credits) and Mathematics 2 (10 credits). It is available in both semesters for TR060 (but cannot be taken twice); it is only available in semester 2 for TR061 or TR062 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 Practicals: In the Foundation Physics for Earth and Life Sciences students complete a minimum of three practical experiments, including from those experiments available at the bench in the laboratory during the semester. The emphasis in these practicals whether at home or in the laboratory is on learning to make physical measurements, record keeping in scientific laboratory notebooks, estimating uncertainties in measurements, while using these estimates in analysing data in order to make a quantitative measurement of a physical property. Differing students will attempt a differing set of experiments selected from those available. There may also be a differing availability of laboratory experiments on the bench in both semesters. Students are required to record all data and information related to their experiments in a hardback practical laboratory notebook which is assessed. At-home physics practical experiments may be assigned and evaluated together with the laboratory based practicals.

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 practical experiments: All student's physics experiments are assessed through both online and submission of written experimental reports and through an at-the-bench laboratory notebook assessment. These reports and notebooks must include and require a documented 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: There is required reading and textbook for this course is an online e-Book, "Physics: Principles with Applications" by Giancoli from Pearson publishers. The e-Book includes access to the online homework platform used for assessment, and purchasing this bundle is a requirement for enrolling on this course. The School of Physics has negotiated a group-discount for this book and details of how to obtain this discount will be shared with students after enrolment.

Online Assignments: Online assignments are submitted through the online homework platform associated with the "Physics: Principles with Applications" by Giancoli. The electronic access is associated with the required text book and details of how to register once you have purchased the e-Book will be shared after enrolment.

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 to further clarify concepts met in the textbook and lectures to reinforce 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 and at-home assessed practical work; and online tutorial homework assignments.

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

Foundation Physics Course Coordinator:

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Junior Freshman Physics Coordinator:

Prof. Matthias Möbius

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Administrative Officer

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SEU10001/SEU10002: Science Education, Communication, and Society

Semester 1 OR semester 2, 10 credits

Introduction

This module explores the relationship between science and society. Communication and collaboration are essential skills for researchers and on successful completion of this module students should be able to:

- Interpret the key concepts of theory and practice in the fields of science education and communication
- Assess science learning and communication, the evolving relationship between science and society, and their own responsibilities for sustainable development

Critically appraise their communication and presentation skills

This module will provide practical and theoretical foundations 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 taught and communicated, an awareness of how research policy and public perception is crafted, and a familiarity with interdisciplinary opportunities and challenges arising at the interface of science and society.

The course will equip students with key communication skills as well as a knowledge of science education (both formal and informal), 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 learning 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 deeper understanding of science education and communication and an appreciation of research beyond their chosen fields
 - Independent research will be encouraged as well as the analysis and synthesis of evidence
 - Self-assessment and peer-assessment aspects of the module will nurture 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 science and society
 - Responsible, inclusive, and sustainable open research will be explored
3. To develop continuously
 - The module will foster self-motivated learning and the enhancement of academic skills
 - Students will be supported in developing their capacity for critical reflective practice
 - Professional development and career pathways will be highlighted throughout the course content
4. To communicate effectively
 - The module will task students with presenting work individually and in groups across a range of media

- Students will appraise how science is communicated in public, academic, and political environments
- Opportunities will be created for students to improve their abilities to write and speak about science

Module content

1. Introduction to Science Education, Communication and Society Module and Assessment
2. History of Science
3. Theories of Learning
4. Models of Science Communication
5. Ethics & Responsible Research
6. Science Governance & Policymaking
7. Citizen Science
8. Science as Culture
9. Engaging the Media
10. Writing Science
11. Speaking Science
12. Module Review, Feedback, and Assignment Support

Recommended reading list

- Broks, P., Gascoigne, T., Leach, J., Lewenstein, B. V., Massarani, L., Riedlinger, M., & Schiele, B. (2020). *Communicating Science: A Global Perspective*. ANU Press.
- Sagan, C., & Druyan, A. (1996). *The demon-haunted world: Science as a candle in the dark*. New York: Random House
- Trench, B. et al. (2016). *Little Country, Big Talk: Science Communication in Ireland*. Dublin: The Pantaneto Press.

Assessment details

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

The module will be assessed entirely through continuous assessment (using the Blackboard suite of tools), with both summative and formative assessment components including:

- Online engagement before, during, and after lectures and tutorials
- Reflective journaling
- Group presentations
- Peer-assessment and self-assessment
- End of semester essay

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

Contact hours

2 hours lectures and 1 hour tutorial = 3 hours per week
X 11 weeks = 33 hours per term

Module Coordinator

Dr. Joseph Roche

E-mail: Joseph.Roche@tcd.ie

School of Education

Phone: 01 896 4851

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/teaching-learning/academic-affairs/ug-prog-award-regs/index.php>

Information in relation to all undergraduate Regulations can be found via the following:

<https://www.tcd.ie/teaching-learning/academic-affairs/ug-regulations/>

Attendance

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

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

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

Absence from College – Medical and Absence Certificates

MEDICAL CERTIFICATES

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

Please note: a student may self-certify for no more than 1/3 of laboratory sessions in a module and no more than 1/3 of course work in a module.

- Science **Medical Certificate** Form (**use with med cert from doctor**) – Forms to be submitted via the Science website: <https://www.tcd.ie/Science/TR060/junior-freshman/>

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, – Forms to be submitted via the Science website: <https://www.tcd.ie/Science/TR060/junior-freshman/>

- Science Medical **Self Certification** Form (**use for 3 days med not covered by doctor**) – Forms to be submitted via the Science website: <https://www.tcd.ie/Science/TR060/junior-freshman/>

Please note: a student may self-certify for no more than 1/3 of laboratory sessions in a module and no more than 1/3 of course work in a module.

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 – – Forms to be submitted via the Science website: <https://www.tcd.ie/Science/TR060/junior-freshman/>

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 accepted.

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. The specific requirements for attendance and completion of course work for Junior Freshman TR060 are listed below. 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>

Attendance and Completion of Course Work: Freshman TR060

1. Attendance at Junior Freshman and Senior Freshman laboratory sessions and completion of the associated exercises is compulsory, so that students acquire the competencies necessary for the Sophister level.
2. A student who does not attend a practical cannot submit an assignment based on, or associated with, that practical.
3. Students can self-certify for a **maximum** of one-third (1/3) of practical sessions and one-third (1/3) of the course work associated with an individual module (course work includes lecture MCQ tests, practical assignments, on-line exercises, on-line practicals, field work and any other exercise that contributes to the course work mark for that module).
4. A student who fails to attend more than one-third (1/3) of practical sessions in a module without submission of appropriate certification cannot pass that module without completion of a supplementary practical session, or an alternative exercise in the event that a practical is not possible.
5. Regardless of circumstances, a student who has passed the module overall but has failed the course work component may be required to complete additional exercises to acquire essential skills when deemed necessary by the module coordinator in consultation with the Directors of Freshman Biology Teaching and/or Biological and Biomedical Sciences.
6. Individual cases and exceptional circumstances will be considered on their merits.

Plagiarism

Plagiarism is defined as “taking someone else's work or ideas and passing them off as one's own”. Plagiarism can occur in many ways; **deliberate** copying and pasting text from books, reviews, research papers, newspapers; from internet sources (e.g. Wikipedia), including social media, or copying from another student's assignment. Importantly, sometimes plagiarism can be **accidental** – such as when a student copies text from one of the above sources into their notes without noting (by inverted commas or a note-to-self) that it is copied verbatim from that source - and subsequently using this text in an assignment or exam answer. Furthermore, taking a segment of text from any of the above sources and simply rewriting each sentence in turn in a different tense OR using synonymous nouns, verbs, adverbs or adjectives is also plagiarism.

Therefore, it is very important for students to indicate in their notes, those that are written **in their own words** and those that are **copied** from published sources.

All plagiarism, regardless of it being **deliberate or accidental**, is **academic fraud**, is a most serious disciplinary offense, and is treated as such by Trinity College Dublin.

To help you guard yourself against accusations of plagiarism there is an online tutorial **‘Ready, Steady, Write’** at <http://tcd-ie.libguides.com/plagiarism/ready-steady-write>.

The **'Ready, Steady, Write'** tutorial is compulsory for all Junior Freshman students and you will be asked to sign a declaration confirming that you have attended (in BYU11101 module in Blackboard).

Detailed information on what plagiarism is, how to avoid it and the consequences of committing plagiarism are laid out at <http://tcd-ie.libguides.com/plagiarism>

The College rules and further information can be read in Paragraph 95, Part B of the College Calendar (<https://www.tcd.ie/calendar/undergraduate-studies/>).

More guidance on how to avoid plagiarism will be given within Module BYU11101. As a rule of thumb you should: (1) write answers / assignments **in your own words**; (2) in your notes, keep track of from where and how you gather information from published sources; (3) rewrite key points of information **in your own words**; (3) use these key points to create a framework around which you write the essay **in your own words**.

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'. When submitting assignments and online examinations students will be required to sign and submit an accompanying declaration that they have not committed plagiarism or engaged in collusion with other students.

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.

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

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

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/>

Dates to Note:

Freshman Orientation:	20 th to 24 th September 2021
Semester one term dates:	27 th September to 17 th December 2021
Study Week Semester 1:	25 th to 29 th October 2021
Semester one examinations:	10 th to 14 th January 2022
Semester two term dates:	24 th January 2022 to 15 th April 2022
Study week semester 2:	7 th to 11 th March 2022
Semester two examinations:	2 nd to 6 th May 2022

Teaching Term Dates 2021-2022					
Michaelmas Term Monday 27 September 2021 - Friday 17 December 2021			Hilary Term Monday 24 January 2022 - Friday 15 April 2022		
Teaching wk. 1	Week 03	13 Sept – 17 Sept	Teaching wk. 1	Week 22	24 Jan - 28 Jan
Teaching wk. 2	Week 04	22 Sept - 24 Sept	Teaching wk. 2	Week 23	31 Jan – 04 Feb
Teaching wk. 3	Week 05	27 Sept - 01 Oct	Teaching wk. 3	Week 24	07 Feb - 11 Feb
Teaching wk. 4	Week 06	04 Sept - 07 Oct	Teaching wk. 4	Week 25	14 Feb - 18 Feb
Teaching wk. 5	Week 07	11 Oct - 15 Oct	Teaching wk. 5	Week 26	21 Feb - 25 Feb
Teaching wk. 6	Week 08	18 Oct - 22Oct	Teaching wk. 6	Week 27	28 Feb – 04 Mar
Study week	Week 09	* 25 Oct - 29 Oct	Study week	Week 28	07 Mar - 11 Mar
Teaching wk. 8	Week 10	01 Nov - 05 Nov	Teaching wk. 8	Week 29	*14 Mar - 18 Mar
Teaching wk. 9	Week 11	08 Nov - 12 Nov	Teaching wk. 9	Week 30	21 Mar - 25 Mar
Teaching wk. 10	Week 12	15 Nov - 19 Nov	Teaching wk. 10	Week 31	28 Mar - 01 Apr
Teaching wk. 11	Week 13	22 Nov - 26 Nov	Teaching wk. 11	Week 32	04 Mar - 08 Apr
Teaching wk. 12	Week 14	29 Nov – 03 Dec	Teaching wk. 12	Week 33	*11 Apr - 15 Apr
Teaching wk. 13	Week 15	06 Dec – 10 Dec			
Teaching wk. 14	Week 16	13 Dec – 17 Dec			

* Monday 25th October 2021 Bank Holiday - College closed

* Thursday 17th March 2022 St Patricks Day - College closed

* Friday 15th April 2022 – College closed

TR060: Biological and Biomedical Sciences

Contact details:

Course Director TR060: Biological and Biomedical Sciences

Professor Andrew Jackson

E-mail: jacksoan@tcd.ie

Phone: 01 896 2728

Freshman Biology Teaching Co-coordinator

Dr Glynis Robinson

E-mail: robinsog@tcd.ie

Phone: 01 896 2895

Executive Officer:

Ms. Helen Sherwin-Murray

E-mail: BTC.Administrator@tcd.ie

Ph: 01 896 1117

Science Course Office

Professor Áine Kelly

Ph: 01 896 2025

Associate Dean of Undergraduate Science
Education

Ann Marie Brady

E-mail: science@tcd.ie

Science Course Office Manager

Ph: 01 896 2829

Ms. Agnes Gogan

E-mail: gogana@tcd.ie

Senior Executive Officer

Ph: 01 896 2022

Ms. Mary Pat O'Sullivan

E-mail: mpsullvn@tcd.ie

Executive Officer

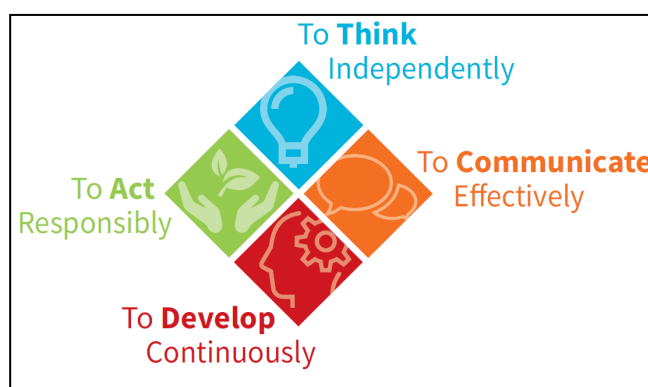
Ph: 01 8961970

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 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.

Appendix 1

Appendix 1: General Information	
ITEM	REFERENCE/Source
General Regulations	<p>Calendar, Part II - General Regulations and Information, Section II, Item 12: https://www.tcd.ie/calendar/undergraduate-studies/general-regulations-and-information.pdf</p> <p>Calendar, Part III, General Regulations, Section 1.20 https://www.tcd.ie/calendar/graduate-studies-higher-degrees/complete-part-III.pdf</p> <p><u>Attendance Requirements:</u> Calendar, Part II, General Regulations and Information, Section II, Items 17-23 Calendar, Part III, General Regulations and Information, Sections 1.23; 2.11; and 3.2</p> <p><u>Absence from Examinations</u> Calendar, Part II, General Regulations and Information, Section II, Item 35 Calendar, Part III, Section 3.5</p> <p><u>Calendar – General Regulations:</u> https://www.tcd.ie/calendar/undergraduate-studies/general-regulations-and-information.pdf</p> <p><u>Plagiarism Policy and information:</u> https://www.tcd.ie/teaching-learning/UG_regulations/Plagiarism.php https://libguides.tcd.ie/friendly.php?s=plagiarism</p>
General Information	<p>Timetables are available via my.tcd.ie portal: https://my.tcd.ie/urd/sits.urd/run/siw_lgn</p> <p>Blackboard: https://tcd.blackboard.com/webapps/login/</p> <p>Academic Registry: https://www.tcd.ie/academicregistry/</p> <p>Data Protection: https://www.tcd.ie/info_compliance/data-protection/student-data/</p> <p>Dignity & Respect Policy https://www.tcd.ie/equality/policy/dignity-respect-policy/</p>
Foundation Scholarship	<p>Foundation and Non Foundation Scholarship: Calendar, Part II www.tcd.ie/calendar/undergraduate-studies/foundation-and-non-foundation-scholarships.pdf</p>

Appendix 1: General Information

	<p>Science Foundation Scholarship information sheet: https://www.tcd.ie/Science/assets/documents/PDF/Foundation-Scholarship-Information%202018-19.pdf</p>
Teaching and Learning	<p>Academic Policies: https://www.tcd.ie/teaching-learning/academic-policies/</p> <p>Student Learning and Development: https://www.tcd.ie/Student_Counselling/student-learning/</p> <p>Student Complaints Procedure: https://www.tcd.ie/about/policies/160722_Student%20Complaints%20Procedure_PUB.pdf</p> <p>Dignity & Respect Policy https://www.tcd.ie/equality/policy/dignity-respect-policy/</p> <p>Student Evaluation and Feedback: https://www.tcd.ie/teaching-learning/quality/quality-assurance/evaluation.php</p> <p>Avoiding Plagiarism: https://libguides.tcd.ie/friendly.php?s=plagiarism/about</p> <p>National Framework for Qualifications: http://www.nfq-qqi.com/index.html</p>
Student support	<p>Student Support Services: https://www.tcd.ie/students/supports-services/</p> <p>Student Services Booklet: www.tcd.ie/students/assets/pdf/Student%20Services%20Booklet%20(web%20version).pdf</p> <p>Senior Tutor & Tutorial Service www.tcd.ie/students/assets/pdf/Student%20Services%20Booklet%20(web%20version).pdf</p> <p>Graduate Studies https://www.tcd.ie/graduatestudies/</p> <p>Mature Student Office https://www.tcd.ie/maturestudents/</p>
Co-curricular activities	<p>Central Societies Committee: https://www.tcd.ie/calendar/general-information/students-unions-societies-and-clubs.pdf</p> <p>DUCAC: https://www.tcd.ie/Sport/student-sport/ducac/?nodeId=94&title=Sports_Clubs</p>

Appendix 1: General Information

Information on TCDSU and GSU, Including student representative structures	<p>TCDSU https://www.tcdsu.org/</p> <p>TCDSU Student Representation Overview https://www.tcdsu.org/aboutus</p> <p>TCD GSU https://www.tcdgsu.ie/</p> <p>GSU - Student Representation Overview https://www.tcdgsu.ie/becomearep/</p>
Emergency Procedure	<p>In the event of an emergency, dial Security Services on extension 1999. Security Services provide a 24-hour service to the college community, 365 days a year. They are the liaison to the Fire, Garda and Ambulance services and all staff and students are advised to always telephone extension 1999 (+353 1 896 1999) in case of an emergency.</p> <p>Should you require any emergency or rescue services on campus, you must contact Security Services. This includes chemical spills, personal injury or first aid assistance.</p> <p>It is recommended that all students save at least one emergency contact in their phone under ICE (In Case of Emergency).</p>

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 Science, Technology, Engineering and Mathematics (STEM) Trinity College Dublin 2, Ireland.

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

PH: _____ +353 1 896 1970
E-mail: _____ science@tcd.ie
Web: _____ www.tcd.ie/Science

tcd.ie/science