This handbook applies to all students taking TR071 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 the course handbooks, the provisions of the General Regulations will apply.

Produced by: The Science Course Office
Trinity College
The University of Dublin
Dublin 2

Tel: +353 1 896 2829

Web address: http://www.tcd.ie/Science

Edited by: Ms Anne O’Reilly and Ms Ann Marie Brady

www.tcd.ie/science
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Overview

The purpose of this booklet is to provide information on subjects and modules that will be available in the Senior Freshman year in Science.

The Senior Freshman year will build on the material covered in the Junior Freshman year which will help decide on the career path to follow.

The modules chosen in the Junior Freshman and Senior Freshman years will determine the Moderatorship(s) for which students are qualified. Reading this booklet carefully ensures that students are aware of the Moderatorship pre-requisites and the module requirements before making choices. Should students wish to discuss their options please call into the Science Course and we will do our best to help.

We wish you well for the coming year.

Contacts:

Associate Dean of Undergraduate Science Education (ADUSE)
Professor Kevin Mitchell
Tel: 01 896 2025
E:mail: aduse@tcd.ie

Administrative Officer: Ms Anne O’Reilly
Tel: 01 896 2023
E:mail: science@tcd.ie
Programme Structure

In the Senior Freshman year students will select modules to a total of 60 credits (30 from each semester) from the following subject areas:

- Biology
- Chemistry
- Geography
- Geology
- Mathematics
- Physics

The Senior Freshman year is divided into Semester 1 (Michaelmas term) and Semester 2 (Hilary term) and you must select modules to the value of 60 credits for the year with no more than 30 credits from Semester 1 and 30 credits from Semester 2.

When choosing modules for the Senior Freshman year you must take into account:

- **Module requirements,**
  - for example: If you are taking BY2209 you must also take BY2201 and BY2205
  - If you are taking PY2P10 & PY2P20 you must also take MA22S1, MA22S2, MA22S3 and MA22S4 (full details of Module requirements are on page 5 of this booklet)

- **Moderatorship pre-requisites,**
  - for example: If you wish to compete for a place in Biochemistry you must take BY2201, BY2203, BY2205 and BY2208 (full details of Moderatorship pre-requisites are on page 6 of this booklet)

Confirm your modules by ticking a box against the modules of your choice in the online form and submit the form no later than **Thursday 23rd March 2017.**

**SF subject choice forms are available online:**
https://www.tcd.ie/Science/local/undergraduate-students/sf/

If you wish to change your mind before term begins in September 2017, you can resubmit the online form with a subject line of "change of module choice" and a note in the form specifying "change of module choice”. Please note that in some cases it may not be possible to take certain combinations due to timetable clashes. For instance BY2207 and BY2210 clash with PY2P20 labs and lectures therefore cannot be taken as a combination of modules.

**Students can apply to change their second semester module choices up to the end of the first semester by calling into the Science Course Office.**

**If you need help with your selection, please do not hesitate to call into the Science Course Office.**
The Senior Freshman year consists of the following:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Modules</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOLGY</td>
<td>BY2201: Cell Structure and Function</td>
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<tr>
<td></td>
<td>BY2202: Vertebrate Form and Function</td>
<td>5</td>
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<td>BY2203: Metabolism</td>
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<td>BY2204: Evolution</td>
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<tr>
<td></td>
<td>BY2205: Microbiology</td>
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<tr>
<td></td>
<td>BY2206: Ecosystem Biology and Global Change</td>
<td>5</td>
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<td>BY2207: Behaviour</td>
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<td></td>
<td>BY2209: Infection and Immunity</td>
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<td></td>
<td>BY2210: Agriculture, Environment and Biotechnology</td>
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<tr>
<td>CHEMISTRY</td>
<td>CH2201: Chemistry Semester 1</td>
<td>10</td>
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<td>CH2202: Chemistry Semester 2</td>
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<tr>
<td>GEOGRAPHY</td>
<td>GG2024: Physical Geography: Changing Environments</td>
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<td>GG2025: Human Geography: Changing Worlds</td>
<td>10</td>
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<tr>
<td>GEOLOGY</td>
<td>GL2205: The Dynamic Earth 1: rocks and evolution</td>
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<td>GL2206: The Dynamic Earth 2: structure and microscopy</td>
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<td>MATHEMATICS</td>
<td>MA22S1: Multivariable calculus for Science</td>
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<tr>
<td></td>
<td>MA22S2: Vector calculus for Science</td>
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<td>MA22S3: Fourier analysis for Science</td>
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<td>MA22S4: Mechanics</td>
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<td>MA22S6: Numerical Data analysis techniques</td>
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<td>PHYSICS</td>
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<td>PY2P20: Modern Physics</td>
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## TR071 Modules and Semesters

### SEMESTER ONE

**Michaelmas Term**  
*(25/9/2017 - 15/12/2017)*

<table>
<thead>
<tr>
<th>Subject</th>
<th>Modules</th>
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<tbody>
<tr>
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<td>BY2203: Metabolism</td>
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<td>BY2204: Evolution</td>
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<td>Chemistry</td>
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<td>Geography</td>
<td>GG2024: Physical Geography: Changing Environments</td>
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<td>Geology</td>
<td>GL2205: The Dynamic Earth 1: rocks and evolution</td>
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<tr>
<td>Maths</td>
<td>MA22S1: Multivariable calculus for Science</td>
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<td></td>
<td>MA22S3: Fourier analysis for Science</td>
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### SEMESTER TWO

**Hilary Term**  
*(15/01/2018 - 06/04/2018)*

<table>
<thead>
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<th>Subject</th>
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<td>BY2207: Behaviour</td>
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<td>BY2208: Genetics</td>
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<td>BY2209: Infection and Immunity</td>
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<td>BY2210: Agriculture, Environment and Biotechnology</td>
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<td>Geology</td>
<td>GL2206: The Dynamic Earth 2: structure and microscopy</td>
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<td>MA22S4: Mechanics</td>
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<td>MA22S6: Numerical Data analysis techniques</td>
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<td>Physics</td>
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## Senior Freshman Pre-requisites and module requirements 2017-2018

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<th>SF requirement</th>
<th>JF Requirement</th>
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<td>Biology</td>
<td>BY2202: Vertebrate Form and Function</td>
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<td>Biology</td>
<td>BY2203: Metabolism                                                        BY2201</td>
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<td>Biology</td>
<td>BY2204: Evolution</td>
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<td>Biology</td>
<td>BY2205: Microbiology</td>
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<td>BY2206: Ecosystem Biology and Global Change</td>
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<td>Biology</td>
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<tr>
<td>Biology</td>
<td>BY2208: Genetics</td>
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<td>BY2209: Infection and Immunity                                            BY2201 and</td>
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<td>BY2205</td>
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<tr>
<td>Biology</td>
<td>BY2210: Agriculture, Environment and Biotechnology</td>
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<td>Chemistry</td>
<td>CH2201: Chemistry 1                                                       CH1101 and CH1102</td>
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<td>Chemistry</td>
<td>CH2202: Chemistry 2                                                       CH2201</td>
<td>CH1101 and CH1102</td>
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<td>Geography</td>
<td>GG2024: Physical Geography: Changing Environments</td>
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<td>Geography</td>
<td>GG2025: Human Geography: Changing Worlds</td>
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<td>Geology</td>
<td>GL2205: The Dynamic Earth 1: rocks and evolution                          GL2205</td>
<td>GL1101</td>
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<tr>
<td>Geology</td>
<td>GL1101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>MA22S1: Multivariable calculus for Science                              MA1S11, MA1S12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>MA22S2: Vector analysis for Science                                       MA22S1 and MA22S3</td>
<td>MA1S11, MA1S12</td>
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<tr>
<td>Mathematics</td>
<td>MA22S3: Fourier analysis for Science                                      MA22S1</td>
<td>MA1S11, MA1S12</td>
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<tr>
<td>Mathematics</td>
<td>MA22S4: Mechanics                                                        MA22S1, MA22S3</td>
<td>Cannot be taken with MA22S6</td>
<td>MA1S11, MA1S12</td>
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<tr>
<td>Mathematics</td>
<td>MA22S6: Numerical and data analysis techniques                             Cannot be taken with MA22S4</td>
<td>MA1S11 or MA1M01</td>
<td></td>
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<tr>
<td>Physics</td>
<td>PY2P10: Classical Physics                                                 MA22S1 and MA22S3</td>
<td>PY1P10, PY1P20 MA1S11, MA1S12</td>
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</tr>
<tr>
<td>Physics</td>
<td>PY2P20 Modern Physics MA22S1, MA22S2, MA22S3, MA22S4</td>
<td>PY1P10, PY1P20 MA1S11, MA1S12</td>
<td></td>
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</table>
# Table of Prerequisites for Moderatorship 2017

<table>
<thead>
<tr>
<th>Moderatorship</th>
<th>Senior Freshman</th>
<th>Junior Freshman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry¹</td>
<td>BY2201, BY2203, BY2205, BY2208</td>
<td>CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
</tr>
<tr>
<td>Chemistry</td>
<td>CH2201, CH2202</td>
<td>CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
</tr>
<tr>
<td>Environmental Sciences</td>
<td>4 of the following: BY2201, BY2202, BY2203, BY2204, BY2205, BY2206, BY2207, BY2208, BY2209, BY2210</td>
<td>BY1101, BY1102</td>
</tr>
<tr>
<td>Genetics</td>
<td>BY2201, BY2203, BY2205, BY2208</td>
<td>BY1101, CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
</tr>
<tr>
<td>Geography</td>
<td>GG2024, GG2025</td>
<td>GG1024 and/or GG1025</td>
</tr>
<tr>
<td>Geology</td>
<td>GL2205, GL2206</td>
<td>GL1101</td>
</tr>
<tr>
<td>Immunology¹</td>
<td>BY2201, BY2203, BY2205, BY2208</td>
<td>CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
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<tr>
<td>Microbiology</td>
<td>BY2201, BY2203, BY2205, BY2208</td>
<td>BY1101, CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
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<td>Molecular Medicine¹</td>
<td>BY2201, BY2203, BY2205, BY2208</td>
<td>CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
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<tr>
<td>Neuroscience¹</td>
<td>BY2201, BY2202, BY2203, BY2208</td>
<td>CH1101, CH1102, &amp; MA1S11 or MA1M01</td>
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<tr>
<td>Physics</td>
<td>PY2P10, PY2P20, MA22S1, MA22S2, MA22S3, MA22S4</td>
<td>PY1P10, PY1P20, MA1S11, MA1S12</td>
</tr>
<tr>
<td>Physics and Astrophysics</td>
<td>PY2P10, PY2P20, MA22S1, MA22S2, MA22S3, MA22S4</td>
<td>PY1P10, PY1P20, MA1S11, MA1S12</td>
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<tr>
<td>Physiology²</td>
<td>BY2201, BY2202, BY2203, BY2208</td>
<td>MA1S11 or MA1M01</td>
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<tr>
<td>Plant Sciences</td>
<td>4 of the following: BY2201, BY2202, BY2203, BY2204, BY2205, BY2206, BY2207, BY2208, BY2209, BY2210</td>
<td>BY1101 or BY1102</td>
</tr>
<tr>
<td>Zoology</td>
<td>BY2201, BY2202, BY2203, BY2208</td>
<td>BY1101, BY1102, &amp; MA1S11 or MA1M01</td>
</tr>
</tbody>
</table>

¹Junior Freshman Biology 1101 is advisable
²Junior Freshman Biology 1101 and 1102 are advisable
Biology

Ten, 5 credit modules are offered in biology, which build on the material covered in the Junior Freshman year and provide a foundation for advanced studies in the Sophister life sciences moderatorships. Students may select no more than eight (40 credits) of these modules, as appropriate.

**BY2201 Cell Structure and Function**  
5 credits  
(Coordinator: Prof Emma Creagh – Biochemistry and Immunology: ecreagh@tcd.ie)

The module runs for five weeks in the first half of the first semester (Michaelmas Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

BY2201 will provide the student with a comprehensive account of the essential principles of Cell Biology and Biochemistry. The structure, function and biochemistry of the eukaryotic cell and its sub-cellular organelles will be detailed, including mechanisms such as DNA and protein synthesis and the Cell Cycle. Cytoskeletal function (how filaments coordinate cell division, mobility and intracellular movement) will also be explained. Students will attain a good understanding of the Structure and Function of Proteins, which are the most variable macromolecules in living systems and serve crucial functions in essentially all biological processes. This will provide the background to explore topics such as Enzyme Kinetics, Signal Transduction (how cells receive, process and respond to information from the environment) and Neurochemistry (Nervous tissue metabolism and the mechanism of action of neurotransmitters). The lecture course will be delivered in parallel with a laboratory-based series of experiments in Biochemistry.

**Learning outcomes:**
On successful completion of this module, students will be able to:
- Describe the structure and function of the cell and its constituting organelles.
- Demonstrate an understanding of the structures of peptides and proteins, the techniques used in purifying and characterising proteins, proteins involved in oxygen transport, and enzyme mechanisms.
- Demonstrate an understanding of how biological signals are sent, amplified, and received in the cellular context (signal transduction), and as an example, how this is achieved in cells of the neurosystem.

**BY2202 Vertebrate Form and Function**  
5 credits  
(Coordinator: Prof Áine Kelly – Physiology: aikelly@tcd.ie)

The module runs for five weeks in the second half of the first semester (Michaelmas Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

BY2202 covers the anatomy and physiology of humans and other vertebrates, with emphasis on the importance of anatomical structure to the function of physiological systems. The systems covered in detail include the nervous, musculoskeletal, cardiovascular, respiratory, renal, digestive, endocrine and reproductive systems.

The practical component of the module includes two laboratory classes in vertebrate anatomy and three laboratory classes in which fundamental neurophysiological, cardiovascular and respiratory parameters are measured in human subjects.

http://www.tcd.ie/Science/
Learning outcomes
On successful completion of this module, students will be able to:

- Explain the nature of vertebrate skeletal structure, support and movement.
- Interpret cell-cell communication in the nervous and endocrine systems.
- Describe and contrast the functions of different muscle types.
- Outline the evolution and development of the human renal and digestive systems.
- Describe the fundamental structure and function of the human cardiovascular, respiratory, renal and digestive systems.
- Interpret endocrine function and reproduction.
- Make simple measurements of basic sensory, neurophysiological, cardiovascular and respiratory variables in human subjects.
- Dissect the rat thorax and abdomen, and identify the major organs.

BY2203 Metabolism 5 credits
(Coordinator: Prof Emma Creagh – Biochemistry and Immunology: ecreagh@tcd.ie)

The module runs for five weeks in the second half of the first semester (Michaelmas Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

The principles of metabolism and its control will be explored in BY2203 using the glycolytic pathway as the principal example. It will be seen that the rate of flux through the different enzyme reactions is determined by differences in gene regulation, kinetics, and hormonally driven phosphorylation/dephosphorylation. The way this pathway is differentially regulated in different cell types and organs will show how metabolic diversity is achieved. Storage of glucose and breakdown, and how cells and organisms generate free energy follows. In addition, the atomic-level structural aspects of the ‘nanomachines’ involved in key pathways will be discussed. After being introduced to the metabolism of the other two macro-nutrients (namely fats and proteins), a final integration of carbohydrate (glucose) metabolism will show how all of the pathways are highly interconnected. The lecture course will be delivered in parallel with a laboratory course. (Prerequisite: BY2201)

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

- Demonstrate an understanding of the metabolic pathways - the energy-yielding and energy-requiring reactions in life.
- Demonstrate an understanding of the diversity of metabolic regulation, and how this is specifically achieved in different cells.
- Describe and appreciate the modern techniques utilised in understanding the key mechanistic steps at atomic-level detail.
- Describe how these biochemical processes are not isolated but tightly integrated, with specific control sites and key junctions.

BY2204 Evolution 5 credits
(Coordinator: Prof Trevor Hodkinson – Natural Sciences: hodkinst@tcd.ie)

The module runs for five weeks in the first half of the first semester (Michaelmas Term) of the academic year and comprises of four lectures per week (approx. 20 hours total contact time) together with 3-4 assignments, requiring a further 15+ hours.

BY2204 is designed to teach evolution and the main concepts explaining Natural Diversification. In the first part, general evolutionary concepts are covered, including an historical perspective that spans pre-Darwinian and post-Darwinian thinking and goes from the macro-evolutionary
http://www.tcd.ie/Science/
concepts (origins of life, speciation, Natural Selection, Kin Selection and altruism and population genetics) to the micro-evolutionary details (molecular evolution, phylogenetics, human evolution and evolution and development). The second part, covers evolutionary patterns and processes in plants, including plant-animal/plant-fungi coevolutionary dynamics and how constraints are artificially intensified during domestication of plants and animals. Practicals, some of a computational nature, will support both parts of the module.

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

- Appreciate one of the most revolutionizing fields in science. Evolution has been the subject of intense studies since ancient times and the fuel of heated controversies between creationists and evolutionary scientists.
- Show how organisms change as the result of interacting with their dynamic environment.
- Describe how life evolves and the processes driving its diversity. Examples will be provided through the lectures demonstrating that our knowledge of historical changes at the molecular level can aid in answering why organisms present different morphological traits.
- Demonstrate a knowledge of evolution can help shed light on many applied aspects of biology including agriculture, medicine and conservation.

**BY2205 Microbiology**

5 credits

(Coordinator: Prof Joan Geoghegan – Genetics and Microbiology: geoghejo@tcd.ie)

The module runs for five weeks in the first half of the second semester (Hilary Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

BY2205 provides a comprehensive introduction to the microbial sciences through lectures and practical classes provided by experts in the field. Students will learn about the biology of the major groups of microbes, including bacteria, viruses, yeast and protozoa. The course explains how microorganisms grow and develop, how they interact with the environment and with one another. This module will equip the students with a sound foundation in microbial physiology, cell biology and molecular biology.

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

- Describe the diversity of bacteria, viruses and eukaryotic microorganisms.
- Discuss the interactions of microbes with humans, plants and animals during health and disease.
- Explain the importance of the human microbiome.
- Describe the mammalian immune system and the interactions of microbes with the immune and other physiological systems.
- Describe the structure of Gram-positive and Gram-negative bacteria and the importance of each component of the bacterial cell envelope.
- Describe bacterial cell division and biosynthesis of the cell wall.
- Describe how infectious organisms such as viruses and bacteria cause disease and give examples of these.
- Discuss the virus replication cycle and how viruses spread.
- Describe the basic life cycles of budding and fission yeasts.
- Explain why *Saccharomyces cerevisiae* is a model organism for the study of molecular biology of eukaryotic cells.
- Explain the mating process and the molecular basis of mating type determination and switching in *Saccharomyces cerevisiae*.

http://www.tcd.ie/Science/
• Explain the molecular basis of genetic switches that control gene expression in bacteria and their viruses (bacteriophages).

BY2206 Ecosystem Biology and Global Change 5 credits
(Coordinator: Prof Fraser Mitchell – Natural Sciences: fraser.mitchell@tcd.ie)

The module runs for five weeks in the second half of the second semester (Hilary Term) of the academic year and comprises of four lectures and one three-hour practical session or field trip per week (approx. 35 hours total contact time).

BY2206 focuses on exploring how organisms interact with their environment across the range of global biomes (both terrestrial and aquatic). The adaptation of organisms to their environment is a persistent theme throughout. Ecological modelling is used to investigate ecosystem functioning and maintenance in relation to environmental change. The lectures are supported by four diverse practical classes, one is held in the Biology Laboratory, one in the TCD Botanic Gardens, one in a computer lab and the final one on a field trip to the North Bull Island. These practicals serve to illustrate the wide range of ecological concepts covered in the lectures.

Learning outcomes
On successful completion of this module, students will be able to:
• Demonstrate knowledge of how the global climate system operates.
• Describe examples of the major terrestrial and aquatic ecosystems.
• Demonstrate knowledge of how biotic and abiotic factors impact on ecosystems.
• Describe how energy and nutrients flow through ecosystems.
• Demonstrate knowledge of the basic concepts of ecological modeling.
• Run ecological models using EcoBeaker software.
• Demonstrate knowledge of the impact of environmental change on global ecosystems.

BY2207 Behaviour 5 credits
(Coordinator: Prof Nicola Marples – Natural Sciences: nmarples@tcd.ie)

The module runs for five weeks in the first half of the second semester (Hilary Term) of the academic year and comprises of four lectures per week, together with a series of practicals and assessments (approx. 35 hours total contact time).

The animal behaviour module comprises a series of lectures, four assessments carried out online after watching a video and two practicals. One of the practicals is carried out in your own time, at Dublin Zoo, and assessed online. The other is carried out as a group in a timetabled slot, and is followed by an explanatory lecture, and an online assessment. The module covers a wide range of topics, beginning with a brief history of behavioural research. You then have a series of lectures on different influences on behaviour including group dynamics, genetic, hormonal, developmental and neurobiological influences. These lectures will be given by experts in each of these fields. You are then introduced to various aspects of learning, cultural transmission, cognition and intelligence in animals. The module concludes with a lecture and then a class debate on the ethics of animal-human interactions.

Learning outcomes
On successful completion of this module, students will be able to:
• Place the study of behaviour in context related to a historical perspective.
• Describe the range of factors which influence animal behaviour, linking the understanding of behaviour to a number of other biological study areas.

http://www.tcd.ie/Science/
• Outline the basics of learning, both through classical mechanisms and through cultural transmission.
• Discuss the concept of animal intelligence and our understanding of consciousness in non-humans.
• Form a reasoned ethical position about human interactions with animals.
• Build from a sound basis of understanding of basic behavioral ecological concepts.

BY2208 Genetics 5 credits
(Coordinator: Dr Matthew Campbell – Genetics and Microbiology: Matthew.Campbell@tcd.ie)

The module runs for five weeks in the first half of the second semester (Hilary Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

BY2208 will provide an introduction to analytical, molecular and cellular genetics. Topics will include: DNA and RNA synthesis and the genetic code; principles of gene expression and the mechanisms that control it - with illustrations of importance in development and behaviour; human genetic analysis - deciphering the genetics of disease - and insights from the human genome project; variation in genetics among human populations; the genetic basis of cancer. A parallel practical course will introduce techniques in molecular genetics and bioinformatics.

Learning outcomes
On successful completion of this module, students will be able to:
• Describe the fundamental molecular principles of genetics.
• Interpret the structure and function of DNA, RNA and protein.
• Explain the way in which genes code for proteins.
• Demonstrate the relationship between phenotype and genotype in human genetic traits.
• Describe the basics of genetic mapping.
• Show how gene expression is regulated.
• Describe the genetic basis of cancer.

BY2209 Infection and Immunity 5 credits
(Coordinator: Prof Cliona O’Farrelly – Biochemistry and Immunology: ofarrecl@tcd.ie)

The module runs for five weeks in the second half of the second semester (Hilary Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

The focus of this module is on pathogens and their interaction with host organisms, particularly humans. Students will learn about major pathogenic bacteria, viruses, protozoa and fungi, the mechanisms by which they cause disease, and approaches to controlling them. Innate and acquired immune responses to these pathogens will be presented. Molecular processes and genetic influences underpinning resolution or exacerbation of infection will be explored. Mechanisms for manipulation of host defence will also be covered. (Prerequisites: BY2201 and BY2205)

On successful completion of this module, students will be able to:
• Describe the general features of the major microbial pathogens covered and explain the mechanisms by which they cause disease and the methods used to control them
• Describe the innate and acquired immune responses to the pathogens covered and explain how host defence can be manipulated, e.g. by vaccination

http://www.tcd.ie/Science/
• Discuss the molecular processes and genetic influences underpinning resolution or exacerbation of infection
• Demonstrate experimental skills in the microbiological and immunological techniques covered.
• Demonstrate an appreciation of the ways in which our knowledge of infection and immunity is based on the results of experimentation.

**BY2210 Agriculture, Environment and Biotechnology**  5 credits
(Coordinator: Prof Mike Williams – Natural Sciences: michael.williams@tcd.ie)

The module runs for five weeks in the second half of the second semester (Hilary Term) of the academic year and comprises of four lectures and one three-hour practical session per week (approx. 35 hours total contact time).

By 2050 the UN estimates that the world will need 70% more food, 55% more clean water and 60% more energy than it does today. These demands will have to be addressed alongside changing climate, increased pollution and depleting natural resources. Plants are central to our efforts to sustainably use biological resources and are among our most valuable resources. Their sustainable utilization is crucial for the future of humankind as plants provide the food we eat, many of the medicines we depend on and the air we breathe. They also regulate our climate. This module discusses how plants, and to a lesser extent animals, are exploited as bioresources in agriculture, environmental sciences and biotechnology. It covers domestication, sustainable agriculture, plant breeding and biotechnology, biological pest control, pollination services, non-food crops, conservation of genetic resources, bioprospecting and ethnobiology, the regulation of the global carbon cycle, climate change, water technology and pollution.

On successful completion of this module, students will be able to:
• Demonstrate a detailed knowledge of agricultural plants, domestication and non-food crops
• Show how biotechnology and plant breeding methods are used to produce new plants for agriculture and medicine
• Explain how agriculture can be made more sustainable
• Explain the major methods of biological pest control and the use of insects as pollination services
• Demonstrate a detailed knowledge of plant genetic resource conservation
• Explain the key concepts of bioprospecting and ethnobiology

**Contact:**

Director, Biology Teaching Centre  Dr John Rochford
Tel: 01 896 2237
E-mail: rchfordj@tcd.ie

Executive Officer, Biology Teaching Centre  Ms Diane Touzel
Tel: 01 896 1117
E-mail: BTC.Administrator@tcd.ie

Web:  http://www.tcd.ie/Biology_Teaching_Centre/
Chemistry

Introduction
The Senior Freshman course in Chemistry consists of two modules Chemistry 1 (CH2201 10 credits) and Chemistry 2 (CH2202 10 credits). Both modules consist of core Physical, Inorganic and Organic Chemistry topics at an intermediate level, which further develop the material covered in the JF year and are the basis for further detailed studies in the Sophister years.

Tuition will consist of lectures, tutorials and practicals. The practical element will include the preparation and analysis of a variety of inorganic compounds, studies on synthetic organic chemistry, and set experiments/exercises in physical chemistry and molecular modelling, which complement the lectures.

Students will also engage in a team-based activity that will involve research, preparation and delivery of a PowerPoint presentation on some aspect of every-day chemistry.

Students must have taken CH1101, CH1102 and MA1S11 OR MA1M01 during the Junior Freshman year.

Module CH2201 10 credits
(Coordinator: Prof Paula Colavita: colavitp@tcd.ie)
This module will cover topics in:

• Molecular Orbital Theory: An appreciation of atomic orbital functions and their importance in determining fundamental chemical properties Recap of localized bonding models and hybridization. Introduction to qualitative molecular orbital (MO) theory including the concept of positive, negative and zero overlap interaction as a function of energy difference and molecular orbital shape. MO analysis of simple molecules and its relationship to molecular properties. Orbital basis for ligand field-splitting in transition-metal complexes.


• Chemical Thermodynamics: This foundation course in classical chemical thermodynamics addresses the First, Second and Third Laws of Thermodynamics, as well as the interrelationships between the state functions that govern the direction and extent of physical and chemical changes. This topic provides the basis for understanding many of the empirical physical laws of phase equilibria introduced in the Junior Freshman year. The concept of the chemical potential in ideal systems is used to develop the van’t Hoff and Clausius-Clapeyron equations, as well as the temperature dependence of phase equilibria, which explain phenomena such as solubility and the full range of colligative properties of solutions.

• Chemical Kinetics: Introduction to the principles of chemical reaction kinetics with the development of pertinent mathematical skills essential for kinetic analysis of simple chemical systems, and the application of kinetic ideas to an understanding of enzyme and heterogeneous catalysis.
• **Introduction to Organic Synthesis:** Introduces the students to a number of new concepts in organic chemistry and builds on their knowledge developed in first year. The module begins with an in-depth discussion of stereochemistry including absolute-configuration and the Cahn-Ingold-Prelog rules for assignment of stereochemistry. The Definition of diastereoisomers and the relationship between enantiomers and diastereoisomers is discussed. Resolution of racemic mixtures is also covered. Conformational analysis, including Newman projections diagrams is discussed. An introduction to carbohydrate chemistry and a discussion of common protecting groups in organic chemistry is provided. The use of radical reactions in Organic synthesis is also discussed. This is followed by in-depth discussion of aldol, carbonyl and beta-dicarbonyl chemistry for the formation of C-C bonds. HSAB theory, the Michael addition reaction and Diels-Alder reaction are all covered in detail.

**Module CH2202 10 credits**
(Coordinator: Prof Paula Colavita: colavitp@tcd.ie)
This module will cover topics in:

• **Inorganic Chemistry of the Environment**
The aim of this course is to give chemists an introduction to environmental, inorganic chemistry concepts. The course is wide-ranging, including aspects of physics, geography, biology and geology. Emphasis is put on natural cycles and the interaction of elements with their environment, as well as the ways in which anthropogenic influences are affecting environmental equilibria. Aspects include the hydrological cycle, global warming, acidification, immobilisation of heavy metal ions, the carbon cycle and fuels.

• **Nuclear and Medicinal Inorganic:** Nuclear chemistry, including the different kinds of decay, kinetics, mass loss and energy, half-life, radio-carbon dating, nuclear metals in medicine (radiation therapy).
Medicinal chemistry including HSAB principle, chelation therapy (Fe, Hg, Ti, Pb), and cisplatin for cancer treatment (DNA adducts, side effects, resistance).

• **Theoretical and Quantum Chemistry:** The student will be introduced to the basic aspects of quantum mechanics and the use of Schrödinger’s equations to describe particle systems in chemistry. This topic will emphasize how the solutions to Schrödinger’s equation are connected to experimental observables and spectroscopic results, and how to use these results to obtain structural information about molecules and atoms.

• **Chemistry of Aromatic Compounds:** This topic will consider the importance of aromatic chemistry by illustrating the number of important drugs (and some other important everyday chemicals) containing an aromatic moiety. The student will receive a brief recap on the structure of benzene, bonding, bond lengths, aromatic stabilization, and on comparison of the chemistry of alkenes to that of aromatic compounds (addition versus substitution reactions). An overview of electrophilic aromatic substitution reactions with detailed mechanistic considerations and an analysis of directing effects will be provided. The requirements for the different methods of nucleophilic aromatic substitution will be discussed. Applications of organometallic chemistry to aromatic compounds will be described. Aromatic chemistry will then be employed as a vehicle to develop the skills and logic required for a successful approach to synthetic chemistry.

• **Organic Spectroscopy:** This topic is concerned with the use of spectroscopic techniques to elucidate the structure of organic compounds. The importance of structural determination will be discussed. The course will focus mainly on Nuclear Magnetic Resonance spectroscopy (NMR) but will also highlight how other techniques such as
Infrared spectroscopy (IR), Ultra Violet/Visible spectroscopy (UV/Vis), mass spectrometry and X-ray diffraction can be used in conjunction with NMR to confirm the structure of a compound. The background of NMR will also be described in some detail, including how the signals arise, what determines chemical shift and how coupling develops. A number of worked examples will be employed to further highlight these concepts. The strength of the other techniques described above, with respect to organic structural elucidation, will be considered.

- **Introduction to Molecular Modelling.** Definition of potential energy surfaces and their importance in defining chemically relevant parameters and the definition of local and global turning points. Basic approaches to exploring potential energy surfaces through optimization, molecular dynamics and Monte-Carlo techniques. Molecular modelling will be applied to a range of chemical problems.

**Contact:**

**Year Co-ordinator**

Prof P.E. Colavita  
Tel: 896 3562  
E-mail: colavitp@tcd.ie

**Co-ordinator of Freshman Teaching**

Dr P.N. Scully  
Tel: 01 896 1972  
E-mail: pnscully@tcd.ie

**Web:**  
http://chemistry.tcd.ie/
Geography

Senior Freshman Geography builds on issues raised in modules taught in the Junior Freshman year. Topics covered at Senior Freshman level include more detailed investigations of environmental change; landscape-forming processes, biogeography, cultural, economic and historical geography.

GG2024 Physical Geography: Changing Environments 10 credits
(Module Co-ordinator: Prof M. Bourke: bourkem4@tcd.ie)

This module represents a foundation in modern physical geography and is designed to explain and analyse environmental change during the last 2.6 million years (the Quaternary period). The module will take a number of key elements of contemporary environmental change and analyse modern process, past records and archives of environmental change. Elements of the course are designed to prepare students for sophister physical geography modules.

GG2024 Learning Outcome:
On successful completion of this module students will be able to:

- Identify important topics and themes in contemporary physical geography.
- Appraise some of the major current debates in physical geography.
- Illustrate how records of past change can be developed from a range of different environments.
- Explain how an understanding of modern processes is fundamental to our ability to reconstruct the past and predict future environmental change.

GG2025 Human Geography: Changing Worlds 10 credits
Module Co-ordinator: Prof M. Sokol: sokolm@tcd.ie

This module introduces students to a number of key issues within contemporary human geography and exposes them to a range of methodological approaches and research techniques. The overarching theme of the module is the way in which historical, cultural, environmental, political and economic geographies are changing under the force of globalization. Specific areas covered include an examination of globalisation from a historical perspective; approaches, methods and sources in historical geography; emergence of global environmentalism in a changing world; the creation of ‘third world’ and the impact of globalisation on the developing world; and political and economic aspects of globalisation.

GG2025 Learning Outcome:
On successful completion of this module students will be able to:

- Identify important topics and themes in contemporary human geography;
- Appraise some of the major current debates in human geography;
- Outline and contrast a range of research methods in human geography.

Contact:
Freshman co-ordinator: Prof. Martin Sokol
Tel: 01 896 2355
E-mail: sokolm@tcd.ie

Web: http://www.tcd.ie/Geography/
Geology

Senior Freshman Geology courses all have GL1101 as a prerequisite. There are two modules, one in Michaelmas Term and one in Hilary Term. Module GL2205 in Michaelmas term is a prerequisite for the GL2206 module in the Hilary Term. Taking both modules provides a coherent package of material relating to our planet.

An optional short residential field course in Michaelmas term will visit the spectacular geology around the Giant’s Causeway in Antrim. Acceptance on this, which will have limited numbers, will be on a first come basis. Similarly a second optional residential field course in Hilary term to County Wexford will take place during part of the study week and an adjacent weekend. Attendance at these field courses is very strongly recommended for those students wishing to moderate in Geology.

GL2205 The Dynamic Earth 1: rocks and evolution 10 credits
(Co-ordinator: Professor Balz Kamber: kamberbs@tcd.ie)

The overall objective of the course is to illustrate the dynamic nature of planet Earth both from its rock and fossil record. The course initially approaches the solid materials that make up the outer parts of the Earth, the lithosphere, namely rocks and their basic building blocks, minerals. A pathway is taken through the rock cycle from initial formation from mantle material into igneous rocks, their subsequent breakdown at the Earth’s surface and reconstitution into sedimentary rocks and the alteration of these rocks through burial at elevated temperatures and pressures. Techniques of describing and reaching first stage interpretations of rocks and minerals in hand sample are covered.

Equipped with an appreciation of the dynamic nature of the solid Earth, the course then introduces the time dimension to life, which has existed on planet Earth for much of its history. Fossil organisms are the data that record the evolution of life on the planet. In this course the aims are to provide (1) the means to identify a broad range of invertebrate and vertebrate fossils; (2) an understanding of form and function in fossil organisms and their links to living floras and faunas; (3) an overall appreciation of the evolutionary record of life on Earth.

GL2205 Learning Outcome:
On successful completion of the module students will be able to describe and identify common kinds of rock, and the minerals they contain, in hand sample. They will be able to trace the dynamic progression of Earth materials from one kind of rock to another in the context of plate tectonic settings. They will be able to describe and classify a broad range of organisms found in the fossil record, and to explain the concepts of fossilization, evolutionary sequences and lineages. They will be able to outline the uses of fossils in palaeobiological, palaeogeographic and evolutionary studies, and to state the basic principles of taxonomic procedure.
GL2206  The Dynamic Earth 2: structure and microscopy  10 credits
(Co-ordinator: Dr David Chew: chewd@tcd.ie)

This module investigates the structure of the Earth from the scale of plate tectonics through to investigation using the polarising microscope. The tectonics lectures provide an overview of active plate tectonic processes in a variety of tectonic environments. The structural geology lectures cover the principles of rock deformation and the classification of structural features. A series of practical exercises aim to develop an understanding of plate tectonics and the visualisation of structures in three dimensions. The second half of the module introduces the principles of crystallography to the study of minerals, and deals with the theory and practice of using a polarised light microscope to look at minerals in very thin transparent slices of rock called thin sections. The rock-forming minerals are examined in detail in terms of where they are found, what they look like through the microscope, what chemical elements they contain, and their physical stability.

GL2206 Learning Outcome:
On successful completion of this module students will be able to state the basic geodynamic principles of plate tectonics and describe the different plate tectonic environments and how they evolve in time and space. They will be able to discuss the principles of rock deformation and to classify structural features. They will be able to read, interpret and create simple geologic maps and to create a crude structural cross section from a geologic map. They will be able to define terms used in basic crystallography, and to outline the crystal structures, the chemical compositions, the appearance, the stability and the occurrence of the main rock-forming minerals. They will be able to use a polarised light microscope to describe and identify minerals in thin sections of rock, and to explain the physical principles of this technique.

Contact:

Course Advisor: Dr David Chew
Tel: 01 896 1165
E-mail: chewd@tcd.ie
Web: http://www.tcd.ie/Geology
Mathematics

The programmes that require Mathematics are the moderatorships in Physics and Human Genetics. Apart from requirements, mathematics is increasingly used in many different branches of Science. If you enjoy mathematics, and have done Mathematics MA1S11/MA1S12 in your Junior Freshman year, there are a number of modules you can select. (Please note that MA1S11/MA1S12 are prerequisites for all modules listed below, with the exception of MA22S6).

Physics requires a strong background in multivariable calculus, Fourier Methods, partial differential equations and a treatment of mechanics (modules MA22S1, MA22S3, MA22S2, and MA22S4).

MA22S1 Multivariable calculus for Science 5 credits
(Coordinator: Prof. S. Sint)
Description: (Michaelmas term.) Vector-valued functions (curves); Functions of several variables (partial derivatives, chain rule, gradient, tangent planes); Lagrange multipliers; Line intergrals; Multiple integrals;

MA22S3 Fourier analysis for Science 5 credits
(Co-ordinator: Prof. S. Sint)
Description: (Michaelmas term.) Further linear algebra (vector spaces, linear independence, bases, change of basis); Fourier analysis; Ordinary differential equations and special functions; [Must be taken with MA22S1]

MA22S2 Vector calculus for Science 5 credits
(Coordinator: Prof. S. Sint)
Description: (Hilary term.) Surface integrals, theorems of Gauss, Green and Stokes; Partial differential equations; [Prerequisites: MA22S1, MA22S3]

MA22S4 Mechanics 5 credits
(Coordinator: Prof. S. Sint)
Description: (Hilary term.) A treatment of mechanics including motion in two and three dimensions; [Prerequisites: MA22S1, MA22S3, Cannot be taken with MA22S6]

MA22S6 Numerical and data analysis techniques 5 credits
(Coordinator: Prof. S. Sint)
Description: (Hilary term.) Numerical linear algebra; Mathematical statistics; Practical (computer) work; [Prerequisites: MA1S11 or MA1M01, Cannot be taken with MA22S4]

Contact:

Course coordinator Professor Stefan Sint
Tel: 01 896 8559
E-mail: sints@tcd.ie
Web: http://www.maths.tcd.ie/
Physics

Tuition will consist of lectures, practicals and tutorials in physics at intermediate level. Lectures are given on oscillations, optics, electricity and magnetism, thermodynamics, special relativity, nuclear physics, materials physics, and astronomy. Practicals include set experiments, computational exercises and group study projects. This tuition may only be taken by students reading the appropriate elements of Senior Freshman mathematics:

Lectures in Physics in SF year are given in two modules (Classical Physics and Modern Physics). Students must take both modules, comprising Lectures, Laboratory Classes, Group Study Project, and Small Group Tutorials (see below)

PY2P10 Classical Physics 10 credits
(Co-ordinator: Prof Hongzhou Zhang: hozhang@tcd.ie)
This module combines four elements of classical physics as follows:

- **Electricity & Magnetism II:** Magnetism, magnetic field lines and flux; Lorentz force on moving charge; Energy of and torque on a current loop in a magnetic field; magnetic fields of moving charges; Biot-Savart Law illustrated by magnetic fields of a straight wire and circular loop; forces between current-carrying straight wires; Ampere’s Law in integral form illustrated by field of a straight conductor of finite thickness. Electromagnetic induction and Faraday’s Law in integral form; Lenz’s Law; induced electric fields and motional emf’s; summary of Maxwell equations in integral form; Mutual inductance and self-inductance. R-L circuits and L-R-C circuits. AC circuits, phasor diagrams, reactance, resonance, transformers and complex representation of reactance. Power analysis. R-C integration and differentiation, R-C low- and high-pass filters and active filters.


PY2P10 Learning Outcomes:
On successful completion of this module, the students will be able to:

- Solve basic problems in relation to harmonic oscillators
- Relate the concept of oscillations to optical properties of matter and AC circuits
- Describe elementary crystal structures and the response of materials to external forces
- Employ web-based research techniques in a small group project and present the results in the form of a poster
- Describe how the laws of thermodynamics react to properties of matter
• Either prepare an extensive report detailing methodology, data gathering and interpretation of a physical experiment and obtain, pre-process, display and analyse experimental data using software packages such as Origin or analyse, modify and run Python language programs to perform computer experiments

PY2P20 Modern Physics  10 Credits
(Co-ordinator: Prof Hongzhou Zhang: hozhang@tcd.ie)
This module combines four elements of modern physics as follows:
• **Waves & Optics**: Maxwell equations in differential form. Coulomb's and Gauss' Laws; Biot-Savart and Ampere's Laws; absence of magnetic monopoles; Faraday’s Law and magnetic induction. Electric dipoles, dielectric polarisation and dielectric susceptibility; magnetic dipoles, magnetisation and diamagnetic susceptibility; continuity equation, displacement current and Maxwell’s generalisation of Ampere’s Law. Electromagnetic waves in vacuum and isotropic matter. Energy density in time-varying electromagnetic fields and Poynting vector. Reflection, refraction, plane, circular and elliptic polarisation of light; dichroism, birefringence; interference, interferometers, coherence, Young’s slits, near and far field diffraction.
• **Observing the Universe**: Our place in the Universe, its contents (e.g. planets, stars, galaxies) and scale. Basic observational astronomy (e.g., electromagnetic spectrum, telescopes, coordinate system). Basic stellar information (e.g., distance, luminosity, colours). Life and death of stars. Planets and life in the Universe. The structure of our Galaxy and other galaxies. The origin and fate of the Universe

PY2P20 Learning Outcomes:
On successful completion of this module, the students will be able to:
• Describe how modern physics is underpinned by nuclear and particle physics; waves and optics
• Express relativistic effects as observed in different inertial reference frames
• Relate the preparation of materials to the resulting microscopic structure and material properties, based on the interpretation of phase diagrams
• Either prepare an extensive report detailing methodology, data gathering and interpretation of a physical experiment and obtain, pre-process, display and analyse experimental data using software packages such as Origin or analyse, modify and run Python language programs to perform computer experiments

www.tcd.ie/science
Laboratory Classes:
Students are required to attend one 3-hour laboratory session each week. The experiments are designed to continue the development of personal initiative and experimental and computational skills. Reports on these experiments are assessed during the year.

Group Study Projects:
Students are asked to investigate a given topic in Physics and present their findings in the form of a poster. Students work in groups of about four.

Small Group Tutorials:
Students are required to attend tutorials and to complete associated homework.

Contact:
Senior Freshman Year Head: Prof Hongzhou Zhang  
Tel: 01 896 4655  
E-mail: hozhang@tcd.ie

Web: http://www.physics.tcd.ie/
General Information

Absence from College/Med Certs
All Freshman Science Students – TR071 Science; Chemistry with Molecular Modelling; Earth Sciences; Human Genetics; Medicinal Chemistry; Nanonscience, Physics and Chemistry of Advanced Materials:

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 on the science web page and copies are available in the Science Course office before the beginning of 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. Students are advised NOT to take a screenshot of timetables on my.tcd.ie as this will not reflect the most up-to-date information. Timetables should be viewed regularly in real time.

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 (other reasons Sport etc.,) – 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). 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) at the earliest opportunity.
Timetables

Lecture timetables are published through my.tcd.ie and can be obtained in hard copy from the Science Course Office 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 most up-to-date timetable information is available via my.tcd.ie. DO NOT take screenshots as this does not reflect up-to-date information.

Lab Allocations

The Science Course Office is responsible for laboratory allocations for Science, Chemistry with Molecular Modelling, Human Genetics, Medicinal Chemistry and Nanoscience, Physics and Chemistry of Advanced Materials. Due to the large number of students who need to be assigned it is not possible to change labs unless you have a valid reason:

- **Medical Condition** – must be confirmed with a letter from doctor, counselling services etc as appropriate
- **Work commitments** – a letter must be provided from your employer on COMPANY HEADED PAPER.
- **Sporting commitments** – DUCAC letter must be provided PRIOR (at least one week) to the event taking place.

Module changes

Students who wish to change their module choice may do so by calling into the Science Course Office or via the following link:
https://www.tcd.ie/Science/local/undergraduate-students/sf/

Please note that changes to semester one modules may be submitted until 6th October 2017 and semester two changes may be submitted until Friday 1st December 2017. Changes after these dates will not be permitted.

E-mails and correspondence

The Science Course Office will only use valid TCD e-mail addresses when contacting a student or class group. Students are required to supply their full name and student number in all correspondence with the Science Course Office.
SENIOR FRESHMAN STUDENTS EXAMINATION REGULATIONS 2016-17:

SCIENCE (TR071) – UBSC-SCIE-1F (All routes)
HUMAN GENETICS (TR073) – UBGM-HGEN-1F
CHEMISTRY WITH MOLECULAR MODELLING (TR074) – UBCHCH-CMMO-1F
MEDICINAL CHEMISTRY (TR075) – UBCH-MCHE-1F
NANOSCIENCE, PHYSICS AND CHEMISTRY OF ADVANCED MATERIALS (TR076)- UBES-NANO-1F
EARTH SCIENCES (TR077) – UBNS-EARS-1F

1. GENERAL COLLEGE REGULATIONS
General College regulations with regard to examinations shall apply to all examinations in Science as set out in the University Calendar 2016-17
https://www.tcd.ie/calendar/undergraduate-studies/

2. EXAMINATION REGULATIONS – SENIOR FRESHMAN
2.1. Examination timetables are published in advance of the dates of examinations on the College website at https://www.tcd.ie/academicregistry/exams/timetables-dates/
The College reserves the right to alter the published time and date of an examination in exceptional circumstances. Students should ensure that they are available for examinations for the duration of the relevant examination session as stated in the Almanack.

2.2 Senior Freshman students must, in the first instance, sit the annual examination for their course.

To gain a pass in the Senior Freshman year, students must achieve an overall credit-weighted average mark of at least 40 per cent (grade III) and accumulate 60 credits by (a) passing all modules outright or (b) passing by compensation.

Students passing the Senior Freshman year are qualified to rise to the Junior Sophister year.

2.3 To compensate at the Annual/Supplemental examinations, students must
(i) obtain an overall mark of 40% or higher AND

EITHER
(ii) obtain marks of 40% or higher in individual modules to the value of 55 credits AND obtain marks of 30% or higher in each of the remaining modules.

OR
(iii) obtain marks of 40% or higher in individual modules to the value of 50 credits AND obtain marks of 35% or higher in each of the remaining modules.
2.4 Students who are unsuccessful in the annual examinations may re-sit examinations in the failed modules at the supplemental examination. (There is no fee for the Supplemental Examination).

2.5 Students who are not qualified to rise to the Senior Freshman year, but whose overall mark is 34.5% or higher in either the annual or supplemental examination, may be permitted to repeat the Senior Freshman year in order to improve their performance.

2.6 Students whose overall mark is 34.49% or lower in the annual examinations and supplemental examinations are not permitted to repeat their year and must withdraw from the course.

Students failing to take the Annual Examination are not permitted to take the Supplemental Examination or repeat the year, except with the permission of the Senior Lecturer. Students permitted to defer their first sitting until the Supplemental Examination will be permitted to compensate as in 2.3 above.

A student may not repeat the Senior Freshman year more than once, except by special permission of the University Council.

Science Course Office

September 2017
Important information

Attendance

17 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.

18 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.

19 The requirements for attendance at lectures and tutorials vary between the different faculties, schools and departments. Attendance is compulsory for Junior Freshmen 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. For professional reasons lecture and tutorial attendance in all years is compulsory in the School of Engineering, the School of Dental Science, the School of Medicine, the School of Nursing and Midwifery, the School of Pharmacy and Pharmaceutical Sciences and for the B.Sc. in Clinical Speech and Language Studies. Attendance at practical classes is compulsory for students in all years of the moderatorship in drama and theatre studies and drama studies two-subject moderatorship.

20 In special circumstances exemption from attendance at lectures for one or more terms may be granted by the Senior Lecturer; application for such exemption must be made in advance through the tutor. Students granted exemption from attendance at lectures are liable for the same annual fee as they would pay if attending lectures. Students thus exempted must perform such exercises as the Senior Lecturer may require. If these exercises are specially provided, an additional fee is usually charged.

21 Students who in any term have been unable, through illness or other unavoidable cause, to attend the prescribed lectures satisfactorily, may be granted credit for the term by the Senior Lecturer and must perform such supplementary exercises as the Senior Lecturer may require. The onus for informing the Senior Lecturer of illness rests with individual students who should make themselves familiar with the general and more detailed school or course regulations regarding absence from lectures or examinations through illness. In addition, issues with students may arise from time to time, which in the opinion of the Senior Lecturer affect a student’s ability or suitability to participate in his or her course. If required by the Senior Lecturer, students (other than those subject to §28 below) are obliged to undergo a medical examination or assessment by a doctor or specialist nominated by the Senior Lecturer at the expense
of the College for the purpose of obtaining an opinion as to the student’s medical fitness to continue with his/her studies or as to his/her ability or suitability to participate in his/her course to the standards required by the College. Students found to be unfit following such a medical examination or assessment may be required to withdraw until such times as they are deemed fit to resume their studies. Students who fail to attend such a medical examination or assessment within a reasonable period may be required by the Senior Lecturer to withdraw until such time as they attend the aforementioned medical examination or assessment and are deemed fit to resume their studies.

**Non-satisfactory attendance and course work**

All students must fulfil the requirements of their chosen modules, with regard to attendance and prescribed course-work. Students will be deemed non-satisfactory in each module in which they fail to comply with more than a third of the requirements. Students reported as non-satisfactory may be refused permission to take their annual examinations and may be required by the Senior Lecturer to repeat their year.
Plagiarism- 2016/17

Throughout your studies in Trinity College Dublin you will develop and write assignments that require research. Your ideas will be expressed through words, images, diagrams and other multimedia forms. As you research you will be expected to understand and build upon the work of others. This requires acknowledging correctly and fully the contributions of others to your own scholarship. Regardless of what discipline you enter in Trinity, the cornerstone of its scholarship is academic honesty. So no matter what form your scholarly writing takes, you are expected at all times to take responsibility for the integrity of your work as you advance knowledge in your field of study. The word plagiarism is derived from the Latin words meaning ‘kidnapper’. In its simplest sense, plagiarism can be seen as stealing someone else’s words or ideas and passing them off as your own, although plagiarism comes in many forms. In some educational systems, rules for avoiding plagiarism may not be clearly defined. Some of you may be studying in Ireland for the first time and may have different culturally-based understandings of plagiarism. However, whether unintentional or intentional, plagiarism is your responsibility and you need to know exactly what it is in order to avoid it.

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

Students should read the items listed below to ensure that they understand plagiarism.
2. The 2016-17 Calendar entry on plagiarism; https://www.tcd.ie/Science/current/PDF/plagiarism/Plagiarism.pdf
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 2016-17 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.


www.tcd.ie/science
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 coordinated by the Senior Tutor’s Office which is located on the ground floor in House 27.

For a list of all current Tutors and their contact details via the following the Senior Tutors website: https://www.tcd.ie/Senior_Tutor/

Students are advised to read the "Managing College" booklet. A PDF version can be found via the following link: https://www.tcd.ie/Senior_Tutor/Tutor%20Booklet%20Summer%202015.pdf

Financial Assistance

If you are experiencing financial difficulties, there are some supports within the College that you can apply for. The Student Support Officer (Helen Richardson) in the Senior Tutor’s Office is responsible for financial assistance for undergraduate students in TCD. Further information on the different types of assistance is available on the Financial Assistance section of the Senior Tutor’s website http://www.tcd.ie/Senior_Tutor/Financial%20Assistance/). If you have any queries please contact Helen/Donncha on 01-896-1095/2551.

Opening Hours
We are 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

How do I contact my Tutor?
You can contact your Tutor by email, phone or by visiting his/her office. Go to https://www.tcd.ie/Senior_Tutor/ to find the email address, college address and extension number of your Tutor.

If you do not know who your Tutor is then go to https://my.tcd.ie/urd/sits.urd/run/siw_lgn which is on the TCD Local Homepage and enter your student number and details as requested.

2. 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.
Disability Services

The Disability Service aims to provide appropriate advice, support and information to help students and staff with disabilities.

Contact Us
The Disability Service https://www.tcd.ie/disability/, Reception is located in Room 2054, beside the Lecky Library, in the Arts Building, Trinity College Dublin. You can make appointments here:

Making an Appointment
For queries, you can contact us as follows:
- By Phone: (01) 896 3111
- By Text / SMS (for Deaf Students): 086 3442322
- By Email: disb@tcd.ie
- To find us see map (http://www.tcd.ie/Maps/map.php)

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
- Fax: (01) 8963464
- Email: student-counselling@tcd.ie

Brief Consultation

Students who have never used the service before are advised to avail of a Brief Consultation slot. Brief Consultation is a drop-in service reserved for new clients who have not already made an appointment with us and it runs during term time (October to May) from Monday to Friday through lunch (1.00pm-2.00pm).

Each day there are two half-hour slots available. Brief Consultation cannot be booked in advance and Students are seen on a first come first served basis, so just call in person to reception on the 3rd floor of 7-9 South Leinster Street.

NOTE:
While every effort will be made to give due notice of major changes, the Science Course Office reserves the right to suspend, alter or initiate courses, timetables, examinations and regulations at any time.
<table>
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Please consult your timetable via my.tcd.ie regularly to ensure you have the correct timetable information. SCREEN SHOTS ARE NOT ADVISED as timetables are subject to change.
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Please consult your timetable via my.tcd.ie regularly to ensure you have the correct timetable information. SCREEN SHOTS ARE NOT ADVISED as timetables are subject to change.
## Dates to Note

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<tr>
<td>Thursday</td>
<td>23 March 2017</td>
<td>Closing date – Submit choice of module forms online</td>
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<tr>
<td>Friday</td>
<td>7 April 2017</td>
<td>End of Semester Two</td>
</tr>
<tr>
<td>Monday</td>
<td>10 April 2017</td>
<td>Trinity Week begins</td>
</tr>
<tr>
<td>Tuesday</td>
<td>2 May 2017</td>
<td>Annual Examinations begin</td>
</tr>
<tr>
<td>Friday</td>
<td>26 May 2017</td>
<td>Annual Examination ends</td>
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<tr>
<td>Friday</td>
<td>16 June 2017</td>
<td>Annual Examination Results Published</td>
</tr>
<tr>
<td>Monday</td>
<td>28 August 2017</td>
<td>Supplemental Examination begins</td>
</tr>
<tr>
<td>Friday</td>
<td>8 September 2017</td>
<td>Supplemental Examination ends</td>
</tr>
<tr>
<td>Friday</td>
<td>15 September 2017</td>
<td>Supplemental Examination Results Published</td>
</tr>
<tr>
<td>Monday</td>
<td>25 September 2017</td>
<td>Michaelmas Lecture Term begins (Semester 1)</td>
</tr>
<tr>
<td>Monday</td>
<td>6 November 2017</td>
<td>Study week begins</td>
</tr>
<tr>
<td>Friday</td>
<td>1 December 2017</td>
<td>Closing date for change of Semester two modules choices</td>
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<tr>
<td>Friday</td>
<td>15 December 2017</td>
<td>Michaelmas Lecture Term ends (Semester 1)</td>
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All of the above dates are accurate at time of publication. However the Science Course Office reserves the right to modify these dates as necessary.
Science Course Office Contact Details:

All Senior Freshman TR071 email queries should be addressed to sfsco@tcd.ie

Associate Dean of Undergraduate Science Education (ADUSE)

Professor Kevin Mitchell
Tel: 01 896 2025
E:mail: aduse@tcd.ie

Administrative Officer:
Ms Anne O’Reilly
Tel: 01 896 2023
E:mail: science@tcd.ie

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

Ms Agnes Gogan
Tel: 01 896 2022
E-mail: jfsco@tcd.ie

Address:
Science Course Office
Atrium/Student Concourse
Hamilton Building
Trinity College
Dublin 2

Website: http://www.tcd.ie/Science/

Course Office Hours: Monday to Friday
09:30 – 12:30 (mornings)
13:30 – 16:00 (afternoons)