TR060: Biological and Biomedical Sciences
Junior and Senior Fresh Module Pathway information

Core Modules

The Core modules are mandatory for all TR060 students. They provide students with crucial foundational knowledge in Biology, Chemistry and Mathematics in their Junior Fresh year. In Senior Fresh, Core modules expand to cover greater depth across Biological and Biomedical Sciences while broadening students' learning by including modules in Statistics and the Philosophy and Ethics of Science.

Open Modules

Open modules allow students to explore further relevant topics that are personally interesting and enrich one's curriculum. The selection available is designed to augment the core modules and they reflect in some part the diversity of career opportunities available to biologists.
They are not formally linked to any of the 11 moderatorships although you may find some more aligned to your preference than others. You are free to choose your open modules as you wish.

Allocation to Moderatorships

On completion of Senior Fresh, students are allocated into one of 11 moderatorships based on their final grade in their SF year. This is calculated based on solely on the SF year and includes both Core and Open modules. Please see the Allocation of Places regulations for further details:
https://www.tcd.ie/media/tcd/science/pdfs/science-allocation-of-places-regulations-tspmc2023.pdf

EDU11001/2 Science Education:

This module explores science communication as a field of research and practice and how it affects the relationship between science and society. Communication and collaboration are essential skills for researchers and this module provides a solid transferable skill relevant to all future careers. There is also an entire career pathway in science communication that one could pursue on completion of this undergraduate degree.

PYU11F10/F20 Foundation Physics for life and Earth Scientists.

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. Application of fundamental principles from physics can be a major asset to understanding biological systems and can provide quite a unique and sought after skillset in a biologist.

GSU11001: Spaceship Earth: An introduction to Earth System Science

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. This is a topic with obvious relevance to the challenges society faces in managing our natural resources and our own health and wellbeing in a sustainable manner.

GSU11005: Introduction to Geology: A Beginner's guide to Planet Earth

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. Understanding the past is key to understanding the forces that have shaped life on earth today, and can give insight into how life might adapt to global environmental change.

GSU22001: From Atoms to rocks: Introduction to Geochemistry

This module will introduce fundamental chemical concepts, using geological examples to demonstrate their importance in Earth Science. The module provides an overview of high- and low-temperature geochemistry, outlining both how elements are processed in the Earth's crust/mantle, and providing an overview of the interaction between dissolved elements in natural waters and the rocks which they come in contact. There are many applications in geochemistry that find a home in addressing biological questions since organisms have to pull their minerals and constituent elements from the environment. Living things also contribute to massive movement of elements and minerals through the earth system and understanding these processes have wide-ranging implications for how we study life on earth. On a more human perspective, research biologists can use this geologist's toolset to track the change of elemental isotope values in tissues to study metabolic rates of specific tissues and trace the effects of disease.

GSU22005: Sedimentary Processes and Environments

This Module will introduce key physical, chemical, biological and sedimentary processes, deposits and examples of contemporary sedimentary depositional environments. It will analyse and explain the generation, transport and preservation of sediments, as diagnostic tools to link surface processes with the geological records of Earth history, as well as modern environmental change.
To achieve the module learning aims, the module will introduce examples of environmental change, and their impact on the sedimentary depositional environment at that time, such as Snowball Earth, Oceanic Anoxic Events, Hyperthermals, the Messinian Salinity Crisis, and Quaternary Glacial-Interglacial Cycles.

GSU22006: Physical Geography: Dynamic Earth

This module will give students an understanding of key physical geography concepts. You will build on keys areas of Geography from the JF Spaceship Earth and Anthropocene modules. Life has continually evolved in and adapted to a changing world. Understanding this journey both before and after humans fundamentally changed the direction of travel is an essential part of solving our understanding of life on earth and the ability to predict how best we can manage the natural world.

CHU22205: Chemistry for Biologists

To provide core 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. Chemistry underpins many aspects of biology, particularly for molecular, cellular and environmental systems. While not essential for any moderatorship, there are definite benefits for all moderatorships in having more detailed understanding of chemistry. Equally, many research biologists across the broad spectrum of subjects do not require anything more than the basic understanding of chemistry provided in the core modules.

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Senior Fresh Biology Open Modules:

In addition to the open modules described above, the Senior Fresh year provides an opportunity to focus in more depth on some key aspects of biology beyond what the core programme provides. Some of these obviously align more with some of the 11 moderatorships than others, but again, this is a chance to either pick something you like and study it in more detail, or to branch out and explore your interests in an adjacent topic.

BYU22206: Microbes, Immune Systems and their interactions

In this module, students will learn about the cells and molecules of defence systems and about the complex interactions between microbes and their hosts which can lead to significant disease, but which are also required for health. Students will learn about the molecular and cellular biology of key pathogens (viral, bacterial and parasitic) which currently threaten human populations. They will learn about immune systems and the diverse mechanisms used by immune molecules and cells to detect and respond to these microbes; they will be introduced to concepts of immune manipulation by vaccines and immunotherapies.

BYU22207: Genomes, Disease and Diversity

Through lectures and practical exercises students are provided with a broad overview of genomics and the impact of new approaches across the biosciences. We will introduce the basics of new technologies and show the application of these to the study of: a) inherited traits, including Mendelian and complex human diseases; b) the non-inherited somatic genome with particular focus on cancer; c) human kinship and origins; d) the microbiome; and e) the genomics of ecology.

BYU22208: Molecular Nutrition

The aim of this module is to develop an understanding of the molecular basis of life through study of the role of nutrients, not only as a source of energy but, as key elements that determine our cellular and whole-body physiology. The metabolism of carbohydrates, proteins and lipids and the role of vitamins will be presented in the context of human health and disease. The consequences of vitamin deficiencies, mechanisms that allow cells to survive starvation and metabolic derangements such as diabetes and those caused by alcohol consumption will be discussed.

BYU22209: Fundamentals of Behaviour

Behaviour is a unique trait in animals that allows them to respond rapidly to a changing environment. Most of the exciting, fast-moving phenomena we associate with living organisms – fighting, flying, flocking, swimming, sensing, mating, communicating, spreading disease, and more – fall under the umbrella of behaviour. As well as being important to understand in natural contexts, all of these traits and processes also have correlates or analogues in human behaviour and society, adding further motivation to understanding them deeply and on a fundamental level. Ultimately, taking this perspective, the study of behaviour is the study of rapid responses and interacting agents in all forms.

In this course, students will be introduced to the fundamental mechanisms and theories underlying behavioural processes and taught how to think like a behavioural scientist. I detail what behaviour is and how it works across all possible scales, conveying the groundwork in the underlying structure of nervous systems and building through physiology, learning, communication, collective behaviour, and social systems, up to responses to environmental stress. Drawing these lessons together, I discuss the role that behavioural science plays in understanding and managing animal populations and species in a rapidly changing world. In all cases, I pepper the lectures with equivalent or similar behavioural processes in humans, encouraging students to apply the lessons more generally. Ultimately, this helps to derive an understanding of behaviour to take away in this and many other fields.

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BYU22210: Sustainable Agriculture and the Bioeconomy

The aims of this module are to familiarise the student with concepts of sustainable development, and the role of living systems in the bioeconomy (particularly agriculture) in both the current global crises and their potential solutions.
Practicals will focus on techniques relevant to the biotechnology industry, sustainability of food production and health indices of global diets.

Notes:

- While Junior Fresh core modules are automatic prerequisites for the Senior Fresh Biology and Chemistry modules, please ensure that you fulfil the open module prerequisites for the other modules. For example, some of the GSU modules in SF year have a prerequisite module in JF.
- Open modules can be taken in may be taken in many different combinations. However, where there is a timetable clash students will be asked, where necessary change their open module choice.
- Students must take 60 credits per year (30 per semester). This is a college regulation.