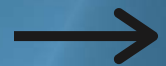


2021



MINDS UNDERGROUND™ BIOLOGY SUMMER SCHOOL



Overview

Our Virtual Summer Series aim to widen your knowledge over the summer period, under the expert guidance of our team of Oxbridge graduates, giving you the opportunity to acquire or develop skills and expertise relevant to your subject interests, in preparation for future university entrance, including personal statement writing and potential interviews.

What to Expect

Each class is hosted by a specialist in the field, with an emphasis placed on deepening subject knowledge and inspiring you in your independent preparation. Come armed with questions, notebooks, a readiness to engage in critical discussion and ensure you keep a file with notes on each session to refer back to when it comes to applications.

Logistical Details

All classes will take place over Microsoft Teams. Teams invites and links will be sent out prior to the Summer School commencing.

Mentors will set some pre-reading/ research prior to sessions, and optional tasks between classes. Post-session reading lists will be issued for you to engage in further independent exploration where applicable.

Dates: Classes will be held every Tuesday, 5.30-6.30pm UK time over a 12-week period: Tuesday 22nd June - Tuesday 7th September



2021 Summer School

Our Hosts

Amber and Amelia are our hosts for the Biology Summer School this year. Amber will be focusing on the big elements of Biology - whole organism/ ecosystem-related topics, whilst Amelia will be focusing on the smaller side of things (cell biology, biochemistry, immunology, pathology etc.)

This should give students a great overview of university level topics and thinking in preparation for applications.

Agenda

Amber will be taking the first 6 consecutive classes of the Summer School, with Amelia following with the next 6.



Amber

Amber graduated with a 1st Class degree in Biological Sciences from the University of Oxford, ranking top in St. Hugh's College. Amber held the role of President of St Hugh's Biological Society whilst at Oxford, explaining and discussing biological topics with students from other courses. She enjoys supporting students in their investigation of prominent biological questions, with specialities mainly within evolution, ecology and animal behaviour.



Amelia

Amelia graduated from the University of Cambridge with a 2.i in Biological Natural Sciences, where she specialised in Cell Biology, Biochemistry, Immunology, Cancer, and Genetic Diseases. Amelia's final year project focused on investigating MYC mutations in Diffuse Large B-cell Lymphoma.

Both mentors have since worked closely with students applying to top UK universities (including Oxbridge).



The Agenda: Amber



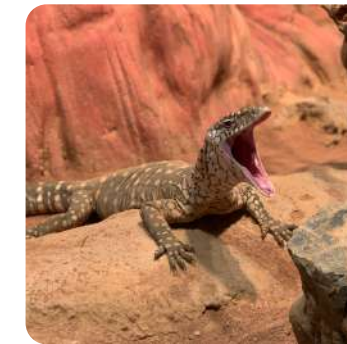
The Variety of Life

Biology is the study of living things, but how do we define life? This class will explore the unifying themes of which the study of life reveals, exploring how life first evolved and how to classify all life that exists today.



Species, Populations and Ecosystems: Study and change

We can organise biological systems from atoms and cells to an entire biosphere. At each level, we can study the interaction between parts to build complex and fascinating biological systems. This class will allow us to build key theory on both species, population and ecosystem ecology, learning key concepts from selection to demography.



Ethology and Behaviour

The study of animal behaviour sheds light on the underpinning of detailed systems. This class will provide an overview of behavioural systems, highlighting the complementary nature of proximate and ultimate perspectives.



The Agenda: Amber



Evolutionary Parasites

We may consider parasites to be microorganisms, but parasites can exist at all levels. **How can we apply the gene selection view to explain the evolution of parasites?** This class will explore an extraordinary system of exploitation by teasing apart the relationship between the cuckoo and its host species.



Descent With Modification: A Darwinian View of Life

A new era of biology began in 1859 when Charles Darwin published *The Origin of Species*, which focused biologists' attention on the great diversity of organisms. This class will explore the Darwinian view of descent with modification, exploring key evidence and wisdom for the Theory of Natural Selection.



Conservation Biology and Restoration

According to recent analysis, the sixth mass extinction of wildlife on Earth is accelerating. More than 500 species of land animals are on the brink of extinction and are likely to be lost within 20 years. Conservation biology is the study of the conservation of nature and of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from extinction. This class will explore the need for conservation and allow discussion on how we can tackle the current issues our living world is facing.



The Agenda: Amelia



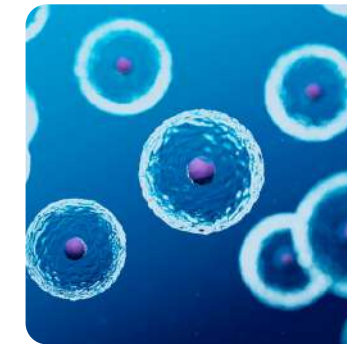
Tiny Biological Machines: The Birth and Death of Cells

This masterclass delivers a brief introduction to cell theory, before delving into the cell cycle, elaborating on how the cell cycle is driven, regulated and executed. The aim is to offer a sophisticated understanding of when, why and how cells are born in multicellular organisms. Equally as important is the question, when, why and how do cells die? In addressing this, the class approaches concepts such as accidental cell death, programmed cell death (i.e. apoptosis) and cellular senescence, and their relevance to the health and disease of multicellular organisms.



The Biological Blueprint: Understanding the Cellular Genome

Like any machine, a cell is useless without instructions; deoxyribonucleic acid (DNA) encodes these cellular instructions. There is roughly two meters of DNA in every cell in the human body, yet it fits easily into a microscopic nucleus. This masterclass unravels sophisticated details about the contents of DNA (coding versus non-coding), how DNA is packaged at various levels into chromatin, and how this chromatin is remodelled to regulate the expression of genes in the DNA. The class also touches on the concept of genomic imprinting, offering an insight into sex-specific gene expression regulation, and how it can go awry.

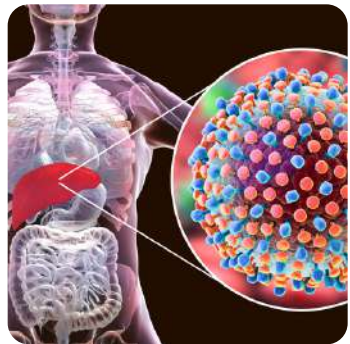


Creating a Human: Stem Cells and Cellular Differentiation

What are stem cells? What do they do? Where are they found? What is multipotency, pluripotency and totipotency? How do embryonic stem cells differ from adult stem cells in their potencies and biological roles? How are there 200 different specialised cell types in the human body harbouring the same DNA? This masterclass provides advanced solutions to all of these questions. The class also explores stem cell research breakthroughs such as induced pluripotent stem cells (iPSCs) for stem cell therapy and personalised medicine, and organoids for organ replacement and drug testing.



The Agenda: Amelia



Fighting Against the Environment: Immune Cells Versus Pathogens

This class recaps on the different types of infectious agents (i.e. pathogens) and how they threaten our health, before addressing mammalian defences, namely the innate and adaptive immune systems. The structure of these immune systems and their main cellular constituents will be discussed. Furthermore, the adaptive immune system offers a fantastic opportunity to exemplify the importance of intercellular communication. Specifically, the theory of the “3-tier signalling system” between adaptive immune cells will be introduced. The class will also explore interesting ways in which pathogens (mainly viruses and bacteria) fight back against their hosts, leading onto what ensues when pathogens win. Case studies such as tuberculosis, HIV, and/or COVID-19 will be used. The class will end on insights into the development of the COVID-19 vaccine(s).



Fighting Against Ourselves: Genetic Diseases, Autoimmune Diseases and Cancer

Non communicable diseases (NCDs) are the leading cause of human death worldwide. This masterclass will provide sophisticated details on NCDs, namely genetic and autoimmune diseases, delving into case studies for both. Furthermore, the class will provide an advanced introduction to cancer, discussing key examples of etiological mutations, and debating whether cancer should be considered a genetic disease (or an epigenetic disease).



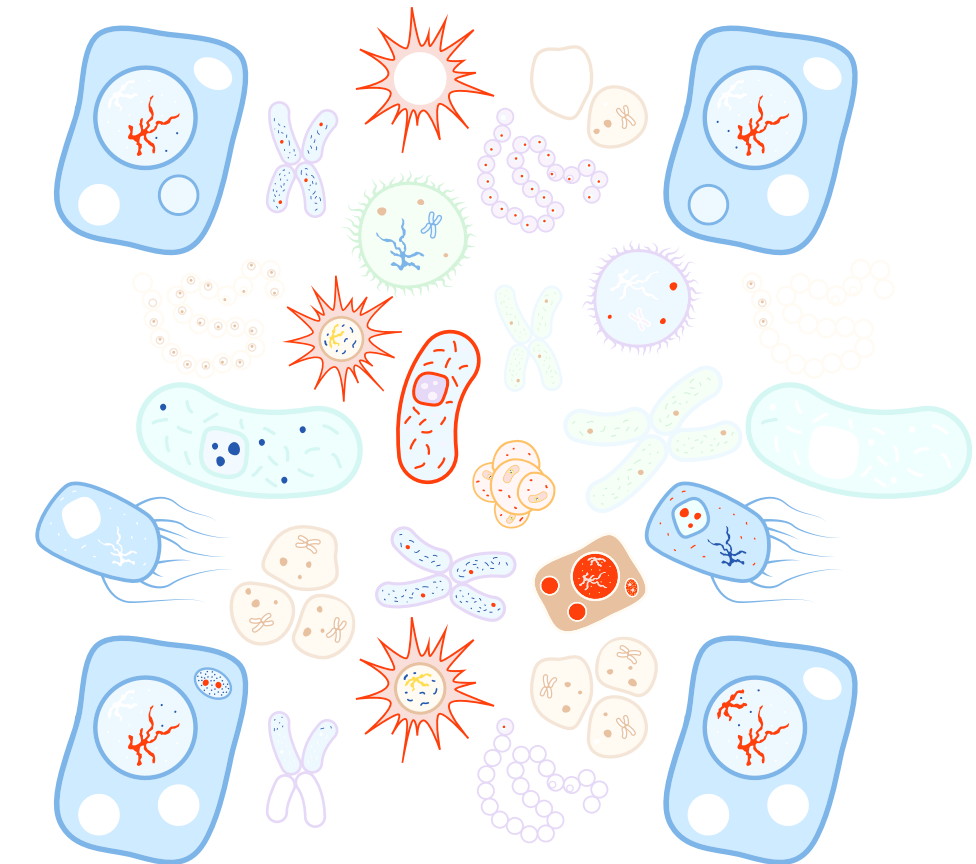
Treating Cancer and Other Genetic Diseases

Many drugs prescribed in the 21st century still do not have a known mechanism of action. For example, paracetamol was discovered accidentally 100 years ago and has been in general use for over 50 years, but the mechanism of action of the painkiller is still not fully understood. When it comes to treating life-threatening diseases like cancer, we cannot wait to accidentally come across a cure; we must actively find/create one. We can use knowledge of the cause of the disease to do this. Disease gene identification is therefore an important scientific research focus. This masterclass introduces different techniques employed for disease gene identification, providing notable case studies. The class also discusses potential problems which may arise, such as in the case that the disease has no genetic components or more than one genetic component. Once the disease gene is identified, then what? To end, the class discusses how drugs can be rationally designed to specifically target disease genes, and how disease genes could even be “cut out” as a form of gene therapy in the future. →

Biology Calendar

Please find your calendar for the 12 Biology Summer Series classes below! You will receive some pre-reading before each session and suggestions for further independent exploration (reading, problem sheets, podcasts etc.) post-session, if applicable.

TUES 22ND JUNE The Variety of Life (Amber) 5.30-6.30pm	TUES 29TH JUNE Species, Populations & Ecosystems (Amber) 5.30-6.30pm	TUES 6TH JULY Ethology & Behaviour (Amber) 5.30-6.30pm	TUES 13TH JULY Evolutionary Parasites (Amber) 5.30-6.30pm
TUES 20TH JULY Descent With Modification (Amber) 5.30-6.30pm	TUES 27TH JULY Conservation Biology & Restoration (Amber) 5.30-6.30pm	TUES 3RD AUG Tiny Biological Machines (Amelia) 5.30-6.30pm	TUES 10TH AUG The Biological Blueprint (Amelia) 5.30-6.30pm
TUES 17TH AUG Creating a Human (Amelia) 5.30-6.30pm	TUES 24TH AUG Fighting Against the Environment (Amelia) 5.30-6.30pm	TUES 31ST AUG Fighting Against Ourselves (Amelia) 5.30-6.30pm	TUES 7TH SEPT Treating Cancer & Other Genetic Diseases (Amelia) 5.30-6.30pm




Any questions? Get in touch!

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