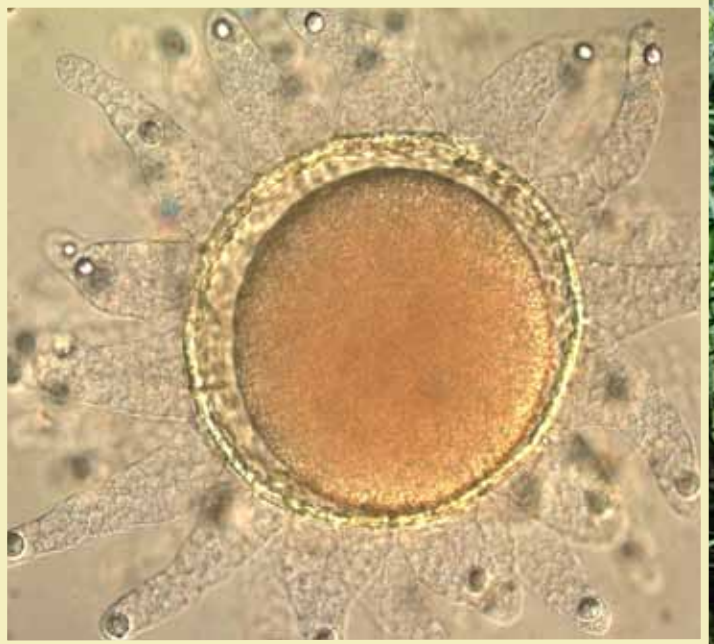


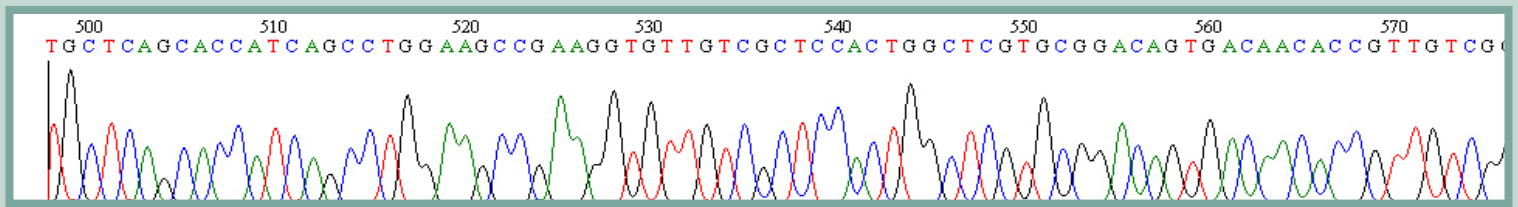
# BIOLOGICAL SCIENCES AT OXFORD



## Undergraduate Course Brochure

[www.biology.ox.ac.uk](http://www.biology.ox.ac.uk)





# BIOLOGY AT OXFORD

Oxford has had a worldwide reputation in Biology for both teaching and research for well over 100 years and has hosted some of the defining events that have shaped modern biology. For example, the Oxford University Museum of Natural History, opened in 1860, was the first purpose built museum of its kind in the world and it was here that Bishop Wilberforce and Thomas Henry Huxley famously debated Charles Darwin's *Origin of Species*. In the 20th Century, Oxford biologists pioneered many more aspects of the subject. Charles Elton published his ground-breaking studies of field ecology, Niko Tinbergen presented his fundamental concepts of animal behaviour, Edmund Warburg co-authored one of the first comprehensive field guides to the flora of the British Isles and Richard Dawkins proposed the *Selfish Gene*.

In the 21st Century, Biological Sciences (Biology for short) at Oxford is a single honours degree course taught jointly by the Departments of Plant Sciences and Zoology. The course combines traditional core topics, such as animal and plant evolution and systematics, with modern developments and techniques in all spheres of biology, from the molecular and cellular to the whole organismal and ecological. It makes full use of Oxford's major research expertise in all these areas, and one of the course's major strengths is this fundamental association between teaching and research. We believe that the focus on biology in depth over three years in combination with the tutorial system and world-class scientific research provides a degree course that is second to none.

## BIOLOGICAL SUBJECTS AT OXFORD

We pride ourselves that the breadth of expertise in Oxford covers all the mainstream topics in biology. In general, all the major research areas in the Departments of Plant Sciences and Zoology contribute to the Biological Sciences course. These include animal behaviour, cell and developmental biology, ecology, entomology, epidemiology of infectious diseases, evolution, forestry, genetics, marine biology, microbiology, ornithology, parasitology, animal and plant cell biology, animal and plant molecular biology, pathology, physiology, and plant systematics.

The course leads to a single Honours degree in Biological Sciences. However, each student can design a personalised course from the extremely broad nature of the themes taught and the option system in the third year. This may be a very diverse course encompassing a wide range of topics, or highly specialised in detailed aspects of animals, plants, cells or ecology – it's up to you. Frequently, strongly held notions of subject interest which our students arrive with are soon dispelled as new and exhilarating topics become available.

## WHAT IS SPECIAL ABOUT THE TEACHING AT OXFORD?

Biological Science at Oxford is taught through the media of lectures, practicals (lab and field) and classes or seminars. The major additional component is the tutorial system that stimulates in-depth discussion and analysis. The emphasis is on developing your own ideas by reading the research literature as well as text books, and as you progress to the second and third years, your abilities to critically review and comment on both scientific literature and more controversial current affairs are finely honed.

As part of the tutorial system, every undergraduate is a member of a college, under the personal guidance of a college tutor, who will be an academic in the Departments of Plant Sciences or Zoology, and an active research scientist. Your tutor takes a keen interest in your welfare and intellectual development, directing your studies to ensure that you get the best teaching from other specialists in your chosen subjects. Your tutor will guide you in your choice of topics and reading material, and you write an essay each week, which is discussed in detail during tutorials.



# THE COURSE STRUCTURE

Biological Sciences at Oxford is a three year course. You will spend the first year encountering the full range of biology, developing an understanding of the integration between the levels and discovering, perhaps to your surprise, the similarities of some of the laws governing interactions between molecules, cells, individuals and populations. To many, the transition from A level (or equivalent) biology to first year university biology is a surprise which takes some coming to terms with. We take you back to basics, and reintroduce you to the essential excitement of living things. In the second year the depth of material covered increases in preparation for the third year. Here you will be able to specialise, pursuing the latest research, both pure and applied, in those subjects that interest you most. Recent changes to the course structure have placed additional emphasis on emerging topics relevant to society such as GM crops, bio-fuels, stem cells and ageing.



## WHAT DOES THE BIOLOGICAL SCIENCES COURSE CONSIST OF?



**FIRST YEAR:** There are no options in the first year. Everyone studies four major strands of which the first three are examined at the end of the year:

**Cells and Genes:** the molecules and mechanisms that underpin cell function and early development in all organisms.

**Organisms:** the history of the Earth and the origin of life; the full range of organisms from prokaryotes to humans; how microbes, invertebrates, vertebrates and plants are adapted for life in water or on land.

**Ecology:** factors that determine the genetic, spatial and age structure of populations or organisms; the ways that populations change over time (populations dynamics), and how species (including humans) interact with each other and the environment.

**First Year Quantitative Methods:** provides the foundation for Quantitative Methods in the second year.

**Practicals :** In the first year all practicals are compulsory. They will not necessarily be linked to lectures, but will focus on providing practical skills relevant to modern biology, from the cellular and molecular to the ecological and taxonomic. There will be a one-week residential field course to West Wales in the summer term. Here, living organisms (including staff and students) are studied in a range of environments, both terrestrial and marine. In the second year, additional practical skills will be taught that follow on from those acquired in the first year, to give an essential foundation for project work.

**SECOND YEAR:** Lectures will be offered under eight themes, two of which are compulsory. Students are encouraged to attend lectures within all themes but are likely to specialise in four or five.

## THE COMPULSORY THEMES:

**Evolution:** is a central theme of biology. Darwin's theory of natural selection provides a robust framework for explaining evolutionary patterns, yet the study of evolution is still rich in controversy and unanswered questions. New analytical methods and the flood of molecular sequence data have provided additional insights into evolutionary relationships and the resulting patterns seen, for example, in the fossil record. Evolutionary biology is one of Oxford's great strengths, and the Evolution course is taught by leaders in the study of systematics, adaptation, natural selection, molecular evolution, and the evolution of sex.

**Quantitative Methods:** covers Statistics and Computing. Statistics are important tools for every biologist, helping us to design both observational and experimental studies and then making sense of the data. Computers play an important role in modern biology, and both departments are well



equipped with computer networks for teaching and research, to which all biology students have access.

### THE OPTIONAL THEMES:

**Adaptations to the Environment:** All organisms both alive and extinct are a result of natural selection under pressures from the habitats and ecosystems within which they live. Whales for example have evolved to dive deep in the sea to find their prey, whilst desert cacti have developed spines and waterproofing to survive in arid conditions. This course combines ecology and environmental biology with plant and animal morphology and physiology to explain how the myriad life in Earth has adapted to survive in the most difficult conditions imaginable.

**Animal Behaviour:** The theme of this course is animal form, function and animal behaviour. Understanding the ways in which animals are adapted to their environment involves studying, for example, the fossil record, the biomechanics of feeding and locomotion, reproductive biology, the mechanisms of sense organs, the brain and nervous system, the neurobiological basis of behaviour. Animal behaviour, including that shown by humans, covers a wide range of topics including social behaviour and cooperation, aggression, kin selection, learning and memory, cultural transmission, navigation and communication.

**Cell & Developmental Biology:** During the last decade there has been explosive growth in our understanding of cellular phenomena, central to life processes. Building on an understanding of the behaviour of macromolecules derived from biochemistry and molecular biology, cell biology complements studies of development and genetics, and forms the basis for our understanding of physiology, neurobiology and whole organism biology. The course provides an insight into the complex interplay of structures and processes occurring within the cell and its organelles that give it life, many of which have fundamental biomedical relevance. Developmental biologists examine how genetically determined patterns arise at the cellular level and then the mechanisms by which they are coordinated, first to produce tissues and organs, and finally to generate the complete plant or animal. Particular emphasis is placed on the mechanisms by which gene expression is regulated both temporally and spatially throughout the life cycle. Comparative developmental biology provides the basis for the diversity of multicellular life on the planet

**Disease:** Pathogens, parasites and the diseases they cause, are recognised as playing significant roles in the behaviour, ecology and evolution of their hosts. When they infect humans, domestic animals and crops, they also cause major economic problems throughout the world; about one quarter of the world's human population suffers from infections such as malaria, schistosomiasis, hookworm and AIDS, whilst plant diseases account for about 15% of world crop losses. Contrasting approaches to the study of host-parasite relationships (from molecular biology to ecology) illustrate the many ways in which man attempts to control the medical and economic consequences of all kinds of parasites (including viruses, bacteria, fungi, protists, worms and arthropods).

**Ecology:** As human populations continue to grow at alarming rates and their impact increases, the urgency of understanding how the environments we occupy function has never been greater. As we study the inter-relationships between the living world of animals and plants and their non-living environment we can build the sound scientific basis essential for any attempt at long-term conservation of the natural world. The course emphasises the applications of theoretical ecology to conservation biology, resource management and global environmental change. Although most aspects of biology contribute to our understanding of the living world around us, environmental biology largely remains a study of whole organisms, which is why it is so popular and continues to attract major global interest. A full range of terrestrial and marine, tropical and temperate environments, are considered.

**Plants and People:** Plants are fundamental to all living communities. Starting with their origin in the sea and later invasion of land, we examine the ecological, evolutionary, structural and reproductive diversity of all land plants, with special emphasis on their importance in agriculture. Studies on biochemical mechanisms at the cellular and molecular level examine the physiological basis of plant growth and development and responses to environmental stress. A key aspect is genetic engineering and the potential



uses of transgenic plants. In this context, the role of microbes is also considered. Microbes affect all other organisms; some cause infectious diseases, others carry out essential chemical transformations in the carbon, nitrogen and sulphur cycles of the biosphere, and many are now exploited in biotechnology for the production of food, medicines and enzymes as well as in waste disposal and detoxification.



**THIRD YEAR:** The 6 general themes will diversify into 20 or so specialist options of 16 lectures each. Students will be free to select any combination from these options which cover the full breadth of active research in the departments. Students are recommended to take a minimum of six options but can take more if they wish to do so.

### THE HONOURS PROJECT

All undergraduates undertake a research project during their second and third years, supervised by a member of academic staff, which contributes to the degree assessment. The topic may be the student's own idea or one chosen from suggestions by members of the departments. Students carry out practical research, either in the lab or field, analyse data using rigorous scientific method and conventions, and write a report. The level expected is similar to early stage graduate work and the results from many of these projects have been published in scientific journals – an early chance to get into print! The breadth of topics is vast; examples in the recent past range from how embryonic cells differentiate into nerve cells, to the number of fish on a coral reef.



### COURSE ASSIGNMENTS

During their third year all undergraduates undertake one extended essay or another piece of written work, and one oral presentation plus a written abstract. There is complete freedom to choose the appropriate topic, and any subject within the areas covered or touched upon by any of the themes or options is eligible, but the format of the assignment will be specified by the particular theme.

### UNIQUE TEACHING FACILITIES

Oxford is extremely well endowed with a whole variety of facilities of enormous value to our staff and students. These include the University Museum of Natural History, the first purpose-built in the country, the Botanic Garden and Harcourt Arboretum, which include a national reference collection of 7,000 different types of plants, the Fielding Druce Herbarium, which contains some of the oldest and most important botanical collections in the UK, and Wytham Wood, which is arguably one of the best studied broad-leafed woodlands in the world. Also based at Wytham is the University Farm, now managed by the Food Animal Initiative (FAI), a business whose aim it is to turn animal welfare benefits into commercially viable systems and thereby to improve farm profits and ethical standards in the farming industry. All are used for teaching in one part of the course or other, and biology students are encouraged to use these facilities to the full, either for serious work, or simply for pure enjoyment.



### TRAVEL

Third year biologists have the option of attending botanical or tropical ecology field courses to the Canary Islands or to Sabah (N.E. Borneo) respectively, as part of the Honours course. Places on these courses are limited, and full costs (including flights) must be met by the students. Outside of the formal curriculum, Oxford biologists have a strong tradition of travel in both temperate and tropical countries, often as part of a scientific expedition. Students organise expeditions of their own to different



parts of the world (Indonesia, Madagascar and Papua New Guinea are three recent examples), to undertake projects with scientific purpose. These are planned through the University Exploration Club, helped by members of the two Departments who themselves frequently carry out research overseas. Alternatively, our first and second year students can take part in organised scientific trips with groups such as Operation Wallacea and Coral Cay Conservation. As with the expeditions, the field work for the Honours project can be carried out whilst overseas, as long as appropriate supervisory arrangements are in place and risk assessments have been carried out beforehand.



### WHY SHOULD I APPLY TO OXFORD TO READ BIOLOGICAL SCIENCES?

Many UK universities offer excellent Biology courses. We at Oxford firmly believe that we are one of the best, and that we also have many features, such as the tutorial system, that combine to produce a 'value added factor' which is hard to beat. The fact that Oxford is the oldest university in the country may not be so important (though it may impress one or two), but the sheer quantity and quality of libraries, museums, reference collections, societies (scientific, sporting or just odd), and so on is arguably unsurpassed elsewhere. The collegiate system is not unique, but it does provide an immense amount of care, support, encouragement and sense of belonging, and the joint college/department tutorial teaching process, though perhaps daunting at first, means that Oxford graduates are extremely well prepared for life after university.

If you are interested in studying Biology at university, and your teachers, tutors or advisors think that you have the potential to get in, why not give us a go? Please note that every application to Oxford is considered very carefully on an individual basis, and we take great pride in being able to select the most suitable people.

### WHAT QUALIFICATIONS DO I NEED?

Most of our candidates are studying A-levels at school or college, but we also accept applicants with equivalent higher level qualifications such as Scottish Highers, International Baccalaureate (IB), and so on. If you are offered a place to read Biological Sciences at Oxford before your A-levels, this will be conditional upon your grades the following summer. We have to ask for 2 A-levels at grade A, plus 1 A-level grade at A\* (in a science or maths). Biology (or Human Biology) at A-level is normally required, and the two other A-levels can be a mixture of arts and sciences. There are no 'ideal' combinations of subjects.

### HOW DO I APPLY TO OXFORD TO READ BIOLOGICAL SCIENCES?

You apply to Oxford in much the same way as you apply to any other University in the UK – but note the earlier closing date for applications. On the basis of your UCAS form, you may be called for interview in December by your 'first choice' college. Interviews are designed to enable you to show your enthusiasm, curiosity and motivation for biology and your ability to study.

We are not testing your factual knowledge but your ability to think. If you express an interest in a particular aspect of biology, be prepared to talk intelligently about it. The process is rigorous, but sympathetic, so that you can show us your best. There will not be any written tests, but you may be asked to interpret a written passage or a simple set of data given to you before the interview. As well as an interview at your first choice college, you will have a second interview in another allocated college. This will require you to stay overnight in Oxford (at no cost). Following both interviews, tutors from all colleges meet and ensure that the best candidates from all colleges are offered places.



### HOW DO I CHOOSE A COLLEGE?

21 colleges at Oxford take Biological Sciences students. You can either put down your preference for one particular college, or you can leave the choice of college to the University administration and be allocated by computer using a formula designed to ensure the fair distribution of candidates. For more details, look at the college's website in the first instance. Please note that the choice of college for a biologist will not affect the quantity and quality of teaching you receive, since the bulk of your working time will be spent in the departments and you will receive tutorials from academics from both departments and a range of colleges. The college mainly provides somewhere to live, relax and enjoy all that Oxford is able to provide.

### WHAT NEXT?

Talk to family, friends and academic advisors. Visit our website ([www.biology.ox.ac.uk](http://www.biology.ox.ac.uk)), and look out for Open Days which are normally held concurrently with Oxford Colleges in June/July and September. For details, or to ask questions, contact:-

Undergraduate Teaching Coordinator

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*Please note that some details of the course may change from year to year to match teaching resources.*



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