WHTC University application subject guides

Biology

This guide has been written to help support you in your application to university. It contains the following information relevant to your subject to help you decide where to apply and put together the best application that you possibly can:

1. Links to the top courses for this subject in the UK
2. Entrance requirements
3. Recommended A-levels
4. Admissions tests
5. Recommended reading
6. Interesting MOOCs
7. Useful additional resources
8. Related courses
9. Oxbridge example interview questions

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1. Course links

Below are links to the top courses for this subject in the UK (according to The Complete University Guide). Click on the links to find information about what the course is like, what you'll learn, and loads of information about things such as fees and accommodation. However, remember that there are loads of other great universities out there, so check out The Complete University Guide or just google studying your subject at university.

1. University of Cambridge (Natural Sciences BA)
2. University of Oxford (Biology MBioI)
3. University College London (Biological Sciences BSc)
4. Imperial College London (Biological Sciences BSc)
5. University of Bristol (Biology BSc)
6. University of Sussex (Biology BSc)

2. Entrance requirements

Here are the grades that the university suggests you need to get in to that course, and the likely offer that they will give you.

1. Cambridge: A* A* A (must include: two Science/Mathematics subjects).
2. Oxford: A* A A (to include Biology and one other Science/Mathematics. A* must be achieved in Science/Mathematics subjects)
3. UCL: A A A (Biology required plus one from Chemistry, Life and Health Sciences, Mathematics or Physics)
4. Imperial College London: A A A (must include: A in Biology and one other Science/Mathematics subject)
5. Bristol : A A B (must include Biology; Chemistry/Physics/Mathematics)
6. Sussex: A A B – A B B (must include at least one from Biology, Chemistry or Physics)

3. Recommended A-levels

Different universities may differ as to what A-levels they ask you for. Some might list one subject as ‘essential’, while another might list the same subject as just ‘helpful’, so make sure to check out the course page (under Section 1 of this document, or on the university website) to be sure what your chosen university expects!

Expectations of universities vary quite widely therefore it is important to read into the finer detail. However, normally Biology and at least one other Science/Mathematics subject (i.e. Chemistry, Physics, Maths) is required.

4. Admissions tests

What admissions tests are you typically required to sit in addition to submitting your application? This also differs from uni to uni, so if your chosen university isn't on this list, make sure you check out the course page so you know exactly what you need to apply.

University of Cambridge: pre-interview written assessment

University of Oxford: none

UCL: none

Imperial College London: none

University of Bristol: none

University of Sussex: none

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5. Recommended reading

Reading some relevant books or articles is a really great way to demonstrate your passion for your chosen subject in your personal statement, and show how you've gone beyond the curriculum. Plus, if you really want to spend three years or more studying this subject at university, it should be enjoyable! Try taking notes and jotting down your thoughts as you're reading so that you can share some of this in your personal statement

General scientific magazines and publications

Nature – www.nature.com
Free to access articles

Nature is a British multidisciplinary scientific journal, first published on 4 November 1869. It is one of the most recognizable scientific journals in the world, and was ranked the world's most cited scientific journal by the Science Edition of the 2018 *Journal Citation Reports* and is ascribed an impact factor of 43.070, making it one of the world's top academic journals.

New Scientist – www.newscientist.com

Free to access articles

New Scientist, first published on 22 November 1956, is a weekly English-language magazine that covers all aspects of science and technology. Based in London, it publishes editions in the UK, the United States, and Australia. Since 1996 it has been available online.

Science - https://www.sciencemag.org
Free to access scientific articles

Science, also widely referred to as Science Magazine, is the peer-reviewed academic journal of the American Association for the Advancement of Science and one of the world's top academic journals.

National Geographic - https://www.nationalgeographic.com
Some free to access scientific articles

National Geographic (formerly the ***National Geographic Magazine*** and branded also as **NAT GEO**) is the official magazine of the National Geographic Society. It has been published continuously since its first issue in 1888, nine months after the Society itself was founded. It primarily contains articles about science, geography, history, and world culture.

General scientific journals

Bioessays - https://onlinelibrary.wiley.com/journal/15211878
Some free to access peer-reviewed journals

BioEssays is a monthly peer-reviewed review journal covering molecular and cellular biology. Areas covered include genetics, genomics, epigenetics, evolution, developmental biology, neuroscience, human biology, physiology, systems biology, and plant biology. The journal also publishes commentaries on aspects of science communication, education, policy, and current affairs.

Cell – www.cell.com
Free to access peer-reviewed journals

Cell is a peer-reviewed scientific journal publishing research papers across a broad range of disciplines within the life sciences.

BMC Evolutionary Biology – www.bmcevolbiol.biomedcentral.com
Free to access peer-reviewed journals

BMC is a peer-reviewed scientific journal publishing articles on all aspects of molecular and non-molecular evolution of all organisms, as well as phylogenetics and palaeontology

Royal Society of Biology -
www.rsb.org.uk/education/publications/bioscience-journals
Free to access peer-reviewed journals

RSB is home to a range of a peer-reviewed scientific journals which publish articles on topics ranging from molecular biology to applied microbiology.

Recommended books

Some of the content and examples may be out of date, however these books are very good for general understanding.

The Selfish Gene by Richard Dawkins

As relevant and influential today as when it was first published, The Selfish Gene has become a classic exposition of evolutionary thought. Professor Dawkins articulates a gene's eye view of evolution - a view giving centre stage to these persistent units of information, and in which organisms can be seen as vehicles for their replication.

The Emperor of All Maladies: A Biology of Cancer by Mukherjee

A historical assessment of cancer addresses both the courageous battles against the complex disease and the misperceptions and hubris that have compromised modern understandings, providing coverage of such topics as ancient-world surgeries and the developments of present-day treatments.

The Art of Genes: How Organisms Make Themselves by Enrico Coen

Over the past twenty years there has been a revolution in biology--for the first time scientists have been able to unravel the details of how organisms make themselves. The mechanisms by which a fertilized egg develops into an adult can now be grasped in a way that was unimaginable a few decades ago. *The Art of Genes* is the first account of these exciting new findings, and of their broader significance in how we view ourselves.

The Language of the Genes: Biology, History and the Evolutionary Future by Steve Jones

This study is an attempt to bring genetics and evolution more into the public domain. It looks at genetic engineering and the social issues it raises, as well as considerations of cultural, demographic and linguistic history.

The Third Chimpanzee by Jared Diamond

We human beings share 98 percent of our genes with chimpanzees. Yet humans are the dominant species on the planet — having founded civilizations and religions, developed intricate and diverse forms of communication, learned science, built cities, and created breathtaking works of art — while chimps remain animals concerned primarily with the basic necessities of survival. What is it about that two percent difference in DNA that has created such a divergence between evolutionary cousins? Jared Diamond explores how the extraordinary human animal, in a remarkably short time, developed the capacity to rule the world . . . and the means to irrevocably destroy it.

The Greatest Show on Earth: The Evidence for Evolution by Richard Dawkins

Lays out evidence in defense of the theory of evolution and provides a summary of evolutionary biology, with detailed explanations of scientific concepts.

Living with Darwin: Evolution, Design and the Future of Faith by Phillip Kitcher

Charles Darwin has been at the centre of white-hot public debate for more than a century. In *Living With Darwin*, Philip Kitcher stokes the flames swirling around Darwin's theory, sifting through the scientific evidence for evolution, Creation Science, and Intelligent Design, and revealing why evolution has been the object of such vehement attack. Kitcher first provides valuable perspective on the present controversy, describing the many puzzles that blocked evolution's acceptance in the early years, and explaining how scientific research eventually found the answers to these conundrum

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6. Interesting MOOCs

Another great way of learning more about your chosen subject and demonstrating your interest is to take a MOOC, or Massive Open Online Course. These are free courses delivered by universities that you can take online. If the ones below don’t take your fancy, try looking at Class Central -

they have a huge list of different courses for every subject imaginable, and they're all free!

Edx - https://www.edx.org/learn/biology

Free courses to further your knowledge and understanding of Biology

edX is a massive open online course provider. It hosts online university-level courses in a wide range of disciplines to a worldwide student body, including some courses at no charge.

Introduction to Biology - The Secret of Life (MIT Massachusetts Institute of Technology)

7.00x is an introductory level biology course hosted by professor Eric Lander, who was one of the leaders of the Human Genome Project. The course content reflects the topics taught in the MIT introductory biology courses and many biology courses across the world. As a learner, you will first focus on the structure and function of macromolecules such as DNA, RNA and proteins. You will discover how changes in the structure of some of these macromolecules alter their functions and what the implications of such changes have on human health. As you continue in the course, you will apply an understanding of heredity and information flow within cells to human health and disease and will learn about molecular biological techniques and their potential to impact our changing world. After you complete this course, you will have a foundation in biology that will allow you to understand the remarkable medical revolution going on today.

Introduction to the Biology of Cancer Johns Hopkins University

The course introduces the molecular biology of cancer (oncogenes and tumor suppressor genes) as well as the biologic hallmarks of cancer. The course also describes the risk factors for the major cancers worldwide, including lung cancer, breast cancer, colon cancer, prostate cancer, liver cancer, and stomach cancer. We explain how cancer is staged, the major ways cancer is found by imaging, and how the major cancers are treated.

Cell Biology: Mitochondria Harvard University

This course is designed to explore the fundamentals of cell biology. The overarching goal is for learners to understand, from a human-centered perspective, that cells are evolving ensembles of macromolecules that in turn form complex communities in tissues, organs, and multicellular organisms.

We will focus, in particular, on the mitochondrion, the organelle that powers the cell. In this context, we will look at the processes of cell metabolism. Finally, we

will examine the F1F0 ATP synthase, the molecular machine that is responsible for the synthesis of most of the ATP that your cells require to do work. To underscore the importance of cell biology to our lives, we will address questions of development and disease and implications of science in society.

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7. Useful additional resources

There are loads of other great things out there that you might want to look at to develop your interest and strengthen your application, from videos to podcasts, to websites. Here are a few suggestions:

Staircase 12: https://www.univ.ox.ac.uk/applying-to-univ/staircase12/
TED talks: https://www.ted.com/topics/biology
Podcasts:

- The Biologist has some great podcasts that explore questions about science and the natural world.
- BBC Podcasts - Science & Nature
- Stuff you missed in history has some good medical history episodes

Websites:

- BBC Science News – keep up to date with the most recent scientific news
- Nature Scitables – exposure to key scientific concepts in many unseen contexts; an opportunity to stretch your understanding of Biology beyond the A Level syllabus.
- Free Open University courses: https://www.open.edu/openlearn/science-maths-technology/science/biology

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8. Related courses

At university, there are loads of different combinations of subjects that you can do. Maybe you might find one of these alternatives more interesting? A few ideas are listed below with a sample link, but in most cases there are lots of universities that offer these different combinations so make sure to have a good look around!

There are often combination University courses which offer Biology with a foreign language, or some that offer a Year in Industry (work experience for a year).
There are also some courses which allow you to continue your studies onto a Masters degree. These are indicated by an MSc notation and will be 4 year courses.
There is an extensive range of Biology related courses including:

- Biomedical Science
- Biochemistry
- Ecology
- Genetics
- Life Sciences
- Psychology
- Geology
- Earth Sciences
- Natural Sciences
- Human Sciences
- Zoology
- Veterinary Studies
- Medicine

9. Oxbridge example interview questions

As you will know, applicants to Oxford and Cambridge have to take an interview in order to get a place. It is normal to get open-ended questions, as well as being given charts or pieces of writing to analyse. Here is a sample of the kind of questions you might get asked. Remember, you're supposed to not know the answer! They often deliberately choose topics that they think no one will have studied in order to make the questions fair. What they're looking for is to see how you think under pressure, and how you can present your ideas and your logic.

Below is a short snapshot of the variety of questions which have been asked in previous interviews for Oxford University. These have been taken from the university website.

Why do some habitats support higher biodiversity than others?

This question encourages students to think about what high-diversity habitats such as rainforests and coral reefs have in common. In many cases, patterns or correlations can help us to identify the underlying mechanisms. For example, a student might point out that both rainforests and coral reefs are found in hot countries and near the equator. The best answers will attempt to unravel exactly what it is about being hot or near the equator that might allow numerous types of plant and animal to arise, persist and coexist. Do new species evolve more frequently there, or go extinct less frequently? Once students have come up with a plausible theory, I'd follow up by asking them how they would go about testing their idea. What sort of data would they need?

Why do many animals have stripes?

The main aim of the question is to get applicants to think about biological topics and put them in the context of successful adaptations to life on earth. So I might expect students to start by thinking of some stripey animals, then move on to thinking about categories of striped animals – for example those that are dangerous (such as wasps, tigers, and snakes), those that have stripes for camouflage (such as zebras but also tigers), and those whose stripes are harmless mimics of dangerous ones. They might think of specific examples for detailed comparison: tigers and zebras for example both have stripes for camouflage and blending in with background, one to hide from prey and the other to hide from predators.
Other things that would be worth considering include whether stripes may only occur in the young of a species; whether the colour of the stripes matters rather than just the contrasting stripe pattern, and why do stripe size, shape, width and pattern vary in different species. There are no right or wrong specific answers to the questions – I'm just interested in candidates' speculations about the advantages of having stripes.

Is it easier for organisms to live in the sea or on land?

Firstly candidates should define 'easier' – does it mean less complexity, less energy expenditure, less highly evolved, less likely to be eaten etc? Then candidates could think of problems caused by living in the sea, such as high salinity, high pressure, lack of light etc. Problems living on land include extra support for the body, avoiding desiccation, the need for more complex locomotory systems (legs, wings etc) and hence better sensory and nervous systems etc. Then ask in which of the two ecosystems have animals and plants been more successful? So now they have to define 'successful'...

If you could save either the rainforests or the coral reefs, which would you choose?

I'd expect students to be able to use their general knowledge plus their common sense to come up with an answer – no detailed knowledge is required. Students might then be asked about the importance of natural features, such as biodiversity and rare species, and human interests, such as the fuel and food, ecotourism and medicines we get from rainforests or reefs. Finally there are impacts to consider from climate change, soil erosion, pollution, logging, biofuel replacement, overfishing, etc. The final answer doesn't matter – both reefs and rainforests must be managed sustainably to balance conservation and human needs.

Would it matter if tigers became extinct?

This question is not about hoping students will display their expert knowledge of tigers. Most applicants would instinctively answer 'Yes...', but it is the 'because....' that interests me, and can help to distinguish critical thinkers. I might follow up this question by asking if it would matter if less glamorous creatures – like fungi – went extinct.

Ladybirds are red. So are strawberries. Why?

Many Biology tutors use plant or animal specimens – often alive – as a starting point for questions and discussion, so applicants shouldn't be surprised if they are asked to inspect and discuss an insect or a fruit. Red can signal either 'don't eat me' or 'eat me' to consumers. I'm interested in seeing how applicants attempt to resolve this apparent paradox.

Why do lions have manes?

Some of the best interview questions do not have a 'right' or a 'wrong' answer, and can potentially lead off in all sorts of different directions. Applicants might have picked up ideas about the function of a lion's mane from independent reading or from watching natural history documentaries. That's fine – but I'd follow up their response by asking how they would test their theory. When I've used this question in interviews I've had all sorts of innovative suggestions, including experiments where lions have their manes shaved to investigate whether this influences their chances with the opposite sex or helps them win fights over territory.

Here’s a cactus. Tell me about it.

We wouldn't actually phrase the question this way – we give the student a cactus in a pot and a close-up photo of the cactus's surface structure and ask them to describe the object in as much detail as possible using the plant and the photo. We are looking for observation, attention to detail, both at the large and micro scale. We ask them to account for what they see – this means they don't have to use memory

or knowledge about cacti (even if they have it) but to deduce the uses and functions of the shapes, sizes, structures that they have just described. So for example, why be fat and bulbous, why have large sharp spines, surrounded by lots of very small hair-like spines? Why does it have small cacti budding off the main body? There will frequently be more than one logical answer to these questions, and we are likely to follow one answer with another question – for example:
'The big spines are to stop the cactus being eaten, yes, but by what sort of animals?'
We would also bring in more general questions at the end of the cactus discussion, such as what are the problems faced by plants and animals living in very dry habitats such as deserts.

Here are some extra example questions:

1. What are flowers for? How do they attract pollinators? How do you think these attractive traits evolve?
2. What are the difficulties animals face living on the sea shore and can you think of some adaptations that help them survive in this environment?
3. Are humans still evolving? Can you explain why you think that?
4. *show student microscope image* What 3 questions would you ask to try to figure out what this is?
5. Tropical forests are very biodiverse. How can we measure diversity? Can you think of reasons why these regions are biodiverse? Why is it a good thing for an ecosystem to have a lot of biodiversity?
6. Can you explain the processes going on in the cell that lead to a gene being expressed?