Choosing 1A courses

The idea behind the flexibility of the Cambridge Natural Sciences course is that students should take this opportunity to explore what interests them before specialising. Most second-year courses do not require specific 1A courses to have been taken, but some are strong recommendations. Particularly advisable for biologists are Evolution & Behaviour and Cells, whilst chemists would obviously benefit from Chemistry. Possible 1A 'biological' combinations are:

Cells + Chemistry + Physiology – the most common combination but also the most frequently regretted; it is not advisable if you are not passionate about all three. These are the three most intensive courses and all students struggle to manage the extraordinary workload. To cope happily you have to have exceptional organisation and disciplined time management.

Cells + Evolution & Behaviour + Physiology – the second most common combination and as the three subjects support one another this is the most successful combination in terms of 1A results and preparation for 1B. Considered by many biology Directors of Studies to be the ideal biological se and so strongly recommended. An excellent basis for all 1B biological courses.

Cells + Chemistry + Evolution & Behaviour – the third most common combination. Good for Chemists with an interest in biology. Biologists may regret the limited physiological content.

Cells + Earth Sciences + Evolution & Behaviour – a fairly rare combination, good for those with interests in evolutionary processes and a good basis for 1B biological courses

Earth Sciences + Evolution & Behaviour + Physiology – a rare combination, particularly good for those interested in evolutionary and ecological processes

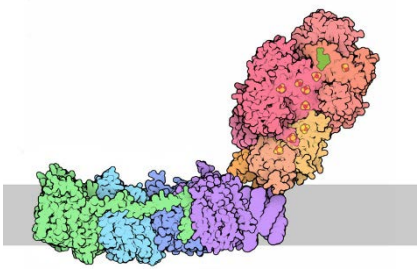
Cells + Chemistry + Earth Sciences – a rare combination, not advisable

Cells + Earth Sciences + Physiology – a very rare combination, not advisable

Chemistry + Earth Sciences + Evolution & Behaviour – a very rare combination, not advisable

In addition, physical sciences courses can be taken in place of one of the biology courses by those with a particularly strong interest in Material Sciences or (extremely rarely) Physics. Material Sciences is a physics course, with only a small component relevant to Chemistry and few biologists who sign up to this persist with it. Physics is inadvisable for anyone who is not primarily a physicist.

The biology courses are described below (a summary, the text from the course website and some comments from recent students):



Biology of Cells - an obviously useful foundation course for biology. This develops from the basic concepts of cell structure and biochemistry to genetics, molecular biology, development and communication. This is a good background for 1B courses in Cell & Development Biology, Biochemistry & Molecular Biology, Physiology, and Plant & Microbial Sciences. It has a reputation for being the most content heavy of all the courses.

<u>From course website:</u>

The course aims to provide an introduction to biology at the molecular and cellular level, and considers what cells are, what they look like, and how they work. The Biology of Cells course is complete in its own right, but it also provides a useful introduction to further studies in biology, biochemistry and genetics, for both biologists and non-biologists. The course is organised jointly by the Departments of Biochemistry, Plant Sciences, Genetics, and Zoology.

In the first term, the lectures deal with the basic structure of cells and macromolecules, with the structure and function of cell membranes, and with the essential biochemistry of cell metabolism. The second term's lectures are concerned with genetics (including the organisation and inheritance of genetic information), genetic engineering, nucleic acid and protein synthesis, and with cell growth and multiplication. 3rd term lectures consider animal and plant development, and cell communication.

The practical side of the course is organised so that, so far as possible, the experiments are related to the subject matter of the concurrent lecture course.

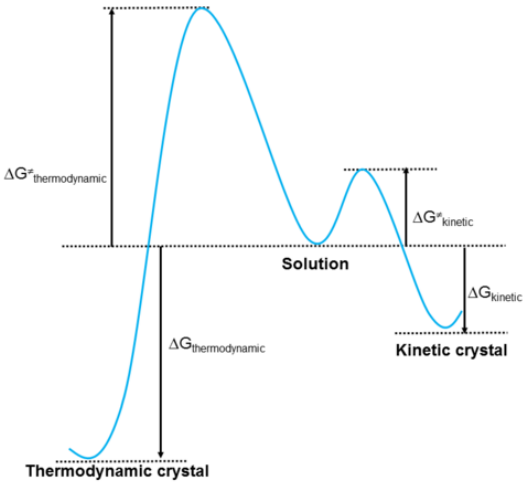
A Level Chemistry is highly desirable: some Chemistry knowledge beyond GCSE is assumed.

<u>Students' comments</u>:

"Although I found Cells to be very content-heavy and detail-oriented (lots of memorisation), the course ultimately provides a solid molecular or biochemical foundation, and it complements other biological 1A modules nicely."

“A very content heavy course which will undoubtedly require a lot of cramming, however essential if you would like to continue with Cell and Developmental Biology or Biochemistry and Molecular Biology in your second year.”
“Biology of Cells is a crash course in molecular biology, you learn a great deal in a short space of time, while a lot of work it is interesting.”

Chemistry – provides the basis for further study of Chemistry at 1B but is not needed for 1B biological courses (even Biochemistry). This builds on A-level and similar courses to develop a greater understanding of chemical structure, reactions, thermodynamics and kinetics. Physicists tend to do better at Chemistry than biologists, but it is worth considering if you are passionate about Chemistry.



From course website:
In this course we begin to explore the complex and subtle relationship between the structure of a molecule and its chemical properties; an understanding of this relationship is central to making sense of the physical and biological worlds. The ideas and concepts introduced in the course are relevant to all areas of molecular science, from biochemistry to materials science, and also form a foundation for more advanced study in chemistry in subsequent years. The course emphasises the underlying concepts in chemistry and how these can be used to rationalise and understand the behaviour of chemical systems and molecular interactions.
The course begins by looking at how chemists use spectroscopy to determine the shape and structures of molecules, and then goes on to consider how modern theories of chemical bonding give us an understanding of why molecules adopt the shapes and structures they do. We will also look at how these theories point to the type of chemical reactivity that a particular molecule will have. The consequences of these shapes and electronic structures are then explored in a number of ways. We will consider how the molecules react and how mechanistic ideas can be used to rationalise and predict the outcome of a chemical reaction. The way in which a qualitative study of the rates of chemical reactions sheds light on mechanisms will be discussed, and the way in which chemical equilibrium can be understood in a quantitative way will be introduced and illustrated. The course closes by drawing together all of these concepts and using them to make sense of the widely different chemistry shown by some key non-metallic and metallic elements.
Practical classes, which are synchronised closely with the lectures, form an essential part of the course. In them students will have the opportunity to try out and experience at first hand the consequences of the ideas introduced in the lectures. Some of the practicals involve "wet chemistry", and some involve making and interpreting quantitative measurements. Students are expected to attend one practical session every two weeks.
Knowledge of A Level Chemistry or equivalent is assumed. A knowledge of calculus is also required.
Students’ comments:
“A very well structured and organised course which gives a decent foundation in Chemistry for your further years.”
“Chemistry is very different to what we did in school, it tends to involve a lot more mathematical thinking than I'd expected, and much of the course focuses on physical chemistry.”
“Chemistry is a good course, it provides important background and can be a nice break from biology.”

Earth Sciences - for many this is interesting because it is largely unfamiliar. It provides an introduction to the history of the Earth, covering plate tectonics, magmatism, metamorphism, atmosphere and ocean process, climate change, erosion, sedimentation and palaeontology.

From course website:
The course is an introduction to the whole field of earth and planetary geology. It covers the nature and properties of the Earth, particularly of the mantle and

the crust; observed and deduced processes of change both of the Earth's interior and also in its oceans and atmosphere; biological, physical, and chemical methods of dating to establish rates of geological and global environmental change; and major economic considerations. Emphasis is placed on practical and field work including general identifications and interpretation of rocks, interpretation of geological maps of large areas, and the use of fossils, sediments and rocks in determining internal and external changes.
Much of the course is concerned with application of principles of physics, chemistry, and biology to gain an understanding of the behaviour of Earth and the planets, so that a school background in some of these subjects is necessary. Previous knowledge of geology is not necessary. Fieldwork is carried out in the Easter Vacation, and is an essential part of the course.
Students' comments:
"Earth is super broad, with topics such as geophysics, palaeobiology and even some astronomy. Do not be afraid to take earth even if you have no background knowledge in physics."
"Earth lecturers are mostly great, and the department is amazing at providing help and guidance. You get to go on a field trip in Easter as well, which is a huge bonus!"

Evolution & Behaviour – biologists are strongly encouraged to take this course; it covers fundamental concepts and prioritises original thought. This course starts with evolutionary theory and population genetics before covering the main steps in evolution of all living things, from the origins of life, plant and animal groups, ending with human origins. Animal behaviour is also included. Of all 1A courses, this is the most distinctive and students taking E&B consistently say it is the most stimulating of all their courses. Second year 'Evolution & Animal Diversity' and 'Ecology, Evolution & Conservation' courses build on this, and it is also particularly useful for Physiology, Plant & Microbial Sciences and is the only 1A course to cover population genetics and development. Any student intending to pursue biological options beyond the first year ought to take this course. Includes an outstanding week's field course in the Easter vacation.
From course website:
Evolution and Behaviour aims to introduce students to the breadth of evolutionary biology, with a special emphasis on whole organism biology. The course is taught jointly by the Departments of Zoology, Genetics, Biochemistry, Plant Sciences, Psychology and the Division of Biological Anthropology.
The course consists of the following themes:
• Evolutionary theory
• The origins of life and cells
• The origin and evolution of plants
• The evolution and diversity of animals
• The evolution of behaviour
• Primate and human evolution
• Evolution of global change
The aims of the course are to introduce students to the major principles of evolutionary theory and ranges from the origins of life, through the evolution of plants and animals to the evolution of behaviour. Lectures and practicals are designed to show how natural selection ultimately underpins all biological processes and how evolution has generated biological diversity. The major transitions in evolution, from the origin of life and of sex, to hominid evolution are detailed, and the evolutionary basis of behaviour in animals, including primates and humans are considered. The practical side of the course comprises practicals that complement lecture material and aim to develop students' practical skills. Some of the practicals are assessed: there is no practical examination.
Evolution and Behaviour provides a broad base for further studies across the whole spectrum of biology, and should be seriously considered by all biologists. The course is also appropriate for physical scientists with an interest in evolutionary biology or psychology.
Evolution and Behaviour is an excellent precursor for 2nd year biological and psychological courses.
Students' comments:
"My favourite course, revealing the big picture and connecting the dots in terms of how the life on Earth developed and adapted to their environment (physically and behaviour-wise) over time. Also, I cannot recommend the field trip enough (EnB is one of two 1A courses that offer it!) - it is very interesting and worthwhile."

“EnB is a great course that trains your essay writing skills whilst giving you a broader perspective of Biology in general. I recommend taking EnB as it complements all biological subjects and helps put Biology in perspective.”
“E&B is an extremely enjoyable course to take and has been useful in contextualising concepts explored in other areas of biology, I cannot recommend it enough!”

Physiology of Organisms - this gives a detailed introduction to the main physiological processes underlying all life, including membrane structure and ion flow, nerve activity, senses, movement, water transport, nutrition and photosynthesis, and homeostasis. A large proportion of this material is introduced in A-level Biology, with the addition of a comparative aspect, covering bacteria, protists and fungi, as well as plants and animals. This course covering a phenomenal amount of descriptive detail, and the comparative aspect is particularly useful, although it has no evolutionary content. For this reason it is particularly recommended that Physiology be combined with Evolution & Behaviour. The difficulty of assimilating the sheer amount of detailed material in this course should not be under-estimated. It complements 1A Evolution & Behaviour and supports 1B Physiology and some aspects of Biology of Disease, Neurobiology and Plant & Microbial Sciences.
From course website:
Physiology is central to the study of life sciences, requiring an understanding of gene expression and cell biochemistry, integrated into whole-organism function. The aim of the Physiology of Organisms course is to compare animal, plant and microbial physiology by understanding parallels in transport systems (circulation and sap flow), gas exchange (respiration and photosynthesis), nutrient acquisition and osmoregulation. At the same time, we consider the contrasting sensory and signalling systems needed to support motility (animals) and developmental plasticity (plants).
The first term of the course focuses on general topics of comparative animal physiology, neurobiology and homeostasis. Most of the second term is occupied with plants and microbes, where molecular insights provide the key to understanding the physiological plasticity of plant form and function. The physiological strategies for bacterial and fungal growth lead to symbiosis and pathological interactions with plants. In the third term you will learn how animals achieve energy balance and consider scaling effects of size on metabolic rate, structure and locomotion in a range of organisms.
Experimental practical classes form an integral part of the course, consolidating lecture material and giving you first-hand experience of biological manipulations and recording observations. The classes are run between the Departments of Physiology, Development & Neuroscience, Zoology and Plant Sciences. Experiments range from investigating membrane properties, to nerves, muscles and organs, as well as respiration - your own gas exchange, and that of plants!
Physiology of Organisms is a core biological course, providing a logical organismal development to IA Biology of Cells, and also underpinning IA Evolution & Behaviour. The course leads into many IB courses, as well as being of general interest to anyone curious to know how complex biological machines work. The Physiology of Organisms course does not assume knowledge of A Level biology or any other course, although some background in biology, chemistry and physics will be useful.
Students’ comments:
“I really enjoyed Physiology: I felt that it led on nicely from topics covered at school, and it was full of interesting examples from a variety of organisms (not just humans).”
“The comparative aspect of the course also made it more interesting than other courses because it involved thinking about broader themes rather than just minute details.”

Mathematics courses
One maths course must be taken, Mathematical Biology is generally the best choice unless Chemistry it likely to be taken in the second year.
Mathematical Biology - This covers mathematical, statistical, and computing methods, providing the statistical and modelling methods needed for all 1A, 1B and part 2 biological courses.
Mathematics - This is more directed towards supporting physical sciences, it lacks the statistical components needed for biology. It is recommended for those likely to continue to 1B Chemistry (but is not essential). It lacks the statistical aspects that will be needed for 1B biological courses.

1B and Part 2 courses

If you have any specific interests in any second year courses (and for some third year specialisations) it is worth considering which 1A courses would facilitate those:

Biochemistry & Molecular Biology – requires 1A Cells, Physiology useful but Chemistry is not needed
Biology of Disease – 1A Physiology would be beneficial
Cell & Developmental Biology – 1A Cells is essential
Chemistry – 1A Chemistry is essential, Cells is useful for Chemistry B
Earth Sciences – 1A Earth Sciences is essential
Ecology, Evolution & Conservation – 1A Evolution & Behaviour strongly advised, Physiology is useful
Evolution & Animal Diversity – 1A Evolution & Behaviour is strongly advised, Physiology is useful
Experimental Psychology – 1A Evolution & Behaviour is useful
Genetics (Part 2) – 1A Evolution & Behaviour introduces evolutionary genetics
History & Philosophy of Science – no recommendations
Neurobiology – 1A Physiology is useful
Pathology – 1A Cells and Physiology are useful
Pharmacology – 1A Physiology is important, Cells and Chemistry are useful
Plant & Microbial Sciences – 1A Evolution & Behaviour is advised, Physiology and Cells also useful
Physiology – 1A Physiology is essential, Cells is useful