NATURAL SCIENCES

Science without boundaries
Breaking down boundaries

York's Natural Sciences programmes provide you with a broad spectrum of options built around the University's interdisciplinary research excellence.

Leading academics from each of the departments below share a common desire to break down disciplinary boundaries. They have worked together to design York’s Natural Sciences programmes in a way that will have the maximum impact on your intellectual, scientific and personal development.

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Many of the most exciting developments in modern science are happening where the boundaries between disciplines meet. It is at these frontiers that the most challenging issues of our times are being tackled – issues such as climate change, energy supply, digital communications, food scarcity, health and wellbeing.

Here at the University of York, we have been breaking down these intellectual boundaries for more than a decade, creating world-leading research institutes where scientists from a range of disciplines work together in pursuit of common goals.

Now these same scientists have come together to create a new degree course for talented and ambitious students with a passion for science and a curiosity for answers, in order to develop the interdisciplinary scientists of tomorrow.

Our programmes are not an intellectual free-for-all: they are built around the work of our internationally acclaimed researchers and research institutes.

This will give you the opportunity to learn from leading scientists in their fields and to study in some of the foremost scientific facilities in the world.

Unlike other pick-and-mix Natural Sciences degree courses, where students have a seemingly limitless range of options, at York we have devoted a great deal of time and thought to constructing options that have genuine academic synergy.

An important feature is the option to follow either the breadth of an interdisciplinary programme or the more focused depth of our specialisation pathways.

But the Natural Sciences programmes at York are not for the faint-hearted. We are looking for people who are eager to try something different; who relish an intellectual challenge; who feel the need to be academically stretched; who have a hunger to learn; and who want to make a difference.

So, if you are keen to experience what is happening at the frontiers of modern science – join us on one of York’s Natural Sciences programmes.

Dr Roddy Vann
Director of the School of Natural Sciences
If you have previously studied combinations of chemistry, mathematics, physics and biology at school – maybe even with psychology or archaeology – you will have been working within the framework of the natural sciences.

However, these subjects are often treated as distinct disciplines with fixed boundaries. Each subject seems to have its own peculiar language, distinctive course content and ways of doing things.

We believe that the best of modern science involves breaking down these intellectual boundaries – enabling scientists from a wide range of disciplines to work together, pooling their talents, energies and intellects to tackle some of the most pressing issues of the day.

It is at the interfaces – the talking and meeting points – between scientific disciplines that the most exciting research is taking place, and where the biggest challenges facing the world today will be tackled and resolved. And, increasingly, employers – whether in the public or the private sector – are looking for graduates with a breadth and depth of experience in a range of disciplines, along with the vital transferable skills of communication, IT, leadership and teamwork.

The Natural Sciences programmes at York will provide you with that breadth and depth.
CHOOSING YOUR PROGRAMME

Interdisciplinary or specialisation – your choice

York’s Natural Sciences programmes fall into one of two categories – interdisciplinary and specialisation. While each category has its own entry points, pathways and final awards, whichever you choose will give you a unique experience of what it is like to work at the interfaces between scientific disciplines. This, we believe, will give you both a broader and a deeper understanding of modern science and will add value to your intellectual development over and above that which can be gained through a single subject science degree.

As a result, you will become much more than just a good scientist: you will develop a wider range of skills equipping you to communicate across disciplines and in other scientific languages. You will have the ability to analyse and solve complex and challenging problems by thinking logically, analytically, precisely and critically.

These transferable skills, coupled with highly developed leadership qualities, will equip you to pursue game-changing roles in fields as diverse as scientific research, public policy, high finance, technology design and development, and cutting-edge computer software applications.

That is why York is the natural choice for science.

Interdisciplinary – these programmes allow multiple subjects to be studied throughout all years, giving valuable insights into the interfaces between different disciplines.

Specialisation – a structure providing breadth on entry while guaranteeing a depth of knowledge and experience in your final specialism. This option will appeal to students who are confident across a range of scientific subjects but have yet to decide which area to focus on.
Interdisciplinary programmes

If you choose the interdisciplinary option in Natural Sciences, you will study a carefully selected combination of subjects which will be accessed by entering one of the five interdisciplinary blocks listed below:

**Interdisciplinary Block 1**

**Biophysical Science**

Biophysical Science
(Biology / Chemistry / Physics / Mathematics)

The Biophysical Science entry point gives you access to a quantitative grounding in the sciences of biology, chemistry and physics before concentrating on Biological Science. As a result, you will be equally comfortable engaging with physics as with biology, and will be able to apply the distinctive conceptual frameworks of these different disciplines to problems at the boundary between physics and the living world.

**Interdisciplinary Block 2**

**Nanoscience**
(Chemistry / Electronics / Physics / Mathematics)

Nanoscience is the study and manipulation of atoms, molecules and nanoscale objects to create unique functional systems. You will learn how using quantum and statistical mechanics and thermodynamics of the very small, and arranging atoms and molecules in specific ways, leads to new materials or systems with remarkable functions. You will develop laboratory skills in our clean room and your final year project could be conducted in, and supervised by, the York-JEOL Nanocentre.
**Interdisciplinary Block 3**

**Neuroscience**
*(Psychology / Biology / Chemistry / Philosophy)*

Neuroscience is the study of the nervous system – specifically the function of a class of cells called ‘neurons’ that exist in all animals and which allow organisms to sense their environments, evaluate new information, learn and remember relationships between stimuli, and respond to events. York is unusual in having neuroscience researchers whose expertise spans a vast range – from the atomic and molecular levels to cognitive processing in whole living brains and to the philosophy of consciousness and theory of mind. There will be opportunities to work in two world-class research centres, the York Neuroimaging Centre and the Centre for Hyperpolarisation in Magnetic Resonance.

**Interdisciplinary Block 4**

**Biological Modelling**
*(Biology / Mathematics)*

Mathematics and mathematical modelling are becoming increasingly important in understanding natural and biological processes; they enhance our understanding of complex systems and enable us to make quantitative predictions. The Biological Modelling programme will enable you to use mathematical techniques to understand the dynamics of the natural world, with an emphasis on ecology, conservation and environment. You will benefit from the established interdisciplinary connections and close collaborations between these departments in both teaching and research.

**Interdisciplinary Block 5**

**Mathematics / Physics / Philosophy**

Mathematics, Physics and Philosophy have substantial areas of two-way and three-way interaction as disciplines. Historically there has been significant cross-fertilisation between mathematics and philosophy, particularly with the development of formal logic in the late 19th and early 20th centuries. Twentieth-century developments in physics, particularly special and general relativity and quantum mechanics, have also proved a fertile ground for philosophical enquiry. This three-way subject combination can be studied through all three or four years, but students are also able to specialise in either Mathematics or Physics by the final year, or alternatively transfer out of Natural Sciences to the Mathematics and Philosophy or Physics with Philosophy combined programmes.
Specialisation programmes

If you choose one of our carefully designed specialisation programmes you will be able to study three or four subjects in the first year. In the second year you will specialise in just two of these subjects, before selecting a single subject for the third year (and fourth year if you follow the MSci programme).

○ Specialisation Block 1

Archaeology / Biology / Chemistry / Environment

You will learn how field and laboratory science can be applied to the study of the human past, and how that application can bridge the ‘two cultures’ of science and the humanities. You will develop the ability to assess environmental problems and recommend solutions with an appreciation of the socioeconomic and political systems within which decisions are made. Depending on your choice of options, your skills development may include hands-on practical fieldwork with leading archaeologists and/or environmental scientists.

○ Specialisation Block 2

Biology / Chemistry / Physics (and Mathematics in Year 1 only)

This entry point exploits the interfaces between the three traditional laboratory sciences of Biology, Chemistry and Physics. It is an ideal choice if you wish to study at greater breadth than would normally be possible with a single-subject degree in any of the three subjects, but feel that you will be ready to specialise in a single subject by the third year.

○ Specialisation Block 3

Chemistry / Mathematics / Physics

The modern disciplines of Chemistry, Mathematics and Physics enjoy a number of synergies. A good example is the science of molecules: group theory in Mathematics informs us about the set of available rotations and vibrations; quantum mechanics in Physics can be used to calculate properties of the chemical bond from first principles; and Chemistry tells us how multiple molecules interact: a powerful combination.
## Specialisation study pathways

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<th>Year(s) 3 (and 4)</th>
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<td>Mathematics</td>
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### Specialisation Block 1
- Archaeology
- Biology
- Chemistry
- Environment

### Specialisation Block 2
- Biology
- Chemistry
- Physics

### Specialisation Block 3
- Chemistry
- Mathematics
- Physics
- Mathematics
- Physics
- Mathematics
- Physics
Your learning experiences on the Natural Sciences degree will be as diverse as the programme itself, ranging from hands-on experiments in state-of-the-art laboratories through to video conferencing, lectures and small group tutorials.

A key part of your learning experience will be in lectures, which you might share with students studying single subjects, while tutorials and seminars will usually be delivered within groups of Natural Sciences students. It is here that you’ll develop your communication and analytical skills, and strengthen your independent thinking and leadership qualities.

At the heart of your Natural Sciences programme will be laboratory work – whether experimental or computational – often interwoven with lectures and tutorials, or as a stand-alone module.

You will have the opportunity to work in the University’s new £10m Chemistry Building, equipped with one of Europe’s largest and most sophisticated student laboratories (above). Here you’ll learn that experiment is not just a useful, transferable skill but also underpins the very nature of empirical science.

Your Natural Sciences programme will culminate in a challenging major project. This will be closely supervised and supported, and will give you the opportunity to showcase everything you’ve learned during your three or four years at York. We’ll encourage you to carry out an original piece of work, and to have your work published in a peer-reviewed journal. Wherever possible, your project will be carried out either in, or with the support of, one of our internationally renowned institutes and researchers.
A week in the life

It is almost impossible to describe a typical week in the life of a Natural Sciences student, such is the range and depth of subjects covered over your three or four-year involvement with York. The timetable below gives an idea of what you might be doing in a sample week in your first year. It shows clearly that this is a challenging course, with a high number of contact hours, supported by lecturers and tutorials that explain the context and relevance of the subject to the wider, interdisciplinary world of Natural Sciences, helping you to become fluent in the many different ‘languages’ of diverse scientific disciplines.

Every week during your course you will have the opportunity to take part in a dedicated Natural Sciences hour. This will include inviting speakers from other universities and research institutes to talk about their specialist fields and explore career options with potential employers. This open access hour gives Natural Sciences students the chance to set their own agenda.

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<th>Monday</th>
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<td>09:00-10:00</td>
<td>Physics of Fields and Waves: Lecture</td>
<td>Electromagnetism: Lecture</td>
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<td>10:00-11:00</td>
<td>Molecular Biology and Biochemistry of the Cell: Practical</td>
<td>Chemistry Molecular Orbital Theory: Lecture</td>
<td>Physics of Fields and Waves: Lecture</td>
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<tr>
<td>11:00-12:00</td>
<td>Spectroscopy: Lecture</td>
<td>Electromagnetism: Lecture</td>
<td>Mathematics for Natural Sciences: Seminar</td>
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<td>12:00-13:00</td>
<td>Mathematics for Natural Sciences I: Lecture</td>
<td>Molecular Biology and Biochemistry of the Cell: Lecture</td>
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<tr>
<td>13:00-14:00</td>
<td>Molecular Biology and Biochemistry of the Cell: Practical</td>
<td>Mathematics for Natural Sciences: Lecture</td>
<td>Electromagnetism: Lecture</td>
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<tr>
<td>14:00-15:00</td>
<td>Blocked-out for sport and other extracurricular activities</td>
<td>Spectroscopy: Lecture</td>
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<td>15:00-16:00</td>
<td>Electromagnetism: Tutorial</td>
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<tr>
<td>16:00-17:00</td>
<td>Electromagnetism: Tutorial</td>
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<tr>
<td>17:00-18:00</td>
<td>Mathematics for Natural Sciences I: Lecture</td>
<td>Natural Sciences hour</td>
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Illustration of a typical Natural Sciences timetable

Doors open on new science studio

At the heart of your studies at York is a state-of-the-art Natural Sciences learning studio and space within a new interdisciplinary science building due to be completed in August 2014. This includes individual data and power to each of the studio’s 60 seats; a teaching wall with equipment to support video-conferencing; and bring your own device (BYOD) technology for interactive work within and between groups.

The learning studio will be part of a dedicated hub, where you can meet other Natural Sciences students, most of whom will have chosen other subject combinations and pathways.

This will be a great place to discuss lectures, exchange ideas and build the kind of friendships that help make life at university much more than just an academic learning process. It will have its own kitchen and plenty of sofas to chill out on.

The new hub will also play a part in your learning experience. With more than £6m invested in the new interdisciplinary science building, the hub will have high-tech digital and e-learning facilities, break out rooms and an area for social gatherings and meetings. These facilities will be the place where Natural Sciences students organise their own events, bringing in outside speakers to inspire and engage.
YOUR FUTURE

Studying the Natural Sciences at York equips students with the skills to succeed in a wide range of careers that require evaluation of complex or incomplete data, fact-based decision-making, problem-solving and teamwork. This includes careers in academia, industry, finance and government. Specific examples of employment for which our graduates will be well-qualified are:

- **Industrial researcher for a chemical engineering company** – to remain competitive in the global marketplace, world-leading companies must innovate. Increasingly they are forming multidisciplinary teams of scientists to develop new products and solutions – as someone well versed in the different languages of science you will be well qualified to join such a team.

- **Management consultant** – in the modern world it is not enough to innovate in new products, companies must also evolve ever more productive and efficient management techniques. The analytical and critical skills you will develop on the Natural Sciences programme, coupled with the ability to see the bigger picture and the other point of view, put you in a strong position for such a consultancy role.

- **Process technologist at an integrated circuit manufacturer** – with physics, chemistry and electronics as key components of the Natural Sciences programme, you will have all the skills needed to work in digital product development. You will also understand how blurring boundaries between biology and computational science is opening up new fields of product development and services – which puts you in pole position to exploit this ever-expanding job market.

- **Project manager in the aerospace industry** – few industries are as demanding as the aerospace industry. The qualities of scientific rigour, accuracy and skills in quantitative methods which they are looking for will be second nature to you after completing a three or four-year Natural Sciences degree at York.

- **Civil servant in the Department for Business, Innovation and Skills** – The UK Government has to harness the talents of the scientific community if British industry is to punch above its weight in the world. It is increasingly looking for interdisciplinary projects that pool the brainpower of bright researchers. Your fluency in a wide range of scientific languages will be invaluable in bringing interdisciplinary teams together.

- **Financial quantitative analyst for an investment bank** – the financial crash has revealed just how important it is for the financial industry to have well-qualified, interdisciplinary scientific graduates who can develop and refine their systems and processes. Your talents as a physicist and mathematician, coupled with a deep understanding of stochastic or random processes, will qualify you to join the hurly burly of the trading floor, or the quieter analytical world of quantitative work for an investment bank. Either way, your skills will be in demand.
ENTRY REQUIREMENTS

The typical entry requirements for applicants taking A levels are shown in the table below. We welcome applications from those taking other qualifications (for example IB, Scottish Highers and BTEC). We also welcome applications from mature students and applicants with international qualifications.

Our selection process includes an interview. As well as giving us the opportunity to assess your suitability for the course, it will give you the chance to find out more about the School of Natural Sciences and life as a student at the University of York.

<table>
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<tr>
<th>Programme</th>
<th>A level requirements</th>
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<td>Typically we require A*AA in the subjects specified below</td>
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<td>Chemistry</td>
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<td>Interdisciplinary</td>
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<tr>
<td>Biological Modelling</td>
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<tr>
<td>Biophysical Science</td>
<td>✓</td>
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<tr>
<td>Mathematics, Physics and Philosophy</td>
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<tr>
<td>Nanoscience</td>
<td>✓</td>
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<tr>
<td>Neuroscience</td>
<td>✓</td>
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<tr>
<td>Specialisation</td>
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<tr>
<td>Archaeology / Biology / Chemistry / Environment</td>
<td>✓</td>
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<tr>
<td>Biology / Chemistry / Physics</td>
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<tr>
<td>Chemistry / Mathematics / Physics</td>
<td>✓</td>
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The UCAS codes for the University of York Natural Sciences programmes are:

- CFGO (BSc)
- FGCO (MSc)

The information in this brochure is correct at the time of going to press. However, for the latest details about our course programmes, entry requirements and the application process please visit [www.york.ac.uk/natural-sciences](http://www.york.ac.uk/natural-sciences).

Open Days

We currently hold three Open Days every year. For the latest information visit [www.york.ac.uk/openday](http://www.york.ac.uk/openday).

If you are unable to come to one of our Open Days, you can also make an independent visit or book a campus tour. For more details visit [www.york.ac.uk/study/undergraduate/open-days/other-ways-to-visit](http://www.york.ac.uk/study/undergraduate/open-days/other-ways-to-visit).

If you would like to visit the School of Natural Sciences while on a campus tour please contact us well in advance and we will arrange for one of our staff to show you our facilities.

For general information about fees and funding visit [www.york.ac.uk/study/undergraduate/fees-funding](http://www.york.ac.uk/study/undergraduate/fees-funding).
In just over 50 years, York has powered its way to become one of the top UK universities, performing equally well on teaching and research quality measures – and is ranked in the top 100 universities in the world and a member of the prestigious Russell Group of universities.

The University is based at Heslington on the edge of the historic city of York, where our colleges are set in an attractive landscaped campus. It is compact, easy to get around, and is a safe, friendly environment in which to study and socialise. The campus also offers excellent sports facilities, including the new £9m York Sport Village with its 1km cycle track.

You'll join a strong network of peers within the School and the University's close collegiate environment, with its emphasis on support and pastoral care, means you'll make friends and settle in quickly.

As a Natural Sciences student you will benefit from the many internationally renowned scientific institutes at York which have played a key role in developing the course programme.

These include: The York-JEOL Nanocentre, home to some of the world's most powerful and sophisticated microscopes; York Neuroimaging Centre, where scientists study the inner workings of the brain; The Centre for Hyperpolarisation in Magnetic Resonance, where researchers are transforming the performance of medical scanning; and the York Plasma Institute, a facility pioneering the quest for fusion energy.

We offer you:

- a very high-quality academic experience
- a commitment to enhancing your employability
- a strong reputation for student support
- affordable and plentiful accommodation
- a lively and stimulating environment
- a beautiful location in one of Europe's finest cities.

For further information about student life on campus visit [www.york.ac.uk/study/student-life](http://www.york.ac.uk/study/student-life).
York – a superb location

Life in the city of York is varied, colourful and lively. A diverse range of shops, galleries, clubs, cafés, museums, music groups and sports clubs means that the city really does offer something for everyone.

With a population of 200,000, York is big enough to feel cosmopolitan but small enough not to be overwhelming. It is a friendly place you can settle into quickly, but which still feels fresh and exciting once you get to know it well.

York was recently voted Britain’s favourite small city in a Rough Guide poll, and its historic streets bustle with visitors from all around the world.

There is plenty to impress, from the famously soaring Gothic Minster and winding medieval streets, to a packed calendar of cultural activities including festivals, concerts and sporting events.

You’ll also be in one of Britain’s best connected cities, offering great transport links to other major cities including London, Edinburgh, Leeds and Manchester, as well as the wealth of beautiful countryside and coastline offered in Yorkshire and beyond.

For more information on student life in York, visit the website at [www.york.ac.uk/study/student-life](http://www.york.ac.uk/study/student-life).
‘If you want to be part of the solution to some of the biggest environmental problems on the planet – from climate change to feeding an ever-growing global population – then Natural Sciences is for you.’

Dr Bryce Beukers-Stewart, co-leader of the Archaeology, Biology, Chemistry and Environment programme