UNIVERSITY OF EXETER

NATURAL SCIENCES

UNDERGRADUATE SUBJECT BROCHURE 2018

KEY INFORMATION AND ENTRY REQUIREMENTS

	UCAS CODE	TYPICAL OFFER	REQUIRED SUBJECTS
BSc Single Honours Natural Sciences	CGF0	A*AA-AAB; IB: 38-34	GCE AL Maths+ grade B and another from Physics, Chemistry or Biology at grade B; IB Maths HL5 and Physics, Chemistry or Biology HL5
MSci Single Honours Natural Sciences	FGC0	A*AA-AAB; IB: 38-34	GCE AL Maths+ grade B and another from Physics, Chemistry or Biology at grade B; IB Maths HL5 and Physics, Chemistry or Biology HL5

+*candidates may offer GCE AL Maths, Pure Maths or Further Maths. Applicants achieving IB Maths SL7 plus IB HL5 in two from Physics, Chemistry or Biology will also be considered*

The full and most up-to-date information about Natural Sciences is on the undergraduate website at **www.exeter.ac.uk/ug/natural-sciences** and we strongly advise that you check this before attending an Open Day or making your application.

We make every effort to ensure that the entry requirements are as up-to-date as possible in our printed literature. However, since this is printed well in advance of the start of the admissions cycle, in some cases our entry requirements and offers will change.

International students

If you are an international student you should consult our general and subject-specific entry requirements information for A levels and the International Baccalaureate, but the University also recognises a wide range of international qualifications. You can find further information about academic and English language entry requirements at **www.exeter.ac.uk/ug/international**

For further details on our entry requirements, please see our Natural Sciences pages at **www.exeter.ac.uk/ug/natural-sciences**

STREATHAM CAMPUS, EXETER

Website: **www.exeter.ac.uk/naturalsciences**

Email: **naturalsciences@exeter.ac.uk**

Phone: **+44 (0)1392 724061**

"I like the multidisciplinary design of the programme and how it's based around Exeter's science strategy research themes, which is a great way to learn 21st century science. The broad first year allows you to develop your interests and then flexibility in future years allows you to forge your own pathway. The teaching has been excellent with lots of help in tutorial sessions and workshops."

Daniel Barlow, MSci Natural Sciences

NATURAL SCIENCES

Contribute to our understanding of critical global issues and find solutions to the challenges they present

Develop skills required to excel in multidisciplinary science careers

Study with a community of internationally respected scientists

3-year BSc and 4-year research-focused MSci

£260 million investment in science, engineering and medicine

> The significant problems we face cannot be solved at the same level of thinking we were at when we created them.
>
> Attributed to Albert Einstein

Finding solutions to the key challenges facing society, from an ageing population to climate change, requires a new scientific approach inspired by a new generation of scientists.

Increasingly, the advances being made are taking place as the barriers between traditional subjects break down. This multidisciplinary approach relies on the application of core skills and knowledge from familiar scientific disciplines and emerging areas of research. For example, chemistry and mathematical thinking are meeting engineering concepts, creating a whole new way of doing biology. These novel fields of research generate exciting insights that we can harness to tackle some of the grand challenges of the 21st Century.

Our Natural Sciences degrees give you the opportunity to advance in the more traditional subjects whilst also engaging with inspirational new areas of modern scientific innovation and research including mathematical and computational biology; biophysical, biochemical and biomedical science; and energy research.

Athena SWAN

The Athena SWAN Charter recognises and celebrates good employment practice for women working in Science, Technology, Engineering, Mathematics and Medicine (STEMM) in higher education and research. Find out more at **www.exeter.ac.uk/ug/athenaswan**

DEGREE PROGRAMMES

Single Honours

BSc and MSci Natural Sciences

- ☐ Explore the scientific concepts required to explain the natural world, from the properties of novel nano-materials such as graphene, to the richness of the living world and complex dynamic systems such as the Earth's climate
- ☐ Interact with leading researchers in student-led seminars and workshops, undertake multidisciplinary group projects and, if taking the MSci programme, have the opportunity to undertake a semester abroad at one of our world-class partner universities
- ☐ Build foundations in the fundamentals of physical, biological and mathematical sciences and gain the flexibility to specialise in areas of specific interest as the programmes progress

The innovative design of the programmes, which expose you to contemporary science, is inspired and underpinned by some of the exciting and world-leading interdisciplinary research being carried out at the University of Exeter. This includes:

- ☐ climate change and sustainable futures
- ☐ systems biology
- ☐ functional materials
- ☐ extrasolar planets

In your third year you will have the opportunity to join a research group associated with these themes to undertake a research project and contribute to cutting-edge science. For MSci students, this project will be extended into the fourth year when you have the option to spend the majority of your time conducting research, with the aim of publishing the results.

How your degree is structured

The degrees are divided into core and optional modules, which gives you the flexibility to structure your degree according to your specific interests and ambitions. Individual modules are worth 15, 30, 45 or 60 credits each and full-time undergraduates need to take 120 credits in each year. Please note that modules may be subject to change. For up-to-date details of the programmes and modules, please check **www.exeter.ac.uk/natural-sciences**

BSc Natural Sciences

Year 1 You will be introduced to the significant scientific challenges that inspire and permeate this programme. You will develop core knowledge in biology, chemistry, physics, mathematical modelling, computation and data analysis and, importantly, explore the connections between these different areas. This approach is fundamental to understanding interdisciplinary scientific issues in areas such as energy, forces and fields, matter and materials, complex dynamic systems, and living systems.

At the heart of the programme is the *Frontiers in Science* module which runs through the first and second years. This enables you to bring together concepts from different disciplines, through a mixture of laboratory sessions, research seminars, and workshops, extending your understanding of fundamental scientific ideas. You will develop key skills such as an understanding of scientific methodology and research report writing. In the seminars you will hear about current research from leading scientists with opportunities to shape your activities in line with your interests.

- Experimental Science
- Foundations in Natural Science
- Frontiers in Science I
- Mathematics and Computing: Integrative Tools for Natural Sciences

Year 2 Enhance the skills developed in the first year and deepen your knowledge across the fundamental sciences, whilst also starting to shape your individual route through the programme. You will continue to develop mathematical and computational skills that underpin modern science and shape the remaining focus of your studies in subjects spanning biosciences, mathematics, engineering, physics, psychology, geography, and sport and health sciences.

In addition to the *Frontiers in Science 1* core module, you can select six modules chosen from across the topic areas below, though students have the opportunity to undertake others outside of the programme, including a foreign language.

Optional modules are grouped into topic areas which reflect the interdisciplinary nature of much modern scientific research and which will lead naturally into the research you undertake in the third year. You will work closely with your tutor to tailor your studies to suit your developing interests.

- Frontiers in Science II

Energy, Forces and Fields

- Differential Equations
- Electromagnetism I
- Physical Chemistry
- Systems, Series and Transforms
- Thermal Physics

Matters and Materials

- Condensed Matter II
- Differential Equations
- The Physics of Living Systems
- Quantum Mechanics I
- Structure and Reactivity of Organic Compounds II
- Systems, Series and Transforms

Complex Dynamic Systems

- Biogeography and Ecosystems
- Ecology and Environment
- Numerics and Optimisation
- Observing the Universe
- Systems, Series and Transforms

Living Systems

- Advanced Cell Biology
- Analytical Techniques in Biochemistry
- Bioinorganic Chemistry
- Genomics and Introductory Bioinformatics

Year 3 Third year studies will build on your knowledge and interests and extend your high-level training in modern scientific skills. You will have a fantastic opportunity to undertake an independent research project related to one of the University's key interdisciplinary science research areas: climate change and sustainable futures, functional materials, systems biology, and extrasolar planets. Within this framework, you will determine the specifics of the research to suit your interests.

To complement your research project, you will also undertake a group project. This provides the opportunity to pursue your interests as part of a wider network of researchers. Finally, you will select three optional modules in order to build on and develop the core skills and knowledge you acquired during your second year.

Group Project

Research Project

MSci Natural Sciences

Years 1–3 See above under BSc Natural Sciences. In the third year, instead of studying the Group Project, you will have the option to spend a semester abroad plus study two optional modules in Exeter. Your time spent abroad will be assessed and you will gain credits towards your final degree whilst gaining vital experience and employability skills.

Year 4 For students enrolled on the MSci, the final year provides an opportunity to continue the individual project started in the third year, working alongside leading scientists at the University. These mentors will provide the academic supervision to hone advanced technical laboratory research skills and analytical expertise. Research projects could, for example, be an exploration of the electronic properties of graphene, simulations of extrasolar planets, an investigation of the acoustic properties of lungs or the optical properties of cyanobacteria. You will have the option to extend your project further with the aim of publishing your results in the scientific literature.

You will also select from a number of optional modules, which explore other areas of interdisciplinary science and expand your ability to think at the frontiers of the scientific disciplines. Intensive two- or three-week problem-based learning modules will allow your scientific research, analysis and debating skills to be further developed. You can also choose from a variety of optional modules that will allow you to tailor this final year to your interests.

LIVING SYSTEMS INSTITUTE

The Living Systems Institute (LSI) is a state-of-the-art building comprising over 7,500m^2 of high-quality research laboratories and unique collaborative working spaces.

It houses an array of world-class facilities and aims to bring together around 200 cell and molecular biologists, mathematicians, physicists, biomedical scientists and engineers.

The Institute facilitates novel, research-led teaching through our established undergraduate Natural Sciences programmes. Our aim is to recruit the very best students each year and to train the next generation of scientists who can readily collaborate across disciplines – from physical sciences and mathematics to cell biology and medicine – to solve future problems. For more information visit **www.exeter.ac.uk/livingsystems**

LEARNING AND TEACHING

Our degrees will place you at the heart of a research-inspired community of internationally respected scientists, who are exploring some of the most important developments of the future and whose success in research is matched by their passion for teaching. Our relationship with students is one of partnership and facilitation. Staff and student enthusiasm results in the best possible undergraduate experience.

We use a wide variety of techniques and approaches to help you learn and get the most from your degree. Our teaching methods make full use of both traditional and contemporary approaches, including lectures, tutorials, laboratory sessions, study groups, problem-based project modules and web-based learning. Study groups will be an important aspect of enabling students from different backgrounds to gain a broad scientific background.

Working through examples, solving problems and developing your mathematical and analytical skills are a vital part of being a scientist, so coursework forms a component of most modules. Modules will have a reading list that will consist of chapters from textbooks and research articles from journals.

You will benefit from excellent student-staff ratios, small group tutorials and accessible lecturers. You will be offered personal tutoring in small groups with an academic member of staff who you will see every week. You will have at least 15 hours of direct contact time with your lecturers and tutors per week in your first year and will be expected to undertake independent and self-motivated study as part of your degree. During your studies you will learn to work independently and become a scientific thinker.

Alongside your academic studies you will develop expertise in communication, team working and project management, and the ability to debate and reflect on the effects of new scientific developments on society and individuals.

Taking modules outside of your programme

Depending on your programme you may take up to 30 credits in another subject (subject to academic approval and timetabling), for instance a language or business module, to develop career-related skills or widen your intellectual horizons. If you achieve at least 60 credits in a language via our Foreign Language Centre you may be able to have the words 'with proficiency in' and the language added to your degree title. Further details about the FLC can be found at **www.exeter.ac.uk/flc**

For full details of the assessment criteria for each module, check the relevant subject areas on our website at **www.exeter.ac.uk/natural-sciences**

Study Abroad

If you study the MSci you will have the opportunity to study overseas for one semester at one of our world-class partner institutions. The semester abroad will be taken during your third year and will be assessed. Visit **www.exeter.ac.uk/natural-sciences** for further information.

"I was first drawn to study Natural Sciences due to its breadth of study. Having enjoyed all my A level subjects I simply could not choose between them and therefore Natural Sciences was the perfect choice due to its multidisciplinary nature. Natural Sciences offers not only breadth of study but also depth and I have been able to expand and develop scientific knowledge as well as appreciate the importance of an interdisciplinary approach. To gain such understanding in multiple disciplines requires hard work and is challenging however I have felt fully supported in my studies. I was drawn to this Natural Sciences course in particular due to the sense of community as a result of the relatively small number of students on the course, allowing strong relationships to form with both students and staff."

Laura Elliott, BSc Natural Sciences

CAREERS

Our Natural Sciences degree will not only provide you with a unique understanding of scientific global challenges facing our society, but will also help you to develop a wide range of key skills for employment and further study such as analytical problem solving, teamwork and organising and communicating information. Whether you choose to pursue a career in scientific research in academia or government, research and development in industry, or a career in law (particularly intellectual property), business, management, or teaching, a University of Exeter Natural Sciences degree will make you highly attractive and will open a wide range of career opportunities.

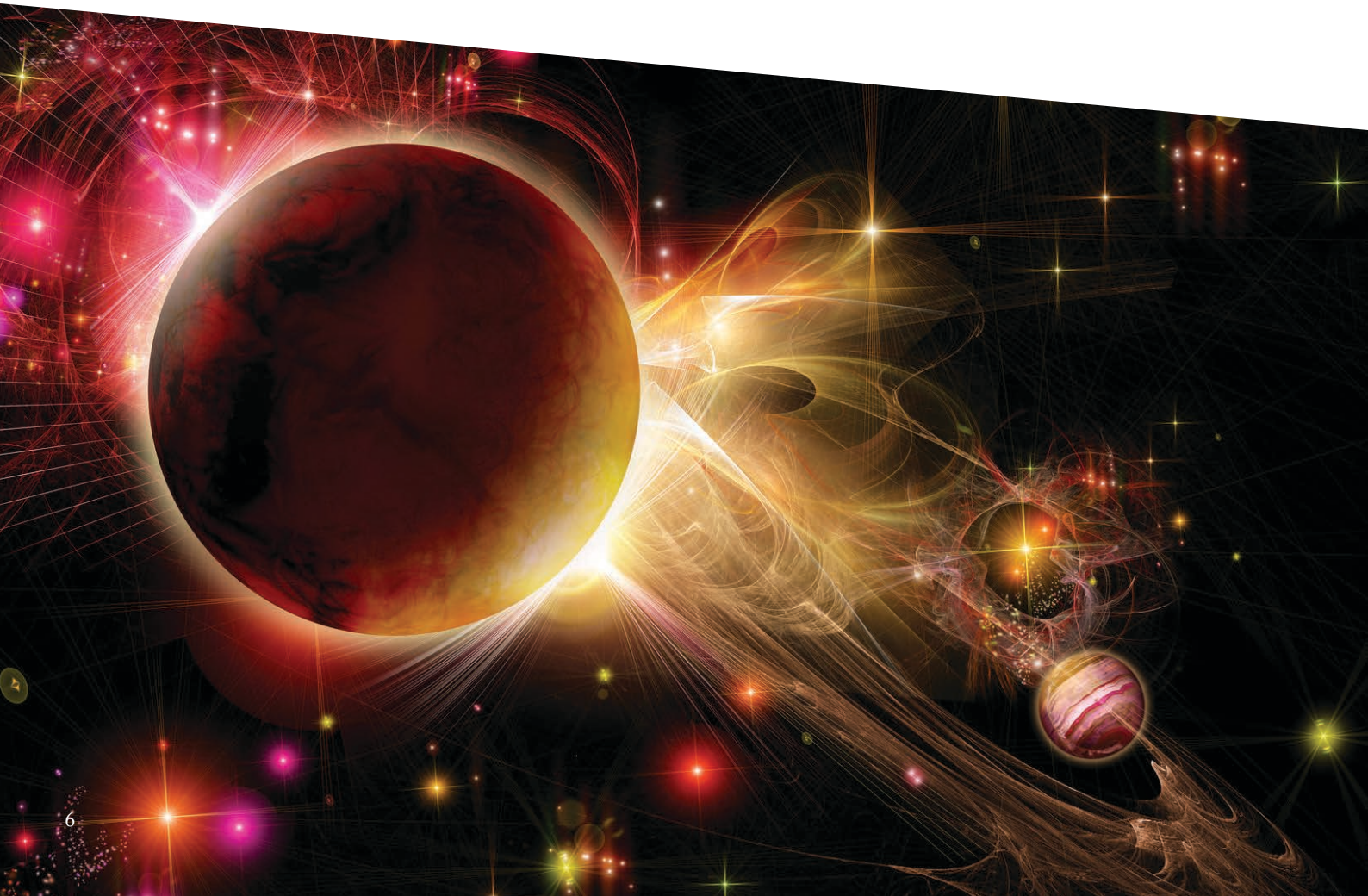
Globally, research in universities and institutions is increasingly being undertaken in truly multidisciplinary settings. As a graduate of a University of Exeter Natural Sciences programme you will have the skills and expertise to make a significant impact in such a setting and to further your academic career by pursuing doctoral training should you choose.

Alternatively, you may wish to follow a career path outside academia. Natural Sciences graduates will be ideally placed to work within organisations and government agencies that draw upon expertise across different fields. You could enrol on a graduate programme with one of these employers, or pursue integrative positions such as project management, technical leadership, or analysis.

We have an excellent reputation with graduate recruiters and our students and graduates compete very successfully in the employment market. We offer a careers advisory service on campus which provides high quality careers information and guidance to all students as well as online facilities such as a CV creator and advice on application and interview techniques.

We also offer the Exeter Award and the Exeter Leaders Award. These encourage you to participate in employability related workshops, skills events, volunteering and employment which will contribute to your career decision-making skills and success in the employment market. Whatever path you want to follow after graduating, we are here to help and support you with all your career and employability needs.

For further information about what the careers service offers at Exeter visit **www.exeter.ac.uk/ug/careers**



MODULES

Please note that availability of all modules is subject to timetabling constraints and that not all modules may be available every year. The optional modules below are just some of those open to Natural Sciences students; you may take any University science-based module providing you satisfy any necessary prerequisites and have not already taken the module or an equivalent.

For up-to-date details of all our programmes and modules, please check the undergraduate section of our website at **www.exeter.ac.uk/natural-sciences**

Year 1

Core modules:

Experimental Science	Gives a broad foundation in experimental science, through laboratory sessions in biology, chemistry and physics, which you will build upon in stage 2 and your research project in subsequent years.
Foundations in Natural Science	Develop core knowledge in biology, chemistry, and physics, whilst exploring the links between them.
Frontiers in Science I	This module is core to the Natural Sciences ethos and will include student-led activities that will allow you to explore the science issues you find fascinating.
Mathematics and Computing: Integrative Tools for Natural Sciences	Provides you with the mathematical skills needed for a range of research areas. Computing is a fundamental part of modern science and you will be given an introduction to programming, together with an overview of developments in computer science.

Year 2

Core module:

Frontiers of Science II	Practical training forms the core of this module and spans the entire academic year: you will design, build, run and analyse experiments that will require elements of computer programming, physics, biology, chemistry and mathematical modelling. Modern apparatus and techniques used across Natural Sciences will be introduced and explained in a series of Exploring Frontiers lectures. Colloquia on hot topics in science will be given by international researchers at the forefront of their fields.

Optional modules:

Advanced Cell Biology	Perform an in-depth study of a range of important cellular processes, including intracellular transport, cell polarity, cell cycle regulation and cell migration.
Analytical Techniques in Biochemistry	You will be introduced to the state-of-the-art methods used to analyse and characterise biological macromolecules.
Biogeography and Ecosystems	Provides an introduction to concepts in biogeography and ecosystem function. You will learn about the most important environmental issues affecting the biosphere, receive an overview of the techniques used to quantify, monitor, and predict changes in current ecosystem patterns, and discuss implications of these issues for the future of our planet.
Bioinorganic Chemistry	Provides a study of the processes of physical chemistry, redox reactions and bioinorganic chemistry. You then move on to study the role of metallochemistry in biology and medicine.
Condensed Matter	Develops your understanding of how electrons and other waves propagate within crystalline materials.
Differential Equations	Introduces some representative types of ordinary and partial differential equations and a number of analytical techniques used to solve them.
Ecology and Environment	Develops your understanding of some of the fundamental concepts and methods in the scientific study of ecology, biodiversity, and the environment. The module uses examples from both terrestrial and aquatic systems.
Electromagnetism I	The electromagnetic force holds atoms, molecules and materials together and plays a vital role in our understanding of almost all existing and potential technological developments.
Genomics and Introductory Bioinformatics	Focuses on state-of-the-art technology for analysis of genomes and gene expression and critically discusses their use in biological research and biotechnology. Practical classes consolidate use of internet-based genomics tools and provide a platform to critically discuss case studies.
Numerics and Optimisation	Explores the use of computers to solve mathematical problems by means of numerical approximation. The techniques discussed form the basis of the numerical simulation and computer modelling of problems in science and business.
Observing the Universe	Provides you with a basic understanding of the universe and its contents, and a good understanding of astrophysical measurement.
Physical Chemistry	Extends thermodynamics of chemical reactions to electrochemical reactions and other key processes. The statistical basis of thermodynamics is also elaborated and reaction mechanisms are expanded to encompass complex reactions. Quantum chemistry proceeds to semi-quantitative treatments of simple-harmonic motion and of the hydrogen atom.
Physics of Living Systems	Introduces the basic physical concepts and principles required to understand and study living systems. It starts at the molecular level and works up the scale of size and complexity to cover several major systems found in complex organisms.
Quantum Mechanics I	Quantum mechanics is one of the fundamental building blocks of physics. It affects profoundly the way we think about the universe and is the basis for much of condensed-matter, nuclear and statistical physics. This module introduces the basic principles of quantum mechanics and then applies these principles to atomic systems.

MODULES CONTINUED

Structure and Reactivity of Organic Compounds II	Introduces the modern spectroscopic methods (infrared, ultraviolet and nuclear magnetic resonance spectroscopies and mass spectrometry) which are used for determining the structures of organic molecules. Reactions of compounds containing carbonyl groups will be explained, with an emphasis on formation of carbon-carbon bonds, as the key to the construction of the carbon skeletons of complex, biologically active compounds.
Systems, Series and Transforms	Looks at the mathematics of modern signal processing; the interplay between signals and series. It uncovers the mathematics which underpins the miniaturised digital revolution of recent decades.
Thermal Physics	Develops the discussion of thermal properties into classical thermodynamics and shows how the laws of thermodynamics arise naturally from the statistical properties of an ensemble. Real-world examples of the key ideas are presented.

Year 3

Core modules:

Group Project	You will work together in a group of 5-8 students, supervised by an academic member of staff, to undertake a significant technical challenge that will require you to utilise all the expertise you have learned so far during your studies.
Research Project	Project work provides the opportunity to carry out research and detailed investigation into a specific area linked to the University's science strategy themes. It develops your analytical and problem-solving skills in a context where you won't be told the 'right' answer; rather you must discover and validate an answer yourself.

Year 4

Core modules:

Research Project	Based in one of our academic research groups, you will continue and develop the research project started in the third year.
Research Project Extension	For those whose research is progressing well, this module provides an opportunity to extend the research with the aim of publishing your results in scientific literature.

Optional modules

There are a range of optional modules available in Years 3 and 4. A selection of these modules can be found below:

Bioinformatics	Analysis of the large datasets obtained in biological science and medical research requires a range of skills and knowledge drawn from computer science, physical sciences and mathematics and statistics as well as biological sciences. Bioinformatics is the discipline that integrates algorithms and methods from these disciplines to model biological systems and infer patterns hidden in complex data.
Climate Change and its Impacts	This module is designed to give you an overview of climate change research. The module comprises a combination of lectures, supplemented by practical exercises (computer, data analysis, experimental lab), guest lecture(s), and written exercises. These will allow you to develop a range of skills while gaining first-hand experience running models used in climate change research.
Dynamical Systems and Chaos	Provides you with a good understanding of asymptotic behaviour of nonlinear dynamics. You will be exposed to methods for dynamical systems, including nonlinear ordinary differential equations, maps and chaos.
Energy Metabolism	This module aims to advance your knowledge of metabolic biochemistry by studying in detail the reactions in anaerobic energy metabolism, oxidative phosphorylation and photosynthesis, and appreciate how these reactions can lead to the generation of oxidative stress.
Fluid Dynamics of Oceans and Atmospheres	This module lays the foundations for an understanding of large scale weather patterns and ocean circulation. It will introduce you to the kinds of dynamics that can occur in stratified and rotating fluids, and introduce key concepts, such as conservation and balance, that are used to understand and analyse such flows.
Frontiers in Molecular Cell Biology	In this module we will explore selected topics at the forefront of cell biology and you will be introduced to a range of experimental techniques that are used to investigate how cells function.
Further Advanced Topics in Chemistry	This module explores cutting-edge interdisciplinary chemistry research, covering topics such as organic synthesis, electrochemistry, spectroscopic techniques, and materials chemistry.
Magnetic Fields and Fluid Flows	This module deals with the motion of electrically conducting fluids in the presence of magnetic fields, a subject known as magnetohydrodynamics (MHD). MHD flows play a crucial role in the dynamics of a variety of astrophysical systems, including stars, planets, accretion discs, and galaxies.
Mathematics of Climate Change	This module will provide a background in the mathematics underlying human-induced climate change. It will provide you with a good general understanding of the climate system, against which to assess the likely role of anthropogenic forcing factors. Topics of study will include observations of climate change, climate feedbacks, and geoengineering.
Mathematical Biology and Ecology	Provides an opportunity to learn how mathematics may be usefully employed in the biosciences to assess population and demographic phenomena. Students will use computer software to build and analyse models using real-world examples from nature.

Metamaterials	This module combines expertise from Physics, Chemistry, and Biology to create and engineer new materials with properties that are not found in nature.
Nuclear and High Energy Particle Physics	This module is an introduction to nuclear and particle physics delivered as a series of lectures and integrated self-study packs presenting topics as a series of keynote areas forming the foundations of the subject.
Organic Synthesis and Drug Design	In this module we show how the basic reactions covered in the first and second years can be applied to the synthesis of biologically important molecules such as pharmaceuticals. Methods for designing synthetic routes to these compounds will also be explained using case studies.
Physical Methods in Biology and Medicine	This module will discuss principles and current techniques used for the understanding of biology at the cellular and molecular levels and the particular challenges arising during their application to living systems. In addition, it will highlight some of the contributions these approaches can make to medicine and the life sciences.
Stars	The study of stellar systems encompasses a wide range of physics, including gravitation, quantum mechanics and thermodynamics. This module takes these fundamental physical concepts and uses them to derive the properties of stars.

ABOUT THE UNIVERSITY OF EXETER

Top 1% of universities worldwide *(Times Higher Education)*

9th in *The Times and The Sunday Times Good University Guide 2017*

Six months after graduation, 94% of our first degree graduates were in employment or further study *(HESA 2014/15)*

Our teaching is inspired by our research, 98% of which is of international quality *(2014 Research Excellence Framework)*

We have 21,000 students from 181 countries, and they are the most satisfied in the Russell Group *(NSS)*

VISIT US TO FIND OUT MORE

Open Days

You can register your interest now for our Open Days and receive priority access to book your place*; visit **www.exeter.ac.uk/opendays**

** Pre-registration guarantees priority access to the booking system and is not an absolute guarantee of a place at any of our Open Days. Booking is essential and is on a first-come, first-served basis.*

Exeter campuses:
Friday 2 June 2017
Saturday 3 June 2017
Thursday 2 September 2017

Campus Tours

We run campus tours at the Streatham Campus each weekday, and at St Luke's Campus on Tuesdays and Fridays, during term time. You'll be shown around by a current student, who'll give you a first-hand account of what it's like to live and study at the University.

Phone: +44 (0)1392 724043

Email: visitus@exeter.ac.uk

www.exeter.ac.uk/ug/natural-sciences

2017CAM5043