CORE MODULES: BSc (Hons) Bioscience

You must take modules worth 120 credits at each level of the course. Each module is worth a specified number of credits.

Year one for full-time students (Level 4)

Cell Biology 1 and 2 (15 credits each)

- *The Cell Biology 1 and 2 modules cover the fundamental principles which underpin the study of biology. The content is wide-ranging, introducing the history and philosophy of science, key biological theories, knowledge and techniques. Cell Biology 1 covers a range of topics including the scientific method, experimental design and ethics, basic chemistry for the biosciences, and an introduction to genetics and evolution. Cell Biology 2 focuses on broad aspects of biology such as zoology, botany and ecology, as well as biophysics, before moving onto an introduction to the concepts of the biology of disease. This modules aims to help you develop key scientific skills, such as the ability to design experiments and carry them out competently and to present and describe data effectively. Emphasis is also given to the development of good basic numeracy, IT and communication skills and to the ability to work independently and as part of a team.*

Mathematics for the Biosciences (15 credits)

- *A knowledge and understanding of mathematics is essential to being a competent scientist. "Mathematics for the Biosciences" aims to provide you with the core mathematical skills required to perform tasks in experimental design, data collection and data interpretation. By the end of this module you will be able to perform mathematical calculations and apply the skills learnt to specific biomedical science case studies. Each mathematical concept is introduced in a lecture where you will gain an understanding of the key principles. Each lecture will be followed by a tutorial session where you will be able to apply these principles to relevant biomedical situations. This will develop your understanding of and ability to use the mathematic principles as well as allowing you to visualize how they can be used in an appropriate real-life setting. The subjects covered include arithmetic and algebra, scientific notation, moles, molarity and dilutions, drawing graphs, handling data and basic statistical analyses. In addition, you will apply your skills to the scientific principles of reaction rates, equilibria and growth curves. You will learn how to carry out statistical tests using appropriate software.*

Human Anatomy and Physiology 1 (15 credits)

- *This module provides you with a solid foundation of human anatomy and physiology, with the study of the structure and function of the human body at the microscopic and macroscopic levels. We examine the fundamental principles of physiology, including the concepts of homeostasis, set points and feedback mechanisms. Histology, the study of cells and tissues, is central in our understanding how the organs and organ systems work, and is a central theme of the module. Running in parallel with 'Foundations of Cell biology', we discuss how the basic cellular building blocks are used to construct tissues, which then make up organs and organ systems. We then focus on specific organ systems, including the nervous, cardiovascular, respiratory and lymphatic and immune systems. There will also be an introduction to haematology. Understanding the basic physiology of a system allows us to understand the perturbations found in disease, and examples of the biological basis of disease are discussed where appropriate.*

Foundation in Cell Biology (15 credits)

- *Cells are the fundamental units of life. This module will introduce you to the different types of prokaryotic and eukaryotic cells, with their identifying characteristics and properties. Eukaryote cellular organelles, including the plasma membrane, nucleus, endomembrane system, lysosomes, mitochondria and chloroplasts, and the cytoskeleton, are examined, together with cellular energetics, the cell growth and division cycle, and mitosis and meiosis. A brief overview of bacterial, viral and organelle diseases is given, which provides you with an introduction to 'General Microbiology' and pathology modules in later years. Laboratory skills are developed throughout the module, as are skills in presenting data and discussing results.*

General Microbiology (15 credits)

- *Microbiology is the study of microorganisms, the taxonomic diversity of which is reflected in the huge diversity of their life styles. You will explore the structure and function of the major groups of microorganism, including bacteria, archaea, algae, fungi, protoctists and viruses. You will learn the basic concepts of microbiology and use them in the laboratory, in order to obtain a deeper understanding of the subject area, and its applicability in clinical laboratories. We will consider the diversity of microorganisms from many different perspectives including their structure, function, taxonomy and ecology, as well as introducing some of the diseases with which they are associated. The aim of this introductory module is to also teach the key practical techniques, such as oil immersion microscopy, aseptic technique, and culturing and staining of microorganisms, which you will apply in later modules such as 'Laboratory Techniques for the Biomedical Sciences'. You will gain basic knowledge that is explored further in modules such as 'Principles of Pathology' and 'Microbial Pathogenicity', examining how infectious diseases damage the human host, and the challenges faced by antimicrobial resistance.*

Human Anatomy and Physiology 2 (15 credits)

- *This module follows on from 'Human Anatomy and Physiology 1'. The focus on functional histology (which emphasises the importance of tissue design in relation to its role) continues, and additional organ systems are surveyed, many of which are regulated by or form part of the endocrine system. Additional organ systems discussed include the musculoskeletal and integumentary systems, the gastro-intestinal system, and accessory structures such as the liver, gall bladder and pancreas, and the urinary and reproductive systems. There is also brief overview of embryology and development. Where appropriate, examples of human disease, disorder and dysfunction are introduced in parallel with the descriptors of normal structure and function. These introductory topics are explored further in 'The Physiology of Organ Systems,' and are the basis of the pathology modules.*

Introduction to Biochemistry and Molecular Biology (15 credits)

- *This module builds on from topics covered in 'Foundations of Cell Biology' and provides a sound basis for understanding the processes of life at the molecular level. The structure and function of the four major classes of biological macromolecules are discussed. Key aspects of biochemistry and molecular biology are considered, including enzyme structure and function, their kinetics and modulation, together with the central pathways of metabolism (glycolysis, Krebs cycle and oxidative phosphorylation). Genetic material and its replication, and the mechanisms and control of gene expression, are also studied. Throughout the module a number of different biochemical techniques will be discussed and then applied in laboratory practicals. The module concludes by looking at the basics of genetic engineering, focusing on the use of restriction enzymes and cloning vectors. Students will also be guided through some of the basic calculations which are used daily in working laboratories. The topics introduced in this module will be explored in more depth in 'Metabolism and its Control'.*

Year two for full-time students (Level 5)

Diagnostic Techniques in Pathology (15 credits)

- *Diagnostic Techniques in Pathology is one of a series of modules that enables you to acquire the key knowledge and skills required of a biomedical scientist. This module provides you with the knowledge which underpins the roles of, and diagnostic techniques used by, the major clinical disciplines within modern pathology laboratories (Molecular Biology, Medical Microbiology, Clinical Chemistry, Cellular Pathology, and Haematology). You will learn about basic sample handling, storage and screening within the various pathology laboratories. There is a firm grounding in the legal requirements for safe working practice, ethical issues, quality assurance procedures and identifying potential risks and hazards within pathology laboratories. You will explore the concepts of reference ranges and the use, analysis and evaluation of quality control data. In addition, a range of separation techniques and the principles behind some of the major analytical methods will be described. You will gain an understanding of the application of computerisation and automation within pathology laboratories, and an awareness of how patient data can be presented in a case study. Finally you will learn the fundamental principles used in obtaining results, and how these results are communicated to stakeholders.*

Laboratory Techniques for the Biomedical Sciences (30 credits)

- *In this laboratory-based module, which runs throughout the year, you will develop your experience and understanding of the techniques that are used in the Biomedical Sciences in both clinical and research settings. You will be provided with experience in a variety of laboratory skills appropriate to the key subjects of Molecular Biology, Cellular Pathology, Clinical Chemistry, Haematology and Medical Microbiology. In addition to equipping you with the relevant laboratory skills, there will be continued engagement with good laboratory practice, and health and safety practices that are required of laboratory scientists in research and clinical laboratories. You will also be provided with further experience in the analysis of experimental data. Additionally, this module will introduce you to techniques and experimental skills that could be employed during your final year research project.*

Preparation for Research (15 credits)

- *This module is designed to introduce you to the concept of preparing to undertake an independent research project. For some, the thought of designing and writing a project proposal will be a daunting task. This module is an opportunity to customise your degree by being involved in an area of research that interests you. The module is made up of lectures, workshops and practicals designed to give you the knowledge and experience to help you write your research proposal, as well as prepare you for when you move through to the third year and start your dissertation research project.*

Principles of Genetics (15 credits)

- *The discovery of the structure of DNA by Watson and Crick, and the publication of the Human Genome, arguably represent the most significant scientific advances of the twentieth century. In the modern era, the study of genetic underpins all of biology. Following on from concepts introduced in 'Core Biology', and running parallel with the molecular mechanisms of DNA discussed in 'Metabolism and its Control', Principles of Genetics provides an integration of concepts at the organismal, cellular, chromosomal, protein and DNA levels. Genetics offers a biologically-based explanation for morphological, physiological, and even behavioural traits in an organism, and also gives us a mechanism for the generation and maintenance of variation and the raw material for evolution. Modern genetics and genetic engineering offers hope for the cure of many diseases, topics which will be expanded upon in 'Medical Genetics'.*

Principles of Pathology (15 credits)

- *In this module you will learn how disease starts, how it spreads, and how the body responds. You will consider the biology of disease from the molecular level to the whole organism, especially the causes of cellular injury and how this leads to a failure of cellular and organ function. After the course you will be able to identify and classify particular diseases with respect to their origin and spread, disease mechanisms, complications and sequelae and prognosis and evaluate external and internal factors in disease (e.g. genetic, environmental factors and infective agents). You will also be able to discuss responses to disease including acute and chronic inflammation and the immune response, and their contribution to the pathology.*

Work Based Learning (30 credits)

- *Students will be encouraged to explore of their professional/occupational practice, along the strands developed in previous modules, as a source of learning. In this module students will be expected to demonstrate a significant degree of autonomy in the management of their learning, will demonstrate a detailed knowledge of relevant theoretical underpinning and be able to analyse and evaluate both information and argument. Students will be required to demonstrate the application of theory to practice. Students will be in a work environment for a substantial part of this module. During this work placement students will be required to keep a diary which will assist in the production of an action plan which will reflect upon their work practice. Students will agree a topic with module tutor and produce a report on this. The topic must be related to their work practice. Demonstration of an ability to work within a team will be an important aspect of the placement and report. Students will be required to log at least 45 hours of work practice. This must be IT related and may be at the student's existing place of employment. Students who are unable to find a suitable work placement will be found an appropriate placement.*

Final year for full-time students (Level 6)

Undergraduate Major Project (30 credits)

- *You'll create in a substantial piece of individual research and/or product development work, focused on a topic of your choice in life science. You could chose your topic from a variety of sources including research groups, previous/current work experience, your current employer, a suggestion from your tutor or a topic you're specifically interested in. You'll identify problems and issues, conduct literature reviews, evaluate information, investigate and adopt suitable development methodologies, determine solutions, process data, critically appraise and present your finding using a variety of media. Regular meetings with your project supervisor will ensure your project is closely monitored and steered in the right direction.*

Molecular Cell Biology (15 credits)

- *Cambridge is regarded as the 'home' of molecular cell biology, and is the hub of the UK biotechnology industry. This module will extend your knowledge and understanding of cell structure, function and disease at the molecular level, with particular emphasis on the evaluation and discussion of the experimental evidence that has contributed to current concepts, models and treatments. Processes such as signal transduction, protein sorting, protein targeting, phagocytosis and receptor-mediated endocytosis are discussed as part of your overall consideration of the relationship between molecular structure and biological function in cells and their substructures. Viral infection of eukaryotic cells will also be given detailed consideration, as will the role of viruses in oncogenesis and other factors that contribute to the molecular basis of cancer. Case studies are used to extend your ability to critically analyse data derived from the increasingly sophisticated techniques used to study biology at the molecular and cellular level. This module is recommended for those undertaking their research project in allied subjects.*

Special Topics in Bioscience (15 credits)

- *Identify and develop a detailed knowledge and understanding of topics at the forefront of the study of biosciences. Over the 12 week semester you'll choose a series of topics for discussion and debate, both within the classroom setting and online, and you'll promote awareness and understanding of the current strengths and weaknesses of current theory and research focus. You'll also consider the ethics of science, its public understanding and how advances in science can be effectively communicated to the wider public audience. You'll continually focus on improving your research and discussion skills with many of your exchange of ideas taking place using the Visual Learning Environment (VLE).*

Special Topics in Cell and Molecular Biology (15 credits)

- *Identify and develop detailed knowledge and understanding of topics at the forefront of the study of Cell and Molecular Biology. Over the 12 week semester you'll choose a series of topics for discussion and debate, both within the classroom setting and online. You'll work to promote awareness and understanding of the strengths and weaknesses of current theory and research focus as well as considering the ethics of science, its public understanding and how advances in science can be effectively communicated to the wider public audience. You'll improve your research and discussion skills with many of the exchange of ideas will take place using the Virtual Learning Environment (VLE).*

Medical Genetics (15 credits)

- *Our increased understanding of genetics has had a profound impact on human affairs. Much of our food and clothing and increasingly, therapeutic agents, come from genetically improved organisms. An increasing proportion of human illnesses have been shown to have a genetic component. Genetic knowledge and research have provoked new insights into the way we see ourselves, particularly in relation to the rest of the biological world. Building from the concepts introduced in 'Core Biology', 'Principles of Genetics' and 'Metabolism and its Control', you will focus on the enormous input genetics has had into our understanding of, and developing treatments for, human disease. Topics such as epigenetic and chromosomal changes, genetics of inborn errors of metabolism, pharmacogenetics and the advent of personalised medicine, developmental genetics, and genetics of cancer are discussed, among others. There will also be an opportunity for you to put your views forward with regards to the ethical dilemmas presented by our greater understanding of and ability to manipulate the genome.*

Current Advances in Biomedical Science (15 credits)

- *This module fosters your knowledge of up-to-date research from the biomedical and bio-molecular fields in preparation for your career after graduation. Enhancement of employability is a key feature. The module is delivered by professionals who will speak about their own careers and specialist interests, and draw on areas that you have studied over your three years at Anglia Ruskin University. The module includes three conference days. The first conference day will focus on increasing your employability, the second concentrates on postgraduate studentships, while the third (scientific) conference day will enable you to evaluate critically data presented by eminent guest researchers, and present a group poster that will be assessed by a panel of two scientists. In addition, you will attend a series of lectures and a "journal club" focused on advanced bio-molecular techniques used in academic research and the biotechnology / pharmaceutical industries. Self-directed learning is encouraged, with focus on reading presentations provided by the speakers and current journal articles rather than using standard texts.*

Microbial Pathogenicity (15 credits)

- *This module looks at the breadth of microbial pathogenicity. As such it considers, bacterial, fungal and viral diseases of humans and animals. You will explore the deeper concepts of virulence, the molecular genetics and regulation of virulence whilst also considering the key issues relating to global epidemiology of new and emerging infections. In addition, we will study the complexity of the host-parasite relationship from both sides and critically appraise the broad range of pathogenic mechanisms exhibited by selected microorganisms through case studies and critical review of journal articles. Practical sessions underpin lecture and seminar content, to enable a thorough ability to understand topics in a theoretical and practical sense. Attention is also given to the challenges faced with selection and management of appropriate treatment strategies, including mechanisms of antibiosis and the various causes and effects of treatment failure. You will thus be able to interpret and contextualise microbial pathogenicity by demonstrating a comprehensive understanding of the subject and the challenges faced to public health.*