Anglia Ruskin University

Course Information Sheet

BSc (Hons) Biomedical Science

Mode and course length – Full-Time (4 years)

Location – ARU Cambridge Campus

Awarding Body – Anglia Ruskin University. As a registered Higher Education provider Anglia Ruskin University is regulated by the Office for Students.

Overview

Our Biomedical Science degree will give you an intellectually stimulating education in the fast-moving field of the science that underpins modern medicine. Learn about the human body at the molecular, cellular, organ and systems levels in health and disease.

You'll be taught by highly-qualified lecturers who carry out their own research in areas including cancer, diabetes, antibiotic resistance and haemostasis, among others. Our teaching is therefore research-led by our lecturers who are passionate about their subjects.

On this degree you'll learn key biological concepts that are fundamental to understanding, investigating and treating human disease. You'll begin by studying general biology, human anatomy and physiology, microbiology and cellular and molecular biology, which will give you a solid foundation of knowledge on which to build. You'll go on to develop an understanding of the diagnostic techniques used in modern professional practice and learn about the biomedical disciplines, which include haematology and transfusion science, clinical biochemistry, cellular pathology, medical genetics, medical microbiology and clinical immunology. In your final year you'll integrate and deepen your knowledge as you learn about human pathology and current advances in biomedical research, as you become an independent learner. Also in your final year, with individual support from a supervisor, you will have the opportunity to carry out a research project of your own which may be laboratory- or literature-based research.

As a student you'll learn in lots of different ways, including in lectures, small groups and laboratory sessions. In lectures you'll be taught key concepts and the latest research findings; in small groups you'll work on case studies and scientific problems to develop analytical skills. In the lab you'll get plenty of opportunities to gain hands-on practical lab skills. You'll also be developing your teamwork skills by working in small groups. We are always developing innovative and interactive ways to teach. Our lecturers and other support staff are enthusiastic and knowledgeable and work hard to create a supportive learning community for all our students.

The state-of-the art facilities in our new Science Centre include specialist tissue culture and microbiology laboratories, as well as general teaching and research labs. We have a wide range of specialist laboratory equipment which you will use in practicals and your projects. We maintain strong links to a number of hospitals within the NHS, and related industries within the East of England. You have the option of a placement year between your second and third year.

Biomedical Science is a multidisciplinary subject and you'll develop a broad range of transferable skills, which are valued highly by graduate employers. These include written and oral presentation skills, numeracy and IT skills, intellectual, critical and analytical skills, as well as experimental and practical laboratory skills. During the degree you will have a number of tutorials about employability aimed at helping you to understand and succeed in the graduate job market. Towards the end of your degree we invite external speakers to come and talk to you about the range of career options open to you.

Course Delivery

Our courses are delivered through teaching and learning methods which provide students with the widest possible exposure to a modern and innovative higher education experience.

These methods vary and could include attendance at lectures and seminars, undertaking laboratory exercises or work-based activities, practical work, performances, presentations, field trips, other relevant visits and e-learning through Canvas, our online learning management system.

Each course is divided into a number of 'modules' which focus on particular areas, each of which has a specific approach to its delivery. This information is published to students for each module they take via the Module Definition Form (MDF) and Canvas.

Assessment

We use a number of ways to track your learning, and to make sure you're developing the knowledge and skills you need. These include essays, exams and practical analysis.

Fees

Information about your course fee including any annual fee increases or deposits (if required) can be found in your offer letter.

Additional Costs

Poster printing - £20

Cost of printing dissertation/individual project

Modules

Core Modules

Year 1: Foundation in Optometry, Medical and Life Sciences

This module will provide students with the necessary skills to begin studying at level 4 in courses related to Optometry, Medical Science and Life Sciences.

Students will be introduced to the core skills necessary to succeed in higher education, including thinking critically, researching and referencing appropriately, demonstrating appropriate numeracy and ICT skills, and communicating effectively verbally and in writing.

In addition to these fundamental study skills, Students will be given an introduction to the various scientific disciplines underpinning the life sciences. Fundamental mathematical skills will be covered in order to support students' other subjects and give them confidence in manipulating data.

Students will be introduced to molecular and cellular biology, and how these fields are applied to real-world investigations. Students will also study the biology of micro and macro organisms, with reference to both human and animal structures.

Students will be introduced to the core concepts of chemistry, with a particular focus on organic chemistry, and will also be given a grounding in the core principles of physics, applied to living organisms.

The module is made up of the following 8 constituent elements:

- Interactive Learning Skills and Communication (ILSC)
- Information Communication Technology (ICT)
- Critical Thinking
- Maths for Scientists
- Cellular Biology
- Biology – Physiology
- Chemistry
- Physics for Life Sciences

Year 2: Mathematics for the Biosciences

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.

Year 2: Human Anatomy and Physiology 1

This module introduces the students to functional anatomy and physiology in man. A knowledge base and appropriate terminology to study human anatomy and physiology at a macroscopic, microscopic and biochemical level is provided. Throughout the module, the concepts of homeostasis, set points and feedback mechanisms is discussed, the perturbations of which underlie dysfunction and disease. A brief overview of cell biology (covered in more detail in Foundations of Cell Biology) is followed by an introduction to histology, which emphasises the importance of tissue design in relation to its role. The anatomy and physiology of the following organs and systems are then discussed in detail: the brain, nervous system and the special senses, the heart and cardiovascular physiology, the respiratory system and the lymphatic and immune systems. There will also be an introduction to haematology. The module has a large component of practical work, which reinforces the concepts discussed in the lectures. Both anatomy- and physiology-based practicals are carried out, which develop practical skills in class. The module introduces concepts that have a strong medical bias, focussing on the maintenance of health and complements the trimester 2 module, 'Human Anatomy and Physiology 2'.

Year 2: Foundations of Cell Biology

Foundations of Cell Biology is designed to provide an introduction to the cellular basis of life, focusing on their nature and roles of different cell types, including animal, plant and microbial cells. The module provides students with a basic understanding of biological organisation and biochemical processes at the cellular level. As such Foundations of Cell Biology is a core module for students taking the Biomedical Science and Bioscience degree courses. The module introduces and examines the different types of prokaryotic and eukaryotic cells, their identifying characteristics properties and key structural differences. The role of viruses as cellular parasites is also considered. It also explores the basics of cell structure and function, focusing on cell membranes and organelles, cellular energetics, the cell growth and division cycle, paying particular attention to mitosis and meiosis. Understanding cell structure and function also requires a basic knowledge of the nature, roles and chemical structures of key biomolecules, namely carbohydrates, lipids, nucleic acids and proteins. As well as providing subject specific knowledge, relevant to biomedical sciences, this module helps develop a number of transferable skills including practical (laboratory) techniques and skills relevant to employment including literacy and numerical skills. Standard texts are available via the library and online companion website.

Year 2: Core Biology 1

The 'Core Biology 1' and 'Core Biology 2' modules cover the fundamental principles that underpin the study of biology. The content is wide-ranging, introducing the history and philosophy of science as well as key biological theories, knowledge and techniques. 'Core 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 and biodiversity. Students will also be inducted into the correct methods of working in a laboratory, including use of risk assessments and health and safety best practice.

The module delivery is closely integrated with the personal tutorial sessions, which students have with their personal tutor. Students will thus develop key scientific skills, such as the ability to: write scientifically; find, use and critically evaluate sources of information; and apply correct referencing guidelines with avoidance of plagiarism. Students will also be introduced to the concepts of scientific integrity and intellectual property. Emphasis is also placed on the application of good basic numeracy, IT and communication skills, and the ability to work independently and as part of a team. In addition, students will be encouraged to develop their personal development portfolio, with embedded reflective practice.

Year 2: Human Anatomy and Physiology 2

This module goes hand-in-hand with Human Anatomy and Physiology 1 in providing a systematic introduction to functional anatomy and physiology in man. The module offers a thorough factual and conceptual knowledge base for the study of

physiology at the macroscopic, microscopic and biochemical levels. The focus on functional histology (which emphasises the importance of tissue structure in relation to its role) complements the trimester 1 module Human Anatomy and Physiology 1 as additional organ systems are discussed. These organ systems include: the musculoskeletal system, the endocrine system, the urinary system and fluid and electrolyte balance, the integumentary system, the digestive system including the liver and biliary system, the endocrine and exocrine pancreas, and the reproductive system. Where appropriate, examples of human disease, disorder and dysfunction are introduced in parallel with the descriptors of normal structure and function. A foundation in developmental biology is also provided in this module, introducing the student to key concepts in embryology including fertilization, proliferation, differentiation, gastrulation, implantation, organogenesis and placentation. Human Anatomy and Physiology 2 also provides an arena for the introduction of some basic techniques and associated instrumentation used in laboratory diagnosis and the general practice of biomedical science. The module has a large component of practical work, which reinforces the concepts discussed in the lectures. Both anatomy and physiology-based practicals are carried out, which develop practical skills in class. The knowledge of homeostasis (and failures thereof) gained in this module underpins higher level modules;The Physiology of Organ Systems and Principles of Pathology at level 5, and Human Pathology at level 6.

Year 2: General Microbiology

Microbiology is the study of microorganisms - organisms that are too small to be seen without magnification. The taxonomic diversity of microorganisms is reflected in the huge diversity of their lifestyles. In this module you will explore the major groups of microorganism: bacteria, fungi and viruses. In so doing, you will learn the basic concepts of microbiology and apply them to a scientific understanding of the subject area. You will consider the diversity of microorganisms from many different perspectives including their cell structure, function, taxonomy and ecology.

Microorganisms have a long history of association - mostly negative - with humans, and the importance of microorganisms as human pathogens is explored, as are their actual and potential uses.The increasingly important issue of antimicrobial resistance will also be studied. Throughout this module you will be introduced to the latest advances in microbiology, whilst also learning a sound basic understanding. Furthermore, through a series of laboratory-based classes, you will be given training in handling microorganisms and the use of aseptic technique as the basis for preparing cultures. You will also acquire the fundamental practical skills required by a microbiologists and biomedical scientists, including performing a Gram stain, viable counts, subculturing techniques and maintaining safe and efficient working practices. The laboratory sessions are held within a well-equipped microbiology suite. The range of laboratory techniques experienced in this module coupled with the broad theoretical basis will be useful for a range of laboratory-based careers, particularly in the biomedical sciences

Year 2: Introduction to Biochemistry and Molecular Biology

This module works hand in hand with the 'Foundations of Cell Biology' module and to provide a sound knowledge of the processes of life at the molecular level. As such it is a core module for the Biomedical, Bioscience and Bioinformatics degree courses. The module focuses on consideration of all key aspects of biochemistry and molecular biology: structural and functional biochemistry, enzyme action, kinetics and inhibition, nature and role of antibiotics, metabolism, biochemical techniques, genetic material, the mechanism and control of gene expression and recombinant DNA technology. Consideration is given to the genetic and molecular bases of disease via study of a number of heritable conditions. There is a substantial practical element in the module as well as data-handling and problem-solving exercises. As well as providing subject specific knowledge, this module helps develop a number of transferable skills including practical techniques and skills relevant to employment including familiarity with laboratory instrumentation, data collection, literacy, numeracy and data analysis. Standard texts are available via the library and via an online companion website.

Year 2: Core Biology 2

The ‘Core Biology 1’ and ‘Core Biology 2’ modules cover the fundamental principles that underpin the study of biology. The content is wide-ranging and addresses broader biological concepts such as zoology, botany, ecology and biodiversity. Development of multicellular organisms, and the influence of development on evolution are discussed, as well as scaling laws and their influence on structure and function of organs and organisms. The fundamental laws of physics that underpin the function of biological systems are also discussed.

The module then shifts focus to the history of medicine and an introduction to the biology of disease. Tools to help us diagnose and treat disease, including an introduction to the biomedical science disciplines, aspects of pharmacology - in particular the importance of plant-derived chemicals - and technologies incorporating medical physics, are discussed. The causes of disease

are varied, and we touch on a number of these, including diet, aging, neurological pathology, infectious organisms, vector-borne disease and toxicological considerations, in preparation for the pathology modules at Levels 5 and 6. Epidemiology of disease is discussed within these topics. Incorporated into the module is a visit to the Botanic gardens, with a tour of the history of plants in medicine.

The module aims to help students develop key scientific skills, such as the ability to design experiments and carry them out competently, identify and solve problems 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. Development of students' personal development portfolios is embedded in the module.

Year 2: Personal and Professional Development – Level 4

At Anglia Ruskin University we strive to ensure that students receive an outstanding academic education and student experience and understand that, whilst embedding employability skills within the credit-bearing curriculum is important, it is only part of the set of achievements needed in order to obtain career employment.

This 0-credit module will be used to track and verify the progress students have made with respect to key employability skills and endeavour. Students will work closely with their personal tutor, SU Volunteering Service, Study Skills Plus, and the Faculty Employability Advisor to engage with co-curricular and extracurricular opportunities and activities to enhance their personal attributes.

Year 3: Diagnostic Techniques in Pathology

'Diagnostic Techniques in Pathology' introduces the Biomedical Science diagnostic disciplines of medical microbiology, clinical chemistry, cellular pathology, haematology, transfusion science and immunology. The module will include the day-to-day workings of an NHS pathology department as well as the scientific background of the diagnostic procedures performed.

Students will be able to describe and discuss 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 and quality assurance procedures; students will study legislation governing these, which will enable them to identify potential risks and hazards within pathology laboratories.

The concepts of reference ranges and the use, analysis and evaluation of quality control data will be explored, as will a range of separation techniques and the principles behind some of the major analytical methods.

This will include developing an understanding of automated systems and laboratory information management systems (LIMS).

Finally students will learn the fundamental principles used in obtaining results and how results are communicated to service users. Teaching is delivered by appropriately qualified academic / biomedical scientists.

Year 3: Metabolism and its Control

Building on the knowledge gained at level 4, you will further examine a range of metabolic pathways with a view to gaining a detailed understanding of the overall strategy of metabolism and the internal logic of key metabolic pathways. The effects of drugs and inhibitors and the role of allosteric enzymes in the feedback control of metabolism will be also be discussed. Attention is also paid to the organisation of the genome and how genetic material is transcribed and translated. This leads to an understanding of the significance of inborn errors of metabolism and the effects of therapeutic drugs on individual reactions of metabolism. Finally, there is a more detailed examination of cellular specialisation and the structure and biological functions of the major cellular organelles, plus intracellular trafficking and hormonal signalling. As well as providing you with detailed subject specific knowledge, this module helps develop a number of transferable skills including practical (laboratory) techniques and skills relevant to general employment including report writing, data collection, handling and presentation.

Year 3: Principles of Genetics

Genetics is the study of the structure, function and inheritance of genes and is fundamental to the understanding of life; genetics unifies the biological sciences. The study of genes offers a biologically-based explanation for morphological, physiological, and behavioural traits of an organism. It also provides a mechanism for the generation and maintenance of variation; the raw material for evolution. The module starts with a consideration of the classical patterns of inheritance, building on concepts covered in the level 4 module Core Biology 1. This module aims to develop an understanding of the relationship between genotype and

phenotype through an integration of concepts at the organismal, cellular and molecular levels. Gross structural chromosome mutations and the phenotypic consequences of these mutations are investigated. Classical and modern techniques for establishing the physical locations of genes are considered, as well as insights into gene function and genetic diseases. The module goes on to look at how traits may be determined by many genes and also how genes may interact with environmental factors. Genetic variation found in populations is examined together with the mathematical methods used for such analysis. The regulation of gene expression in bacteria and development genetics is also covered. Finally the module considers the genetics of cancer and the study of epigenetics. Modern tools of genetic analysis are incorporated throughout the module as well as through a case-study. An understanding of genetic processes is developed through a variety of problems, case studies and simple breeding experiments. As well as gaining specific subject knowledge, this module helps develop a number of transferable skills including practical laboratory techniques and skills relevant to general employment including data collection, handling and presentation and report writing.

Year 3: Principles of Pathology

This 15 credit module builds on the principles introduced in Human Anatomy and Physiology 1 and 2, Foundations of Cell Biology, Core Biology 2 and covered in Diagnostic Techniques in Pathology. As such, it is the second module in the series that develops student knowledge and understanding of the main pathology disciplines. The module is also intended to provide a detailed knowledge of the processes of general pathology for the Level 6 module Human Pathology. By developing the concept of the biology of disease from the molecular level to the whole organism, it allows consideration of the causes of cellular injury and further develops how these lead to a failure of cellular homeostasis and function. In this context, students will also be expected to be able to identify and/ or classify particular diseases with respect to their aetiology, pathogenesis, complications and sequelae and prognosis. Other concepts which are considered comprehensively include acute and chronic inflammation, the immune response to disease, and aetiological agents of disease (e.g., genetic, environmental factors and infective agents.) With respect to the latter, emphasis will be placed on understanding the structure, classification, biochemistry and control of significant pathogenic agents. The basic principles of the biology of disease also provide an unifying theme to the module, which is developed through further consideration of genomics and the implications of age, gender, ethnic origin and epidemiology. Key to understanding disease diagnosis and progression is a comprehension of the range of diagnostic techniques currently used in pathology laboratories. Students are required to demonstrate specific knowledge and understanding of these techniques by deciphering case studies . As a corollary, modern-day ethical considerations of biomedical research, and disease diagnosis and treatment are also discussed. Resources include current textbooks (see below), web-based information and image files as well as lecturer-prepared visual aids to assist conceptual understanding. As well as providing students with subject specific knowledge, this module helps develop a number of transferable skills including an appreciation of the basis of laboratory techniques and skills relevant to employment including group management and problem-solving, literacy and numerical skills.

Year 3: The Physiology of Organ Systems

This module builds upon the level 4 Human Anatomy and Physiology modules and develops a detailed knowledge of major theories of physiological principles, extending and broadening the skill base, whilst fostering increasing autonomy. Centred around the concepts of homeostasis and the biology of disease, the module starts with an introduction to the role of drugs and drug action, and their role in physiology and pathophysiology. The module then examines circulatory function in detail, looking at normal functioning and control of the heart and circulatory system, and differential supply of blood to the tissues. Respiration and its control are examined, in relation to gas exchange in the lungs and the tissues. The response of the body to physiological perturbations including altitude, diving, exercise and pregnancy are discussed. Additional aspects covered include a detailed discussion of the brain and neurotransmitters, liver metabolism, and relationships between diet and risk of disease. There is a detailed examination of blood as a tissue, closely surveying both the cellular and plasma fractions, and the physiological responses to haemorrhage. Students receive an overview of normal integrated physiological processes which is then contrasted with changes resulting from disease conditions, thus preparing them for more detailed analysis of systemic disease at level 6. Case studies are investigated and discussed for each topic. The students participate in practical sessions, with collection of physiological data using themselves as subjects.

Year 3: Laboratory Techniques for the Biomedical Sciences

This module is designed to develop the students' experience and understanding of techniques that are used in the Biomedical Sciences in both clinical and research settings.

Students will be provided with experience in a variety of laboratory skills appropriate to the key subjects of Molecular Biology,

Cellular Pathology, Haematology and Medical Microbiology. In addition to equipping students with requisite laboratory and mathematical skills, there will be continued engagement with good laboratory practice, and health and safety practices that are required of biomedical scientists in research and clinical laboratories. Students will also be provided with further experience in the analysis of experimental data. Additionally, this module will introduce students to techniques and experimental skills that could be employed during the final year research project. The majority of the teaching will be through practical classes where students will gain hands on experience of the techniques taught. Lectures will be used to provide further theoretical background to the techniques used and the processes required for the analysis, interpretation and presentation of results. Lectures and feedback sessions will take place during practical classes where appropriate. Teaching will be predominantly delivered by ARU lecturers but where appropriate, lecturers from outside ARU will be employed to provide expert tuition, professional support and assistance. These will include biomedical and research scientists.

Year 3: Preparation for Research

This is a level 5 (second year) module designed to prepare the student for their Level 6 research project; the Level 6 project can be based around practical laboratory research, meta-analysis of a literature topic or a bioinformatics approach.

This module will introduce the concept of independent, student-directed research, giving them the opportunity to design and propose a research project under the guidance of a supervisor. During the process, each student will be assigned a supervisor to help and guide them through the process, from the initial concept to the final research proposal.

The module will deliver a range of lectures, workshops and practical work designed to introduce information, skills and requirements necessary for preparing a successful research proposal. These include defining and developing a conceptual framework under supervision, finding and reviewing relevant literature, identifying and understanding appropriate materials and methods for analyses, understanding the potential outcomes and impact of the research, ethical considerations, and health and safety considerations. The module will contain a theoretical assessment designed to test the student's ability to undertake essential research techniques. In addition, the student will attend small group / individual sessions with their assigned supervisor to give research- and project-specific guidance.

Year 3: Personal and Professional Development – Level 5

At Anglia Ruskin University we strive to ensure that students receive an outstanding academic education and student experience and understand that, whilst embedding employability skills within the credit-bearing curriculum is important, it is only part of the set of achievements needed in order to obtain career employment.

This 0-credit module will be used to track and verify the progress students have made with respect to key employability skills and endeavour. Students will work closely with their personal tutor, SU Volunteering Service, Study Skills Plus, and the Faculty Employability Advisor to engage with co-curricular and extracurricular opportunities and activities to enhance their personal attributes.

Year 4: Human Pathology

This module is designed to develop a systematic and critical knowledge of clinical human pathology at a molecular, cellular, tissue, and whole patient level. This module builds on the key material introduced in Principles of Pathology at level 5 and provides the student with a detailed understanding of the pathological processes at the biochemical, (immuno) histological and morbid anatomical levels. A wide survey of these processes, as they are found in diseases of the main organ systems follows, with an emphasis on clinically important areas. Case study analysis develops critical evaluation of evidence to support synthesis of conclusions/recommendations and investigation of contradictory information. This development of earlier knowledge and understanding, collectively reinforces the student's understanding of the relevance of the pathological processes that underpin clinical manifestations of the biology of disease. The core lecture material therefore focuses on individual organ systems; each week considering the aetiology, and pathogenesis of, for example, the (cardio) and (cerebro) vascular system, the lung, liver, oral/GI tract, kidney and breast. The pathology of tumourogenesis is studied in detail, in addition to material on tumour pathology described in individual tissues. The module also reviews current clinical techniques used in disease diagnosis (pap smears, FISH, Western blot analysis, immunoassay, PCR, microarrays, etc.). Assessments are designed to encourage critical analysis and include a written essay assignment using individually researched materials. By establishing a thorough understanding of pathologies of the major organ systems, this module prepares the student for biomedical orientated careers. It also helps develop a number of transferable skills, relevant to general employment.

Year 4: Specialist Topics in Biomedical Science

Specialist Topics in Biomedical Science aims to develop the understanding of the more advanced disciplines of pathology. This will build upon the knowledge of routine diagnostic pathology disciplines gained in the diagnostic techniques in pathology module. This module is designed to impart a systematic knowledge of the theory, skills and techniques required of a graduate biomedical scientist.

Upon completion of this module, students will be able to critically evaluate laboratory techniques used in specialist disciplines including reproduction and fertility, paediatrics and neonatology, neurology, gerontology, drug monitoring and forensic pathology. The module will also consider the theoretical and practical aspects of pathology through the application of knowledge and practical skills in each discipline. On top of a sound understanding of the scientific principles, the students will gain an appreciation of the governance and legislations involved.

Teaching will be delivered through lectures as well as group practical case work, where students will perform the role of the pathologist and biomedical scientist and collate, interpret and critically evaluate information relating to a specific case study. Students will be supported through seminars and regular formative feedback sessions. Students will be allocated groups and are expected to engage regularly with their peers and module tutor through attendance at every teaching session and also via the LMS discussion boards, tutorial work and directed self-learning.

Year 4: Undergraduate Project

You are required to undertake a final year research project, as a key component of your degree, focused on a topic relevant to your degree field. Your project may be based on current Anglia Ruskin University research interests, something of interest to you or, if suitable work-place supervision is available, related to the research of your previous, or current, employer. Your project must show evidence of appropriate academic challenge, technical expertise, and progress. You will be required to identify and formulate problems and issues, conduct a literature review, evaluate information, investigate and adopt suitable research methods, and use appropriate methods for data collection, analysis and processing. You will demonstrate that you have fulfilled these criteria via regular meetings with your project supervisor where you will show evidence of project development via discussion and the presentation of spoken, written and other appropriate evidence.

Year 4: Medical Genetics

Genetics has had a profound impact upon human affairs, particularly in the sphere of medicine; an increasing proportion of human illnesses have been shown to have a genetic component. Genetic knowledge and research have provoked new insights in both medical science and ethical debate. This module focuses on the enormous input genetics has had into understanding, and developing treatments for, human disease. Through the study of a wide range of inherited conditions, students will learn to recognise whether single or multiple genes, or major chromosomal changes, are responsible for a particular aberration, and how an underlying genetic change relates to the clinical manifestation of the disease in question. Among other topics, disorders of metabolism, epigenetics and related disorders, developmental genetics and related disorders, and haemoglobinopathies and thalassemias, will be covered. The current state of genomics research will be considered, along with possible future developments. This naturally leads to a discussion of topics such as genetic testing, gene therapy, and pharmacogenetics, which we consider both from the molecular genetics viewpoint and in light of the ethical, social and psychological issues raised by such procedures and developments. As well as providing students with subject specific knowledge, this module helps develop a number of transferable skills including practical (laboratory) techniques and skills relevant to both biomedical and applied sciences and general employment - including report writing, critical thinking, data collection and handling, and presentation. The examination of case studies is an integral part of this module.

Year 4: Clinical Immunology

This module is designed to develop a comprehensive and detailed knowledge of clinical immunology at a molecular, cellular, tissue, and whole patient level. By establishing a thorough understanding of the normal and pathological operation of the immune system, this module will prepare the student for a consideration of the role and significance of immunity to infection, and the positive and negative roles of inflammation in health and in disease. Lecture material progresses from: the origins, development and properties of lymphoid cells through antibody structure and function; antigen-presenting cells and lymphocyte activation; humoral and cell-mediated immunity; innate and aquired immunity to pathogens; autoimmunity; hypersensitivity; immunodeficiency and immunisation; through to transplantation immunology, and vaccine design. Topics receiving in-depth coverage focus on the mechanisms that underpin immunological dysregulation in numerous clinically relevant disease states. In

order to synthesise appropriate levels of diagnosis and treatment strategies, students are asked to critically evaluate clinical data and are expected to engage in problem solving via analysis of clinical case studies of immunological disease. Where appropriate lecture material also includes detailed descriptions of immunological techniques, and the application of these techniques in the diagnosis and treatment that underpin ethical patient care. Information management skills will be developed through an autonomously written, researched essay assignment, which is expected to reflect recent developments in the field, and recognises the limits of current hypothesis. Group working is developed through formative oral discussion of case studies or equivalent. Resources include current textbooks, independent reading from current periodicals as selected and made available by the lecturer and lecturer-prepared visual aids to assist conceptual understanding.

Year 4: Current Advances in Biomedical Science

The overall aims of the module are to encourage interest in exciting current research from the biomedical, bio-molecular, and bioinformatics fields, and foster employability with the development of graduate skills, including the use of social media platforms for research and networking purposes. The module aims to integrate and advance knowledge of key subject areas in preparation for post-graduation careers.

The module aims will be achieved primarily through the delivery of lectures, workshops, and conference days. Sessions will focus upon cutting-edge research, together with its implications for biomedical and biomolecular sciences, as well as highlighting different post-graduate research opportunities. Parts of the module are delivered by professionals who will speak about their own careers and specialist interests, and draw on areas that students have studied over their time at Anglia Ruskin University.

This module encourages students to identify and develop a detailed knowledge and critical understanding of topics at the forefront of biomedical and biomolecular science. It further encourages students to appreciate the uncertainties, ambiguities and limits of such knowledge. The ethical, economic and other constraints upon research and development will be considered.

Coursework for the module will focus upon student-centred learning, enabling students to demonstrate their capacity for scientific thought and independent work. Students are encouraged to develop their own scientific and employability interests. They are allowed the freedom to choose the subjects for coursework assignments within the broad fields of biomedical and biomolecular science; subject choices must be approved by the module leader. The scientific emphasis is on developing an interest in, and understanding of, cutting-edge techniques and research studies. Further, the coursework will promote critical evaluation of particular aspects of biomedical science and the work of others. Hence, awareness and understanding of the strengths and weaknesses of research techniques and studies will be developed, supported by teaching sessions that will enable students to critically evaluate data presented by eminent guest researchers.

Optional Modules

(Subject to availability)

Year 4: Molecular Cell Biology

This module is designed to 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 will be discussed as part of your overall consideration of the relationship between molecular structure and biological function shown by cell membranes, cell organelles and other subcellular structures. Viral infection of eukaryotic cells will also be given detailed consideration, as will the role of viruses in oncogenesis, and other factors which contribute to the biochemical and immunological basis of cancer. As well as providing you with a detailed subject specific knowledge, this module develops a number of useful transferable and employability skills including devising, sustaining and presenting arguments, both orally and in writing, in a way that is well-organised and recognises the limits of current hypotheses.. In addition, students will develop practical and bioinformatics skills. Students will also work as a team to develop and present a Wikipage on a particular aspect of molecular cell biology. Standard texts are available via the library and via an online companion website.

Year 4: Microbial Pathogenicity

The aim of this module is to provide students with a deeper understanding of microbial pathogenicity, which is essentially how

microbes cause disease. In order to achieve this we will be looking at “host-pathogen” interactions during infection. Particular emphasis will be on the microbe and how it exerts its arsenal in order to cause damage to the host. The major focus will be on bacterial diseases of humans and animals, and we will also consider fungal, parasitic and viral diseases.

We will study the virulence mechanisms of a number of important pathogenic bacteria using exemplars, providing an in-depth knowledge of specific pathogens. We will cover virulence gene regulation, delivery of virulence factors and toxins and the genetics behind these. We will also study zoonotic diseases and new and emerging pathogens.

We will also look at how some “friendly bacteria” otherwise known as commensals are able to, under certain conditions, cause disease and become opportunistic pathogens.

In addition we will be studying how bacteria become resistant to antibiotics and ask the question what does this mean for the future fight against bacteria?

We will briefly cover vaccination and how research scientists are developing vaccines. The module will be delivered by lectures, practicals and seminars.

Year 4: Biomedical Case Studies

This module is available to students as part of their level 6 module choices and is designed to help students integrate their knowledge of biomedical sciences across a range of disciplines. This module will be taught using a case-based approach and is designed to give students experience of disease diagnosis, medical testing, treatment options and potential patient outcomes. In addition, this module will look at the biological basis that underlies the case histories, which biological processes are defective, how the defect(s) leads to the symptoms observed and the molecular basis of any treatment options. Students will be expected to undertake a significant degree of self-directed learning with respect to the case histories and will work individually and in small groups to develop their understanding of the subject material.