

## Course Information Sheet

# BSc (Hons) Pharmaceutical 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

Location of study:

Level 3 – ARU Cambridge Campus

Level 4-6 – ARU Chelmsford Campus

Pharmaceutical scientists are in demand in the public and private sectors. Become one. On this course, you'll gain the theory, medical knowledge and laboratory skills you need to work successfully in pharmaceutical companies, but also in clinical research and public health as well as the food and cosmetic industries.

You'll learn how the human body functions, the impact that disease has on the body, and how normal function can be restored through drug therapy. You'll explore the sciences that underpin drug discovery and development - and the important role of systematic, conceptual and analytical thinking. Add to this an understanding of quality assurance assessments and regulatory principles associated with drug discovery, development and manufacturing.

We also focus on skills that are prized not just in the pharmaceutical industry but across the public and private sectors. You'll acquire essential laboratory skills and research techniques, as well as develop your inter and intra professional skills. You'll also learn how to identify and solve problems, and develop your communication, management and leadership skills.

## 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'll make sure you're progressing correctly in a number of ways, including multiple choice tests, exams, reflective essays, oral and poster presentations, scientific report writing and independent project work.

One-to-one tutor sessions will help you get a solid understanding of all the relevant subject matter. Assessments will focus on helping you change from someone who consumes knowledge, to someone who generates it and is able to think independently.

## Fees

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

## 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: Cellular and Molecular Biology**

Following an introduction on biodiversity, evolution and natural selection, this module provides the basics of cellular and molecular biology. Cell biology studies the properties of cells including their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division and death. Molecular and cellular biology are interrelated, since most of the properties and functions of a cell can be described at the molecular level. The field overlaps with other areas of biology and chemistry, particularly biotechnology, developmental biology, physiology, genetics and microbiology.

This module will be delivered face-to-face and students will be expected to attend theory and practical sessions as well as participate in online study using the Canvas site, internet resources and on-line discussions as required. The practical component of this module will ensure that students are familiar and competent with a range of fundamental laboratory techniques and skills. Students will not only develop confidence in using equipment to collect data, but also in the presentation and interpretation of these data. Regular formative tests will be delivered in class with feedback and feed forward to enable students to monitor their progress and facilitate deep learning along. In addition, a formative group poster presentation to facilitate preparation for the summative assessment will be done.

#### **Year 2: Human Anatomy and Physiology**

The human body is a complex collection of systems interacting in a way that allows it to meet the demands of a daily routine. It has the ability to adapt to changing environments to maintain the internal environment within the physiological range for its survival. In the first trimester, this module will focus on the basics of human anatomy and physiology and provide an underpinning basis for future modules. Links with ill health, well-being and disruption to homeostatic mechanisms will be put into context of

normal anatomy and physiology. This will be followed by cell structure, function and histology, the nervous system and endocrine system, and the musculoskeletal - and respiratory systems. In trimester two, the organ systems that will be studied including the cardiovascular system, urinary system, the lymphatic system, digestive system and the reproductive system. Where appropriate, relevant pathophysiology will be introduced in parallel with the normal structure and functioning of the above systems. This module involves anatomy and physiology-based practical sessions that develop practical skills and assessed in the laboratory.

This module involves anatomy and physiology-based practical sessions whereby practical skills will be acquired.

## **Year 2: Scientific Communication and Professional Skills**

This module is focusing on developing the essential scientific and professional skills that are required in the bioscience field in general. It also aims to teach the pre-laboratory work planning and preparation such as health and safety documentations and laboratory experimental design. This also includes the professional skills and training required to operate common laboratory apparatus, such as glassware, microscopy, pH meter, weighing and measuring volumes, pipetting, and spectrophotometer.

The module also covers the communication of scientific information in many forms such as laboratory reports, journal articles and presentation skills. In addition, skills such as referencing, and searching for literature will be addressed. Related numeracy skills such as SI units, converting between different expression of concentration, and basic statistics are also embedded.

To improve digital literacy, computer sessions will be delivered in which basic skills, such as drawing graphs, using functions in spreadsheets, presenting data in tables, and creating presentation slides will be covered.

This module will be delivered using face-to-face learning and students will be expected to attend these sessions as well as participate in online study using Canvas, internet resources and online discussions as required.

## **Year 2: Fundamentals of Drugs and Medicine**

The aim of this module is to introduce the physicochemical principles underlying a range of disciplines that constitute Pharmaceutical Science (pharmacology, pharmaceuticals, drug discovery and development as well as pharmacovigilance). This module introduces students to the concept of formulating medicines, the design of dosage forms, the factors that influence the route of administration as well as the basic physicochemical principles underlying the formulation and stability of liquid and colloidal dosage forms.

This module will be delivered using face-to-face learning and students will be expected to attend sessions as well as participate in on-line study using our LMS (Canvas), internet resources and on-line discussions as required. The practical component of this module will ensure that students are familiar with the principles of good laboratory practice and learn a range of fundamental physical pharmacy and laboratory techniques. In this module students will also develop confidence in using equipment as well as collection, presentation and interpretation of data.

## **Year 2: Principles of Biomedical Science**

Biomedical science is the application of biological sciences to the study of medical sciences. This module builds on the anatomy & physiology delivered in trimester and looks at the multidisciplinary nature of biomedical science. Biomedical science requires a sound understanding of each of the constituent clinical disciplines. These are medical microbiology, clinical biochemistry, haematology, histopathology & cytology, clinical genetics and clinical immunology.

There is a focus on providing an introduction to a range of global diseases and infections and appropriate methods of prevention and cure. The fundamentals of diagnostic techniques used to analyse human samples in the investigation of causative agents will also be covered. A range of common human diseases, such as cancers, anaemia, diabetes, cystic fibrosis and microbial infections will be used to provide background theory on the role of biomedical science.

The mechanism of pathology, the physiological consequences to the human and range of diagnostic investigations used as part of a differential diagnosis. Furthermore, gaining an understanding of the basic laboratory techniques which are relevant to the biomedical disciplines, such as aseptic technique, human blood smears, Polymerase Chain Reaction and Gram stain, will enable theory to be put into practice in order to enhance understanding, to develop relevant professional and practical skills and to enhance employability profiles.

An overview of quality assurance procedures, the role of reference ranges and various forms of oral and written communication

will be embedded throughout the module as formative assessments.

Students will be expected to attend face-to-face sessions (lectures, tutorials, seminars, workshops and practical) as well as participate in online study using Canvas.

## **Year 2: Principles of Metabolism**

This module provides an overview of the biological chemistry and the nutritional, physiological and biochemical processes in health. It will form a solid basis to enable appreciation of the major nutrient need and sources through the lifespan, how they are absorbed into our bodies and the metabolic reactions that occur to produce energy. As such, students will become aware of the major nutrient sources required for health and the major biochemical processes occurring in human cells including the major pathways of carbohydrate, amino acid, lipid metabolism. A broad understanding of the relationship between diet, energy production and health will form a basis to understand how factors influence metabolic balance and whole-body homeostasis. Linkage to disease states also enable one to appreciate, at a basic level, how select states (e.g. ageing, nutrient deficiencies, digestive pathologies, endocrine imbalance or genetic mutations) can disrupt normal metabolism and/or physiological function.

A combination of lectures, seminars, tutorials and practical sessions (including enzyme kinetics) will be utilised to facilitate the expansion of knowledge and understanding on the effect of altered states in health and in disease. Regular formative tests will be delivered in class to enable students to monitor their progress.

This module provides the foundation for the Level 5 module, Essential Physiological Biochemistry.

## **Year 3: Essential Physiological Biochemistry**

Biochemistry, sometimes called biological chemistry, is the study of chemical processes within and relating to living organisms. By controlling information flow through biochemical signalling and the flow of chemical energy through metabolism, biochemical processes give rise to the complexity of life. Over the last decades of the 20th century, biochemistry has become so successful at explaining living processes that now almost all areas of the life sciences from botany to medicine to genetics are engaged in biochemical research. Today, the main focus of pure biochemistry is on understanding how biological molecules give rise to the processes that occur within living cells, which in turn relates greatly to the study and understanding of tissues, organs, and whole organisms. This module builds on the Level 4 module, 'Principles of Metabolism'. It shows how the physiological actions of selected organs can be explained by their particular biochemical processes. It focusses on the metabolic integration, rather than pathways, investigating the liver, communication systems (endocrine and neurological), blood and vascular system, muscle and adipose tissue and renal biochemistry.

## **Year 3: Pharmaceutical Formulations**

Pharmaceutics concerns the process whereby a new drug can be presented to patients in a suitable form (tablets, capsules, liquids etc.) to maximize absorption and achieve the required therapeutic concentrations in the body. In this module, the formulation and manufacturing of solid dosage forms (tablets and capsules) and semi-solid dosage forms (creams and ointments) as well as other dosage forms will be explored. Students in this module will be introduced to the properties and function of excipients, the impact of crystal structure on the formulation as well as the important characteristics of powders relevant to formulation and the theory of tablet compression. In addition, the process of extemporaneous preparation, labelling and packaging of dosage forms will be described.

This module will be delivered using face-to-face learning and students will be expected to attend sessions as well as participate in on-line study using our (Canvas), internet resources and online discussions as required. The practical component of this module will ensure that students are familiar with the principles of pharmaceutical technology and laboratory practice and learn a range of formulation techniques hence developing confidence in using equipment as well as collection, presentation and interpretation of data.

## **Year 3: Principles of Pharmacology**

This module aims to describe the principals of pharmacology. This includes how drugs produce their effects on the body by acting at specific targets (pharmacodynamics), as well as the absorption, disposition of drugs in body compartments with time, metabolism of drug molecules and ultimately the elimination of drugs (pharmacokinetics). In addition, the mechanism of chemical neurotransmission in the central nervous system and the autonomic nervous system will be explained along with the function and neurotransmission in the sympathetic and parasympathetic nervous system. Drugs acting on both systems, their

mechanism of action and their applications will also be discussed as well as the action of neurotransmitters through the development of the concept of drug-receptor interactions. In addition, how drugs are producing their effects and the different mechanism of actions they show when interacting with their receptors, how to distinguish between agonists and antagonists and how to create dose-response curves and interpret them will be explored. The application of these concepts is illustrated by examples of the pharmacology of drugs used to treat cardiovascular and behavioural disorders.

This module will be delivered using face to face sessions as well as participate in on-line study using Canvas, internet resources and online discussions as required. Regular formative tests will be delivered in class to enable students to monitor their progress.

### **Year 3: Medicinal Chemistry and Analytical Techniques**

This module describes the role of medicinal chemistry in the discovery, design and development of therapeutic agents. This involve presenting current approaches to drug discovery including structure-based design, analogue-based design, combinatorial and multiple parallel synthesis. The module will also emphasise the production and characterisation of clinically important drugs from natural sources and the relationship between the chemical structure of a drug and medicinal properties, and the application of docking and scoring functions. Identification of potential drug targets and their exploitation for therapeutic purposes. The principles and applications of spectroscopic techniques in the analysis of pharmaceuticals. Information from electromagnetic radiation on molecular structure, with emphasis on UV/vis spectroscopy, infra-red spectroscopy and <sup>1</sup>H and <sup>13</sup>C NMR spectroscopy. The main methods of inorganic analysis and the principles of chromatographic separation. The module will be delivered as a combination of taught lectures, practical and tutorials. The practical and tutorial sessions will complement the lecture material and will develop laboratory skills and the ability to conduct relevant calculations. On-line study using our Canvas, internet resources and the use of formative on line discussions will be used to encourage student learning and engagement.

### **Year 3: Research Methods**

Students are expected to complete a research project in their final year; therefore, this module requires the development of a research proposal. This module provides the student with the necessary tools to undertake research using qualitative, quantitative or mixed methods of inquiry. This module will also serve to aid their critical analysis of published research. It will build on those transferrable skills introduced from the beginning of the course and will look at the development of a research project from conception to completion, concentrating on the forming and shaping of a study using a variety of approaches. As such, this module will involve the development of an understanding of the use of statistics in research and will introduce students to some of the statistical data analysis techniques used in the medical and scientific literature. It will also create an appreciation for the rationale involved in making the correct choices when undertaking research and evaluating the relative 'strength' of evidence-based practice in healthcare.

### **Year 4: Undergraduate Major Project**

The Undergraduate Major Project is the culmination of the degree – it gives students a chance to demonstrate all they have learned. The project module is very different from other modules. Although students are supervised, the onus is on the student to identify the research question and generate aims, objectives and hypotheses. Research will be conducted under the guidance of the supervisor where the student will generate and analyse data, and the results communicated scientifically both in writing and verbally. The Undergraduate Major Project module therefore allows students to engage in a substantial piece of individual research that will focus on a topic relevant to their course, which follows on the research proposal and ethics application developed for the Research Methods module. The project may be in the form of primary research (e.g. laboratory, population studies, generating questionnaire-based data, clinical service evaluation, or other relevant acceptable research). The chosen topic will require the student to apply their subject knowledge and apply suitable methodologies. Importantly, students will apply and demonstrate their problem-solving skills by creative and innovative thinking.

Student progress will be monitored closely through regular meetings with the project supervisors, ensuring the student stays on track.

### **Year 4: Applied Pharmacology**

The therapeutic application of drugs for specific conditions is considered in this module. The principles of drug action on major organ systems including the cardiovascular, central and peripheral nervous system, respiratory, gastrointestinal, and the endocrine system are covered in this module. Lectures will address major disease processes in each system and the mechanisms by which drugs exert their pharmacological/therapeutic effects. This includes a thorough grounding on intrinsic and extrinsic factors influencing physiological function, incorporating mechanisms at the integrated systemic. Consideration will be given to changes in structure and function in different physiological conditions (including ageing) and disease states and to

pharmacological control of homeostasis. The basis of the incidence of undesirable side-effects brought about by combinations of drugs is explained. To introduce students to the importance of pharmaco-economics and pharmacovigilance in clinical pharmacology and the regulatory aspects of the pharmaceutical industry. This module will cover aspects of genetic factors that affect the metabolism of foreign compounds and drug-receptor interactions. Lectures address current views on the relationship between pharmacogenetic polymorphisms and disease susceptibility and potential approaches to drug design using pharmacogenomics. Regular formative tests will be delivered in class to enable students to monitor their progress.

#### **Year 4: Biotechnology**

In this module, students will explore the use, manipulation and application of biotechnology in areas such as health, industry, and the environment with particular emphasis in pharmaceutical and medical sciences. Knowledge of current key examples of use of biotechnology in these areas will be investigated. The module will adopt both face-to-face and independent approaches to learning to develop an in-depth knowledge on mechanisms by which biological systems can be manipulated.

Workshops will be held to explore recent advances in biotechnological products. Case studies will introduce the student to the assessment and therapeutic efficacy of biotechnology products and explore the major approaches in pharmaceutical and medical sciences. They will also analyse examples of research studies pertinent to biotechnology and explore the importance of ethics within research and its application. Canvas and internet resources will be used effectively during the module, specifically for tutorials and case studies.

#### **Year 4: Specialist Case Studies**

This module is designed to help students integrate their specialist subject knowledge from their chosen degree sciences in the wider context of medical and pharmaceutical science. This module will be taught using a team-based learning approach, where students will be put into teams by the academic staff leading the module. Each team will contain students from all subject areas to ensure that students will be able to contribute relevant subject information to the critical student-led discussions that will form the basis of problem-based scenarios. Each team will be provided with a patient-based scenario and will work together to identify the most likely diagnosis and therapeutic agent to use as the most effective form of treatment. Tutorials, workshops, practicals and supporting lectures will frame this problem-solving module.

#### **Year 4: Drug, Development and Regulatory Affairs**

Based on the previous knowledge/experience of pharmaceuticals and medicinal chemistry, students will explore the processes involved in the development of a new drug, from discovery to marketing including a chronological account of the drug development process. The principles of quality assurance as applied to the processes involved in the development, manufacture and distribution of medicines will be addressed. This will include market assessment and evaluation of clinical need different stages of clinical trials, drug licensing procedures patents, approval and post-marketing surveillance. In addition, current topics about advanced drug delivery systems will be introduced. Student also will be involved in workshops and team work to critically discuss topical issues in the pharmaceutical industry and to develop their own prospective applications for new products. Drug Development and Regulatory Affairs module will be delivered using Face to face learning and students are expected to attend face to face sessions as well as participate in on-line study using our Canvas, internet resources and on line discussions as required. Student will have opportunities to develop their presentation and writing skills and to reflect their previous learning experience by writing their drug development reports.