Year One Courses

PHS1101 The Billion-Dollar Pill - Bench to Bedside Drug Development

Pre-requisite: H2 Chemistry or equivalent

This course will provide the knowledge and understanding on the complete development plan ensuring successful lead identification in the drug discovery process, describing preclinical studies, formulation and product developments, clinical trials and post-marketing studies. The importance of quality, quality assurance and control and key global/regional regulatory frameworks and strategies for product development will be covered. Following post-marketing approval, upcoming innovative regulatory and marketing strategies for effective lifecycle management of a pharmaceutical product such as improved patient compliance, revenue growth, expanded clinical benefits, cost advantages, life extension exclusivity etc will also be introduced.

PHS2102 Physicochemical and Biochemical Principles of Drug Action

Pre-requisite: PHS1101

Building on PHS1101, this course introduces the fundamental principles behind drug-receptor theory that serve as a foundation for understanding both the drug and the target in drug development. Theory of drug-receptor binding and impact on drug action and design will be exemplified with pharmaceutically relevant and clinically approved drug products to illustrate the application of fundamental knowledge of cellular and biochemical processes in drug target identification and pharmacophore optimization. Completion of this course will further prepare students for future courses on biopharmaceutics, drug metabolism and strategic development of pharmaceutical drug products.

Year Two Courses

PHS2101 Physiology for Pharmaceutical Science

Pre-requisite: PHS1101

This course is aimed to provide fundamental knowledge and understanding of the normal function of the human body. The underlying physiological processes within each of the following human body systems will be covered: 1. musculoskeletal system, 2. cardiovascular system, 3. blood and immune system, 4. respiratory system, 5. endocrine system, 6. digestive system, 7. renal system, and 8. nervous system.

PHS2103 Essentials of Pharmaceutical and Synthetic Chemistry

Pre-requisite: PHS1101

Building on PHS1101, this course covers topics in pharmaceutical chemistry, synthetic organic chemistry, and pharmaceutical analysis that are key to drug synthesis, stability and analysis in the process of drug discovery and development. The importance of the concept of quality control and quality assurance in the drug development process will be highlighted in light of pharmacopoeial requirements for ensuring product safety and quality based on both active pharmaceutical ingredients and excipients. Assays validation will be covered in light of pharmaceutical regulatory requirements. Completion of this course will prepare students for courses on development and regulation of pharmaceutical and health products.

PHS2104 Macromolecules in Pharmaceutical Science

Pre-requisite: PHS1101

Protein- and nucleic acid-based biopharmaceutical products and therapeutics such as monoclonal antibodies, growth hormones, vaccines and biotechnologically derived diagnostic aids/tests are making significant medical advances in improving human health. This course therefore provides students with the knowledge in the physicochemical properties, pharmacology and production of such biopharmaceuticals, as well as the principles and advances in biotechnological techniques that have increasing applications in medicine. The principles and practical capability of various analytical instruments for macromolecule characterization and quality assurance of biopharmaceuticals will be also be covered.

PHS2105 Principles of Pharmaceutical Formulations I

Pre-requisite: PHS1101

This course gives insights into the pre-formulation considerations covering different physicochemical properties important to pharmaceutical formulation development, as well as giving an introduction to dosage forms including solutions and disperse systems. The fundamental knowledge of the physicochemical properties, manufacture, and applications of these dosage forms will be discussed.

PHS2191 Laboratory Techniques in Pharmaceutical Science I

Pre-requisites: PHS2102 and PHS2103

This course introduces the theory and practical applications of major tools and techniques used in in the continuum of drug discovery and development. Factual knowledge in pharmaceutical/medicinal chemistry techniques, such as synthetic skills, lead optimization, molecular modelling, will be integrated with laboratory practice.

Year Three Courses

LSM3211 Fundamental Pharmacology

Pre-requisite: PHS2102

This course aims to provide basic principles of receptor pharmacology and of pharmacokinetics with emphasis on molecular and cellular mechanisms of action, clinical uses and adverse effects using lectures, tutorials and practicals. The lecture topics will start with the classical drug receptor theory followed by pharmacokinetics and molecular pharmacology of drug receptors and their regulation including receptor-mediated signal transduction and membrane ion channel function. Autonomic pharmacology (adrenergic and cholinergic) will be introduced. The course also focuses on the pharmacology of autacoids, non-steroidal anti-inflammatory agents, corticosteroids, immunosuppressants, anti-asthma drugs, and anti-arthritic drugs.

PHS3101 Principles of Pharmaceutical Formulations II

Pre-requisite: PHS2105

This course gives an introduction to solid dosage forms including tablets, capsules, powders and granules, as well as topical products and transdermal delivery. Formulations of emerging importance including biologics, polymers and biomaterials will be discussed. Fundamental knowledge of product quality and stability will be covered.

PHS3102 Principles of Drug Design and Development

Pre-requisite: PHS2102 and PHS2103

This course will demonstrate the application of chemical and pharmacological sciences in the processes of drug discovery beginning from lead identification phase to pre-clinical study phase. The main learning will focus on how molecules are modified into potential drug candidates through achieving suitable pharmacodynamic and pharmacokinetic profiles. Approaches in pharmacophore identification and principles in lead optimisation will be introduced. Chemical diversity in drugs will be illustrated through a selection of commercially available drugs. Structure-activity relationship will be elucidated using drugs of different pharmacological actions. The approaches to how drug disposition (ADMET) is optimised in the pre-clinical phase will be highlighted.

PHS3191 Laboratory Techniques in Pharmaceutical Science II

Pre-requisite: PHS2191

This course extends from PHS2191 to introduce the theory and practical applications of further major tools and techniques used in the continuum of drug discovery and development. Factual knowledge in drug metabolism and pharmacokinetic techniques, such as enzyme kinetics, CYP inhibition, drug-drug interaction assays; and in pharmaceutical biology, such as cell viability/toxicity testing, DNA extraction and purification, aseptic techniques/cell culture, will be integrated with laboratory practice.

PHS4101 Pharmacokinetics and Biopharmaceutics

Pre-requisite: PHS2101

This course provides students with a comprehensive foundation of the concepts of pharmacokinetics and biopharmaceutics. The applications of these concepts are important in the drug discovery and development process. Major topics include: basic principles, concepts and processes of drug absorption, distribution, metabolism and excretion, kinetics of drugs following intravascular and extravascular routes of administration, design of appropriate dosage regimens, and application of pharmacokinetic concepts in drug design and development.

Year Four Courses

PHS4121 Regulation of Healthcare Products

Pre-requisite: PHS1101

The availability of healthcare products is governed by the regulations of individual jurisdictions, resulting in the disparity of requirements hindering the access of valuable therapeutics to patients. As such, the development of therapeutics should always consider the regulations involved and the impact to the timely availability to patients, and eventually the effectiveness of the healthcare system. This course aims to introduce the fundamental concepts of regulatory affairs, covering major frameworks, trending innovation in regulatory processes, key influencers and concerns arising from gaps in regulatory capacities. This knowledge expands on the understanding of product life cycle management, and enables a further appreciation of the intricate relationships among stakeholders in healthcare.

(Continued on next page… for major elective courses)

Elective Courses (Pass any 8 units from the following)

PHS4201 Microbiology for Pharmaceutical Science

Pre-requisite: PHS3101

This course aims to equip students with knowledge and practical skills in the fundamentals of pharmaceutical microbiology and controls in microbial contamination of pharmaceutical products, medical devices and the environment. This course will give an insight into the nature of microorganisms, with greater emphasis on bacteria and their significance to the pharmaceutical industry and medicine. It will discuss the characteristics and morphology of microorganisms, their growth requirements, reproduction, enumeration and identification and relate this knowledge to disinfectants and disinfection, and the concept of sterility and sterilization methods for pharmaceutical products and medical devices.

PR4204 Special Drug Delivery

Pre-requisite: PHS3101

The aim of this course is to provide an understanding of the science and technology of rate-controlled administration of therapeutic agents with comprehensive coverage of the basic concepts, fundamental principles, biomedical rationales and potential applications. Major topics include: Fundamentals of rate-controlled drug delivery; major delivery systems such as parenteral, oral and aerosols.

PR4205 Bioorganic Principles of Medicinal Chemistry *(to be confirmed)*

Pre-requisite: To be updated in due course [Note: The prerequisite will be one of the PHS essential courses (up to Level 3000)]

Learning objectives: To learn the different approaches in the design of drugs that are capable of interacting specifically with enzymes, DNA and other cellular targets. Major topics: A mechanistic, chemical and biochemical approach to medicinal chemistry, emphasizing enzymatic and macromolecular targets of drug action. Peptide, peptidomimetics and oligonucleotides.
[Note: Course description to be updated in due course]

PR4207 Applied Pharmacokinetics and Toxicokinetics

Pre-requisite: PHS4101

Paracetamol is one of the most frequently used medication in the world for treating fever and pain. Yet, it is also the most common agent to cause severe liver toxicity and emergency admissions to hospitals. So, is paracetamol a drug or a poison? Students will learn the fundamental toxicokinetic (TK)/toxicodynamic (TD) considerations to discuss when a drug is a drug or poison. The course also dives into the current and emerging trends in ADME and toxicity testing in drug discovery. Special PK topics such as nonlinearity and PK of protein drugs will be covered.

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PHS4288 Research Project in Pharmaceutical Science (8 units, year-long course)

Pre-requisite: PHS3191

This 8-unit, year-long course aims to provide hands-on research experience to final year students to nurture their passion for inquiry and knowledge creation via project work. It aims to develop higher order thinking skills such as critical evaluation of information, as well as to hone students' written and oral academic communication skills. Students will have the opportunity to be introduced to experimental techniques, data collection and analysis that are relevant to the pharmaceutical science. Students will carry out their research projects under the supervision of Pharmacy academic staff.

PHS4991 Exchange Enrichment Level 4000

For students going for Student Exchange Programme (SEP)

This major-coded placeholder course allows students to read a pharmaceutical science-related course offered at the SEP partner universities that are not offered or cannot be mapped to any NUS courses. Students requesting to map a pharmaceutical science-related course offered at the SEP partner universities to the major-coded placeholder course will submit the course description and detailed syllabus for review by the Department SEP coordinator and programme director(s) who will assess the content and depth for suitability to map as major elective.