Course Descriptions International Enrichment Program 2019

1. Medical and Surgical Sciences

This course will introduce students to the working scientific background common to specialties across the medical field. It will cover disciplines taught at medical school including anatomy, pathology, physiology, biochemistry, pharmacology, basic medical examinations and surgical techniques. Teaching will be delivered through lectures, group work, practical experiments and simulation. Students will learn about different medical and surgical specialities, which will be particularly relevant to their own career planning.

2. Stem Cell Biology, Nanotechnology & Regenerative Medicine

This course focuses on increasingly important facets of modern-day medicine and examines stem cell biology, nanotechnology and regenerative medicine. These key areas provide the scientific underpinning for a paradigm shift in medical and surgical practice and will equip students with a detailed knowledge of the biomedical science that is at the forefront of future therapies destined to repair diseased and damaged organs. Students will study each of these broad research areas, learn how new technologies are adopted, and examine cutting edge stem cell techniques. Teaching will progress through classroom lectures, group discussions and practical sessions, enabling students to develop a robust scientific understanding of these revolutionary fields, alongside presentation and communication proficiency.

3. Neuroscience

The field of neuroscience is one that has continued to advance rapidly. This course is aimed at providing students with a fast-paced and highly interactive study in the field of neuroscience. Although much has been discovered in recent years, there is still a lot we do not know - and knowledge of this could potentially lead to ground breaking therapeutic targets. Lectures are designed to provide knowledge on the foundations of neuroscience at the cellular and molecular level, whilst introducing students to a range of topics in neuroscience including cognitive and behavioural neuroscience. Students will learn via focused group work, class presentations, experimentation and group quizzes. By the end of the course, students should be able to understand

the general principles and science governing the nervous system, the aetiology governing a host of neurological and neurodegenerative disorders as well as read, understand and critically assess related texts.

4. Medicinal Chemistry (Receptors & Enzymes, the Body's Molecules, Pharmacokinetics & Metabolism)

This hybrid, interdisciplinary course will begin with a firm grounding in cellular structures, processes and the body's macromolecular makeup (including proteins, nucleic acids, carbohydrates, and lipids). Students will learn about complex in-vivo and in-vitro cellular and medicinal interactions, the detailed function of enzymes and enzymatic receptors, and their impact on metabolic processes. Pharmacokinetics will cover the fate of drugs in the body (including absorption, distribution, metabolism and elimination), alongside the design and optimisation of new therapeutics. Laboratory experiments will provide hands-on reinforcement to theoretical instruction and students will have the opportunity to discuss potential career options in scientific, biomedicine and health-related specialties.

5. Bacteriology, Parasitology & Clinical Microbiology

The beginning of this course will introduce students to the systems and processes in the living cell – the foundational concepts underpinning clinical microbiology, bacteriology and parasitology. The course will cover how microorganisms (predominantly viral and bacterial pathogens) infect host cells, through to disease causation, diagnosis, and management from both a patient and infection control perspective. Students will gain a broad knowledge spanning key human infections and medically important viruses, bacteria, fungi and parasites. They will learn how routine and specialist diagnostics tests are carried out, how cutting edge research is challenging current management paradigms and gain significant levels of practical and theoretical understanding.

6. Biotechnology, Bioengineering and Applied Biosciences

The beginning of this course will introduce students to foundational concepts from biotechnology's major supporting sciences (biochemistry and microbiology) and the core principles underlying modern bioscience. The course will then briefly cover some of biotechnology's basic divisions such as bioinformatics, bioprocess engineering, and medical biotechnology. Students will have the chance to develop practical skills through lab-based workshops related to biotechnology. The last phase of

the course will cover the world of ‘biotechnology start-ups’, and introduce students to the ways in which real-world biotechnology products are conceptualised, funded, launched and marketed.

7. Quantum Mechanics, Quantum Technologies & Modern Physics

This interdisciplinary course introduces students to the key mathematical and physical science principles that underpin ‘the smallest building blocks in the planet’. During their study of quantum physics, quantum mechanics and quantum technologies, students will cover material primarily offered at university undergraduate level and will learn how modern physics intersects with quantum theory, nanophysics and quantum communication. As the course progresses, students will study advanced devices, simulation and links to other scientific disciplines. Students will also be introduced to the real-world application of scientific theory, learn about cutting-edge research in the field and explore potential career options.

8. Astronautics, Space Science & Satellite

This course will introduce students to mainstream space science and the key topics taught at university undergraduate level that govern astronautics. Students will learn about the physical and mathematical principals underpinning space science and how critical deductions from observations are made - this is particularly relevant in the study of the universe. The course will teach students how to think abstractly, develop scientific intuition and infer findings from available data when things cannot be objectively measured. Students will learn about the theoretical fundamentals and key disciplines in this cutting-edge field, alongside the study of real-world cases and applications of hardware design, manufacturing and in-orbit operations. Potential career options for students considering this field of study for their university major will also be explored.

9. Manufacturing Systems & Engineering

This course will introduce students to the discipline of engineering, and then provide students with grounding in some of the fundamental methods specific to manufacturing systems. Students will be introduced to the concepts of mechanical engineering, civil engineering and aerospace engineering and learn how machining technology, quality tools and automation are driving this dynamic industry. Students will undertake simulated projects spanning commissioning, planning, and construction

phases, and will be introduced to state-of-the-art research in the areas of advanced materials and processes. Career options will be discussed for those interested in pursuing this specialty.

10. Petrochemical & Petroleum Engineering

This course will introduce students to the different subfields of engineering, and then provide students with grounding in the fundamental methods relating to petrochemical and petroleum engineering. Students will be introduced to core theoretical and practical concepts, including project planning and management, commercialization and novel resources such as biofuels. Students will emerge from this course with a solid foundation in cutting-edge petrochemical engineering research and modern-day applications, along with a substantial insight to careers in this field.

11. Artificial Intelligence & Computer Science

This course delves into the interaction between artificial intelligence and computer science by exploring key concepts in automation, programming and system implementation, machine learning, and robotics. Students will learn about how intelligent systems are designed, built and evaluated through both theoretical expertise and practical knowledge to solve real-life problems. Students will utilize computer science to solve basic AI problems and coding puzzles, and learn how AI is transforming society from industrial, governmental and academic perspectives. Students will also explore employment and future research trends.

12. App Lab: Coding, Web & Mobile Application Development

This course will introduce the basic principles of computer science, operating systems, software engineering and digital electronics to students interested in the web and mobile industry. Students will learn basic theoretical concepts in computer architecture, computation theory and computer networking, before exploring specific topics in computer programming and application. This course will combine technology, interface design considerations and application development theory to web and mobile platforms. Theory and practice will be closely intertwined via classroom activities and projects.

13. Cybersecurity, Cryptography & Forensics

This course introduces students to the fundamental components of computer science with special focus on key tenets of cybersecurity and cryptography. Students will begin by understanding the basic architecture of computers and database systems, and will gain an understanding of the nature of security threats that computers systems face. The course will progress on to more specific topics and case studies in cybersecurity and cryptography, such as the Cybersecurity Enhancement Act, ARP poisoning and Ethical Hacking. Students will learn how to utilize digital evidence, solve basic problems using programming languages and gain exposure to the tools employed in computer security and forensics.