



## Proposed Syllabus for Medical Science (MS) Module

### 1. MODULE DESCRIPTION:

Why do people get cancer? What happens to the brain when we get older? What is checkpoint therapy? Can stem cells be used to cure any disease? Is ultrasound useful for administering drugs? Antibiotics – can they be dangerous?

This module provides an insight into the latest topics in medicine and health-related subjects. Leading experts and researchers in the medical sciences will guide students through the intricacies of medical and clinical research, paying particular attention to cutting-edge technologies in a variety of medical areas. Students will investigate process involved in the likes of neuroscience, oncology, surgery and immunology. Focus is also placed on advanced drug development and biomedicine, and how these are changing into the future. This course offers insight into the importance of interdisciplinary teamwork, to improve our medical knowledge and practice, as well as developing a comprehensive knowledge of framework and ethics in clinical practice, to develop as well-rounded physicians in the future.

#### The course is for students of:

Medicine, Genetics, Psychology, Public Health, Pharmacology and other related fields.

### 2. LEARNING OUTCOMES:

Upon completion of this module, students will be able to:

- Develop understanding of the state-of-the-art tools and techniques in biomedical research.
- Appreciate the importance of interdisciplinary teamwork in cutting-edge research.
- Explore the ethical and regulatory issues in research and practice.
- Understand the complexities human health, for example in oncology and neuropsychology.
- Gain insight into the role of nanotechnology in biomedical applications such as vaccinations, drug delivery or cell cultures.
- Gain understanding of biomaterial manufacturing processes and its role in regenerative medicine.



### 3. MODULE DETAILS:

#### Course Overview

##### Unit 1: Medical Imaging and Technology

Medical imaging plays a pivotal role in modern healthcare, enabling clinicians to visualize, diagnose, and treat a wide range of medical conditions with precision and accuracy. This unit will allow students to explore advancements in medical imaging and therapeutic technologies, highlighting the profound impact of Artificial Intelligence (AI). Students will discuss latest innovations in medical imaging and drug delivery technologies with world-leading experts, and understand how these technologies are revolutionizing diagnostics, treatment, and patient care.

- AI and Medical Imaging: The Current and Future State
- Technology Enhanced Drug Delivery
- Advances in Biomaterials
- Future Directions in Medical Imaging and Therapeutic Technologies
- Computer-Aided Drug Design

##### Unit 2: Advanced Drug Discovery and Therapeutics

Drug Discovery and Therapeutics represent the cutting-edge of biomedical research and pharmaceutical development. This unit offers an in-depth exploration of the scientific, technological, and methodological advancements in drug discovery and the development of new therapeutics. Students will be well-prepared to contribute to the evolving landscape of medical research and therapeutic development by combining theoretical knowledge with practical insights into the following fields:

- Drug Discovery and Development
- Towards New Therapeutics in Atrial Fibrillation
- Integration of Proteomic and Genomics
- Drug Design and Recovery: Historical and Theoretical
- From Molecules to Medicine

##### Unit 3: Ethics and Healthcare Systems

The intersection of ethics and healthcare systems is critical for ensuring that medical practice and healthcare delivery are conducted with integrity, fairness, and respect for all individuals. This module provides a comprehensive examination of the ethical principles and healthcare systems that form the foundation of modern medical practice, both in the UK and on an international scale.

- Medical Research Ethics
- Healthcare System in the US
- Working in General Practice
- The Impact of Covid-19 on Healthcare



#### Unit 4: Neuroscience and Brain Research

Neuroscience and brain research stand at the forefront of scientific inquiry, seeking to unravel the complexities of the human brain and its vast capabilities. This unit presents a comprehensive and in-depth exploration of cutting-edge research and advancements in neuroscience. Focusing on crucial areas such as therapeutic interventions, disease quantification, neurodegenerative disorders, and cognitive studies as follows, students will develop a comprehensive understanding of the latest developments and future directions in brain research.

- Deep Brain Stimulation: Real Life Cases and Troubleshooting.
- Quantifying Parkinson's Disease and Digital Phenotyping
- Neurodegenerative Diseases: Formation and Features
- Current Developments in Cognitive and Behavioral Neuroscience
- Neuroinflammation and Neuroimmunology
- Psychology for Medicine: Scientific History of Memory, the Who's Who

#### Unit 5 Oncogenesis and Gerontology: Intersecting Pathways

The fields of oncogenesis and gerontology intersect in intriguing and complex ways, offering insights into the mechanisms of aging and cancer development. This unit delves into the cutting-edge research and emerging therapies on cancer and aging, offering comprehensive knowledge of the biological processes and innovative treatments shaping the future of oncology and gerontology. Students will have the opportunity to explore:

- Evolutionary Perspectives on Cancer and Ageing
- Extracellular Vesicles and Their Role in Endometriosis
- Mechanisms Controlling Epigenetic Patterning and its Relevance to Cell Function
- Challenges in Cancer Therapy
- Using Biomarkers to Optimise Cancer Treatment
- Why Do We Remove Lymph Nodes in Colon Cancer Surgery?

#### Unit 6: Advanced Topics in Integrative Physiology and Disease Mechanisms

Understanding the intricate web of physiological processes and how their dysregulation leads to disease is fundamental to advancing medical science and improving patient care. This unit provides a thorough investigation into the complex interplay between physiological mechanisms and disease pathways, offering an in-depth perspective enriched by cutting-edge research discoveries. Throughout the course, students will engage deeply with a range of pivotal topics, gaining insights into:

- Gastrointestinal Diseases and Disorders
- Introduction to Autonomic Nervous System Physiology and Pharmacology
- Intestinal Formation and Dysregulation
- Stem Cell Therapy: Recent Advances
- Biomaterials for Tissue Engineering and Regenerative Medicine
- Extracellular Vesicles and Their Role in Endometriosis



- Utilising a Systems Vaccinology Approach to Elucidate the Mechanisms Underlying Immune Responses to Childhood Immunisation

#### Proposed Reading List

- Siddhartha Mukherjee (2009). *A Biography of Cancer*. London: Fourth Estate Ltd. Part 1, 4 and 6
- Jones, S. (2012). *The Language of the Genes*. HarperCollins UK.
- Stryer, L., Berg, J., Tymoczko, J. and Gatto, G. (2023). *Biochemistry*. 10th ed. New York Macmillan Learning WH Freeman.
- Alberts, B. (2002). *Molecular Biology of the Cell*. 4th ed. New York: Garland Science Taylor & Francis. Chapter 9
- Bodmer, W.F. and Mckie, R. (1997). *The Book of Man: The Human Genome Project and The Quest to Discover our Genetic Heritage*. New York: Oxford University Press.

***More readings and resources will be given prior to the start of the programme.***