

## MMI Clinical & Translational Research Scholars Programme

### Year 1 Taught Education Modules

#### Core Modules

Name of Module	Content of Module
Molecular Medicine: Human Disease	This module explores the molecular mechanisms of a number of human diseases. It takes a disease centric standpoint and applies knowledge gained from the study of genetics and cell biology to investigate the dysregulated molecular systems that combine to give rise to particular disease states. It gives examples of how state of the art knowledge is being used to generate therapeutic approaches aimed at redressing such dysfunctional systems.
Molecular Mechanisms of Disease Pathogenesis	This module explores key systems that underlie pathology. This module approaches disease topics from a mechanistic standpoint. Immune mechanisms and cellular remodelling in response to mutagenesis and environmental stimuli are central to a wide spectrum of human disorders including immune mediated diseases and cancer. It therefore applies basic knowledge of genetics and cell signalling to a multifaceted investigation of molecular pathology of disease.
Communication, Teamwork and Research Ethics.	<ul style="list-style-type: none"> <li>- The first day workshop focuses on all aspects of the scientific publication process, from understanding the literature and the objectives of a scientific paper, to learning how to write and submit papers and build a good publication record.</li> <li>- The second day workshop focuses on research ethics.</li> </ul> Part 1 involves debate on falsification and fabrication of data that concerns PhD students. Part 2 comprises study of 2011 material from the US Office of Research Integrity.
Integrated Pharmacology	This module is aimed at graduate students with an interest in drug discovery and delivery and in vivo effects of drugs in the context of Pharma drug development programmes.
Fundamental Biological Imaging	This module is designed for students who wish to understand and become critically aware of the basic principles, practice and applications of rapidly developing imaging technologies. Particular focus is given to white and fluorescent light-based imaging approaches. A series of lectures will inform about the concepts of imaging and microscopy; application of histology, immunohistochemistry and immunofluorescence; basics of wide-field microscopy, confocal microscopy and high content screening microscopy; techniques in light microscopy and live cell imaging; and also the relationship between light microscopy and electron microscopy. Structured practical sessions will also allow the students to gain first-hand experience in the operation of various pieces of microscopy equipment.
Biostatistics	The main theme of this module is that the students should meet and understand many of the basic statistical ideas they may meet and use in their future research. The emphasis throughout the course is on the Application of Statistics and will rely heavily on a statistical computing package called MINITAB. The course concentrates on how, in any research context, to pose answerable and generalisable questions, design an experiment to answer such, carry out the appropriate statistical procedures on the resulting data from the experiment and finally to interpret and report the conclusions/answers to the questions posed on the basis of this analysis.

## Optional Modules

Stem Cells and Gene Therapy	This module is designed to provide up to date information on stem cell biology and gene therapy with an emphasis on current and developing clinical strategies.
Translational Research in Haematology and Oncology	This module will introduce students to the main elements of translational research in haematology and oncology, with an emphasis on translating basic science to the clinic. Elements covered during this course will include cancer biology, identification of new drug targets, high throughput approaches to drug screening, medicinal chemistry, pre-clinical validation of new compounds, including evaluation in cell lines and primary cancer cells, animal models and early phase clinical development. This course will provide a broad overview to those wishing to pursue further research in this area, including biomedical scientists as well as physicians.
Drug Development and Clinical Trials Design	This module will introduce students to the main elements of the development of therapeutic or preventative drugs and their evolution as agents for clinical application, through clinical research and clinical trials following GCP guidelines. This will cover all phases of the clinical trial process, identification of new drug targets, high throughput approaches to drug screening and pre-clinical validation of new compounds.
Making Clinical Research Change Practice	This module is intended to highlight the factors and strategies which will promote, or hinder, the adoption of positive changes in routine clinical practice. Collaboration will occur with multiple stakeholders including patients, voluntary organisations, providers, funders and industry. Using real case examples, it will encourage reflection on how best to ensure that hard earned research success leads to individual patient and population gain.
Introduction to Biomarker Discovery	Practical procedures will include: <ul style="list-style-type: none"> <li>• Specimen handling.</li> <li>• The collection, processing, storage and analysis of biomarkers in umbilical cord blood and placental samples.</li> <li>• Biobank management: sample security, storage and tracking</li> <li>• Ethics of biobank storage and patient consent</li> <li>• Physiological markers of disease: including heart rate variability, near infra red spectroscopy and electroencephalography</li> <li>• Observation of Magnetic Resonance Spectroscopy</li> <li>• Proteomic and metabolomics analysis.</li> </ul>
Neonatal Brain Injury	Practical procedures will include: <ul style="list-style-type: none"> <li>• Attendance at ward rounds in the neonatal intensive care unit</li> <li>• Observation of neonatal neurological examinations on the postnatal wards</li> <li>• Observation of neonatal neurological diagnostic tests including, electroencephalography (EEG), cerebral ultrasound and magnetic resonance imaging (MRI)</li> <li>• Processing of physiological datasets in neurological disorders including seizures, hypoxic ischaemia and stroke</li> <li>• Observation of neurodevelopmental follow-up examinations</li> <li>• Signal analysis, electroencephalography, cerebral ultrasound, MRI</li> <li>• Neurodevelopmental follow-up</li> </ul>



Cardiovascular Biology	<ul style="list-style-type: none"><li>• Role of Platelets/Endothelial cells in patho-physiology of vascular inflammation and remodelling</li><li>• Monocytes/macrophages dynamics in vascular inflammation and repair</li><li>• Cytology of SM progenitors/SMC from mouse to humans</li><li>• Targeting Platelets/Endothelial cells specific markers, Monocytes/macrophages and SM progenitors/SMC to treat vascular disorders</li><li>• Myocardial Infarction pathophysiology</li><li>• Post myocardial infarct repair mechanisms</li><li>• Novel Targets for myocardial infarct repair</li><li>• Translational research from bench to clinics</li><li>• Innovations in cardiovascular medicine</li></ul>
Gastrointestinal Health: Mouth to Anus and Everything in Between	<ul style="list-style-type: none"><li>• Gastroenterology in health and disease</li><li>• Genes and Genomes within the gastrointestinal tract</li><li>• GI immune system</li><li>• Mining microbes</li><li>• Oral health and disease</li><li>• Gut associate virology</li></ul>