

**MSc in Cellular & Molecular Immunology -2008**  
**Course contents**

**CORE CURRICULUM**

**Semester 1**

**Unit 1: Overview of the Immune System**

- Introduction to the immune system: Innate and adaptive immunity, General properties of the immune responses.
- Cells, tissues and organs of the immune system: Hematopoiesis, Cells of the immune system; Lymphocytes, Antigen presenting cells; dendritic cells & mononuclear phagocytes and granulocytes
- Anatomy and functions of primary, secondary & tertiary lymphoid tissues: Bone marrow, Thymus, Lymph nodes and lymphatic system, spleen, Cutaneous immune system and mucosal immune system
- Pathways and mechanisms of lymphocyte recirculation and homing: Recirculation of naïve T lymphocytes and B lymphocytes, Cell adhesion molecules & Migration of lymphocytes to sites of inflammation
- Evolution of immunity

**Unit: Molecular Immunology**

- Molecules of the immune system:
  - Acute phase proteins: C-reactive protein, serum amyloid A, fibrinogen, mannose-binding protein and complement components
  - Cytokines: Properties of cytokines, cytokine receptors, cytokine antagonists, secretion, cytokine network, cytokine-related diseases & therapeutic uses
  - The complement system: Functions of complement, components, regulation of complement system, biological sequences and deficiencies
- Antigens: Immunogenicity vs antigenicity, Factors that influence immunogenicity, haptens and pattern recognition receptors
- Immunoglobulins: Structure & function, Organization and expression of immunoglobulin genes, Monoclonal antibodies, Antibody cloning and engineering
- The Major Histocompatibility Complex: The general organization and inheritance, MHC molecules and genes, Genomic map of MHC genes and MHC and disease susceptibility
- T-cell Receptors and accessory membrane molecules, Antigen processing and presentation

**Unit 3: The Immune Response**

- Innate immunity: Innate immune response, features and components of the innate immune system; barriers; anatomic, physiologic, phagocytic & inflammatory, circulating effector cells, circulating effector proteins and cytokines
- Inflammatory response, mediators of inflammation, Role of innate immunity in local and systemic defense against microbes and Role of innate immunity in stimulating adaptive immune responses
- Adaptive immunity
  - T-cell maturation, activation and differentiation; B-cell generation, activation and differentiation, Regulation of B-cell development & immune effector functions and Immunological tolerance of lymphocytes
  - Effector mechanisms of Cell-Mediated immunity
  - Effector mechanisms of Humoral immunity
  - Collaboration between innate & adaptive immunity and Regulation of the immune effector response

**Unit 4: Antigen-Antibody interactions: Principles and Applications  
And Immunological techniques**

- Antibody affinity and avidity, Cross reactivity, Immunoassays & immunodiagnosis
- Antigen-Antibody interactions: Precipitation reactions, Agglutination reactions, Radioimmunoassay, ELISA, Western blotting, Immunoprecipitation, Immunofluorescence
- Identification of cell populations: Flow cytometry & fluorescence, Immunohistochemistry, Immunoelectronmicroscopy
- Isolation of cell populations: Fluorescent activated cell sorting (FACS), density-dependent centrifugations, panning
- Functional assays: Complement activity, phagocytic assay, lymphocyte proliferation, cytotoxicity, Assays for antibody and cytokine production

**Other topics:** Philosophy of Science, Research Methodology & Biostatistics, Ethical, Legal and Social Implications of Science, Introduction to Information Technology

## **Semester 2.**

### **Unit 5: Immunopathology (Immune disorders)**

- Autoimmune diseases: Spectrum of autoimmune diseases, Organ-specific and systemic autoimmune diseases, genetic factors and pathogenesis, animal models, aetiology, mechanisms of induction of autoimmunity and therapeutic approaches
- Immunodeficiencies: Primary immunodeficiencies: Lymphoid immunodeficiencies, immuno-deficiency of myeloid lineage, defects in complement proteins, experimental models of immunodeficiencies, AIDS and other acquired or secondary immunodeficiencies
- Hypersensitivity: IgE-mediated (Type I) hypersensitivity, Antibody-mediated (Type II) hypersensitivity, Immune complex-mediated (Type III) hypersensitivity and Type IV or delayed-type hypersensitivity (DTH)

### **Unit 6: Immunity in Defense and Disease**

- Immune mechanisms induced by microbes:
  - Immunity to extracellular and intracellular bacteria; mechanisms of immunity related to bacterial surface structures, First and second line defenses, antigen specific protective mechanisms
  - Immunity to viruses; innate immune responses, host defense involving B and T cells, strategies for evading immune defenses, immunopathology
  - Immunity to fungi
- Immunity to parasites (protozoans & nematodes); Features of parasitic infections, effector mechanisms, role of T cells in development of immunity, escape mechanisms, immunopathological consequences, Emerging infectious diseases
- Immunity to tumours; tumor antigens, immune response to tumors, evasion of immune response by tumors, immunotherapy for tumors

### **Unit 7: Immunomodulation**

- Immunotherapy
- Vaccinology: Principles of vaccinology; active and passive immunization, Designing vaccines for active immunization: whole-organism vaccines, different types of antigens used as vaccines, purified macromolecules, recombinant vector vaccines, DNA vaccines and multivalent subunit vaccines
- Safety and effectiveness of vaccines; vaccines of the future
- Immunization programmes, Combination vaccines and Regulatory mechanisms in Sri Lanka
- Global vaccine initiative and Elimination programmes in Sri Lanka

## **OPTIONAL UNITS**

### **Optional Unit 1: Recombinant DNA Technology**

- Structure of DNA, Structure of genes, Extraction of DNA, DNA manipulation enzymes and their applications, Restriction Endonucleases and their applications, DNA sequencing and Polymerase Chain Reaction (PCR)
- DNA cloning: Construction of genomic DNA libraries; Construction of cDNA libraries: isolation of mRNA, synthesis of cDNA and cloning of cDNA; screening of libraries; cloning DNA fragments into plasmid vectors; Genetic transformation and gene expression in prokaryotic & eukaryotic cells

### **Optional Unit 2: Cancer Immunology**

- Cancer: origin and terminology & malignant transformation of cells, Tumors of the immune system, Immune response to tumors, Tumor evasion of the immune system, Tumor antigens & markers, Oncogenes and cancer genetics, Cancer immunotherapy, Cancer Epidemiology, Therapies available in Sri Lanka, Current diagnostics & Research needs

### **Special topics**

- Philosophy of Science
- Research Methodology & Biostatistics
- Introduction to Information Technology and Bioinformatics
- Ethical, Legal and Social Implications of Science

## **List of Faculty for MSc- Cellular & Molecular Immunology**

### **Core Units**

Prof Anura Weerasinghe  
 Dr Enoka Corea  
 Dr Dharshan de Silva  
 Dr Rajiva de Silva  
 Dr Nishali Ekanayake  
 Dr Samitha Ginige  
 Dr Sepali Gunawardena  
 Dr Shiroma Handunnetti  
 Dr Janaka Munasinghe  
 Dr Sisira Pathirana  
 Dr Preethi Perera  
 Dr Preethi Randeniya  
 Dr Omala Wimalaratne

### **Optional units**

Prof E H Karunanayake  
 Prof K H Tennekoon  
 Dr Baddhika Jayaratne  
 Dr Damayanthi Pieris  
 Dr Saroja Siriwardena