

Semester V

Paper No- 14: Immunobiology

Marks: 150

The immune system distinguishes between self and foreign molecules and thus alerts and mediates protection against attack by potentially infectious organisms. Malfunctioning of the immune system leads to a number of disorders and diseases. Immunobiology is a comprehensive study of the organization and functioning of the immune system with its network of cells and molecules. Understanding the biology of the immune system is, therefore, key to developing strategies towards prevention and cure to a number of disorders and diseases that result due to interference in the functioning and regulation of the immune system. This paper covers the structure, organization, function and regulation of and by the immune system keeping the above aspects in mind.

THEORY

Total Lectures: 48

Unit I: Introduction (Chapter 1 and 3: Kuby)

(2 Lectures)

Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response.

Unit II: Structure, properties and functions of the immune system (Chapter 2 and 7: Kuby)

(10 Lectures)

- (a) Hematopoiesis, T and B lymphocyte, NK cells, monocytes and macrophages; neutrophils, eosinophils, basophils, mast cells and dendritic cells; thymus and bone marrow; lymph nodes, spleen, MALT, GALT and SALT; pattern recognition receptors.
- (b) Mechanisms of pathogen killing by macrophages and neutrophils.
- (c) Complement system: Components of the complement activation classical, alternative and lectin pathways; biological consequence of complement activation, methods to study complement fixation.
- (d) Inflammation

Unit III: Adaptive immune response (Chapter 4, 8, 10, 11, and 12: Kuby)

(20 Lectures)

- (a) Antigens and haptens: Properties (foreignness, molecular size, heterogeneity); B and T cell epitopes; T dependent and T independent antigens.
- (b) Major Histocompatibility Complex: Organization of MHC and inheritance in humans; concepts of polygeny and polymorphism with respect to MHC.
- (c) Antigen presenting cells, antigen processing and presentation pathway (cytosolic and endocytic), MLRs.
- (d) Humoral immune response: Concepts of B cell development in bone marrow, generation of plasma cells and memory B cells in lymphoid organs. Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes and subclasses and biological activities of antibodies; concepts of antibody diversity and class

switching. (isotype, allotype and idiotype); transport of IgA, Hybridoma technology, monoclonal antibodies; basic concepts of abzymes, immunotoxin, chimera, hybrid antibodies, antigen-antibody interactions.

(e) Cell mediated immune response: T cell maturation in thymus, thymic selection, self MHC restriction of T cells, T cell receptor complex. T cell sub-types and their effector function. Trimolecular complex formation between APC and Naïve T cells, clonal expansion. Cytokines properties and functions of Interferon and Interleukins (IL1, IL2, IL4).

Unit IV: Immunological principles of various reactions and techniques (8 Lectures)
(Chapter 6: Kuby)

Affinity and avidity, cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA (indirect, sandwich, competitive, chemiluminescence, and ELISPOT assay), western blotting, immunofluorescence, flow cytometry and fluorescence, and immunoelectron microscopy.

Unit V: Vaccines and Immunotherapeutics (4 Lectures)
(Chapter 19: Kuby)

Types and their characteristics, adjuvants, overview of National Immunization Course.

Unit VI: Dysfunctions of immune system (4 Lectures)
(Chapter 15 and 16: Kuby)

Types of hypersensitivity, overview of autoimmunity. Immunodeficiency disorders: Animal models of primary immunodeficiency (nude mouse and SCID mouse); specific impaired functions in lymphoid and myeloid lineage.

PRACTICALS

1. To perform immunodiffusion by Ouchterlony method.
2. Immunodiffusion by Mancini method
3. Analysis of the ouchterlony and Mancini method
4. To perform ELISA checkerboard experiment.
5. To perform Complement fixation assay
6. To perform Agglutination inhibition Assay
7. To perform sandwich ELISA.
8. To perform Widal test.

ESSENTIAL BOOKS

1. Immunology, 6th edition, (2006), J. Kuby et al, W.H. Freeman and Company, New York.

SUGGESTED READINGS

1. Microbiology, 7th edition, (2008), Prescott, L., John Li Harley, Donald A. Klein, McGraw Hill.
2. Roitt's Essential Immunology, 12th edition, (2011), Wiley-Blackwell Science.
3. Immunology, 8th edition, (2012), Male, D., Brostoff, J., Roth, D.B. and Roitt, I., Elsevier-Sanders.
4. An Introduction to Immunology, Immunochemistry and Immunobiology, 5th edition, (1988), Barrett, James T., Mosby Company, St. Louis.
5. Immunology: An Introduction, 4th edition, (1994), Tizard, I.R., Saunders College Publishing, Philadelphia.