

Veterinary Immunology (MVSc Programme)

Course contents

VIM601/VMC606 **Principles of Immunology** **2+1** **Sem. I**

Objective

To impart knowledge about fundamental principles of immunology and its applications in various fields.

Theory

UNIT-I: History of immunology, immunity types, cardinal features, phylogeny. Vertebrate immune system: lymphoid organs and tissues; development of B and T lymphocyte repertoires and other leukocytes, differentiation markers and other distinguishing characters of leukocytes; lymphoid cells trafficking.

UNIT-II: Antigens: fundamental features, types, factors affecting immunogenicity, adjuvants. Antibodies: structure, functions and classification; theories of antibody production; immunoglobulin genes and genetic basis of antibody diversity. Complement system: activation pathways and biological activities.

UNIT-III: Major histocompatibility complex: structure, functions and gene organization. T lymphocyte subsets. Antigen-specific T cell receptors: structure, gene organization and genetic basis of diversity. Immune response development: phases of humoral and cell mediated immune response development, cellular interactions, properties and classification of various cytokines, immunoregulation.

UNIT-IV: Immunity against veterinary infectious agents, immunological surveillance and cancer immunity, immunological tolerance, its breakdown and autoimmunity, immuno-deficiencies: types and examples, hypersensitivity: classification, mechanisms of induction and examples.

Practical

Preparation of antigens for laboratory animals immunization, production, collection and preservation of antisera; quantitation of immunoglobulins and antisera by zinc sulphate turbidity and single radial immunodiffusion: examination of lymphoid organs of animals: tests for *in vivo* and *in vitro* phagocytosis; separation and counting of peripheral blood lymphocytes; separation and concentration of immunoglobulin by ammonium sulphate precipitation and dialysis; demonstration of antigen- antibody interactions and serological tests such as agar gel precipitation, immunoelectrophoresis, bacterial agglutination, direct and passive hemagglutination, latex agglutination, complement fixation, enzyme-linked immunosorbent assay, immunoblotting.

Suggested Readings

Kindt TJ, Goldsby RA & Osborne BA. 2007. Kuby Immunology. 6th Ed. WH Freeman.

Male D, Brostoff J, Roth DB & Roitts I. 2007. Immunology. 7th Ed. Mosby/Elsevier.

Tizard IR. 2004. Veterinary Immunology: An Introduction. 7th Ed. Saunders/Elsevier.

VIM-602 **Immunochemistry** **2+1** **Sem. I**

Objective: To impart knowledge about structure and functions of molecules of the immune system

To impart knowledge about structure and function of molecules of the immune system

Theory

UNIT-I: Introduction to molecules of the immune system; innate immune system molecules: toll-like receptors, complement and others; adaptive immunity molecules: Immunoglobulins and T cell receptors.

UNIT-II: Immunoglobulins: relationship between structure and function, phylogeny, normal profiles in neonates and adult animals; allotypes of rabbit, chicken, bovine and other species; idiotypes: role in immunoregulation and use as vaccines; immunoglobulins of domestic animals; monoclonal antibodies and their uses; recombinant antibodies.

UNIT-III: Antigens: proteins, polysaccharides, lipids, nucleic acid, hormones. Toll-like receptors and their ligands; vaccinal antigens; manipulation of antigenic determinants; modern immunomodulators: molecular structure, mode of action.

UNIT-IV: Complement system with special reference to domestic animals: classical, alternate and lectin pathways of activation. Cytokines: classification, structure and functions.

Practical

Purification of immunoglobulins: demonstration of salt precipitation, gel filtration and ion exchange chromatography, monitoring of purity with gel diffusion, immunoelectrophoresis and SDS-PAGE, Preparation of immunoadsorbents and antigens. Immunofluorescence. Enzyme linked immunoassay. Quantitation of haemolytic complement activity in sera.

Suggested reading

Kindt TJ, Goldsby RA & Osborne BA. 2007. Kuby Immunology. 6th Ed. WH Freeman.

Male D, Brostoff J, Roth DB & Roitts I. 2007. Immunology. 7th Ed. Mosby Elsevier.

Tizard IR. 2004. Veterinary Immunology: An Introduction. 7th Ed. Saunders/Elsevier.

VIM-603

Immunobiology

2+1

Sem. I

Objective: To impart knowledge about immune system cells and their interactions for immune responses and immunoregulation

Theory

UNIT-I: Lymphoid organs of domestic animals, development of immune cells and apoptosis. Lymphocyte traffic in mice, sheep, pig and cattle. Innate immune system & its link to adaptive immune system

UNIT-II: Subsets of lymphocytes and leukocyte differentiation antigens of man and animals. T-cell antigen receptors. Phagocytes and antigen presenting cells.

UNIT-III: Lymphocyte activation, Antigen presentation, immunoregulation. Cellular interactions in the immune response, cytokines, MHC restriction, NK cells, Tregs and Immunological tolerance.

UNIT-IV: Immunology of reproduction, transplantation immunology, mucosal immunity and immunity of bovine mammary glands.

Practical

Lymphoid organs of calf; thymectomy, bursectomy, skin grafting and rejection, graft versus host reactions. Tests for cell mediated immune response: macrophage and leukocyte migration inhibition assays, cytotoxicity assay, lymphocyte transformation, contact sensitivity test, *in vitro* phagocytosis, ELISPOT assay for cell enumeration.

Suggested Reading

Elgert, KD. 2009. Immunology. 2nd Ed. Wiley-Blackwell Publishers

Tizard IR. 2004. Veterinary Immunology: An Introduction, 7th Ed. Saunders/Elsevier.

Ezekowitz, RAB and Hoffmann, JA. 2003. Innate Immunity. Humana Press.

UNIT-I: Introduction and historical development. Host-parasite relationship. Mechanisms of immunity in infectious diseases. T cells, B cells, NK cells, Macrophages. Complement, ADCC, MHC, etc. in relation to infectious diseases.

UNIT-II: Immunobiology of major viral, bacterial and fungal diseases of animals. Types of vaccines in infectious diseases and current trends in vaccine development.

Practical

Antibody levels in infected and vaccinated animals, lymphocyte proliferation assay, ELISPOT assay for cell enumeration, primary and secondary immune response curves, pathogen challenge of vaccinated animals.

Suggested Reading

Sell, S. 2001. Immunology, Immunopathology and Immunity. ASM Press.

Pier, GB *et al.* 2004. Immunology, Infection and Immunity. ASM Press.

VIM-607

Vaccinology

2+0

Sem. II

Objective: To understand science and practice of vaccines for prevention of infectious and non-infectious diseases.

Theory:

UNIT-I: History of veterinary vaccinology. Vaccines: classification, comparison of major types. Components of various types of vaccines: immunogens, adjuvants stabilizers, preservatives, vehicles. Vaccine qualities: definitions and methods of testing. Vaccine development: cost effectiveness of preventive immunization programmes, stages of development, clinical trials and regulatory requirements.

UNIT-II: Traditional vaccines: inactivated, attenuated and toxoid vaccines. Methods of construction of traditional vaccines: microbial cultures, embryonated eggs, cell culture; Seed-lots of vaccine organisms. Methods of inactivation and attenuation of pathogens.

UNIT-III: Modern vaccines: nucleic acids, vectored vaccines, recombinant expressed immunogens, synthetic peptides, marker vaccines, etc. Combination/multivalent vaccines. Novel immunomodulators and delivery systems. Modern methods of vaccine construction: methods based on synthetic chemistry and rDNA technology.

UNIT-IV: Vaccine formulation: pharmacopeial requirements. Vaccine stability and preservation: cold chain. Immunization schedules of veterinary vaccines, logistic problems and vaccination failure. Strategies of diseases control and eradication by vaccination.

Suggested Reading:

Dodds WJ, Schulz R. (Eds). 1999. Veterinary Vaccines and Diagnostics. Vol. 41 (Advances in Veterinary Medicine) 1st Ed. Academic Press.

Levine MM, Kaper JB, Rappuoli R, Liu MA & Good MF. 2004. New Generation Vaccines. 3rd Ed. Marcel-Dekker.

Pastoret PP, Blancou J, Vannier C &Verschueren C. 1997. Veterinary Vaccinology Elsevier.

VIM- 608

Techniques in Immunology

0+3

Sem. II

Objective: To impart technical skills for handling immune system cells and molecules, and their applications in diverse fields

Theory

Objective: To impart knowledge about clinical conditions involving immune responses and immune system

Theory

UNIT-I: Hypersensitivity reactions in domestic animals: types, induction, diagnosis, prevention and treatment. Transplantation immunology: graft rejection, graft versus host and host versus graft reactions

UNIT-II: Autoimmune diseases: mechanisms of induction of autoimmune responses, classification, diagnosis, prevention and management and treatment of autoimmune diseases of domestic animals.

UNIT-III: Immunodeficiency diseases: types, clinical signs & symptoms, diagnosis and management of immunodeficiency disorders in domestic animals.

UNIT-IV: Immune system cancers, immunotherapy of cancers, congenital defects in immune system.

Practical

Detection of IgE and immune complexes in sera samples, delayed type hypersensitivity in laboratory animals, contact hypersensitivity, examination of clinical cases.

Suggested Reading

Sheehan, C. 1997. Clinical Immunology, 2nd Ed. Lippincott Publishers.

Samster, M *et al.* 1988. Immunological diseases, 4th Ed. Little Brown & Co.

Valli, VE. 2007. Veterinary Comparative Hematopathology. Blackwell Publishing.

Detrick B & Hamilton RG. (Eds). 2006. Manual of Molecular and Clinical Laboratory Immunology. 7th Ed. American Society for Microbiology.

List of Journals: as included under Veterinary Microbiology

E-Resources: as included under Veterinary Microbiology

Suggested broad topics for Master's and PhD research:

- Understanding basic immune mechanisms of domestic animals
- Identification and characterization of antigens of infectious agents, including parasites of domestic animals
- Roles of cytokines and chemokines in domestic animals
- Hybridoma & phage display technologies for monoclonal and recombinant antibody production
- Development of modern immunodiagnostic tests for infectious and non-infectious diseases
- Development of modern vaccines, delivery systems and adjuvants
- Immunological interventions in management of allergies, cancers, autoimmune and immunodeficiency diseases in domestic animals