NATS 3001 ADVANCED IMMUNOLOGY

Credit Points 10

Legacy Code 300905

Coordinator Graham Jones (https://directory.westernsydney.edu.au/search/name/Graham Jones/)

Description The human immune system is a milieu of cells, cytokines, chemokines, growth factors and cell adhesion molecules which form an elaborate molecular communication network through a number of signalling networks and molecules. The relevance of this knowledge for understanding the pathology and specific diseases of the human immune system are emphasised through the subject. This subject also provides an in depth analysis of the molecular mechanisms of cell to cell communication, cell activation, the immunological synapse, transplant rejection (including adoptive transfer experimentation), antigen presentation, B and T cell recruitment and MHC restriction. Medical and diagnostic applications of hybridoma technology, antibody engineering and advances in vaccine development are discussed. The laboratory course will develop technical and interpretative skills in relevant techniques, in particular the ImmunoCAP technology for asthma and allergy diagnosis.

School Science

Discipline Medical Science

Student Contribution Band HECS Band 2 10cp

Check your fees via the Fees (https://www.westernsydney.edu.au/currentstudents/current_students/fees/) page.

Level Undergraduate Level 3 subject

Pre-requisite(s) BIOS 2014

Equivalent Subjects NATS 3033 - Molecular Biological of the Immune System

Learning Outcomes

On successful completion of this subject, students should be able to:

1. Describe the structures and roles of key molecules in the immune response, including antibodies, complement, B and T cell receptors, MHC molecules and cytokines.
2. Explain the events involved in B and T cell receptor gene rearrangements, the generation of antibody diversity and class switching.
3. Explain the role of MHC genes in generating histocompatability.
4. Discuss current knowledge about the molecular basis of the immune response, including the roles of cytokines and cell signalling pathways for both humoral and cell-mediated responses.
5. Analyse the roles of the humoral and cell-mediated responses in dealing with different types of infection and explain the interrelationships between these two arms of the immune system.
6. Explain the applications of this knowledge for the production and use of monoclonal antibodies, the engineering of antibodies, and the development of new therapeutics and immunodiagnostic assays.
7. Demonstrate an understanding of advances in vaccine development, including protein and DNA vaccines, and the issues which relate to successful vaccine design.
8. Present, organise and interpret experimental data in concise written English.
9. Explain and apply principles relating to immunological and immunochemical methodologies for the design and conduct of effective diagnostic and research procedures.
10. Access and analyse relevant scientific journal papers.
11. Present a written critique of an assigned topic.
12. Conduct qualitative and quantitative laboratory techniques involving antibodies and understand their applications.

Subject Content

1. Overview of the immune system ? immunoglobulins, cytokines, receptors, CD molecules; cell types and tissues; innate and humoral immunity.
2. Antibodies ? role as adaptor molecules; immunoglobulin structure and properties; immunoglobulin classes ? characteristics and separate roles; immunoglobulin super-gene family.
3. Characteristics of antigen-antibody binding.
4. Complement activation by immune complexes.
5. Structure and role of Fc receptors in phagocytosis of immune complexes.
6. Structure of B-cell receptors.
7. Generation of diversity in B-cell receptors and antibodies - Light and Heavy chain gene rearrangements; class switching of antibodies ? genetic mechanism; affinity maturation of antibodies - mechanism. Relationship to B-cell differentiation. Role of cytokines.
8. B-cell co-receptor structure and signalling mechanism.
9. Major Histocompatability Complex - Class 1 and 2 MHC, molecules: structure, function, location; MHC genes and alleles; role in histocompatability.
10. T cell receptor and co-receptor structures and roles; activation and signalling mechanism. Roles of CD4 and CD8.
11. T cell receptor gene rearrangements and their relevance. Self-tolerance.
12. Antigen processing in B-cells - exogenous antigen processing pathway, activation of B cells and presentation to T cells for a humoral response. Endogenous antigen processing pathway, activation of TH and Tc cells, generation of Cytotoxic T Cells and their action. Role of cytokines.
13. Immunotechnologies ? production and applications of monoclonal antibodies vs polyclonal antisera; diagnostic and therapeutic techniques using antibodies e.g. ELISA, immunotoxins; antibody engineering and its applications.
14. Vaccines ? viral, protein and DNA vaccines; design, development and difficulties e.g. malaria, HIV vaccines.
15. Molecular basis of diseases involving the immune system ? hypersensitive reactions e.g. allergy; autoimmune diseases; cancer and the immune system.
16. Laboratory skills in antibody-based techniques, their applications and interpretation e.g. precipitin-based analyses; ELISA; Western blotting, ImmunoCAP.

Assessment

The following table summarises the standard assessment tasks for this subject. Please note this is a guide only. Assessment tasks are regularly updated, where there is a difference your Learning Guide takes precedence.

Type	Length	Percent	Threshold	Individual/ Group Task
Innate Immunity and Infection: the inflammasome	2000 words	40	N	Individual

Monoclonal Antibodies and Immune Therapy	15 minutes	30	N	Group
Critical Analysis "A tale of two vaccines"	2000 words	30	N	Individual

Prescribed Texts

- Owen, JA, Punt, J, Stranford, SA & Jones, PP 2013, Kuby immunology, 7th edn, W.H. Freeman, New York.
- Or, Murphy, K, Travers, P & Walport, M 2012, Janeway's immunobiology, 8th edn, Garland Science, New York.
- Williams, AE 2011, Immunology: mucosal and body surface defences, Wiley, New York, Proquest eBook Central database.