

BIOL09047
Applied Immunology, Immunotherapeutics &
Vaccine Technology

Full Title	Applied Immunology, Immunotherapeutics & Vaccine Technology		
Status	Uploaded to Banner	Start Term	2020
NFQ Level	09	ECTS Credits	05
Module Code	BIOL09047	Duration	Semester - (13 Weeks)
Grading Mode	Numeric	Department	Physical & Life Sciences
Module Author	Teresa Hanley		
Co Authors	Teresa Kenirons		

Module Description

This module reviews key aspects of the adaptive and innate immune responses. It addresses the response elicited following challenge with antigenic molecules (naturally & artificially) and the key cells and molecules involved. It describes the specific structure of immunoglobulins and their structure function relationships. The development of polyclonal and monoclonal antibodies is discussed along with the manipulation and engineering of antibodies as biotherapeutic agents. The various traditional and modern approaches to the development of vaccines are evaluated. Case studies are used to demonstrate the effectiveness of vaccines in treating infectious disease.

Learning Outcomes

On completion of this module the learner will/should be able to:

- Evaluate the respective roles of both the innate and adaptive immune responses *in vivo* and critically evaluate the exploitation of the adaptive immune response to produce antibodies.
- Give a detailed description of antibody structure, analyse the structure/function relationship and discuss key modifications that affect immunogenicity, affinity and potency of antibodies as therapeutic molecules.
- Develop a strategy and design an experimental approach to produce and characterise a polyclonal antibody.
- Analyse the development of monoclonal antibodies from murine to humanised molecules, critically evaluate their effectiveness as therapeutic agents and effectiveness of more advanced formats including bispecifics and chimeric antigen receptor (CAR)-T cells
- Articulate a clear understanding of the mechanisms underlying passive and active vaccination, critically evaluate the effectiveness of both traditional and modern vaccines, respectively, and discuss the challenges posed in the development and production of new vaccines.

Indicative Syllabus

1. Review of the Immune Responses:

The mammalian immune response

Pathogen recognition, Immune Tolerance, Innate and adaptive arms of the immune response

2. The cells, organs and microenvironment of the immune system

Haematopoiesis,

Lymphoid Organs

3. The Innate & Adaptive Immune Responses

Antigen recognition – receptors in innate and adaptive immunity

Communication – cytokines

The innate immune response

The adaptive immune response – B cell response, T cell response

4. Antibody Structure and function

Review of basic structure of IgG.

Immunoglobulin fine structure

Antibody-mediated effector functions

Antibody classes and biological activities

5. Antibodies, their Preparation and Use:

Antigenicity and Immunogenicity.

Factors affecting Immunogenicity.

Polyclonal Antibodies.

How to generate a monoclonal antibody (mAb), main features & characteristics?

From murine to human mAb.

Characterisation of Mab.

Bispecific antibodies

6. Other Immunotherapeutics

Car-T cell therapy

7. Vaccines:

Active vs passive immunisation, Designing vaccines: whole organisms, purified macromolecules, recombinant vectors, DNA vaccines, multivalent Subunit vaccines. Case studies on the development of vaccines for Tuberculosis, Influenza, ebola virus disease, Covid 19. Production of vaccines.

Teaching and Learning Strategy

Online lectures, tutorials and individual and group assignments.

Assessment Strategy

Written examination, on-going continuous assessment

Repeat Assessment Strategies

Written examination and/or assignment

Indicative Coursework and Continuous Assessment:		50 %		
Form	Title	Percent	Week (Indicative)	Learning Outcomes
Group Project	Assignment	20 %	Week 8	1,2,3
Essay	Assessment	30 %	Week 12	4

End of Semester / Year Formal Exam:		50 %		
Form	Title	Percent	Week (Indicative)	Learning Outcomes
Open Book Exam	Final Examination	50 %	End of Semester	1,2,3,4,5

Blended Delivery Mode Average Weekly Workload:			3.00 Hours		
Type	Description	Location	Hours	Frequency	Weekly Avg
Lecture	Lecture (Online)	Not Specified	2	Weekly	2.00
Online Learning	Discussion Group (Online)	Not Specified	1	Weekly	1.00

Required Reading Book List

Jenni, S., (2018). *Kuby Immunology*. 8th Edition. W.H.Freeman & Co Ltd.

Journal Resources

Ruei-Min Lu, Yu-Chyi Hwang, I-Ju Liu, Chi-Chiu Lee, Han-Zen Tsai, Hsin-Jung Li & Han-Chung Wu (2020) Journal of Biomedical Science Vol 27 No 1. Review: Development of Therapeutic Antibodies for the Treatment of Disease.

Krishnamurthy, A. & Jimeno, A. (2018) Bispecific Antibodies for Cancer Therapy: A Review. (2018) Pharmacology & Therapeutics Vol 185 pages 122-134.

Singh, S. et al. (2018) Monoclonal Antibodies: A Review. Current Clinical Pharmacology. Vol 13 No. 2 pages 85 - 99

Holzinger, A., Barden, M. & Abken, H. (2016) The Growing World of CAR T Cell Trials: A Systematic Review. Cancer Immunology Immunotherapy Vol 65 pp 1433 - 1450

Programme Membership

GA_SADVG_O09 202000 Postgraduate Diploma in Science in Advanced Biopharmaceutical Science