

Macao Polytechnic Institute

School of Health Sciences and Sports

Bachelor of Science in Biomedical Technology (Medical Laboratory Technology and Pharmacy Technology)

Module Outline

Academic Year 2021 / 2022 Semester 1

Learning Module	Cell Biology			Class Code	BSCB1101
Pre-requisite(s)	Nil				
Medium of Instruction	Chinese & English			Credit	3
Lecture Hours	35 hrs	Lab/Practice Hours	10 hrs	Total Hours	45 hrs
Instructor	Lei Iun Fan, Miriam		E-mail	iflei@ipm.edu.mo	
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Description

This is a three-credit fundamental learning module for the biomedical technology students. The fundamental unit of life is the cell; therefore, cell biology forms the base upon which all modern biology and medicine is built. This course will emphasize the study of eukaryotic cell structure and function, including bioenergetics, membrane transport, cellular communication, flow of genetic information and cell division. Experimental techniques used in understanding cell biology will be discussed along with the cellular basis.

Learning Outcomes

After completing the learning module, students will be able to:

1. Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Describe the molecular basis of various cellular processes.
3. Understand how these cellular components are used to generate and utilize energy in cells
4. Understand the cellular components underlying mitotic cell division.
5. Discuss how our understanding of cell biology has resulted in medical advances, and discuss current biomedical issues in a cellular context.
6. Carry out a range of laboratory exercises, demonstrating the various cell types under microscopy.

Content

1. Introduction (3 class hours)
 - 1.1 History of cell biology
 - 1.2 Unit & diversity of cell
 - 1.3 Cell theory
 - 1.4 Tools of cell biology
 - 1.5 Cell components
 - 1.6 Viruses

2. Subcellular organization of cells (3 class hours)
 - 2.1 Organelles of the prokaryotic cell
 - 2.2 Organelles of the eukaryotic cell

3. Plasma membranes (6 class hours)
 - 3.1 Membrane composition and structure
 - 3.2 Plasma membrane model
 - 3.3 Properties
 - 3.4 Cell junction & cell adhesion
 - 3.5 Extracellular matrix
 - 3.6 Membrane Transport
 - 3.7 Cell signaling and communications

4. Ribosome: From DNA to Protein (2 class hours)
 - 4.1 The genetic code & central dogma
 - 4.2 Transcription
 - 4.3 Translation: protein synthesis
 - 4.4 Post-translational events
 - 4.5 Mutations

5. Endomembrane system (2 class hours)
 - 5.1 Protein sorting
 - 5.2 Protein secretion
 - 5.2.1 Signal peptide hypothesis
 - 5.3 Post-translational modifications
 - 5.4 Lysosome
 - 5.5 Other internal membrane-bound organelles

6. Cellular energetics (6 class hours)
 - 6.1 Mitochondria
 - 6.1.1 Aerobic respiration

- 6.1.2 Glycolysis and Citric acid cycle
- 6.1.3 Electron transport and oxidative phosphorylation
- 6.1.4 Fermentation
- 6.1.5 Chemiosmosis
- 6.1.6 Endosymbiosis theory
- 6.2 Chloroplast
 - 6.2.1 Identifying photosynthetic reactants and products
 - 6.2.2 Overview of photosynthesis
 - 6.2.3 Photorespiration
 - 6.2.4 C4 and CAM pathways
- 7. Cytoskeleton (5 class hours)
 - 7.1 Microfilaments
 - 7.1.1 Dynamics of actin
 - 7.1.2 Myosin
 - 7.1.3 Muscle cell
 - 7.1.4 Non-muscle cell
 - 7.1.5 Cell locomotion
 - 7.2 Microtubules
 - 7.2.1 Structure
 - 7.2.2 Microtubule dynamics and associated proteins
 - 7.2.3 Kinesin, Dynein and intracellular transport
 - 7.2.4 Cilia and flagella
 - 7.2.5 During mitosis
 - 7.3 Intermediate filaments
 - 7.3.1 Functions and types
- 8. Cell nucleus (4 class hours)
 - 8.1 Nuclear membrane
 - 8.2 Chromatin & chromosomes
 - 8.3 Nucleolus
 - 8.4 Cell cycle
 - 8.5 Cell division: mitosis and meiosis
 - 8.6 Cytokinesis
 - 8.7 Cell aging & apoptosis
 - 8.8 Apoptosis vs necrosis
 - 8.9 Mutations and genetic diseases
- 9. Test and Final exam (4 class hours)

Laboratory Practice 1

10. Cauliflower cloning (2 class hours)

- 10.1 Experience in and be able to perform techniques employed in primary cell culture.

Laboratory Practice 2

11. Plant cell (2 class hours)

- 11.1 Free hand sectioning

- 11.2 Wet mount

- 11.3 Simple stain

- 11.3.1 Demonstrate laboratory skills in both staining and microscopy method.

Laboratory Practice 3

12. Animal cell (2 class hours)

- 12.1 Permanent slide

- 12.2 Wet mount

- 12.3 Simple stain

- 12.3.1 Demonstrate laboratory skills in both staining and microscopy method.

Laboratory Practice 4

13. Cell division – mitosis & meiosis (4 class hours)

- 13.1 Fixation, stain, squash method

- 13.1.1 Demonstrate laboratory skills in both staining and microscopy method.

- 13.1.2 Identify the main stages of mitosis and meiosis.

Teaching Method

Lectures, videos, practical classes and discussion.

Attendance

Attendance requirements are governed by the “Academic Regulations Governing Bachelor’s degree programmes of Macao Polytechnic Institute”. Students are not eligible to attend the final examination and re-sit examination, moreover, an “F” will be given as the final grade to students who have less than the stated attendance for the enrolled learning module.

Assessment

This learning module is graded on a 100 point scale, with 100 being the highest possible score and 50 being the passing score. Any students scoring less than 35% of the total mark in the final examination will be given an “F” grade for the course even if the overall grade is 50% or higher.

	Item	Description	Percentage
1	Assignments	Homework	10 %
2	Lab	Lab Practice	20 %
3	Mid exam	Chapter 1-6	30 %
4	Final exam	Chapter 7-12	40 %
		Total Percentage:	100 %

Teaching Material(s)

Textbook(s)

1. Bruce Alberts, Karen Hopkin, Alexander D. Johnson, David Morgan, Martin Raff, Keith Roberts, Peter Walter (2018) Essential cell biology, 5th edition, Garland Science

Reference

Reference book(s)

1. Alberts, Bruce (2014) Molecular Biology of the cell, 6th edition, Garland Science
2. Cooper, G.M. and Hausman, R.E. (2019). The Cell: A Molecular Approach 8th ed. New York, NY: Oxford University Press.
3. Lodish H, Berk A, Zipursky SL, et al (2021) Molecular Cell Biology 9th edition. New York: W. H. Freeman
4. Gerald Karp (2018) Cell biology 8th ed., international student version John Wiley & Sons, Inc.,c.
5. Jeff Hardin, Gregory Paul Bertoni, Lewis J. Kleinsmith (2020) Becker's World of the Cell 10th ed. Pearsons,
6. 翟中和、王喜忠、丁明孝 (2013) 細胞生物學 第四版 高等教育出版社
7. 丁明孝、王喜忠等 (2020) 細胞生物學 第五版 高等教育出版社

Journal(s)

Website(s)

Alberts, Bruce (2002) Molecular Biology of the cell, 4th edition, Garland Science

Available at <http://www.ncbi.nlm.nih.gov/>

Lodish H, Berk A, Zipursky SL, et al (2000) Molecular Cell Biology. 4th edition. New York: W. H. Freeman

Available at <http://www.ncbi.nlm.nih.gov/>