

**Macao Polytechnic Institute**  
**School of Health Sciences and Sports**  
**Bachelor of Science in Nursing**

**Module Outline**

**Academic Year 2021 / 2022 Semester 1**

<b>Learning Module</b>	Microbiology (微生物學)			<b>Class Code</b>	NMIC1101
<b>Pre-requisite(s)</b>	Nil				
<b>Medium of Instruction</b>	Chinese and English			<b>Credit</b>	3
<b>Lecture Hours</b>	11 hrs 13 hrs 13 hrs	<b>Practice/ Discussion Hours</b>	2 hrs 4 hrs 2 hrs	<b>Total Hours</b>	45 hrs
<b>Instructor</b>	PENG Yi Hong LAM Im Fong, Cristina XIANG Kuan Hui		<b>E-mail</b>	<a href="mailto:iflam@ipm.edu.mo">iflam@ipm.edu.mo</a>	
<b>Office</b>	Rm M706, Meng Tak Building, Main Campus		<b>Telephone</b>	85993432	

**Description**

This 45-hour learning module is one of the foundation subjects of the Nursing program. It will introduce basic principles in microbiology. Information regarding classification of microorganisms and characteristics base on analysis techniques. This learning module utilizes the theoretical approach to the study of microorganisms and offers the student a comprehensive knowledge of the fundamentals of microbiology. It includes practical techniques and discussion of handling microorganisms designed to complement lecture topics. It is necessary and useful for student who will applying to health professional program. It includes 37 lecture hours and 8 practical or discussion hours.

## **Learning Outcomes**

After completing this learning module, students are able to:

1. Master the fundamental characteristics and types of microorganisms, with an emphasis on health applications.
2. Understand the physiology, growth, reproduction and genetics of microorganisms.
3. Understand the processes through which microorganisms, including bacteria, viruses, fungi, protozoa and parasites cause key infectious diseases.
4. Master basic microorganism analysis techniques including microscopy, culture, aseptic techniques and microbiology laboratory safety.

## **Content**

### **Theory**

Part A: Lecturer: Peng Yi Hong

1. Introduction to medical microbiology ( 2 hours )
  - 1.1 The Scope of Microbiology:  
Define microbiology and microorganisms, and identify the major organisms included in the science of microbiology.
  - 1.2 The Historical Foundations of Microbiology:  
Outline the major events in the history of microbiology, including the major contributors to the early development of microscopy, medical advances, aseptic techniques, and the germ theory of disease. Explain the main features of the scientific method, and differentiate between inductive and deductive reasoning and between hypothesis and theory.
  - 1.3 Taxonomy:  
Organizing, Classifying, and Naming Microorganisms. Define taxonomy and its supporting terms classification, nomenclature, and identification. Describe the goals of nomenclature and how the binomial system is structured. Know how to correctly write a scientific name.
  - 1.4 Discussion ( 1 hour )
2. A survey of cells and microorganisms (2 hours )
  - 2.1 Major characteristics of prokaryotic cell:  
Describe the fundamental characteristics of cells. Describe the generalized anatomy of bacterial cells. Distinguish among the types of external cell appendages. Explain the concept of the cell and describe its structure.
  - 2.2 Major characteristics of eukaryotic cells:  
Describe the evolutionary history of eukaryotic cells. Provide a substantial theory regarding how eukaryotic cells originated and how multicellularity came to be. List the

eukaryotic groups and their body plans. Describe the plan of a basic eukaryotic cell and organelles, and indicate the structures all cells possess and those found only in some groups.

### 3. Microbial nutrition, metabolism and microbial growth ( 2 hours )

#### 3.1 Microbial metabolism:

Describe the major environmental factors to which microbes must adapt for survival

#### 3.2 Nutritional requirements:

Define nutrition and nutrients and their subcategories based on need and quantity.

Describe the main categories of nutritional types among organisms.

#### 3.3 Environmental conditions:

Describe the range of temperatures a microbe can function within. Explain the adaptive temperature groups, with examples of microbes that exist in them. List the major gases and describe microbial requirements for these gases. Outline the adaptations of microbial groups to variations in pH. Identify microbial adaptations to osmotic pressure.

#### 3.4 Biofilm:

Define growth and explain the process of binary fission. Describe the process of population growth and how it is measured. Explain the stages in the population growth curve and its practical importance.

#### 3.5 Discussion (1 hour )

### 4. Normal flora, Infection and disease ( 3 hours )

#### 4.1 Normal flora:

Describe some of the major interactions between humans and the microbes that share our habitats. Discuss the characteristics of the normal microbiota and the types of functions they serve. Briefly relate the sources and conditions that influence the development of microbiota in the major body systems. Identify which bodily sites remain free of living organisms, and explain why this is necessary.

#### 4.2 Etiology and classifying of infectious diseases:

Identify and define the terms associated with infectious diseases.

#### 4.3 Patterns of disease:

Describe the clinical stages of infection. Use correct terminology to explain the manifestations of infections and inflammation.

#### 4.4 Spread of infections:

Discuss the major portals of exit and how they influence the end stages of infection and disease. Differentiate between communicable and noncommunicable infectious diseases.

#### 4.5 Nosocomial infections:

Explain the primary methods of tracking infections and diseases in a population. Discuss important aspects of health-care-associated infections and their impact on patients in clinical settings. Explain what is meant by universal precautions, and discuss how they are implemented.

## 5. Microbial control ( 2 hours )

### 5.1 Terminology:

Summarize the major categories of microbial control and its purposes. Identify the targets of antimicrobial control agents, and explain what effects these agents have.

### 5.2 Physical methods:

List the major types of physical agents used in controlling microbes. Describe the basic effects of physical method on microbes.

### 5.3 Chemical methods:

Define the terms that are used to describe chemical control of microbes.

### 5.4 Microbial resistance to control agents:

Explain the desirable features of antimicrobial chemicals and what factors influence their effectiveness.

## Part B: Lecturer: Lam Im Fong

### 1 Innate & adaptive immunity ( 2 hours )

#### 1.1 Nonspecific Defenses mechanism:

Summarize the characteristics of basic host defenses. Differentiate between the three lines of defense. Explain the nature of the different types of innate, nonspecific defenses.

#### 1.2 Inflammation:

Describe the main events in the inflammatory reaction, and explain what is occurring in each. Describe the mechanism behind fever, and explain its beneficial and harmful effects.

#### 1.3 Specific defenses mechanism:

Summarize the general features of adaptive, acquired immunity. Define immunocompetence, antigens, specificity, and memory as they relate to the immune system. Outline the overall phases in a specific immune response.

#### 1.4 Vaccine:

Explain the purposes of immunotherapy and immunization. Describe the sources and uses of artificial passive immunization and artificial active immunization or vaccination. Discuss which factors are involved in vaccine development and new strategies for developing vaccines.

#### 1.5 Disorders in immunity:

Summarize the main categories of immunopathology and their medical consequences. Discuss the factors involved.

- 2 Bacterial diseases of the digestive system ( 2 hours )
  - 2.1 Structure and function of the digestive system:  
Name the structures of the digestive system that contact food.
  - 2.2 Normal flora of the digestive system:  
Identify parts of the gastrointestinal tract that normally have microbiota.
  - 2.3 Microbial disease of digestive system:  
Describe the events that lead to have disease of digestive system.
  - 2.4 Discussion (1 hour )
  
- 3 Bacterial diseases of the respiratory system ( 2 hours )
  - 3.1 Structure and function of the respiratory system:  
Differentiate pharyngitis, laryngitis, tonsillitis, sinusitis, and epiglottitis. Describe how microorganisms are prevented from entering the respiratory system.
  - 3.2 Normal flora of the respiratory system:  
Characterize the normal microbiota of the upper and lower respiratory systems.
  - 3.3 Microbial disease of the upper respiratory system:  
List the causative agent, symptoms, prevention, preferred treatment, and laboratory identification tests for streptococcal pharyngitis, scarlet fever, diphtheria, cutaneous diphtheria, and otitis media.
  - 3.4 Microbial disease of the lower respiratory system:  
List the causative agent, symptoms, prevention, preferred treatment, and laboratory identification tests for pertussis and tuberculosis. List the etiology, method of transmission, and symptoms of melioidosis.
  - 3.5 Practice (1 hour)
  
- 4 Bacterial diseases of the urinary and reproductive systems ( 2 hours )
  - 4.1 Structure and function of the urinary system:  
List the antimicrobial features of the urinary system.
  - 4.2 Structure and function of the reproductive system:  
Identify the portals of entry for microbes into the female and male reproductive systems.
  - 4.3 Normal flora of the urinary and reproductive systems:  
Describe the normal microbiota of the upper urinary tract, the male urethra, and the female urethra and vagina.
  - 4.4 Diseases of the urinary system:  
Describe the modes of transmission for urinary and reproductive system infections. List the microorganisms that cause cystitis, pyelonephritis, and leptospirosis, and name the predisposing factors for these diseases.
  - 4.5 Diseases of the reproductive systems:  
List the causative agents, symptoms, methods of diagnosis, and treatments for gonorrhea, nongonococcal urethritis (NGU), pelvic inflammatory disease (PID), syphilis,

lymphogranuloma venereum (LGV), chancroid, and bacterial vaginosis.

4.6 Viral diseases of the reproductive systems:

4.7 Practice (1 hour)

5 The Parasites of Medical Importance (2 hours)

5.1 The Parasites of Humans

5.2 Major Protozoan Pathogens

5.3 The Flagellates (Mastigophorans)

5.4 Apicomplexan Parasites

5.5 A Survey of Helminth Parasites

5.6 Nematode (Roundworm) Infestations

5.7 Flatworms: The Trematodes and Cestodes

5.8 The Arthropod Vectors of Infectious Disease

5.9 Practice (1 hour)

Part C: Lecturer: Xiang Kuang Hui

1 The Fungi of Medical Importance (2 hours)

1.1 Fungi as Infectious Agents

1.2 Organization of Fungal Diseases

1.3 Subcutaneous Mycoses

1.4 Cutaneous Mycoses

1.5 Superficial Mycoses

1.6 Opportunistic Mycoses

1.7 Fungal Allergies and Intoxications

2 The fundamental properties of viruses (2 hours)

2.1 Virus structure and chemical compositions

2.2 Virus classification

2.3 Virus replication

3 The DNA Viruses That Infect Humans (4 hours)

3.1 Viruses in Human Infections and Diseases

3.2 Enveloped DNA Viruses: Poxviruses

3.3 Enveloped DNA Viruses: The Herpesviruses

3.4 The Viral Agents of Hepatitis

3.5 Nonenveloped DNA Viruses

3.6 Discussion (1 hour)

4 The RNA Viruses That Infect Humans (4 hours)

4.1 Enveloped Segmented Single-Stranded RNA Viruses

- 4.2 Enveloped Non-segmented Single-Stranded RNA Viruses
- 4.3 Other Enveloped RNA Viruses: Coronaviruses, Togaviruses, and Flaviviruses
- 4.4 Arboviruses: Viruses Spread by Arthropod Vectors
- 4.5 Retroviruses and Human Diseases
- 4.6 Nonenveloped Single-Stranded and Double-Stranded RNA Viruses
- 4.7 Prions and Spongiform Encephalopathies
- 4.8 Practice (1 hour)

Mid-term examination ( 2 hours )

Final examination ( 2 hours )

### **Teaching Method**

Lectures, discussion, videos

### **Attendance**

Attendance of the learning module is in accordance with the attendance stated in 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**

The examination and reports are graded according to the percentage, with 100 being the full score and 50 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 learning module even if the overall grade is 50% or higher.

	<b>Item</b>	<b>Description</b>	<b>Percentage</b>
1.	Mid-term Examination	Lecture 1 – Lecture 6	40%
2.	Final Examination	The remained lectures	55%
3	Assignment	Specific topics related	5%
4	Re-sit	All lectures	--
<b>Total Percentage:</b>			<b>100%</b>

## **Teaching Material(s)**

### **Textbook(s)**

醫學微生物學與寄生蟲學 第四版 黃敏 吳松泉 人民衛生出版社 ISBN 978-7-117-23945-5

Talaro, Kathleen P., 2017 Foundations in Microbiology 10<sup>th</sup> edition, McGraw Hill education

Gerard J. Tortora, Berdell R. Funke, Christine L. Case, 2018 Microbiology An introduction 13<sup>th</sup> edition, Pearson

## **Reference**

### **Reference book(s)**

Stephen Gillespie, Kathleen Bamford, 2012 Medical microbiology and infection at a glance 4<sup>th</sup> edition, John Wiley

Gary Lee 2015 Microbiology and infection control for health professionals 6<sup>th</sup> edition, Pearson

James G. Cappuccino, Chad T. Welsh 2017 Microbiology A laboratory manual 11<sup>th</sup> edition, Pearson

Michael J. Leboffe, Burton E. Pierce 2015 Microbiology Laboratory Theory & Application 4e, Morton Publishing