

Course Book of Principles Microbial Physiology

First Semester

4th Year Biology

Department of Biology

College of Science

2021 - 2022

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Course instructor: Prof. Dr. Mustafa Mohammad Haider

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Course objective:

Microbial physiology is the science that deals with the function, intracellular and extracellular structures of prokaryotic (e.g. bacteria and Archaea) and eukaryotic (e.g. Molds and Yeasts) microorganisms. By the end of the course, students will have a comprehensive knowledge on the cell ultra-structures and their role in the physiology of the microorganisms such as carboxysomes, magnetosomes, proteosomes and peroxisomes. In the course, students will also gain insights into the morphology and the size of the microorganism cells as well as their functions in regulating the influx of substances into the cells, which in turn control the growth and life cycle of the microorganisms. More specifically, the ultra and molecular structure of the cell membrane (CM) of bacteria archaea and eukaryotic microorganisms is explained. More emphasis is put on the transport mechanisms of nutrients across CM and its impact on the growth of microorganism.

Another objective of the course is to shed light on the factors that regulate the microbial growth such as nutrient, availability of the oxygen, temperature, hydrogen ion concentration and osmotic pressure.

Course Delivery:

Lectures: 2 lecture hours/week (theoretical) +3hrs Practical

Credit: 3 units

Class size: 50 - 55

Learning activities:

1- Theory (25.0⁰)

Short quizzes

Two seasonal examinations

Final examination (40⁰)

2- Practical (15⁰)

Short quizzes

One seasonal practical examinations

Final practical examination (20⁰)

3- Questions:

Different types of questions: Explanations, identifications, shorts answer questions, multiple choices, comparison (theoretical examination).

Unknown specimens and experiments (practical examination)

Syllabus

Part one: Microbial cell structure

Cell morphology

The importance of cell size

Bacterial cell wall

Structure of peptidoglycan

Gram positive cell wall

Gram negative cell wall

Archaeal cell wall

Eukaryotic cell wall

Other bacterial cell surface

Fimbriae and pili

S-layer

Capsule and slime layer

Bacterial flagella

Structure and composition

Flagellar arrangement

Function

Bacteria with peritrichous flagella

Bacteria with polar flagella

Taxis

Eukaryotic flagella, structure and mechanism

Part two: Prokaryotic cytoplasmic membrane

Archaeal cytoplasmic membrane

Eukaryotic cytoplasmic membrane

Transport methods across cytoplasmic membrane

The intracellular structure of prokaryotes

The bacterial chromosome and plasmid

Ribosome and other multiprotein complexes

Part three: The intracellular membranes of prokaryotes

Cytoskeleton

Nutrient storage structure

Gas vesicle

Carboxysomes

Magnetosomes

Endospore

Part four: The internal cellular structures of eukaryotic cells

Microbodies

Reserve materials

Mitochondria and mitochondrial DNA

Lipid particles

Proteosomes

Vacuoles

Tonoplasts

Plasmid

Part Five: Microbial growth

The growth and growth rate

Growth stages

Factor effecting microbial growth

Nutrition,

Aeration,

Hydrogen ion concentration (pH)

Osmotic pressure, water

Sound,

CO₂,
Radiation
Extremophiles
Microbial stress responses

Syllabus	
First Course	
Subject	Practical Principles Microbial Physiology
Class	Fourth
Study Year	2019 – 2020
Lecturer	Dr. Mustafa Mohammad and Mr. Samir Khudeda Ali

#	Topics	weeks	hours
1.	Introduction to study of microbial physiology	1	2
2.	Measurement of microbial growth and generation time	2 & 3	4
3.	Control of microbial growth: Study the effect of temperature on microbial growth	4	2
4.	Effect of pH on microbial growth	5	2
5.	Effect of osmotic pressure on microbial growth	6	2
6.	Effect of radiation (Ultra violet) on bacterial growth	7	2

7.	Effect of disinfectants and antiseptics on microbial growth	8	2
8.	Fermentation	9 & 10	4

Course Reading list:

- 1- Moat, A. G. and Foster, J. W. (1998). Microbial physiology. 2nd ed. John Wiley and Sons, New York.
- 2- Michael J. W., Neil L. M., John S. R. and Gary, H. (2001). Black Well Science Ltd. U.k.
- 3- Moat, A. G. and Foster, J. W. (2002). Microbial physiology. 4th ed. John Wiley and Sons, New York.
- 4- Griffin, D. H. (1994). Fungal physiology. 2^{ed} ed. John Wiley and Sons, New York.
- 5- Net.