

INTER AMERICAN UNIVERSITY OF PUERTO RICO
METROPOLITAN CAMPUS
SCHOOL OF SCIENCE AND TECHNOLOGY
NATURAL SCIENCE DEPARTMENT
MASTER'S IN SCIENCE IN MOLECULAR MICROBIOLOGY

SYLLABUS

I. GENERAL INFORMATION

Course Title	:	Microbial Physiology and Metabolism
Code and number	:	MOMI 5210
Credits	:	3
Academic term	:	
Instructor	:	
Office hours and location	:	
Office telephone	:	
E-mail	:	

II. DESCRIPTION

Evaluation of the relationship between microbial structure and function with emphasis on intermediary metabolism. Integration of physiological mechanisms. It includes cell division and growth, the response to stressors, and regulation.

III. OBJETIVES

It is expected that at the end of the course, the student will be able to:

1. Compare the use of various omics and traditional tools applicable to the study of microbial physiology in the genomic era.
2. Differentiate the various metabolic activities present in microorganisms that allow them to occupy diverse ecological niches and their contribution to the growth and survival of microorganisms.
3. Contrast different mechanisms of microorganism responses to stress conditions and their adaptations to extreme environments.
4. To formulate an ethical and professional approach to the critical issues related to the

handling of microorganisms in the study of microbial physiology.

Competencies of the graduate profile addressed in this course:

1. Recognize the importance of Microbiology in the omics era, in aspects related to human health and ecosystem balance.
2. Value the importance of ethical standards related to scientific conduct in research, respect for confidentiality and the defense of intellectual property.
3. Evaluate scientific information from diverse sources.

IV. CONTENT

- A. Prokaryotic Cell Structure
 1. Appendages
 2. Cell Walls
 3. Periplasm
 4. Cell Membranes
 5. Cytoplasm

- B. Cell Growth and Division
 1. Growth Measurements
 2. Growth Physiology
 3. Growth Performance
 4. Growth Kinetics
 5. Balanced Growth and Continuous Growth
 6. Cell Division
 7. Chromosome Replication

- C. Membrane Bioenergetics
 1. Chemosmotic Theory
 2. Electrochemical Energy
 3. Ionophores
 4. Oxidation-Reduction Reactions (Oxyreductions)
 5. ATP synthesis

- D. Electron Transport
 1. Aerobic and Anaerobic Respiration
 2. Electron Transporters
 - a) Mitochondria
 - b) Bacteria

- E. Photosynthesis
 1. Phototrophic Prokaryotes
 2. Photosynthetic Pigments
 3. Purple Photosynthetic Bacteria
 4. Chlorobiaceae ("Green Sulfur Bacteria")
 5. Photosynthetic Efficiency

- F. Regulation of Metabolic Pathways
 1. Patterns of Metabolic Regulation
 2. Kinetics of Regulatory and Non-Regulatory Enzymes
 3. Regulation by Covalent Modification

- G. Bioenergetics in the Cytosol
 1. Highly Energetic Molecules and Group Transfer Potential
 2. Role of Group Transfer Reactions in Biosynthesis
 3. ATP Synthesis by Substrate-Level Phosphorylation

- H. Metabolic Pathways
 1. Glycolysis
 2. Pentose Phosphate Pathway
 3. Entner-Doudoroff pathway
 4. Citric Acid Cycle
 5. Glyoxylate Cycle

- I. Metabolic pathway of:
 1. Lipids
 2. Nucleotides
 3. Amino acids
 4. Aliphatic Hydrocarbons

- J. Cell Wall Biosynthesis
- K. Capsule Biosynthesis
- L. Inorganic Metabolism
 1. Nitrate and Sulfate Assimilation
 2. Nitrate and Sulfate Dissimilation
 3. Nitrogen fixation
 4. Lithotrophy

- M. Metabolism of 1C Compounds
 1. CO₂ Fixation Systems
 2. Methanotrophs

- N. Fermentations
 1. Propionate Fermentation
 2. Acetate Fermentation (Acetogenesis)
 3. Lactate Fermentation
 4. Acid-Mixed Fermentation
 5. Butanediol Fermentation
 6. Butyrate Fermentation

- O. Environmental Stress Responses
 1. pH maintenance
 2. Osmotic Pressure and Osmotic Potential
 3. Heat-Shock Response (HSR)

- 4. SOS Response
- 5. Oxidative Stress
- P. Solute Transport
- Q. Protein Transport and Secretion

V. LEARNING ACTIVITIES

- 1. Conferences and lectures by visiting speakers.
- 2. Reading and discussion of research papers

VI. EVALUATION

	Score	% Final Score
2 Exams	200	50
1 Oral presentation	100	25
1 Final Exam	100	25
Total	400	100

VII. SPECIAL NOTES

A. Auxiliary services or special needs

All students who require auxiliary services or special assistance must request these at the beginning of the course or as soon as they know that they need them, through the proper registry, in the Office of Orientation with Sr. José Rodríguez.

B. Honesty, fraud, and plagiarism

Dishonesty, fraud, plagiarism and any other inappropriate behavior in relation to academic work constitutes major infractions sanctioned by the General Student Regulations. The major infractions, as stated in the General Student Regulations, may have as a consequence, suspension from the University for a definite period greater than one year or the permanent expulsion from the University, among others sanctions.

C. Use of electronic devices

Cellular telephones and any other electronic device that could interrupt the teaching and learning processes or alter the environment leading to academic excellence will be deactivated. Any urgent situation will be dealt with, as appropriate. The handling of electronic devices that allow students to access, store or send data during evaluations or examinations is prohibited.

D. Compliance with the Provisions of Title IX

The Federal Higher Education Act, as amended, prohibits discrimination because of sex in any academic, educational, extracurricular, and athletic activity or in any other program or function, sponsored or controlled by a higher education institution, whether or not it is conducted within or outside the property of the institution, if the institution receives federal funds.

In harmony with the current federal regulation, in our academic unit an Assistant Coordinator of Title IX has been designated to offer assistance and orientation in relation to any alleged incident constituting discrimination because of sex or gender, sexual harassment or sexual aggression. The Assistant Coordinator, Sr. George Rivera, can be reached by phone at 787-250-1912, extension 2262 o 2147, or by e-mail griverar@metro.inter.edu.

The Normative Document titled Norms and Procedures to Deal with Alleged Violations of the Provisions of Title IX is the document that contains the institutional rules to direct any complaint that appears to be this type of allegation. This document is available in the Web site of Inter American University of Puerto Rico (www.inter.edu).

VIII. EDUCATIONAL RESOURCES

Textbook

White,D., Drummond, J., Fuqua, C. (2012). *The Physiology and Biochemistry of Prokaryotes*. Oxford University Press. ISBN: 978-0-19-539304-0.

IX. BIBLIOGRAPHY

Book

Madigan, M. T., Martinko, J. M., Stahl, D. A., Clark, D. P. (2012). *Brock Biology of Microorganisms*. Pearson Education, Inc., Benjamin Cummings, San Francisco, CA . ISBN: 13: 978-321-64963-8.

Electronic Resources:

Harvard Science <http://www.harvardscience.harvard.edu/>

Sistemas de Centros de Acceso a la Información – Universidad Interamericana de Puerto Rico www.cai.inter.edu/bases.htm/

Rev: 2022