

**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	:	Microbe-Host interactions
Code and number	:	MOMI 5310
Credits	:	3
Academic term	:	
Instructor	:	
Office hours and location	:	
Office telephone	:	
E-mail	:	

**II. DESCRIPTION**

Analysis of the cellular and molecular mechanisms that characterize commensal and parasitic microbe-host relationships, with emphasis on the immune response.

**III. OBJETIVES**

At the end of the course the student will be able to:

1. Recognize the importance of normal microflora in aspects related to human health and ecosystem balance.
2. Evaluate scientific information from diverse sources.
3. Argue ideas and results of research on symbiotic relationships between microbes and their host.
4. Evaluate case studies from the point of view of ethical standards related to scientific conduct in research.

**Competencies of the graduate profile addressed in the course:**

Demonstrate knowledge in:

Establish the importance of Microbiology in the genomic era, in aspects related to human health and ecosystem balance.

Evaluate scientific information from diverse sources.

Possess skills to:

Argue ideas and research results, before the scientific community, orally and in writing, in Spanish and English.

Demonstrate an attitude to:

Value the importance of ethical standards related to scientific conduct in research, respect for confidentiality and defense of intellectual property.

#### IV. CONTENT

- A. Review of immunity
  - 1. Innate response: mechanisms, physical, chemical, and cellular
    - a) Inflammation
    - b) Recognition of microbial molecules (PRRs and PAMPs).
    - c) Normal microflora as an innate defense mechanism of the host.
  - 2. Adaptive response, immune memory and tolerance.
  - 3. Integrated immune response against infectious agents.
  - 4. Adaptation and tolerance to the normal microflora
  
- B. The infectious process
  - 1. Invasion and colonization
    - a) Tropism and molecular recognition
    - b) Examples of commensalist colonization in plants
      - (1) Nodulation in legumes by rhizobia
      - (2) Mycorrhizas
      - (3) Frankia in trees
      - (4) Lichens
      - (5) Incorporation of Ti plasmid into plants
  - 2. Reproduction
    - a) Persistence and survival
  - 3. Dissemination
    - a) Mechanisms of infection transmission
  - 4. Intermediate hosts, vectors, reservoirs and zoonosis
  - 5. Microbial pathogenesis
    - a) Parasite-host interactions
      - (1) Intercellular signals during infection.
    - b) Mechanisms of cell and tissue damage
      - (1) Induction of autoimmunity and hypersensitivity
  
- C. Microbial virulence factors
  - 1. Secretion products
    - a) Toxins
      - (1) Pathogenicity islands
      - (2) Secretion systems I, II, III and IV
    - b) Antioxidants
    - c) Hydrolytic enzymes
  - 2. Surface molecules and other chemicals
    - a) Endotoxin (LPS) in Gram-negatives
    - b) Teichoic acid in Gram-positives
    - c) Glycoproteins and glycolipids
    - d) Superantigens
  - 3. Mechanisms of resistance to antimicrobial agents
    - a) Betalactamase

- b) Cassette mec (MRSA)
- c) Klebsiella cassette (KPC)
- 4. Strategies for evasion of the immune response
  - a) Genetic variation of antigens
  - b) Molecular mimicry (molecular mimicry)
  - c) Evasion and survival of phagocytosis
  - d) Chemical interference
  - e) Reduction of iron levels
  - f) Persistence and longevity strategies.
  - g) Modulation of host immune response (phosphorylcholine).

D. Essays on symbiosis and commensal relationships.

**Suggested topics:**

1. Microbes and diet
  - a) What do the cow and the Hoatzin have in common?
  - b) Escherichia coli and Helicobacter pyori: friend or foe?
2. The human microbiome.
  - a) Caesarean section or natural childbirth? The composition of the human microbiome.
  - b) Fecal transplants, Clostridium difficile and ulcerative colitis.
  - c) Obesity, Crohn's disease, gastroesophageal reflux: evils of modernity associated with an altered microbiome.
3. The role of the microbiome in regulating the host immune response.
  - a) What's wrong with this picture: IL-4, IgE and eosinophilia: indicators of allergies and asthma in developed countries and antiparasitic mechanisms in the "third world".
  - b) Induction of intestinal lymphoid tissue (GALT) by probiotic activity.
  - c) Speak, friend and enter: intercellular signaling systems between microbes and plants that promote a healthy symbiotic relationship.

**V. ACTIVITIES**

1. Illustrated lectures in power point format.
2. Audiovisual presentations of animated videos and virtual methods.
3. Additional readings available online on the Blackboard platform.
4. Study and discussion of research cases applied to immunology.

**VI. EVALUATION**

The course evaluation consists of:

	<b>Score</b>	<b>% Final Score</b>
3 Exams	300	75
Symbiosis Essay	100	25
<b>TOTAL</b>	<b>400</b>	<b>100</b>

## **VI. 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 or 2147, or by e-mail [griverar@metro.inter.edu](mailto: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](http://www.inter.edu)).

## **VIII. EDUCATIONAL RESOURCES**

### **Textbooks**

There will not be an assigned textbook for this course, but a selection of readings from essays and scientific articles related to the topics of each unit.

## Supplementary Readings

1. Proposed Model: Mechanisms of Immunomodulation Induced by Probiotic Bacteria: C. Maldonado Galdeano, A. de Moreno de LeBlanc, G. Vinderola, M. E. Bibas Bonet and G. Perdigón. *Clinical and vaccine Immunology*. March 2007. doi: 10.1128/CVI.00406-06  
<http://cvi.asm.org/content/14/5/485.full.pdf+html>
2. Plant–Microbe Communications for Symbiosis. Masayoshi Kawaguchi Kiwamu Minamisawa *Plant Cell Physiol* (2010) 51 (9): 1377-1380. doi: 10.1093/pcp/pcq125.  
<http://pcp.oxfordjournals.org/content/51/9/1377.full.pdf+html>
3. Comparative analyses of foregut and hindgut bacterial communities in hoatzins and cows Filipa Godoy-Vitorino, Katherine C Goldfarb, Ulas Karaoz, Sara Leal, Maria A Garcia-Amado, Philip Hugenholtz, Susannah G Tringe, Eoin L Brodie, and Maria Gloria Dominguez-Bello. *The ISME Journal* (2012) 6, 531–541  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3280141/pdf/ismej2011131a.pdf>

## IX. BIBLIOGRAPHY

### Text

1. Abbas, A.K., Lichtman, A.H., and Pillai, S. (2011) *Cellular and Molecular Immunology*. 7<sup>ma</sup> edición. W.B. Saunders, Co. ISBN: 9781437715286.
2. Murphy, K. (2011). Janeway's *Immunobiology*, 8<sup>va</sup> edición. Garland Science Publishing, New York, NY. ISBN: 9780815342434.
3. *Molecular Biology of the Cell*, 5th Edition, 2009., Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. 2008 Garland Science, Abingdon, OX, UK. ISBN: 9780815341055

### Electronic Resources

1. Kuby Immunology Book Website:  
<http://bcs.whfreeman.com/immunology6e/default.asp?uid=0&rau=0>
2. Roitt Essential Immunology Book Website: <http://www.roitt.com/>
3. Case It: Computer Simulations of Molecular Biology Techniques:  
<http://caseit.uwrf.edu/>