

**INTER AMERICAN UNIVERSITY OF PUERTO RICO**  
**METROPOLITAN CAMPUS**  
**Department of Natural Sciences**  
**Biomedical Sciences Program**

**SYLLABUS**

**I. GENERAL INFORMATION**

Course Title: Biochemistry of Human Physiology  
Code and Number: BMSC 4015  
Credits: 3 credits  
Code and Number:  
Academic Term:  
Instructor:  
Office Hours and Location:  
Office Telephone:  
E-mail:

**II. DESCRIPTION**

Study of metabolic transformations that chemical compounds and biopolymers undergo at cellular level. Physiological studies that include bioenergetics, vitamin and hormone metabolism, anabolism and catabolism of carbohydrates, lipids and proteins, production of energy through the cycle of tricarboxylic acid and oxidation phosphorylation. Credits 3 Prerequisite: CHEM 2222.

**III. OBJECTIVES**

At the end of the course, the student must:

1. Describe the molecular structures of the monomers that make up the Macromolecules.
  - 1.1 distinguish between the structures of the twenty common amino acids.
  - 1.2 diagram the molecular arrangement that results in the formation of a peptide bond.
  - 1.3 distinguish between monosaccharide, disaccharide and polysaccharide molecules.
  - 1.4 distinguish between types of glycosidic bonds.
  - 1.5 Describe the molecule of a fatty acid.
  - 1.6 recognize the structures of non-polar and polar lipids.
  - 1.7 describe the components of nucleic acid molecules
2. Describe the functioning of the enzymes.

- 2.1 define the terms  $K_m$ ,  $V_{max}$ , "turnover number", and  $K_i$ .
  - 2.2 to recognize Lineweaver-Burk plot charts.
  - 2.3 distinguish between enzymes that obey the kinetics of Michaelis-Menten and others Which do not (allosteric enzymes).
  - 2.4 distinguish between types of enzymatic inhibition.
  - 2.5 identify the cofactors corresponding to each type of family of enzymes.
3. Understand the relationship between structure and function of biomolecules.
    - 3.1 distinguish between the molecular structures of peptides with biological activity (Hormones and antibiotics).
    - 3.2 explain the relationship between the levels of structure and biological function of protein.
    - 3.3 recognize the structural architecture levels in proteins.
    - 3.4 explain the role of lipids in biological membranes.
    - 3.5 explain the role of nucleic acids in cells.
4. Understand the chemical reactions that are important for sustaining life.
    - 4.1 mention the enzymes involved in the synthesis and degradation of glycogen.
    - 4.2 identify enzymes involved in glycolysis.
    - 4.3 mention the glycolysis reactions that result in the production of ATP.
    - 4.4 distinguish between glycolysis and gluconeogenesis in terms of the enveloped enzymes.
    - 4.5 relate biosynthesis to the oxidation of fatty acids.
    - 4.6 explain the importance of production of ketone bodies in diabetics
    - 4.7 explain how cholesterol is converted to bile acids.
    - 4.8 explain how lactate occurs during vigorous activity.
    - 4.9 diagram the different types of nitrogen compounds and their importance Physiological
    - 4.10 mention different ways of degradation of amino groups in amino Acids and their connection with urea formation.
    - 4.11 explain the relationship between nucleotide degradation and gout (accumulation of uric acid).
    - 4.12 relate the Krebs cycle to glycolysis, lipid metabolism, and Protein metabolism
5. Explain the flow of energy in the cells.
    - 5.1 Recognize the chemical reactions that occur in the metabolism.
    - 5.2 Understand the concept of free energy (G).
    - 5.3 Understand the basis of the energy function of the ATP molecule.
    - 5.4 Explain what is meant by coupled reactions.
    - 5.5 Explain the mechanism of oxidative phosphorylation

## IV. CONTENT

### Unit I: Nature and function of macromolecules

#### A. Peptides and Proteins

1. Structure and characteristics of amino acids to.
  - a. Amino acid classes
  - b. Modified Amino Acids
  - c. Stereo isomers
2. Methods used to detect the presence of amino acids.
3. Peptides of physiological importance
4. Proteins
  - a. Structure levels
  - b. Examples of proteins of physiological importance

#### B. Enzymes

1. Properties of enzymes
2. Classification of enzymes
3. Enzymatic kinetics
  - a. Kinetics of Michaelis-Menten
  - b. Lineaweaver-Burk mapping
  - c. Inhibition of enzymes
  - d. enzymatic regulation
4. Catalysis
  - a. Catalytic mechanism
  - b. Cofactors in enzymatic catalysis
  - c. Mechanism models

#### C. Structure and Characteristics of Carbohydrates

1. Monosaccharides
  - a. Structure of Monosaccharides
  - b. Methods used to detect the presence of monosaccharides
  - c. Examples of monosaccharides of physiological importance
2. Disaccharides
3. Oligosaccharides
4. Polysaccharides
  - a. Homopolysaccharides
  - b. Heteropolisaccharides

#### D. Lipids

1. Fatty acids and their derivatives

2. Triglycerides
3. Eicosanoids
4. Waxes
5. Phospholipids and sphingolipids
6. Terpenes and steroids
7. Steroids

#### E. Physiological applications of lipids

1. Membranes
2. Lipoproteins

### Unit II: Metabolism of carbohydrates, lipids and nitrogen compounds

#### A. Carbohydrate Metabolism

1. Glycogen metabolism
2. Glucolysis
3. Gluconeogenesis

#### B. Lipid Metabolism

1. Oxidation of fatty acids
2. Fatty acid biosynthesis
3. Biosynthesis of ketone bodies
4. Cholesterol metabolism

#### C. Metabolism of Oxidation Products of Carbohydrates and Lipids

1. Cyclic acid cycle
2. Electron transport
3. Oxidative phosphorylation

#### D. Effects of physiological activity on carbohydrate metabolism

#### E. Nitrogen metabolism I: Synthesis

1. Biosynthesis of amino acids
2. Neurotransmitters

#### F. Nitrogen metabolism II: Degradation

1. Catabolism of amino acids
2. Disorders of amino acid catabolism
3. Cycle of urea
4. Degradation of neurotransmitters

5. Degradation of nucleotides and drop \

## V. ACTIVITIES

- A. Lectures
- B. Collaborative works.

## VI. EVALUATION

### 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 the Coordinator of Services to Students with Disabilities, Dr. Maria de los Angeles Cabello, located in the Counseling Program, Room 419, on the fourth floor of the John Will Harris Building, 787-2501912, extension 2306.

#### 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 other 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 Rodríguez, can be reached by phone at 787 250-1912, extension 2262, 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. RESOURCES AND DIDACTIC MATERIALS

### A. Textbook

Concepts in Biochemistry, Rodney Boyer. 3ra edición. Brooks/Cole. 2006.

### B. Supplementary Text

Biochemistry, Jeremy Mark Berg. 2002. W.H. Freeman.

Bioquímica, Jeremy Mark Berg. 2003. Editorial Reverté.

Fundamentals of Biochemistry, Donald Voet, Judith G. Voet y Charlotte W. Pratt. Wiley. 2002

Lehninger Principios de Bioquímica. 2001. Ediciones Omega.

Lehninger Principles of Biochemistry, Albert L. Lehninger. 2005. W.H. Freeman.

Medical Physiology: A cellular and molecular approach, Walter F. Boron, Emile L. Boulpaep. 2005. Elsevier-Health Science Division.

Principles of Biochemistry, Robert Horton, et.al. 2002. Prentice Hall.

Textbook of Biochemistry with Clinical Correlations, Thomas M. Devlin. 5th Edition. Wiley-Liss. 2002.