

## Bari English Medical School (BEMC)

Academic Year 2021-2022

Teaching program of **Biochemistry** – Integrated course of **Biochemistry**

### Course year II – I Semester

N° CFU 5

Total hour **60**

#### Learning goals

This course provides an overview of the main aspects of biochemistry by relating molecular interactions to their effects on the organism as a whole, especially as related to human biology. Biochemical and molecular mechanisms underlying pathophysiological processes in different organs will be explored. The essential theoretical knowledge accrued from this biochemistry course will represent a basis for subsequent professional application.

#### Expected learning Results

**Knowledge and understanding:** Upon completion of the course, the student should be able to explain the biochemical functions of individual cells and the whole human body, including regulation of metabolic processes.

**Applying knowledge and understanding:** The student should be able to apply the knowledge acquired to understand and solve problems. In particular, the student should be able to predict the metabolic effects caused by alterations on individual reaction step of a process, and to describe and explain connections between molecular changes and changes in the metabolism for the most common diseases.

**Making informed judgements and choices:** The student should be able to integrate knowledge and develop an autonomy of judgment that should be applied in the subsequent courses.

**Communicating knowledge and understanding:** The student should know how to describe and communicate the main concepts of systematic biochemistry.

**Capacities to continue learning:** The student should have developed skills in reading and understanding reviews and original research papers within medical biochemistry.

#### Contents

The course focuses on the integration of metabolism and hormonal regulation that usually exists between our organs. Specifically, the course will cover the following main topic

1. Cell communication and signaling
2. Reactive oxygen species (ROS)
3. Regulation of metabolic pathway
4. Gastrointestinal system
5. Liver
6. Adipose tissue
7. Blood
8. Muscle
9. Nervous system
10. Extracellular matrix and connective tissue

#### ECTS credit details

Lectures: **CFU 5** **Hours 60**

Laboratory classes **CFU 0** **Hours 0**

### **Prerequisites/requirements**

Chemistry and biochemical propedeutics

### **Teaching methods**

Lectures classes (Powerpoint); Group activity (Presentation of scientific articles)

### **Evaluation methods**

The examination consists of a written part (multiple choices and open questions) and a subsequent oral dissertation on the topics developed during the theoretical lectures. The evaluation of the preparation of the student occurs on the basis of established criteria. Entrance Test and *In-Itinere* Tests could be also proposed in order to check the acquisition of the main basal concepts.

The final vote will be a weighted average of the vote of this course, of Biochemistry part I and Molecular Biology.

### **Evaluation criteria**

**Knowledge and understanding:** Describe the functions of the main metabolic pathways in different organs, and their regulation.

**Applying knowledge and understanding:** Describe the interconnections of the metabolic processes in different organs throughout different conditions.

**Making informed judgements and choices:** Understand the importance of the main metabolic pathways in physiological and pathological conditions and the way to control them.

**Communicating knowledge and understanding:** Capacity to read, summarize and communicate experiments and results from original research articles.

**Capacities to continue learning:** Individual study and research based on scientific reviews and original articles to analyse in details and keep update the knowledge about the metabolic processes.

### **Textbooks**

Marks' Basic Medical Biochemistry, 5th Edition. *Michael Lieberman – Alisa Peet*. Wolters Kluwer  
Textbook of Biochemistry with Clinical Correlations, 7th Edition. *Thomas M. Devlin*. Wiley  
Biochemistry, 9th Edition. *Jeremy M. Berg, Lubert Stryer, John L. Tymoczko*, Macmillan

### **Subject Teacher**

Dr. Elena Piccinin, RTDA

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### **Visiting hours**

Only by previous agreement. Tutoring could be also on e-learning platforms. Please, send an email.

## Syllabus

Main Topic	Topic	Description
Cell Communication and Signaling	Hormones	Classification; Steroid Hormones; Thyroid Hormones
	Hormone-Receptor Interaction	Scatchard analysis; RIA and ELISA techniques
	Receptors	Classification; GPCR; Tyrosine-Receptor; Hormone Receptor
	Receptor Regulation	
	Second Messenger	cAMP; DAG; IP3
	Cancer	
Reactive Oxygen Species	ROS	Definition and Characterization of ROS
	Mechanismo of ROS regulation	Antioxidant Scavenging Enzymes; Non enzymatic antioxidants
	Pathophysiological role of ROS	ROS in protein activity and immunological response; Free mediated radical cell injury
	Progeria	
Regulation of metabolic pathways	Metabolic Regulation	Principles and key point in metabolic regulation
	Glucose homeostasis	
	Starve-Feed Cycle	Well Fed State; Early fasting state; Fasting State; Early Refed State: characteristic and metabolic control
	Hormonal regulation of fuel metabolism	Glucagon and Insulin: characteristic and main functions
	Transgenic Animal model	Principal characteristic and applications of transgenic; knockin and knock out mice
Gastrointestinal System	Gastrointestinal System	Characteristic
	Digestion and Absorption	Digestion and Absorption of Carbohydrates; Proteins and Lipids; Glycaemic Index
Liver	Liver	Characteristic
	Hepatic Metabolism	Main aspect of Hepatic Metabolism; Metabolic control of hepatic metabolism
	Bile Acids Metabolism	Bile; Enterohepatic circulation; Jaundice
	Detoxification Reactions	Phase I and Phase II reactions; Cytochrome P450; Acetaminophen Metabolism; Ethanol Metabolism
	Fatty Liver Disease	ALD; NAFLD
Adipose Tissue	Adipose Tissue	Characteristic of White, Brown, Beige and Pink Adipose Tissue
	WAT metabolism	Lipoprotein Lipase; Biosynthesis and degradation of TAG; TAG Cycle
	BAT metabolism	Thermogenesis; UCP family

	Adipokines	Leptin; TNFalpha; Adiponectin
	Obesity and Metabolic Syndrome	Main characteristic and criteria; Insulin Resistance
Muscle	Skeletal Muscle	Structural organization; Skeletal muscle contraction; Muscular Dystrophy
	Cardiac Muscle	Characterization and differences with skeletal muscle
	Smooth muscle	Smooth muscle contraction; Action of NO; NO Synthase; Myoglobin
	Calcium homeostasis	Calcium homeostasis; Protein regulated by calcium
	Muscle metabolism	Muscle fibers; Creatine Phosphate; Muscle metabolism; Myocardial infarction
Nervous System	Nervous System	Characterization; Membrane potential; Action Potential; Patch clamp techniques
	Ion channels	Ion Channels; Voltage Gated Channel
	Synapses	Electrical and chemical synapses
	Neurotransmitters	Acetylcholine; Catecholamines; Serotonin; Hystamine; Glycine; Glutamate; GABA
	Receptors	Ionotropic and metabotropic receptors
Bone	Bone	Characteristic; Bone remodelling Cycle; Collagen; Bone mineralization process
	Vitamin D	Vitamin D metabolism; Vitamin D deficiency and excess
	Parathyroid hormone	
	Calcitonin	
Blood	Blood	Blood composition
	Lipoproteins	Classification and metabolism; Reverse Cholesterol Transport; Tangier Disease
	Cholesterol	Lipid Rafts; Cholesterol biosynthesis; Cholesterol homeostasis; Atherogenesis
	Biochemistry of erythrocytes and other blood cells	Erythropoiesis; Heme metabolism
	Coagulation	Coagulation Cascade
	Iron Metabolism	