



General information	
Academic subject	Electrophysiology
Degree course	Master degree in Environmental Biology
Academic Year	2021/22
European Credit Transfer and Accumulation System (ECTS)	4
Language	Italian
Academic calendar (starting and ending date)	II Semester (March- June 2022)
Attendance	yes

Professor/ Lecturer	
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Virtual headquarters	Teams
Tutoring (time and day)	Every day by appointment

Syllabus	
Learning Objectives	Basic knowledge of the electrophysiological techniques and their application in basic and applied research
Course prerequisites	Basic knowledge of physics, biochemistry and cellular physiology
Contents	<ul style="list-style-type: none">• The development of electrophysiology: from Galvani to MEA• Research and experimentation in electrophysiology:<ul style="list-style-type: none">- Maintenance of isolated tissues and organs for physiological research- Electrical measurements on biological preparations• Electricity Electric current and voltage; Ohm's law; Electric circuits, circuit elements; Kirchoff's Laws; Elements in series and in parallel; Resistance-capacitance circuits• Diffusion laws of electrolytes• Genesis of resting membrane potential Nernst Equation Goldman-Hodgkin-Katz equation The equivalent circuit model of the membrane• Structure and function of ion channels• Genesis of electrical signals Graded potential: genesis and propagation Action potential: genesis and propagation• Voltage and current clamp technique• Membrane potential Measurements: Reversible (calomel; Ag / AgCl) and irreversible (Pt) electrodes Intracellular microelectrodes• Patch Clamp technique



	<ul style="list-style-type: none"> • Transepithelial Potential Electrical characteristics of epithelial tissues • Ussing chamber: set up and applications Short circuit current measurements • Transepithelial electrical resistance (TEER) • Multi Electrode Array technique (MEA) • Amperometry to study synaptic activity • Application of electrophysiological methods Intracellular ion-selective microelectrodes to measure the cytoplasmic ionic concentrations Use of microelectrodes to study ionic transport in isolated tissues/organs Extracellular recordings and their analysis
Books and bibliography	<p>“ Fisiologia e biofisica delle cellule”- Taglietti-Casella - Ed. EdiSES</p> <p>“FISIOLOGIA dalle molecole ai sistemi integrati” Carbone, Cicirata, Aicardi – Ed. EdiSES</p>
Additional materials	PowerPoint presentations of the lectures will be provided as a guide and support. The recommended texts have broader contents than those of the course and must be used in relation to the teacher's instructions.

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
100	32		68
ECTS			
4			
Teaching strategy		Lectures	
Expected learning outcomes			
Knowledge and understanding on:		<ul style="list-style-type: none"> ○ Basic knowledge of the principles of electricity and electrical measurements ○ Knowledge of the electrophysiological aspects underlying the genesis of the cell membrane potential and its role in polarized and non-polarized epithelial cells ○ Knowledge of electrophysiological methodologies for the study of the electrical properties of cells and epithelia 	
Applying knowledge and understanding on:		<ul style="list-style-type: none"> ○ Ability to understand which electrophysiological methodology is most suitable for the study of particular characteristics of the electrical properties of cells and epithelia. 	
Soft skills		<ul style="list-style-type: none"> • <i>Making informed judgments and choices</i> Ability to understand, analyze and evaluate the scientific literature relating to electrophysiology. • <i>Communicating knowledge and understanding</i> Ability to expose, in written and oral form, the acquired knowledge with language skills, scientific terminology and appropriate graphic tools • <i>Capacities to continue learning</i> 	



	Acquire autonomous skills of understanding highly complex technical-scientific texts, monographs, scientific journals, IT tools and databases in the electrophysiological field.
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Assessment and feedback	
Methods of assessment	Oral exam
Evaluation criteria	<p>Assessment of the ability to explain in a clear way and with adequate language the knowledge acquired regarding the contents of the course relating to:</p> <ul style="list-style-type: none">- Electrophysiological techniques in basic and applied research- Maintenance of isolated tissues and organs in physiological research;- Methods for electrophysiological electrical measurements on biological preparations. <p>Evaluation of the ability to grasp the key elements of the various topics and to use the information learned, making adequate correlations for understanding the questions posed and for managing the answers. In particular, the student must demonstrate:</p> <ul style="list-style-type: none">- ability to link the various study topics together;- ability to present, critically analyze and solve theoretical problems;- ability to argue the proposed theses;- ability to use appropriate language and graphic tools in presenting the topics;- ability to independently learn the topics covered from accredited scientific sources.
Criteria for assessment and attribution of the final mark	To pass the exam, the student must demonstrate that he has achieved the expected results (described above) at a level that allows him to discuss and to integrate the various topics covered during the course.
Additional information	