General information		
Academic subject	***Physiology***	
Degree course	*Environmental Sciences*	
Academic Year	*III*	
European Credit Transfer and Accumulation System (ECTS)		6
Language	*Italiano*	
Academic calendar (starting and ending date)	*1 March-15 June*	
Attendance		

Professor/ Lecturer	
Name and Surname	Francesco Pisani
E-mail	
Telephone	
Department and address	*Department of Biosciences, Biotechnologies and Biopharmaceutics. Campus, New building of biological departments. IV floor, Room 48.*
Virtual headquarters	
Tutoring (time and day)	*Monday, 10 am*

Syllabus	
Learning Objectives	*The course aims to provide the theoretical, conceptual and technical tools to critically address the knowledge of the basic biophysical and functional mechanisms of eukaryotic cells and of the structural and functional specificities that allow cells, tissues and organs to respond to internal and external stimuli. and to keep the organism in a state of homeostasis. In accordance with the Dublin Descriptors, at the end of the course and to pass the exam, the student must demonstrate: D1 Knowledge and understanding. Knowledge of the biophysical mechanisms of eukaryotic cells and of the specific functional characteristics of the cells and organs treated that allows him to articulate the exposition in a logical way and connect the topics covered. D2 Ability to apply knowledge and understanding. Ability to exhibit, critically analyze and solve theoretical problems on cellular and organ functions. Ability to autonomously analyze and re-elaborate scientific articles published in international journals and online databases. D3 Autonomy of judgment. Autonomy in the choice and critical evaluation of different information or opinions (available in experimental articles, review articles and accredited scientific sources, also in English) on issues related to cell and organ physiology. D4 Communication skills. Ability to present, in written and oral form, the knowledge acquired with properties of language, scientific terminology and appropriate graphic tools. D5 Learning skills. Ability to independently select, understand and learn concepts of cell and organ physiology from accredited scientific sources, also in English. In addition to lectures and laboratory exercises, in order to promote the active participation of students and the carrying out of work independently, attending students are involved in the preparation of short reports / presentations on physiology issues that enhance the importance homeostatic mechanisms, such as examples of environmental pathophysiology and physiology. The topics, chosen by the student, are explored through the use of study material deriving from accredited sources, online or in print, and*

	experimental articles published in international journals and exposed in the classroom (with the aid of slides).
Course prerequisites	*Basic knowledge of Biochemistry*
Contents	*The animal cell and transport mechanisms* *• Plasma membrane, structure, composition, functions.* *• Simplified biophysical models describing the transport dynamics across a membrane: Free-phase diffusion. Osmosis.* *• Simplified biophysical models describing simple diffusion. Fick's law. Simple diffusion of weak acids and bases.* *• Facilitated dissemination. Saturation kinetics. Glucose permease.* *• Ion channels: Gating and selectivity. Density of ionic charge and solvatazoine water.* *• Primary active transport. Classes and mechanisms. The Na + / K + pump, H + / K + pump, Ca2 + pumps.* *• Secondary active transports. Examples of renal and intestinal transporters. Counter transporters.* *• Endocytosis, exocytosis, pinocytosis.* *• Transepithelial transport. Transepithelial potential. Absorption of sugars.* *Electrical properties of the plasma membrane:* *• Equilibrium potential and Nerst equation* *• Gibbs-Donnan equilibrium* *• Membrane potential and Hodgkin-Katz-Goldman equation* *• Genesis of the action potential* *• phases and molecular mechanisms of the action potential. Refractory period and propagation.* *• Origin and frequency of discharges. The encoder.* *Perception of the environment* *• Frequency coding. Specificity and sensitivity of sensory receptors* *• Nerve and sensory cell receptors.* *• Transduction and receptor potential* *• Tonic and Phasic Encoder* *• Sensory units* *• Skin sensory receptors* *• Inner ear mechanoreceptors* *• Thermoreceptors* *• Nociceptors* *• Chemoreceptors and transduction* *• Photoreceptors, cones, rods, retina, retinal sensory units and bipolar cells* *Synaptic transmission* *• Types of neurons and trigger zone* *• Chemical and electrical synapses* *• Presynaptic mechanisms* *• Transport, accumulation and release of neurotransmitters.* *• Structure and function of presynaptic vesicles* *• Post-synaptic mechanisms. Excitatory and inhibitory synapses.* *• Spatial and temporal integration and summation.*

	Intercellular signaling and signal transduction *• Communicating junctions* *• Ligand-receptor axis* *• Autocrine and paracrine signals* *• Hormones and neurohormones* *• Cellular receptors. Location, structure and function.* *• Ionotropic and metabotropic receptors* *• 7-domain G protein coupled receptors* *• Pathways of transduction of the second messengers. G proteins and adenylate cyclase. Inositidic Messagegri. Routes of Ca2 +* *Motor proteins, contractility and skeletal muscle* *• The cellular cytoskeleton and motor proteins* *• Operative cycle and Myosin II* *• Dynamism of actin* *• Skeletal muscle. Organization of fibers. Myofibrils and sarcomeres. Ultrastructure and dynamics. Neuromuscular junction. Plaque potential and muscle action potential. Electromechanical coupling. Biomechanics of fibers. Myoglobin and energy sources.*
Books and bibliography	*Fisiologia e Biofisica delle Cellule. Edises. Tagletti, Casella.* *Koeppen B. M., Stanton B. A. - Berne & Levy. Fisiologia - Casa Ed. Ambrosiana. D. U. Silverthorn - Fisiologia umana. Un approccio integrato - Ed. Pearson. D. Randall, W. Burggren, K. French - Fisiologia animale. Meccanismi e adattamenti - Ed. Zanichelli. Alberts B. et al - Biologia molecolare della cellula - Ed. Zanichelli*
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
130	*36*	*30*	*64*
ECTS			
6	*4*	*2*	
Teaching strategy			
	The lectures are supported by projection of videos in the classroom, consultation of bibliographic material and databases for the preparation of a short paper and discussions in the classroom. The slides of the lectures and exercises, the bibliographic information on / and the scientific articles used, the website references (links) to the multimedia material used to support the teaching of each lesson, are provided to the student at the beginning of the next lesson. *Students (attending or not) can contact the teacher via e-mail to make appointments and / or to receive explanations and teaching material.*		
Expected learning outcomes			
Knowledge and understanding on:	○ The student must acquire notions relating to the structure of animal cells and animal tissues.		

Applying knowledge and understanding on:	
Soft skills	• *Making informed judgments and choices* ○ The student must be able to argue independently and to quickly range between the topics of the discipline.

Assessment and feedback	
Methods of assessment	*The evaluation will be carried out by means of an oral exam.*
Evaluation criteria	• *The student will also be evaluated according to the ability of transversal understanding*
Criteria for assessment and attribution of the final mark	*The oral exam is graded out of thirty. The exam is passed with a grade of at least eighteen.*
Additional information	

Bari,
11.09.2021

Firma

(Prof.)