



BIO1261

Biophysics

[45h+30h exercises] 6 credits

This course is taught in the 1st and 2nd semester

Teacher(s): Alain Cornet, Pierre Defrance, Patrick Gilon, Jean-François Rees (coord.)
Language: French
Level: First cycle

Aims

The course aims to the analysis of the fundamental biological questions by the means of physics. It follows upon teaching physics and biology in BAC1. During this teaching, these disciplines will be integrated in the analysis of fundamental biological questions, focused on the interactions of the cell with its physical environment and on the physical laws governing the physiology of cells. Teaching will aim at the understanding of important physical concepts, while integrating them in the living world. Teaching will establish the link of Biology with Physics, showing the relevance of Physics in the analysis and the comprehension of biological phenomena.

Main themes

To achieve these goals, the course will be articulated according to two axes. In the first, the nature and the interactions of the electromagnetic radiations with cells will be analyzed. That includes Maxwell's equations, the electromagnetic waves (classification and characteristics), the physical properties of light, the visual systems and ocular optics. The perception of the sound waves by the cells and the auditive systems, including echolocation will be also investigated; finally, radioisotopes and their biological effects will be studied; The use of the electromagnetic radiations in biology will be also illustrated (microscopy, medical imagery). The second chapter will approach the phenomena of ionic substances transport through physiological membranes and their roles in the cellular excitability and the transmission of information.

Content and teaching methods

The teachers will start from the biological question, and will frame it by the concepts of physics necessary to its comprehension. That could be carried out partially by the examination of case studies. The course will approach the following concepts:

1. Electromagnetic radiations and their biological effects; Maxwell's equations; Electromagnetic waves: classification and characteristics; Physical properties of light; Photons and visual systems; Ocular optics; use of the light in the analyses of biological phenomena; light and photosynthesis; Sound waves and hearing; Nature of sound waves; Biological systems for the production of sounds; Auditive systems; Middle and intern ear; Physiology of the ciliated cell; Echolocation; Nuclear physics and living organisms; Nature and properties of radioactive elements; Method of detection and quantification; Effects of radiations on living tissue; Use of radioactive elements in biology and medicine.
2. Mechanisms of transport: Transport of molecules through biological membranes; Diffusion; Osmosis and osmotic pressure; Osmoregulation in plants and animals;
3. Biological electricity: Electric properties of membranes; Equilibrium potential; Equation of Nernst; Membrane resting potential; Equation of Goldmann; Action potential; Ionic bases of the action potential; Ion channels; Propagation in excitable cells; Measurement techniques of membrane electric phenomena

Other credits in programs

BIOL12BA	Deuxième année de bachelier en sciences biologiques	(6 credits)	Mandatory
VETE12BA	Deuxième année de bachelier en médecine vétérinaire	(6 credits)	Mandatory