FSA2220 Introduction to life science

[60h] 6 credits

This course is taught in the 2nd semester

Teacher(s):	Spyridon Agathos, Georges Bastin, Jean Lebacq, Philippe Lefevre (coord.), Vincent Legat, Yves-Jacques Schneider
Language:	French
Level:	Second cycle

Aims

This course consists of an introduction to cellular biology and physiology for engineers. It comprises the #cellular# and #systems# aspects of physiology, and is accessible to all students who are in third year of the engineering curriculum.
The course is organized in three parts (A, B, C), with an introductory part A (30h00) and two additional parts B and C (15h00 each). The first part (A) focuses on the introduction to the cell world and its functioning as well as to the physiological systems of the entire body.
Parts B and C focus on system aspects on the one hand, and on cellular and biochemical aspects on the other hand. They emphasize with numerous examples the application of the state of the art of the engineer in the biomedical and biotechnological fields.

Main themes

This course consists of an introduction to cellular biology and physiology for engineers. It comprises the #cellular# and #systems# aspects of physiology, and is accessible to all students who are in third year of the engineering curriculum.

Content and teaching methods

Part A (30h00): Introduction to biology and physiology.
The first section of Part A will focus on the bases of cellular biology and physiology.
The physiological cell systems are approached, aiming at comprehending the necessity of physiological systems of the entire body:
1. Biochemistry: the chemical reactions of the living substance; the role of water
2. The cell: basic unit of the living
3. Biomolecules
4. Proteins: structures and functions
5. How do cells draw their energy from food?
6. From DNA to proteins
7. Synthesis and proteins addressing
8. Cell membrane transports
9. Cellular communications
The second section of Part A will introduce the physiological systems of the entire body: the body is an open system that maintains a controlled inner environment (homeostasis) constantly mixed (blood and circulatory system), and exchanging substance with the outer environment through interfaces (respiratory system, digestive system and urinary system).
Information exchanges are approached: within the body (neuroendocrinian mechanisms of the control of homeostasis) in the first place, and then between the body and the exterior (sensori-motor functions and upper functions of the nervous system).
Last but not least, the reproductive function is analyzed.
Part B (15h00): Complement in systems physiology.
This part of the course focuses on an in depth study of a few chosen topics, in order firstly to bring the students to perceive the interest of the interaction between the engineer and the biologist, and secondly to prepare the students to the following process in specialization:
1. The circulatory function: blood properties, cardiac pump function, hemodynamics and lymphatic flow, regulatory mechanisms of the circulatory function, physiopathological mechanisms.
2. The respiratory function: lungs gaz exchanges, gaz transport between lungs and the tissues, regulation of the respiratory function, physiopathological mechanisms.
3. The major functions of the nervous system: acquisition, coding and sensorial information handling, motricity control circuits, sensorimotor co-ordination.
4. The introduction to physiological systems modeling in the entire body, with applications, for example in system analysis, fluid mechanics, signal processing and dynamics of articulated systems.
Part C (15h00): Complement in cellular biology and biochemistry.
This part of the course mainly based on cellular biology and biochemistry will study in depth a few topics and will show possible applications in the field of bioengineering. By way of example, but not exhaustively:
1. The defense mechanisms of the body. Application: biocompatibility.
2. The energetic metabolism. Application: cellular culture modeling in bioreactors.
3. The enzymatic kinetics. Application: enzymes in bioreactors.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Part A is an introductory course, with no prerequisite.
Part A is a prerequisite for parts B and C.
This course also constitutes a gate to engineers with regards to specialized teaching in biomedical engineering and bioengineering.
Various introductory scientific books will be recommended in the framework of the course, and the written support will consist of teachers# transparences. Access to databases of various other courses, and links to reference scientific books will be encouraged.
Examination: a combination of a project, written and oral examination.

Programmes in which this activity is taught

BRAS3DS	Diplôme d'études spécialisées en brasserie
MAP2	Ingénieur civil en mathématiques appliquées

Other credits in programs

MAP21	Première année du programme conduisant au grade d'ingénieur civil en mathématiques appliquées	(6 credits)
MECA21	Première année du programme conduisant au grade d'ingénieur civil mécanicien	(6 credits)
MECA22	Deuxième année du programme conduisant au grade d'ingénieur civil mécanicien	(6 credits)