UCLouvain

lbbmc2107

2025

Microbial cellular physiology

The version you're consulting is not final. This course description may change. The final version will be published on 1st June.

5.00 credits	36.0 h + 18.0 h	Q2

Teacher(s)	Claeys Bouuaert Corentin ;Declerck Stephan ;Desguin Benoît ;Hols Pascal ;Laloux Géraldine ;Morsomme Pierre ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	Based on conferences from invited speakers and on recent literature (books, reviews and research articles) the topics that are treated in the activity are organised around three axes : 1. Biosynthesis and function of the cellular envelopes : "The microbial cell in space" Microbial cell envelopes are crucial for maintaining the shape of microorganisms, for preserving their integrity against external stresses, and for ensuring communication with their environment. They provide an interface where many different transactions take place (transport of metabolites, secretion, stimuli sensing, cell-to-cell signalling, adhesion, etc.). Topics developed in this part of the activity are : Structure, composition, and dynamics of microbial cell walls. Molecular mechanisms of resistance to drugs, antibiotics and bacteriocins. Cell adhesion and stimulation of the immune system. Proteins secretion and post-modification. Molecular mechanisms of environmental stimuli sensing. Some of these topics are viewed in the light of recent genomics and post-genomics data. Biotechnological and biomedical aspects are also considered. 2. Control of the cell cycle : "The microbial cell in time" The bacterial cell cycle is orchestrated by multiple processes that are tightly coupled in space and time to ensure proper co-ordination between chromosome replication, segregation and cell division. These processes take place at specific locations within the cell, and are controlled by rather sophisticated molecular mechanisms. Topics developed in this part of the activity are : structure of the bacterial genome, DNA condensation and organisation within the nucloïd, chromosome replication and segregation, mechanisms of cell elongation and cell division. Current knowledge based on model systems will be discussed. Specific features of the bacterial cell cycle will be compared to that of other micro-organisms including eucaryots (e.g. Saccharomyces cerivisiae and Schizosaccharomyces pombae). 3. Microbial metabolism, control and biotechnological applications : "domesticating microbes"Bio-transformations mediated by micro-organisms play a key role in the ecology of the planet (e.g., by detoxifying of polluting compounds in soil and water). Micro-organisms are also exploited for the preservation of food, and more recently, for large-scale production of a variety of bio-molecules in chemical, food and pharmaceutical industry.Topics developed in this part of the activity are: Bio-control of bacterial metabolism in fermentation processes and bio-remediation Metabolic engineering of micro-organisms (yeast, lactic acid bacteria, corynebacteria, zymomonas, etc.) for industrial production of simple and complex compounds (e.g., amino-acids, ethanol, lactate, vitamins, drugs, etc.). In silico reconstruction of metabolic pathways and predictive approaches.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 The primary goal of this activity is to provide an in depth view of specific aspects of microbial cell physiology (metabolism, cell envelopes, interaction with the environment, cell cycle and cell division) and their implication in terms of biomedical and biotechnological applications (bio-remediation, metabolic engineering). This new background will be built up based on the most recent experimental approaches aiming at addressing physiological problems at both molecular and global levels (biochemistry, structural biology, fluorescence techniques, high-resolution microscopy, bioinformatics and functional genomics, etc).At the end of the activity, the trainee should be able to develop specific topics from the recent literature, to formulate new working hypothesis relevant to specific issues, and to propose experimental strategies aiming at solving these issues, just like a scientist working in the field would do.
Evaluation methods	Students present a seminar based on a recent article connected to the course. Integration of the subject is examined during a discussion following the seminar.

Content	Vol.1 The content of the course is divided into specific modules developed by each teacher based on recent literature and his/her main field of expertise. Concepts are developed so as to reach the current state of the art, both in terms of knowledge and technological developments. Vol 2 External speakers from the academic world or industry are invited to contribute based on their personal scientific and professional activities. Excursions outside the university are organised in order to meet professionals of the field in their specific environment.
Other infos	Precursory courses: Students must be familiar with most fundamental concepts and techniques in microbiology and molecular biology
Faculty or entity in charge	BIOL

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Biochemistry and Molecular and Cell Biology	BBMC2M	5		
Master [60] in Biology	BIOL2M1	5		