UCLouvain

wfarm1282

2023

General microbiology

3.00 credits	20.0 h + 15.0 h	Q1

Teacher(s)	Michiels Thomas ;
Language :	French
Place of the course	Bruxelles Woluwe
Prerequisites	- Principles of biology and basic biochemistry (nature and function of macromolecules : proteins, sugars, lipids ; metabolism ; biological membranes ; energy) - Cellular biology : compartments of the cell, membranes, transport, function of organelles - Molecular biology : principles of gene expression in bacteria and in eucaryotes *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	**Table of contents :** **A. General introduction** 1. Discovery and description of microorganisms 2. Definition of Microbiology (Eucaryotes versus procaryotes ; viruses versus bacteria) **B. Bacteriology** **1. Growth of bacteria** a. Growth conditions (temp., pH, salinity, pressure') b. Nutrients c. Growth curve d. Methods used to measure bacterial growth e. Evolution **2. Structure of bacteria** a. Size and shape b. The bacterial cell : - Cytoplasm components - Plasma membrane (phospholipid bilayer) and proteins (F0F1 ATP synthetase, respiratory chain components, permeases, export and secretion factors...) - Bacterial wall : Peptidoglycan, Gram staining - Morphology of Gram-positive bacteria - Morphology of Gram-negative bacteria (including periplasm, outer-membrane, LPS..) - Surface structures (pili, flagellum, capsule) - Spores - At the community level : formation of biofilms **3. Membranes and transport of molecules** a. Import - Porins and surface receptors (gram-negative) - Permeases (H+ symporters, ATPase-driven, phosphorylation-driven : PTS) b. Export and secretion - The Sec-dependent pathway - Secretion systems in Gram-negative bacteria **4. Genetic information** a. The E. coli chromosome, its replication and error rate of polymerases b. Plasmids (replication, coding capacity, copy number, compatibility) c. Expression of bacterial genes (transcription and translation signals) d. Transcription regulation : **- operon** (ex. the lactose operon concept) - **regulon** (ex. SOS response, 'igma"""") - **two-component systems** (phosphorelays) ''''''''''''''''**ional regulation** (small RNAs) ''**inter'bacterial regulation** : quorum sensing e. Mutations - mutation types and frequency - detection of mutants (screening versus selection)

	f. Bacteriophages - ', lytic cycle and lysogeny g. Transfer of genetic information - transformation, transduction, conjugation, transposition - limitation of genetic transfer (restriction-modification, the CRISPR-Cas system) **5. Anti-bacterial agents and antibiotics** a. Disinfectants and antiseptics (chemicals, heat, filtration, UV and gamma radiations) b. Antibiotics: antibiotic examples, targets and mode of action - metabolism - replication and transcription - Ribosomes - cell wall synthesis - membranes c. Antibiotic resistance - antibiotic inactivation - target modification or overproduction - target replacement - efflux pumps d. Abuse and misuse of antibiotics, and origin of resistances **C. Virology** **1. General introduction** a. Historical discoveries in Virology b. Virion morphology and structure (components : nucleic acids, capsid, envelope...) c. The viral cycle : Attachment, uncoating and entry, gene expression, réplication, assembly, egress (according to the nature of the virus) d.Transmission and propagation e. Classification **2. Selected examples illustrating the diversity of replication cycles according to the genome and virion properties.** a. SV40, a small non-enveloped DNA virus b. poliovirus, a positive-stranded non-enveloped RNA virus c. influenza, a segmented, negative-straded RNA virus d. HIV, a lentivirus (example of retrovirus) Practicals on bacteriology, gene transfer and antibiotic resistance are organized as part of this course
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 After the course, the student will be able to - Define essential terms used in bacteriology and virology - Describe the morphology and components of Gram-positive and Gram-negative bacteria - List and explain the role of factors involved in protein, metabolites and nucleic acids transmoprt in bacteria (import, secretion, gene transfer....) - Decipher and explain a regulation pathway simlar to those explained in the course - Propose an hypothetical signal transduction pathway explaining a given bacterial property - Explain the principle of the activity and specificity of antibacterial and antiviral agents - List a series of major antibiotics (penicillin, sulfonamides, aminoglucosides...) and explain there mode of action - Deduce some steps of the replication cycle of viruses, based on their nature (DNA versus RNA viruses, segmented versus non-segmented geneomes, enveloped versus non-enveloped....) In addition, the student will develop an analytical spirit and be able to - find the limitations of result interpretations and so called « scientific demonstrations » - define the logics behind regulation pathways ; - interpret simple data and calculations on bacterial growth, mutation rates...
Evaluation methods	The exam is organized as a written exam. The exam includes a section with multiple choice questions (10 to 12 points /20), and a section with short open-ended questions and/or exercices in which students will be evaluated on their capacity to implement their knowledge. For the students who attended the practicals, 3 points will be devoted to the evaluation of these practicals in the global mark of the exam (on 20 points). Evaluation of the practicals will be based on the technical skill of the student, the quality of the report and on the quality of answers to questions related to the practicals in the general exam.

Teaching methods	Lectures and tutorial classes (possibly by Teams or life+streaming according to the COVID evolution) Practicals are organized in the framework of this course. Attendence to the practical is mandatory to validate the course.
Content	Introduction to the world of viruses and bacteria. Topics include : - structure and organization of typical bacteria (Gram+ or Gram-) - bases of bacterial functioning (compartmentalization, transport, energy) - nature, functioning, and evolution of bacterial (and bacteriophage) genomes - DNA transfer within the bacterial cell and between bacteria - priniciples of antibiotics activity, and development of antibiotic resistance - structure, organization and mode of replication of viruses that infect eucaryotic cells - functioning of viruses and consequences of the infection, based on selected examples
Inline resources	Files with informations, exercices and with slides presented in the course are available on MoodleUCL (https://moodleucl.uclouvain.be/).
Bibliography	Syllabus (texte + illustrations présentées au cours), disponible sur Moodle Site Web d'initiation à la virologie (+ tests et quiz) http://www.virologie-UCLouvain.be Prescott, L. M., Harley, J. P. & D. A. Klein (2003). Microbiologie. Bruxelles : De Boeck
Other infos	For students who can not document a previous attendence to equivalent practicals in Microbiology, attendence is mandatory. In cas of absence to the practicals, the global mark for the course (including the theoretical part) will be set to 0/20 for the entire academic year.
Faculty or entity in charge	FARM

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Bachelor in Biomedicine	SBIM1BA	3	WMD1120 AND WMD1006 AND WSBIM1001	🔍
Bachelor in Pharmacy	FARM1BA	3	WMD1120P AND WMD1006	🔍