UCLouvain

wfarm1282

2018

General microbiology

3 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
Aims	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 1 - 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... - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	Written exam made of three parts : - multiple choice on basic knowledge - short open questions and interpretations of simple cartoons - exercices involving multichapter and dynamic parts of the course

Teaching methods	The course will be given in classical lecture hall, with use of slides and blackboard drawings. The course will focus as much as possible on the dynamic and mechanistical aspects of microbiology. Links will be established between different chapters in a dynamic fashion and links will be established as much as possible with other teachings such as molecular biology and biochemistry, medical microbiology, pharmacology, and immunology. Part of the course is available in e-learning (in french) at the url : www.virologie-uclouvain.be Practicals on bacteriology, gene transfer and antibiotic resistance are organized as part of this course
Content	Introduction to the nature of viruses and bacteria - impact of the microbial wold on the global ecosystem - functional complexity of simple organisms (simple and complex regulation pathways) - fast evolution and outstanding adaptation capacities of microbes - efficacy of basic mechanisms such as cell division and replication - genetic flexibility and ease of genetic exchanges and their consequence in the emergence of antibacterial and antiviral resistances. - nature and basic replication cycle of viruses - link between the nature of the viral genome and virion properties with the replication cycle of the virus in a single cell and with its interaction with the host
Bibliography	Syllabus : text + illustrations (slides) Web site for initiation to virology http://www.virologie-UCLouvain.be Prescott, L. M., Harley, J. P. & D. A. Klein (2003). Microbiology. De Boeck Ed.
Faculty or entity in charge	FARM

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Biomedicine	SBIM1BA	3	WMD1120 AND WMD1106	🔍
Bachelor in Pharmacy	FARM1BA	3	WMD1120P AND WMD1006	🔍