UNIWERSYTET GDAŃSKI

Course title
Mikrobiologia / Microbiology

ECTS code
13.3.0971

Name of unit administrating study
Faculty of Chemistry

Studies

Field of study	Type	Form	
Chemistry	Bachelor	Full-time studies	

Teaching staff
Prof. dr hab. Piotr Skowron

Forms of classes, the realization and number of hours

A. Forms of classes, in accordance with the UG Rector's regulations
lecture, laboratory classes

B. The realization of activities
in-class learning

C. Number of hours
60 h (30 h lecture, 30 h laboratory classes)

ECTS credits 4

classes - 60 h
tutorial classes – 10 h
student's own work – 30 h

Total: 100 h - 4 ECTS

The academic cycle
2021/22 winter semester

Type of course
obligatory

Language of instruction
Polish

Teaching methods

Team work
Conducting experiments
Experimental results analysis with discussion
Lecture with multimedia presentation

Form and method of assessment and basic criteria for evaluation or examination requirements

A. Final evaluation, in accordance with the UG study regulations
lecture – exam
auditorium classes – course completion (with a grade)

B. Assessment methods
Exam (test, open questions, oral)
Final grade assessment (Conducting the experiments during laboratory part, written documentation, project or presentation and final test)

C. The basic criteria for evaluation or exam requirements
Lecture assessment:

1. Test and open questions exam,
2. supplementary oral exam
3. Final grade consistent with the scale given in UG Study Regulations
4. Additional term for the students, who didn't achieve 51% of possible assessment points.

Laboratory
1. Conducting the experiments during laboratory part, according to the given protocol and laboratory report in a written form (lab diary).
2. Pre-test on each lab meeting
3. Final test covering whole lab manual content
4. Multimedia presentation on subject proposed by the teacher.

Required courses and introductory requirements
None

Aims of education
1. Presenting the topics given in lecture and lab course contents.
2. Introducing the students to microorganisms cultivation methods
3. Introducing students to microorganisms identificaton methods
4. Introducing students to microorgamisms characterisation methods

5. Providing and excercising the aseptic work rules and good laboratory procedures in work with microorganisms
6. Providing and excercising the ability of individual planning and conducting the microbiological experiment.

Course contents

A. Lecture course contents:
Procaryotic and Eucaryotic microorganisms characterisation. Unicellular and multicellular microorganisms. Infectious particles on the boundaries of life: viruses, bacteriophages, virioids, prions. Molecular community of life on Earth and its origins. Similarities and differences in cellular organisations of procaryotic and eucaryotic organisms. Microorganisms cells chemical composition, structure and function relations of biological compounds. Morphological forms of cells. Types of cilia, structure and functions of fimbriae and conjugative pili. Cell covers: cell membranes, cell wall structure of (+), Gram (-) bacteria, Archaebacteria, Algae, Fungi and Protozoa, bacterial envelopes. Structure and functions of periplasmatic space and cytoplasmic membrane. Mechanisms of substance uptake by cells: simple diffusion, diffused diffusion, active transport, group translocation. Nucleoid and its organisation. Proteins connected with nucleoid s organisation in the bacterial cell. Extra-chromosomal genetic elements (plasmids). Ribosomes and translation. Magnetosomes, carboxysomes. Chromatophor bodies.Spare substances. Survival forms: endospores, conidiae, microspores, cysts. Bacteriophages and viruses structure. Microorganisms growth and growth control. Development cycles. Microbiological media types, bacterial culture types. Bacterial growth curve, phases of bacterial growth. Physical and chemical conditions influence on bacterial growth. Microorganisms environmental impact. Methods of microorganisms observation. Patogenesis. Microorganisms nutrition. Modes of nutrients intake. Ectoenzymes. Microorganisms differentiation according to utilized carbon source: autotrophs (photoautotrophs, chemolitoautotrophs), heterotrophs (prototrophs, auxotrophs). Nitrogen sources. Atmospheric nitrogen binding process. Sulfur and other elements sources. Microorganisms differentiation according to the utilized source of energy (phototrophs, chemolitotrophs, chemoorganotrophs). Basic metabolic processes. Katabolic and anabolic reactions. Aerobic respiration, anaerobic respiration, fermentation. ATP production, types of phosphorylation: oxydative and substrate-level phosphorylation. Photosynthesis, characteristics, chlorophile and accompanying dyes. Photosynthesis organellae. Chemosynthesis. Chemosynthetizing bacteria characteristics (nitrifying bacteria, sulphur, hydrogen, iron-oxidizing bacteria). Life cycles of microorganisms and viruses. Genotype and phenotype. DNA and RNA structure and organisation Genes and their expression products. Replication. Enzymes of DNA replication. Transcription. Gene expression control – positive and negative regulation. Genetic engineering and molecular biotechnology basics.

Bibliography of literature

A. Literature required to pass the course

• Salyers, A.A., Whitt, D.D.: Mikrobiologia. Różnorodność, chorobotwórczość i środowisko. Wydawnictwo Naukowe PWN, Warszawa 2003
• Kunicki-Goldfinger, W.J.H. Życie bakterii. Wydawnictwo Naukowe PWN, Warszawa 2005
• Schlegel, H.G. Mikrobiologia ogólna. Wydawnictwo Naukowe PWN, Warszawa 2000
• Libudzisz, Z., Kowal, K., Żakowska, Z. (red.) Mikrobiologia techniczna. Mikroorganizmy i środowiska ich występo-wania. Wydawnictwo Naukowe PWN, Warszawa 2007
• Libudzisz, Z., Kowal, K., Żakowska, Z. (red.) Mikrobiologia techniczna. Mikroorganizmy w biotechnologii, ochronie środowiska i produkcji żywności. Wydawnictwo Naukowe PWN, Warszawa 2008
• Kur, J.: Ćwiczenia z mikrobiologii ogólnej. Wydawnictwo Politechniki Gdańskiej, Gdańsk 1993
• Tortora, G.J., Funke, B.R., Case, C.L. Microbiology. An introduction. Pearson International Edition, San Francisco 2007

B. Extracurricular readings

• E. M. Szewczyk Diagnostyka bakteriologiczna. Wydawnictwo Naukowe PWN, Warszawa 2005
• Brown T. A. [red. wyd. pol. Piotr Węglański] Genomy, Wydawnictwo Naukowe PWN,Warszawa 2009, wyd.2
B. Literatura uzupełniająca
• Stryer L. Biochemia. Wydawnictwo Naukowe PWN, Warszawa 1999
• J. Baj, Z. Markiewicz Biologia molekularna bakterii. Warszawa 2006

Knowledge

1. Student names and describes differences in the structure of procaryotic and eucaryotic cell.
2. Student knows the structure and methods for observation of Procaryotic cell.
3. Student knows modes of nutrients bacterial uptake, involving transmembrane transport systems.
4. Student knows bacterial metabolic processes (aerobic respiration, anaerobic respiration, fermentation, photosynthesis, chemosynthesis).

5. Student knows and understands aspects regarding bacterial genetics (differences between genotype and phenotype, DNA and RNA structure and organisation, replication, transcription and translation processes, gene expression control).
6. Student knows chosen apects of microorganisms applications in the genetic engineering.
7. Student knows modes of sterilization, microbiological media types and types of bacterial cultures in laboratory conditions.
8. Student describes chosen bacterial species, belonging to Enterobacteriaceae.
9. Student knows microorganisms sustaining the physiological microbiota of human organism as well as pathogenic microorganisms.
10. Student knows possible actions for pathogenic microorganisms eradication, groups of antimicrobial chemical substances, their mechanism of action and drug resistance.

Skills

1. Is able to prepare the place to work and work aseptically.
2. Follows given experimental procedures and rules of work with microorganisms.
3. Performs chemical calculations needed to perform microbiological experiments.
4. Is able to prepare microbiological media, perform microbiological streaks using different techniques and to culture aerobic and anaerobic microorganisms.
5. Is able to prepare microbial slades preparation and perform microscopic observation of different slides.
6. Is able to perform a swab and assess the drug resistance.
7. Is able to analyze chosen biochemical features of the bacteria.
8. Is able to identify microorganisms upon their morphological and biochemical features.
9. Individually plans the course of experiments to perform.
10. Discussess obtained experimental results.
11. Is able to involve knowledge from different fields while concluding after an experiment.
12. Explains microbiological topics in understandable and professional language.

Social competence

1. Student understands need of further education.
2. Student shows creativity as well in individual and team work.
3. Student is careful when handling chemicals or biological materials.