

EC 06-VII Biology, Metabolism and Systematics of Microorganisms

Code	EC 06-VII
ECTS credits	4
Attendance time	7 Semester
Language of instruction	Ukrainian
Duration	1
Cycle	Each Winter Semester
Coordinator	Associate professor, PhD Olha Vinnikova
Instructor(s)	Associate professor, PhD Olha Vinnikova
Allocation of study programmes	Biology
Recommended prerequisites	Microbiology; Biochemistry; Physics and Bioecology
Learning objectives	Theoretical knowledge and practical skills in the taxonomy of prokaryotes, studying the peculiarities of metabolism and biology of prokaryotes.
Syllabus	<p>Chapter 1. Basics of nutrition of prokaryotes. Energy metabolism</p> <p>Topic 1. Catabolism and anabolism. Types of nutrition of prokaryotes: heterotrophic and autotrophic. Energy sources, electron donors and carbon sources in the nutrition of prokaryotes. Sources of energy production by microorganisms: organic and inorganic compounds, light energy.</p> <p>Topic 2. Chemoorganotrophic production of energy. Preparatory metabolism, its features and functions. Catabolic transformation of hexoses. Fermentation. Breath. Cycle of tricarboxylic acids, glyoxylate shunt, pentose phosphate cycle.</p> <p>Topic 4. Chemolithotrophic production of energy. Electrons transport respiratory chains. Electron donors and acceptors in the metabolism of prokaryotes. General features of chemolithotrophy, types of chemolithotrophy. Anaerobic oxidation of ammonia. Diversity of anaerobic</p>

respiration in prokaryotes. Methanogenesis as a unique mode of existence of archaeotes.

Topic 5. Phototrophic production of energy by prokaryotes.

Photosynthesis and phototrophy. Methods of light energy assimilation: oxygenic and anoxygenic phototrophy. The principle of operation of photosystems. Quasi-phototrophy of erythrobacteria and halobacteria.

Chapter 2. Constructive metabolism of prokaryotes.

Topic 6. Anabolism. Carbon autotrophy. Ways of synthesis of carbohydrates by microorganisms. The structure of anabolism, its connection with catabolism. Assimilation of inorganic carbon by microorganisms. Carbon autotrophy.

Topic 7. Nitrogen assimilation by microorganisms. Assimilative nitrate reduction and nitrogen fixation. Sources of nitrogen used by microorganisms. Assimilative nitrate reduction. Nitrogen fixation. The structure and functioning of the nitrogenase complex. Synthesis of amino acids. Synthesis of nucleotides. Features and mechanism of purine synthesis. Features and mechanism of synthesis of pyrimidines.

Chapter 3. The place of bacteria in the biological megasystem. Systematics of archaea

Topic 8. Systematics, nomenclature and principles of classification of prokaryotes. Terminology of systematics, nomenclature, identification. Definition of the terms "species", "strain", "clone" in prokaryotes. International Code of Bacterial Nomenclature. Determinants of bacteria: "Bergey's Manual of Determinative Bacteriology", "Bergey's Manual of Systematic Bacteriology".

Topic 9. Systematics of archaea. Phylums AI Crenarchaeota, AII Euryarchaeota. New phylum of archaea: peculiarities of structure, physiology, metabolism, ecological niches of representatives of the phylum Nanoarchaeota, phylum Thaumarchaeota, phylum Aigarchaeota. Phantom phylum Lokiarchaeota.

Chapter 4. Systematics of bacteria

Topic 10. Phylums B1-VII.

Topic 11. Phototrophic bacteria.

Topic 12. The most heterogeneous Phylum BXII.

	<p>Topic 13. Bacteria that have a predominantly gram-positive morphotype and are capable of forming endospores.</p> <p>Topic 14. The former group of actinomycetes and obligate energetic parasites.</p> <p>Topic 15. Few phylums of bacteria.</p>
Literature	<p>Bergey's manual of systematic bacteriology: 2nd edition. Vol. 1, 2A, 2B, 2C, 3, 4, 5. – Springer, 2001-2012.</p> <p>Rosenberg E., DeLong E., Thompson F. et al. The prokaryotes: Prokaryotic physiology and biochemistry. – Berlin Heidelberg: Springer-Verlag, 2013. – 682 p.</p> <p>Boone D.R., Castenholz R.W., Garrity G.M. (eds.) Bergey's Manual of Systematic Bacteriology. Volume 1. The Archaea and the Deeply Branching, and Phototrophic Bacteria. – 2-nd edition. –Springer, 2001. – 721 pp.</p> <p>Elsas J.D., Trevors J.T., Rosado A.S., Nannipieri P. Modern Soil Microbiology 3rd Edition. – CRC Press, 2019. – 472 p.</p> <p>Tate Robert L. Soil Microbiology 3rd Edition. – Wiley-Blackwell, 2021. – 570 p.</p>
Teaching and learning methods	Lecture (3 WH), Laboratory (1 WH)
Workload	<ul style="list-style-type: none"> • Classroom hours: 32 h • Laboratory hours: 16 h • Individual study time/preparation and postprocessing: 72 h <p>Total: 120 h</p>
Assessment	The assessment consists of written test and preliminary graded study achievements.
Grading procedure	The module grade is the sum of preliminary study achievements and the final test grade.
Basis for	Course project in specialty.