



JAGIELLONIAN
UNIVERSITY
IN KRAKÓW

Life Systems

Educational subject description sheet

Basic information

Field of study Joint Bachelor in Sustainability		Education cycle 2025/26	
Speciality Environmental & Life Sciences		Subject code UJ.WPAJBSELSS.840.16542.25	
Organizational unit Faculty of Law and Administration		Lecture languages english	
Study level first cycle (joint degree programme)		Subject related to scientific research Yes	
Study form full-time degree programme		Disciplines Earth sciences and the environment, Biological sciences	
Education profile General academic		ISCED classification 0521 Environmental sciences	
Mandatory obligatory		USOS code	
Subject coordinator	Piotr Szwedo		
Lecturer	Richard Williams, Daniel Schubert, Manuel Hernández Fernández		
Period Semester 3	Examination graded credit	Number of ECTS points 5.0	
	Activities and hours Lecture: 45		

Goals

C1	To provide the basic knowledge on biological systems, the patterns of complexity and the levels of biotic organisation.
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Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge - Student knows and understands:			
W1	the molecular and cellular fundamentals of living organisms; the student shows understanding of basic cellular and tissue functions; the student can explain classic genetics. The student is introduced to concepts of biological species, population, community and ecosystem	JBS_K1_W01, JBS_K1_W03, JBS_K1_W06, JBS_K1_W07	written credit, credit with grade
W2	the fundamental evolutionary concepts and processes, as well as their relationship with ecological, and biogeographical determinants; interprets the factors that conditioned the origin and persistence of life on Earth and the relationships among living organisms; understands the characteristics of the past biosphere, including its re-organisation after global changes and the spatio-temporal distribution of extinct organisms.	JBS_K1_W02, JBS_K1_W03, JBS_K1_W04, JBS_K1_W06, JBS_K1_W07	written credit, credit with grade
W3	the characteristics of the current biosphere, including the organisation and distribution of present-day organisms; the student comprehends the diversity of living organisms and the basic differences in their development and organization.	JBS_K1_W03, JBS_K1_W04, JBS_K1_W06, JBS_K1_W07	written credit, credit with grade, presentation
Skills - Student can:			
U1	critically analyse academic literature from the field of life sciences, correctly formulating simple research questions on the basis of source materials and systematically finding answers to those questions with the help of the academic teachers.	JBS_K1_U01	written credit, credit with grade, presentation
U2	present this information-defending a substantiated opinion, in the English language at the CEFR B2 level.	JBS_K1_U02	credit with grade, presentation
U3	apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.	JBS_K1_U03	credit with grade
Social competences - Student is ready for:			
K1	to spread awareness on global change (on an evolutionary scale), can consider different visions of the past and future and develop their own evidence-based opinions in reference to the balance of values linked to the economy, well-being and the environment.	JBS_K1_K03	written credit, credit with grade
K2	to defend the importance of scientific data and methods as a basis for decision-making in life sciences, focusing on particular on the difference between science and pseudoscience in selected examples.	JBS_K1_K05	credit with grade

Calculation of ECTS points

Activity form	Activity hours*
Lecture	45
exercises performance	30

preparation for final test	30
preparation for classes	45
Student workload	Hours 150
	ECTS 5.0

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes
1.	Introduction to the unifying themes of biology: organization; information; energy; interactions; evolution	W1, W2, W3, U1, K1
2.	Chemistry of Life: chemical basis of life, macromolecules, prokaryote and eukaryote cells, organelles.	W1, U1, K1
3.	Cell processes 1: cell metabolism, respiration, and fermentation	W1, U1, K1
4.	Cell processes 2: photosynthesis, cell cycle, cell regulation	W1, U1, K1
5.	Genetic basis of evolution: Mendel, genes, inheritance, Central Dogma, genetic mutation	W1, U1, K1
6.	Populations genetics: genetic variation and recombination, Hardy Weinberg equilibrium, species concepts	W1, U1, K1
7.	Evolutionary theories: natural selection, continental drift, modern synthesis, punctuated equilibrium, evidence for evolution	W2, U1, K1
8.	Phylogeny and the Tree of Life: molecular v. morphological phylogeny; two kingdoms v. 3 domains; diversity	W2, W3, U1, U3, K1
9.	Macroevolutionary processes: spatial and temporal scales in evolution; adaptive vs. non-adaptive processes; Earth system and biosphere evolution; significance of fossil record	W2, U1, K1
10.	History of Life on Earth I: Precambrian Earth: Earth/life origin; prokaryotic world: archaic life; cyanobacteria and the Great Oxidation Event. Endosymbiotic origin and early diversification of Eukarya. Palaeozoic Earth: biodiversification; mass extinctions	W2, U1, K1
11.	History of Life on Earth II: Mesozoic Marine Revolution. Cretaceous terrestrial revolution. Evolutionary radiations of modern birds and mammals in the Palaeocene-Eocene greenhouse Earth. Neogene-Quaternary development of modern ecosystems	W2, W3, U1, K1
12.	Microbial diversity: Viruses, Bacteria, Archaea, (Fungi), "Protists", microbial species concept; Extremophiles; Megadiversity, mega-abundance, importance to global biomass; "Is everything everywhere?"; Importance of microbes to sustainability	W2, W3, U1, K1
13.	What's in a drop of water? (3 hours Practical Lab) <ul style="list-style-type: none"> o Microbe observation o Gram stain o Biocontrol of bacterial growth using phages: interpretation of results. 	W2, W3, U1, K1

No.	Course content	Subject's learning outcomes
14.	Diversity of algae, fungi and plants: Diversity of algae; Shared traits of plants (Alternation of generations, multicellular, dependent embryos, walled spores, apical meristems, cuticle, stomata); Non-vascular and vascular plants; Seed plants: Gymnosperms and Angiosperms; Fungal characteristics and diversity; Importance of algae, fungi, and plants to sustainability (food, energy, medicine, ecosystem services)	W2, W3, U1, K1
15.	Introducing animal diversity: Shared characteristics; Body plan (cavities; cleavage); Invertebrate diversity; focus on Insecta; Vertebrate diversity; Importance of animals to sustainability (food, medicine, pollination, other ecosystem services) Seminar discussion (1 hour): what living group is most important for sustainable life on Earth?	W2, W3, U1, U2, K1, K2

Course advanced

Teaching methods :

discussion, case study

Activities	Examination methods	Credit conditions
Lecture	written credit, credit with grade, presentation	Written exam - 50%; Groupd presentation and discussion - 20%; Personal work - 20%; Class participation - 10%

Entry requirements

None

Literature

Obligatory

1. Core textbooks will be 'Biology: A Global Approach', Global Edition (12th edition) by Campbell et al. Michael J. Benton (Editor), 2019. Cowen's History of Life (6th Edition). Wiley-Blackwell

Effects

Code	Content
JBS_K1_K03	The graduate can consider different visions of the future and develop own evidence-based opinions in reference to the balance of values linked to economic development, social welfare, and environmental protection.
JBS_K1_K05	The graduate can defend the importance of scientific data and methods as a basis for decision-making.
JBS_K1_U01	The graduate can critically analyse academic literature, formulate research questions and conduct research under supervision.
JBS_K1_U02	The graduate can present and report knowledge, methodologies, ideas, problems and solutions, clearly and comprehensively, in different forms destined for different audiences - including discussions and debates which require defending a substantiated opinion, as well as conversations in a foreign language at the CEFR B2 level.
JBS_K1_U03	The graduate can apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.
JBS_K1_W01	The graduate can describe the concept of sustainability and recognize the differences in relevant definitions, models and approaches.
JBS_K1_W02	The graduate can explain the axiological background of sustainability and summarize key stages of development of the concept.
JBS_K1_W03	The graduate can give examples of sustainability-related dilemmas and hypothesize on the optimal course of action.
JBS_K1_W04	The graduate can identify sustainability-related problems specific to selected cultural, geographical, and political contexts.
JBS_K1_W06	The graduate can describe interconnections between various aspects of sustainability and identify their significance in the context of natural and social sciences, with a special focus on disciplines included in the selected specialisation track (law and politics; chemistry and physics; chemistry and biology; economics and geography; economics, management and engineering; humanities).
JBS_K1_W07	The graduate can apply the theory and methodology of disciplines included in the selected specialisation track to sustainability-related problems, taking into consideration practical limitations such as protection of intellectual property.