SYLABUS

Nazwa przedmiotu/ Course title	Systematic and evolution
Nazwa jednostki prowadzącej przedmiot/Unit name	W. Szafer Institute of Botany Polish Academy of Sciences, Institute of Animal Systematic and Evolution Polish Academy of Sciences
Kierunek studiów/Field of study	Doctoral School of Natural and Agricultural Sciences
Forma studiów/Type of study	Full-time
Rodzaj przedmiotu/ Course type	Compulsory
Rok i semestr studiów/Year and semester of study	Winter semester 2024/2025
Stopień, imię i nazwisko koordynatora przedmiotu/ Degree, name of co-ordinator	Dr hab. Paweł Kapusta/ dr hab. Grażyna Szarek-Łukaszewska
Stopień, imię i nazwisko osoby prowadzącej (osób prowadzących) zajęcia z przedmiotu/ Degree, name of person(s) teaching the course	Dr hab. Grzegorz Worobiec, dr hab. Joanna Lenarczyk, dr Valerii Darmostuk, dr Monika Woźniak-Chodacka, Agnieszka Klimek-Kopyra, dr hab. Łukasz Przybyłowicz, dr hab. Georgalis Georgios, dr hab. Aneta Arct, dr hab. Łukasz Kajtoch
Forma(y) zajęć, liczba realizowanych godzin/ Type of course, number of hours	Lectures, 15 h
Cele przedmiotu/Aim of the course	
The student learns modern research methods of the systematics, taxonomy and evolution of plants, algae, fungi and animals. Confronts the classical identification of organisms (morphology, morphometry) and their systematic relationships with the determination of taxa and their phylogeny at the molecular level. Learns about the differences in methodology used in research on modern, subfossil and fossil material. Learns modern	

<table>
<tr><td colspan="2">methods and tools for field research used in botany and zoology. Expands knowledge about new trends in taphonomic, paleontological, phylogenetic, phylogeographic and evolutionary research.</td></tr>
<tr><td>Wymagania wstępne/
Prerequisites</td><td>Basic knowledge of biology</td></tr>
<tr><td>Efekty kształcenia/ Learning outcomes</td><td><u>Wiedza/Knowledge</u>:
The student has knowledge of modern methods used in the study of plants, algae, fungi and animals, allowing their identification using classical and molecular methods. He/she uses modern equipment for field research. The student has knowledge of new trends in taphonomic, paleontological, phylogenetic, phylogeographic and evolutionary research.

<u>Umiejętności/Skills</u>:
The student is able to propose a methodology appropriate to solve a specific research problem, knows the advantages and limitations of various research methods, is able to properly interpret the obtained results and find solutions to possible problems, is able to compare the obtained results with information from different sources and present correct conclusions.

<u>Kompetencje społeczne/Attitudes</u>:
The student is able to discuss the latest developments in the methodology of research on organisms and communicate the acquired knowledge in an accessible way; critically assesses the possibilities of their application, strives to expand his knowledge.</td></tr>
<tr><td colspan="2">Treści programowe / Program content</td></tr>
<tr><td colspan="2">Part I
Lecture 1: Fossil plants and fungi: taphonomy, taxonomy and palaeoecology (2h):
• preservation of plant and fungal remains,</td></tr>
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- fossils of anamorphs and teleomorphs of fungi,
- plants and fungi as paleoenvironmental and paleoclimatic proxies ,
- plant-fungal interactions in the past,
- fossils as a main source of information to calibrate phylogenetic trees.

Lecture 2: Which algae are the ancestors of higher plants? Systematics and evolution of green algae (2h):

- variety of morphological forms,
- differences between green algae and other algal systematic groups,
- features common for green algae and higher plants,
- reasons for changes in green algal systematic,
- advantages of geometric morphometrics over classic morphometrics in studies on taxa with complex cell shapes,
- evolution of morphology and genome.

Lecture 3: Taxonomy and evolution of neglected groups of fungi: the case of lichen-inhabiting fungi (2h):

- fungi as a key driver of multicomponent symbiotic interactions between different organisms,
- phylogenetic and taxonomic problem of polymorphic fungi,
- the influence of new data about lichen-inhabiting fungi on studies of lifestyle evolution in Ascomycetes.

Lecture 4: A modern perspective on taxonomy of a critical group of plant species (1.5 h):

- mechanisms shaping the diversity and variability of plants,
- Linnean vs. Integrative taxonomy,
- genus *Oenothera* as an example of a critical group.

Part II

Lecture 5: Taxonomy, systematics, zoological nomenclature (2 h):

- Why do we need Latin names for organisms?
- How to understand the Latin notation of the species name?
- How to describe a new species?
- Why do names change?
- Taxonomic revision – what is it and why?
- Marking keys.

Lecture 6: Palaeontology - a case study on the fossil record and evolution of amphibians and reptiles (2h):

- Geologic time, fossils, and fossilization process.
- Major principles of classification and nomenclature.
- Basic information on the skeletal anatomy.
- Major taxonomic groups of amphibians and reptiles.

Lecture 7: The evolution of parental care (2 h):

- Costs and benefits of parental care.

• Gender differences in parental care. • Genetics and epigenetics of parental care. • Patterns of parental care in vertebrates and invertebrates. Lecture 8: Hybridization and introgression – phenomenon and consequences (1.5 h): • Mechanisms of interspecific crossbreeding • Phenotypic and genotypic consequences of hybridization. • Interspecific crossbreeding and speciation. • Examples of hybridizing taxa.	
Metody dydaktyczne/ Teaching methods	Lectures
Sposób(y) i forma(y) zaliczenia / Evaluation	Pass mark. Successful completion of the course requires attendance at lectures and passing the final examination.
Metody i kryteria oceny/ Methods and criteria of assessment	Attendance at lectures confirmed by signing the attendance list. Final grade on material learned in lectures - exam.
Całkowity nakład pracy studenta potrzebny do osiągnięcia założonych efektów w godzinach oraz punktach ECTS /Total student workload needed to achieve the assumed effects in hours and in ECTS credits	27 h (15 h - lectures, 10 h - exam preparation, 2 h - exam) – 1 ECTS
Język wykładowy/ Language	English
Praktyki zawodowe w ramach przedmiotu / Internship as part of the subject	-
Literatura /Literature	Part I Lecture 1: • Florjan S., Worobiec G. 2016. Skamieniałości roślinne. Zarys tafonomii roślin. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, pp. 220.

	• Taylor, T.N., Krings, M., Taylor, E.L. 2015. Fossil fungi. Academic Press, London. • Strullu-Derrien, C., Selosse, M. A., Kenrick, P., & Martin, F. M. 2018. The origin and evolution of mycorrhizal symbioses: from palaeomycology to phylogenomics. New Phytologist, 220(4): 1012-1030. Lecture 2: • Lee R. E. 2009. Phycology. Fourth edition. University Press, Cambridge, 547 pp. • Lenarczyk J., Saługa M., Piątek J. 2020. Integrative approach helps clarify confusing taxonomy of the *Pseudopediastrum boryanum* species complex (Chlorophyceae), including recognition of five distinct species. Journal of Phycology 56: 1557–1574. • van den Hoek C., Mann D.G., Jahns H.M. 1995. Algae. An introduction to phycology. University Press, Cambridge, 627 pp. Lecture 3: • Maharachchikumbura, S. S. N., et al. 2021. Integrative approaches for species delimitation in Ascomycota. Fungal Diversity, 109(1), 155–179. https://doi.org/10.1007/s13225-021-00486-6 • Sanders, W. B. (2023). Is lichen symbiont mutualism a myth? BioScience, 73(9), 623–634. https://doi.org/10.1093/biosci/biad073 • Wu, B., & Cox, M. P. (2021). Comparative genomics reveals a core gene toolbox for lifestyle transitions in Hypocreales fungi. Environmental Microbiology, 23(6), 3251–3264. https://doi.org/10.1111/1462-2920.15554 Lecture 4: • Stace A. Clive. 1989. - Plant Taxonomy and Biosystematics. • John W. Davey & Mark L. Blaxter. 2011. RADseq: next-generation population genetics. Briefings in functional genomics 9(5): 416-423. • Ralph E. Cleland. 1972. Oenothera cytogenetics and evolution. Part II Lecture 5: • Mayr E., Ashlock P.D. 1991. Principles of Systematic Zoology. New York : McGraw-Hill • Bolton, B. 2007. How to conduct large-scale taxonomic

	revisions in Formicidae. Memoirs of the American Entomological Institute, 80: 52-71. • Strona https://www.iczn.org/ Lecture 6: • Sues, H.-D. 2019. The Rise of Reptiles. Johns Hopkins University Press, Baltimore, 400 pp. • Carroll, R.L. 1988. Vertebrate paleontology and evolution. New York: W.H. Freeman and Company, 698 pp. • Szyndlar, Z. and G.L. Georgalis. 2023. An illustrated atlas of the vertebral morphology of extant non-caenophidian snakes, with special emphasis on the cloacal and caudal portions of the column. Vertebrate Zoology 73:717–886. Lecture 7: • Royle N.J., Smiseth P.T. Kölliker M. The evolution of parental care. Oxford University Press, 2012. • Stearns S.C . "The evolution of life histories, Oxford University Press, 1992. • Krebs J.R., Davies N.B. Wprowadzenie do ekologii behawioralnej, PWN, Warszawa 2022. Lecture 8: • Mallet J. Hybridization as an invasion of the genome. Trends in Ecology & Evolution. 2005; 20(5):229-237. • Schwenk K., Brede N., Streit B. 2008. Introduction. Extent, processes and evolutionary impact of interspecific hybridization in animals. Phil. Trans. R. Soc. B3632805–2811. • Dowling, T. E., & Secor, C. L. (1997). The Role of Hybridization and Introgression in the Diversification of Animals. Annual Review of Ecology and Systematics, 28, 593–619.
Podpis koordynatora przedmiotu/ Signature of co-ordinator	
Podpis kierownik Szkoły Doktorskiej/ Signature of the Head of Doctoral School	

Passing rules

1.The exam is conducted and graded by the course coordinator.

2. The exam is conducted in the form of a written test.

3. The written exam consists of open and closed questions - single-choice or multiple-choice scored according to the following rules:

a) maximum 2 points are awarded for a correct answer in an open question;

b) a correct answer in a single-choice question is awarded 1 point;

c) for a correct answer to a multiple-choice question, 0.5 point is awarded for each correct answer.

4. The exam grade is based on the total points obtained in the written test and is determined according to the following rules:

Percentage (%) of the total points available	Grade	
	Verbal	Numerical
91 – 100	Very good	5,0
81 – 90	Good plus	4,5
71 – 80	Good	4,0
61 – 70	Satisfactory plus	3,5
55 – 60	Satisfactory	3,0
0 – 54	Fail	2,0

5. An unexcused absence (Terms and Conditions of the Doctoral School § 11 item 1e) from the examination will result in a grade of "2.0" (Fail).

6. The exam is passed when 55% of the total points possible in the written test have been obtained.

7. Positive grades in the examination are not subject to improvement to a higher grade.

8. If a doctoral student receives a fail grade in an exam, she/he is entitled to only one resit exam during the academic year.

9. The resit exam shall be conducted in accordance with these rules.

10. The grade is entered in the student book by the person conducting the exam.