Przedmioty do wyboru prowadzone w języku angielskim
na kierunku Biologia (studia II stopnia) w roku akademickim 2021/2022

Winter semester

No	Course Title	Number of hours	Coordinator	Substantive content
1	**Avian biology**	10W	Dr hab. Paweł Brzęk	Course presents summary of avian systematics, anatomy, physiology, behaviour and reproduction. Flight adaptations, as well as similarities and differences between birds and mammals (the only two groups of extant endotherms) will be particularly emphasized. Because birds are a common subject of studies in different fields of biology, lectures will frequently refer to more general problems of evolutionary, physiological and behavioral ecology. Impact of human activity on birds and bird conservation will be also discussed. 1. General overview of modern birds. Definition of species in birds. 2. Physiology and ecology of birds. Adaptations for flight. Comparison of birds and mammals – the only two groups of extant endotherms. 3. Avian flight: feathers, types of flight, migration, navigation. 4. Avian reproduction: altricial and precocial birds, hatching asynchrony, brood parasites. 5. Human-caused threats to birds, bird conservation.
2	**Aquatic restoration**	10K	Dr Katarzyna Puczko	The aim of this course is to present standards for ecologically successful aquatic restoration. Students will learn about differences in functioning natural and transformed freshwater ecosystems, water quality assessment using trophy indicators, habitat quality assessment using River Habitat Survey (RHS) and River Macrophyte Index (RMI). We focus on the best practices for freshwater restoration on the example of projects implemented in Europe. The short-term and long-term effect of aquatic restorations will be analysed.
3	**Forensic biology**	5W/10L	Dr hab. Ada Wróblewska, prof. UwB	Introduction to forensic science (FS) – (History and development of FS; Organization of FS laboratories) Crime Scene Investigation – (Crime scene investigation process; Protocol at the crime scene; Recording the crime scene; Collection of evidences) The nature of evidence – (Classification of evidence: physical, real, known-unknown, individual class; Identification, The DNA typing situations) Microscopy in criminology – (types of microscopes, SEM, microspectrophotometry) Fingerprints – (Origin of fingerprints; Anatomy of Fingerprints; Detection and visualization of fingerprints; comparison of fingerprints) DNA and RNA molecular markers in forensic biology. STR loci and SNP characteristic and usage for forensic DNA profiling. Human mitochondrial genome – forensic testing and interpretation.

				mRNA and miRNA - potential biomarkers for distinguish bodily fluids, time and cause of death. Plastid DNA as a molecular marker in forensic botany.
4	**Introduction to bioinformatics**	15L	Dr Maciej Matosiuk	Main goal of the course is to prepare students for efficient work in unix (Linux) environment using command line tools. Students will also learn easy ways to automatize their multiple task work with simple scripts, even on remote servers. Large part of the course will focus on practical manipulation of text files including pattern recognition as an easy guide to prepare input files for multiple applications. 1. Introduction to Linux: GUI, documentation, file system organization, command structure in terminal. (2 hours) 2. Terminal commands every user should know. Build-in text editors (gedit, nano). Useful operators. How to connect and work on remote servers. (3 hours) 3. How to work with text files: easy way for identification of complex patterns and their modification/replacement with powerful language of regular expressions (regex). (4 hours) 4. How to create and execute a bash script. Futher automatization of scripts using loops (for, while, until). (4 hours) 5. Main molecular biology databases. (2 hours)
5	**Physiological ecology**	10W	Dr hab. Paweł Brzęk	The main goal of the course is to present physiological traits and features of animals as an evolutionary adaptation to challenges posed by environmental conditions. Both variation and evolution of physiological traits will be particularly emphasized. 1. What is 'physiological ecology'? Natural variation of physiological traits and its importance for fitness under natural conditions. Research methods used in physiological ecology, particularly artificial selection. 2. Energy metabolism of animals under natural conditions, its limits and importance for fitness. Ecto- and endothermy. Energetics of activity. Scaling of metabolic rate. 3. Evolutionary physiology of digestive system. 4. Gas exchange in animals, including adaptation to life at high altitude and for diving. 5. Water and salt physiology of animals living in different habitats.
6	**Plant-pathogen interactions**	10W	Dr Violetta Macioszek	Topics of lecture focus on mechanisms on plant resistance against pathogens and molecular interactions of plant and pathogens molecules during signal transduction of defense reactions in host cells. Concepts of classical and modern plant pathology will be presented. Also examples of the most devastating diseases caused by viruses, bacteria and fungi in the crop plants mostly in Europe will be described.
7	**Social insects**	5W/10L	Dr Tomasz Włodarczyk	Social insects are one of the most intriguing organisms on our planet. The sacrifice of own reproduction in favour of fitness of other individuals posed a serious challenge to the Darwinian view of evolution. Moreover, advanced insect societies add a new level to the organisation of living things, called superorganisms. During the course students are introduced into the theoretical background explaining social phenomena in insects and other animals. The emphasis is made on the peculiarities of hymenopteran insects (ants, wasps, bees) in that respect. The general rules are exemplified with the natural history of socially primitive and advanced species. During laboratory courses students prepare experiments demonstrating the communication

				systems in ants. They also use experimental setups to study division of labour and competition between alien ant colonies. Students also practice techniques useful in the field studies of ants and learn how to recognize selected species during the trip to the nearby meadow and pine forest.
8	**Thermal biology**	10W	Dr Julita Sadowska	Temperature is a property that affects and shapes the organisms phenotype in a vast range of ways, and has been linked to characteristics like growth rate, survival and reproduction, even spatial body size patterns or population densities. However, not all organisms will be affected equally by a change in temperature, and even the same organism in different life stages will present a different response. Moreover, anthropogenic climate change also has a biological impact on all organisms with some ecosystems warming up significantly faster than they would for thousands of years. Even human societies seem to be affected by the evolving thermal housing conditions, which may have a potential impact on the development of the obesity prevalence. The course will cover such topics like thermal heterogeneity, thermal sensitivity and thermoregulation among different groups of organisms, as well as thermal adaptation, acclimation, life histories, and anthropogenic effects.

W – lecture, L – laboratory, K – seminar, ZT – field course

Summer semester

No	Course Title	Number of hours	Coordinator	Substantive content
1	**Animal bioacoustics in theory and practice**	5W/10ZT	Dr Krzysztof Deoniziak	Animal bioacoustics covers all matters related to the production, transmission, and reception of sound in nature, as well as the investigation and use of natural sound by people and impacts of anthropogenic sounds by on animals. The course is divided into lectures and practicals that will focus on methods for studying animal sound communication. During lectures students will be presented with an overview of animal acoustic communication. Practicals aim at giving the students hands-on experience of sound recording, sound analysis, and playback experiments. Using interactive sound analysis software we will work on acoustic signals produced by birds, amphibians and insects Poland and beyond.
2	**Evolutionary ecology**	10W	Dr hab. Paweł Brzęk	The goal of the course is to present modern theory of evolution and its role in explaining the origin of different life history and behavioral strategies. Most examples will refer to evolution and variation observed under natural conditions. 1. Basic assumptions of modern theory of evolution. Mechanisms of trait inheritance, examples of non-genetic inheritance. 2. Selection in the wild. Factors maintaining genetic variation in nature. Adaptation and constraint – definition and examples. 3. Evolution of life history traits (age and size at reproduction, lifespan, number and size of offspring). Evolutionary trade-offs. 4. Evolution of mating systems. Sexual selection. 5. Role of kinship in evolution – kin selection, evolution of altruism and eusociality, parent-offspring conflict.
3	**Freshwater ecosystems**	5W/10ZT	Dr hab. Maciej Karpowicz	The aim of this course is to present different type of freshwater ecosystems in NE Poland. Students will learn about the functioning and monitoring of freshwater ecosystems, main groups of organisms in lakes (macrophyte, phytoplankton, zooplankton, macroinvertebrate), biological and hydrochemical sampling. We especially focused on the degradation and restoration of limnic ecosystems on the example of hypertrophic Siemianówka Reservoir. The effect of this reservoir on the lowland Narew River ecosystem will be analyzed
4	**Inventory methods for ungulates**	4W/11ZT	Prof. Mirosław Ratkiewicz	The rules of research in the field. Identification, collection and preservation of biological traces left by different species of mammals in the field. Analysis of the collected data - estimating density of the large mammals (boar, moose, red deer, roe deer, wolf). Observation of the large mammals interacting with their environments. Practical application of traditional and modern methods in the field study of wild mammals
5	**Natura 2000 network**	10ZT	Dr hab. Piotr Zieliński, prof. UwB	During the course, students will be introduced to current EU Directives for habitats and species protection. During the fieldwork at Natura 2000 sites in Podlasie region, students on the base of

				their own observations will identify species and habitats important for the EU, will define the threats to these habitats and species to identify non-compliance farming on Natura 2000 sites. Students will assess the impact of various forms of human activity on the functioning of the area and indicate own proposal management of the area of Natura 2000.
6	**Natural environment of North East Poland**	10W	Prof. Andrzej Górniak	NE Poland in the geologic map of Europe. Effects of pleistocen glaciation on relief, sediments and water net. Relict permafrost in NE Poland. Neotectonic activity and lakes location and kraton hydrogeology. Pleistocen, artesian groundwaters basin. Features of climate of NE Poland, climatic types in the Koeppen climate classification, continentalism advancement, the recent global changes effects. River hydrology, typology of rivers and their regimes. Artificial forms of surface water- Augustów Canal, Great Masurian Lakes System, specificity of Siemianówka Reservoir, small retention ponds. Water quality and ecological state of freshwaters in NE Poland. Effects of melioration on water cycle in catchments.
7	**Novel technologies in wildlife studies**	15ZT	Dr Paweł Mirski	Novel technologies in wildlife studies will be presented during field-working course Field classes will contain short theoretic introduction to each topic and equipment handling Topics raised and the field course: The use of trail cameras in fauna monitoring and behavioral studies GPS logging devices to use in movement ecology studies Thermovision for night monitoring of fauna UAV images in bird breeding surveys Bioacoustic monitoring of birds and bats and automatic classification of sound
8	**Plant population ecology**	15ZT	Dr Edyta Jermakowicz	The aim of this field course is to introduce students with the primary concepts and methods used in plants population ecology. Students will carry out the research from framing the questions, through design and conducting the study in the field, to data visualization and interpretation. Exercises will focused on collecting the data about plants size structure and reproduction and spatial patterns of plant populations in context of different environmental conditions and plants communities. The field works will be performed on common and rare plants species in the areas of urban green areas as well in national parks in north-east Poland.
9	**Techniques in plant physiology**	15L	Dr Violetta Macioszek	Techniques in Plant Physiology - The exercises are an introduction to the methods and techniques commonly used in plant physiology - measurements of primary and secondary metabolism parameters during plant growth and development as well as during abiotic and biotic stress. Laboratory classes in the field of primary metabolism use standard methods, such as e.g. measurements of the content of assimilation pigments or reducing and non-reducing sugars in plant tissues, as well as modern methods, e.g. with the use of devices for measuring the kinetics of chlorophyll a fluorescence. The exercises also use methods related to the measurements of secondary metabolism, which are aimed at showing its changes during stress, e.g. drought or temperature, when an increase or decrease in the content of e.g. phenolic compounds is induced. Arabidopsis mutants, defective at various points of metabolic pathways, are also used, which allows for phenotypic assessment of the influence of various metabolites on plant development. We will use different techniques e.g. measurement of photosynthetic efficiency, phenolic compounds content and DNA isolation to explore several important processes which help plants

				to survive in their environment. Students also will be acquainted with basics of plant cell *in vitro* culture. Upon completing this course, student should be familiar with contemporary methods used in plant physiology, especially used in research connected with plant stress physiology.

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