Elective courses offered by Institute of Biology

Course: **An introduction to bird ringing**	
Course Instructor: **dr Krzysztof Deoniziak**	
Language: **English**	
Semester: **winter/summer**	Number of hours: 15 *Field course: 1**5**
Substantive content: • Bird ringing provides information on migration, longevity, mortality, population, territoriality, feeding behavior, and other aspects that are studied by ornithologists, which contributes to conservation of avian populations. • This course will take place at Akcja Siemianówka, the biggest inland bird ringing station in Poland localized on the northern edge of Białowieża Forest and during a citizen science project Akcja Karmnik • During the course students will learn about all the methods and activities connected with bird ringing, through the process from handling a bird safely to taking basic measurements • Students will also learn about migrant and resident bird species observed and ringed in NE Poland	
Literature: Balmer DE, Coiffait L, Clark J, Robinson R. 2008. Bird ringing: a concise guide. British Trust of Ornithology Busse P, Meissner W, Cofta T. 2015. Bird ringing station manual. De Gruyter Svensson L. 2010. Collins Bird Guide. Collins	
Forms and conditions of credit: Participation in discussion during field course	

Course: **Animal bioacoustics in theory and practice**	
Course Instructor: **dr Krzysztof Deoniziak**	
Language: **English**	
Semester: **winter/summer**	Number of hours: 15 *Lecture: **5** *Field course: **10**
Substantive content: • 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
Literature: Bradbury JW, Vehrencamp SL. 2011 Principles of animal communication. Sinauer Associates Inc. Charif RA, Waack AM, Strickman LM. 2010. Raven Pro 1.4 User's Manual. Cornell Lab of Ornithology. Specht R. 2012. Avisoft-SASLab pro. Avisoft Bioacoustics Sueur.
Forms and conditions of credit: Participation in lectures and laboratory work

Course: **Avian Biology**	
Course Instructor: **dr hab. Paweł Brzęk**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** *Lecture: **10**
Substantive content: 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.	
Literature: 1. Bicudo J. E. P. W., Buttemer W. A., Chappell M. A., Pearson J. T., Bech C. 2010. Ecological and environmental physiology of birds. Oxford University Press. 2. McNab B.K. 2002. The physiological ecology of vertebrates. Cornell University Press, Ithaca, New York.	
Forms and conditions of credit: - attendance	

Course: **Biology of peatlands**	
Course Instructor: **dr hab. Danuta Drzymulska**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** Lecture: **10**

Substantive content:

Lecture concerns different aspects of peatland functioning:

- hydrological conditions of mires
- biodiversity of organisms
- plant communities connected with peat substratum
- peat forming process and typology of peat
- relations peat unit-subfossil plant community
- palaeoecological methods of peat study with particular role of macrofossil pant remain analysis
- distribution of peatlands on the Earth
- use of peat
- peatland restoration over the world

Literature:

Birks H.J.B., Birks H.H. 1980. Quaternary palaeoecology. Edward Arnold, London.
Charman D. 2002. Peatland and environmental change. John Wiley & Sons, Chichester.
Joosten H., Clarke D. 2002. Wise use of mires and peatlands. International Mire Conservation Group and International Peat Society.
Rydin H., Jeglum J. 2008. The Biology of Peatlands. Oxford University Press.

Forms and conditions of credit:

attendance, writing of short multiple choice test

Course: **Ecological genetics**

Course Instructor: **dr hab. Katarzyna Jadwiszczak**

Language: **English**

Semester: **winter/summer**	Number of hours: **10** *Lecture: **2** *Laboratory: **8**

Substantive content:

- Definitions of terms: locus, gene, allele, recessive, dominant, homozygote, heterozygote, Hardy-Weinberg equilibrium, Hardy-Weinberg assumptions
- Analyses of the frequencies of genotypes and alleles in populations
- Testing random mixing in populations

Literature:

1. Holsinger KE. 2012. Lecture notes in population genetics. Stanford University, Stanford, USA.
2. Elseth GG, Baumgardner KD. 1984. Genetics. Addison-Westley, USA.

Forms and conditions of credit:

evaluation for solving exercises during classes

Course: **Environmental biochemistry**

Course Instructor: **dr Alicja Piotrowska-Niczyporuk**

Language: **English**

Semester: **winter/summer**	Number of hours: **10** *Laboratory: **10**

Substantive content: Environmental biochemistry refers to the interaction of organisms with their abiotic environment and other organisms by chemical means. Biotic and abiotic factors determine the biochemical flexibility of organisms, which otherwise easily adapt to environmental changes by altering their metabolism. Sessile plants, in particular, have evolved intricate biochemical response mechanisms to fit into a changing environment. The aim of course is the identification of chemical pollutants in various environmental samples and the comparison the effects of xenobiotic compounds on the plant growth and biochemical parameters. Students will possess the ability to use different methods regarding the determination the contents of toxic compounds in various analyzed samples (plant material, water) using chemical methods such as spectrophotometric methods, HPLC, color reactions, microscopic observations. They analysis of the effect of pollutants on the growth and metabolic parameters in plant cultures. 1. Plant toxins – plant secondary metabolites. Identification of plant toxins such as alkaloids, glucosides, tannins in various plant species. Determination of the contents of oxalates in various food samples and stimulants. Determination of the amounts of isothiocyanates in different vegetables. The effect of temperature on the concentration of these compounds in plan material (3 hours) 2. Heavy metal stress. The effect of heavy metals on the plant growth and the contents of metabolites such as proteins and photosynthetic pigments. Comparison the toxicity of different heavy metals on the plant cultures. Defense reaction of plants against the effect of heavy metals. Determination of phytochelatins in plant cultures exposed to heavy metal stress. The measurement the contents of metals present in various environmental samples. (3 hours) 3. Pesticides. The effect of pesticides on the plant growth and the contents of proteins and photosynthetic pigments. Calculation of LD_{50} for various pesticides based on the effect of these compounds on *Daphnia* species. (3 hours) 4. Indicators of water quality. Determination of the presence sulphur and ammonia nitrogen in different water samples. The measurement the contents of carbon dioxide, chlorides, phosphates, surfactants and thiosulfates in water samples from different aquatic ecosystems. Determination of alkalinity and acidity of water. The comparison of results with standards in force in Poland. Classification of waters to water quality class. (3 hours)	
Literature: 1. Manahan S., Environmental Chemistry. CRC Press, Taylor and Francis Group, 2010. 2. Krauss G.-J., Nies D.H., Ecological Biochemistry. Environmental and Interspecies Interactions. Wiley-Blackwell, 2014. 3. Rajvaidya N., Markandey D.K., Environmental Biochemistry, APH Publishing, 2005. 4. Hochachka P.W., Mommsen T.P., Environmental and Ecological Biochemistry. Elsevier, 1995. 5. Harborne J.B., Introduction to Ecological Biochemistry, Elsevier, 1994, 2002.	
Forms and conditions of credit: 1. Reports on the experiments 2. Preparation for classes (discussion/ppt presentation) 3. The presence 4. Test	

Course: **Evolutionary Ecology**	
Course Instructor: **dr hab. Paweł Brzęk**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** *Lecture: **10**
Substantive content: 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.

Literature:

1. Fox, Ch.W., Roff D. A., Farbairn D.J. 2001. Evolutionary Ecology. Concepts and Case Studies. Oxford University Press.
2. McNab B.K. 2002. The physiological ecology of vertebrates. Cornell University Press, Ithaca, New York.
3. Stearns S. C., Hoekstra R. F. 2005. Evolution: an introduction. Oxford University Press.

Forms and conditions of credit:

- attendance

Course: **Experimental botany**	
Course Instructor: **dr Izabela Tałałaj; dr Edyta Jermakowicz; dr hab. Ada Wróblewska**	
Language: English	
Semester: **summer**	Number of hours: **15** *Field course: **15**

Substantive content:

Exercises will focused on experiments in the field and different methods will be presented for explaining the various aspects of plant reproduction. Student will perform artificial hand pollination, manipulations of different parts of flower attractants and floral display and manipulations of co-flowering plant species. Experiments will be performed on rewarding and deceptive orchid species occurring in polish national parks.

Literature:

Forms and conditions of credit:

Reports

Course: **Floodplain ecology**	
Course Instructor: **dr hab. Piotr Zieliński**	
Language: **English**	
Semester: **summer**	Number of hours:**15** *Lecture: **5** *Field course: **10**

Substantive content:

The students will be introduced to the structure of the landscape of lowland river valleys. Basic information of hydrological regime of lowland rivers. The relationships between the state of preservation of floodplains and its biodiversity. Students will use popular in EU method for hydromorphological assessment - River Habitat Survey for describing the degree of anthropogenic transformation of the river valley. Students will Making phytosociological studies. Students will perform phytosociological studies on the base of Mean Trophic Rank method.

Literature:

Raven, P. J. River Habitat Quality: the physical character of rivers and streams in the UK and Isle of Man. Environment Agency, 1998.

Holmes, N. T. H., J. R. Newman, and S. Chadd. Mean trophic rank: a user's manual. Environment Agency, 1999

Forms and conditions of credit:

Participation in lectures and preparing of report after the field course.

Course: **Freshwater ecosystems**

Course Instructor: **dr inż. Maciej Karpowicz**

Language: **English**

Semester: **summer**	Number of hours: **15** *Field course: **10** *Laboratory: 5

Substantive content:

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.

Literature:

Lampert, W., Sommer, U. 2007. Lilmnoecology. Oxford University Press.

The riverine ecosystem synthesis : toward conceptual cohesiveness in river science / James H. Thorp, Martin C. Thoms and Michael D. Delong.

Key to identification of phytoplankton species in lakes and rivers: guide for laboratory classes and field research / ed. by Lubomira Burchardt ; Adam Mickiewicz University in Poznań, Faculty of Biology W. Szafer Institute of Botany, Polish Academy of Sciences.

Ekosystem zbiornika Siemianówka w latach 1990-2004 i jego rekultywacja / pod red. Andrzeja Górniaka ; [autorzy oprac.: Andrzej Stefan Górniak et al.] ; Uniwersytet w Białymstoku. Zakład Hydrobiologii.

Forms and conditions of credit:

Discussion during field course, final report

Course: **Harmful algae**	
Course Instructor: **dr hab. inż. Magdalena Grabowska**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** *Lecture: **10**

Substantive content:

1. Toxic algae in freshwater and marine ecosystems.
2. Types of toxins and their effect on other organisms and water quality.
3. Methods of detection of toxins.
4. Influence of strongly eutrophic Siemianówka dam reservoir on lowland Narew River; kinds/types of toxins;
5. Regulation on Cyanotoxins in Legislation.

Literature:

Chorus I. 2005. Current approaches to cyanotoxin risk assessment, risk management and regulations in different countries. Federal Environmental Agency, Berlin.

Grabowska M., Pawlik-Skowrońska B. 2008. Replacement of *Chroococcales* and *Nostocales* by *Oscillatoriales* caused a significant increase in microcystin concentrations in a dam reservoir. Oceanological and Hydrobiological Studies 37 (4): 23-33.

Grabowska M., Mazur-Marzec H. 2011. The effect of cyanobacterial blooms in the Siemianówka Dam Reservoir on the phytoplankton structure in the Narew River. Oceanological and Hydrobiological Studies 40 (1): 19-26.

Hindák F. 2009. Colour Atlas of Cyanophytes.

Forms and conditions of credit:

Discussion during lectures.

Course: **Introduction to Molecular Biophysics**	
Course Instructor: **Dr Szymon Sekowski**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **15** *Lecture: **5** *Laboratory: **10**

Substantive content:

Main aim of this course is to provide students with the basics of molecular biophysics.

The lectures will present molecular aspects of UV-Vis-NIR spectrophotometry, UV-Vis spectrofluorimetry and elements of membranology. Participants will learn about electromagnetic radiation, properties of electromagnetic wavelength, absorption and emission of light, electron transitions, fluorescence, phosphorescence, delaying fluorescence, energy transfers mechanisms, fluorescence labelling. Applications of spectrophotometric and spectrofluorometric techniques in biomedical research (cell-drug, channel-ligand interactions) will be discussed.

During laboratory work, students will get hands-on experience with spectrophotometry and fluorescence measurements. Exercises will include: spectrophotometric analyses of molecules concentrations, detection of cell damage, fluorescence quenching in proteins, fluorescence anisotropy analysis of membrane fluidity, analysis of free radicals.

Literature:

"Fundamentals of UV-visible spectroscopy" Tony Owen (book)

"Biophysical And Biochemical Aspects Of Fluorescence Spectroscopy" T. Gregory Dewey (book)

"Topics in fluorescence spectroscopy" vol.6 Protein fluorescence, Joseph R. Lakowicz (book)

Forms and conditions of credit:

Participation in lectures and laboratory work. Successful report on laboratory work.

Course: **Monitoring of freshwater ecosystems**

Course Instructor: **dr hab. Piotr Zieliński**

Language: **English**

Semester: **summer**	Number of hours: **15** *Lecture: **10** *Field course: **10**

Substantive content:

During the course students will be introduced to environmental monitoring method used EU for freshwater ecosystems ecological assessment. We will discuss the use of bioindication methods in water ecosystems research and the determination of ecological state of these environments. During fieldwork held in urban areas (Bialystok) and protected areas the Biebrza valley – Biebrza National Park (Field Station of the Institute of Biology, University of Bialystok in Gugny), students will gain the ability to prepare reports and conduct environmental monitoring at the local scale of different types of water.

Literature:

Berry, P. A. M., Garlick, J. D., Freeman, J. A., & Mathers, E. L. (2005). Global inland water monitoring from multi-mission altimetry. Geophysical Research Letters, 32(16).

Downes, Barbara J., et al. Monitoring ecological impacts: concepts and practice in flowing waters. Cambridge University Press, 2002.

Holmes, N. T. H., J. R. Newman, and S. Chadd. Mean trophic rank: a user's manual. Environment Agency, 1999

Forms and conditions of credit:

Participation in lectures and preparing of report after the field course.

Course: **Natura 2000 network**

Course Instructor: **dr hab. Piotr Zieliński**

Language: **English**

Semester: **summer**	Number of hours:**10** *Field course: **10**
Substantive content: 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.	
Literature: Borre, Jeroen Vanden, et al. "Integrating remote sensing in Natura 2000 habitat monitoring: Prospects on the way forward." Journal for Nature Conservation 19.2 (2011): 116-125. Söderman, Tara. "Natura 2000 appropriate assessment: Shortcomings and improvements in Finnish practice." Environmental Impact Assessment Review 29.2 (2009): 79-86.	
Forms and conditions of credit: Participation in fieldwork and preparing of report after the field course.	

Course: **Natural Environment of North East Poland**	
Course Instructor: **prof. dr hab. Andrzej Górniak**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** *Lecture: **10** *Field course: 0
Substantive content: 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.	
Literature: McCann T. (2008), The geology of Central Europe: Volume 1: Precambrian and Palaeozoic; Volume. 2: Mesozoic and Cenozoic. Geological Society of London. Tockner et al. [ed.] 2009. Rivers of Europe. Elsevier, Amsterdam. 700 pp. Website of the Polish Geological Institute: http://www.pgi.gov.pl; webpages in English related to regional geology, resources and geotourism in Poland	
Forms and conditions of credit: active participation in the course, preparing a presentations from themes offered by instructor.	

Course: **Physiological Ecology**	
Course Instructor: **dr hab. Paweł Brzęk**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** *Lecture: **10**
Substantive content: 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.	
Literature: 1. Hill R., Wyse G., Anderson M. 2004. Animal physiology. Sinauer Associates, Sunderland, USA. 2. Karasov W.H., Martinez del Rio C. 2007. Physiological ecology. Princeton University Press, Princeton, USA. 3. McNab B.K. 2002. The physiological ecology of vertebrates. Cornell University Press, Ithaca, New York.	
Forms and conditions of credit: - attendance	

Course: **Plant breeding systems**	
Course Instructor: **dr Izabela Tałałaj; dr Edyta Jermakowicz; dr hab. Ada Wróblewska**	
Language: **English**	
Semester: **summer**	Number of hours:**15h** *Field course: **15h**
Substantive content: Exercises will focused on three primary subjects: 1) introduction to the most important information about the diversity of plant breeding system, 2) ecological and evolutionary factors shaping particular breeding system, 3) the effects of a particular breeding system on three levels: individual, population and species. The information will be presented during short lectures and fieldwork carried out on the different orchid species growing in polish national parks.	
Literature:	
Forms and conditions of credit: Reports	

Course: **Plant population ecology**	
Course Instructor: **Izabela Tałałaj, Phd; Edyta Jermakowicz, Msc; Ada Wróblewska, dr hab.; Paweł Mirski, Msc**	
Language: **English**	
Semester: **summer**	Number of hours: **15h** *Field course: **15h**
Substantive content: The aim of this field course is to introduce students with the primary concepts and methods used in plants population ecology. Exercises will focused on collecting and interpreting the data about plants size structure and reproduction, in context of different environmental conditions. The field works will be performed on rare plants species in the area of national parks in north-east Poland.	
Literature:	
Forms and conditions of credit: Reports	

Course: **Reactive oxygen and nitrogen species in health and disease**	
Course Instructor: prof. Maria Zamarajewa, Dr Szymon.Sękowski	
Language: English	
Semester: winter/summer **summer**	Number of hours: *Lecture: 3 *Laboratory: 7
Substantive content: Course “Reactive oxygen and nitrogen species in health and disease “” describes the processes of free radical formation in living organisms. In particular, it focuses on formation of reactive oxygen and nitrogen species (RONS), main sources of ROS, their properties and methods of determination. This course also focuses on physiological and pathophysiological effects of free radicals on living cells and organisms, and on defense systems against oxidative stress. "Metabolism of Fe and its role in oxidative stress are discussed. "This course will provide understanding of the mechanisms of free radical formation in biological objects, their role in biological processes, and basic methods used in the studies of oxidative stress.	
Literature: 1. Reactive Oxygen Species in Chemistry, Biology, and Medicine, Springer , Berlin 2013. 2. Free Radicals in Human Health and Diseases .Editor: Vibna Rami, Umesh Chand Singh Yadav, Springer. 2012. 3. Free Radicals, Nitric Oxide and Inflammation: Molecular, Biochemical and Clinical Aspects, IOS Press, Series: Life and Behaviour Sciences, V.344, 2001	
Forms and conditions of credit: **Satisfactory completion of lab and written test examination**	

Course: **Road ecology**	
Course Instructor: **dr Adam Hermaniuk**	
Language: **English**	
Semester: **summer**	Number of hours:**15** *Field course: **15**
Substantive content: Background and aim of the course: Traffic is now one of the most important factors impacting upon wildlife. Furthermore, as road infrastructure is developing steadily, its negative effect can only be expected to increase. The aim of the course is to analyse mortality of vertebrates due to traffic on Carska Road in the Biebrza National Park. Course contents: - the impacts of roads and traffic on terrestrial animal populations; - field methods to evaluate the impact of roads on wildlife; - mortality assessment on the Carska Road; - identification of the killed vertebrates using identification keys; - traffic intensity assessment; - determination of the road sections with the highest mortality on the basis of the collected results; - road-wildlife mitigation planning, how to reduce the negative effects of traffic road.	
Literature: Forman, R. T.T., D. Sperling, J. A. Bissonette, A. P. Clevenger, C. D. Cutshall, V. H. Dale, L. Fahrig, R. France, C. R. Goldman, K. Heanue, J. A. Jones, F. J. Swanson, T. Turrentine, & T. C. Winter. 2003. Road Ecology; Science and Solutions. Island Press, Covelo, CA.	
Forms and conditions of credit: oral presentation	

Course: **Scientific Methodology and Experimental Design**	
Course Instructor: **dr. Julita Sadowska**	
Language: **English**	
Semester: **winter/summer**	Number of hours: **10** *Seminar: 10
Substantive content: The aim of this course is to familiarize students with steps of the Scientific Method. Students will learn about the role and correct hypothesis formulation in research, experimental design and research planning with particular focus on the ecological/ecophysiological studies (including the definition of a sample, correct sample unit identification and collection methods, replications and pseudoreplications, techniques of taking	

notes). Discussed topics also include data processing an ethical issues in science and scientific writing/publications (data manipulation, plagiarism, authorship issues, duplicate or concurrent publications, conflicts of interest, frauds, animal use and local law).

Literature:

1. Lampert, W., Sommer, U. 2007. Lilmnoecology. Oxford University Press.
2. Quinn, G.P., Keough, M.J. 2002. Experimental design and data analysis for biologists. Cambridge University Press.
3. Sand-Jensen, K. 2007. How to write consistently boring scientific literature. Oikos, 116: 723 – 727.
4. Hurlbert, Stuart H., 1984, Pseudo-replication and the design of ecological field experiments, Ecological Monographs, 54:187-211.
5. http://www.the-aps.org/mm/Publications/Info-For-Authors/Ethics-posters/Ethics_Poster_2008_aps-pdf.pdf

Forms and conditions of credit:

- 100% attendance
- Participation in discussion during class
- Student project: students design a study/project in accordance with the scientific method

Course: **Selected data analysis techniques for biologists**

Course Instructor: **dr hab. Piotr Jadwiszczak**

Language: **English**

Semester: **winter/summer**	Number of hours: **5** *Laboratory: **5**

Substantive content:

- Fisher's and Neyman-Pearson's approaches to verification of statistical hypotheses
- Selected parametric and randomization tests. Monte Carlo simulations
- Elements of Bayesian methodology – Bayes' rule in practice

Literature:

Quinn G. and K. Keough. 2008. Experimental Design and Data Analysis for Biologists. Cambridge University Press

Forms and conditions of credit: evaluation of the results of problem solving exercises during classes

Course: **Soils and landscape**

Course Instructor: **prof. dr hab. Andrzej Górniak**

Language: **English**

Semester: **winter/summer**	Number of hours: 10 *Lecture: **5** *Field course: **5**

Substantive content:

Soil pedon development. Natural factors of soil genesis. FAO classification of soils; diagnostic horizons, horizons features and relations in the main soil profiles in Europe. Differentiation of soil landscapes on the Earth, with special attention of Polish soil catena in the physiographic regions. Relationships between plant communities, water, climatic conditions and type of soils. Agricultural and forest soils values, specific plantation and forest types. Field study of soil pedons in the lowland valley, mineral soil catena in the old glaciation highland, soils of morains and kems. Methods of descriptions of soil profile in the field, filed measurement of pH and $CaCO_3$ content, sampling, texture and soil aggregation.

Literature:

Album of Polish Soils. PTGleb. Warszawa

Polish classification of Soils (English resume). Rocz. Glebozn. 2011, 62,3.

Forms and conditions of credit: active participation in the course, preparing a protocol of field study of 5 soil profiles according to scheme prepared by instructor.

Course: **Techniques in Plant Physiology**

Course Instructor: **dr Aleksandra Staszak**

Language: **English**

Semester: **winter/summer**	Number of hours: **15** *Laboratory: **15**

Substantive content:

Techniques in Plant Physiology - the primary purpose of this course is to present students some methods used by plant physiologist to understand how plants function and how they are able to live in different condition, especially stress condition. We will use different techniques e.g. measurement of gas exchange (use of oxygen electrode), electrolyte leakage test, protein isolation and separation by SDS-PAGE electrophoresis, 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.

Literature:

Narwal S.S., Bogatek R., Zagdańska B.M., Sampietro D.A, Vattuone M.A. (ed.). Plant Biochemistry. Studium Press, LLC, India (2009)

Bisen P. S. Laboratory Protocols in Applied Life Sciences. CRC PressTaylor & Francis Group

Taiz L., Zeiger E. (ed.) - Plant Physiology. Sinauer Associates, Sunderland (2006)

Forms and conditions of credit:

1. Attendance in all laboratory
2. Brief lab report after each laboratory

Course: **Techniques of molecular biology - laboratory**

Course Instructor: **dr Magdalena Czajkowska**

Language: **English**

Semester: **winter/summer**	Number of hours: **15** *Laboratory: **15**

Substantive content:

1. Main rules of work in Molecular Biology Laboratory
2. Practice of pipetting
3. DNA extraction
4. Gel electrophoresis
5. Molecular species identification:
   - PCR – amplification of *cyt b* gene
   - Clean-up of PCR products
   - Sequencing reaction
   - Purification of sequencing reaction products with the ExTerminator kit (A&A Biotechnology)
   - Separation of sequencing products on a 3130 Genetic Analyzer (Applied Biosystems)
   - NCBI website and BLAST tool

Literature:

Carson S., Miller H.B., Witherow D.S. Molecular Biology Techniques: A Classroom Laboratory Manual, 3th ed. 2012. Elsevier.

Tagu D., Moussard C. Techniques for Molecular Biology. 2006. CRC Press.

Ream W., Field K.G., Molecular Biology Techniques: An intensive Laboratory Course. 1999. Academic Press. Elsevier.

Allison L.A. Fundamental Molecular Biology, 2ed. 2012. Wiley-Blackwell.

Freeland J.R. Molecular ecology. 2011. Wiley-Blackwell.

Avise J.C. Molecular Markers, Natural History, and Evolution. 2004. Sinauer, Sunderland, MA.

Avise, J.C. (ed.). 2010. **Molecular Ecology and Evolution: the Organismal Side.** World Scientific Publishing, Singapore

Forms and conditions of credit:

- **presence on each classes;**
- **active participation in laboratory work**.

Course: **Thermal biology**

Course Instructor: **dr Julita Sadowska**

Language: **English**

Semester: **winter/summer**	Number of hours: **10** *Lecture: **10**

Substantive content:

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.

Literature:

1. *Angilletta, M.J.* Jr. 2009. *Thermal Adaptation:* A Theoretical and Empirical Synthesis. Oxford University Press.
2. McNab, B. 2002. The physiological ecology of vertebrates. A view from the energetics. Comstock Pub Assoc.
3. Hayes, J.P., Garland, T. Jr. 1995. The evolution of endothermy: testing the aerobic capacity model. Evolution, 49: 836 – 847.

Forms and conditions of credit:

- 100% attendance
- Participation in discussion during class

Course: **Urban ecology and wildlife**

Course Instructor: **dr Krzysztof Deoniziak**

Language: **English**

Semester: **winter/summer**	Number of hours: 15 *Lecture: 1**5**

Substantive content:

• Urban ecology has emerged as a key element of conservation and behavioural research

• This course provides a basic grounding in main concepts of biodiversity and ecology within an urban environment

• Students will gain an understanding of how wildlife interacts with urbanization and how researchers study changes in biology and ecology of city dwellers

Literature:

Forman RT. 2014. Urban Ecology, Science of Cities. Cambridge University Press

Gil D, Brumm H. 2014. Avian Urban Ecology. Oxford University Press

McCleery RA, Moorman C, Peterson MN. 2014. Urban wildlife conservation. Springer

Parris KM. 2016. Ecology of urban environments. Wiley-Blackwell

Forms and conditions of credit:

Participation in lectures