

Institute of Botany

Białowieża Geobotanical Station

Head: dr. Bogdan Jaroszewicz, b.jaroszewicz@uw.edu.pl

Scientific activity of the Station focuses on ecology of natural forests, plant ecology, plant invasions and plant-animal interactions. The research is based on long-term studies, with the oldest ones started in 1960s.

Your laboratory training will focus on field and lab experiments related to seed dispersal and survival. Field experiments will be carried out in the Białowieża Forest and at Biebrza Marshes (North-East Poland).

Techniques and skills. Students will be trained in investigation of ecological phenomena related to plant dispersal:

- sampling of soil for seed bank studies, conduction of greenhouse experiments,
- design of field experiments focused on plant dispersal, especially by zoochory,
- determination of plant species on the basis of seed and seedling morphology.

Institute of Experimental Plant Biology

Department of Plant Bioenergetics

Head: prof. Anna M. Rychter, arychter@biol.uw.edu.pl

Scientific activity: Energy economy of the plant cell; influence of environment and role of mitochondria in maintaining cell redox homeostasis; cyanide-resistant respiration and alternative oxidase (regulation and activity); influence of environmental factors on formation of reactive species and oxidative defense systems.

Projects offered for visiting students:

1. Analysis of ROS production in mitochondria isolated from leaves and roots of *Arabidopsis thaliana* plants with sulfur deficiency. (30 ECTS)
2. The influence of ammonium supply on ROS metabolism in *Arabidopsis*. Analysis of scavenging enzymes and low-molecular-mass antioxidants. (30 ECTS)

You will receive training in (some of) the following techniques: spectrophotometry, oxygraphy, luminometry, HPLC, immunodetection, gel electrophoresis, electron and fluorescence microscopy.

Institute of Biochemistry

Department of Metabolic Regulation

Head: dr. hab. Maciej Garstka, garstka@biol.uw.edu.pl

Scientific activity. Metabolism of glucose and amino acids under normal and pathological conditions; proteome and lipidome of thylakoid membranes, changes in chloroplast structure under chilling stress.

Projects offered for visiting students:

- Plant Division - Prof. Maciej Garstka
Relationship between chloroplasts structure and arrangements of photosynthetic complexes. Analysis of lipid and protein composition of thylakoids of higher plants. Investigations of chloroplast structure by confocal laser scanning microscopy. (30 ECTS)
- Animal Division - Prof. Jadwiga Bryła
Glucocorticoid effects on regulation of gluconeogenesis with the use of renal tubules grown in primary cultures. Regulation of AMPK signaling pathways. Role of antioxidant in energy metabolism. Inhibition of renal NADPH oxidase as a potential therapeutic strategy in diabetes type 2. Purification and molecular identification of vertebrates enzymes that function is unknown. (30 ECTS)

Institute of Biochemistry

Department of Molecular Biology

Head: prof. Krzysztof Staroń, staron@biol.uw.edu.pl

Scientific activity. Investigation of selected nuclear proteins: topoisomerase I (topo I), enhancer of rudimentary homolog (ERH) and protein kinase CK2 (CK2). Studies are aimed at finding protein partners of topo I, ERH and CKII and understanding the structural basis of the interactions as well as their role

in subnuclear localization of the proteins. Two of these proteins are also targets of anti-cancer drugs.

Projects offered for visiting students:

1. Protein kinase activity of topo I. (30 ECTS)
2. Interactions between ERH and its protein partners. (30 ECTS)
3. Apoptotic proteins phosphorylated by CKII. (30 ECTS)

Techniques used: bacterial transformation, heterologous protein expression; DNA isolation and purification, PCR, DNA recombination in vitro, DNA electrophoresis, protein isolation and affinity purification, Blue Native- and SDS-PAGE, western-blotting, protein interaction assays, siRNA, eukaryotic cell cultures, confocal and fluorescence microscopy of tagged proteins.

Institute of Microbiology

Department of Applied Microbiology

Head: prof. Jacek Bielecki, jbielecki@biol.uw.edu.pl

Scientific activity. Mechanisms of microbial pathogenesis and production of vaccines, use of live vectors (*Listeria monocytogenes*) in biotechnology of new-generation vaccines (induction of intracellular immunity, use of molecular mechanisms of toxin activity and different determinants of pathogenesis in vaccine design), anti-cancer vaccines.

Projects offered for visiting students: investigation of molecular mechanisms of bacterial toxin activity and different determinants of pathogenesis for use in vaccine design; construction of bacterial strains expressing toxins as potential anti-cancer vaccines.

Methods used: determination of cytotoxicity of chosen bacterial pathogenic factors in eukaryotic cells, cloning and expression of genes encoding bacterial toxins. Modern molecular biology, microbiology (cloning, PCR, Southern (DNA) blotting, Northern (RNA) blotting, Western blotting, DNA sequencing, oligo-directed mutagenesis, protein expression), advanced microscopy and optical imaging techniques. Some experience in tissue culture methods is desirable.

Institute of Microbiology

Department of Bacterial Genetics

Head: prof. Dariusz Bartosik, bartosik@biol.uw.edu.pl

Research group of prof. Katarzyna Jagusztyn-Krynicka

Scientific activity. Investigations of pathogenic bacteria: functional analysis of *Campylobacter* and *Helicobacter* unique genes whose products are potentially involved in pathogenesis, construction of avirulent *Salmonella* expressing *Campylobacter* antigens and evaluation of the efficacy of vaccine prototype (animal model - chickens).

Projects offered for visiting students:

1. Biochemical and functional characterization of the Epsilonproteobacteria Dsb (disulfide bonds) proteins . (30 ECTS)
2. Anti-campylobacter vaccine. (30 ECTS)

Techniques used: classical bacterial genetics and molecular microbiology. Laboratory is equipped for conducting work on gene cloning, evaluation of gene expression, protein purification and studying interaction between pathogen and eukaryotic cells.

Institute of Microbiology

Department of Bacterial Genetics

Head: prof. Dariusz Bartosik, bartosik@biol.uw.edu.pl

Research group of prof. Dariusz Bartosik

Scientific activity. Biology of mobile genetic elements (MGE) - transposable elements, integrons, plasmids and bacteriophages, as well as genomic islands and islets acquired by lateral transfer events. We analyze MGEs in strains of Proteobacteria isolated from various environments. The analyzed elements are a source of genetic modules used for construction of specific cassettes useful in genetic engineering and biotechnology.

Projects offered for visiting students: identification and characterization of novel bacterial plasmids and transposable elements; cloning of basal plasmid replicons (by construction of shuttle plasmids), characterization of the thus obtained mini-derivatives (e.g. determination of host range etc.); DNA sequencing and bioinformatic sequence analyses. Transposable elements will be identified using entrapment vectors which enable capture of functional TEs. 30 (ECTS)

Techniques used: isolation of plasmid and megaplasmid DNA, DNA cloning, introduction of foreign DNA into bacterial cells, PCR amplification, DNA sequencing, DNA hybridization, bioinformatic sequence analyses.

Institute of Zoology

Department of Hydrobiology

Head: prof. Joanna Pijanowska, j.e.pijanowska@uw.edu.pl

Scientific activity. Evolutionary and population ecology of plankton and fish. Phytoplankton-zooplankton and zooplankton-fish interface. Molecular, behavioral, life-history and morphological adaptations to predation and food limitations. Role of Heat Shock Proteins (HSP) in individual reaction to stress from biotic and abiotic factors in *Daphnia* as a model.

Projects offered for visiting students: two patterns of prey selection by a planktivorous fish (roach as a predator harvester, and a predator hunter) and prey (*Daphnia*) demographic, life-history and behavioral responses to the risk of predation; variations in life history, morphology and depth selection behavior of *Daphnia* mediated by the presence of filamentous cyanobacteria.

Techniques used: standard methods in growing planktonic algae, cyanobacteria, zooplankton (flow-through cultures) and fish in lab cultures; video techniques in fish behavioural studies; "plankton organ" as a tool for studying depth selection patterns in *Daphnia*.

Institute

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Zoology

Department of Parasitology

Head: prof. Edward Sinski, esinski@biol.uw.edu.pl

Scientific activity: Biology of parasites including immunology of nematode infections in laboratory models. Immunomodulation and immunogenesis of resistance and/or susceptibility to parasite infections. Cytokines and Th1 and Th2 responses to parasites. Apoptosis. Ecology and molecular biology of host-parasite interactions. Helminthes in wild animal populations. Environmental and zoonotic reservoir of parasites for human communities. Vectors, reservoirs, environmental conditions and transmission of tick borne diseases (TBD) pathogens.

The laboratory training will consist of:

- a. *Heligmosomoides polygyrus*: Apoptosis and opioid peptides in immunoregulation during primary infection. Antiparasitic control - changes in larvae glycoproteome impact the parasite infectivity. Using immunological and molecular methods we will be looking for immune recognition and response to the nematode antigens altered by plant saponines. Training programme for MSc students.
- b. *Cryptosporidium* and *Giardia* project- detection of waterborne protozoa of public health interest in environmental samples (watre, food and fecal samples). Training programme for MSc students.
- c. The study on the helminth communities in small rodents populations. Diversity, specificity and the role of rodents as intermediate hosts for human parasites, i.e. *Echinococcus multilocularis*.
- d. The ecology, epidemiology and genetic diversity of tick transmitted pathogens. Training programme for MSc students.

Students will be trained: to improve effectiveness in research and knowledge in parasitism and parasitic diseases.

Institute of Zoology

Department of Immunology

Head: prof. Grażyna Korczak-Kowalska

Research group of prof. Nadzieja Dreła, ndrela@biol.uw.edu.pl

Scientific activity: senescence of the immune system in mammals - characterization of structural and functional changes of lymphoid organs and cells, role of natural regulatory T cells and glucocorticoids in the maintenance of tolerance and homeostasis of the immune system in ageing.

Projects offered for visiting students:

1. Regulation of development and function of natural regulatory T cells by glucocorticoids in young and senescent immune system (30 ECTS)
2. Toll-like receptors signaling in development and function of natural regulatory T cells (30ECTS)

You will receive training in: primary cultures in vitro of lymphoid cells (lymphocytes, macrophages), cultures in vitro of dendritic cell lines, functional assays for effector and regulatory T cells, cell sorting techniques (FACSARIA, MACS), lymphoid cells phenotyping.

Institute of Genetics and Biotechnology

Head: prof. Pawel Golik, pgolik@igib.uw.edu.pl

Scientific activity: - regulation of gene expression in filamentous fungi (prof. Piotr Weglenski, Dr Agnieszka Dzikowska), - RNA turnover and mitochondrial gene expression in yeast (prof. Pawel Golik), - mitochondrial gene expression in vertebrates (prof. Piotr Stepień), - mitochondrial mutations in human

disease (prof. Ewa Bartnik, Dr Katarzyna Tonska), - small nuclear RNA expression in yeast and plants (prof. Joanna Kufel) - applications of molecular genetics to population and conservation biology and archaeology (prof. Piotr Weglenski, Dr Ana Stankovic), - proteomics and mechanisms of nuclear RNA turnover (prof. Michal Dadlez, Dr Andrzej Dziembowski), - mutagenesis and DNA repair (prof. Barbara Tudek). More details can be found at the website: <http://www.igib.uw.edu.pl/index.php?id=80>

Example of the projects available for MS students (contact the respective Principal Investigators for current possibilities, contact information to be found on the Institute's website):

- nucleo-mitochondrial interactions in yeasts - functional analysis of the Irc3p putative RNA helicase (prof. Pawel Golik) 30 (ECTS)
- RNA maturation and surveillance in yeasts and plants (prof. Joanna Kufel) 30 (ECTS)

Techniques: basic culture and phenotype analysis of bacteria, yeasts, filamentous fungi, vertebrate cells and Arabidopsis, bacterial and yeast transformation, heterologous protein overexpression; DNA isolation and purification, PCR, DNA recombination in vitro, DNA electrophoresis, protein isolation and affinity purification, SDS-PAGE, western-blotting, protein interaction assays, siRNA, microscopic observation of fluorescently tagged proteins, isolation of mitochondria from yeast and vertebrate cells, protein-RNA interactions.