

## Graduate School in Science – From cells to organisms

prerequisites of admission:

basic biology, chemistry

**1<sup>st</sup> year**

title	kind of activity	hours/ week	hours/ year	form of crediting	credits
<b>General School Seminar</b>	seminar	2	60	participation	4
<b>Cell Structure and Function</b>	lecture	2	30	exam (test)	3
	classes	2	30		2
<b>Principles of Cell Biochemistry and Physiology</b>	lecture		30		3
	classes		120		8
<b>Basic Cellular and Molecular Neuroscience</b>	lecture	3	45	exam (test)	5
	classes	3	45		3
<b>Basic Microscopy Methods</b>	lecture	2	15	report	2
	classes	2	15		1
<b>Laboratory Project</b>	students laboratory	5	150	project report	10
2 optional lectures*	lecture	2x2	60	essay or test	4
tutorials	tutorial	2	60	as arranged with tutor	4

Required number of credits to complete 1<sup>st</sup> year: 42

**2<sup>nd</sup> year**

title	kind of activity	hours/ week	hours/ year	form of crediting	credits
<b>General School Seminar</b>	seminar	2	60	participation	4
<b>Immunobiology</b>	lecture	2	30	exam (test)	3
	seminar	2	30		2
<b>Morphology and Function of the Cells in Endocrine Systems</b>	lecture	2	30	exam (test)	3
	classes	2	30		2
<b>Tissue culture</b>	lecture		20	exam (test)	2
	classes		10		1
<b>Advanced Microscopy Methods</b>	lecture		30	report	3
	classes		30		2
<b>Functional anatomy of the nervous system</b>	lecture		30	exam (test)	3
	classes		30		2
<b>Diploma Project</b>	laboratory project	12	360	diploma exam	24
2 optional lectures*	lecture	2x2	60	test	4
tutorials	tutorial	2	60	as arranged with tutor	4

Required number of credits to complete 2<sup>nd</sup> year: 46

-----

\* optional lectures of student's choice from the list of lectures for all School specializations

**General School Seminar** – with participation of students and tutors of various specializations.

Seminar Format: two hours per week in two semesters.

Description: General Seminar aims at improving interdisciplinary background of School students and their better integration.

Responsible – School Management

### **Advanced Microscopy Methods**

Course Format: two hours of lecture and two hours of classes per week in the second semester (30+30 hrs.)

Description: The course presents different electron microscopes: transmission (TEM) and scanning (SEM), and electron microscope techniques. Students learn how to prepare biological samples for SEM and TEM. The aim of the course is also to demonstrate the following techniques: energy dispersion X-ray microanalysis, cytochemistry and immunocytochemistry methods. Additionally, students will learn quantitative analysis, and 3D reconstruction of images.

Responsible person: Assoc. Prof. Elżbieta Pyza

### **Basic Cellular and Molecular Neuroscience**

Course Format: three hours of lecture and three hours of classes per week in the first semester (45+45 hrs.)

Description: An overview of fundamental aspects of nervous system function. The course emphasizes the ionic and molecular basis of neuronal excitability, synaptic transmission and signal transduction.

Responsible person: Assoc. Prof. G. Hess

### **Basic Microscopy Methods**

Course Format: one hour of lecture and one hour of classes per week in the first semester (15+15 hrs.)

Description: Theoretical bases of optical microscopy and practical approach to light microscopy techniques: adjustment of Kohler illumination, basic methods of microscopic observations, types of objectives, condensers, eyepieces and their application in biological sciences, microscopes of phase contrast, interference, and fluorescence.

Responsible person: Assoc. Prof. Elżbieta Pyza

### **Cell Structure and Function**

Course Format: two hours of lecture and two hours of classes per week in the first semester (30+30 hrs.)

Description: Internal organization of the cell, structure of cell organelles and their functions. Cell regulation. Cell cycle. Apoptosis. Cellular clock.

Responsible person: Assoc. Prof. Elżbieta Pyza

### **Functional anatomy of the nervous system**

Course Format: two hours of lecture and two hours of classes per week in the second semester.

Description: Anatomy of the nervous system; structure and function of the somatosensory and motor systems; sleep and awareness; limbic system, functional specialization of cerebral hemispheres; speech disorders; brain injury. Practical training: observations of brain and nervous tissue preparations; discussion on selected themes included in the course.

Responsible: Assoc. Prof. Krzysztof Janeczko

### **Immunobiology**

Course Format: two hours of lecture and two hours of seminar per week in the second semester (30+30 h.).

Description: innate immunity versus lymphocyte-mediated immunity; memory and specificity; immunomorphology; immunomodulation; immunopathology; parasite-immune system interactions; evolution of immunity; immunotoxicology; interactions of the immune- and neuroendocrine systems.

Responsible - Prof. Barbara Płytycz

### **Morphology and function of the cells in endocrine systems**

Course format: two hours of lecture and two hours of classes per week in the second semester (30 + 30 h.).

Description: Organization of the endocrine system; genes and hormones; mechanisms of hormone action; assessment of endocrine function; hypothalamus and pituitary gland; thyroid gland; endocrine control of calcium homeostasis; endocrine function of fluid balance; endocrine control of glucose homeostasis; male and female reproductive endocrinology.

Responsible- Assoc. Prof. Maria Słomczyńska

### **Principles of Cell Biochemistry and Physiology**

Course Format: two hours of lecture and 8 hours of classes per week in the second semester (30+120 hrs.)

Description: Structure and function of proteins. Enzymes - mechanisms of function. DNA and RNA - structure and function. Lipids and carbohydrates. Cell membrane - structure and function. Main metabolic pathways in the cell.

Responsible: Prof. Anna Lityńska

### **Tissue culture**

Course format: two hours per week- lecture (20h) followed by two hours of classes (10h) in the first semester (20 + 10 h.)

Description: General techniques, primary cultures from embryonic tissues, cultures of specific cell types

(epithelial cells, mesenchymal cells, gonads), cell lines, cell separation techniques, immortalization of cells, cell cycle analysis, cytotoxic assays.

Responsible- Assoc. Prof. Maria Słomczyńska

**Laboratory Project** – aims at acquainting students with the basic experimental tool and methods of cell biology, biochemistry, immunology, neurophysiology etc., as well as main methods of analysis and interpretation of experimental data. It consists of a series of small projects supervised by the teaching staff.

**Diploma Project** – the one-year project, supervised by a professor, fulfills requirements for MS Diploma Thesis of the Jagiellonian University and most European Universities.

The seminars associated with lectures aim at detailed analysis of relevant experimental aspects of the problems presented in the lectures.

## Basic Cellular and Molecular Neuroscience

Course Format: three hours of lecture and three hours of classes per week in the first semester (45+45 hrs.)

Description: An overview of fundamental aspects of nervous system function. The course emphasizes the ionic and molecular basis of neuronal excitability, synaptic transmission and signal transduction.

Responsible person: Assoc. Prof. G. Hess  
Prof. Barbara Plytycz, PhD  
Department of Evolutionary Immunobiology

## FROM CELLS TO ORGANISMS - IMMUNOBIOLOGY

**Prerequisites of admission:** Basic biology

### 1<sup>st</sup> year

Title	Kind of activity	Hours/week	Hours/year	Form of crediting	Credits
Immunobiology	Lecture, Seminar	2 2	30 30	Exam (test)	3 2
Laboratory project (Immunobiology)	Students laboratory	5	30	Project report	

### 2<sup>nd</sup> year

Title	Kind of activity	Hours/week	Hours/year	Form of crediting	Credits
Laboratory project (Immunobiology)	Students laboratory	5	30	Project report	
Diploma project	Laboratory project	12	360	Diploma exam	24

## Immunobiology

Course format: two hours of lecture and two hours of seminar per week in the sec.semester (30+30 h.). Laboratory Project: 5 hours per week for 6 weeks in the sec.semester of 1<sup>st</sup> year and 5 hours per week for 6 weeks in the 1<sup>st</sup> semester of 2<sup>nd</sup> year

**Description:** innate immunity versus lymphocyte-mediated immunity; memory and specificity; immunomorphology; immunomodulation; immunopathology; parasite-immune system interactions; evolution of immunity; immunotoxicology; interactions of the immune- and neuroendocrine systems.

Responsible - Prof. Barbara Plytycz

### **Laboratory project**

**second semester of 1<sup>st</sup> year** - aims at acquainting students with the basic experimental tools and methods in Immunobiology (identification and in vitro investigations of immunocompetent cells)

**first semester of 2<sup>nd</sup> year** - a series of small projects on comparative immunobiology supervised by the teaching staff

Responsible - Prof. Barbara Plytycz

**Diploma project** - the one-year project, supervised by a professor, concerning investigations of the effects of external (e.g. heavy metals, temperature, drugs, nutrition, etc.) and internal factors on immunity of representatives of invertebrates (earthworms) and vertebrates (fish, amphibians, mammals).

Responsible - Prof. Barbara Plytycz

### Tissue culture

Course format: two hours per week- lecture (20h) followed by two hours of classes (10h) in the first semester (20 + 10 h.)

Description: General techniques, primary cultures from embryonic tissues, cultures of specific cell types ( epithelial cells, mesenchymal cells, gonads), cell lines, cell separation techniques, immortalization of cells, cell cycle analysis, cytotoxic assays.

Responsible- Dr M.Ślömczyńska

### Morphology and function of the cells in endocrine systems

Course format: two hours of lecture and two hours of classes per week in the second semester (30 + 30 h.).

Description: Organization of the endocrine system; genes and hormones; mechanisms of hormone action; assessment of endocrine function; hypothalamus and pituitary gland; thyroid gland; endocrine control of calcium homeostasis; endocrine function of fluid balance; endocrine control of glucose homeostasis; male and female reproductive endocrinology.

Responsible- Dr Maria Ślömczyńska

### **Principles of cell biochemistry and physiology: 30 hs , 120 hs (lab) (Anna Lityńska/ M.Przybyło)**

- ◆ Cell culture
- ◆ The fractionation of cell's content by differentiation centrifugation
- ◆ Isolation and purification of proteins
- ◆ Measurement of protein concentration by spectrophotometry
- ◆ Chromatographic methods:
  - The principles of affinity chromatography
  - Coupling of ligand
  - Separation
  - Aminal immunization
- ◆ Electrophoretic methods
  - SDS-PAGE
  - Protein staining
  - Electroblotting

Immunodetection  
Protein mass determination  
Image analysis

- ◆ Glycoproteins analysis
  - Detection
  - Differentiation with lectins
  - Glycan structure analysis
  - Enzyme digestion
- ◆ Cell adhesion and migration determination
- ◆ Physiology of tumor cells

Structure and function of proteins. Enzymes- mechanisms of function. DNA and RNA - structure and function. Lipids and carbohydrates. Cell membrane - structure and function. Main metabolic pathways in cell.

Prof. Anna Lityńska, PhD  
Department of Animal Physiology  
Laboratory for Glycobiology

## From cells to organisms - Principles of cell biochemistry and physiology

Prerequisites of admission: Basic biology

1<sup>st</sup> year

Title	Kind of activity	Hours/week	Hours/year	Form of crediting	Credits
Principles of biochemistry and physiology	Lecture, Seminar	2 1	30 15	Exam (test)	3 1
Laboratory project	Students laboratory	4	60	Project report	4

2<sup>nd</sup> year

Title	Kind of activity	Hours/week	Hours/year	Form of crediting	Credits
Laboratory project	Students laboratory	4	60	Project report	4
Diploma project	Laboratory project	12	360	Diploma exam	24

### Principles of cell biochemistry and physiology:

**Course format:** two hours of lecture and one hour of seminary per week in the sec. semestr (30 + 15)

Laboratory project: 4 hours per week in the sec. semestr and 4 hours per week in the 1<sup>th</sup> semestr of 2<sup>th</sup> year.

**Description:** Structure and function of proteins, lipids and carbohydrates. Enzymes - mechanisms of function. DNA and RNA - structure and function. Cell membrane -function. Main metabolic pathways in cell.

Responsible - Prof. Anna Lityńska

#### Laboratory project:

second semestr of 1<sup>th</sup> year: aim of acquainting students with the basic experimental tools and methods

(electrophoretic methods, measurement of protein concentration, immunodetection, cell culture)

first semestr of 2<sup>th</sup> year: small project on protein isolation, purification and analysis supervised by the teaching staff

**Diploma project** - the one year project, supervised by professor, concerning investigation on glycosylation profile of adhesion proteins

Responsible: Prof. Anna Lityńska