**MEDICAL UNIVERSITY OF ŁÓDŹ**

**PREMEDICAL PREPARATORY COURSE**

**(SYLABUS)**

1. **Name of the department providing the course**: Zakład Chemii i Biochemii Klinicznej
2. **Course title**: **Biology**
3. **Course language: English**
4. **Type of course unit**: compulsory
5. **Course aims**: As a result of the implementation of the curriculum course the student obtains basic information about the structures and functions of complex organic molecules within biological systems and applies knowledge of the biological processes. Students will gain information about the structure and functioning of different organisms with the special emphasis of human body at molecular, cellular and subcellular levels.
6. **Types of educational activities and number of hours allocated**:

| | Lecture | Seminar | Laboratory classes | classes | Total |
|---|---|---|---|---|---|
| **stationary** | | 96 | 32 | | **128** |
| **on-line** (in the real time scheduled in the timetable) | | | | | |
| **e-learning** (on the e-learning platform) | 32 | | | | **32** |
| **Total** | **32** | **96** | **32** | | **160** |

7. **Names of course unit's faculty**: prof. Ireneusz Majsterek, dr Jacek Kabziński, mgr Aleksandra Binda, mgr Maciej Skrzypek
8. **Prerequisites:** none
9. **Learning activities and teaching methods**:
10. **Course unit content:**

Lectures:

Lecture 1:

THE CHEMISTRY OF LIFE part 1

1. The Chemical Context of Life

2. Water and Life

Lecture 2:

THE CHEMISTRY OF LIFE part 2

1 Carbon and the Molecular Diversity of Life

2 The Structure and Function of Large Biological Molecules

Lecture 3:

THE CELL, part 1

1. A Tour of the Cell

2. Membrane Structure and Function

3. An Introduction to Metabolism

4. Cellular Respiration and Fermentation

Lecture 4:

THE CELL, part 2

1. Photosynthesis

2. Cell Communication

3. The Cell Cycle

Lecture 5:

GENETICS part 1

1 Meiosis and Sexual Life Cycles

2 Mendel and the Gene Idea

3 The Chromosomal Basis of Inheritance

4 The Molecular Basis of Inheritance

5 Gene Expression: From Gene to Protein

Lecture 6:

GENETICS part 2

1 Regulation of Gene Expression

2 Viruses

3 DNA Tools and Biotechnology

4 Genomes and Their Evolution

Lecture 7:

MECHANISMS OF EVOLUTION

1 Descent with Modification: A Darwinian View of Life

2 The Evolution of Populations

3 The Origin of Species

4 The History of Life on Earth

Lecture 8:

THE EVOLUTIONARY HISTORY OF BIOLOGICAL DIVERSITY

1 Phylogeny and the Tree of Life

2 Plant Diversity

3 An Overview of Animal Diversity

4 The Origin and Evolution of Vertebrates

Lecture 9:

PLANT FORM AND FUNCTION

1 Plant Structure, Growth, and Development

2 Soil and Plant Nutrition

3 Plant Responses to Internal and External Signals

Lecture 10:

ANIMAL FORM AND FUNCTION part 1

1 Basic Principles of Animal Form and Function

2 Animal Nutrition

3 Circulation and Gas Exchange

Lecture 11:

ANIMAL FORM AND FUNCTION part 2

1 The Immune System

2 Osmoregulation and Excretion

3 Hormones and the Endocrine System

Lecture 12:

ANIMAL FORM AND FUNCTION part 3

1 Animal Reproduction

2 Animal Development

Lecture 13:

ANIMAL FORM AND FUNCTION part 4

1 Neurons, Synapses, and Signaling

2 Nervous Systems

Lecture 14:

ANIMAL FORM AND FUNCTION part 5

1 Sensory and Motor Mechanisms

2 Animal Behavior

Lecture 15:

ECOLOGY part 1

1 An Introduction to Ecology and the Biosphere

2 Population Ecology

Lecture 16:

ECOLOGY part 2

1 Community Ecology

2 Ecosystems and Restoration Ecology

Seminars – topics for students to cover with presentations as a subject for discussion:

## Seminar 1:

1. Briefly describe the unifying themes that characterize the biological sciences.
2. Diagram the hierarchy of structural levels in biological organization.
3. Explain how novel properties of life emerge from complex organization.
4. Describe the dilemma of reductionism.
5. Describe the two major dynamic processes of any ecosystem.
6. Name two characteristics shared by all cells.
7. Distinguish between prokaryotic and eukaryotic cells.
8. Describe the basic structure and function of DNA.
9. Discuss the goals and activities of systems biology. List the three research developments that have advanced systems biology.
10. Explain the importance of regulatory mechanisms in living things. Distinguish between positive and negative feedback.

## Seminar 2:

1. Distinguish between an element and a compound.
2. Identify the four elements that make up 96% of living matter.
3. Define the term trace element and give an example.
4. Draw and label a simplified model of an atom. Explain how this model misrepresents our understanding of atomic structure.
5. Distinguish between each of the following pairs of terms:
    a. Neutron and proton
    b. Atomic number and mass number
    c. Atomic weight and mass number
6. Explain how the atomic number and mass number of an atom can be used to determine the number of neutrons.
7. Explain how two isotopes of an element are similar. Explain how they are different.
8. Describe a biological application that uses radioactive isotopes.

## Seminar 3:

1. With the use of a diagram or diagrams, explain why water molecules are:
    a. polar
    b. capable of hydrogen bonding with 4 neighboring water molecules
2. List four characteristics of water that are emergent properties resulting from hydrogen bonding.
3. Define **cohesion** and **adhesion**. Explain how water's cohesion and adhesion contribute to the movement of water from the roots to the leaves of a tree.
4. Distinguish between **heat** and **temperature**, using examples to clarify your definitions.
5. Explain the following observations by referring to the properties of water:
    - Coastal areas have milder climates than adjacent inland areas.
    - Ocean temperatures fluctuate much less than temperatures on land.
    - Insects like water striders can walk on the surface of a pond without breaking the surface.
    - If you slightly overfill a water glass, the water will form a convex surface above the top of the glass.
    - If you place a paper towel so that it touches spilled water, the towel will draw in the water.
    - Ice floats on water.
    - Humans sweat and dogs pant to cool themselves on hot days.

## Seminar 4:

1. Explain how carbon's electron configuration explains its ability to form large, complex and diverse organic molecules.
2. Describe how carbon skeletons may vary, and explain how this variation contributes to the diversity and complexity of organic molecules.
3. Describe the basic structure of a hydrocarbon and explain why these molecules are hydrophobic.
4. Distinguish among the three types of isomers: structural, geometric, and enantiomer.
5. Name the major chemical groups found in organic molecules. Describe the basic structure of each chemical group and outline the chemical properties of the organic molecules in which they occur.

## Seminar 5:

1. List the four major classes of macromolecules.
2. Distinguish between monomers and polymers.
3. Draw diagrams to illustrate condensation and hydrolysis reactions.

4. Distinguish between monosaccharides, disaccharides, and polysaccharides.
5. Describe the formation of a glycosidic linkage.
6. Distinguish between the glycosidic linkages found in starch and cellulose. Explain why the difference is biologically important.
7. Describe the role of symbiosis in cellulose digestion by animals.

## Seminar 6:

1. Distinguish between magnification and resolution.
2. Describe the principles, advantages, and limitations of the light microscope, transmission electron microscope, and scanning electron microscope.
3. Explain why cell fractionation is a useful technique.
4. How We Study Cells
5. A Panoramic View of the Cell
6. The Nucleus and Ribosomes
7. The Endomembrane System
8. Mitochondria and Plastids
9. The Cytoskeleton
10. Cell Surfaces and Junctions

## Seminar 7:

1. Explain the meaning of the statement that phospholipids and most other membrane constituents are amphipathic molecules.
2. Explain how the fluid mosaic model of membrane structure explains each experimental finding:
    a. Actual membranes adhere more strongly to water than do artificial membranes composed only of phospholipids.
    b. Membranes with different functions may differ in type and number of membrane proteins.
    c. Membrane proteins are not very water-soluble.
    d. EMs of freeze-fracture membrane preparations show protein particles interspersed in a smooth matrix.
3. Describe the fluidity of the components of a cell membrane and explain how membrane fluidity is influenced by temperature and membrane composition.
4. Explain how cholesterol resists changes in membrane fluidity as temperatures change.
5. Explain how hydrophobic molecules cross cell membranes.
6. Distinguish between channel proteins and carrier proteins.
7. Explain how aquaporins facilitate the passage of water through membranes.
8. Define diffusion. Explain why diffusion is a passive and spontaneous process.
9. Explain why a concentration gradient of a substance across a membrane represents potential energy.
10. Distinguish between solutions that are hypertonic, hypotonic, and isotonic to cell contents.
11. Define osmosis and predict the direction of water movement based on differences in solute concentrations.
12. Describe how living cells with and without cell walls regulate water balance.

## Seminar 8:

1. Explain the role of catabolic and anabolic pathways in cellular metabolism.
2. Distinguish between kinetic and potential energy.
3. Distinguish between an isolated and an open system. Explain why an organism is considered an open system.
4. Explain the first and second laws of thermodynamics in your own words.
5. Explain why highly ordered living organisms do not violate the second law of thermodynamics.
6. Write and define each component of the equation for free-energy change.
7. Describe the function of enzymes in biological systems.
8. Explain why an investment of activation energy is necessary to initiate a spontaneous reaction.
9. Explain how enzyme structure determines enzyme specificity.
10. Explain the induced-fit model of enzyme function.
11. Describe how allosteric regulators may inhibit or stimulate the activity of an enzyme.
12. Explain how the binding of oxygen to hemoglobin illustrates cooperativity.

## Seminar 9:

1. In general terms, distinguish between fermentation and cellular respiration.
2. Write the summary equation for cellular respiration. Write the specific chemical equation for the degradation of glucose.
3. Define oxidation and reduction.
4. Name the three stages of cellular respiration and state the region of the eukaryotic cell where each stage occurs.
5. Describe how the carbon skeleton of glucose changes as it proceeds through glycolysis.
6. Explain why ATP is required for the preparatory steps of glycolysis.
7. Identify where substrate-level phosphorylation and the reduction of $NAD^+$ occur in glycolysis.

8. Describe where pyruvate is oxidized to acetyl CoA, what molecules are produced, and how this process links glycolysis to the citric acid cycle.
9. List the products of the citric acid cycle. Explain why it is called a cycle.
10. Describe the point at which glucose is completely oxidized during cellular respiration.
11. Distinguish between substrate level phosphorylation and oxidative phosphorylation.
12. Distinguish between fermentation and anaerobic respiration.
13. State the basic function of fermentation.

## Seminar 10:

1. Describe the basic signal-transduction pathway used for mating in yeast. Explain the evidence that these pathways evolved before the first multicellular organisms appeared on Earth.
2. Define 'paracrine signaling' and give an example.
3. Explain how plant and animal hormones travel to target cells.
4. List two advantages of using a multistep pathway in the transduction stage of cell signaling.
5. Explain how an original signal molecule can produce a cellular response when it may not even enter the target cell.
6. Describe how phosphorylation propagates signal information.
7. Describe how signal information is transduced into cellular responses in the cytoplasm and in the nucleus.
8. Describe how signal amplification is accomplished in target cells.
9. Describe the roles of *ced-3*, *ced-4,* and *ced-9* in apoptosis during embryonic development in *Caenorhabditis elegans.*
10. Describe the events that may trigger signals from within a cell to trigger apoptosis.

## Seminar 11:

1. Explain how cell division functions in reproduction, growth, and repair.
2. Describe the structural organization of a prokaryotic and eukaryotic genome.
3. Describe the major events of eukaryotic cell division that enable the genome of one cell to be passed on to two daughter cells.
4. List the phases of the cell cycle and describe the sequence of events that occurs during each phase.
5. List the phases of mitosis and describe the events characteristic of each phase.
6. Recognize the phases of mitosis from diagrams and micrographs.
7. Draw or describe the mitotic spindle, including centrosomes, kinetochore microtubules, nonkinetochore microtubules, asters, and centrioles (in animal cells).
8. Describe the roles of checkpoints, cyclin, Cdks, and MPF in the cell cycle control system.
9. Describe the internal and external factors that influence the cell cycle control system.

## Seminar 12:

1. Explain how the observations of cytologists and geneticists provided the basis for the chromosome theory of inheritance.
2. Explain why *Drosophila melanogaster* is a good experimental organism for genetic studies.
3. Describe how sex is genetically determined in humans and explain the significance of the *SRY* gene.
4. Explain why sex-linked diseases are more common in human males.
5. Distinguish between linked genes and sex-linked genes.
6. Describe the independent assortment of chromosomes during Meiosis I. Explain how independent assortment of chromosomes produces genetic recombination of unlinked genes.
7. Distinguish between parental and recombinant phenotypes.

## Seminar 13:

1. Explain the reasoning that led Archibald Garrod to suggest that genes dictate phenotypes through enzymes.
2. Describe Beadle and Tatum's experiments with *Neurospora* and explain the contribution they made to our understanding of how genes control metabolism.
3. Distinguish between the "one gene-one enzyme" hypothesis and the "one gene-one polypeptide" hypothesis and explain why the original hypothesis was changed.
4. Explain how RNA differs from DNA.
5. Explain how RNA polymerase recognizes where transcription should begin. Describe the role of the promoter, the terminator, and the transcription unit.
6. Explain the general process of transcription, including the three major steps of initiation, elongation, and termination.
7. Explain how RNA is modified after transcription in eukaryotic cells.

## Seminar 14:

1. Recount the scientific investigations that led to the discovery of viruses. Include the contributions of Adolf Mayer, Dimitri Ivanowsky, Martinus Beijerinck, and Wendell Stanley.
2. List and describe the structural components of viruses.

3. Explain why viruses are obligate intracellular parasites.
4. Explain how a virus identifies its host cell.
5. Describe bacterial defenses against phages.
6. Distinguish between the lytic and lysogenic reproductive cycles, using phage λ as an example.
7. Which viral genes are expressed during the prophage stage? Explain the significance of prophage gene expression in the lysogenic cycle and to viral disease.
8. Describe the reproductive cycle of an enveloped virus.
9. Describe the reproductive cycle of an HIV retrovirus.

## Seminar 15:

1. Distinguish between phylogeny and systematics.
2. Explain the following characteristics of the Linnaean system of classification:
    a. Binomial nomenclature
    b. Hierarchical classification.
3. Explain the justification for the proposal to replace Linnaean classification with phylocode designations for monophyletic taxa.
4. Explain the statement: "A phylogenetic tree represents a hypothesis about evolutionary relationships."
5. Explain why it is crucial to distinguish between homology and analogy before selecting characters to use in the reconstruction of phylogeny. Describe how homology and analogy can be distinguished from each other.
6. Explain why bird and bat wings are homologous as vertebrate forelimbs but analogous as wings.
7. Define molecular systematics. Explain some of the problems that systematists may face in carrying out molecular comparisons of nucleic acids.

## Seminar 16:

1. Explain why it might be said that the history of life on Earth is one long "age of prokaryotes".
2. Describe the structure, composition, and functions of prokaryotic cell walls.
3. Distinguish between the structure and staining properties of gram-positive and gram-negative bacteria.
4. Describe how prokaryotes carry out photosynthesis and cellular respiration when they lack compartmentalized organelles such as chloroplasts and mitochondria.
5. Explain why prokaryotes are unable to grow in very salty or sugary foods, such as cured meats or jam.
6. State the function(s) of each of the following prokaryotic features:
    a. capsule
    b. fimbriae
    c. sex pilus
    d. nucleoid
    e. plasmid
    f. endospore
7. List three factors that give rise to high levels of genetic diversity in prokaryotes.
8. Describe three processes that produce recombinant DNA in prokaryotes.
9. Explain how R plasmids confer antibiotic resistance on bacteria.

## Seminar 17:

1. Explain why the kingdom Protista is no longer considered a legitimate taxon.
2. Describe the different nutritional strategies of protists.
3. Describe the evidence that supports the theory that mitochondria and plastids evolved by serial endosymbiosis. Explain what living organisms are likely relatives of the prokaryotes that gave rise to mitochondria and plastids.
4. Describe the evidence that suggests that mitochondria were acquired before plastids in eukaryotic evolution.
5. Explain the role of secondary endosymbiosis in the evolution of red and green algae.

## Seminar 18:

1. Describe four shared derived homologies that link charophytes and land plants.
2. Describe the characteristic that defines members of the kingdom Plantae.
3. Describe four characteristics that distinguish land plants from charophyte algae. Explain how these features are adaptive for life on land.
4. Define and distinguish between the stages of the alternation of generations life cycle.
5. Define the term 'secondary compound'. List three secondary compounds and explain their adaptive value to plants.
6. Describe evidence that suggests that plants arose roughly 475 million years ago.

## Seminar 19:

1. Name five terrestrial adaptations that contributed to the success of seed plants.
2. Compare the size and independence of the gametophytes of bryophytes and seed plants.
3. Contrast homospory and heterospory, mentioning which taxa of seed plants display each condition.
4. Describe the ovule of a seed plant.

5. Contrast the gametophytes of bryophytes and seed plants.
6. Explain why pollen grains were an important adaptation for successful reproduction on land.
7. Explain how a seed can be said to include contributions from three distinct generations.
8. Compare spores and seeds as dispersal stages in plant life cycles.

## Seminar 20:

1. List the characteristics that distinguish fungi from members of other multicellular kingdoms.
2. Explain how fungi acquire their nutrients.
3. Describe the basic body plan of a fungus.
4. Distinguish between ectomycorrhizal fungi and arbuscular mycorrhizal fungi.
5. Describe the processes of plasmogamy and karyogamy in fungi.
6. Explain the significance of heterokaryotic stages in fungal life cycles.

## Seminar 21:

1. List the characteristics that combine to define animals.
2. Describe the evidence that suggests animals may have first evolved over a half billion years ago.
3. Describe the evidence of animal life in the Neoproterozoic Era.
4. Explain the possible relationship of Ediacaran phyla to Cambrian animal phyla.
5. Explain the significance of the Cambrian explosion. Describe three hypotheses for the cause of the Cambrian explosion.
6. Distinguish between grades and clades of animal taxa.
7. Outline the major grades of the animal kingdom based on symmetry, embryonic germ layers, the presence or absence and type of coelom, and protostome or deuterostome development.
8. Distinguish between radial and bilateral symmetry. Explain how animal symmetry may match the animal's way of life.
9. Distinguish among the acoelomate, pseudocoelomate, and coelomate grades. Explain the functions of a body cavity.
10. Distinguish between the following pairs of terms:
    a. diploblastic and triploblastic
    b. spiral and radial cleavage
    c. determinant and indeterminate cleavage
11. Compare the developmental differences between protostomes and deuterostomes, including:
    a. pattern of cleavage
    b. fate of the blastopore
    c. coelom formation

## Seminar 22:

1. Explain why sponges are considered to be basal animals.
2. Label a diagram of a sponge (including the spongocoel, choanocyte, mesohyl, amoebocyte, osculum, and spicules). Describe the function of each part.
3. Describe how a sponge feeds and digests its food.
4. List the characteristics of the phylum Cnidaria that distinguish it from other animal phyla.
5. Describe the specialized cells that are found only in Cnidarians.
6. Describe the features that led to the name of the clade Lophotrochozoa.
7. List the characteristics of the phylum Platyhelminthes that distinguish it from the other animal phyla.
8. Distinguish among the four classes of Platyhelminthes. Name one member of each class.
9. Describe the generalized life cycle of a trematode. Name one fluke that parasitizes humans.
10. Explain how trematodes evade detection by the immune systems of their hosts.
11. Describe the anatomy and generalized life cycle of a tapeworm.
12. Describe unique features of rotifers that distinguish them from other pseudocoelomates.
13. Define parthenogenesis. Describe how rotifers may reproduce asexually.

## Seminar 23:

1. Invertebrate Chordates and the Origin of Vertebrates
2. Craniates are Chordates with a Head
3. Vertebrates are Craniates with a Backbone
4. Gnathostomes are Vertebrates with Jaws
5. Tetrapods are Gnathostomes with Limbs
6. Amniotes have Tetrapods with Amniotic Eggs
7. Mammals are Amniotes with Hair and Milk
8. Humans are Bipedal Mammals with Large Brains

## Seminar 24:

1. Distinguish between anatomy and physiology.
2. Explain how physical laws constrain animal form.

3. Use examples to illustrate how the size and shape of an animal's body affect its interactions with the environment.
4. Describe the challenges and benefits that come with complex animal form.
5. Distinguish between regulators and conformers for a particular environmental variable. Explain how an animal may be both a regulator and a conformer.
6. Define homeostasis. Describe in general terms how an animal maintains homeostasis.
7. Distinguish between positive and negative feedback mechanisms. Which type of mechanism contributes to homeostasis?
8. Define thermoregulation. Explain in general terms how endotherms and ectotherms manage their heat budgets.
9. Name four physical processes by which animals exchange heat with their environment.
10. Discuss the role of hair, feathers, and adipose tissue in insulation.
11. Define bioenergetics.
12. Describe the basic sources of chemical energy and their fate in animal cells.
13. Define biosynthesis.

## Seminar 25:

1. Nutritional Requirements of Animals
2. Overview of Food Processing
3. The Mammalian Digestive System
4. Evolutionary Adaptations of Vertebrate Digestive Systems
5. Homeostatic Mechanisms and Energy Balance

## Seminar 26:

1. Circulatory Systems of Animals
2. The Structure and Arrangement of Blood Vessels
3. The Components of Blood
4. Gas Exchange in Animals

## Seminar 27:

1. Innate Immune Defenses Against Infection
2. How Acquired Immunity Arises
3. Acquired Immune System Defenses
4. Immunity in Health and Disease

## Seminar 28:

1. An Overview of Osmoregulation
2. Variation in Excretory Systems
3. The Vertebrate Kidney

## Seminar 29:

1. Overview of Animal Reproduction
2. Mechanisms for Fertilization
3. Human Reproduction and Pregnancy

## Seminar 30:

1. Compare the concepts of preformation and epigenesis.
2. List two key functionss of fertilization.
3. Describe the acrosomal reaction and explain how it ensures that gametes are conspecific.
4. Describe the cortical reaction.
5. Explain how the fast and slow blocks to polyspermy function sequentially to prevent multiple sperm from fertilizing the egg.
6. Describe the changes that occur in an activated egg and explain the importance of cytoplasmic materials to egg activation.
7. Compare fertilization in a sea urchin and a mammal.
8. Describe the general process of cleavage.
9. Explain the importance of embryo polarity during cleavage. Compare the characteristics of the animal hemisphere, vegetal hemisphere, and gray crescent in amphibian embryos.
10. Describe the formation of a blastula in sea urchin, amphibian, and bird embryos. Distinguish among meroblastic cleavage, holoblastic cleavage, and the formation of the blastoderm.

11. Describe the significance of changes in cell shape and cell position during embryonic development. Describe the role of the cytoskeleton in these cellular processes.
12. Describe the process of convergent extension.
13. Describe the locations and functions of cell adhesion molecules.
14. Describe the role of the extracellular matrix in embryonic development.
15. Describe the two general principles that integrate our knowledge of the genetic and cellular mechanisms underlying differentiation.

Seminar 31:

1. Compare and contrast the nervous systems of the following animals and explain how variations in design and complexity relate to their phylogeny, natural history, and habitat: hydra, sea star, planarian, nematode, clam, squid, and vertebrate.
2. Compare the structures and functions of the central nervous system and peripheral nervous system.
3. Explain how the spinal cord produces reflex movement.
4. Distinguish between the white and gray matter of the central nervous system.
5. Describe the embryonic development of the vertebrate brain.
6. Describe the structures and functions of the following brain regions: medulla oblongata, pons, midbrain, cerebellum, thalamus, epithalamus, hypothalamus, and cerebrum.
7. Describe the specific functions of the brain regions associated with language, speech, emotions, memory, and learning.
8. Describe and explain the effect of surgical severing of the human corpus callosum.
9. Describe our current understanding of human consciousness.

Seminar 32:

1. Differentiate between sensation and perception.
2. Describe the four general functions of receptor cells as they convert energy stimuli into changes in membrane potentials and then transmit signals to the central nervous system.
3. Distinguish between sensory transduction and receptor potential.
4. Since all action potentials are the same, explain how the brain distinguishes between different sensory stimuli.
5. Describe how sensory stimulus energy may be amplified during transduction.
6. Explain the role of mechanoreceptors in hearing and balance.
7. Describe the structure and function of invertebrate statocysts.
8. Explain how insects may detect sound.
9. Refer to a diagram of the human ear and give the function of each structure.
10. Distinguish between tastants and odorants.
11. Explain how the chemoreceptors involved with taste function in insects and humans.
12. Using a diagram, identify the components of a skeletal muscle cell.
13. Explain the sliding-filament model of muscle contraction.
14. Name and briefly describe the molecules that store energy for continued muscle contraction.
15. Explain how muscle contraction is controlled.
16. Explain how the nervous system produces graded contraction of whole muscles

Laboratory 1:

Learning to use the microscope.

Watching and discussing demonstration preparations.

Laboratory 2:

Watching and discussing preparations – structure and morphology of a cell, part 1.

Laboratory 3:

Watching and discussing preparations – structure and morphology of a cell, part 2.

Laboratory 4:

Watching and discussing preparations – Zoology, vertebrates, mammals – anatomical, part 1.

Laboratory 5:

Watching and discussing preparations – Zoology, vertebrates, mammals – anatomical, part 2.

Laboratory 6:

Watching and discussing preparations – Zoology, vertebrates, mammals – pathological, part 1.

Laboratory 7:

Watching and discussing preparations – Zoology, vertebrates, mammals – pathological, part 2.

Laboratory 8:

Preparing your own preparations for observation - potato, onion.

11. **Course objectives**:
    - *Knowledge:*
      *Student gains knowledge about:*
      *chemical processes occurring in living organisms*
      *structure and functioning of animal and plant cells at every level of advancement*
      *all systems (especially circulatory, respiratory, digestive, nervous, hormonal, reproductive, immune) their structure and functions*
      *ecology and biosystems on a macro scale*
    - *Skills:*
      *Student obtains:*
      *Knowledge of biological diversity and basic biological phenomena and processes.*
      *Planning and conducting observations and experiments; drawing conclusions based on their results.*
      *Using information from the analysis of source materials.*
      *Reasoning and application of acquired knowledge to solve biological problems.*
      *Knowledge of the determinants of human health.*
      *Attitude towards nature and the environment.*
    - *Attitudes and transferrable (generic) competencies:*
      *Student:*
      *is aware of the need for a permanent, lifelong learning,*
      *demonstrates active role in the pursuit of their professional development and feels responsible for his actions,*
      *systematically enriches professional knowledge and improves skills, with a view to professionalism,*
      *respects the values, moral duties and skills in interpersonal relations,*
      *develops the ability to active listening,*
      *communicates effectively,*
      *controls errors and barriers in the communication process,*
      *uses the technique of verbal and non-verbal communication*

12. **Required and recommended learning resources (readings):**
    - *Required: Campbell Biology 12th Edition*
      *Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Rebecca Orr*
    - *Recommended: Human Biology: Concepts and Current Issues 9th Edition*

*Michael D. Johnson*

13. **Assessment methods and criteria:** Online tasks on the remote learning platform in the form of a quiz/test. Developing a presentation based on the materials provided and presenting it.
14. **Additional information:**
    ABSENCE POLICY:
    During the entire course (winter semester and summer semester combined), 5 absences are allowed.
    If the student is absent from a class where his or her presentation is due, it must be made during the next class.
    If a class in which the student is absent has an assignment/test, student must ask the instructor to set a new date.
    More than 5 absences require a sick note from a doctor.

**Statement and signature of the course leader:** *I hereby state that the content of the curriculum included in the syllabus below is the result of my individual work completed as part of work contract/cooperation resulting from a civil law contract, and that author rights to this title are not the property of a third party.*

**Dean's signature:**

**Data:**