

Medical Biology – Description of courses

1st year

I semester

Course name: Developmental biology (USOS Code: B-BM.074Eng)

Course coordinator: Dr hab. Monika Hułas-Stasiak

Prerequisites: Knowledge of zoology, anatomy and physiology of a high school program.

Course description: Types and importance of animal reproduction (asexual and sexual reproduction). Sexual reproduction. Sexual selection. The female and male reproductive system. Gametogenesis (oogenesis, spermatogenesis). Hormonal regulation of the reproductive system (hypothalamic-pituitary-gonadal axis). Fertilization, cleavage, and gastrulation in various systematic groups (amphibians, birds, mammals). The main mechanisms of embryonic development during gastrulation (germ layers: ectoderm, mesoderm, endoderm) and development of the primary organs. Adaptation to embryonic life (transitional organs). Morphogenetic processes in the later stages of ontogenesis. In vitro fertilization and cloning.

Recommended literature: Sadler T.W. (2006) Langman's Medical Embryology, 10th edition, Wolters Kluwer/Lippincott Williams and Wilkins Company; Gilbert S.F. (2010) Developmental biology, 9th edition, Sinauer Associates.

Course name: General and inorganic chemistry with elements of analytical chemistry (USOS Code: C-B.010B)

Course coordinator: Dr hab. Bożena Czech

Prerequisites: Basic knowledge of chemistry at the level of secondary school.

Course description: The course describes the main principles of chemistry. The Atomic Theory, elements, atomic orbitals and electron configuration. Periodic Table and periodic laws. Compounds, chemical nomenclature, chemical bonds, hybridization, VSEPR theory. Chemical Formulas and Equations. Types of chemical reactions. Thermochemistry and Thermodynamics. Chemistry of solutions, dissociation, hydrolysis, solubility. Acids and bases. Oxidation-Reduction Reactions. pH, buffers, complex compounds. Electrochemistry. Titration.

Recommended literature: Silberberg Martin S., Principles of general chemistry, McGraw-Hill Higher Education, Boston, 2007; Petrucci Ralph H. et al., General chemistry: principles and modern applications, Pearson Prentice Hall, 2007.

Course name: Information technology (USOS Code: MFI-B.033Eng)

Course coordinator:

Prerequisites: Basic computer skills.

Course description: Text editors, text formatting, tables, mathematical formulae. Set up a page and prepare documents for printing. Calculating in a spreadsheet, formatting data, drawing charts and their description. Creating multimedia presentations. Rules of creating correct presentations. Moving documents between different editors and creating PDF files. Graphic editors: an overview of text and graphics editing mechanisms, combining graphics with text, the most popular formats for saving graphics.

Recommended literature: Materials (printed or available on-line) provided by the teacher during classes.

Course name: Intellectual property protection (USOS Code: B-B.028Eng)

Course coordinator: Dr hab. Magdalena Karaś

Prerequisites: There are no prerequisites, and a scientific background is not required.

Course description: This course is a basic study of the core subjects of intellectual property law. It is intended for gaining knowledge in IP law and concomitant policy, and learn about national and international

grant, enforcement and defense of intellectual property rights. The course aims are to develop understanding of the IP law concerning and patents (in particular - biotechnological patents) in modern business. The course gives students the theoretical foundations, and analytical skills, sufficient to be able to evaluate IP problems that arise in practice (plagiarism, correct citation, transfer of IP rights and duration, limitations and exceptions).

The lectures cover the following topics: 1. Genesis and development of intellectual property law.

2. Copyright - works and subjects of related rights on Copyright; permitted personal and public use of works, copyright on the Internet, database protection. 3. Patent law (an outline of the protection of utility models, inventions, biotechnological inventions). 4. The law of distinctive signs (company, trademarks, geographical indications). 5. Polish and European industrial designs law. 6. Infringement of intellectual property rights (infringement of copyright and industrial property rights), intellectual property protection measures. 7. Rules and routes of IP creations registration (national, regional, international) versus not-registered. 8. Acquisition of rights to IP products by third parties.

Recommended literature: Auxiliary materials and presentations from lectures are made available to students by the teacher. Polish Act On Copyright And Related Rights – English version. Polish Act On Industrial Property Law – English version.

Course name: Mathematics with elements of statistics (USOS Code: MFI-B.023Eng)

Course coordinator: Dr hab. Przemysław Matuła, prof. UMCS

Prerequisites: Mathematics on secondary school level, elementary computer skills including spreadsheet program and graphing calculator.

Course description: Elements of logic – statement calculus. Elements of set theory - The algebra of sets. Cartesian product and relations. Functions and their properties. Overview of elementary functions. Linear functions and systems of linear equations. Matrix algebra and matrix algebra in Excel. Sequences of real numbers. Limits and continuity of functions of one variable. Derivative and differentiation with applications, higher order derivatives. Integral calculus. Multivariable calculus – limits, continuity, derivatives of functions of several variables with applications. Elements of statistics, basic statistical functions in Excel.

Recommended literature: Neuhauser Claudia - Calculus for Biology and Medicine, Pearson (2014); Phoenix David - Introductory Mathematics for the Life Sciences, CRC Press (1997); Stoll-Set Robert R. - Theory and Logic, Dover Publications (1979).

Course name: Microbiology (USOS Code: B–BM.070Eng)

Course coordinator: Dr. hab. Iwona Komaniecka, prof. UMCS

Prerequisites: Basic knowledge of biochemistry at the level of secondary school.

Course description: Introduction to microbiology. History of microbiology. Evolution of life on the Earth. Prokaryotic and eukaryotic microorganisms. Structure and functions of prokaryotic cell. Growth and development of microorganisms. Effect of physical and chemical factors on microbial growth. Antibiotics. Introduction into medical microbiology. Microorganisms nutrition: carbon, nitrogen, hydrogen, oxygen, phosphate, sulphur. Microbial metabolism: oxygenic and anoxygenic respiration, fermentation, photosynthesis, chemosynthesis. Interactions between microorganisms and other organisms in the environment. Characteristics of bacteriophages: their structure and reproduction.

Recommended literature: Willey Joanne M., Sherwood Linda M., Woolverton Christopher J. (Eds) - Prescott, Harley, and Klein's Microbiology, 7th ed., 2008; Black Jacquelyn G. - Microbiology. Principles and Explorations, 8th ed., 2012; Madigan Michael T., Martinko John M., Bender Kelly S., Buckley Daniel H., Stahl. David A. (Eds) - Brock Biology of Microorganisms, 14th ed., 2015.

Course name: Mycology (USOS Code: B-B.025Eng)

Course coordinator: Dr Urszula Świdorska-Burek

Prerequisites: –

Course description: *Lectures:* Structure of fungi and fungus-like organisms. Specific components of fungal cells. Vegetative and generative fungal structures. Morphology and anatomy of fungal fruiting bodies. Types

of asexual and sexual reproduction, sporogenesis, spore propagation. Trophic forms. Fungal metabolites and their application. The role and importance of fungi in the ecosystem. Modern criteria for classification of fungi, an overview of major taxa (The Code of Nomenclature). *Labs*: Cell and thallus structure of true fungi and fungus-like organisms. Characteristic of the most important vegetative and generative fungal structure. Characteristics of selected substrate types of resettlement substrates colonized by fungi; the characteristics of the eucarpic fungi. Characteristic of selected representatives of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, anamorphic fungi, and Lichenes. Structure, development, reproduction, spreading of parasites, saprotrophs, symbionts and endophytes.

Recommended literature: Alexopoulos C.J. 1952. Introductory Mycology. John Wiley & Sons, New York; Deacon J. 2006. Fungal biology. 4th edition, Blackwell Publishing; Ingold C.T. 1961. The Biology of Fungi, Hutchinson Educational; Moore D., Robson G.D., Trinci A.P.J. 2011. 21st Century Guidebook to Fungi, Cambridge University Press, New York.

Course name: Physics with elements of biophysics (USOS Code: B-B.017Eng)

Course coordinator: Dr hab. Maria Stolarz, Dr Kamila Kupisz

Prerequisites: General knowledge in physics and biology at high school level.

Course description: SI basic units, vectors, mathematical operation on vector quantities, analysis of measurement errors. Lipid membrane - surface tension and method of its measurement, surfactants, monolayers, bilayers, black lipid membrane (BLM). Biological membranes; cell structure, composition, physicochemical properties. Transport through membranes, ion channels. Membrane potential; equilibrium (Nernst's) potential, resting potential, action potential. Electrical conductivity of living organisms. Radiation, light intensity, radiant power density, photon flux density. Light absorption through the medium. Biophysics of visual processes, an eye.

Recommended literature: Davidovits P., Physics in Biology and Medicine, 2008; Dillon P.F. Biophysics. A Physiological Approach, 2012; Dill K.A., Bromberg S., Molecular Driving Forces, 2011; Sperelakis N. (ed.), Cell Physiology Source Book: Essentials of Membrane Biophysics 2011.

Course name: Training (USOS Code: B-B.171Eng)

The module includes three on-line trainings :

- **Work Hygiene and Safety**
- **Ethics and Disciplinary Liability of Students**
- **Library Training**

Prerequisites: -

Course description: During the **Work Hygiene and Safety** course the student will gain knowledge about selected legal basis related to health and safety of work in universities, elements of ergonomics, physiology and work hygiene, possible risks and their prevention, fire protection rules, and emergency first aid. **Ethics and Disciplinary Liability of Students** course will deal with general issues concerning legal basis of students' disciplinary responsibility, student's ethics, a catalogue of student's rights and duties. During the **Library Training** the student will learn the principles of using the collections and services of the Maria Curie-Skłodowska University Library, gain practical skills in using the Library's offer, will learn how to search for literature useful at any level of study.

Recommended literature: -

Course name: Physical education

Course description: Several physical activity courses are offered by the Centre for Physical Culture UMCS including: aerobic, badminton, fitness, basketball, volleyball, football, spinning, swimming, aqua fitness, defence techniques, physiotherapy exercises and others. Students can choose the kind of physical activity they want to practice. The course is obligatory but no ECTS points are achieved.

II semester

Course name: Botany and zoology field classes (USOS Code B-BM.066Eng)

Course coordinator:

Prerequisites: Passed laboratories in botany and zoology.

Course description: Flora (spore and vascular plants) and fauna (invertebrates and vertebrates) of the most valuable areas of the Lublin region. The most important components of the flora and fauna of national parks. Characteristic features of landscape parks. Forms of plant and animal protection. Adaptation of plants and animals to live in various environmental conditions (xerothermic and peat communities, aquatic and terrestrial). Impact of habitat factors (soil, climate) on the distribution of plants and animals. Collection, preparation and identification of materials.

Recommended literature: Key-books, guides and atlases for individual groups of plants and animals.

Course name: General and systematic botany (USOS Code: B-BM.065Eng)

Course coordinator: Prof. dr hab. Wiesław Mułenko

Prerequisites: -

Course description: Plant cell structure. Plant body organization forms. Tissues – structure and classification. Vascular plant organs (root, stem, leaves) – morphology, anatomy, modifications. Flowers and inflorescences – structure, classification, methods of pollination of plants. Fruit and seeds – development, structure, ways of spreading. Methods of plant reproduction, transformation of generations in telome plants (metagenesis). Flower structure, double fertilization. Ecological groups of plants. Role and tasks of plant systematics, botanical nomenclature principles. Theories of origin of thallus and axillary plants. Overview of the main lines of plant development – the polyphyletic nature of algae, development directions of terrestrial plants. Overview of the most important groups of systematic plants.

Recommended literature: Bresinsky A. *et al.* 2013. Strasburger's Plant Sciences. Including Prokaryotes and Fungi. Vol. 1 and 2. Springer Verlag, Berlin; Szweykowka A., Szweykowski J., 2019. Botany. Part I and II, Morphology and Systematics. WN PWN, Warszawa; Crang R., Lyons-Sobaski S., Wise R.. 2018. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants 1st ed. 2018 Edition, Kindle Edition; <https://www.amazon.com/Plant-Anatomy-Concept-Based-Approach-Structure-ebook/dp/B07L1K9F1X>; <https://www.amazon.com/Plant-Anatomy-Concept-Based-Approach-Structure-ebook/dp/B07L1K9F1X>

Course name: General and taxonomic zoology with principles of taxonomy (USOS Code: B-BM.071Eng)

Course coordinator: Dr hab. Halina Kucharczyk, prof. UMCS

Prerequisites: -

Course description: Theory of classical and phylogenetic classification of animals. Biodiversity and the tree of life. Diagnostic and adaptive features of the animals phyla including comparative morphology, anatomy, ecology, physiology, life history and biocenotic meaning. The examples of the interaction between animal species and between animal as well as other organisms. Animal taxa identification and observation under laboratory and natural condition. Meaning of the selected animal species for the scientific research, medicine and economy. The animals' species dangerous for human. Global animal protection.

Recommended literature: Hickman C.P., Jr., Larry s. Roberts L.S., Keen S.L., Eisenhour D.J., Larson A. Integrated Principles of Zoology. Publisher: New York, McGraw Hill Education; Miller S.A., Harley J.P. Zoology. Tenth edition 2007. Publisher: McGraw Hill Education; Ruppert E.E., Fox R.S., Barnes R.D.. Invertebrate Zoology. A functional Evolutionary Approach. Publisher: Brooks/Cole Pub Co.

Course name: Human Anatomy (USOS Code: B-BM.061Eng)

Course coordinator: Dr hab. Joanna Jakubowicz-Gil, prof. UMCS

Prerequisites: Completed course in Developmental biology.

Course description: The purpose of this course is to aid students in acquiring a basic understanding of the structures of the human body and their relationships using a systems-based approach. Students will be introduced to anatomic terminology in order to facilitate this understanding. The main concepts concerning anatomy and physiology especially regards: microscopic anatomy; the classification, structure and function of tissues; the structure of the human body: body parts, axes, planes and body metamerism; the structure, topography, function and clinical considerations of the body systems: skeletal, muscular, cardiovascular, lymphatic, nervous, respiratory, gastrointestinal, urogenital, endocrine, integumentary; anthropology and morphometry.

Recommended literature: Atlas of Human Anatomy – Sobotta; Human Anatomy – Martini, Timmons, Tallitsch; Anatomy for Students – Drake, Vogl, Mitchell.

Course name: Parazytology (USOS Code: B-BM.083Eng)

Course coordinator: Dr hab. Maria Grochowska, prof UMCS

Prerequisites: -

Course description: *Lectures:* Definitions of basic terms in parasitology: parasitology, parasitism, parasite, host. Types of biological interactions. Classification of parasites and hosts. Systematic position of parasites. Parasite-host interactions. Systems and organs attacked by various species of parasites. Morphological and physiological adaptations of parasites to the parasitic lifestyle. Infection history. Methods/routes of invasion and leaving the host by parasites. Diagnostics of parasitic invasions. Prevention of parasitic diseases. *Labs:* Systematic review, morphology, biology, medical and sanitary significance of selected species of parasites belonging to Protista, Platyhelminthes, Nematoda, Acari and Insecta.

Recommended literature: Loker E.S., Hofkin B. 2018. Parasitology: A Conceptual Approach, Taylor & Francis Inc ; Renuka K. 2015. Handbook on parasitology, Partridge Publishing; Ruppert E.E, Fox R.S, Barnes R.D. 2004. Invertebrate Zoology: A Functional Evolutionary Approach, Cengage Learning; Sougata Ghosh 2017. Paniker's Textbook of Medical Parasitology, Jaypee Brothers Medical Publishers; Lonc E., Złotorzycka J. 2000. Principles of Modern Protozoological Parasitology, Wydawnictwo Uniwersytetu Wrocławskiego; Kasprzak W., Majewska A.C. 1998. Study guide to accompany practical medical parasitology and to inquire into biology of human parasites, Karol Marcinkowski University of Medical Sciences in Poznań. Department of Biology and Medical Parasitology.

Course name: Physical chemistry (USOS Code: C-B.009AEng)

Course coordinator: Dr hab. Aleksandra Szczeń

Prerequisites: Basic knowledge of general chemistry, mathematics and physics.

Course description: The properties of gases. Basic concepts of phenomenological thermodynamics with special emphasis on three laws of thermodynamics. Thermodynamic functions. Physical transformations of pure substances and simple mixtures. Osmosis and its applications. Phase equilibrium for interfaces: liquid-vapour, solid-liquid. The Gibbs phases rule. Azeotropes, eutectic systems. Phenomena occurring on phase boundary. Foundations of kinetics of chemical processes. Equilibrium constant. Factors affecting chemical processes. Equilibrium and dynamic electrochemistry: electrochemical cells, electrode potentials, electrolysis, corrosion.

Recommended literature: Atkins P.W. Physical Chemistry, Oxford University Press 2009; Atkins P., de Paula J. Keeler J. Atkins' Physical Chemistry, Oxford University Press 2018.

Course name: The elements of organic chemistry for biology students (USOS Code: B-B.013AEng)

Course coordinator: Dr hab. Anna Matuszewska, prof. UMCS

Prerequisites: Passed course of general and inorganic chemistry

Course description: The structure and properties of organic compounds. Molecular symmetry and asymmetry, isomerism. Classification and nomenclature. Mechanisms of major reactions of organic compounds: substitution, addition, elimination. Main groups of organic compounds: hydrocarbons, alcohols, phenols,

amines, aldehydes, ketones, carboxylic acids, heterocyclic compounds. Polymers. Main chemical constituents of living organisms: lipids, amino acids and proteins, mono- and polysaccharides, nucleic acids.

Recommended literature: McMurry J. Organic chemistry. Books/cole Cengage Learning, 2012; Hart H., Craine L.E., Hart D.J., Hadad Ch.M. Organic Chemistry: A Short Course 2009; McMurry J. Organic Chemistry with Biological Applications. Cengage Learning, 2011.

Course name: Foreign language

Course description: Different languages are available for students depending on whether they originate from a country with a native/official English language. As a general rule, other language than the official language of the country of origin is studied. For the students from English-speaking countries Polish language course is recommended. The students from non-English-speaking countries may perfect their English or choose another language. Foreign language course is held for four semesters.

2nd year

III semester

Course name: Animal physiology – an extensive course (USOS Code: B-B.016Eng)

Course coordinator: Prof. dr hab. Piotr Wlaź

Prerequisites: –

Course description: During the course the following issues are discussed: phenomena related to the excitability of the body's cells, structure and functions of the nervous system (characteristics of individual brain structures and spinal cord, reflex activity, characteristics of the autonomic and peripheral nervous system and senses, the role of the central nervous system in the regulation of the functions of individual organs), skeletal and smooth muscle physiology, blood – blood functions and blood cells, structure and functions of the respiratory, cardiovascular, digestive and excretory systems, hormonal regulation of physiological function.

Recommended literature: Barrett K., Barman S., Boitano S., Brooks H.- Ganong's Review of Medical Physiology; Hill R.W., Wyse G. A., Anderson M. - Animal Physiology.

Course name: Biochemistry (USOS Code: B-BM.062En)

Course coordinator: Dr Justyna Sulej

Prerequisites: Completed course in organic chemistry.

Course description: This course provides an overview of the main aspects of biochemistry focuses on structure, systematics, function and basics of metabolism of the biological macromolecules including the amino acids, proteins, enzymes and their cofactors, carbohydrates, lipids, non-amino acid nitrogen compounds and nucleic acids. Topics will include the regulation of metabolism and gene expression. Included also will be the fundamentals of enzymes/proteins spatial structure and function. Basics of cofactors and vitamins. Basics of biochemistry of biological membranes, including transport and cell signaling. Routes and location of primary and indirect metabolism. Basics of integration and regulation of basic and indirect metabolism.

Recommended literature: Pratt C.W. and Cornely C. Essential biochemistry. Hoboken, John Wiley & Sons, Inc., 2014; Voet D.J., Voet J.G., Pratt C.W., Principles of Biochemistry, 5th global ed., John Wiley & Sons, Inc., 2018; Berg, Tymoczko, Stryer, Biochemistry, New York: W.H. Freeman and Company, 2012.

Course name: Environmental protection (USOS Code: B-BM.087Eng)

Course coordinator: Dr hab. Marek Kucharczyk, prof. UMCS

Prerequisites: General knowledge of botany, zoology, ecology and geography.

Course description: Forms of environmental exploitation. Degradation of pedosphere: erosion, biological degradation, contamination of soils. Global climate change. Social and economic impacts of climate change. Health effects of air pollution (smog, ozone depletion). Human impacts on the global water cycle. Water pollution (eutrophication, petroleum products, plastics). Water resources, access to drinking water, sanitation and hygiene. The concept of biodiversity – problems of biodiversity protection. Biological extinction and expansion. Forms of environmental exploitation. Environmental exploitation - sustainable development strategy.

Recommended literature: Ahluwalia V.K. 2015. Environmental Pollution and Health, New Delhi: TERI; Harrison R. M. 2001. Pollution: Causes, Effects and Control, 4th ed., Cambridge: Royal Society of Chemistry; Spellman F.R.; Stoudt M.L. Lanham M.D. 2013. The Handbook of Environmental Health, Scarecrow Press.

Course name: Environmental toxicology (USOS Code: B-BM.086Eng)

Course coordinator: Dr hab. Iwona Wojda, prof. UMCS

Prerequisites: Knowledge concerning human anatomy and biochemistry on the level of high school. Basics of biology.

Course description: *Lecture:* Basic terms used in toxicology. Types and characteristics of poisons present in the human environment. Factors determining toxicity: dependence between the physicochemical structure of xenobiotics and their toxic action. Vulnerability of the body to xenobiotics. Resorption and biochemical transformation of toxins in the body, excretion of xenobiotics. Toxic effects of nicotine, ethanol, acrylamide, pesticides and other compounds to which man can be exposed. Toxic substances of plant origin. Cancer mechanisms and factors causing the formation of tumours. *Laboratory:* Research on the effectiveness of pasteurization of food products. Determination of nitrogen compounds in food products. Organophosphatides as choline esterase inhibitors. Determination of microbes in water.

Recommended literature: Stine K.E., Brown T.N. Principles of toxicology, CRC Press, Third Edition.

Course name: Genetics with elements of human genetics (USOS Code: B-BM.068Eng)

Course coordinator: Prof. dr hab. Monika Janczarek

Prerequisites: Completed course in biochemistry (basic course).

Course description: The module covers the knowledge of principles of genetics in prokaryotes and eukaryotes, including humans, at the level of molecules, cells, and multicellular organisms. Topics include Mendelian and non-Mendelian inheritance; mechanisms involved in genetic inheritance; human genetic syndromes; structure and function of DNA, chromosomes, and genomes; organization of prokaryotic and eukaryotic genomes; DNA replication, recombination and repair; transcription and regulation of gene expression; mutations and mutagenesis and their effects on gene expression.

Recommended literature: Brown T.A., Genomes 3, Garland Science 2007; Krebs J.E., Goldstein E.S., Kilpatrick S.T., Lewin. Genes XI, 2014; Hartwell, Hood, Goldberg, Reynolds, Silver, Veres. Genetics: From Genes to Genomes, University of North Carolina Greensboro, The McGraw-Hill Companies, Inc. 2009.

Course name: Radiology (USOS Code: B-BM.085Eng)

Course coordinator: Prof. dr hab. Mariusz Gagoś

Prerequisites: Completed course of physics with elements of biophysics.

Course description: Natural and artificial radioactivity. The effect of ionizing radiation on cells and tissues. Fundamentals of radiation protection. Physical and technical basics of radiology. Conventional radiology (RTG). Computed tomography (CT). Nuclear resonance tomography (NMR). Scintigraphic methods of Nuclear Medicine. Tomographs: SPECT and PET. Ultrasound. Methods of registering and receiving images. Discussion of the above-mentioned diagnostic methods based on examples of the diagnosis of specific disease entities.

Recommended literature: Mikla Victor. Medical Imaging Technology. 2013. Elsevier.

IV semester

Course name: Basics of individual entrepreneurship (USOS Code: B-B.029Eng)

Course coordinator: Dr hab. Joanna Czarnecka, prof. UMCS

Prerequisites: Basic knowledge of mathematics.

Course description: The aim of this course is to familiarize students with basic economic terms and the meaning of entrepreneurs and enterprises in the modern market economy. The basic issues are: market economy and the place of enterprises in a market economy, organizational and legal forms of enterprises, finance and evaluation of the financial condition of enterprises, business plan and its preparation, financial market and financial institutions in a market economy, households in a market economy, the role and place of the state in a mixed economy.

Recommended literature: PDF materials prepared for the course by the teacher. Foundation for Economic Education (FEE) materials.

Course name: Basics of pharmacology (USOS Code: B-BM.084Eng)

Course coordinator: Prof. dr hab. Piotr Wlaź

Prerequisites: Basic knowledge of human anatomy and physiology.

Course description: Drug definition. Mechanism of drug action. Membrane transport, absorption and distribution of drugs. Metabolism, excretion of drugs, and kinetics of elimination. Factors affecting drugs action. Drugs interactions. Adverse and toxic effects of the drugs. Drug dependence. Discovery and development of new drugs. Pharmacogenetics. Detailed pharmacology – characteristics of selected groups of drugs (e.g., antidepressants, neuroleptics, sedatives, anxiolytics, antiepileptics, analgesics, cardiovascular drugs).

Recommended literature: Goodman and Gilman's The Pharmacological Basis of Therapeutics, Laurence Brunton, Bruce A. Chabner, Bjorn Knollman, 11th edition, McGraw-Hill

Course name: Cell biology – an extensive course (USOS Code: B-B.004Eng)

Course coordinator: Dr Joanna Strubińska

Prerequisites: The course requires basic knowledge of chemistry and biochemistry issues.

Course description: The study of cell biology is fundamental to learning about living organisms. This course will provide students with understanding of internal organization and functions of the eukaryotic cell. Diversity and complexity of cellular structure and functions will be study with special emphasis on: basic research methods used in cell biology- especially microscopes; chemical composition, bonds and their effect on inter- and intramolecular interactions; membrane structure, and function including- fluidity, asymmetry, transport, cell-cell signalling, cell adhesion; cytoskeleton with motor proteins and cell movement; cell junctions and the extracellular matrix; organelles structure and function; cell cycle, divisions and their regulation; cell death – necrosis, apoptosis (programmed cell death) and cancer development.

Recommended literature: Essential Cell Biology by Bruce Alberts, Karen Hopkin, Alexander D Johnson, David Morgan, Martin Raff, Keith Roberts, Peter Walter, New York, NY : Garland Science, 2014 or 2019 (fourth or fifth edition).

Course name: Ecology (USOS Code: B-BM.067Eng)

Course coordinator: Dr hab. Piotr Sugier, prof. UMCS

Prerequisites: Basic knowledge in the field of botany and zoology.

Course description: Basic concepts of ecology. Ecology and other sciences. Levels of organization in ecology. Ecological factors affecting the organism. Principle of ecological tolerance. Theory of ecological niche. Life forms of plants and animals. Life history traits and adaptation strategies of organisms. Population abundance and density. Spatial organization of populations. Types of population structures. Processes in population. Concept of the ecosystem. Food chains and food networks in different types of ecosystems. Primary and

secondary productivity. Energy flow through the ecosystem. Nutrient cycling and biogeochemical cycles. Species interactions (neutral, negative, and positive). Role of biological and physical factors in a developing community structure. Ecological succession. Diversity and characteristics of biomes. Scientific methods including field and laboratory methods to understand ecological patterns and processes (observation, sampling, data recording, data analysis and reporting).

Recommended literature: Begon M., Townsend C.R., Harper J.L. 2006. Ecology. From individuals to ecosystems, 4th edition, Blackwell Publishing, Oxford; Krebs Ch.J. 2009. Ecology: the experimental analysis of distribution and abundance, 6th edition, University of British Columbia, Vancouver.

Course name: Elements of pathophysiology (USOS Code: B-BM.078Eng)

Course coordinator: Dr hab. Joanna Jakubowicz-Gil, prof. UMCS

Prerequisites: Completed course in Animal physiology and Human Anatomy.

Course description: Introduction: concepts of health and disease, causes and mechanisms of diseases' development, cellular responses to stress and noxious stimuli. Pathophysiology of pain. Pathophysiology of carcinogenesis. Molecular mechanisms of carcinogenesis. Pathophysiology of selected central nervous system diseases. Nutrition alterations. Molecular mechanism of inflammation. Mechanisms of cell injury and cell death.

Recommended literature: Pathophysiology Made Incredibly Easy! 5th ed, I. Lippincott Williams & Wilkins; Robbins Basic Pathology 10th ed, Elsevier.

Course name: Ethics (USOS Code: F-B.014Eng)

Course coordinator: Dr hab. Tomasz Kitliński

Course description: Ethics as a philosophical discipline. Basic ethical categories. Review of basic moral norms (moral norms in defence of biological existence, in defence of dignity, independence, privacy, justice, serving the need for trust). Main problems of bioethics (transplantation, abortion, euthanasia, in vitro fertilization, genetic engineering). Ecological ethics - outline of the basic issues.

Recommended literature: Singer P., Ethics in the Real World: 86 Brief Essays on Things that Matter, Melbourne 2016; Beabout G. & Hannis M., Ethics: the Art of Character, Glastonbury 2016; Printed materials or pdf copies provided by the teacher.

Course name: Evolutionary biology (USOS Code: B-BM.063Eng)

Course coordinator: Dr hab. Marek Kucharczyk, prof. UMCS; Dr hab. Iwona Wojda, prof. UMCS

Prerequisites: General knowledge of botany, zoology, genetics and ecology.

Course description: The origin of genetic variation: gene mutations, recombination and variation, alterations of the karyotype. Variation: sources of phenotypic variation, genetic variation in natural populations, variation among populations. Nature of selection and adaptations, levels of selection. The concept of species. Speciation as a result of selection, adaptive radiation, extinction. Evolution of reproduction; sexual reproduction and mating systems. Biological altruism and its evolution. Evolution of interactions: coevolution of enemies and victims, mutualism, evolution of competitive interactions. Ability to defend against infections as a condition for the survival of organisms. Red Queen Hypothesis. Immune mechanisms found in the world of living organisms and their evolution.

Recommended literature: Futuyma D.J. 2017. Evolution (4th ed.). Sunderland, MA: Sinauer Associates.

Course name: Molecular biology with elements of molecular diagnostics (USOS Code: B-BM.BA.064Eng)

Course coordinator: Prof. dr hab. Marek Tchorzewski (for education cycle 2018/2019), Dr Kamil Deryło (for education cycle 2019/2020)

Prerequisites: Completed course of Biochemistry.

Course description: DNA, RNA and protein structure and function; central dogma of molecular biology; genome organization; genetic code, gene expression; tools for analysing gene expression; role of molecular biology in medical practice.

Recommended literature: Allison L.A. - Fundamental Molecular Biology, 2nd edition (2011); Alberts B. et al. - Molecular biology of the cell, 6th edition (2015); Brown T.A. - Genomes, 4th edition (2017); Patrinos G., Ansorge W., Danielson P.B. (eds) - Molecular diagnostics (2016).

Course name: The history of philosophy with elements of natural philosophy (USOS Code: F-B.019Eng)

Course coordinator: Dr hab. Tomasz Kitliński

Course description: Introduction to philosophy. Differentia specifica of the notion and the field of philosophy. Life and thought of Socrates. The philosophy of Plato. The philosophy of Aristotle. The philosophy of the Greek and Roman stoics. The philosophy of Blaise Pascal. Fyodor Dostoevsky's novella Notes from Underground and its philosophical significance. Friedrich Nietzsche, his life and philosophy. Existentialism. Albert Camus' The Plague and its philosophical significance. An Introduction to Natural Philosophy. Ancient Greek Natural Philosophy. The New Natural Philosophy of the Seventeenth Century. The Revolution in Natural Philosophy – the Nineteenth and Twentieth Century. Natural Philosophy for the Twenty-First Century.

Recommended literature: Russell B., History of Western Philosophy, London 1995; Plato, Phaedrus, Cambridge 2018; Marcus Aurelius, Meditations, New York 2002; Tolstoy L., The Death of Ivan Illich, Hertfordshire 2004; Dostoyevsky F., Notes from Underground, London 1994; Nietzsche F., The Gay Science, Cambridge 2001; Wilson C., The Outsider, Newburyport 2016; Sartre J.-P., Existentialism is a humanism, Yale 2007; The Words, London 2000; Camus A., The Plague, London 2002; Gill M.L. & Pellegrin P. (eds), Companion to Ancient Philosophy, New Jersey, 2006; Grant E., A History of Natural Philosophy. From the Ancient World to the Nineteenth Century, Cambridge, 2007; Dodig-Crnkovic G. & Schroeder M.J. (eds), Contemporary Natural Philosophy and Philosophies, Basel 2019; Printed materials and pdf copies provided by the teacher.

3rd year

V semester

Course name: Academic lecture

Course coordinator:

Prerequisites: -

Course description: Every semester a new offer of academic lectures is prepared. Students may register to a selected lecture according to his/her interest providing the fact that the lecture is not assigned to the discipline of study (biology). The lectures are open for the whole academic society and are conducted by the best lecturers from all faculties of the University.

Course name: Applied biology in medicine (USOS Code: B-BM.073Eng)

Course coordinator: Dr hab. R. Gosik, Dr A. Rysiak

Prerequisites: General knowledge of botany and zoology.

Course description: The importance and use of plants, algae, lichen and fungi in human life and medicine. Selected plant-building elements useful from a medical point of view: cell – main primary (spare substances) and secondary metabolites; secretory tissues - structure, occurrence and functions; pollen, seeds and fruits - identification, ways of spreading, pollen analysis of honey, soil seed bank. Lower plants, lichens, and fungi – as a source of secondary metabolites, ways spreading and use in medicine. Vascular plants and their role in medicine: poisonous, medicinal (herbal), useful and invasive plants.

Animals (Invertebrates and Vertebrates) as reservoirs and vectors of diseases and pathogens. Annoying and dangerous species - recognition, pathogen transmission, importance, harmfulness. Allergy to selected animals. Common, synanthropic species and their interaction with human. Animals as a source of drugs and medicinal product. Animals in humane therapy. Animals in EBM medicine, alternative and folk medicine.

Recommended literature: Handbook of Poisonous and Injurious Plants. L. S. Nelson, R. D. Shih, M. J. Balick. The New York Botanical Garden, Springer, 2007; Bryophyte Ecology. Vol. 5. Uses: Household and personal uses. Medicine and antibiotics. Technological and commercial use. Glime J.M. eBook sponsored by Michigan Technological University and The Int. Ass. of Bryologists, 2008-2015. <http://www.bryoecol.mtu.edu/>; Parasitology, An Integrated Approach. Ian Gunn, Sarah Jane Pitt, Willey & Blackwell. 2012; Handbook of Clinical Toxicology of Animal Venoms and Poisons Julian White, Jürg Meier. 1995; Medical Entomology for Students. M. Service, Cambridge University Press; 2012.

Course name: Biochemistry of nutrition (USOS Code: B-BM.072Eng)

Course coordinator: Dr Justyna Sulej

Prerequisites: Completed course in biochemistry.

Course description: This module will highlight the role of nutrients and nutrient metabolism in human health. The course covers the structural and functional characteristics of macronutrients (amino acids, proteins, carbohydrates, lipids) and micronutrients (vitamins) in food consumed by humans. Biochemical mechanisms associated with the digestion and assimilation of macronutrients. Molecular aspects of nutrition and integration of metabolic pathways of food ingredients. Bases of human nutrition in relation to the organs and systems of the body and physiological conditions (e.g. pregnancy, lactation, growth, puberty, aging).

Recommended literature: Voet D.J., Voet J.G., Pratt C.W., Principles of Biochemistry, 5th global ed., John Wiley & Sons, Inc., 2018; Mann J., and Truswell A.S. Essentials of human nutrition. Oxford University Press 2007; Appleton, A., and Vanbergen O. Crash Course: Metabolism and Nutrition. Elsevier Health Sciences, 2012.

Course name: Biological basics of herbal medicine (USOS Code: B-BM.075Eng)

Course coordinator: Dr A. Rysiak, Dr hab. S. Dresler, prof. UMCS

Prerequisites: General knowledge of botany and plant physiology.

Course description: The scope of research and history of herbal medicine. Plant drug forms: herbal raw materials and their classification. Obtaining herbal material from natural habitats: legal bases, harvesting methods, conservation. Herb cultivation on an industrial scale. Review of plant communities rich in herbal raw materials: the concept of phytocoenosis, classification of phytocoenoses, non-forest communities (aquatic and non-aquatic, meadows, and grasslands, synanthropic communities) and forests.

General information, basic definitions (herbal raw material, active compounds) rules of harvesting plant materials, modern methods and techniques for examining medicinal plants. Groups of compounds belonging to primary metabolites (carbohydrates, fats: oils, proteins) and secondary (phenolic compounds, phenylpropanoids, coumarins, tannins, flavonoids, anthocyanins, quinones, terpenes, alkaloids, essential oils) determining the biological and pharmacological activity of plant raw materials. Knowledge of side effects, toxicity, possible side effects, addiction potential. The use of plant raw materials for utility purposes in various industries. Plant taxonomy and morphology: vegetative and generative organs of plants as a source of herbal drugs. Review of natural plant communities for abundance of medicinal plants. Basics of pharmacological recipe - dosage of drugs.

Recommended literature: Handbook of Herbs and Spices, vol. 1 and 2. Edited by K. V. Peter. Woodhead Publishing Limited, Cambridge, England, 2001, 2004; Plant Specialized Metabolism: Genomics, Biochemistry, and Biological Functions, Edited by G. Arimura, M. Maffei. CRC Press, USA, 2016.

Course name: Genetic engineering – a basic course (USOS Code: B-B.124Eng)

Course coordinator: Dr hab. Andrzej Mazur, prof. UMCS, Dr hab. Małgorzata Marczak

Prerequisites: General knowledge of genetics and molecular biology, completed courses of genetics and microbiology.

Course description: The basis of *in vitro* DNA recombination. Techniques for transgenic organisms production. DNA sequencing techniques (including NGS) and projects. Transcriptome and proteome analyses. From gene to function – DNA mutagenesis and gene knockouts. Analyses of biomolecules interactions. Application and safety of recombined DNA technology

Recommended literature: Brown T.A. Genomes, Taylor & Francis Inc. 2017; Watson J.A., Caudy A.A., Myers R.M., Witkowski J.A. Recombinant DNA. Genes and genomes - short course. Cold Spring Harbor Laboratory Press, 2007.

Course name: Human evolution (USOS Code: B-BM.079Eng)

Course coordinator: Dr hab. Marek Kucharczyk, prof. UMCS

Prerequisites: General knowledge of anatomy and genetics.

Course description: Human origins studies: a historical perspective. Man as a biological species - systematic position. Specific features and diversity of primates. Size of body and brain, senses, diet, transport, interpersonal relations and communication in primates. Hominid evolution and the emergence of the genus Homo. Human family tree. Modern human origins and dispersal. Out-of-Africa versus the multiregional hypothesis. Genetic variation and human evolution. What makes us human: language, culture, ideology, spirituality, and morality.

Recommended literature: Tuttle R. H. (2014). Apes and Human Evolution. Cambridge, Massachusetts: Harvard University Press; Cela C., Camilo J; Ayala, F. J., 2007. Human Evolution : Trails From the Past. Series: Oxford Biology. Oxford: OUP Oxford; Tuttle, R.H. Apes and Human Evolution. Cambridge, Massachusetts: Harvard University Press.

Course name: Human immunology with elements of virology (USOS Code: B-BM.069Eng)

Course coordinator: Dr Magdalena Mizerska-Kowalska

Prerequisites: General knowledge of medical microbiology and cell biology.

Course description: The role and basic features of the immune system. Organs and cells of the immune system. Structure and role of MALT and SALT. Mechanisms of communication between cells of the immune system (cytokines, adhesion molecules). Structure and biological characteristics of antigens and antibodies. Lymphocyte differentiation. Humoral and cellular immune response. Passive and active mechanisms of innate immunity (phagocytosis, complement system, non-specific bactericidal substances, interferon). Recognition of microorganisms by non-specific mechanisms of immunity. Anti-infective immunity against various groups of microorganisms (bacteria, viruses, fungi) and parasites. Immune tolerance - mechanisms that provide self-tolerance, factors leading to the abolition of self-tolerance, some autoimmune diseases. Types of hypersensitivity, mechanisms of hypersensitivity, examples of hypersensitivity related diseases, basic diagnostic tests. General characteristics of viruses - structure, properties, classification, replication. Theories of origin of viruses. Variability of viruses on the example of influenza virus. Pathomechanisms of viral infections.

Recommended literature: Delves P.J., Martin S.J., Burton D.R. Roitt's Essential Immunology. Blackwell Publishing Ltd. 2011; Male D., Brostoff J., Roth D., Roitt I. (eds) Immunology 8th edition, Imprint: Saunders, Published Date: 17th September 2012; Janeway C.A., Travers P. Immunobiology, Garland Publishing Inc. 1994; Harper D.V. Viruses Biology Applications Control, Garland Science 2012; Mahy B.W.J. (ed.) Human and Medical Virology, 2010.

Course name: Physical bases of instrumental diagnostics and physiotherapy (USOS Code: B-BM.080Eng)

Course coordinator: Prof. dr hab. Kazimierz Trębacz

Prerequisites: Knowledge of basic principles of physics and human physiology.

Course description: Electrocardiography, ECC - physical phenomena in a human heart, principle of measurement, application, data analysis, bases of diagnostics of a circular system, Electrical phenomena in a nervous system. Electroencephalography, EEG, - physical principles, application, data analysis. Ultrasounds - emission, detection, ultrasonography, lithotription. Computer tomography, CT - X-radiation, principle of

functioning and application of CT. Positron emission tomography, PET - physical bases, principles of design, application in medical diagnosis and behavioral tests. NMR spectroscopy and NMR tomography - physical bases, application, resolution. Scintigraphy - radioactive isotopes, types of radiation, impact of radiation on the human organism, application of scintigraphy. LASER - principle of operation, application in ophthalmology, dermatology, and dentistry. An impact of light on a human body, application of different light sources in therapy and rehabilitation. An influence of temperature on a human organism. Thermography - physical bases, application. An influence of pressure changes on an organism, hyperbaric chambers. Application of light microscopy in diagnostics.

Recommended literature: Hall J.E. 2011. Guyton and Hall Textbook of Medical Physiology Saunders Elsevier; Wilson J.D., Buffa A.J., Lou B. College Physics (7th Edition) Pearson.

Course name: Specialization practical training (USOS Code: B-B.170Eng)

Course coordinator:

Prerequisites: -

Course description: The aim of the specialization practical training is to broaden the theoretical knowledge gained during the studies and to develop the ability to apply it in practice, to shape the skills necessary for future professional work, to create conditions for professional activation of students on the labour market and to learn the principles of organization and mechanisms of functioning of potential employers. The 3-week internship can take place in various types of companies, enterprises in the region or in the whole of Poland, also in the laboratories of the departments within the Faculty of Biology and Biotechnology of UMCS.

VI semester

Course name: Biochemical methods in clinical analysis (USOS Code: B-BM.082Eng)

Course coordinator: Dr hab. Marcin Grąz, prof. UMCS

Prerequisites: Biochemistry course completed.

Course description: Organization of work in the laboratory. Stages of the analytical process. Processing of obtained results. Types of measurement errors. Standardization of research. Validation of analytical method. The use of enzymes in medical analytics. Fundamentals of electrophoretic, chromatographic and spectroscopic methods and its use in medical analytics.

Recommended literature: Wilson K., Walker J. Principles and techniques of biochemistry and molecular biology. Cambridge University Press, 2005.

Course name: Biomaterial engineering in medicine (USOS Code: B-BM.081Eng)

Course coordinator: Dr hab. M. Osińska-Jaroszuk

Prerequisites: General knowledge of chemistry and physics.

Course description: General characterization of biomaterials - definition, properties. Requirements for biomaterials -biocompatibility, biotolerance, biofunctionality. Division and types of biomaterials used in medicine: ceramic, metallic, metal alloys, composite and polymers. Corrosion of metallic implants. Surface modifications of biomaterials. Tissue response to implants (normal wound-healing process, body response to implants). Biological testing of biomaterials (*in vitro* and *in vivo* assessment of tissue compatibility, assay methods). Physical and chemical testing of biomaterials. Degradation of biomaterials in the biological environment (chemical and biochemical degradation of polymers). Application of biomaterials in medicine, biology and cosmetology. Biomaterials as a drug carriers. Tissue engineering materials and regeneration.

Recommended literature: Wong J.Y., Bronzino J.D. 2007 Biomaterials CRC Press is an imprint of the Taylor & Francis Group; Rattner B.D., Hoffman A.S., Schoen F.J, Lemons J.E. 2004 Biomaterials Science An Introduction to Materials in Medicine 2nd Edition Elsevier Academic Press; Park J., Lakes R.S. 2007 Biomaterials An Introduction Third Edition Springer Science&Business Media, LLC.

Course name: Biotechnology (USOS Code: B-B.197Eng)

Course coordinator: Prof. dr hab. Jerzy Rogalski

Prerequisites: General knowledge of microbiology, biochemistry and organic chemistry.

Course description: The nature of biotechnology, patenting inventions in biotechnology, safety in biotechnology, organisms involved in biotechnology processes, bioprocess/fermentation technology, homogenisation, concentration and purification techniques in biotechnology, biocatalysers and enzyme technology, single cell protein, immobilization techniques for live cells, enzymes and small weight substances, food and beverage biotechnology, biotechnology and medicine, bioremediation, biofuels, nanobiotechnology.

Recommended literature: Smith J.E. (2004) Biotechnology studies in biology, 4th ed., Cambridge Univ. Press, UK; Kun L.Y. (2004) Microbial biotechnology – principles and applications, World Scientific Publishing Co. Pte. Ltd., UK; Bagchi D., Bagchi M., Moriyama H., Shahidi F. (2013) Bio-nanotechnology – a revolution in food, biomedical and health sciences, Wiley-Blackwell, UK.

Course name: Human ecology (USOS Code: B-BM.077Eng)

Course coordinator: Dr Magdalena Franczak

Prerequisites: -

Course description: Basics concepts of human ecology. History of the development of human ecology. Human ecology and other sciences. Human as biological and social unit. Biological evolution and human cultural evolution. Forms of human societies. Civilizations. Human population as an element of the ecological system. Biocenotic interactions with other species. Homeostatic mechanisms of the individual and population. Environmental factors (abiotic, biotic and social) affecting human development and health. Geographical distribution of human population and the impact of geoclimatic conditions. Genetic, physiological, and social adaptation to the environment and to environmental changes. The development of civilization: demographic and health changes. Effects of population density on health, social organization, and environmental quality. Diseases of civilization. Stress: symptoms, management, and prevention. Ecology of work environment. Ecological aspects of human activity. Ecology and evolution of nutrition.

Recommended literature: Bates D.G., Tucker J. (eds). 2010. Human ecology: contemporary research and practice. Springer, New York, London; Dyball R., Newell B. 2014. Understanding human ecology: a system approach to sustainability. Routledge, London, New York; Frisancho A.R. 1993. Human adaptation and accommodation. The University of Michigan Press, Ann Arbor.

Course name: Mechanisms of evolution (USOS Code: B-B.190Eng)

Course coordinator: Dr Marzanna Paździuch-Czochra

Prerequisites: General knowledge of biochemistry and genetics.

Course description: Biological evolution - evolution before Darwin, Darwin's principles, modern neo-Darwinism. Basic concepts of modern evolution theory. Microevolution: mechanisms of inheritance, genetic and individual variation, natural selection at the level of organisms, mutational-selection balance. Genetic polymorphism and its importance for evolution. Epigenetic inheritance. Phylogenesis: methods of reconstruction of phylogenesis based on morphological and molecular data. Contemporary problems of evolution theory.

Recommended literature: Futuyma D.J. 2017. Evolution (4th ed.). Sunderland, MA: Sinauer Associates; Stearns S., Hoekstra R. 2005 Evolution (2th ed.) Oxford University Press.

Course name: Pharmacological botany (USOS Code: B-BM.076Eng)

Course coordinator: Dr hab. Małgorzata Wrzesień

Prerequisites: General knowledge of botany and chemistry.

Course description: The medicinal properties of plants and their role in both traditional and modern medicine. History of herbal medicine, and alternative medicinal practices around the world. The basics of ethnobotanical research. Biodiversity, endangered medicinal and aromatic plants. Botanical, ecological, chemical and pharmacological characteristics of common medicinal plants. Biological aspects of natural active

compounds present in plants. Commercial use of herbs. Therapeutic uses of plants (nerve system, metabolic syndrome, urology, gastrointestinal, cardiovascular). Herbal medicinal for dermatologic uses. The psychoactive drugs and poisons obtained from plants (stimulants, hallucinogens, depressants). Toxicity of medicinal plants (*hepatotoxicity*, *nephrotoxicity*, *cardiotoxicity*, *neurotoxicity*). Future of medicinal plants in medicine.

Recommended literature: Lewis W.H., Elvin-Lewis M.P.F. 2003. Medical Botany: Plants Affecting Human Health, 2nd ed. New York: John Wiley & Sons; Van Wyk B.E., Wink M. 2017. Medicinal Plants of the World. Wallingford: CABI Publishing.

Course name: Plant physiology – an extensive course (USOS Code: B-B.35Eng)

Course coordinator: Dr hab. Małgorzata Wójcik, prof. UMCS

Prerequisites: -

Course description: During the lecture, the student will learn about the basic physiological processes taking place in plant organisms, their mechanisms, regulation and dependence of these processes on environmental factors. Issues related to water and mineral management, photosynthesis, respiration, growth and development of plants will be discussed. Modern trends in physiological research and curiosities related to the functioning of plants in our everyday life will be presented. In the course of laboratory exercises, the student will perform experiments and observations on his own to better understand physiological processes taking place in plants. Exercises are performed according to the instructions presented in the scripts and under the guidance of the teacher.

Recommended literature: Buchanan B.B., Gruissem W., Wilhelm J., Russell L. (eds.) Biochemistry & Molecular Biology of Plants, Rockville, Md., American Society of Plant Physiologists; Taiz L., Zeiger E. (eds) Plant Physiology, Sinauer Associates (for both on-line versions are available).

Course name: Seminar (USOS Code: B-B.183Eng)

Course coordinator: promotor of the bachelor thesis

Prerequisites: -

Course description: To obtain a bachelor's degree in science at completing the BSc Medical Biology programme, the graduate must prepare and defend the bachelor thesis. Seminar is conducted in form of individual meetings of the student with his/her promotor in order to prepare the bachelor thesis. During the seminar the subject and content of the thesis as well as its formal and substantive requirements are discussed.

For more information about each course go to

<https://usosweb.umcs.pl/kontroler.php?action=katalog2%2Findex&lang=en> and type the course name or USOS Code. The syllabuses concerning the courses given on the third year will be introduced at the beginning of the V and VI semester.