Medical Biology – Description of courses

(For the educational cycle beginning in the academic year 2023/2024 and later)

1st year

I semester

Courses	No. of hours	Lecture	Classes	Form of course completion	Credits ECTS	
					O	E
Modern trends in biology	20	20	-	Pg	2	-
Basics of zoology	60	15	45 (LB)	Ex	5	-
Basics of botany	60	20	40 (LB)	Ex	5	-
Physics with elements of biophysics	60	20	40 (LB)	Ex	6	-
General chemistry with elements of analytical and physical chemistry	70	25	45 (LB)	Ex	6	-
Calculation in biology	20	-	20 (KW)	Pg	1	-
Utility software package	30	-	30 (LB)	Pg	2	-
Intellectual property protection NHS	15	15	-	Pg	1	-
Foreign language	30	-	30 (KW)	Pg	2	-
Total:	**365**				**30**	**0**
					30	

Forms of classes: LB – Laboratory, KW – Tutorial; Forms of course completion: Ex – exam, Pg – pass with grade; O – obligatory course, E – elective course.

Course name: Modern trends in biology (USOS Code: B-B.2001Eng)
Course coordinator: Dr hab. Joanna Jakubowicz-Gil, prof. UMCS
Prerequisites: -
Course description:
Lecture: Introduction to modern biology with particular attention to the latest achievements in the field of biochemistry and molecular biology, microbiology, environmental biology, medical biology and bioinformatics.
Biochemistry and molecular biology: functional metabolomics as a method of personalized medicine; assessment of the pharmacological potential of natural biologically active substances; molecular/genetic diagnostics (transcriptomics, translatomics, proteomics); biochemical and molecular methods in medicine, agriculture, industry and environmental protection.
Bioinformatics: evolution of bioinformatics: from the analysis of single biological sequences to the analysis of genomes and metabolic networks; metagenomics and bioinformatics analysis of the microbiome as a modern method in medical diagnostics; genomics and transcriptomics at the single-cell level; application of machine learning and artificial intelligence in bioinformatics.
Medical biology: stem cells, differentiation methods, research possibilities, application in medicine; oncogenesis and modern anticancer therapies; animals as experimental organisms and alternative in vitro models; plants in medicine.
Environmental biology: contemporary problems of environmental protection and management; nature monitoring methods; activities aimed at maintaining the proper condition of habitats and limiting the effects of environmental degradation; employment prospects in the broadly understood environmental biology industry.
Microbiology: the world of microorganisms; model organisms in microbiological research; microorganisms in agriculture, forestry, food and mining industries, medicine, environmental protection; metagenomics – a holistic approach to the study of microbiological niches.

Recommended literature: current scientific articles provided by the teacher.

Course name: Basics of zoology (USOS Code: B-B.2002Eng)

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

Prerequisites: General knowledge of animals' biology at the high school level

Course description: This course will contain basic information on the modern concepts in taxonomy, and phylogeny of living and extinct animals according to their biology and bionomy. The complex relationships between living organisms on different levels of body organization and the importance, and use of selected groups in medicine will be presented. Both lectures and laboratories will contain such issues as: biological nomenclature, animals' systematics; phylogeny – tree of life, protozoan groups; development of multicellular animals, characteristics of Porifera and Cnidaria; Triploblastic protostomes; Lophotrochozoa: phyla Annelida and Mollusca; characteristics of Ecdysozoa: phylum Arthropoda, classes: Crustaceomorpha, Chelicerata, Myriapoda, and Hexapoda; characteristics of phylum Chordata, subphylum Vertebrata, classes: Pisces, Amphibia, Reptilia, Aves, and Mammalia.

Recommended literature: Hickman C.P., Jr., Roberts L.S., Keen S.L., Eisenhour D.J., Larson A. 2008. Integrated Principles of Zoology. Publisher: McGraw Hill Education.

Miller S.A., Harley J.P. 2016. Zoology. Publisher McGraw-Hill Education.

Ruppert E.E., Fox R.S., Barnes R.D. 2004. Invertebrate Zoology. A functional Evolutionary Approach. Publisher: Brooks/Cole Pub Co.

Course name: Basics of botany (USOS Code: B-B.2003Eng)

Course coordinator: Dr Urszula Świderska

Prerequisites: General knowledge of botany at the high school level

Course description: The main purpose of the course is to learn about the richness and diversity of plant species, their morphological and anatomical structure, environmental requirements, ways of reproduction, distribution, evolution, relationships with other organisms, and the role and importance in the natural environment. The issues of the classes also concern the great importance and role of plants in human life and in the economy, i.e. their practical use in the food industry, pharmaceutical industry, medicine and biotechnology.

The program also concerns the impact of environmental factors on the development and spread of plants, principles of plant protection, discussion of plant taxonomy, characteristics of representatives of selected groups, selected plant communities, as well as protected species and plants important from a practical point of view (including medicinal plants).

Recommended literature:

1) Bresinsky A., Körner Ch., Kadereit J.W., Neuhaus G., Sonnewald U. 2013. Strassburger's Plant Sciences Including Prokaryotes and Fungi. Vol. 1 & 2. Springer – Verlag Berlin Heidelberg.

2) Shipunov A. 2020. Introduction to botany. http://ashipunov.info/shipunov/school/biol_154/

3) Esau K. 1977. Anatomy of seed plants. John Wiley & Sons, New York, pp. 550.

4) Internet sources: Botanical Dictionary: (http://botanydictionary.org/); Plant Anatomy: http://facweb.furman.edu/~lthompson/bgy34/plantanatomy/plant_shoot.htm; http://www.sci.sdsu.edu/plants/econbot/02-PlantAnatomy.pdf)

Course name: Physics with elements of biophysics (USOS Code: B-B.2004Eng)

Course coordinator: Dr hab. Maria Stolarz

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; equlibrium (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: General chemistry with elements of analytical and physical chemistry (USOS Code: B-B.2005Eng)

Course coordinator: Dr hab. Bożena Czech, prof. UMCS

Prerequisites: General knowledge in chemistry at the high school level

Course description: The course describes the main principles of general analytical and physical chemistry and is divided into several topics considering the main laws, principles, and theories applied in chemistry. During the course, the students will have delivered lectures and attend laboratory classes. The main aim of the lecture is to give a scientific background for understanding the main observations noted in real life and the laboratory. During laboratories, the students will conduct the experiments and become familiar with the basic methods used in the laboratory.

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

Course name: Calculation in biology (USOS Code: B-B.2006Eng)

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: Scientific and decimal notation, unit conversion (Excel). Basic functions – linear, quadratic, polynomials, exponential, logarithmic, glued functions (Graphing calculator). Systems of linear equations, determinants. Percents in structure and dynamic analysis, solutions – concentration, percentage calculations. Sequences of real numbers – models of population growth. Functions – limits, continuity, derivative – interpretation and applications. Definite and indefinite integral – interpretation and application. Elements of descriptive statistics.

Recommended literature: C. Neuhauser – Calculus for Biology and Medicine, Pearson (2014); F. H. Stephenson – Calculations for Molecular Biology and Biotechnology. A Guide to Mathematics in the Laboratory, Academic Press (2004).

Course name: Utility software package (USOS Code: B-B.2007Eng)

Course coordinator: Dr Małgorzata Pac-Sosińska

Prerequisites: -

Course description: This course introduces essential IT tools used in natural and exact sciences, covering remote work tools, file editing, text formatting programs, and data visualization. Students will learn to use the Microsoft Office Suite for creating and formatting documents, spreadsheets, and presentations. The course includes an introduction to raster and vector graphics for data visualization and an overview of relational databases with basic SQL queries. Students will gain basic knowledge about programming algorithms and hands-on experience in Python programming and data analysis using R and RStudio. The course also explores the role of artificial intelligence in education, with practical examples of AI tools.

Recommended literature: 1. Davies T. M. 2016; The book of R. A first course in programming and statistics; 2. Beaulier A. 2009; Learning SQL O'Reilly; 3. Amos D., Bader D., Jablonski J., Heisler F. 2020; Python basics. A practical introduction to Python 3. 4. Materials provided by the lecturer.

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

Course coordinator: Dr hab. Magdalena Karaś

Prerequisites: -

Course description: This course is an 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: Foreign language (USOS Code: B-POL.001.Eng)
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.

II semester

Courses	No. of hours	Lecture	Classes	Form of course completion	Credits ECTS	
					O	E
Cell biology - an extensive course	90	30	60 (LB)	Ex	8	-
The elements of organic chemistry for biology students	60	30	30 (LB)	Ex	5	-
Basics of mycology	30	10	20 (LB)	Pg	2	-
Human anatomy - an extensive course	60	30	30 (LB)	Pg	5	-
Zoology field classes	30	-	30 (CT)	Pg	2	-
Botany field classes	30	-	30 (CT)	Pg	2	-
Parasitology	30	15	15 (LB)	Pg	2	
Elective courses in Humanities and Social Sciences (courses to be chosen from the given list)*	30	30	-	Pg	-	2
Physical education	30	-	30 (KW)	Pg	0	-
Foreign language	30	-	30 (KW)	Pg	2	-
Total:	**420**				**28**	**2**
					30	

Forms of classes: LB – Laboratory, KW – Tutorial, CT – field classes; Forms of course completion: Ex – exam, Pg – pass with grade; O – obligatory course, E – elective course.

* List of the Elective courses in Humanities and Social Sciences is made available in the semester preceding the selection of courses. The examples of courses offered in the academic year 2023/2024 are given at the end of this file.

Course name: Cell biology – an extensive course (USOS Code: B-BMED.2001Eng)
Course coordinator: Dr Joanna Strubińska
Prerequisites: 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, bounds 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: The elements of organic chemistry for biology students (USOS Code: B-B.013Eng)
Course coordinator: Dr hab. Anna Matuszewska, prof. UMCS
Prerequisites: Completed course in General chemistry with elements of analytical and physical 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: Basics of mycology (USOS Code: B-BW.2001Eng)
Course coordinator: Dr Urszula Świderska
Prerequisites: -
Course description: The aim of the course is to introduce the student to the basic issues in the field of mycology, i.e. the science of fungi. During the course, the student learns the diversity and basic life processes of fungi, their anatomical structures, morphological and habitat diversity, trophic forms and methods of reproduction, their systematic position. The course shows the student the threats posed by this group of organisms and the role they play in the natural environment and the human economy, especially in the medical context.
During the lectures, characteristics of the basic taxonomical group, i.e. the most important features of structure (vegetative and generative), types of reproduction and the ways of dispersal are discussed. In addition, the importance of fungi in human life and economy and their use in medicine and biotechnology are presented.
Macro- and microscopic observations are carried out during laboratory classes. They are helpful for identification of symptoms of plant diseases caused by fungi.
Recommended literature: (1) Alexopoulos C.J. 1952. Introductory Mycology. John Wiley & Sons, New York; (2) Deacon J. 2006. Fungal biology. 4th edition, Blackwell Publishing; (3) Ingold C.T. 1961. The Biology of Fungi, Hutchinson Educational; (4) Moore D., Robson G.D., Trinci A.P.J. 2011. 21st Century Guidebook to Fungi, Cambridge University Press, New York; (5) Scripts of classes prepared by the teacher.

Course name: Human anatomy – an extensive course (USOS Code: B-BM.061Eng)
Course coordinator: Dr hab. Joanna Jakubowicz-Gil, prof. UMCS
Prerequisites: -
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: Zoology field classes (USOS Code: B-BM.066ZEng)
Course coordinator: Dr Karol Wagner
Prerequisites: -
Course description: Characteristics, diversity, and identification of basic taxa of animals (invertebrates and vertebrates) with particular emphasis on species having toxicological significance. Animals around us – parasites and disease vectors. Species used in folk and conventional medicine. Basic information on the biology of the species in question, their relationship with the environment. Economic significance of selected species, their susceptibility to anthropopressure, degree of threat and possibilities of protection.
Recommended literature: Materials provided by the teacher.

Course name: Botany field classes (USOS Code: B-BM.066BEng)
Course coordinator: dr Urszula Świderska
Prerequisites: Completed course in Basics of botany
Course description: The aim of the field classes is to apply the knowledge gained during the laboratoruies in the botany course to the natural habitat of plants. Topics include characterisation, diversity and identification of basic plant taxa, especially those used in folk and conventional medicine, as well as those of toxicological importance; basic information on the biology of the species in question, their relationship with the environment; economic importance of selected species, their susceptibility to anthropopressure, degree of threat and opportunities for protection.
Recommended literature: (1) Bresinsky A., Körner Ch., Kadereit J.W., Neuhaus G., Sonnewald U. 2013. Strassburger's Plant Sciences Including Prokaryotes and Fungi. Vol. 1 & 2. Springer – Verlag Berlin Heidelberg; (2) Rothmaler W. 1988 (i następne) Excursionsflora. Cz. 3.Volk und Wissen Volkseigener Verlag, Berlin; (3) Struwe L. 2016. Field identification of the 50 most common plant families in temperate regions (including agricultural, horticultural, and wild species). Rutgers, The State University of New Jersey; (4) Materials provided to students by the teacher.

Course name: Parasitology (USOS Code: B-BM.083Eng)
Course coordinator: Dr hab Rafał Gosik, 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 & Amp; 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 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.

2nd year
III semester

Courses	No. of hours	Lecture	Classes	Form of course completion	Credits ECTS	
					O	E
Biochemistry	90	30	60 (LB)	Ex	8	-
General microbiology	60	30	30 (LB)	Ex	5	-
Genetics with elements of human genetics	60	30	30 (LB)	Ex	5	-
Human physiology	90	30	60 (LB)	Ex	6	-
Premedical first aid	30	-	30 (LB)	Pg	2	-
Radiology	15	15	-	Pg	1	-
Basics of *in vitro* animal cell culture	15	-	15 (LB)	Pg	1	-
Physical education	30	-	30 (KW)	-	0	-
Foreign language	30	-	30 (KW)	Pg	2	-
Total:	**420**				**30**	**0**
					30	

Forms of classes: LB – Laboratory, KW – Tutorial; Forms of course completion: Ex – exam, Pg – pass with grade; O – obligatory course, E – elective course.

Course name: Biochemistry (USOS Code: B-BM.062Eng)
Course coordinator: Dr Justyna Sulej
Prerequisites: Completed course in The elements of organic chemistry for biology students
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: General microbiology (USOS Code: B-BMED.2002Eng)
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. Taxonomy of microorganisms. Structure and functions of procaryotic cell: bacterial cell wall, genome, spare materials, endospores, motility structures. 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: Genetics with elements of human genetics (USOS Code: B-BM.068Eng)
Course coordinator: Prof. dr hab. Monika Janczarek
Prerequisites: Completed course in Biochemistry
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: Human physiology (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: Premedical first aid (USOS Code: B-BMED.2004Eng)
Course coordinator: dr Adrian Zając
Prerequisites: -
Course description: Premedical first aid - legal provisions within the countries. Assessment of the injured person's condition – Recovery Position Steps. Assessment of the injured person's condition – cardiopulmonary resuscitation (CPR). First pre-medical aid in different situations such as: burns, hypothermia and frostbite, fainting, hemorrhages, stings, bites, poisoning, sprains, dislocations, fractures, falls from a height, electric shock, epilepsy attack. First aid kit equipment - requirements and actual status at the University.
Recommended literature: The Complete First Aid Pocket Guide – 2018 (John Furst). First Aid Manual Revised 10th Edition – 2016 (St John Ambulance, British Red Cross, St Andrew's First Aid).

Course name: Radiology (USOS Code: B-BM.085Eng)
Course coordinator: Prof. dr hab. Mariusz Gagoś
Prerequisites: Completed course in 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.

Course name: Basics of *in vitro* animal cell culture (USOS Code: B-BMED.2005Eng)
Course coordinator: Dr Mateusz Pięt
Prerequisites: Completed course in Cell biology
Course description: Basics of mammalian cell culture – types, conditions, culture media. Establishment of primary cell cultures. Subculturing of adherent and non-adherent human and mammalian cell cultures – passaging, cryopreservation. Evaluation of cell density – methods, calculations. Basic analytical methods carried on in vitro cell cultures.
Recommended literature: 1. Verma AS, Singh A. 2020. Animal Biotechnology. Models in Discovery and Translation (2nd ed.). Elsevier Inc.: Chapter 14 - Animal tissue culture principles and applications (Verma A, Verma M, Singh A, p. 269-293). 2. Vikas B, Fasullo M. 2019. Cell Growth. IntechOpen, London: Chapter 7 – Cell-Based Assays in Cancer Research (Vikas B, Sukumaran A). 3. Materials provided by the teacher.

IV semester

Courses	No. of hours	Lecture	Classes	Form of course completion	Credits ECTS	
					O	E
Histology with elements of embryology	30	15	15 (LB)	Pg	2	-
Molecular biology with elements of molecular diagnostics	60	30	30 (LB)	Ex	5	-
General ecology	60	15	45 (LB)	Ex	5	-
Mechanisms of evolution	45	30	15 (KW)	Ex	4	-
Elements of pathophysiology	15	15	-	Pg	1	-
Pharmacological botany	75	30	40 (LB) + 5 (CT)	Pg	5	-
Forensic entomology	30	15	15 (LB)	Pg	2	-
Biochemistry of nutrition	15	15	-	Pg	1	-
Elective courses in Humanities and Social Sciences (courses to be chosen from the given list)*	15	15	-	Pg	-	1
Elective course in biology (courses to be chosen from a given list)**	30	30	-	Pg	-	2
Foreign language	30	-	30 (KW)	Ex	2	-
Total:	**405**				**27**	**3**
					30	

Forms of classes: LB – Laboratory, KW – Tutorial, CT – field classes; Forms of course completion: Ex – exam, Pg – pass with grade; O – obligatory course, E – elective course.

***** List of the Elective courses in Humanities and Social Sciences is made available in the semester preceding the selection of courses. The examples of courses offered in the academic year 2023/2024 are given at the end of this file.

****** List of the Elective courses in biology is made available in the semester preceding the selection of courses. The examples of courses offered in the academic year 2023/2024 are given at the end of this file.

Course name: Histology with elements of embryology (USOS Code: B-BMED.2006Eng)
Course coordinator: dr hab. Monika Hułas-Stasiak
Prerequisites: Completed courses in Human anatomy and Cell biology
Course description: **Lecture:** General structure of the animal's body - hierarchy from cell to organism; tissues that make up the animal's body: epithelial, connective, muscle and nervous tissue – their structure and functions; digestive system – histological structure and functions of individual organs; cardiovascular and

lymphatic system - histological structure and functions of individual elements; male and female reproductive systems (structure and hormonal regulation); selected elements of embryology (fertilization, early stages of embryonic development - cleavage, gastrulation, neurulation, implantation, fetal membranes, placenta). **Laboratory:** structure of animal tissues – microscopic observations respiratory and urinary systems - histological structure and functions of individual organs; nervous system and endocrine system (histology of the spinal cord, cerebellum and cerebral cortex, adrenal glands, pituitary gland, pineal gland and thyroid gland); microscopic observations of selected organs of the digestive system (esophagus, stomach, small and large intestine, liver and pancreas) and circulatory system (vein, artery, capillaries, lymph node, spleen); sense organs: sight, hearing, skin – epidermis and its products; dermis and subcutaneous tissue; male and female reproductive systems – microscopic observations; learning about the early stages of embryo development on the example of frog and chicken embryos (cleavage, gastrulation, neurulation, organogenesis). Formation, structure and functions of the human placenta.
Recommended literature: Stevens A., Lowe J. Human Histology, 2010. Krstic, R.V.: Human Microscopic Anatomy (ed. Springer-Verlag). Sadler TW. Medical Embryology. Lippincott Williams and Wilkins, 2006. Gilbert SF. Developmental biology, 9th edition. Sinauer Associates, 2010.

Course name: Molecular biology with elements of molecular diagnostics (USOS Code: B-BM.BA.064Eng)
Course coordinator: Prof. dr hab. Marek Tchórzewski
Prerequisites: Completed course in 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. at 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: General ecology (USOS Code: B-BMED.2007Eng)
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: Mechanisms of evolution (USOS Code: B-BMED.2008Eng)
Course coordinator: Dr Marzanna Paździoch-Czochra
Prerequisites: General knowledge of biochemistry and genetics
Course description: Macroevolution: nature of selection and adaptation, levels of selection; adaptations: evolutionary analysis of forms and functions; conflict and interaction; evolution of interaction: coevolution of enemies and prey, mutualism, evolution of competitive interactions; biological altruism and its evolution; evolutionary aspects of reproduction, sexual reproduction and reproductive systems; sexual selection; the concept of species; speciation by selection, adaptive radiation, extinction; evolution of higher systematic units.

Microevolution - relations between genome and phenotype; mechanisms underlying the formation of traits; outline of the "path" from genes to phenotype; influence of the environment on the formation and polymorphism of traits; genesis of genetic variation - DNA variation, mutations, mechanisms affecting the level of variation, mutation-selection equilibrium; evolution of genes and genomes; genetic polymorphism and its significance for evolution; epigenetics and evolution.
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: Elements of pathophysiology (USOS Code: B-BM.078Eng)
Course coordinator: Dr hab. Joanna Jakubowicz-Gil, prof. UMCS
Prerequisites: Completed course in Human 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: Pharmacological botany (USOS Code: B-BMED.2017Eng)
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: Forensic entomology (USOS Code: B-BMED.2009Eng)
Course coordinator: Dr hab. Ewa Pietrykowska-Tudruj, prof. UMCS
Prerequisites: Basic knowledge on arthropods
Course description: Lecture: Forensic entomology, state of knowledge, historical background, and precursors. Basics of morphology and anatomy, and selected topics in insect physiology. Biotic diversity and trophic preferences of entomofauna associated with decomposing human remains. Insect succession on carcasses and abiotic factors regulating its rate. Effects of xenobiotics and environmental factors on the development of medico-forensically important insect individuals. Determination of the time of death on the basis of entomological traces by developmental and successional methods. Development of Polish forensic entomology, current status, and future prospects.
Labs: Methods of collecting and preserving entomological material. Principles of preparation and preparation of entomological documentation. Determination and characterisation of insect orders associated with crimes and other aspects of the courts and judicial system. Flies (Diptera), identification on the basis of morphological characters of adult forms and larvae, biology and importance of the most important groups and key species for forensic science. Indicator species - laboratory and outdoor cultures, life cycles and developmental biology.
Recommended literature: Amendt J. Campobasso C.P., Goff M. L., Grassberger M. 2010. Current conceptions in Forensic Entomology. Springer; Byrd J.H., Castner J.L. 2010. Forensic entomology. The utility of Arthropods in legal investigation. CRC Press, Boca Raton-London-New York-Washington D.C., II ed., 418 ss.; Gennard D.

2012. Forensic Entomology, An Introduction. Wiley-Blackwell, II ed., 249 ss.; Smith K.G.V. 1986. A manual of forensic entomology. The trustees of the British Museum (Natural History), London, 205 ss.

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.

3rd year
V semester

Courses	No. of hours	Lecture	Classes	Form of course completion	Credits ECTS	
					O	E
Human immunology	60	30	30 (LB)	Ex	5	-
Environmental protection humans and environment	60	30	15 (LB) + 15 (CT)	Pg	4	-
Presentation of scientific results - training	15	-	15 (KW)	Pg	1	-
Physical basis of instrumental diagnostics and physiotherapy	30	20	10 (LB)	Pg	2	-
Applied biology in medicine	40	-	40 (LB)	Pg	3	-
Herbal medicine with elements of phytotherapy	70	30	40 (LB)	Ex	6	-
Genetic engineering	45	15	30 (LB)	Pg	4	-
Academic lecture	15	15	-	-	-	1
Specialization practical training	100	-	100 (KW)	Pg	4	-
Total:	**435**				**29**	**1**
					30	

Forms of classes: LB – Laboratory, KW – Tutorial, CT – field classes; Forms of course completion: Ex – exam, Pg – pass with grade; O – obligatory course, E – elective course.

Course name: Human immunology (USOS Code: B-BMED.2010Eng)
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.
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: Environmental protection humans and environment (USOS Code: B-BMED.2018Eng)
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: Presentation of scientific results – training (USOS Code: B-BMED.2011Eng)
Course coordinator: Dr hab. Małgorzata Wójcik, prof. UMCS
Prerequisites: -
Course description: Types of scientific publications (primary, secondary, tertiary sources), examples.
Structure of scientific papers. Diploma thesis – composition, structure and formatting, content of particular chapters/sections. Literature review (analysis of Internet sources and use of various databases including Google Scholar, Scopus, Web of Science, PubMed), principles of literature citation. Manners and principles of presenting results, figures, tables, proper description and captioning of figures and tables. Rules of the diploma procedure.
Principles of a good oral and poster presentation of scientific results, practical implications, techniques of delivering a public presentation depending on the audience (professionals, non-specialist audiences, different social groups).
Recommended literature: Material provided by the teacher during the classes.

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, lithotripsy. 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 behavioural 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: Applied biology in medicine (USOS Code: B-BM.073Eng)
Course coordinator: Dr hab. Rafał Gosik, prof. UMCS, Dr Anna 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: Herbal medicine with elements of phytotherapy (USOS Code: B-BMED.2012Eng)
Course coordinator: Dr Anna Rysiak, Dr hab. Agnieszka Hanaka, prof. UMCS
Prerequisites: General knowledge of botany and biochemistry
Course description: The scope of research and history of herbal medicine. Plant drug forms: herbal raw materials and their classification. Dynamics of metabolite content in herbal material. 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 and classification of phytocoenoses, non-forest communities (aquatic and non-aquatic, meadows, and grasslands, synanthropic communities) and forests. Basic definitions (herbal raw material, active compounds), rules of harvesting and drying plant materials, modern methods and techniques for examining medicinal plants. Galenic preparations. Groups of compounds belonging to primary (carbohydrates, fats: oils, proteins) and secondary metabolites (phenolic compounds, phenylpropanoids, coumarins, tannins, flavonoids, anthocyanins, quinones, terpenes, alkaloids, essential oils). Determining the biological and pharmacological activity of plant raw materials. Toxicity, possible side effects, addiction potential. Utilization of plant raw materials for various industrial purposes. 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; Ben-Erik van Wyk, Michael Wink. Medicinal Plants of the World. CAB International, 2018; Duke J. A. Handbook of medicinal herbs. CRS Press, 2002.

Course name: Genetic engineering (USOS Code: B-BMED.2013Eng)
Course coordinator: Dr hab. Andrzej Mazur, prof. UMCS
Prerequisites: General knowledge of genetics and molecular biology, completed courses in 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: 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 their 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: 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

Courses	No. of hours	Lecture	Classes	Form of course completion	Credits ECTS	
					O	E
Plant physiology	60	30	30 (LB)	Ex	5	-
Basics of entrepreneurship	10	-	10 (KW)	Pg	1	-
Human evolution	30	15	15 (KW)	Pg	2	-
Medical aspects of toxicology	60	30	30 (LB)	Ex	5	-
Basics of pharmacology	45	15	30 (KW)	Pg	3	-
Human ecology	30	15	15 (KW)	Pg	2	-
Basics of medical biotechnology	30	30	-	Pg	2	-
Biomaterial engineering in medicine	15	15	-	Pg	1	-
Biochemical methods in clinical analysis	45	15	30 (LB)	Pg	4	-
Seminar	45	-	45 (SM)	Pg	3	
Diploma thesis + final exam	-	-	-	-	2	
Total:	**370**				**30**	**0**
					30	

Forms of classes: LB – Laboratory, KW – Tutorial, CT – field classes; Forms of course completion: Ex – exam, Pg – pass with grade; O – obligatory course, E – elective course.

Course name: Plant physiology (USOS Code: B-BW.2003Eng)
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: Basics of entrepreneurship (USOS Code: B-BW.2004Eng)
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: 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: Medical aspects of toxicology (USOS Code: B-BMED.2014 Eng)
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. Labs: Assessment of microbiological and toxicological quality of dairy products. Identification of preservatives in food. Antinutritional substances in food. Determination of nitrogen compounds in food products. Honey – physicochemical and antimicrobial properties, examples of toxic compounds in honey. Determination of acetylcholinesterase activity - used as

a marker in body poisoning with organophosphorus compounds or carbamates. Determination of microbes in water. Advanced imaging and API-type biochemical techniques for identifying pathogenic fungi, which produce mycotoxins.
Recommended literature: Stine K.E., Brown T.N. Principles of toxicology, CRC Press, Third Edition.

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: 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: Basics of medical biotechnology (USOS Code: B-BMED.2015Eng)
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, 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: Biomaterial engineering in medicine (USOS Code: B-BM.081Eng)
Course coordinator: Dr hab. Monika 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 methalic 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 toMaterials 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: Biochemical methods in clinical analysis (USOS Code: B-BM.082Eng)

Course coordinator: Dr hab. Marcin Grąz, prof. UMCS
Prerequisites: Completed course in Biochemistry
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: Seminar

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 their 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.

*Elective courses in Humanities and Social Sciences
(offered in the academic year 2023/2024)

Course name: Contemporary subculture movements

Form of the course: lecture, 15 hours, 1 ECTS
Course coordinator: Dr Dorota Maj, Faculty of Political Science and Journalism
Prerequisites: -
Course description: The aim of the course is to familiarise students with the phenomenon of contemporary subcultural movements, what role they play in society and how they influence contemporary culture. The course consists of several modules. The first presents theoretical issues and the origins of scientific research on subcultures, showing the change in approach from a phenomenon initially treated as deviant behaviour to its recognition as a permanent part of culture. The next section focuses on the New Left movement and student revolts as catalysts for countercultural movements. The following section looks at the differences between European and American approaches to subcultures. The last part of the course deals with examples of subcultures from Europe, North America and Asia. In this part, we will try to answer the question of who the teddy boys are and why they have been considered as “deadly dangerous”? What does street fashion have to do with subcultures? Can a classical music composer be the instigator of a subcultural revolution?
Recommended literature: articles and audiovisual material provided by the lecturer.

Course name: Baltic states: integral part of Central and Eastern Europe – from the past to present

Form of the course: lecture, 15 hours, 1 ECTS
Course coordinator: Prof. Ēriks Jēkabsons, Faculty of Political Science and Journalism
Prerequisites: -
Course description: The aim of the course is to introduce students to an integral yet due to various historical circumstances, partly forgotten region of Central and Eastern Europe - Lithuania, Latvia and Estonia, often perceived as a single entity in the world, but in reality very different countries from each other linguistically, politically and socially.

This will be done by presenting an overview of the most important developments in the history of these countries, focusing on the processes and developments in the demographic, political, economic and social fields in the 19th and 20th centuries. The course will briefly present the common and divergent features of the development of Lithuania, Latvia and Estonia in the past and in the current situation, which is closely related to the past. The importance of the course is increased by the fact that the Baltic States, Poland and other countries of the region are today united not only by the European Union and NATO, but also by common foreign policy problems and their solution, as well as by close cooperation in the economic, political, scientific and other fields.
Recommended literature: Books and articles from the scientific journals recommended by the teacher.

Course name: The strategic challenges for the contemporary world politics

Form of the course: lecture, 15 hours, 1 ECTS
Prerequisites: -
Course coordinator: Dr Tomasz Wicha, Faculty of Political Science and Journalism
Course description: The focus of the course is the analysis from the perspective of the political science the trends, the events and the contemporary challenges the world faces. The core aspect of the course is the identification of the challenges and the analysis of the strategies of coping with them. There will be the presentation of the contemporary world politics facts and the opinions from the perspective of the political science. The participants will recognise the global challenges and the ways to deal with them successfully.
Recommended literature: The articles recommended by the teacher (optional, only for the volunteers).

Course name: Humanities – their history, subject matter, and methods

Form of the course: lecture, 15 hours, 1 ECTS
Course coordinator: Dr hab. Paweł Bytniewski, prof. UMCS, Faculty of Philosophy and Sociology
Prerequisites: -
Course description: The emergence of the humanities in the form in which they are practiced today was an important event in the intellectual culture of the nineteenth century. Between the 1950s and the 1920s, previously unknown forms of human knowledge appeared in their disciplinary context: psychology, sociology, linguistics, cultural anthropology, and other specialized types of scientific knowledge about man. Previously known, classical types of humanistic cognition – history, and philology – underwent radical changes. The main issues of the lecture are the question of the disciplinary identity of the humanities in terms of their history, method, and subject matter, and their relations with the natural sciences.

Course name: Key issues in medical anthropology

Form of the course: tutorial, 15 hours, 1 ECTS
Course coordinator: Dr hab. Anna Witeska-Młynarczyk, Faculty of Philosophy and Sociology
Prerequisites: -
Course description: The course will focus on the relationship among technologies, the production of knowledge about the material body, and actual medical practice with emphasis on historical, social, cultural and political variables. It will present the students with ethnographic work in the field of medical anthropology.
In the initial segment, our primary focus will be on biomedical advancements and how their utilization leads to profound transformations, affecting not only individual bodies but also society on a broader scale. It's important to recognize that biological technologies are not devoid of ethical or societal implications. We will delve into the unexamined assumptions inherent in the creation and practical application of these technologies, which often mirror the prevailing social and political agendas as well as cultural norms and values.
We will explore the historical development of a systematic and ultimately scientific approach to understanding the human body and its care, a process that began to take shape in the 17th century. This evolution eventually gave rise to what we now refer to as biomedicine. As we progress into the 19th century, a significant shift occurred, whereby the health of individual bodies started being assessed in relation to so-called "norms" derived from statistical data gathered from the biological characteristics of groups of bodies, or populations. This approach led to the conceptualization of disease as fundamentally uniform across different contexts.
Transitioning to more recent contexts, our attention will be on techno/biologicals, which are constructs fashioned from living cells, tissues, and organs. These entities serve the purposes of research facilitation and the replacement of malfunctioning bodily components and systems. The development and use of techno/biologicals pose challenges to several fundamental notions, such as the conventional understanding of the body as a well-defined, distinct entity. Nevertheless, we will also delve into various other topics in this context.
Medical anthropology have made use of diverse theoretical orientations and methodologies over the years to produce a rich body of data. We will get to know some of the conceptual frameworks used in ethnographic works, among others - the phenomenon of medical pluralism and the medicalization of life, including the social construction of disease taxonomies and the significance of illness narratives. We will follow with reading exemplary ethnographies.

Recommended literature: Margaret Lock, Vinh-Kim Nguyen (2010) An Anthropology of Biomedicine, Willey-Blackwell.

Course name: Selected topics in animal ethics

Form of the course: lecture, 15 hours, 1 ECTS
Course coordinator: Ks. Dr hab. Alfred Wierzbicki, prof. UMCS Faculty of Philosophy and Sociology
Prerequisites: -
Course description: An introduction to the most actually discussed issues in Animal Ethics in the framework of the growing movement for animal rights: 1. The cultural context of the contemporary movement for animal rights; 2. The concept of the animal subjectivity based on contemporary animal psychology and evolutionary cognitive science; 3. Axiological status of animals and the question of species egoism 4. Pain and suffering as moral challenge; 5. In face of the idea of animal liberation; 6. The different strategies of affirming animals: „lesser brethren", non-human animals", „animal persons and the priority of the moral sensitivity before the theoretical account in Ethics.

**Elective courses in biology
(offered in the academic year 2023/2024)

Course name: Electron and confocal microscopy

Form of the course: laboratory, 30 hours, 1 ECTS
Course coordinator: dr Justyna Kapral-Piotrowska
Prerequisites: -
Course description: Construction, principle and working of the transmission and scanning electron microscope. Preparation of samples for transmission electron microscopy (TEM): fixation, dehydration, embedding, trimming of blocks, cutting ultra-thin sections, staining. Preparation of samples for scanning electron microscopy (SEM): fixation, dehydration, rying, sputter coating. Observation of specimens using transmission and scanning electron microscope. Construction, principle and working of confocal microscopy. Staining of apoptotic, necrotic and autophagic cells.
Recommended literature: Electron Microscopy: A Brief History and Review of Current Clinical Application, 2014, Ronald E. Gordon. Transmission Electron Microscopy, 2009, David B. Williams , C. Barry Carter
Electron Microscopy: Principle, Components, Optics and Specimen Processing, 2018, Pranab Dey. Methods of Preparation for Electron Microscopy, 1987. Confocal Microscopy: Principles and Modern Practices, 2020, Amicia D. Elliott.

Course name: Graphical image analysis in biology and medicine

Form of the course: laboratory, 30 hours, 1 ECTS
Course coordinator: Dr hab. Piotr Dobrowolski, prof. UMCS
Prerequisites:
Course description: Biomedical image acquisition: microscopy, ultrasonography, computed tomography, magnetic resonance imaging; Image recording formats; 2D and 3D images; Analysis using dedicated software; Image analysis using free open source software; Examples of ImageJ application and its development; Image scale and calibration; Planimetric measurements; Textural analysis; Automation of graphic analysis; Construction of macro commands and scripts; Basic programming languages in graphic analysis; Plug-ins as additional analysis tools; Use and construction of basic neural networks in graphic image analysis.
Recommended literature: The image processing handbook. John C Russ, F. Brent Neal. CRC Press, 7th ed. 2016
https://imagej.net/software/fiji/