

Syllabus for academic year: 2021/2022
 Training cycle: 2021/2022-2026/2027

Description of the course

| | | | |
|-------------------|--|-------------------------------------|---|
| Course | Molecular Biology | Group of detailed education results | |
| | | Group code | Group name |
| | | B | Scientific basics of medicine |
| | | C | Preclinical sciences |
| Faculty | Faculty of Medicine | | |
| Major | medicine | | |
| Level of studies | <input checked="" type="checkbox"/> uniform magister studies <input type="checkbox"/> 1 st degree studies <input type="checkbox"/> 2 nd degree studies <input type="checkbox"/> 3 rd degree studies <input type="checkbox"/> postgraduate studies | | |
| Form of studies | <input checked="" type="checkbox"/> full-time <input type="checkbox"/> part-time | | |
| Year of studies | 1 st | Semester: | <input checked="" type="checkbox"/> winter <input type="checkbox"/> summer |
| Type of course | <input checked="" type="checkbox"/> obligatory <input type="checkbox"/> limited choice <input type="checkbox"/> free choice / optional | | |
| Language of study | <input type="checkbox"/> Polish <input checked="" type="checkbox"/> English | | |

Number of hours

Form of education

| | Lectures (L) | Seminars (SE) | Auditorium classes (AC) | Major Classes – not clinical (MC) | Clinical Classes (CC) | Laboratory Classes (LC) | Classes in Simulated Conditions (CSC) | Practical Classes with Patient (PCP) | Foreign language Course (FLC) | Physical Education (PE) | Vocational Practice (VP) | Directed Self-Study (DSS) | E-learning (EL) |
|---|--------------|---------------|-------------------------|-----------------------------------|-----------------------|-------------------------|---------------------------------------|--------------------------------------|-------------------------------|-------------------------|--------------------------|---------------------------|-----------------|
| Winter semester: 65 | | | | | | | | | | | | | |
| Department of Biology and Medical Parasitology (Dep. in charge of the course) | | | | | | | | | | | | | |
| Direct (contact) education ¹ | - | 25 | - | 15 | - | - | - | - | - | - | - | - | - |
| Distance learning ² | 25 | - | - | - | - | - | - | - | - | - | - | - | - |
| Summer semester: 65 | | | | | | | | | | | | | |
| (Dep. in charge of the course) | | | | | | | | | | | | | |

¹ Education conducted with direct participation of university teachers or other academics

² Education with applied methods and techniques for distance learning



| Direct (contact) education | - | - | - | - | - | - | - | - | - | - | - | - | - |
|--|--|----|---|---|--|---|---|---|---|---|---|---|---|
| Distance learning | - | - | - | - | - | - | - | - | - | - | - | - | - |
| TOTAL per year: 65 | | | | | | | | | | | | | |
| Department of Biology and Medical Parasitology (Dep. in charge of the course) | | | | | | | | | | | | | |
| Direct (contact) education | - | 25 | - | 15 | - | - | - | - | - | - | - | - | - |
| Distance learning | 25 | - | - | - | - | - | - | - | - | - | - | - | - |
| Educational objectives (max. 6 items) | | | | | | | | | | | | | |
| <p>C1. Providing students with knowledge of the basics of modern genetics and its experimental methods and preparing them for the clinical genetics course.</p> <p>C2. Students receive knowledge about the mechanisms responsible for the integrity of the individual organism gene pool and for the transfer of genes between the subsequent generations in Prokaryota as well as in Eukaryota.</p> <p>C3. Students gain information about the influence of environmental pollution by mutagenic and carcinogenic substances on the human organism.</p> <p>C4. Students get knowledge about the methods of molecular biology and their application in genetic studies.</p> <p>C5. Education of students in the basics of medical parasitology, epidemiology and prevention of parasitic diseases. Students receive information about the structure and life cycles of human parasites and learn how to recognize the symptoms of parasitic infection</p> <p>C6. Development social competences needed to practice the medical profession, in accordance with graduate's profile.</p> | | | | | | | | | | | | | |
| Education result for course in relation to verification methods of the intended education result and the type of class: | | | | | | | | | | | | | |
| Number of detailed education result | Student who completes the course knows/is able to | | | Methods of verification of intended education results | Form of didactic class <i>*enter the abbreviation</i> | | | | | | | | |
| B.W10. | knows the structure of simple organic compounds that make up the macromolecules present in cells, the extracellular matrix and body fluids; | | | test, written exam (MCQ) | SE, L | | | | | | | | |
| B.W13. | describes the function of nucleotides in the cell, the I- and II-order structures of DNA and RNA, and the structure of chromatin; | | | test, written exam (MCQ) | SE, L | | | | | | | | |
| B.W14. | knows the functions of the human genome, transcriptome and proteome and the principal methods used to study them, the processes of DNA replication, repair and recombination, transcription and translation and the degradation of DNA, RNA and proteins, and the concepts of regulation of gene expression; | | | test, written exam (MCQ) | SE, L | | | | | | | | |
| B.W18. | knows the processes: cell cycle, proliferation, differentiation and ageing of cells, apoptosis and necrosis and their significance for the functioning of an organism; | | | test, written exam (MCQ) | L | | | | | | | | |
| C.W1. | defines the basic concepts of genetics; | | | test, colloquium, written exam | SE, L | | | | | | | | |
| C.W2. | knows the phenomena of gene linkage and interactions; | | | test, written exam (MCQ) | SE | | | | | | | | |
| C.W3. | knows the proper human karyotype and the different types of sex determination; | | | test, written exam (MCQ) | SE | | | | | | | | |



| | | | |
|--------|---|---|-------|
| C.W4. | describes the chromosome structure and the molecular basis of mutagenesis; | test, written exam | SE, L |
| C.W5. | knows the principles of inheritance of different numbers of traits, inheritance of quantitative traits, independent inheritance of traits and inheritance of non-nuclear genetic information; | test, written exam (MCQ) | SE, L |
| C.W6. | knows the genetic determinants of human blood groups and serological conflict in the Rh system; | test, , written exam (MCQ) | SE |
| C.W7. | knows the aberrations of autosomes and heterosomes that cause diseases, including oncogenesis and cancer; | test, colloquium, written exam (MCQ) | SE, L |
| C.W8. | knows the factors influencing the primary and secondary genetic balance of the population; | test, written exam (MCQ) | L |
| C.W10. | the benefits and risks of the presence of genetically modified organisms (GMOs) in the ecosystem; | written exam (MCQ) | L |
| C.W12. | knows microorganisms, including pathogenic and those present in the physiological flora; | test, written exam (MCQ) | MC |
| C.W13. | describes the epidemiology of viral and bacterial infections, as well as fungal and parasitic infections, taking into account their geographical distribution; | test, written exam (MCQ) | MC |
| C.W15. | knows the consequences of exposure of the human body to various chemical and biological agents and the principles of prevention; | test, written exam (MCQ) | MC, L |
| C.W16. | knows the invasive forms or stages of development of selected parasitic fungi, protozoa, helminths and arthropods in humans, taking into account their geographical distribution; | test, written exam (MCQ) | MC |
| C.W17. | describes the functioning of the parasite-host system and the main symptoms of disease caused by parasites; | test, written exam (MCQ) | MC |
| C.W18. | defines the symptoms of iatrogenic infections, the routes of their spread and the pathogens causing lesions in the various organs; | test, colloquium, written exam (MCQ) | MC |
| C.W19. | knows the basics of microbiological and parasitological diagnostics; | test, , written exam (MCQ) | MC |
| C.U1. | analyzes genetic crosses and pedigrees of human traits and diseases, and assesses the risk of a child being born with chromosome aberrations; | presentation of individually searched information in the group forum during classes; solving genetic crosses and explaining issues during classes | SE |
| C.U4. | performs morphometric measurements, analyzes the morphogram and record disease karyotypes; | presentation of individually searched information in the group forum during classes; work during | SE |



| | | | |
|-------|---|---|----|
| | | classes - solving tasks prepared by the teacher or other students; Oral answer | |
| C.U5. | estimates the risk of an offspring developing a particular disease based on family predisposition and the influence of environmental factors; | microscopic observation and drawing pictures during classes; written test | SE |
| C.U7. | recognizes the most common human parasites on the basis of their structure, life cycles and disease symptoms; | microscopic observation and self-made drawings during classes | MC |
| C.U9. | makes preparations and recognizes pathogens under the microscope; | microscopic observation and self-made drawings during classes | MC |

* L- lecture; SE- seminar; AC- auditorium classes; MC- major classes (non-clinical); CC- clinical classes; LC- laboratory classes; CSC- classes in simulated conditions; PCP- practical classes with patient; FLC- foreign language course; PE- physical education; VP- vocational practice; DSS- directed self-study; EL- E-learning

Student's amount of work (balance of ECTS points):

| Student's workload (class participation, activity, preparation, etc.) | Student Workload |
|--|------------------|
| 1. Number of hours of direct contact: | 40 |
| 2. Number of hours of distance learning: | 25 |
| 3. Number of hours of student's own work: | 93 |
| 4. Number of hours of directed self-study | n/a |
| Total student's workload | 158 |
| ECTS points for course | 6.0 |

Content of classes: (please enter topic words of specific classes divided into their didactic form and remember how it is translated to intended educational effects)

Lectures (Total - 25 hours: 11 x 2 h and 1 x 1 h – the last lecture) – on-line; synchronous by Microsoft Teams or another platform

Lecture 1. DNA, RNA, chromatin, chromosomes, karyotype; The organization of human genome; mitochondrial genome.

Lecture 2. Replication of DNA. Transcription.

Lecture 3. Translation. Regulation of gene expression: operons.

Lecture 4. Regulation of gene expression: eukaryotic organisms.

Lecture 5. The cell cycle and its regulation. Apoptosis. Genetic determinants of the immune system functioning.

Lecture 6. DNA diversity, DNA mutations, DNA repair mechanisms, mutagens, the influence of medicines, chemicals, physical factors, and environmental pollution. Mechanisms of DNA repair.

Lecture 7. Selected human genetic diseases – part 1.

Lecture 8. Selected human genetic diseases – part 2 (X-linked diseases).

Lecture 9. Population genetics.

Lecture 10. Basic methods of molecular biology and their applications.

Lecture 11. Fundamentals of genetic engineering – part 1 (elements of biotechnology).



Lecture 12. Fundamentals of genetic engineering – part 2 (elements of biotechnology – cont., gene editing, GMOs).

Lecture 13. Basics of pharmacogenetics.

Seminars (25 hours: 8 x 3 h and 1 x 1 h – the last seminar) contact/ direct classes

● **Seminar 1.**

Organization of classes. Health and safety rules. Internal regulations and syllabus. **Transmission Genetics.** Basic concepts and definitions of genetics. Mendelian genetics. Mendel's Laws of inheritance (monohybrid, dihybrid crosses); test cross. Incomplete dominance, codominance, multiple alleles, lethal genes, gene interactions, pleiotropy. Extrachromosomal inheritance – examples of mitochondrial diseases (MERRF, MELAS, z. Lebera) and their inheritance; maternal effect;

● **Seminar 2.**

Transmission Genetics. Gametogenesis and meiosis. Morgan's chromosome theory of heredity. Complete and incomplete linkage of genes. X-linked genes. Types of sex determination: sex chromosomes (*Lygaeus*, *Abraxas*, *Protenor*, *Fumea*). Sex determination in humans.

● **Seminar 3.**

Molecular Genetics. Lyon hypothesis and Barr body – definition, mechanism of X chromosome inactivation. Nucleic acids – DNA and RNA structure and functions. Replication of DNA.

● **Seminar 4.**

Molecular Genetics. The genetic code (features and examples of exceptions). Protein biosynthesis in prokaryotes and eukaryotes: transcription and translation – steps of the processes. Enzymes involved in the processes and their role.

● **Seminar 5.**

Molecular Genetics. Protein biosynthesis and its regulation – cont. Operon theory: kinds of operons and their role in gene regulation of prokaryotic genes (lactose operon, glucose catabolite repression; tryptophan operon, attenuation).

● **Seminar 6.**

Human genetics. Mutations – definition, types of mutations (point mutations, structural aberrations, numerical aberrations). Human karyotype (A-G). Consequences of point mutations. Inheritance of diseases caused by point mutations: single-gene disorders – dominant (Huntington's chorea, Alzheimer's syndrome, achondroplasia, polydactyly, syndactyly, brachydactyly, camptodactyly, Recklinghausen disease, Marfan's syndrome, Ehlers-Danlos syndrome) and recessive (phenylketonuria, alkaptonuria, albinism, cystic fibrosis, galactosemia, mucopolysaccharidosis (Hurler's syndrome, Hunter's syndrome), lipidosis (Tay-Sachs disease, Niemann-Pick disease, Gaucher disease), glycogenosis (von Gierke disease, Pompe disease), hemoglobinopathies (thalassemia; sickle cell anemia).

● **Seminar 7.**

Human genetics. Diseases caused by chromosomal numerical aberrations (Down syndrome, Edwards syndrome, Patau syndrome, Klinefelter's syndrome, Turner syndrome) and structural aberrations (Wolf-Hirschhorn syndrome, Cri-du-chat syndrome, Prader-Willi syndrome, Angelman syndrome, Philadelphia chromosome).

Seminar 8. (week 8 or 1) – introductory class to the parasitological part;

Basic terms used in parasitology. Diagnostic methods used in parasitology (type of collected material, coproscopic, immunological, molecular methods)

Parasitic arthropods and their role in disease transmission: Arachnids: *Argas reflexus*, *Ixodes ricinus*, *Demodex folliculorum*, *Sarcoptes scabiei*; Insects: *Pthirus pubis*, *Pediculus humanus*, *Pulex irritans*, *Musca domestica*



Seminar 9. (week 14)

Summary of the material; completion of the classes.

Classes (15 hours: 5 x 3 h) contact/direct classes

Parasitology course content: life cycles, geographical distribution, diagnosis and diagnostic features of the parasites' developmental forms, symptoms of diseases caused by the parasites, pathogenicity, epidemiology, prevention of human parasites infection.

Practical 1.

Parasitic protista (protozoa) – *Trichomonas vaginalis*, *Giardia intestinalis*, *Trypanosoma brucei gambiense*, *Leishmania infantum*, *L. donovani*, *L. tropica*, *Blastocystis* spp.

Practical 2.

Parasitic protista (protozoa) – *Entamoeba histolytica/dispar*, *Acanthamoeba castellanii*, *Naegleria fowleri*; *Plasmodium vivax*, *P. falciparum*, *P. malariae*, *P. ovale*, *P. knowlesi*, *Babesia* spp., *Toxoplasma gondii*, *Cryptosporidium parvum*

Practical 3.

Parasitic worms – flat worms (Trematoda): *Fasciola hepatica*, *Dicrocoelium dendriticum*, *Schistosoma* spp., *Paragonimus westermani*, *Clonorchis sinensis*; **tape worms (Cestoda)** parasitizing in the larval form in human tissues: *Echinococcus granulosus*, *E. multilocularis*

Practical 4.

Parasitic worms – Cestoda - cont.: *Diphyllobothrium latum*, *Taenia saginata*, *Taenia solium*, *Rodentolepis nana*; **roundworms (Nematoda)** causing filariasis: *Dirofilaria repens*, *Loa loa*, *Wuchereria bancrofti*

Practical 5.

Parasitic worms – Nematoda - cont.: *Ascaris lumbricoides hominis*, *Enterobius vermicularis*, *Trichuris trichiura*, *Toxocara canis*, *Strongyloides stercoralis*, *Ancylostoma duodenale*, *Necator americanus*, *Trichinella spiralis*

Other ---

Basic literature (list according to importance, no more than 3 items)

1. Cisowska A., Hendrich A., Kicia M., Leszczyński P., Szydłowicz M., Tichaczek-Goska D., Wesółowska M., Wojnicz D. "Medical Biology for students of Medicine and Dentistry English Division", Wrocław Medical University, Wrocław, 2019
2. Bogitsch B.J., Carter C., Oeltmann T „Human parasitology“ 5th edition, Academic Press 2018 or elder,
3. Klug WS, Cummings MR, Spencer ChA, Palladino, Killian D "Concepts of genetics", 12th edition, Pearson, 2019 or elder

Additional literature and other materials (no more than 3 items)

1. McLennan A.G., Bates A.D., Turner P.C., White M.R.H.: BIOS Instant notes: Molecular Biology. Garland Science, NY & London, 2013
2. Tobias E.S, Connor M., Ferguson-Smith M. "Essential medical genetics" 6th edition, Wiley-Blackwell, 2011
3. Campbell NA, Reece JB, Cain ML et al. Biology. A global approach. Pearson, 2016 (11th edition)

Preliminary conditions: (minimum requirements to be met by the student before starting the course)

Knowledge of genetics and parasitology at the high school level

Conditions to receive credit for the course: (specify the form and conditions of receiving credit for classes included in the course, admission terms to final theoretical or practical examination, its form and requirements to be met by the student to pass it and criteria for specific grades) Attention! Attendance cannot be a condition for passing the course

The student is admitted to the exam after receiving the credit, which consists of passing all partial tests (including seminars and classes) and attendance at all classes in accordance with the study regulations. The percentage criteria for passing the partial tests are identical to the examination criteria. A student may be exempted from the examination with a very good grade (5.0) in two cases: 1) if he/she obtains an average



of at least 4.75 in the partial tests or 2) even if he/she fails the partial test once but he/she will receive a very good grade (5.0) in the re-take test and very good grades in the other partial tests. In the case of the student's absence from classes, e.g. due to illness, due to another important reason (justified by sick leave or another official document), the student is obliged to make up for the missed classes by preparing a presentation or an essay in an electronic version, on a topic assigned by the teacher, or by participating in classes with another group - if it is possible, and always with the prior consent of the tutor. In the case of cancellation of classes for reasons beyond the control of students, e.g. Rector's day, Dean's hours, etc., at the request of the students, the classes will be conducted on a different date agreed with the person conducting the classes or the students will perform additional work as part of self-study. The final exam takes the form of a multiple choice test (MCQ) in genetics and parasitology (lectures, seminars, and exercises). Credits and exams take place in direct contact with an academic teacher or using electronic means of communication.

| Grade: | Criteria for courses ending with a grade ³ |
|-------------------------|--|
| Very Good (5.0) | 92-100% |
| Good Above (4.5) | 84-91% |
| Good (4.0) | 76-83% |
| Satisfactory Plus (3.5) | 68-75% |
| Satisfactory (3.0) | 60-67% |
| | Criteria for courses ending with a credit³ |
| Credit | |

| Grade: | Criteria for exam ³ |
|-------------------------|--------------------------------|
| Very Good (5.0) | 92-100% |
| Good Above (4.5) | 84-91% |
| Good (4.0) | 76-83% |
| Satisfactory Plus (3.5) | 68-75% |
| Satisfactory (3.0) | 60-67% |

| | |
|-------------------------------------|--|
| Department in charge of the course: | Department of Biology and Medical Parasitology |
| Department address: | Mikulicza-Radeckiego 9, 50-345 Wrocław |
| Telephone: | 71 784 15 12 (secretariat) |
| E-Mail: | malgorzata.pekalska-cisek@umed.wroc.pl |

| | |
|----------------------------------|--|
| Person in charge for the course: | Prof. dr hab. Andrzej Hendrich |
| Telephone: | 71 784 15 11; 71 784 15 12 (secretariat); |
| E-Mail: | andrzej.hendrich@umed.wroc.pl |

| List of persons conducting specific classes: | | | | |
|--|---|------------------|----------------------|-----------------|
| Name and surname | Degree/scientific or professional title | Discipline | Performed profession | Form of classes |
| Andrzej Hendrich | prof. dr hab. | medical sciences | academic teacher | L |

³ The verification must cover all education results, which are realized in all form of classes within the course



| | | | | |
|------------------------|---------|------------------|------------------|--------|
| Dorota Wojnicz | dr hab. | medical sciences | academic teacher | SE |
| Maria Wesółowska | dr hab. | medical sciences | academic teacher | SE, MC |
| Dorota Tichaczek-Goska | dr | medical sciences | academic teacher | SE |
| Magdalena Szydłowicz | dr | medical sciences | academic teacher | SE |
| Przemysław Leszczyński | mgr | medical sciences | academic teacher | SE |

Date of Syllabus development

29.06.2021

Syllabus developed by

Dr. Dorota Tichaczek-Goska

Dean's signature

Wrocław Medical University
Faculty of Medicine
Vice-Dean for Medical Studies
.....
prof. Beata Sztjerszczyńska, PhD

Signature of Head(s) of teaching unit(s)

.....
prof. dr hab. Andrzej Hendrich