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| Module title:       | Molecular Cell Physiology      | ECTS | 2 |
| Polish translation: | Fizjologia molekularna komórki |      |   |
| Course:             | Veterinary Medicine            |      |   |

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| Module language: English   |   | Stage: JM-FVM  |  |
| Form of studies: <input checked="" type="checkbox"/> intramural<br><input type="checkbox"/> extramural | Type of module: <input checked="" type="checkbox"/> basic<br><input type="checkbox"/> directional | <input checked="" type="checkbox"/> mandatory<br><input type="checkbox"/> elective | Semester: 3rd<br><input checked="" type="checkbox"/> winter semester<br><input type="checkbox"/> summer semester |
| Academic year: 2023/2024   |   | Catalogue number:  | FVM-V-JMSS-04S-EB03_23   |

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| Module coordinator:                            | Anna Burdzinska, PhD, DVM   |  |                                |
| Teachers responsible for the module:           | Academic teachers of the Institute of Veterinary Medicine; Department of Physiological Sciences; PhD students in accordance to the internal legal acts; visiting professors; other specialists in the field of study  |  |                                |
| Objectives of the module:                      | The aim of teaching the subject "Molecular Cell Physiology" is to provide up-to-date knowledge of the molecular mechanisms regulating the life of an animal cell. During the course, students will learn in detail about the functions of an animal cell, the synthesis of nucleic acids, processes of DNA assembly, protein expression and posttranslational modifications. The mechanisms of cell proliferation and death, which are targets for the therapy of many diseases, will be discussed in detail. The most important signal transduction pathways in cells will be presented, as well as, the examples of their dysregulation in pathological conditions. Moreover, the mechanisms of carcinogenesis, and the biology of neoplastic and stem cells, will be discussed. Attention will be paid to modern veterinary medicine therapies targeting specific cell types. Finally, students will be introduced to the most important research techniques used in basic and preclinical veterinary research and the use of cells in veterinary regenerative medicine. |  |                                |
| Teaching forms, number of hours:               | a) Lectures; 30 hours   |  |                                |
| Teaching methods:                              | <ul style="list-style-type: none"> <li>• <b>Lectures:</b> Original multimedia presentations prepared by academic teachers employed at the Institute of Veterinary Medicine supplemented with animations and videos from open knowledge bases.</li> <li>• Consultations (1h/week). The method and the schedule of consultations will be shown at the start of the semester.</li> </ul>   |  |                                |
| Formal prerequisites and initial requirements: | Required is the basic knowledge of physics, biology and chemistry at the level of basic and middle school.  |  |                                |
| Learning effects                               | Course outcomes:  | Learning outcomes relative to the course outcomes  | Impact on the course outcomes* |
| Knowledge:                                     | 1   | knows the functions and actions of some components of eukaryotic cell (compartmentalization)   |                                |
|  | 2   | knows metabolic processes on the molecular, cellular, organ and organism level   |                                |
|  | 3   | knows mechanisms underlining animal health, disease and their therapy – from the cellular level, through organs, organism, herd to the whole population of animals |                                |
|  | 4   | recognizes relationship between factors influencing homeostasis of biological processes and physiological, and pathological changes                                |                                |
|  | 5   | describes changes in the function of the organism occurring upon alteration of homeostasis   |                                |
|  | 6   | knows laws governing intellectual property   |                                |
| Skills:  | 1   | describes changes in the function of the organism occurring upon alteration of homeostasis   |                                |
|  | 2   | predicts direction of biochemical processes depending on the energetic status of the cell  |                                |
|  | 3   | defines physiological status of the animal as an adaptive process to environmental variability   |                                |
|  | 4   | listens and explain in the language that is understandable and appropriate for the situation   |                                |
|  | 5   | operates in the interdisciplinary team   |                                |
|  | 6   | understands the need of continuous education for professional development  |                                |

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|   | 7  | critically analyses veterinary literature and formulate conclusions based on available literature   |  |  |
| Competences:  | 1  | is able to evaluate and to interpret cell functions and their relationships in maintaining homeostasis  |  |  |
|   | 2  | is able to evaluate physiological parameters of the cell  |  |  |
|   | 3  | is ready to perform basic physiological (scientific) experiments and to draw correct conclusions from the observations                                      |  |  |
|   | 4  | is critical to his/her knowledge, constantly updates it in accordance with the latest state of science, uses scientific sources to expand his/her knowledge |  |  |
|   | 5  | is able to communicate with co-workers and share the knowledge  |  |  |
|   | 6  | is able to formulate opinions regarding various aspects of professional conduct   |  |  |
| Objectives of the module required to obtain learning effects: | <p><u>Lectures:</u></p> <ol style="list-style-type: none"> <li>1. Organization of the cell. The cell nucleus. Replication, transcription, transcription factors, epigenetic regulation of gene expression (2h).</li> <li>2. Translation, post-translational modification of proteins, sorting and distribution of proteins, transport of proteins to endosomes and mitochondria. Constitutive and regulated protein secretion (2h).</li> <li>3. Mitochondria and cellular respiration. Cellular metabolism. Hypoxia, oxidative and nitrosative stress (2h).</li> <li>4. Structure and functions of the cell cytoskeleton and extracellular matrix. Adhesive molecules (2h).</li> <li>5. Cell membrane, membrane transport, intercellular signalling. Molecular mechanisms of multiple drug resistance (2h).</li> <li>6. Plasma membrane and nuclear receptors. The structure, distribution, and functions. Examples of intracellular signal transduction pathways. Second messengers and signal amplification (4h).</li> <li>7. Cell proliferation and the cell cycle. Mechanism of action of cytostatic and immunosuppressive drugs (3h).</li> <li>8. Mechanisms of cell survival and death. Mechanism of action of cytotoxic drugs (2h).</li> <li>9. Methods of elimination of damaged cell structures and proteins. Aging of cells (2h).</li> <li>10. Mechanisms of carcinogenesis. DNA repair mechanisms. Tumour development stages. Tumour angiogenesis and immune escape (3h).</li> <li>11. Stem cells - biology and application in veterinary regenerative medicine. Tissue engineering (2h).</li> <li>12. Monoclonal antibodies in diagnostics and therapy. Molecularly targeted therapies (2h).</li> <li>13. Methods used in the study of animal cells. Cell and tissue cultures. Research on gene expression, protein concentration. Metabolic tests. Structure and ultrastructure assessment. Flow cytometry (2h).</li> </ol> |   |  |  |
| Assessment methods:   | <p>Attendance to the lectures and active participation in classes are mandatory, according to the general academic regulations, the student can be absent on 20% of lectures.</p> <p>Final exam: Final exam contains 25 questions (multiple choice test, 1 point per correct answer). To pass, student must collect 13 points (51%). Retake is provided for students who failed or could not attend the first term. Both terms have the same form.</p> <p>In case of unforeseen, unusual circumstances mandatory remote teaching and remote assessment methods might be adopted.</p>   |   |  |  |
| Detail description of assessment methods;                     | No extra assessment methods are anticipated.   |   |  |  |
| Formal documentation of learning outcome:                     | eHMS entry.<br>Records collected in the course portfolio i.e. individual records of student results, presence lists, database of oral and written questions, written assessments of the students.  |   |  |  |
| Elements impelling final grade:                               | <p>Attendance to the lectures is mandatory, student can be absent on 20% of lectures according to the current academic regulations.</p> <p>The following scale is used to <b>grade the semester</b>:</p> <p>0 - 12 points - failing grade (2.0),<br/> 13 – 15 points – satisfactory grade (3.0),<br/> 16 – 17 points – satisfactory plus grade (3.5),<br/> 18 – 20 points – good grade (4.0),<br/> 21 – 22 points – good plus grade (4.5),<br/> 23 – 25 points – excellent grade (5.0).</p> <p>Once the student failed to pass the final exam twice she/he obtained failing grade.</p>   |   |  |  |
| Teaching base:  | Lecture hall of the Institute of Veterinary Medicine, MS Teams platform, eSGGW platform  |   |  |  |
| Mandatory and supportive materials:                           | <ol style="list-style-type: none"> <li>1. "Student Textbooks: Cell Physiology Sourcebook: A Molecular Approach" by Nicholas Sperelakis (Editor), New York, Molecular Approach, Pflugers Arch</li> <li>2. "Medical Cell Biology" Book by Steven R. Goodman (Editor), Elsevier</li> </ol> <p>Relevant scientific publications, including those of the module coordinator.</p>  |   |  |  |
| ANNOTATIONS   |  |   |  |  |

\* 3 – complete and detailed, 2 – moderate, 1 – basic.

Quantitative summary of the module:

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| Estimated number of work hours per student (contact and self-study) essential to achieve presumed learning outcomes of the module - base for quantifying ECTS: | <b>50 h</b> |
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Total ECTS points, accumulated by students during contact learning:

**1 ECTS**