

**Model syllabus for regulated fields of study *LABORATORY RESEARCH METHODS***

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| 1. **Imprint**
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| **Academic Year** | 2023/2024 |
| **Department** | Doctoral School |
| **Field of study** | Medical sciences and health sciences |
| **Main scientific discipline** *(in accord with appendix to the Regulation of Minister of Science and Higher education from 26th of July 2019)* | Medical sciences and health sciences |
| **Study Profile** *(general academic / practical)* | General academic |
| **Level of studies** *(1st level /2nd level/uniform MSc)* | 3rd |
| **Form of studies**  | Full time studies |
| **Type of module / course** *(obligatory / non-compulsory)* | **obligatory** |
| **Form of verification of learning outcomes** *(exam / completion)* | completion |
| **Educational Unit / Educational Units** *(and address / addresses of unit / units)* | **Chair and Department of Biochemistry** |
| **Head of Educational Unit / Heads of Educational Units** | Prof. dr hab. Marta Struga |
| **Course coordinator** *(title, First Name, Last Name, contact)* | **dr hab. Małgrzata Czystowska-Kuźmicz** |
| **Person responsible for syllabus** *(First name, Last Name and contact for the person to whom any objections concerning syllabus should be reported)* | **dr hab. Małgorzata Czystowska-Kuźmicz** |
| **Teachers** | dr hab. Małgorzata Czystowska-Kuźmicz mczystowska@wum.edu.pl dr Alicja Głuszko, alicja.gluszko@wum.edu.pl mgr inż. Magdalena Długołęcka, magdalena.dlugolecka@wum.edu.plmgr Karolina Soroczyńska karolina.soroczynska@wum.edu.pl prof. dr hab. Sebastian Granica sebastiam.granica@wum.edu.pl  |

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| 1. **basic information**
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| **Year and semester of studies** | II-III | **Number of ECTS credits** | 0.00 |
| **forms of classes** | **Number of hours** | **ECTS credits calculation** |
| **Contacting hours with academic teacher**  |
| Lecture (L) |  |  |
| Seminar (S) | 10 |  |
| Discussions (D) |  |  |
| e-learning (e-L) |  |  |
| Practical classes (PC) | 5 |  |
| Work placement (WP) |  |  |
| **Unassisted student’s work** |
| Preparation for classes and completions |  |  |

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| 1. **Course objectives**
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| O1 | Solidify students knowledge and skills in basic laboratory methods. |
| O2 | Teaching students modern laboratory techniques  |
| O3 | Teaching students how to applicate modern laboratory techniques in scientific research. |

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| Standards of learning – Detailed description of effects of learning *(concerns fields of study regulated by the Regulation of Minister of Science and Higher Education from 26 of July 2019; does not apply to other fields of study)* |
| **Code and number of effect of learning in accordance with standards of learning** *(in accordance with appendix to the Regulation of Minister of Science* *and Higher education from 26th of* *July 2019)* | **Effects in time** |
| **Knowledge – Graduate\* knows and understands:** |
| G.K1 | - standard laboratory safety rules |
| G.K2 | - basic laboratory techniques, fundamental laboratory calculations (% concentration, molarity)s and data management  |
| G.K3 | - safety rules and basic cell culture techniques: - fundamentals of cell culture: cell types, cell morphology and growth, composition and preparation of growth medium, cell maintenance, cell handling (trypsinization, cryopreservation, transfection), definition of subculture, cell density, dissociation of adherent cells, passaging non-adherent cells), biological contamination of cell cultures, acid-base balance in cell culture |
| G.K4 | - analytical techniques used in modern laboratory: gel protein and DNA electrophoresis (gel preparation, protein sample and buffer preparation, gel run conditions and gel staining)Enzyme-linked immunosorbent assay (ELISA) (definition and concept, technical aspect)flow cytometry : definition and concept of flow cytometry, technical aspects, optimizing a flow cytometry experiment, data presentation and analysis, flow-cytometry based functional assays (proliferation, apoptosis, multiplex assays, etc.)gene engineering methodsliquid chromatography; principles, technical aspects, scientific applications |
| G.K5 | - basic laboratory gene engineering techniques |
| G.K6 | - classification, biogenesis, isolation and analysis techniques and biological significance of extracellular vesicles |
| **Skills– Graduate\* is able to:** |
| G.S1 |  - conduct laboratory work in accordance with standard laboratory safety rules;  |
| G.S2 | - carry out basic laboratory techniques like pipetting, fundamental laboratory mathematics (% concentration, molarity) and data management (draw dose-response curve, determining the half maximal inhibitory concentration IC50) |
| G.S3 | - set up the cell culture hood for cell culture experiments and apply basic cell culture techniques: estimating cell confluency, cell counting under a microscope usimg Burker chamber and an automated cell counter, cell trypsinization |
| G.S4 | - plan and prepare a flow cytometry experiment (choice of fluorochromes, panel design, staining procedure), basic operation of a flow cytometer (setting instrument parameters, creating a worksheet, gating strategy), interpret flow cytometry results  |
| G.S5 | conduct EV isolation using size exclusion chromatography, determine EV content by protein concentration determination (BCA-assay) and nanoparticle tracking analysis – size measurements, total particles/vesicles % determination (under assistance) |

*\* In appendix to the Regulation of Minister of Science and Higher education from 26th of July 2019 „graduate”, not student is mentioned.*

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| 1. **Additional effects of learning** *(non-compulsory)*
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| **Number of effect of learning** | **Effects of learning i time** |
| **Knowledge – Graduate knows and understands:** |
| K1 |  |
| **Skills– Graduate is able to:** |
| S1 |  |
| **Social Competencies – Graduate is ready for:** |
| SC1 | Design and carry out research project individual or in team, also in an international environment |

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| 1. **Classes**
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| **Form of class** | **Class contents** | **Effects of Learning** |
| Seminar | Introduction to cell culture | G.K1,G.K3 |
| Cell cultures – continuation | G.K3 |
| Selected research methods used in scientific laboratories- protein gel electrophoresis and DNA gel electrophoresis | GK4 |
| Selected research methods used in scientific laboratories – continuation-- Enzyme-linked immunosorbent assay (ELISA) and flow cytometry | G.K4 |
| The application of flow cytometry in scientific research | G.K4, G.S4 |
| Extracellular vesicles (EVs) – powerful little messengers as a new paradigm in cell biology and medicine | G.K6, G.S5 |
| The application of modern chromatographic techniques in scientific research | G.K4 |
| The application of modern gene engineering techniques in scientific research | G.K4 |
| laboratory class | Basic laboratory methods – introduction to cell culture | G.S1, G.S2, G.S3 |
| Mammalian cell culture - continuation | G>S3 |
| Flow cytometry | G.S4 |
| EV isolation and analysis | G.55 |

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| 1. **Literature**
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| **Obligatory** |
| Materials on the e-learning platform prepared by the Department of Biochemistry – protocols for practical classes, materials from the seminars |
| **Supplementary** |
|  Medical database and professional medical journals, Pubmed, Embase, Scopus, Web of Science |

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| Verifying the effect of learning |
| **Code of the course effect of learning** | **Ways of verifying the effect of learning** | **Completion criterion** |
| *e.g. G.K1, G.S1, K1* | *This field defines the methods used for grading students e.g. pop quiz, test, written report etc.* | *e.g. threshold number of points* |
| G.K.1-G.K-6 | Continuous assessment during seminars – short test on the MT platform after each seminar. The student is obligated to take the short test at a later time with agreement of the teacher even when he/she did not attend the seminarActive discussion during seminars For some seminars the teacher may in advance assign every student to prepare a short presentation regarding the topic of the seminarFinal exam on the MT platform after completion of all seminars and classes in each semester | At least 55% of points Credit by the teacherCredit by the teacherAt least 55% of points  |
| G.S1-G.S5 | Continuous assessment during laboratory classes. Written laboratory reports within the class protocol | Credit by the teacher |

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| 1. **Additional information** *(information essential for the course instructor that are not included in the other part of the course syllabus e.g. if the course is related to scientific research, detailed description of, information about the Science Club)*
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| Practical laboratory classes are held in the **laboratory of the Biochemistry Department (Banacha St. 1, the building of the Faculty of Pharmacy, block I, the 1st floor)**. Seminars are held online on the MS Teams platform.Detailed schedules, updates, information, and useful files will be available on the e-learning platform. The Student is obligated to: - attend all seminars and laboratory classes (attendance list); being late for over 15 minutes is considered as an absence - take the short test after each seminar or prepare materials for the seminar according to the teacher’s instruction- be prepared for the laboratory class: read and understand the class protocol, have a printed copy of the class protocol, perform notes and calculations within the laboratory protocol according to the teacher’s instructions and participate in discussions during seminars and laboratory classes - use university e-mail addresses s0xxxxx@student.wum.edu.pl It is not allowed: - to copy lab reports, assignments, test or exam answers - to allow that someone else could copy another Student's report/assignments/test/examThe Student is entitled to **1 excused absence** (laboratory class or seminar) – in case of illness, certified attendance of an internship, training, conference, other commitments, etc.. Absence due to illness is excused only by a medical note/doctor’s certificate. The student should notify about his/her absence the course coordinator at least 2 days before the planned seminar/class. In the case of an seminar absence, the student is obliged to work by himself/herself through the material presented during the seminar (a pdf file of the presentation will be provided by the teacher) and to take the short test in agreement with the teacher.In justified cases it is possible to change the seminar or laboratory classes group, however the student should notify the course coordinator not later than 1 day . before the planned seminar/class. In case of practical classes the possibility of group change may be dependent on the final group size and has to be confirmed by the course coordinator. Unexcused absences especially from laboratory classes are not allowed and may result in failing the entire course. In exceptional cases, when the student can prove his/her practical experience in a topic covered by a particular practical class/seminar, the course coordinator can excuse his/her absence from this particular class/seminar.Students can get the credit for the whole semester course and can take the final semester exam if she/he credits laboratory classes, seminars and seminar tests. Students who don’t achieve the credit from seminar tests or final semester exam, are allowed to **one retake.** Semester exam grading: 0 - 54 % - 2.0 55 - 64 % - 3.0 65 - 72 % - 3.5 73 - 81 % - 4.0 82 - 90 % - 4.5 91 - 100 % - 5.0 The final grade of the whole course will be calculated from the average grades of the seminar test and semester exams. The final grade of 3.5 and higher may be increased by half a grade in the case of attendance of **all** seminar and laboratory classes.  |

**ATTENTION**

The final 10 minutes of the last class in the block/semester/year should be allocated to students’

Survey of Evaluation of Classes and Academic Teachers