SYLLABUS – A COURSE DESCRIPTION

I. General informaion

1. Course name: **Methods of the experimental work**
2. Course code: **01-BTA-EXPWORK**
3. Course type (compulsory or optional): **compulsory**
4. Study programme name: **Biotechnology**
5. Cycle of studies (1st or 2nd cycle of studies or full master's programme): **2nd cycle of studies**
6. Educational profile (general academic profile or practical profile): **general academic profile**
7. Year of studies (if relevant): **I**
8. Type of classes and number of contact hours (e.g. lectures: 15 hours; practical classes: 30 hours):

   conversatorium: 20 hours
9. Number of ECTS credits: **2**
10. Name, surname, academic degree/title of the course lecturer/other teaching staff:

    dr hab. Andrzej Pacak, apacak@amu.edu.pl
11. Language of classes: English
12. Online learning – yes (partly – online / fully – online) / no: **Materials, as well as contact with the students will be provided using Microsoft Teams platform.**

II. Detailed information

1. Course aim (aims)
   1. Getting to know the principles of the safe work in the laboratory.
   2. Getting to know the possibilities of scientific career.
   3. Getting to know the basic tools and devices used in the laboratory.
   4. Transfer of knowledge concerning the genome, transcriptome and proteome.
   5. Transfer of knowledge concerning the principles of the operation and using modern research tools such as: Real Time PCR technique, Droplet Digital PCR (ddPCR), deep sequencing (NGS, Illumina, Nanopore), FLIM-FRET, CRISPR/Cas9.
   6. Transfer of knowledge regarding the use of bioinformatics tools for analyzing NGS data (CLC Genomics Workbench), for analyzing protein structures (NovaFold). Acquiring skills in Linux commands usage (Ubuntu).
   7. To develop skills to correctly use basic statistical operations: mean, median, standard deviation, p-value, corrected p-value, Poisson statistic.
   8. Developing the ability to plan and conduct correctly experiments and analyze the obtained results. The research topic presented in the academic year 2020/2021 are - diseases caused by triplet nucleotide repeats - Triplet Repeat Expansion Diseases (TREDs).
   9. Developing skills related to the preparation of student's own research project and group discussions on the strengths and weaknesses of the particular project.
2. Pre-requisites in terms of knowledge, skills and social competences (if relevant)

   Knowledge of the structure of: DNA, RNA and proteins. Ability to use English spoken and written. Knowledge of Linux will be helpful.
3. Course learning outcomes (EU) in terms of knowledge, skills and social competences and their reference to study programme learning outcomes (EK)

Course learning outcome symbol (EU)	On successful completion of this course, a student will be able to:	Reference to study programme learning outcomes (EK)
EU_01	choose the right tools to work in the laboratory	BT_W01
EU_02	explain the principles of operation and utilization techniques: Real Time PCR, ddPCR, NGS, NGS data analysis, CRISPR/Cas9, protein structure analysis	BT_U01
EU_03	knows how to: calculate the standard deviation values using a calculator, use basic commands in Linux, perform NGS bioinformatics analyses	BT_W05
EU_04	explain the mechanisms leading to the emergence of diseases caused by the expansion of trinucleotide	BT_W07

	repeats, plan, and select appropriate research tools for conducting the selected experiment within the presented research topic (TREDs) and perform the analysis of the obtained data, be able to search for grant opportunities	
EU_05	present student's research project	BT_K01, BT_K02
EU_06	assimilate/develop new social competences related to the ability to discuss the project presented in a larger group of people, manage stress	BT_U06

4. Learning content with reference to course learning outcomes (EU)

Course learning content	Course learning outcome symbol (EU)
Health and safety rules in the laboratory	EU_01
Planning the experiment and taking notes from it	EU_01
Basic issues related to life sciences at the molecular level: genomics, proteomics, transcriptomics	EU_02
Modern techniques/methods used in life sciences and especially in biotechnology: Real time PCR, ddPCR, NGS, FLIM-FRET, CRISPR/Cas9	EU_02
Basic statistical concepts: mean, median, standard deviation, basic Linux commands, Poisson statistic	EU_03
Example of a research topic: genetic diseases associated with the expansion of trinucleotide repeats (Triplet Repeat Expansion Diseases (TREDs))	EU_04
Preparation of student's own research projects based on proposed topics	EU_05
Project presentation and its evaluation	EU_06

5. Reading list (fragments indicated by the teacher)

1. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer: Biochemistry 6th, 7th editions, W.H. Freeman, , 2012
2. Rob Reed, David Holmes, Jonathan Weyers, Allan Jones: Practical skills in biomolecular sciences 2nd edition, Pearson Education Limited, Harlow, UK, 2003
3. : Safety Sense: A laboratory guide. 2nd edition, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York, USA, 2007
4. Eija Korpelainen, Jarno Tuimala, Panu Somervuo, Mikael Huss, Garry Wong: RNA-seq data analysis: a practical approach, Chapman and Hall/CRC, Abingdon, 2014
5. Aleksandra Smoczynska, Pawel Sega, Agata Stepien, Katarzyna Knop, Artur Jarmolowski, Andrzej Pacak, Zofia Szweykowska-Kulinska: miRNA detection by stem-loop RT-qPCR. In Studying microRNA biogenesis and microRNA responsiveness to abiotic stressed, Humana Press, Springer, Methods Mol Biol., New York, 2019
6. David Elliott, Michael Ladomery: Molecular Biology of RNA, Oxford University Press, Oxford, UK, 2016
Artykuły w czasopismach
1. Wlodzimierz J. Krzyzosiak, Krzysztof Sobczak, Marzena Wojciechowska, Agnieszka Fiszer, Agnieszka Mykowska, Piotr Kozlowski (2012): Triplet repeat RNA structure and its role as pathogenic agent and therapeutic target, Nucleic Acids Research, 40/1
2. Thurman M. Wheeler, Krzysztof Sobczak, John D. Lueck, Robert J. Osborne, Xiaoyan Lin, Robert T. Dirksen, Charles A. Thornton (2009): Reversal of RNA dominance by displacement of protein sequestered on triplet repeat RNA, Science, 325
3. Juliana Costa-Silva, Douglas Domingues, Fabricio Martins Lopes (2017): RNA-Seq differential expression analysis: An extended review and a software tool, PloS one,

12, e0190152
4. Paola Campomenosi, Elisabetta Gini, Douglas M. Noonan, Albino Poli, Paola DAntona, Nicola Rotolo, Lorenzo Dominioni, Andrea Imperatori (2016): A comparison between quantitative PCR and droplet digital PCR technologies for circulating microRNA quantification in human lung cancer, BMC biotechnology, 16, no. 1
5. Adrian Pickar-Oliver, Charles A. Gersbach (2019): The next generation of CRISPR-Cas technologies and applications, Nature Reviews Molecular Cell Biology, 20(8)
6. Marek Marzec, Agnieszka Brąszewska-Zalewsk, Goetz Hensel (2020): Prime Editing: A New Way for Genome Editing, Trends in Cell Biology, 30(4)

III. Additional information

1. Teaching and learning methods and activities to enable students to achieve the intended course learning outcomes (please indicate the appropriate methods and activities with a tick or/and suggest different methods)

Teaching and learning methods and activities	
Lecture with a multimedia presentation	X
Interactive lecture	X
Problem – based lecture	
Discussions	X
Text-based work	
Case study work	X
Problem-based learning	
Educational simulation/game	
Task – solving learning (eg. calculation, artistic, practical tasks)	
Experiential work	
Laboratory work	
Scientific inquiry method	
Workshop method	
Project work	X
Demonstration and observation	
Sound and/or video demonstration	
Creative methods (eg. brainstorming, SWOT analysis, decision tree method, snowball technique, concept maps)	
Group work	X

2. Assessment methods to test if learning outcomes have been achieved (please indicate with a tick the appropriate methods for each LO or/and suggest different methods)

Assessment methods	Course learning outcome symbol					
	EU_1	EU_2	EU_3	EU_4	EU_5	EU_6
Written exam						
Oral exam						
Open book exam						
Written test						
Oral test						
Multiple choice test						
Project	X	X	X	X	X	X
Essay						
Report						
Individual presentation						

Practical exam (performance observation)						
Portfolio						

3. Student workload and ECTS credits

Activity types	Mean number of hours spent on each activity type
Contact hours with the teacher as specified in the study programme	20
Preparation for classes	10
Reading for classes	5
Essay / report / presentation / demonstration preparation, etc.	10
Project preparation	10
Term paper preparation	
Exam preparation	
Total hours	55
Total ECTS credits for the course	2

4. Assessment criteria according to AMU in Poznan grade system

Very good (bdb; 5,0): Excellent presentation of the student’s research topic
Good plus (+db; 4,5): Not providing enough in-depth information
Good (db; 4,0): Providing a descriptive rather than an experimental approach of the presented topic
Satisfactory plus (+dst; 3,5): Not answering the exact problem set in the proposed project
Satisfactory (dst; 3,0): Presentation containing only introduction to the research problem
Unsatisfactory (ndst; 2,0): Lack of the presentation