SYLLABUS – A COURSE DESCRIPTION

I. General informaion

1. Course name: **Digital PCR**
2. Course code: **01-BTA-PCRDIG**
3. Course type (compulsory or optional): **optional**
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): **II**
8. Type of classes and number of contact hours (e.g. lectures: 15 hours; practical classes: 30 hours):
   lectures: 10 hours
   practical classes: 15 hours
9. Number of ECTS credits: **3**
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. Transfer of knowledge concerning operation and use Real-time PCR (qPCR) technology.
   2. Transfer of knowledge concerning droplet digital PCR (ddPCR) and differences between conventional qPCR and ddPCR.
   3. Develop skills associated with cDNA preparation, ddPCR reaction set up.
   4. Transfer of knowledge concerning the use of ddPCR technique in gene expression analysis, Single Nucleotide Polymorphism detection (SNP), in viral RNA detection, detection of genome editing events generated by CRISPR/Cas9 technique used in biotechnology.
   5. Transfer the knowledge of proper use of basic statistics and ddPCR calculations necessary for ddPCR data analysis: mean, median, standard deviation, T-test, Poisson statistic.
   6. Develop skills associated with the preparation of student's own results evaluation report.
2. Pre-requisites in terms of knowledge, skills and social competences (if relevant)
   Principles of RNA isolation, cDNA synthesis, PCR reaction.
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	Utilize the principles of ddPCR technology and use appropriate primers, probes and reagents.	BT_W01
EU_02	Perform RNA isolation, cDNA synthesis and ddPCR reaction.	BT_U02
EU_03	Perform gene expression analysis using ddPCR technique. Student selects appropriate reference genes.	BT_U02
EU_04	Use different ddPCR applications for mutations detection in human gene, detection of genome editing events generated by CRISPR/Cas9.	BT_U01, BT_U02, BT_K05
EU_05	Use appropriate software for primers design, ddPCR data analysis.	BT_K01

EU_06	Correctly interpret ddPCR results. Student is able to evaluate the results in terms of their statistical significance.	BT_K01

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

Course learning content	Course learning outcome symbol (EU)
Droplet Digital PCR technique, EvaGreen and TaqMan probes usage, primer design	EU_01, EU_02
Two methods for the quantitative assessment of gene expression: absolute and relative quantification	EU_01, EU_03
Digital PCR analysis used in molecular diagnostics. Applications used for mutations detection	EU_04
Statistical concepts: Poisson correction, mean, median, standard deviation, p-value, p-value correction, T-test	EU_05, EU_06
Interpretation of the ddPCR results, preparation of reports describing obtained results	EU_05, EU_06

5. Reading list : fragments indicated by the teacher

1. Smoczynska A, Sega P, Stepien A, Knop K, Jarmolowski A, Pacak A, Szweykowska-Kulinska Z.: miRNA detection by stem-loop RT-qPCR in studying microRNA biogenesis and microRNA responsiveness to abiotic stresses., Humana Press, Springer, Methods Mol Biol. , New York, 2019

Artykuły w czasopismach

1. Vendrell J, Mazieres J, Senal R, Rouquette I, Quantin X, Pujol JL, Roch B, Bouidioua A, Godreuil S, Coyaud E, Brousset P, Solassol J. (2019): Ultra-sensitive EGFR T790 Mdetection as an independent prognostic marker for lung cancer patients harboring EGFR del19 mutations and treated with first-generation TKIs., Clin Cancer Res., 25(14)
2. Demaree B, Weisgerber D, Dolatmoradi A, Hatori M, Abate AR. (2018): Direct quantification of EGFR variant allele frequency in cell-free DNA using a microfluidic-free digital droplet PCR assay., Methods Cell Biol., 148
3. Laprovitera N, Grzes M, Porcellini E, Ferracin M. (2018): Cancer Site-Specific Multiple microRNA Quantification by Droplet Digital PCR., Front Oncol., 8:447
4. Campomenosi P, Gini E, Noonan DM, Poli A, D (2016): A comparison between quantitative PCR and droplet digital PCR technologies for circulating microRNA quantification in human lung cancer., BMC Biotechnol., 16(1):60

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	
Problem-based learning	
Educational simulation/game	
Task – solving learning (eg. calculation, artistic, practical tasks)	
Experiential work	
Laboratory work	X
Scientific inquiry method	

Workshop method	
Project work	
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						
Essay						
Report	X	X	X	X	X	X
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	25
Preparation for classes	15
Reading for classes	15
Essay / report / presentation / demonstration preparation, etc.	25
Project preparation	
Term paper preparation	
Exam preparation	
Total hours	80
Total ECTS credits for the course	3

4. Assessment criteria according to AMU in Poznan grade system

Very good (bdb; 5,0): Final report contains information about experiment, correct results and calculations.
Good plus (+db; 4,5): Lack of explanation how the final results were calculated.
Good (db; 4,0): Lack of clear results only numbers without explanations.
Satisfactory plus (+dst; 3,5): Minor errors in data analysis.
Satisfactory (dst; 3,0): Major errors in data calculations.
Unsatisfactory (ndst; 2,0): Lack of report.