

SYLLABUS – A COURSE DESCRIPTION

I. General information

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, Segal 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 czasopiśmie

1. Vendrell J, Mazieres J, Senal R, Rouquette I, Quantin X, Pujol JL, Roch B, Boudioua 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.