

Course title: Molecular techniques		
Programme: Biotechnology		Code: 5.15
Type of course: elective	Course level: I	Semester: IV
Form of classes: Lectures (L), tutorials (T)	Number of hours per week/meeting: 2L, 3Lab.	Credit points: 4 ECTS
Education profile: academic		Course language: English
Enrolment: yes/ no		

GUIDE TO THE SUBJECT

I. COURSE CHART

COURSE OBJECTIVES

- C.1.** To acquire the knowledge on basic molecular analyzes enabling DNA isolation and identification of a particular gene; RNA isolation, reverse transcription, and real-time PCR
- C.2.** To acquire the knowledge on full DNA isolation from different matrices and PCR
- C.3.** Perform genetic identification of fungi and bacteria isolated on solid media

PRELIMINARY COURSE REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of general genetics including the function of genes
2. Basic knowledge of molecular biology in the structure and function of DNA and RNA, and the steps of gene expression; functions of individual genes; sequencing

LEARNING OUTCOMES

EK1 –The student is able to isolate genomic DNA from pure and environmental matrices, isolate RNA and reverse transcription

EK 2 - has the ability to perform a PCR reaction with the preparation of reagents and perform appropriate calculations and gel electrophoresis of reaction products

EK 3 - has the ability to perform real-time PCR with standard preparation and appropriate calculations

EK 4 - can perform gene identification of isolated microorganism

COURSE CONTENT

Form of classes - lectures	Hours
Basic techniques of protein and DNA analysis: methods of DNA and (SDS PAGE) Protein phosphorylation, immunological methods (mono	2
PCR and its variants: RFLP-PCR, RT-PCR, Fast PCR, Hot-Start PCR,	3
Optimization of PCR, design of primers for PCR, gradient, diagnostics and	2
Analysis of SNP, AFLP, SSCP, FISH and DNA microarrays	2
DNA sequencing	2

New generation sequencers and how they work.	2
Barcoding of living organisms (DNA barcoding), DNA metabarcoding	4
Genotyping techniques	4
Comparative genetics, environmental genomics, population genomics,	2
Diagnostics and molecular epidemiology	3
Final test	2
Form of classes – laboratory classes	Hours
Introduction (OSH, laboratory equipment)	3
Isolation of DNA from pure cultures of microorganisms, sewage sludge and wastewater by various methods; introduction	6
Spectrophotometry and electrophoresis as methods for evaluating the quality and quantity of isolated genetic material	3
Classic PCR and multiplex PCR	3
Preparation of standards and reagents for real-time PCR: calculations necessary for analysis	3
Conduct real-time PCR reaction on isolated DNA samples; Preliminary analysis of results based on the standard curve	3
Genetic identification of bacteria - introduction to phylogenetics: PCR reaction, sequencing, analysis of obtained sequences	3
Assumption of the experiment: Plant exposure to heavy metal salts (group work) - goal: to determine changes in the expression of the metallothionein gene encoding the metal ion chelating protein.	3
Isolation of RNA ; evaluation of the quality and quantity of the insulated material	3
Reverse transcription; Preparation of real-time PCR for the test and reference gene	3
Isolation of microorganisms on selective media for genetic identification	3
Genetic identification of three species of bacteria	6
Final test and defense of the lab reports	3

COURSE STUDY METHODS

1. Lectures with the use of interactive tools
2. Laboratory classes, materials needed to perform experiments

METHODS OF ASSESMENT (F - formative; S - summative)

F1. - activity during classes
F2. - assessment of the ability to perform analyzes
S1. - final test
S2. - evaluation of the performance of the reports including analysis and verification of the results obtained

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in lectures	30 h
Participation in classes	.... - h
Laboratory	...45 h
Participation in project classes	.....- h
Participation in seminar	.....- h
Preparation course on e-learning	.....- h
Test	... 6 h
Entrance test for laboratory classes	.....- h
Project's defence	.....- h
Exam	.... -h
Consultation hours	...15 h
DIRECT TEACHING, hours/ ECTS	96 h / 2,6 ECTS
Preparation for tutorials	20 h
Preparation for laboratories	...10 h
Preparation for projects	.....- h
Preparation for seminars	.....- h
Preparation for e-learning classes	.....- h
Participation in e-learning classes	.....- h
Working on project	.....- h
Preparation for tests	...20. h
Preparation for exam	....- h
SELF-STUDY, hours/ ECTS	50 h / 1.4 ECTS
TOTAL (hours)	∑ ...146 h
TOTAL ECTS	4 ECTS

PRIMARY AND SUPPLEMENTARY TEXTBOOKS

Lewin B. Genes VIII. Oxford University Press, USA, 2004; on line http://www.ebook3000.com/dictionary/Genes-VIII-Benjamin-Lewin_69047.html ;
Laboratory Notebook, Scientific Calculator with statistics and linear regression capability, Sharpie labeling pens (fine tip).
Textbooks: 1.An Introduction to Molecular Biotechnology (2nd) TX Wiley-Blackwell Michael Wink 1/23/2012. ISBN: 9783527326372
Seidman & Moore, Basic Laboratory Methods for Biotechnology: Textbook & Laboratory Reference, 2 nd edition. 2009. Prentice Hall. ISBN: 0321570146
Lab Manual: "Molecular Biology Techniques" S. O'Grady et al 2012. ISBN:

BITC2441F2012. One copy of the lab manual will be supplied. Supplemental instruction manuals will be provided on Blackboard.

SUBJECT COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

1. dr Anna Grobelak, agrobelak@is.pcz.czyst.pl

NAME OF LECTURER (s) (NAME, SURNAME, E-MAIL ADDRESS)

1. dr Anna Grobelak, agrobelak@is.pcz.czyst.pl

Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assesment
EK 1	K_W05, K_W06, K_U02, K_U05, K_U08, K_K01, K_K04	C2	Lecture/lab.	1,2	F1,F2,S1
EK 2	K_W05, K_W06, K_U02, K_U05, K_U08, K_K01, K_K04	C2	Lecture/lab.	1, 2	F1,F2,S1
EK 3	K_W05, K_W06, K_U02, K_U05, K_U08, K_K01, K_K04	C2	Lecture/lab.	1, 2	F1,F2,S1
EK 4	K_W05, K_W06, K_U02, K_U05, K_U08, K_K01, K_K04	C1,C3	Lecture/lab.	1,2	F1,F2,S1,S 2

II. OTHER USEFUL INFORMATION

1. All the information on the class schedule is posted on the student information board and online at: www.is.pcz.pl
2. The information about the consultation hours is provided to students on the first class meeting.
3. The information on course completion and grade is provided to students on the first class meeting.