UNIWERSYTET PRZYRODNICZY WE WROCŁAWIU

Molecular biology

Educational subject description sheet

Basic information

Field of study Bioinformatics	**Education cycle** 2021/22
Speciality -	**Subject code** BD000000BBIS.I4.1336.21
Organizational unit The Faculty of Biology and Animal Science	**Lecture languages** english
Study level First-cycle (engineer) programme	**Mandatory** optional
Study form Full-time	**Block** major subjects (conducted) in foreign languages
Education profile General academic	**Disciplines** Biological sciences
	Subject related to scientific research Yes
	Subject shaping practical skills Tak

Teacher responsible for the subject	Magdalena Wołoszyńska
Other teachers conducting classes	Magdalena Wołoszyńska, Bożena Marszałek-Kruk

Period Semester 3	**Examination** exam **Activities and hours** lecture: 30 laboratory classes: 30	**Number of ECTS points** 5.0

Goals

C1	Presenting to the students the molecular basis of storage, variability and expression of genetic information, and techniques applied to isolate and analyze nucleic acids.
C2	Providing students with the knowledge about the structure, physical and chemical properties and the metabolism of nucleic acids, the organization of genetic information in prokaryotic organisms as well as in mitochondria and plastids, and in the nucleus of eukaryotic cell.
C3	Explaining to students DNA mutations and DNA repair systems.
C4	Presenting to the students the genetic code, the participation of various types of RNA molecules and their modification in gene expression
C5	Providing students with the knowledge about the restriction enzymes and their significance for molecular biology, the basics of restriction maps creation and interpretation, cloning (plasmids, vectors), DNA sequencing, transcriptome analysis by means of microarrays and RNASeq technique
C6	Explaining to students the PCR technique and important aspects of real-time PCR.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the molecular basis of the functioning of organisms and genetic diseases.	BI_P6S_WG03, BI_P6S_WG04, BI_P6S_WG05	written exam, oral exam
W2	the structure of living organisms at every organizational level. Understands adaptation processes in the context of changes in morphology, function and environment.	BI_P6S_WG03, BI_P6S_WG04, BI_P6S_WG05	written exam, oral exam
W3	the most useful methods in biological research.	BI_P6S_WG02, BI_P6S_WG10	written exam, oral exam
Skills – Student can:			
U1	perform quantitative and qualitative analyzes correctly, operate efficiently and safely instruments used in chemical laboratories.	BI_P6S_UO16, BI_P6S_UW02	observation of student’s work, test
U2	correctly perform observations in biological and field laboratories, interprete the results and formulate conclusions, using scientific terminology in the field of biology using information technology.	BI_P6S_UK12, BI_P6S_UK14, BI_P6S_UO16, BI_P6S_UW02	observation of student’s work, test
Social competences – Student is ready to:			
K1	systematically update of knowledge in the field of biology and related disciplines, recognize its cognitive significance, critically evaluate his/her knowledge	BI_P6S_KK01, BI_P6S_KK02	written exam, oral exam
K2	critically evaluate news related to the field of biology and given in mass-media.	BI_P6S_KK01, BI_P6S_KK02	written exam, oral exam

Balance of ECTS points

Activity form	Activity hours*

lecture	30
laboratory classes	30
exam / credit preparation	50
exam participation	2
consultations	2
literature study	20
class preparation	15

Student workload	**Hours** 149	**ECTS** 5.0
Workload involving teacher	**Hours** 62	**ECTS** 2.1
Practical workload	**Hours** 30	**ECTS** 1.0

* hour means 45 minutes

Study content

No.	Course content	Activities
1.	Molecular biology classes include the following educational content: understanding what molecular biology is and what it does learning the most important facts about macromolecules or biopolymers a detailed understanding of the relationship between the chemical structure of DNA, physico-chemical properties, the mechanism of biosynthesis and the role of the genetic information carrier learning the basic differences between prokaryotic, organellar and nuclear genes and genomes getting to know the structure of chromatin understanding the mechanism of DNA replication and differentiating between different types of replication learning about the most important properties of DNA polymerases mastering the basic knowledge about mutagenesis, DNA damage and repair, and recombination understanding the relationship between the characteristics of the genetic code and the characteristics of individual amino acids, the consequences of mutations and the mechanism of gene expression understanding the relationship between the structure and the DNA sequence and the RNA transcription mechanism with particular emphasis on the differences between prokaryotes and eukaryotes understanding differences in transcription dependent on the type of gene and RNA polymerase mastering the knowledge about regulation of transcription understanding the mechanisms of maturation of different types of RNA molecules learning about several types of splicing learning about the course of protein translation and biosynthesis mastering general knowledge about nucleases obtaining detailed knowledge about type II endonucleases, their biological role, mechanism of action and role in genetic engineering mastering the ability to read restrictive maps and predict electrophoretic patterns based on the map basic knowledge of such techniques as: Southern hybridization and cloning knowledge of enzymatic modifications to which DNA is subjected during cloning and knowledge of enzymes making these modifications understanding what vectors are and knowledge of basic types of vectors understanding why PCR is cloning in a test tube mastering basic information on the design of PCR reactions, reagents and equipment used understanding the concept of quantitative PCR and real-time PCR analysis	lecture

No.	Course content	Activities
2.	Enzymatic digestion and mapping of an unknown DNA molecule Restriction enzymes (reminder), basics of mapping DNA molecules, preparation of DNA enzyme digestion reactions (composition of the reaction mixture, incubation, star activity), agarose gel electrophoresis (preparation of gel, electrophoresis conditions, DNA visualization). DNA isolation, Genotyping DNA isolation from Arabidopsis thaliana seedlings of Col-0 and phyB5 lines and genotyping of T-DNA insertion mutants by PCR with specially designed primers.	laboratory classes

Course advanced

Teaching methods:

case analysis, educational film, problem-solving method, lecture, classes

Activities	Examination methods	Percentage in subject assessment
lecture	written exam, oral exam	75%
laboratory classes	observation of student’s work, test	25%

Literature

Obligatory

1. Genomy, T.A. Brown, PWN
2. Genetyka molekularna. Pod redakcją P. Węgleńskiego, PWN
3. Krótkie wykłady. Biologia molekularna P. Turner, A. McLennan, A. Bates, M. White, Trzecie wydanie

Optional

1. Bukowiecka-Matusiak M, Woźniak LA Struktura DNA od A do Z. Biologiczne implikacje różnorodności strukturalnej DNA, 2006, Postepy Biochemii 52
2. Phenix-Lan Quan, Martin Sauzade and Eric Brouzes, dPCR: A Technology Review, 2018, Sensors 18
3. Mahdi Zeraati, David B. Langley, Peter Schofield, Aaron L. Moye, Romain Rouet, William E. Hughes, Tracy M. Bryan, Marcel E. Dinger and Daniel Christ, I-motif DNA structures are formed in the nuclei of human cells, 2018, Nature Chemistry,
4. Paweł Golik , POCHODZENIE I EWOLUCJA GENOMU MITOCHONDRIALNEGO, 2009, KOSMOS 58 (3-4)
5. Czechowska A, Błasiak J, Eukariotyczne polimerazy DNA, 2005 Postępy Biochemii 51
6. Elizabeth H. Blackburn,Elissa S. Epel, Jue Lin, Human telomere biology: A contributoryand interactivefactor in aging, disease risks, and protection. 2015, Science
7. Marie-Josèphe Giraud-Panis, Sabrina Pisano, Delphine Benarroch-Popivker, Bei Pei, Marie-Hélène Le Du and Eric Gilson, One identity or more for telomeres? 2013 Frontiers in Oncology 3, 48

Kierunkowe efekty uczenia się

Kod	Treść
BI_P6S_KK01	krytycznej oceny posiadanej wiedzy i jej aktualizacji
BI_P6S_KK02	odpowiedniego określania priorytetów służących realizacji określonego zadania
BI_P6S_UK12	poprawnie wnioskować na podstawie danych pochodzących z różnych źródeł nauk przyrodniczych, rolniczych, technicznych i matematycznych wykorzystując do dyskusji język naukowy
BI_P6S_UK14	posługiwać się językiem obcym w zakresie dziedzin nauki i dyscyplin naukowych, właściwych dla bioinformatyki, zgodnie z wymaganiami określonymi dla poziomu B2 Europejskiego Systemu Opisu Kształcenia Językowego
BI_P6S_UO16	współdziałać i pracować w grupie, przyjmując w niej różne role
BI_P6S_UW02	stosować techniki i narzędzia badawcze w zakresie biologii eksperymentalnej, ze szczególnym uwzględnieniem biochemii, biofizyki i biologii molekularnej
BI_P6S_WG02	specyfikę interpretacji wyników analiz biologicznych
BI_P6S_WG03	zjawiska i procesy fizyczne, chemiczne oraz biochemiczne zachodzące w przyrodzie i w organizmach żywych
BI_P6S_WG04	mechanizmy ewolucji
BI_P6S_WG05	w stopniu zaawansowanym zagadnienia z zakresu praw genetyki klasycznej, molekularnej, populacyjnej oraz cytogenetyki
BI_P6S_WG10	w stopniu zaawansowanym elementarne techniki biologii molekularnej