LEARNING MODULE DESCRIPTION

GENERAL INFORMATION

1. Module title: **NUCLEIC ACIDS BIOTECHNOLOGY TECHNIQUES**
2. Term: **winter**
3. Duration: **15 hours**
4. ECTS: **2**
5. Module lecturer: **Donata Pluskota-Karwatka, dr hab., Prof. UAM, Assoc. Prof**.
6. E-mail: **donatap@amu.edu.pl**
7. Language: **English**

DETAILED INFORMATION

Information about the lecture:

The lecture is addressed to students who want to gain or extend their knowledge about the most important aspects of biotechnology. The lecture will begin with recollecting of basic information concerning the structure of deoxyribonucleic acid (DNA). Then it will continue to show how the DNA became a hearth of technology that is transforming many fields of our life such as pharmacy, agriculture and criminology.

During the lecture the following questions, among many others, will be answered: How bacteria can produce human insulin? What makes a triple helix useful in drug design? Why identical twins are not identical? Why HIV defies the central dogma governing the flow of genetic information? What is cloning and PCR? Does DNA recombination occur in the nature? What is "a gene gun"? What can be advantages/disadvantages of transgenic plants?

Module aim (aims)

The main objectives of the lectures are to introduce students to the field of biotechnology and genetic engineering.

Students will be provided with the following knowledge:

- Structure and significance of DNA and RNA.
- Methods of DNA isolation, purification and detection.
- Enzymes acting on the nucleic acids.
- Recombinant DNA, principles of gene cloning.
- Genetic engineering in pharmaceutical industry and in agriculture.
- Polymerase chain reaction and methods for DNA sequencing

READING LIST

1. M. K. Cambell, S. O. Farrell, Biochemistry, 6th ed., Brooks/Cole, Cengage Learning, 2008.
2. T. A. Brown, Genomes, Garland Science Publishing, 2007.
3. J. D. Watson, DNA the Secret of Life, Alfred A. Knope, New York, 2006.
4. T. A. Brown, Gene Cloning and DNA Analysis: an Introduction, 5th Ed., Blackwell Scientific Publishers, Oxford, 2006.

This literature can be a source of detailed knowledge on nucleic acid biotechnology techniques, but students will be provided with all required information during the lecture.

SYLLABUS:

Week 1: **Structure and significance of DNA**.
Discovery of the DNA structure, primary and secondary DNA structure, types of base pairing, conformations of double helix, transfer of information in the cell**.**

Week 2: **Isolation and purification of DNA. Enzymes acting on nucleic acids**.
Techniques for isolation of DNA from cells (methods for cell's opening, ion-exchange chromatography). Techniques for separation and visualisation of DNA (gel electrophoresis, autoradiography, luminescence, fluorescence). Polymerases, nucleases and ligases as enzymes acting on nucleic acids, examples of restriction endonucleases.

Week 3: **Genes and cloning**.
Natural clones, methods for laboratory cloning: artificial embryo twinning, somatic cell nuclear transfer, cloning vectors, bacteriophages.

Week 4: **Genetic engineering**.
Basic terms for genetic engineering. Polymerase Chain Reaction (PCR), reverse transcriptase, retroviruses (HIV), expression vectors, bacteria as "protein factories.

Week 5: **Genetic engineering in agriculture. Methods for DNA sequencing.**
Applications of genetic engineering, "natural" engineering, genetically modified organisms, methods for insertion of foreign genes into a plant cells. Methods for DNA sequencing.

Week 6: **Discussion and preparation for visit to laboratory of molecular biology.**

Week 7: **Visit to laboratory of molecular biology**.
Subject of the visit: "Digesting of plasmid DNA by the use of restriction endonucleases"; presentation of the laboratory, preparation of reaction, digesting with restriction enzymes, electrophoresis, visualization of the products, discussion.

Student workload (ECTS credits)

Activity types	Mean number of hours* spent on each activity type
Contact hours with the teacher as specified in the programme	**15**
Independent study (1)	**15**
Independent study (2)	**15**
Total hours	**45**
Total ECTS credits for the module	**2**

** Class hours – 1 hour means 45 minutes*
(1) Independent study – examples of activity types: preparation for classes, data analysis,
(2) library-based work, PowerPoint presentation of the chosen topic related to the lecture .