

## Course Description

**Discipline/Course:** Cell biotechnology

**The Basic Educational Program specialty:** Biotechnology

**Institute of High Technology Physics. The department of biotechnology and organic synthesis**

**Instructor:** Alexandra G. Pershina, PhD

**Contact details:** +7 3822 563637, email: allysy@tpu.ru

### Learning Outcomes:

This course introduces the student to the cell and genetic engineering. Students get basics on methods of genetic engineering, manipulation with cells, cell components and genome to produce improved or novel organisms.

**at the level of reproduction:** master the terminology in field of molecular biotechnology

**at the level of understanding:** the key techniques used in the field of cell and genetic engineering

**Theoretical skills:** know the possibility of molecular biology approaches to produce improved or novel organisms

**Practical skills:** apply basic molecular biotechnology methods for manipulation with cells, cell components and genomes

### Course Outline:

**Lecture 1.** Gene Expression

**Lecture 2.** Genetic engineering. Bacterial expression systems.

**Lecture 3.** Mammalian cell biotechnology

**Lecture 4.** Plant cell biotechnology

**Practice 1.** Nucleic acids: structure and properties. Genebank.

**Practice 2.** PCR. Polymerases. Primers. Real-time PCR. Analysis of nucleotide sequences

**Practice 3.** Reverse transcription. Nucleic acids sequencing.

**Practice 4.** Translation. Gene code.

**Practice 5.** Restriction Endonucleases. Ligation. Dephosphorylation.

**Practice 6.** Chemical gene synthesis. Directed mutagenesis.

**Practice 7.** Molecular Cloning Technique. Cloning and Expression vectors.

**Practice 8.** Gene Expression Systems.

**Practice 9.** Expression in mammalian cells.

**Practice 10.** T-DNA. Transgenic plants.

**Practice 11.** Expression in yeast. 2  $\mu$  plasmid.

**Lab 1.** PCR. Amplification of protein coding sequence.

**Lab 2.** Restriction. Agarose gel electrophoresis. DNA-fragment extraction from agarose gel.

**Lab 3.** Ligation and Transformation of *E.coli* cells.

**Lab 4.** Transformed cells selection and recombinant plasmid propagation.

**Lab 5.** Plasmid DNA purification.

**Lab 6.** Mammalian cells culture.

**Lab 7.** Obtaining of a recombinant protein: expression vector design, choosing of expression system and purification protocol

**Course Delivery:** one semester, 8 weeks

**Prerequisites:** “Mathematics”, “Informatics”

**Co-requisites:** “High Voltage Engineering”, “Generation and measurement of high-voltage and high-current signals”

**Final Assessment:** pass/fail exam

**Course Developer:** Alexandra G. Pershina, PhD