Topics for the interview for the Biological Therapeutics - degree programme.

1. Organisation of living matter and cell physiology – structure and functions of prokaryotic and eukaryotic cells; basic life processes at the cellular level.
2. Fundamentals of molecular and cellular biology. Structure and functions of the eukaryotic cell. Mechanisms of gene expression and the regulation of transcription and translation. Basic knowledge of the structure, chemical composition and functions of proteins and nucleic acids.
3. Biotechnology and genetic engineering. Knowledge of the basic methods of molecular biology, including cloning, production and purification stages of recombinant proteins. Classical genetic engineering and genome engineering using CRISPR/Cas9 methods.
4. Biologics and biosimilars – definition and types. Basic knowledge of therapeutic RNA types. Characteristics of biologics and biosimilars. Basic knowledge of antibodies: structure, mechanisms of action, therapeutic and research applications.
5. Modern technologies in the development of biological medicines. Basic knowledge of nucleic acid sequencing techniques.
6. Immunology. Fundamentals of the immune system's function: main types of immune cells and organs. Mechanisms of innate and acquired immunity. Antibodies and their role in biological therapy. Fundamentals of the immunogenicity of biological medicines.
7. Biophysics. Understanding of basic concepts in the biophysics of proteins and nucleic acids, and biophysical methods for studying their properties.
8. Calculations. Ability to perform basic calculations involving the conversion of percentage and molar concentrations, volumes, and the conversion of units of mass, volume and amount of substance.
9. Basic skills in working with nucleic acids: designing primers for PCR reactions, complementary sequences (e.g. probes, etc.), basic methods of analysis, etc.
10. Nucleic acids and proteins. Structure, chemical properties, reactivity and physicochemical principles of interactions.
11. Fundamentals of spectroscopy. Mass spectrometry, nuclear magnetic resonance, absorption and fluorescence.
12. Organic chemistry. Fundamentals of reactivity and methods of synthesising organic compounds. Fundamentals of organic reaction mechanisms.

Read before the exam:

> **Basics of molecular genetics**, e.g., *Genetyka. Krótkie wykłady* (*Genetics: Short Lectures*), *Genes*, or *Genomes* — chapters on the expression of genetic information and nucleic acids.
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> **Basics of immunology**, e.g., *Immunologia. Krótkie wykłady* (*Immunology: Short Lectures*) — chapters on mechanisms of innate immunity, humoral immunity, and vaccines.

Articles and resources:

Zhu, Y., Zhu, L., Wang, X. et al. RNA-based therapeutics: an overview and prospectus. *Cell Death & Disease* 13, 644 (2022). https://doi.org/10.1038/s41419-022-05075-2

Li, T., Yang, Y., Qi, H. et al. CRISPR/Cas9 therapeutics: progress and prospects. *Signal Transduction and Targeted Therapy* 8, 36 (2023). https://doi.org/10.1038/s41392-023-01309-7

Adli, M. The CRISPR tool kit for genome editing and beyond. *Nature Communications* 9, 1911 (2018). https://doi.org/10.1038/s41467-018-04252-2

National Cancer Institute: Immunotherapy — https://www.cancer.gov/about-cancer/treatment/types/immunotherapy