SYLLABUS
Winter semester 2026/2027
Lecturer: prof. Jan Barciszewski

Title of the course	**Biochemistry of nucleic acids**
Institution where the course will take place	Institute of Bioorganic Chemistry Polish Academy of Sciences
Language	English
Learning objectives	Nucleic acid chemistry, biochemistry and molecular biology
Learning outcomes, according to Attachment 2 to the Programme of the Study (valid from October 1st 2026)	P8S_WG (pkt. 1, 2, 4), P8S_WK (pkt. 1, 4), P8S_KR (pkt. 1, 2), P8S_UW (pkt. 1, 2), P8S_UU/UO (pkt. 1), P8S_KK (pkt. 1, 3), P8S_UK (pkt. 2, 3)
Type of the course	Facultative course (non-obligatory)
Semester/Year	Winter semester 2026/2027
Name of the lecturer	Jan Barciszewski
Name of the examiner	Jan Barciszewski
Teaching methods	Lectures with audio-visual techniques
Attendance requirements	Working knowledge of English language
Number of ECTS points	2 ECTS. One ECTS point corresponds to 6 hours of lectures and 4 hours of individual work of a doctoral student related to the assimilation of the material presented during lectures (vidi source texts).
Number of lectures	12 h
Didactic methods	Lectures using current audiovisual techniques
Methods of verification and assessment of learning outcomes	Oral exam
Conditions of a positive evaluation	A passing grade of the exam
Course content	Nucleic acids are perhaps the most significant biopolymers on this planet. They have played a decisive role in the spontaneous creation of life on the Earth four billion years ago. Since that, they continue in storing the genetic information in all forms of life and play key roles in the cellular regulatory processes. Nucleic acids, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), carry genetic information which is read in cells to make the RNA and proteins by which living things function. The well-known structure

	of the DNA double helix allows this information to be copied and passed on to the next generation. During the course we will discuss the structure and function of nucleic acids. We will start with a historical perspective and show some of the early work which led to our understanding of these important molecules and how they functions. Many of these pioneering scientists were awarded Nobel Prizes for their work. We explain the structure of the DNA molecule, how it is packaged into chromosomes and how it is replicated prior to cell division. We will look at how the concept of the gene has developed since the term was first coined and how DNA is copied into RNA (transcription) and translated into protein (translation). The aim of the course is to gain knowledge at a molecular level about the structure and metabolism of nucleic acids as well as about the regulation of transfer of genetic information from genes to proteins. The principles about DNA replication, mutation, repair as well as RNA transcription, posttranscriptional modifications and protein synthesis will be explained; We will acquire knowledge of how nucleotides are synthesized and degraded in cells and understanding of structure-function relationships for nucleic acids and chromatin. We will be interested in knowledge of the enzymatic basis of replication of and error correction in the genome. An understanding of how genes are read and how the transcribed RNA is processed, and how genes are regulated through a coordinated collaboration between proteins and nucleic acid sequences. A lecture course will be also devoted to a study of the principles of nucleic acid chemistry and to the role of nucleic acids in cellular function, Nucleotide metabolism, DNA and RNA structure, Chromatin structure, DNA methylation, histone modification, DNA replication and repair, RNA transcription, processing of mRNA and regulation of gene activity. This course will focus on the relationship of structure to function in RNA and DNA. Methods for studying the primary, secondary, and tertiary structures of nucleic acids will be explored in lectures. Topics covered include enzymic mechanisms for biosynthesis, rearrangement, degradation, and repair of nucleic acid molecules, and processes of replication, transcription, and translation. Nucleic acid biochemistry is emphasized as a basis for understanding storage and transfer of biological information. There is no text book, although standard Biochemistry or Molecular Biology textbooks may serve as additional references (enclosed). This course is designed for graduate students who have a basic knowledge in molecular biology and nucleic acid biochemistry. Some experience in organic chemistry, cell biology, and genetics will also be useful.

Literature of the course materials	1. **Chemical Biology of Nucleic Acids: Fundamentals and Clinical Applications** - V.A. Erdmann, W.T. Markiewicz, J. Barciszewski, (seria RNA Technologies, Vol. 5), Springer, 2014, ISBN 978-3-642-54452-1, doi.org/10.1007/978-3-642-54452-1 2. **Charting a Future for Sequencing RNA and Its Modifications: A New Era for Biology and Medicine** National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Division on Earth and Life Studies; Board on Health Sciences Policy; Board on Life Sciences; Toward Sequencing and Mapping of RNA Modifications Committee; Washington (DC): National Academies Press (US); 2024 Jul 22. PMID: 39159274 Bookshelf ID: NBK606036 DOI: 10.17226/27165