



# ESSENTIALS OF BIOMOLECULES: NUCLEIC ACIDS AND PEPTIDES

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**PRE-REQUISITES** : Basic knowledge in organic chemistry

**INTENDED AUDIENCE** : For Chemistry, Biochemistry and Biotechnology students

**INDUSTRIES APPLICABLE TO** : All major pharmaceuticals and Biotech companies

### COURSE OUTLINE :

This course aims to provide essentials of Chemistry and Biology of two very important classes of biomolecules: nucleic acids (DNA/RNA) and proteins. The course allows to decipher: how structural features are translated into biological functions; how highly organized and selective chemical reactions are adopted that allows DNA to replicate or dictates step-wise synthesis of specific sequence of proteins; how organic chemistry tools in combination with enzymes were ingeniously applied to determine sequences of DNA and proteins and how chemical modifications could be done to mimic similar biological properties. The course also includes modern techniques, development of biomolecular probes as high-throughput detection of biomolecules, single nucleotide polymorphisms and disease diagnosis. Overall, the course falls within the domain of organic chemistry and chemical biology.

### ABOUT INSTRUCTOR :

Prof. Lal Mohan Kundu studied B.Sc. (Honors) in chemistry from RKMRC Narendrapur, Calcutta University in 1998. After completing master degree in chemistry from IIT Kharagpur in 2000, he moved to LMU Munich, Germany to pursue PhD with Prof. Thomas Carell. During this tenure he worked for the development of modified nucleic acids, DNA damage and repair. During postdoctoral stay at University of Alberta, Canada with Prof. Glan Loppnow and subsequently with Prof. Mizuo Maeda in RIKEN, Japan, he worked for the synthesis of modified nucleic acids probes for high-throughput detection of genomic mutations. Dr. Kundu joined the department of chemistry at IIT Guwahati in 2009 as assistant professor. He is currently a Professor and works in organic synthesis of nucleic acids, anticancer agents, peptide chemistry, biomolecular based targeted drug delivery and nanoparticle based therapeutics. His teachings in UG and PG level include: organic chemistry, chemical biology, biological macromolecules.

### COURSE PLAN :

**Week 1:** Introduction, Nucleic acids and proteins

**Week 2:** Synthesis of nucleobases, nucleotides and oligonucleotides

**Week 3:** Solid phase synthesis of oligonucleotides

**Week 4:** DNA replication, Polymerases, DNA sequencing and PCR

**Week 5:** DNA damage, mutations and cancer

**Week 6:** DNA to proteins: transcription, translation and genetic code

**Week 7:** Peptides, sequencing and applications in therapeutics

**Week 8:** Solution phase and solid phase peptide synthesis

**Week 9:** Expansion of genetic code: PNA, LNA and molecular probes

**Week 10:** Modern techniques for biomolecules and disease diagnosis

**Week 11:** Structures and chemistry of sugars and carbohydrates

**Week 12:** Carbohydrate based polymers as biomolecular probes and therapeutics; conclusion