## **DNA Sequence and Structure**

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**Lesson Overview**:

This lesson reviews DNA sequences and the structures they make.

**ASBMB Learning Objectives**

(<https://www.asbmb.org/education/core-concept-teaching-strategies/foundational-concepts/structure-function>)

1. Biological macromolecules are large and complex

* Students should be able to describe the **basic units of the macromolecules** and the **types of linkages** between them *(Introductory)*.

2. Structure is determined by several factors

* Students should be able to discuss the **chemical and physical relationships between composition and structure of macromolecules** *(Introductory)*.
* Students should be able to **compare and contrast the primary, secondary, tertiary and quaternary structures** of proteins and nucleic acids *(Upper)*.
* Students should be able to use various **bioinformatics approaches to analyze macromolecular primary sequence and structure** *(Upper)*.

1. Explore the structure of the DNA in PDB ID [1BNA](https://www.rcsb.org/structure/1bna) and answer the following questions:
   1. How many nucleic acid chains are present in this structure? List their chain identifiers.
   2. How many nucleotides are present in each nucleic acid polymer (chain)?
   3. What is the sequence of the DNA in this structure? Mark which end is 5’ and which is 3’ in this sequence.
   4. The nucleic acid molecule name is listed as follows: DNA(5'-D(\*CP\*GP\*CP\*GP\*AP\*AP\*TP\*TP\*CP\*GP\*CP\*G)-3'). What does the P\* represent in this name?
   5. Visualize this structure using Mol\* (<https://www.rcsb.org/3d-view/1BNA>). What is the handedness of the double helical structure of this sequence? Can you identify the DNA conformation (A, B, or Z-DNA)

1. Explore the structure of the DNA in PDB ID [9DNA](https://www.rcsb.org/structure/9DNA) and answer the following questions:
   1. How many nucleic acid chains are present in this structure? List their chain identifiers.
   2. How many nucleotides are present in each nucleic acid polymer (chain)?
   3. What is the sequence of the DNA in this structure? Is there anything unique about this sequence? Explain.
   4. Visualize this structure using Mol\* (<https://www.rcsb.org/3d-view/9DNA>). What is the handedness of the double helical structure of this sequence? Can you identify the DNA conformation (A, B, or Z-DNA)
2. Explore the structure of the DNA in PDB ID [417D](https://www.rcsb.org/structure/417D) and answer the following questions:
   1. How many nucleic acid chains are present in this structure? List their chain identifiers.
   2. How many nucleotides are present in each nucleic acid polymer (chain)?
   3. What is the sequence of the DNA in this structure? Is there anything unique about this sequence? Explain.
   4. Visualize this structure using Mol\* (<https://www.rcsb.org/3d-view/417D>). What is the handedness of the double helical structure of this sequence? Can you identify the DNA conformation (A, B, or Z-DNA)