## **RNA Sequence and Structure**

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**Lesson Overview**:

This lesson reviews RNA 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 RNA in PDB ID [1csl](https://www.rcsb.org/structure/1CSL) 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 RNA in this structure? Mark which end is 5’ and which is 3’ in this sequence.
   4. Visualize this structure using Mol\* (<https://www.rcsb.org/3d-view/1CSL>). What is the handedness of the helical structure in this PDB entry? Identify the RNA conformation (A, or non-A RNA).
2. Explore the structure of the DNA in PDB ID [4tna](https://www.rcsb.org/structure/4TNA) 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 the nucleic acid polymer chain(s)?
   3. What is the name of this NA polymer?

* 1. What is the sequence of the RNA in this structure? Is there anything unique about this sequence? Explain.

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* 1. Visualize this structure using Mol\* (<https://www.rcsb.org/3d-view/4TNA>). What is the handedness of the double helical parts of this structure?
  2. List the (5’) and the (3’) nucleotide in the tRNA molecule in this structure?
  3. List any two pairs of nucleotides in the tRNA molecule that form traditional Watson-Crick base pairs?
  4. In the modified monomer track shown in the 1D view locate the two consecutive modified nucleotides (H2U) at position 16 and 17. What is the chemical name of this modified nucleotide ([H2U](https://www.rcsb.org/ligand/H2U))? Save an image of this nucleotide and mark how this is different from its parent molecule U.
  5. In Mol\* click on the nucleotides 16 and describe the non-covalent interactions of the base. Save an image of the interactions and include it below.