Module 9 / Overview of DNA and RNA

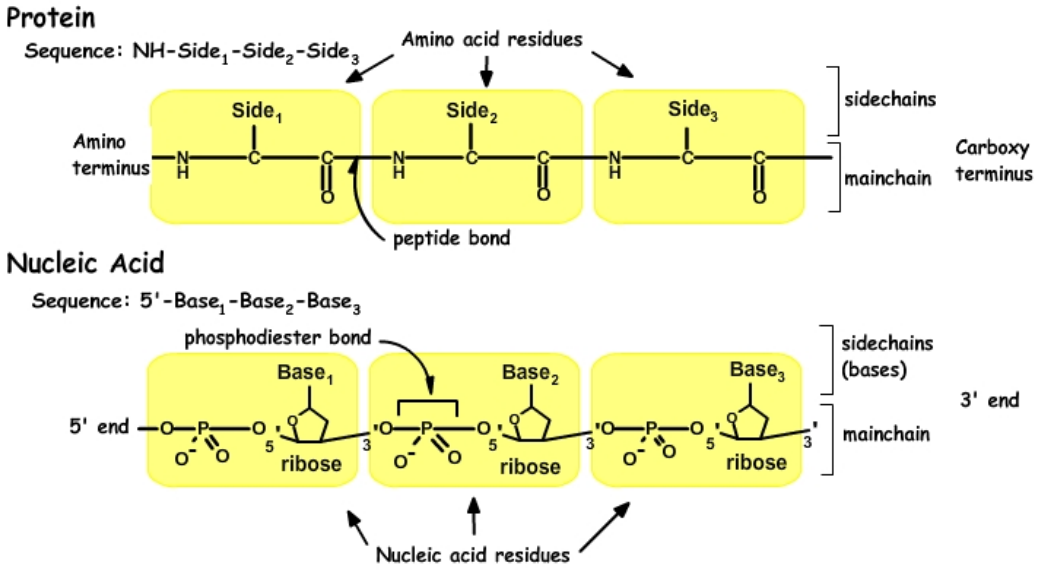


## The Role of DNA and RNA

This section begins our description of the structure and function of DNA and RNA. The ultimate tertiary structures of RNA and DNA are dependent on both the similarities and differences in the primary structure of each of the polymers.

Both DNA and RNA are linear polymers of building blocks. Each block contains a planer nucleotide base that is joined to a sugar, either a deoxyribose in the case of DNA or a ribose in the case of RNA. Each block is joined by a oxygen-phosphate-oxygen bridge. The alternating ribose-phosphate-ribose is referred to as the **backbone** of the nucleic acid polymer, in much the same way the N, alpha-Carbon, and carbonyl atoms in an amino acid form the backbone of a protein. Similarly, the nucleotide bases are analogous to the amino acid sidechains.

Protein and Nucleic Acid Structures




The main features of a protein (top) and a nucleic acid (bottom) polymer are illustrated. Both polymers contain repeating units (amino acids, ribo-bases) linked by bonds (peptide, phosphodiester) to give linear polymers. The mainchain atoms form the linear chain. The sidechains project off of the mainatoms, these are either amino acid sidechains (proteins) or bases (nucleic acids). There is also a defined direction to the chain. In the case of proteins the free amino terminus defines the beginning, and the sequence is simply the order of the amino acids, named here by their sidechains (side1-side2...). In the case of nucleic acids, the ribose has a 5' end and a 3' end. The 5' end is considered to be the beginning and the nucleic acid sequence is given as the order of the bases, beginning at the 5' end.

As with proteins, the bases in the nucleic acid can interact with each other to form complex structures. The most important type of interaction between the bases is hydrogen bonding. If bases on two strands have complimentary hydrogen bonding properties they can form a **basepair**. Double stranded DNA consists of two anti-parallel hydrogen bonded strands. RNA can also exist as an anti-parallel two stranded structure or it can assume more complicated structures, such as the tRNA molecule shown on the previous page. The detailed chemical structure of DNA and RNA will be explored in more detail in the following pages.