THE NUCLEIC ACIDS

Lipids, carbohydrates, and proteins, taken together with water, constitute about 99% of most living organisms.

The remaining 1% includes some compounds of vital importance to the existence, development, and reproduction of all forms of life. Among these are the nucleic acids. Nucleic acids carry the information that directs the metabolic activity of cells.

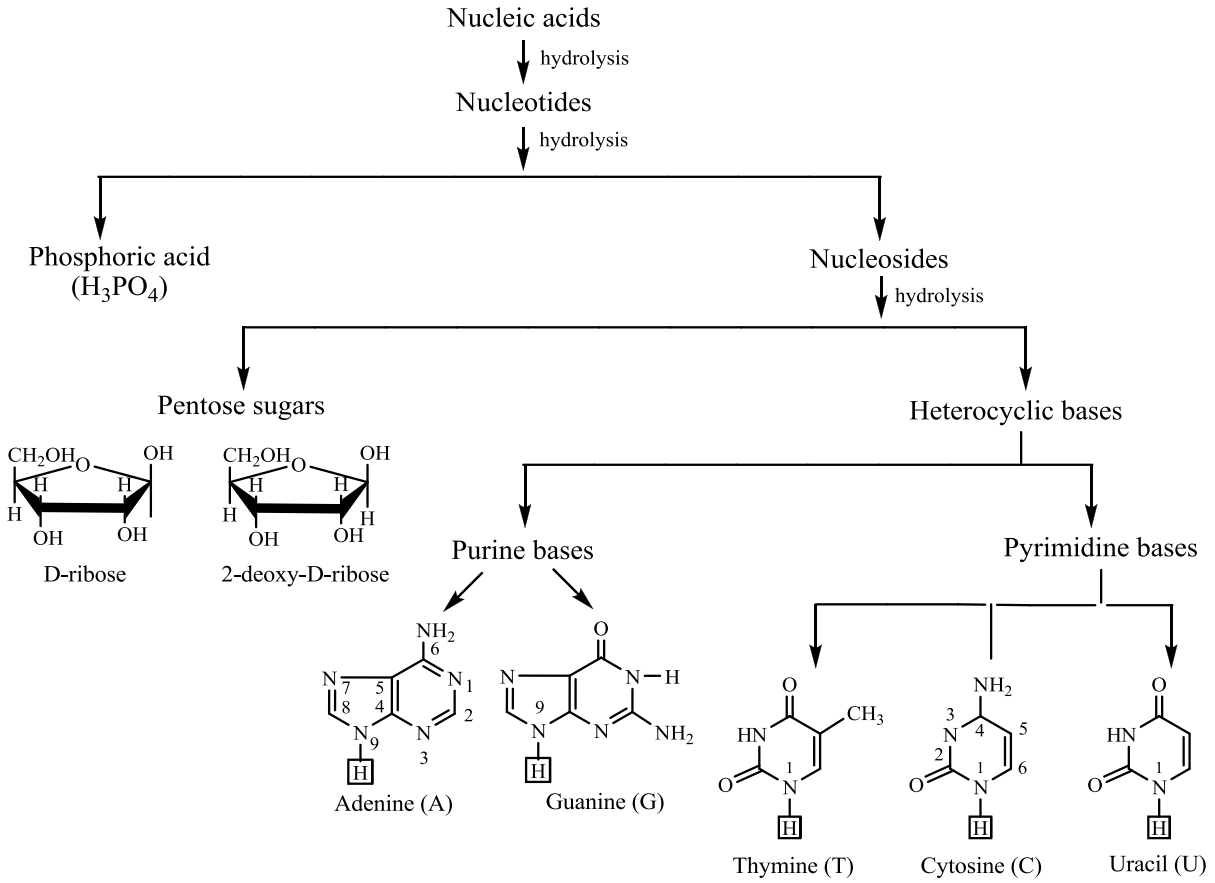
Nucleic acids are polymer of **nucleotides**.

A nucleoside, in combination with phosphoric acid, yields a **nucleotide**. A pentose sugar in combination with purine or pyrimidine base yields a **nucleoside**.

If the sugar is 2-deoxyribose and the bases adenine (A), guanine (G), thymine (T) and cytosine (C), the nucleic acid is DNA (deoxyribonucleic acid). If the sugar is ribose and the bases A, G, uracil (U) and C, the nucleic acid is RNA (ribonucleic acid).

Lipids are organic compounds that are found in living organisms and that are soluble in non polar solvents.

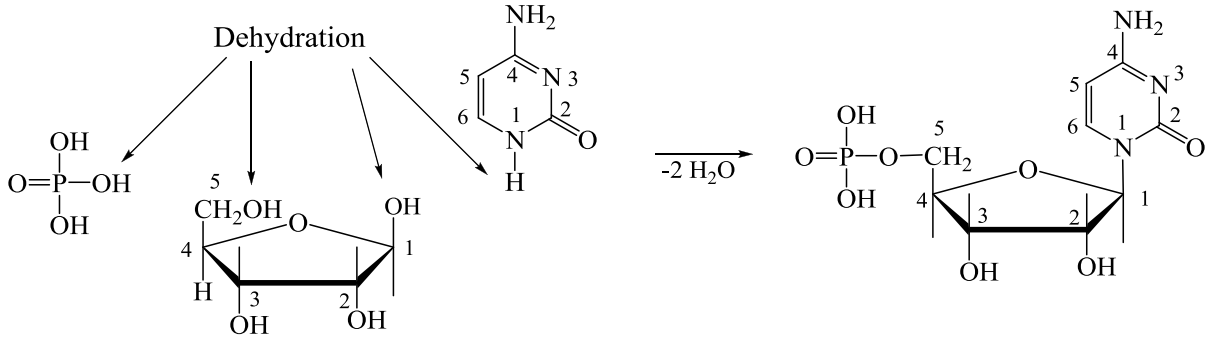
Hydrolysis products of nucleic acids



Each base is symbolized by the first letter of its name, C, T, U, A and G for cytosine, thymine, uracil, adenine, and guanine, respectively. (The N-H hydrogens used in synthesizing nucleotides are enclosed in boxes in Figure. These are the hydrogens at position – 1 of the pyrimidine ring and position – 9 of the purine ring).

A, G and C are used in synthesizing both DNA and RNA nucleotides. T is used only for DNA while U is used only for RNA.

Synthesis of a nucleotide from phosphoric acid, sugar, and base can be described as proceeding by two dehydrations, one between phosphoric acid and the sugar and the other between the sugar and the heterocyclic base. Synthesis of the ribonucleotide from phosphoric acid, ribose, and cytosine proceeds as follows:



cytidine monophosphate
or cytidylic acid (CMP)

Dehydration between phosphoric acid and sugar takes place at C-5 of the sugar. Dehydration between the sugar and the heterocyclic base takes place at C-1 of the sugar and an N-H bond of the heterocyclic base.

Formation of nucleic acids

Nucleic acids are polynucleotides. They are formed by the polymerization of nucleotides. The reaction involves dehydration between nucleotide molecules, specifically dehydration between the OH group at C-3 of one nucleotide molecule and phosphate group at C-5 of another nucleotide molecule.

The linkage joining one nucleotide residue to another is a **phosphodiester linkage**. Consider the reaction of UMP with CMP via dehydration between the OH group at C-3 of UMP and the phosphate group at C-5 of CMP to produce the dinucleotide UMP – CMP.