Tutorial 25: Nucleic Acids

Goals:

- ✓ To be able to describe the structure of nucleosides, nucleotides and nucleic acids.
- ✓ To understand the naming of nucleosides and nucleotides.
- ✓ To be able to describe complementary base pairing in the DNA double helix.

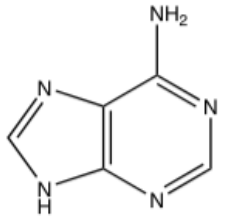
Nucleic Acids

- **Deoxyribonucleic acid (DNA)** is found in the nucleus of cells (except red blood cells). DNA contains genetic information in segments called genes. DNA is a “blueprint” for an organism.

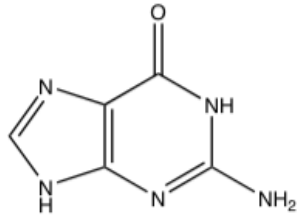
- **Ribonucleic acid (RNA)** is also found in cells other than red blood cells. It is responsible for transmitting and expressing the genetic information of DNA by translating it into proteins.

Nucleosides

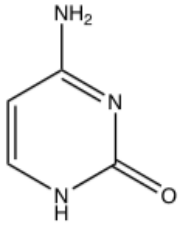
- **Nucleosides** are cyclic sugar units (ribose or deoxyribose) bound to a nitrogen containing base (either a pyrimidine or a purine) via a beta-N-glycosidic bond.



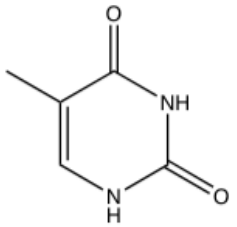
Adenine



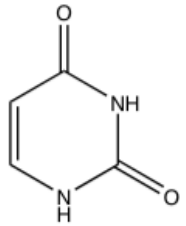
Guanine



Cytosine

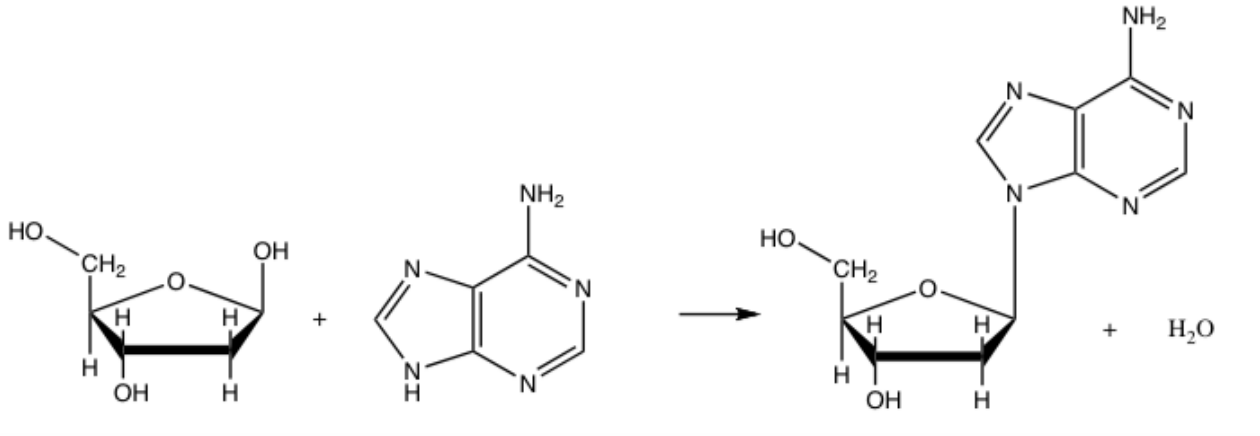


Thymine (DNA only)



Uracil (RNA only)

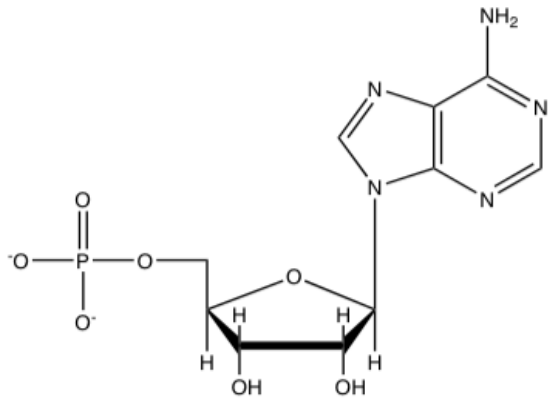
- **Naming nucleosides:**
  - Prefix deoxy- if sugar is deoxyribose
  - No prefix if sugar is ribose
  - Base name –ending, +osine (for purines)
  - Base name –ending, +idine (for pyrimidines)



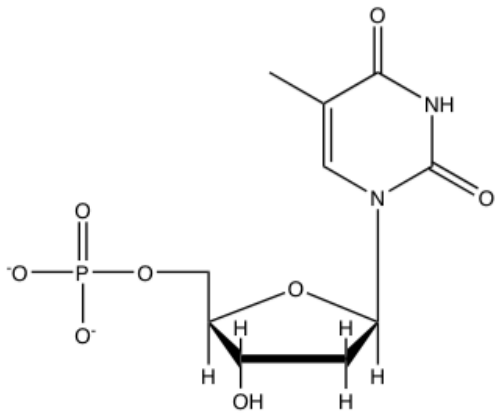
deoxyribose adenine deoxyadenosine (a nucleoside)

Nucleotides

- **Nucleotides** are nucleosides bound to a phosphate at the 5’ position via a phosphate ester linkage.



adenosine 5'-monophosphate (AMP)

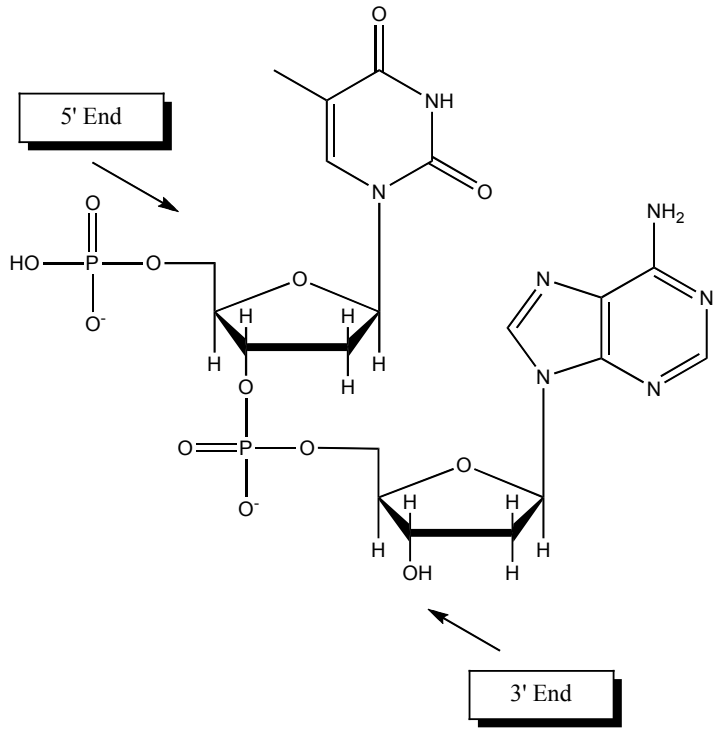


deoxythymidine 5'-monophosphate (dGMP)

- **Naming nucleotides:**
  - Name nucleoside and add 5’-monophosphate (or diphosphate or triphosphate)

Nucleic Acids

- In a **polynucleotides** the –OH off of C-3 of one nucleotide forms a phosphate diester linkage to the phosphate off of C-5 of another nucleotide. The free phosphate group is the 5' end, and the free –OH group is the 3' end.



- Just as the amino acid order is important in proteins, the order of the nucleotides in nucleic acids is significant; 3' TAG 5' is not the same as 3' GAT 5'!

DNA Double Helix

- DNA has 2 polynucleotide strands that are held together by hydrogen bonds. The two strands are coiled together to form a helical structure known as the double helix.

- The polynucleotide backbone is on the outside of the helix, and the bases are on the inside.

- Adenine is always opposite of thymine, and cytosine is always opposite of guanine. This is known as complementary base pairing, and it is fundamental to your understanding of replication, transcription and translation.