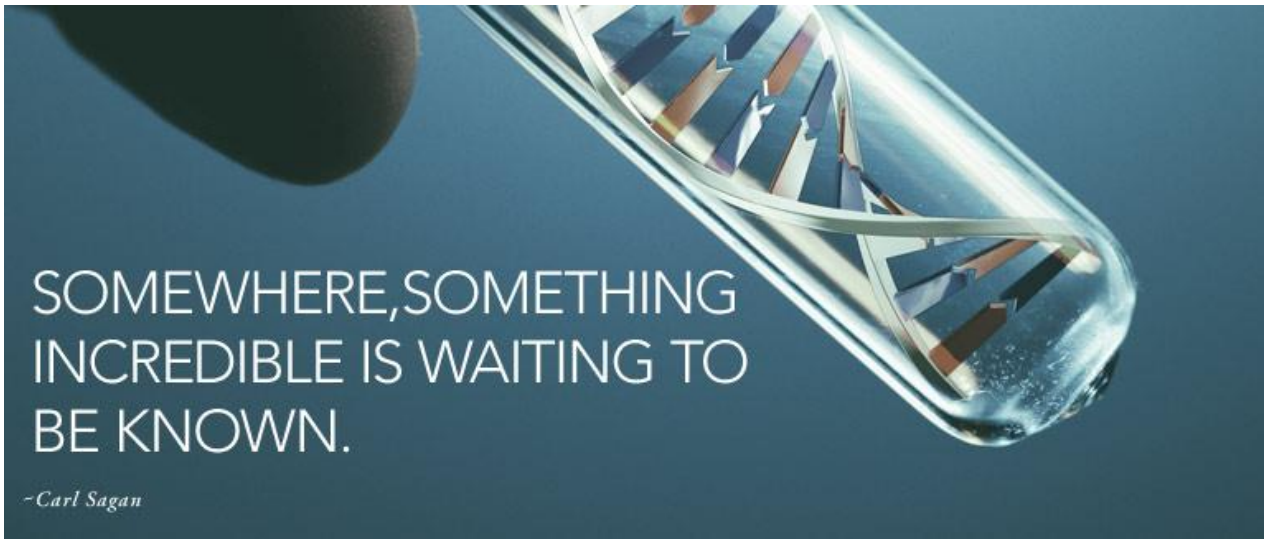
Molecular Biology 1

Lecture #3.



433 Biochemistry Team

- **Protein**

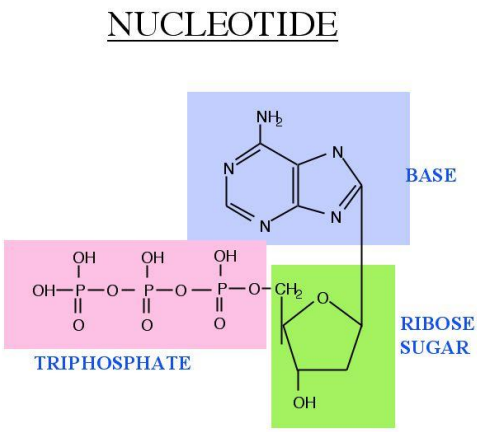
is synthesized by transcribed (copy) the information from DNA to Ribosomes via RNA.

- **What is the Nucleotides?**

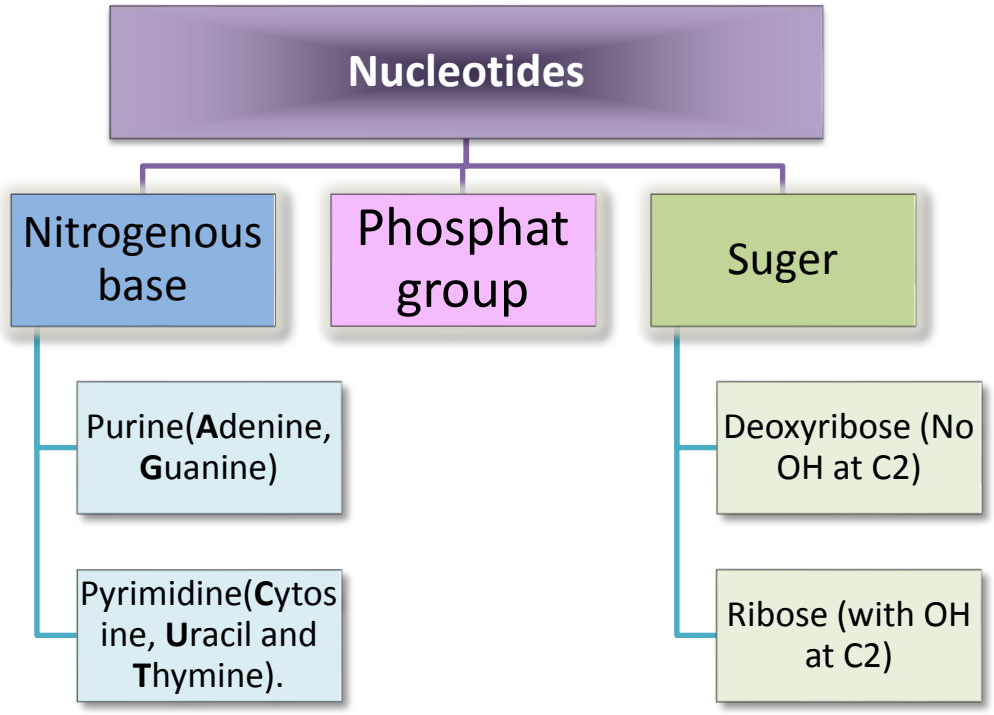
* Nucleotide is located in DNA and RNA. its function is to store and transfer genetic information.

* There are some nucleotides have metabolic function (ATP, NAD, FAD and CoA).

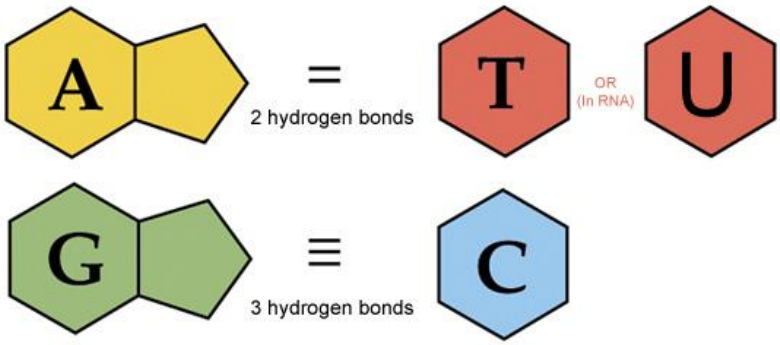
* In nucleic acids there are two types: DNA(Deoxyribonucleic acid) and RNA (Ribonucleic acid)



* Nucleotides are composed of a nitrogenous base, sugar, and phosphate group(s).



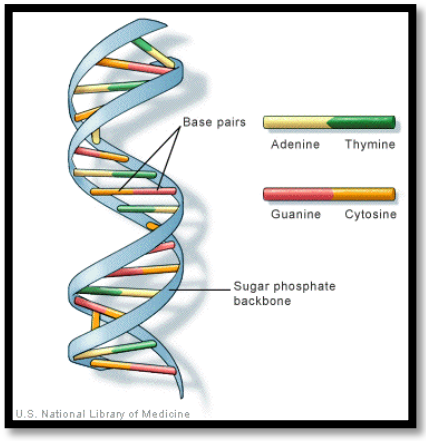
✓ Nitrogenous base: consists of two types: Purine (**A**denine, **G**uanine) and Pyrimidine (**C**ytosine, **U**racil and **T**hymine).



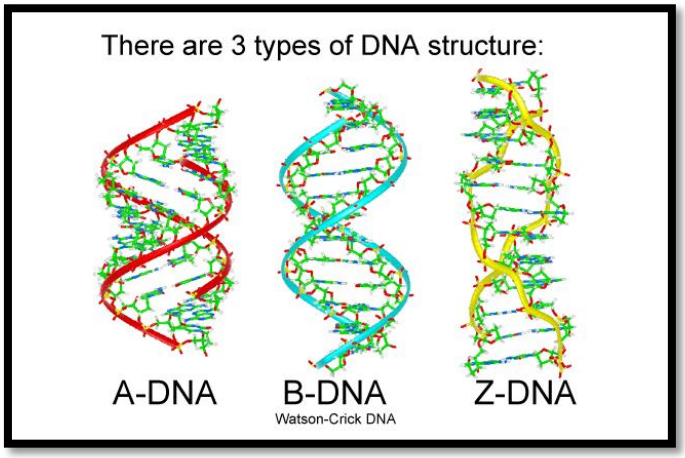
✓ Sugar: Ribose sugar is a pentose sugar (5 carbon ring).

- In Ribonucleotides, the sugar is ribose. But in deoxyribonucleotides the sugar is deoxyribose.
- Nitrogenous base is bounded to C1 of sugar.
- The phosphate group is bounded to C3 or C5 of sugar.

DNA structure: it is double helix strand of nucleotide. It was discovered by James Watson and Francis Crick in 1953. So, it is known as Watson-Crick structure.



Features of Watson-Crick DNA structure:

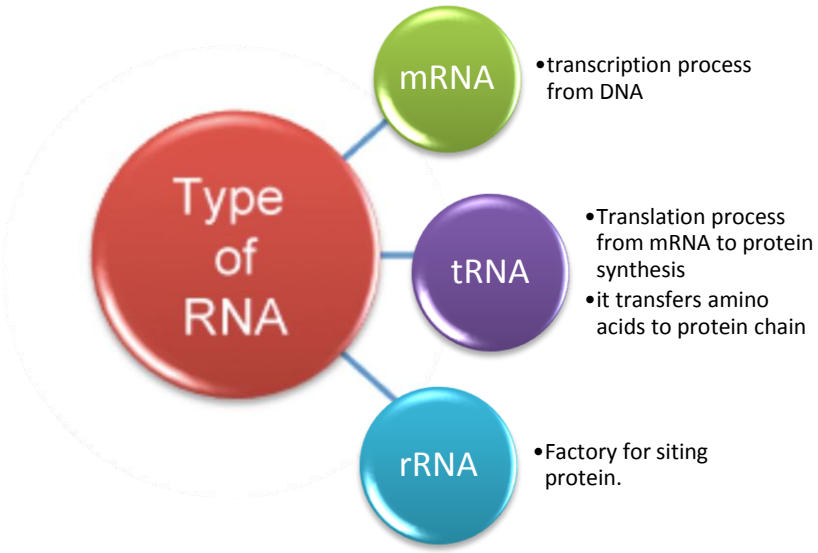


- Two polynucleotide chains wind around a common axis to form a double helix.
- The two strands are **anti-parallel** (run in opposite direction).
- Each strand is a right-handed helix.
- The nitrogenous bases are in the center of the double helix and the sugar-phosphate chains are on the sides.
- The surface of the double helix contains 2 grooves: the major and minor grooves.
- Each base is hydrogen bonded to a base in the opposite strand to form a planar base pair (A-T and G-C), known as complementary base pairing.
- The helix has 10 base pairs (bp) per turn.

DNA supercoiling: The chromosomes of many Bactria and viruses contain circular DNA which is supercoiled.

Melting Temperature (Tm): The temperature at which the double-stranded DNA is separated into two single strands. G-C has Tm higher than A-T because G-C has 3 hydrogen bonds.(A-T has just 2)

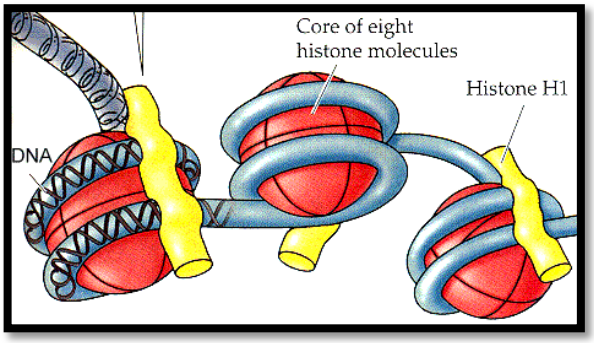
RNA: is a single-stranded polymer of ribonucleotides. There are 3 types of RNA: mRNA, tRNA and rRNA.



DNA STRUCTURE COMPARED TO RNA STRUCTURE

	DNA	RNA
Sugar	Deoxyribose	Ribose
Bases	Adenine, guanine, thymine, cytosine	Adenine, guanine, uracil, cytosine
Strands	Double-stranded with base pairing	Single-stranded
Helix	Yes	No

- The human genome contains 3.5 billion pairs and more than 95% is non-coding (no one has discovered what is its function).
- Histones are a family of basic proteins that associate with DNA in the nucleus and help condense (thicken) it into chromatin. Histones have positively charged amino acid (arginine and lysine). These positive charges bind to negatively charged of phosphate in DNA to stabilize the chromatin structure.



  - Chromatin is DNA associated with Histone.
  - A nucleosome is a section of DNA that is wrapped around a core of proteins. Inside the nucleus, DNA forms a complex with Histones called chromatin, which allows the DNA to be condensed into a smaller volume.
    - ✓ Nucleosome consists of the histone octamer (eight) and DNA. $(H2A)_2(H2B)_2(H3)_2(H4)_2$
    - ✓ H1 binds to linker DNA between the nucleosomes.
    - ✓ It holds 2 complete helical turns of DNA around each nucleosome.

MCQs:

1. ATP and NAD considered as kind of nucleotides :
   a) True
   b) False
2. The bound between Nitrogenous bases are:
   a) Covalent bond
   b) Ionic bound
   c) Hydrogen bound
3. Nitrogen bases bind to:
   a) C1
   b) C3
   c) C5
4. Phosphate groups bind to
   a) C1
   b) C3
   c) C5
5. The helix has ____ base pairs (bp) per turn.
   a) 5
   b) 10
   c) 3
6. rRNA
   a) synthesis protein
   b) transfer amino acid to protein synthesis
   c) transcription DNA

1)A. 2)C. 3)A. 4)B&C. 5)B. 6)A

Some extra link:

- Nucleic acid in general.

- What is DNA?

- RNA interference: