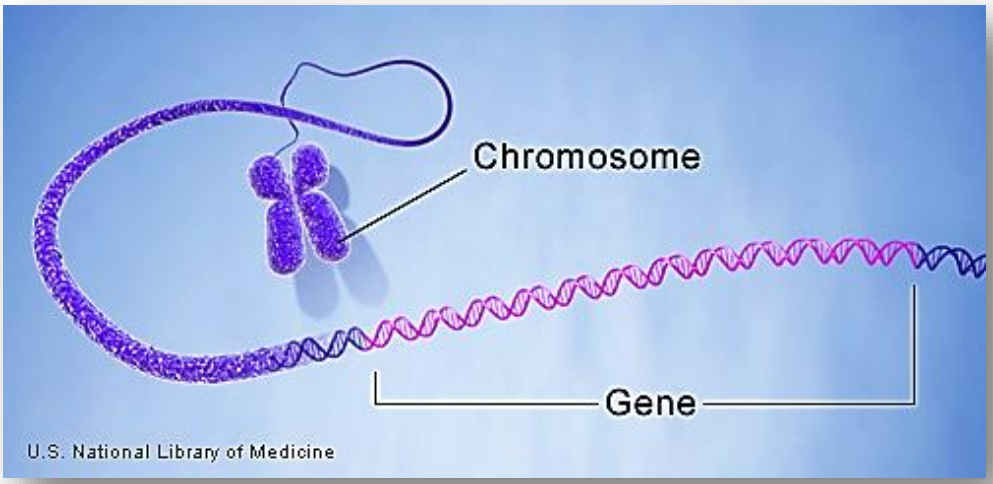
Gene and Gene action

- A gene is the basic physical and functional unit of heredity, a linear sequence of nucleotides along a segment of DNA that provides the coded instructions for synthesis of RNA, which, when translated into protein, leads to the expression of hereditary character.
- Every person has two copies of each gene, one inherited from each parent.
- In humans, genes vary in size from a few hundred DNA bases to more than 2 million bases. The Human Genome Project has estimated that humans have between 20,000 and 25,000 genes.
- Gene action refers to the way in which certain genes exert their effects on the body.



- There are three broad types of gene actions:

(1) Additive gene action

(2) Dominance gene action

(3) Epistatic gene action

The structure of DNA & RNA

- Genetic material of living organisms is either DNA or RNA.

  DNA – **Deoxyribonucleic acid**

  RNA – **Ribonucleic acid**

- Both DNA and RNA are Long molecule made up of units called **nucleotides**.
- DNA is made of **two polynucleotide** strands.
- RNA is made of **a single polynucleotide** strand.
- Each nucleotide is made up of **three basic components**:

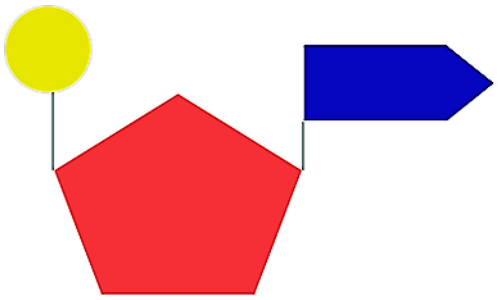
1. **Sugar:** This is a 5-carbon pentose sugar. The sugar in DNA is deoxyribose while the sugar in RNA is ribose.

2. **Phosphate group:** Phosphate groups are important because they link the sugar on one nucleotide onto the phosphate of the next nucleotide to make a polynucleotide.

3. **Nitrogenous base:**

◆ In **DNA** the four bases are:

- Thymine (T)
- Adenine (A)
- Cytosine (C)
- Guanine (G)



◆ In **RNA** the four bases are:

- Uracil (U)
- Adenine (A)
- Cytosine (C)
- Guanine (G)

➢ The Nitrogenous Bases pair up with other bases. For example, the bases of one strand of DNA base pair with the bases on the opposite strand of the DNA.

Adenine always base pairs with Thymine (or Uracil if RNA)

Cytosine always base pairs with Guanine.

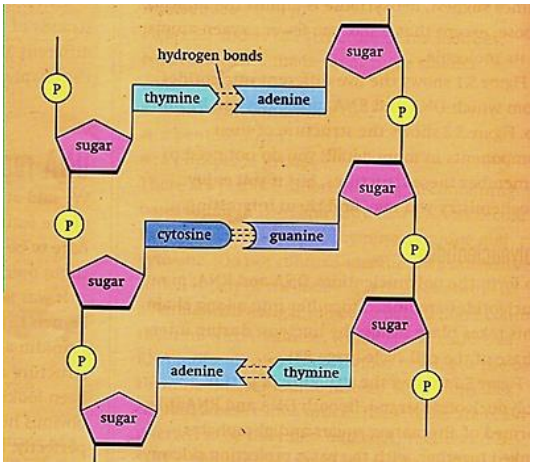
4. Hydrogen bonds:

- Hydrogen bonds can form between certain nitrogenous bases and provide just enough force to hold the two strands together.

- H-bonds form only between given pairs A-T and C-G.

- Two between A and T (A = T).

- Three between G and C (G ≡ C).



Comparison between DNA & RNA

DNA	RNA
Is double stranded	Is a single stranded
Contains the pentose sugar deoxyribose	Contains the pentose sugar ribose
Has the base Thymine (T) but not Uracil (U)	Has U but not T.
Is very long (billions of bases)	Is smaller (hundreds to thousands of bases)
Is self-replicating	Is copied from the DNA so it is not self-replicating