



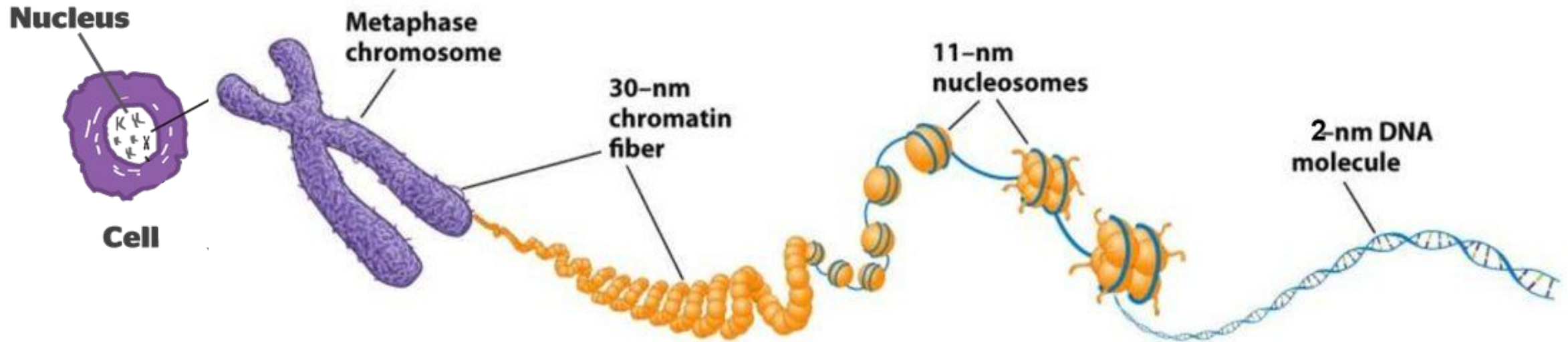
**STRUCTURE AND FUNCTION OF CHROMOSOMES  
&  
CONCEPT OF GENE**

# WHAT IS A CHROMOSOME?

Greek words "*chroma*" meaning color and "*soma*" meaning body

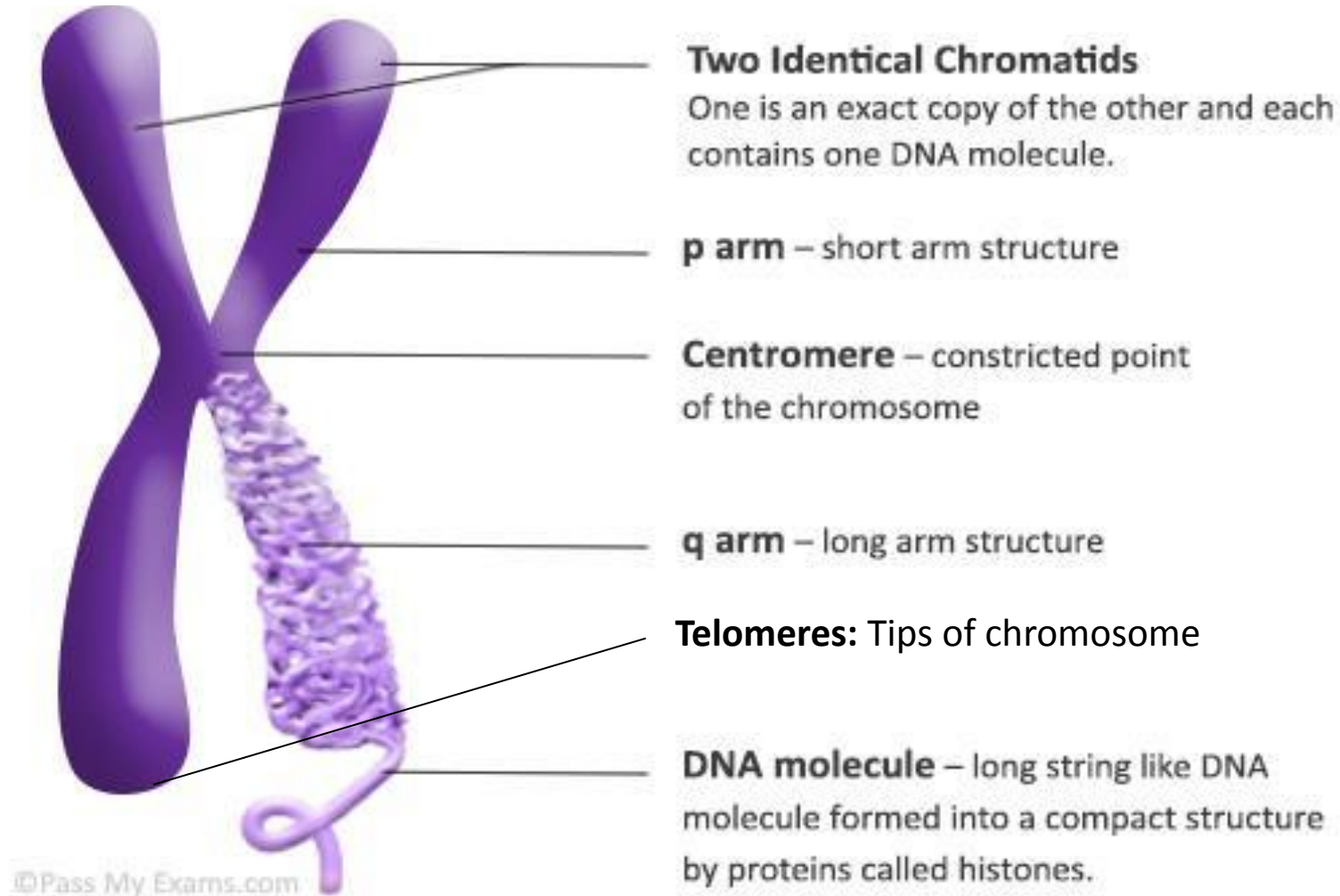
- Chromosomes are structures that contain genetic material.
- They are complexes of DNA and proteins.
- In **prokaryotes**, DNA is organised into a **single circular** chromosome that resides in **nucleoid**.
- In **eukaryotes**, DNA is divided into **multiple linear** chromosomes that are located inside the **nucleus** (of both animal and plant cells).

# What is inside the chromosomes.....



- 2-nm double-stranded DNA molecule
- 11-nm nucleosomes
- 30-nm chromatin fiber

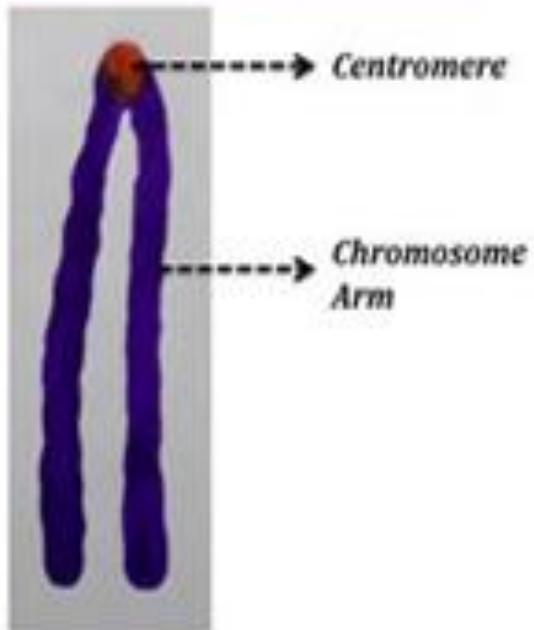
# STRUCTURE OF A CHROMOSOME



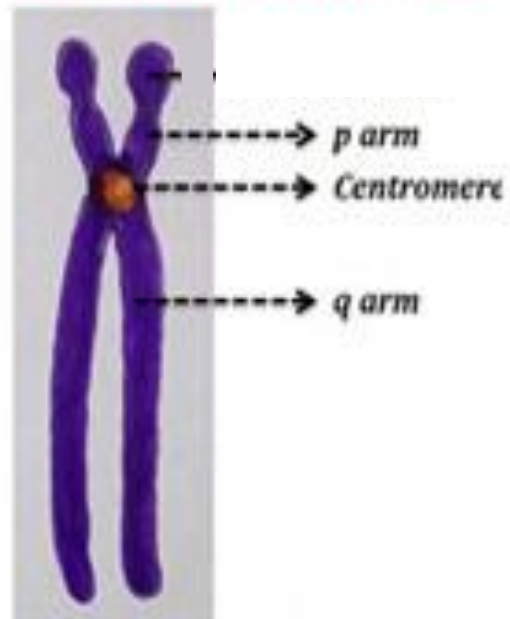
# TYPES OF CHROMOSOMES

## BASED ON THE POSITION OF CENTROMERE

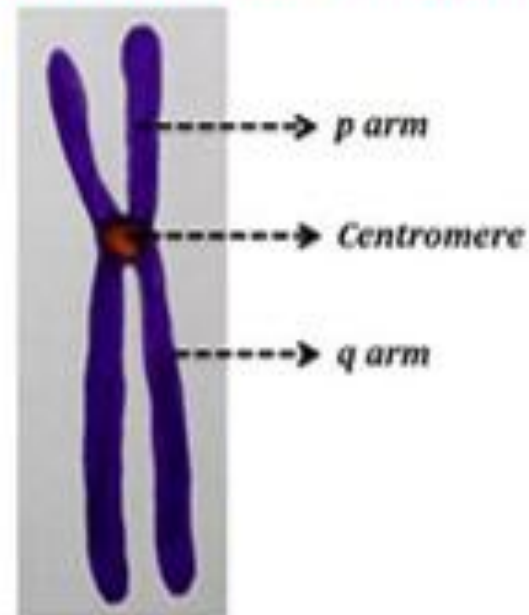
**Telocentric Chromosome**



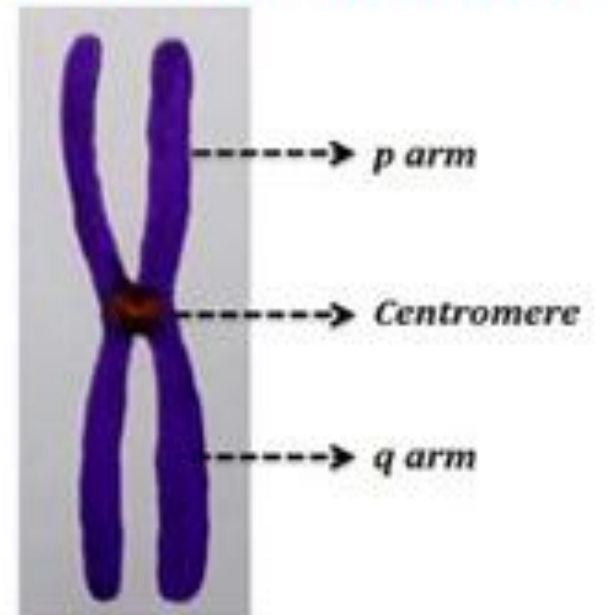
**Acrocentric Chromosome**



**Sub-metacentric Chromosome**



**Metacentric Chromosome**



**There are no telocentric human chromosomes. The Y chromosome contains a short p-arm and can be defined as acrocentric.**

# AUTOSOMES & ALLOSOMES

Human and animal chromosomes are categorized as **autosomes** or **sex chromosomes**.

**Sex Chromosomes** determine an organism's sex.  
All of the others are called **autosomes**

Typical human male

44 autosomes,  
1 X sex chromosome  
1 Y sex chromosome

Typical human female

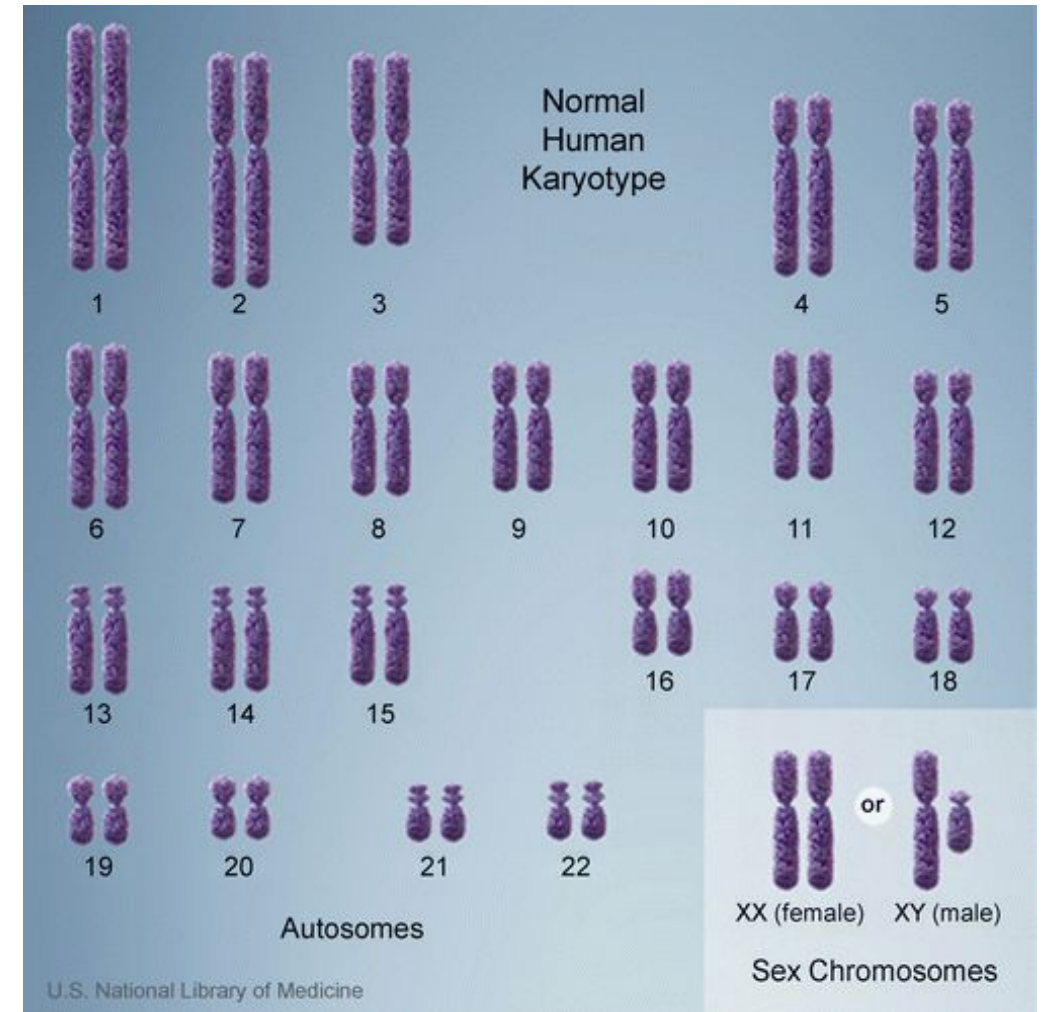
44 autosomes,  
2 X sex chromosomes

## DIFFERENCE BETWEEN AUTOSOMES & ALLOSOMES

| Autosomes   | Allosomes (Sex Chromosomes)                             |
|---|---|
| Chromosomes which are not connected with sex determination. | Chromosomes which are connected with sex determination. |
| Similar in males and females.                               | Dissimilar in males (XY) and female (XX).               |
| Generally 44 or 22 pairs in human beings.                   | Generally 2 or one pair in human beings.                |

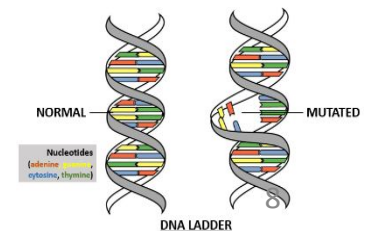
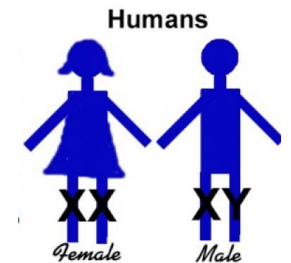
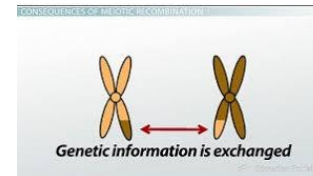
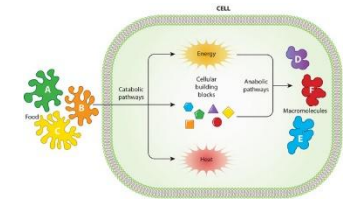
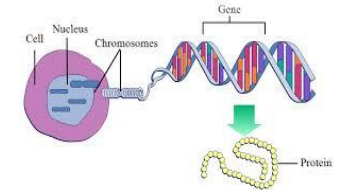
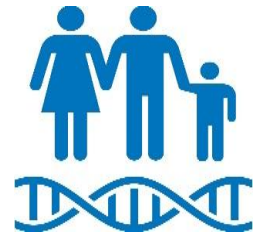
## Karyotype

- The picture of the chromosomes in their condensed form



# FUNCTIONS OF CHROMOSOMES

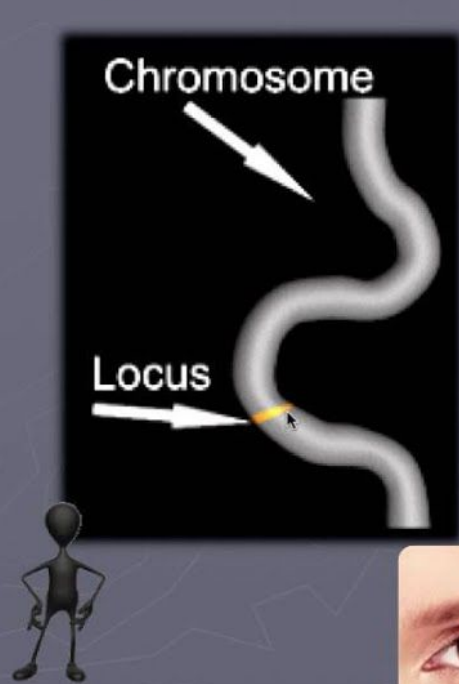
- Chromosomes contain genes and all the hereditary information is located in the genes.
- Chromosomes control the synthesis of structural proteins and thus help in cell division and growth.
- They control cellular differentiation.
- By directing the synthesis of particular enzymes, chromosomes control cell metabolism.
- Chromosomes form link between off springs and parents.
- Some chromosomes called as sex chromosomes determine the sex of the individuals.
- Through the process of crossing-over, chromosomes introduce variations.
- Mutations are produced due to changes in gene chemistry.



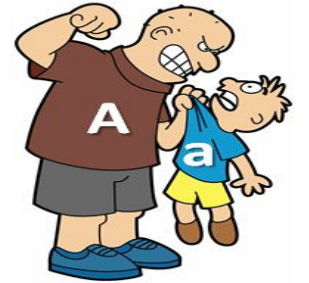


# GENES

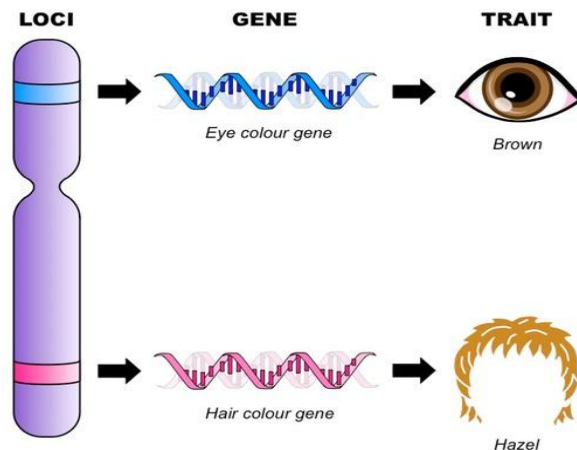
- ▶ Basic unit of **heredity**
- ▶ A **gene** is a segment of DNA on a chromosome that describes how to make a certain protein.
- ▶ Genes are located at a specific **locus** on the chromosome
- ▶ **Genome:** the whole of the genetic information of an organism



A = dominant  
a = recessive



The characteristic associated with a certain allele can sometimes be **dominant** or **recessive**



An individual's **phenotype** is determined by the combination of alleles they have.

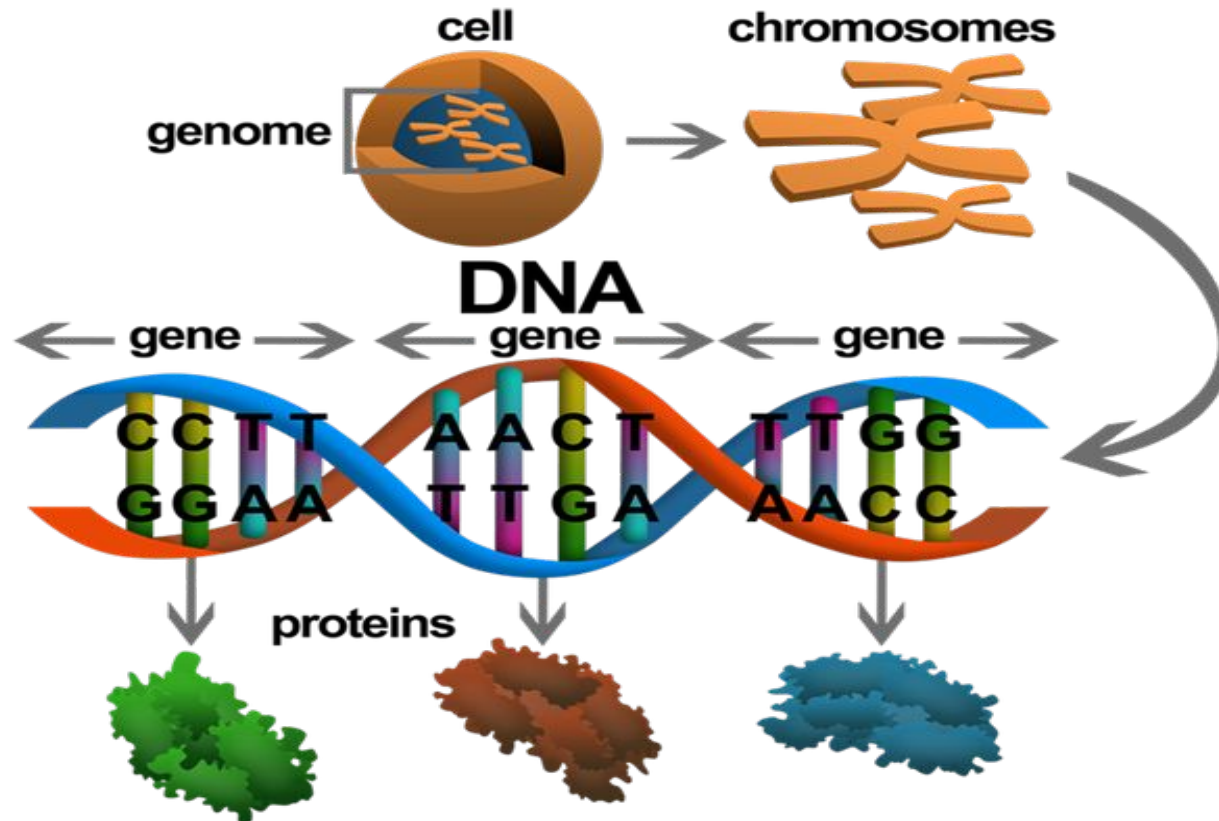


## PHENOTYPE

- Physical appearance of an individual.
- Observable or measurable traits.

# HOW DO GENES WORK ?

Each gene has a special job to do. The DNA in a gene spells out specific instructions—much like in a cookbook recipe — for making proteins



# PRACTICE QUESTIONS

## Short questions

- 1) State the difference between autosomes and allosomes.
- 2) Differentiate between gene and alleles.
- 3) How are dominant alleles different from recessive alleles?
- 4) State the significance of centromere in a chromosome
- 5) Justify the importance of telomeres in a chromosome
- 6) Name two chromosomes which have unequal arms.

## Long questions

- 1) Draw a well-labeled diagram of a chromosome and list its important functions.
- 2) Classify chromosomes based on the position of centromere.
- 3) Describe how DNA is packaged inside a cell.

**IMPORTANT DIAGRAMS** Slide 3, 4 and 5