

BIOTECHNOLOGY GALLERY

DECODING LIFE

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ABOUT THE GALLERY

The gallery introduces to cells, DNA, RNA- Science of genetics as well as provide an opportunity to explore the wonders and applications of biotechnology

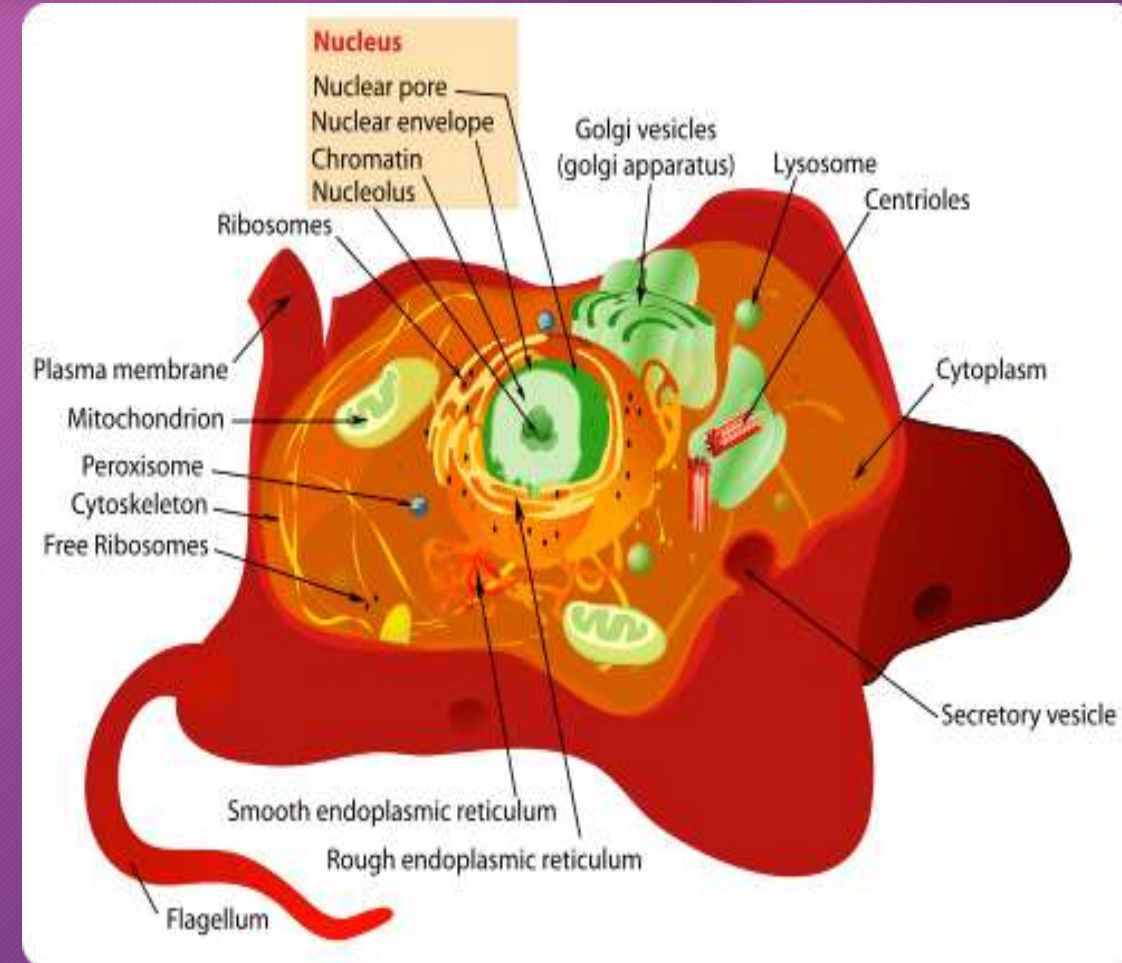
JOURNEY INTO THE CELL

- Exhibit demonstrates about different organelles of the cell.
- when one presses the button indicating a particular organelle, it glows up and the information about the same is also exhibited.
- An interactive exhibit.



JOURNEY INTO THE CELL (General Information)

- Cell is the basic structural and functional unit.
- Nucleus is brain of the cell and holds genetic material and coordinates the cell's activities.
- Two types of cells are Prokaryotic & Eukaryotic.
- Prokaryotic cells do not have membrane bound organelles.
- Eukaryotic cells have membrane bound organelles.



Cell



Tissue

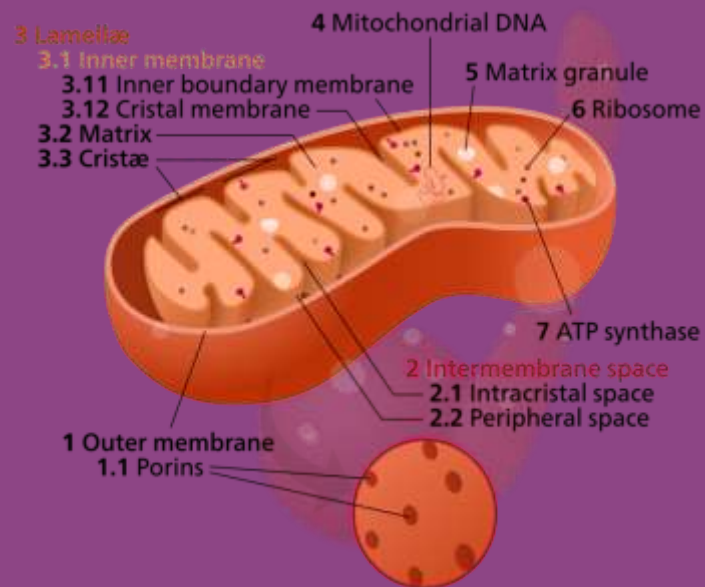


organ



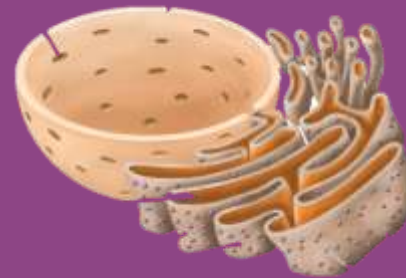
Organ
System

JOURNEY INTO THE CELL (Additional Information)

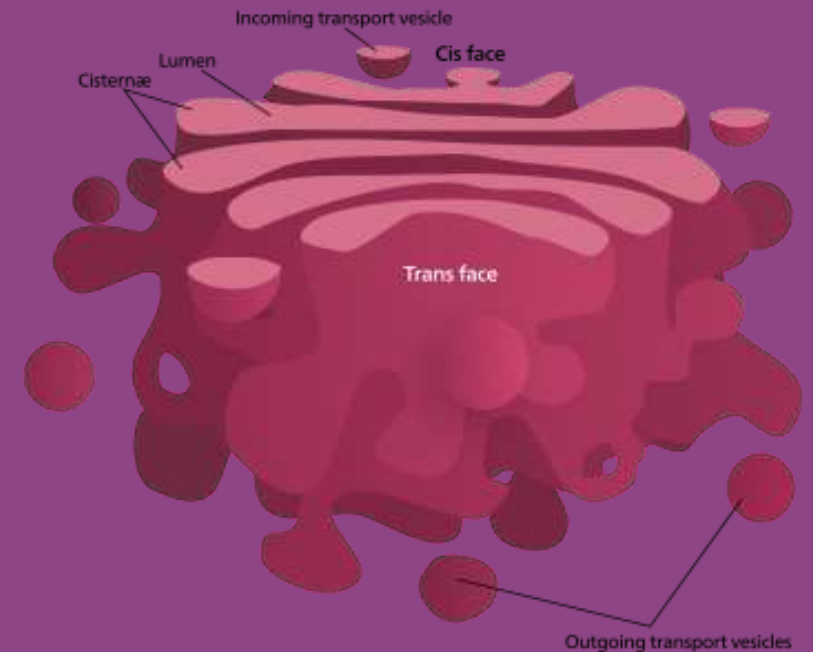


- Mitochondria: is known as power house of the cell and is responsible for cellular respiration.

- Plant cell and animal cell are Eukaryotic.
- Animal cell is different from plant cell because of absence of cell wall & chloroplast.
- Different organelles perform different functions.



- Endoplasmic reticulum plays an important role in the production, processing, and transport of proteins and lipids.



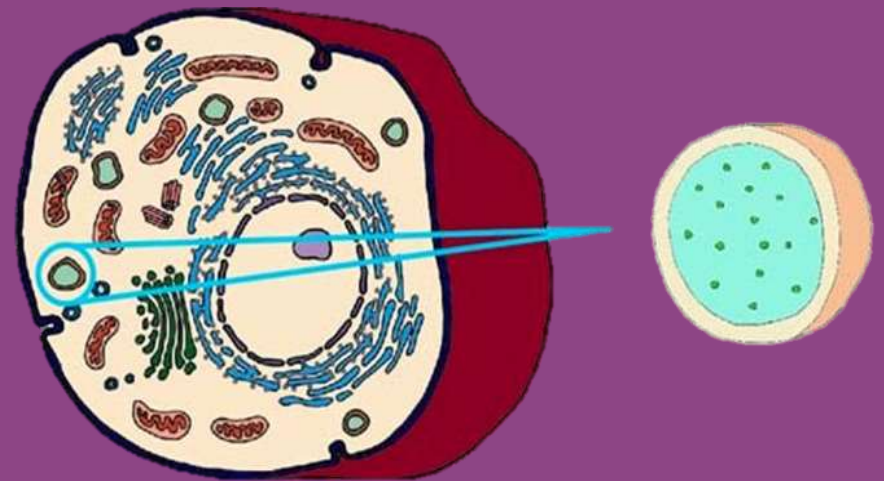
- Golgi apparatus (protein storage) modifies proteins & lipids.

JOURNEY INTO THE CELL (Additional Information)

- **Cytoplasm:** Fills out the space and gives shape to the cell. Keeps organelles in their place.
- **Centrioles:** are used through cell division.



Ribosomes: Aids in Protein synthesis.



Lysosomes: Breaks down waste in an animal cell.

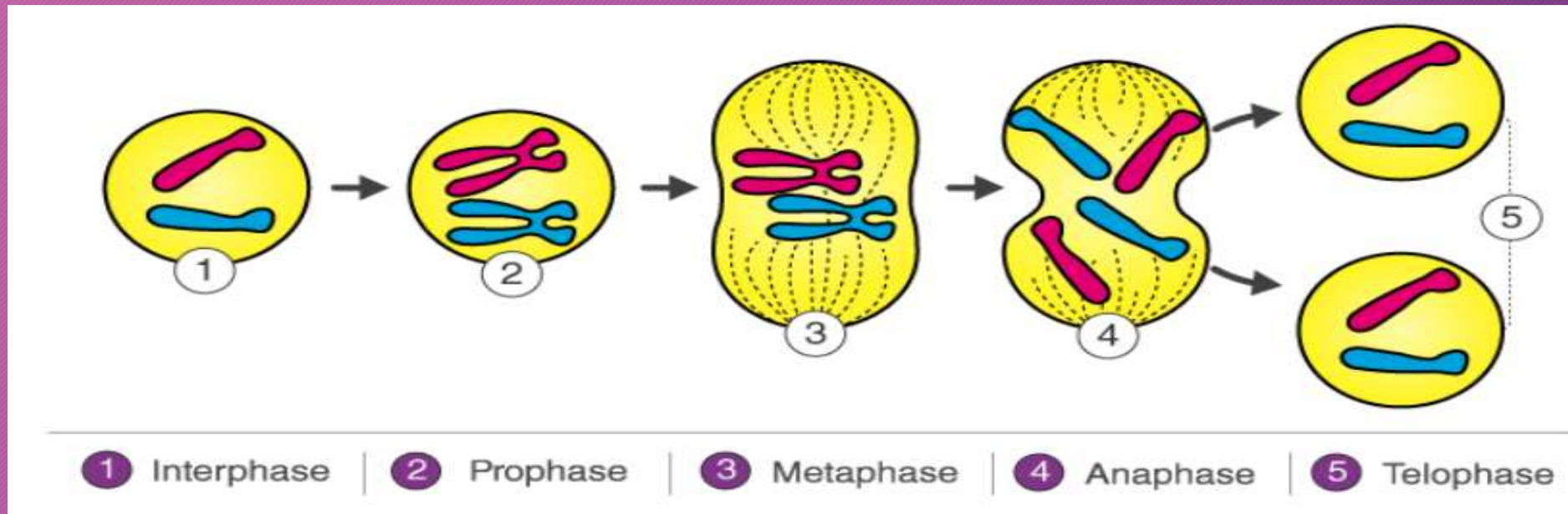
GROWTH PROCESS (General Information)

- The exhibit demonstrates the process of cell division.
- Cell division : Division of a cell into two daughter cells with the same genetic material.
- Types of cell division : Mitosis & Meiosis



GROWTH PROCESS- Cell Division (Additional Information)

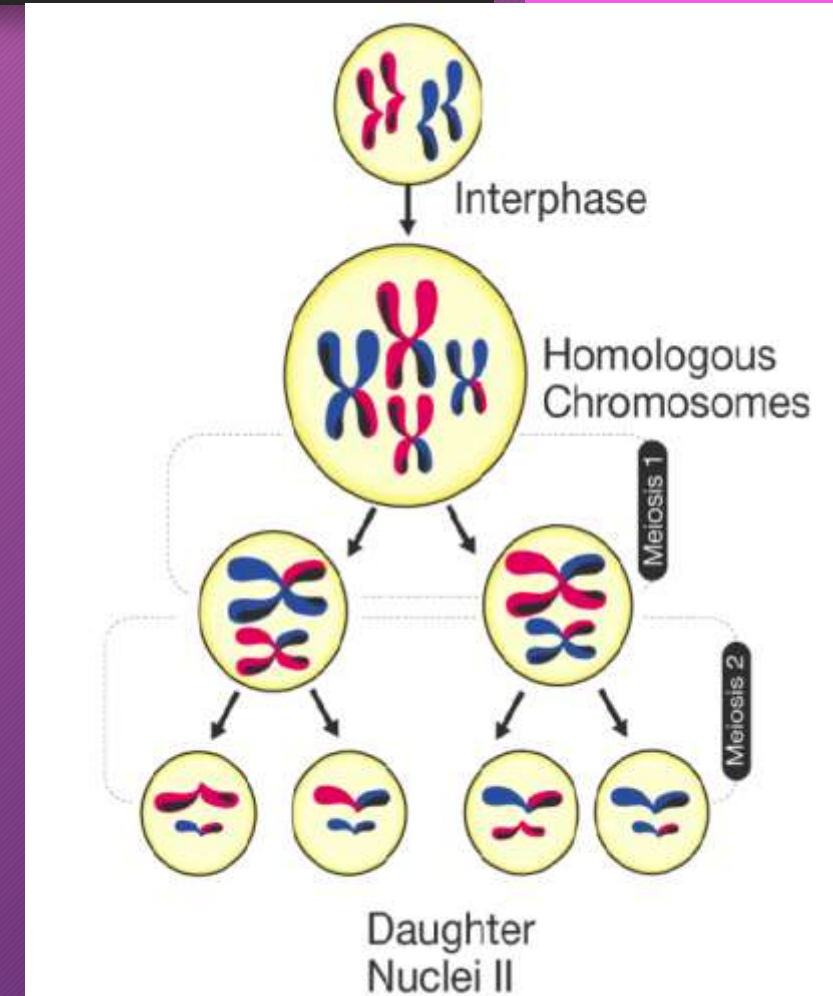
- Mitosis: is a process where a single cell divides into two identical daughter cells (equational division). It occurs in somatic cells.
- Five stages: prophase, prometaphase, metaphase, anaphase, and telophase.



Cont...

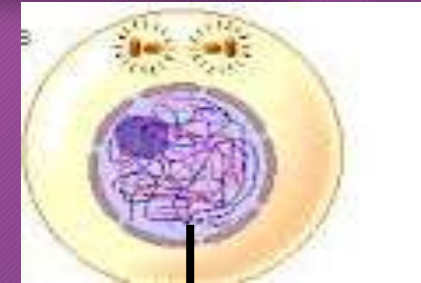
GROWTH PROCESS- Cell Division (Additional Information)

- Meiosis is a process where a single cell divides twice to produce four cells containing half the original amount of genetic information (reductional division). It occurs in germinal cells.
- Meiosis is divided into meiosis I and meiosis II which are further divided into Karyokinesis I & Cytokinesis I and Karyokinesis II & Cytokinesis II respectively.

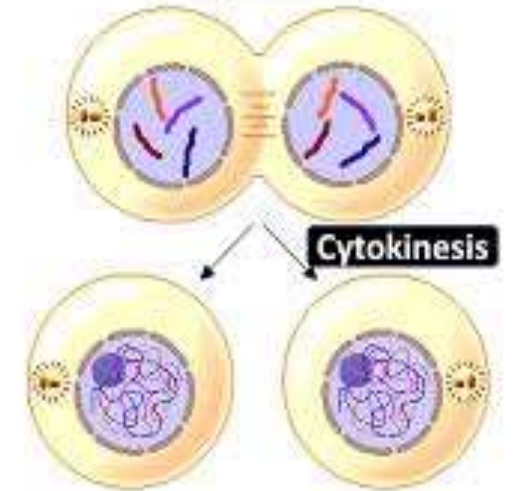


GROWTH PROCESS- Cell Division (Additional Information)

- The division of nucleus (that occurs in four stages as detailed in the previous slides) is called **Karyokinesis**.
- **Cytokinesis** is the division of cells after either mitosis or meiosis I and II. During **cytokinesis**, the cytoplasm (the liquid center of the cell that holds the organelles into place) splits into two equal halves, and the cell becomes two daughter cells.



Karyokinesis



CHROMOSOMAL SEQUENCE IN CELL

- The exhibit demonstrates identification of missing sets of chromosomes and arranging these in a particular sequence.
- An interactive exhibit

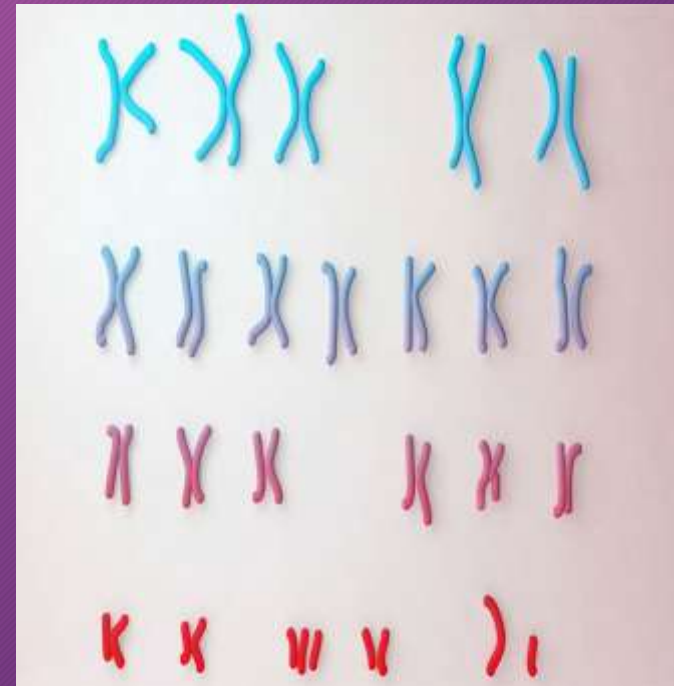


CHROMOSOMAL SEQUENCE IN CELL (General Information)

- Exhibit shows different types of chromosomes depending upon their size and shape.
- Human body has total 44 autosomes and 2 sex chromosomes.

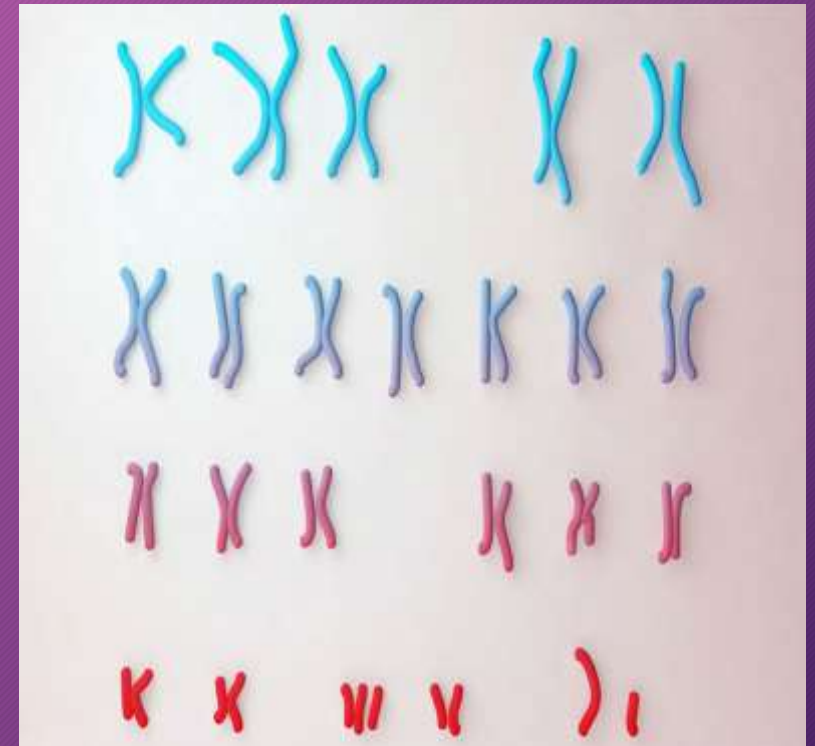
Interesting Facts

- The number of Chromosome pairs in each life form are different
- To date, the **organism with least number of chromosomes** is male Australian ant, *Myrmecia pilosula*, with one **chromosome** per cell (male ants are generally haploid—that is, they have half the **number of normal chromosomes** while the female ant has two **chromosomes** per cell).
- *Ophioglossum*, a fern, has the **highest chromosome**. It has 630 pairs of **chromosomes** or 1260 **chromosomes** per cell



CHROMOSOMAL SEQUENCE IN CELL (Additional Information)

- Karyotype is a test to identify and evaluate the size, shape, and number of chromosomes.
- Karyotyping is the process of pairing and ordering all the chromosomes of an organism.
- In humans Autosomes are numbered 1-22 in decreasing size order.
- Extra or missing chromosomes, or abnormal positions of chromosome pieces, can cause problems with a person's growth, development, and body functions.



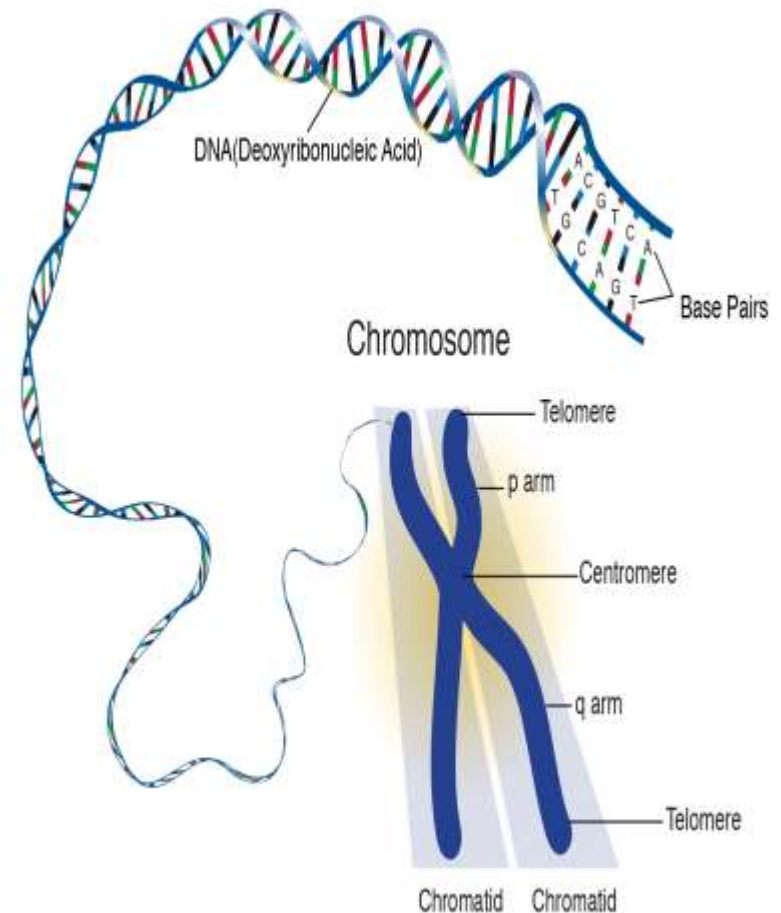
CHROMOSOME (General Information)

- Chromosomes are tiny structures inside cells made from DNA and protein.
- It is found in the nucleus of every cell
- Humans have 23 pairs of chromosomes (44 autosomes & 2 sex chromosomes).
- Humans have about 30,000 genes in their 46 chromosomes
- It carries hereditary information.e.g. eye color, height etc.



CHROMOSOME (Additional Information)

- Chromosomes are structures within cells that contain a person's genes
- Each chromosome is made up of DNA tightly coiled many times around proteins called histones that support its structure
- Different organisms have different numbers of chromosomes
- Sex Chromosomes determine whether one is Male or Female



THREADS OF LIFE

- The exhibit demonstrates about the genetic material
- DNA-Deoxyribonucleic acid
- RNA- Ribonucleic acid



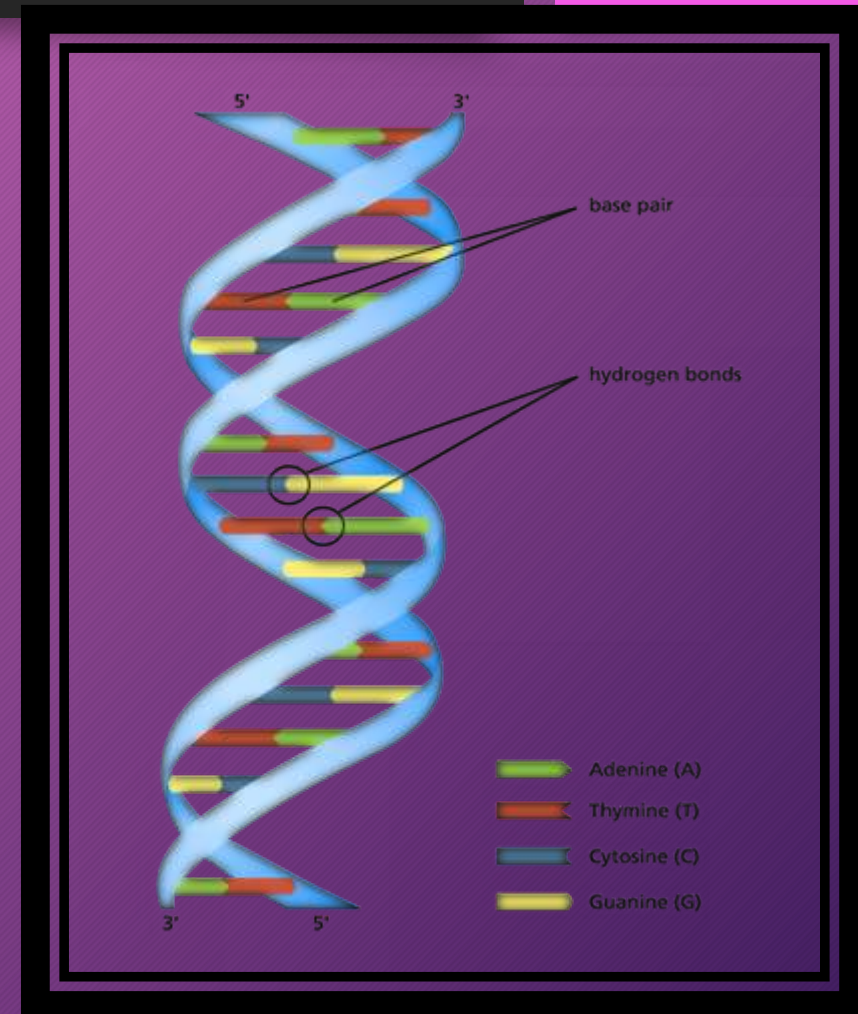
THREADS OF LIFE (General Information)

- DNA - Deoxyribonucleic Acid
- It is the genetic material of most of the living organisms.
- It is present in the Nucleus of cell
- It is a Double helix, twisted ladder Like structure
- DNA carries genetic information of an organism.



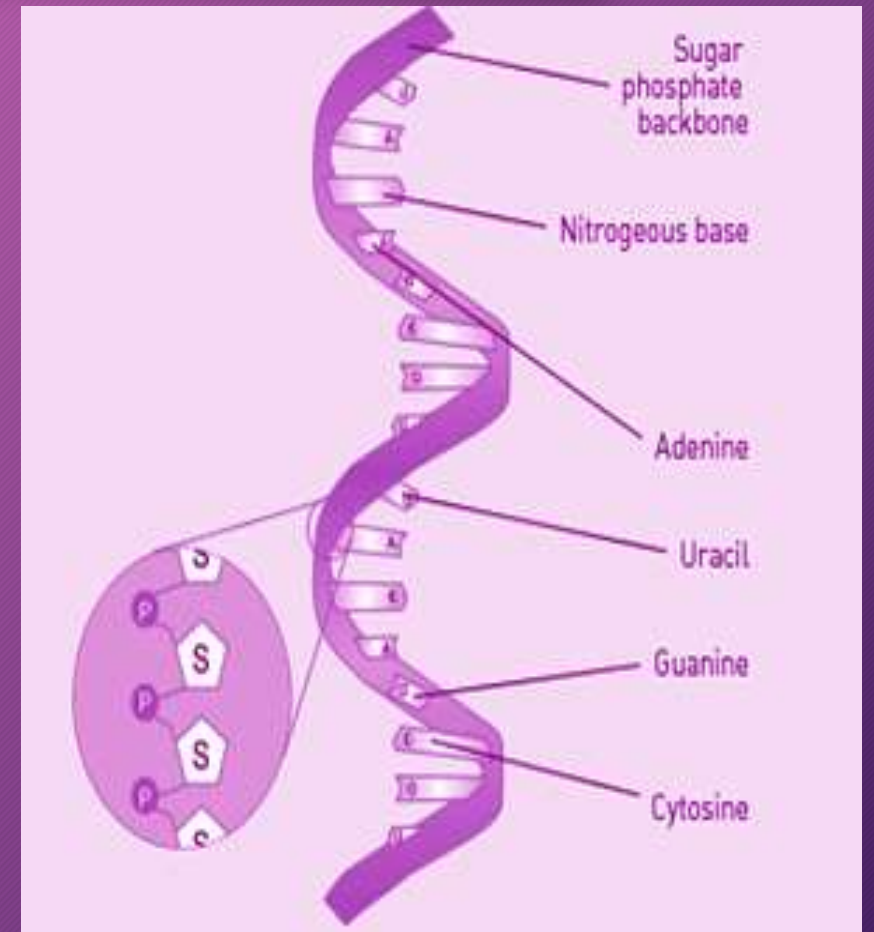
THREADS OF LIFE (Additional Information)

- DNA model is also known as Watson & Crick model
- Chemical composition- deoxyribose sugar, phosphate and nitrogenous base
- DNA has Purines- Adenine, Guanine and pyrimidines - Cytosine, Thymine.
- Adenine pairs with Cytosine & Guanine pairs with Thymine.
- Each strand of DNA has a beginning and an end, called 5' (five prime) and 3' (three prime) respectively.
- The two strands run in the opposite direction (antiparallel) to each other so that one runs 5' to 3' and one runs 3' to 5', they are called the sense strand and the antisense strand, respectively.



RIBONUCLEIC ACID (General Information)

- RNA- Ribonucleic Acid
- RNA is the genetic material in viruses and bacteria
- Unlike DNA it is single stranded
- It has ribose sugar instead of deoxyribose sugar



RIBONUCLEIC ACID (Additional Information)

- Nucleic acid-RNA is a genetic material that can be inherited from generation to the next.
- RNA is a single stranded and less stable as compared to the DNA.
- RNA is made up of 3 parts- ribose sugar, phosphate and nucleotide base
- The nucleotide bases that make up RNA are-Adenine, Cytosine, Guanine and Uracil in place of Thymine.
- RNA is a crucial element in making proteins from DNA.
- There are 3 types of RNA-
 1. Messenger RNA(mRNA)
 2. Transfer RNA (tRNA)
 3. Ribosomal RNA(rRNA)

**COVID 19 is a
RNA**

DNA REPLICATION (General Information)

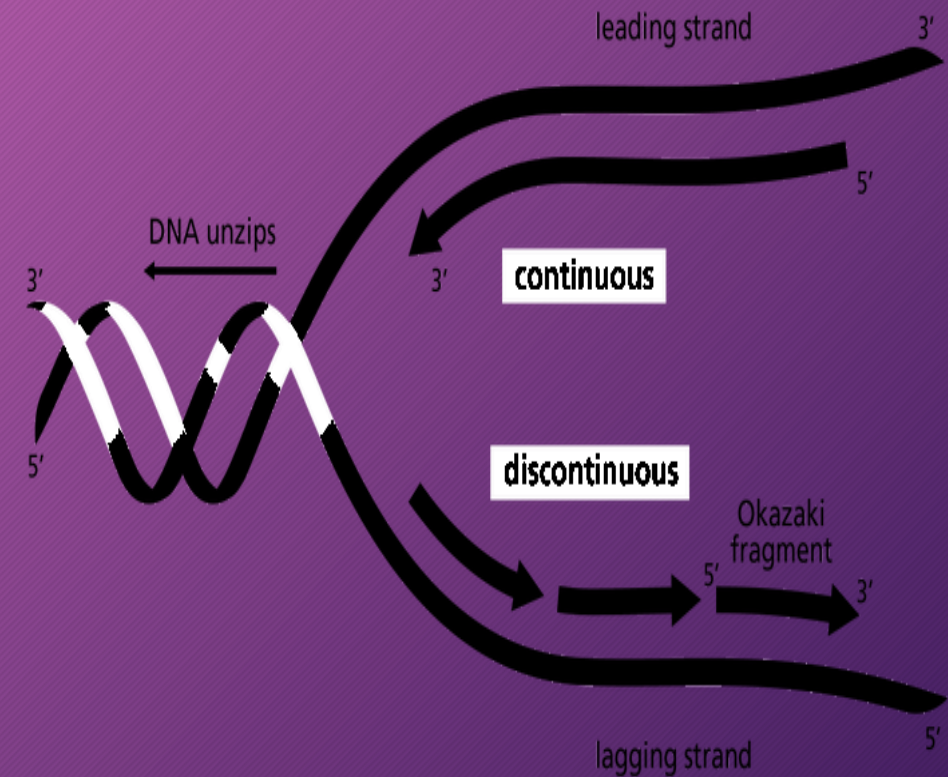
- DNA replication is the process by which DNA makes a copy of itself during cell division.



THREADS OF LIFE (Additional Information)

- Enzymes Involved in DNA Replication
 1. Helicase : Unwinds the DNA double helix
 2. Primase : Lays down RNA primers
 3. DNA polymerase III : Main DNA synthesis enzyme
 4. DNA polymerase I : Replaces RNA primers with DNA
 5. Ligase : Fills in the gaps

DNA replication fork



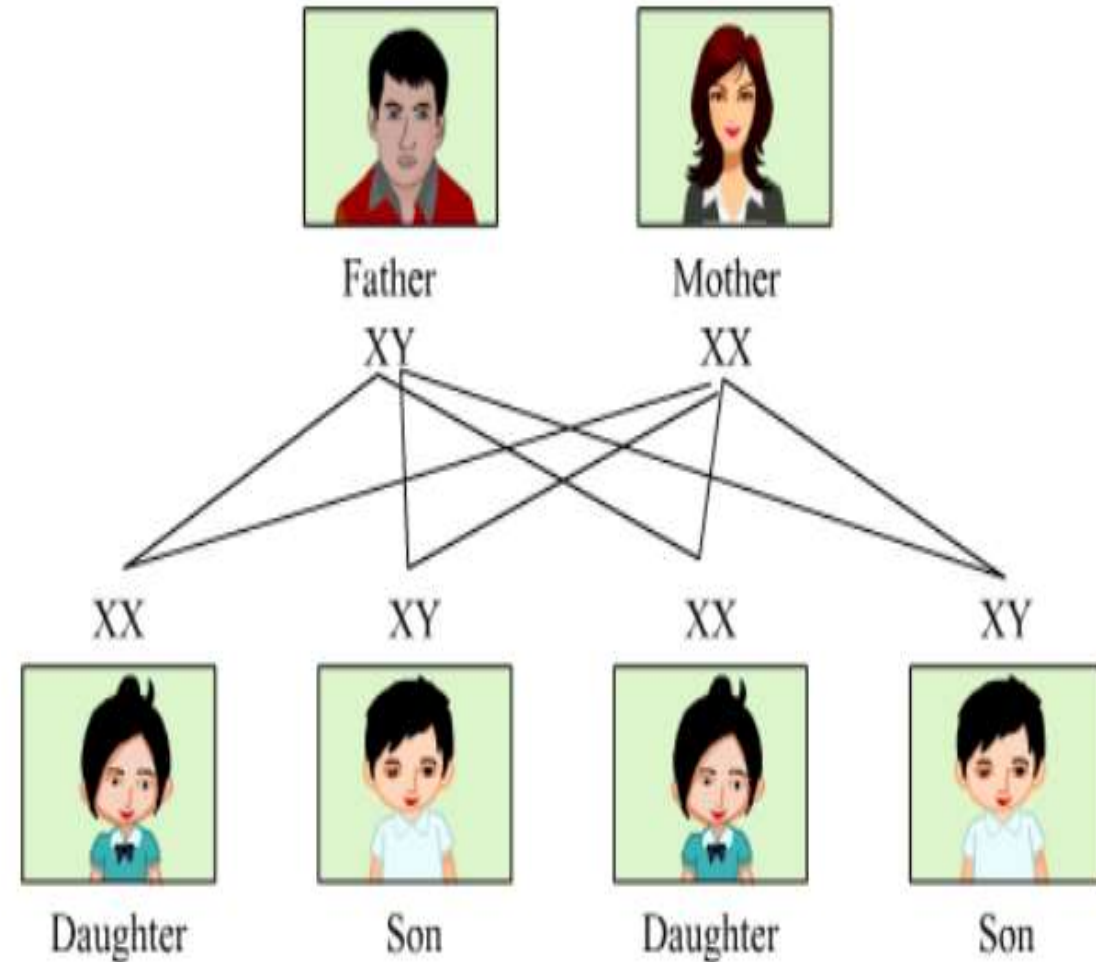
WHO IS RESPONSIBLE FOR THE SEX OF THE CHILD? (General Information)

- Exhibit demonstrates about the fact that father is responsible for sex of the child.
- Male has XY chromosomes.
- Female has XX chromosomes.



EXPLANATION ABOUT THE EXHIBIT (Additional Information)

- In humans and other mammals, biological sex is determined by a pair of sex chromosomes: XY in males and XX in females
- Male determine the sex of a baby depending on whether their sperm is carrying an X or Y chromosome.
- The Y chromosome carries factors responsible for triggering male development
- An X chromosome from father combines with the mother's X chromosome to make a baby girl (XX) and a Y chromosome will combine with the mother's to make a boy (XY).



AM I UNIQUE?

- An interactive exhibit.
- On pressing the buttons to select particular traits one can compare how unique he/she is.
- On completing the test the left display gives information about total number of persons who checked in and the right side display gives information about no of persons having checked in with similar traits.



AM I UNIQUE ? (General Information)

- Genetic inheritance is a basic principle of genetics and explains how characteristics are passed from one generation to the next.
- Exhibit demonstrates that we all are different from one another by some special characters such as colour of eyes, skin, hair etc. are inherited i.e. controlled by genes/alleles while others are due to environmental conditions.



AM I UNIQUE ? (Additional Information)

- There are four types of inheritance
 1. Complete dominance: when one allele - or “version” - of a gene completely masks another. For e.g. Eye color
 2. Incomplete dominance: when a **dominant** allele, or form of a gene, does not completely mask the effects of a recessive allele. For e.g. skin color, height
 3. Co-dominance: when both alleles at a gene locus are fully expressed in the phenotype. For e.g. Blood Group.
 4. Sex-linked: The transmission to successive generations of traits that are due to alleles at gene loci on a sex chromosome. For e.g. Colorblindness, Hemophilia

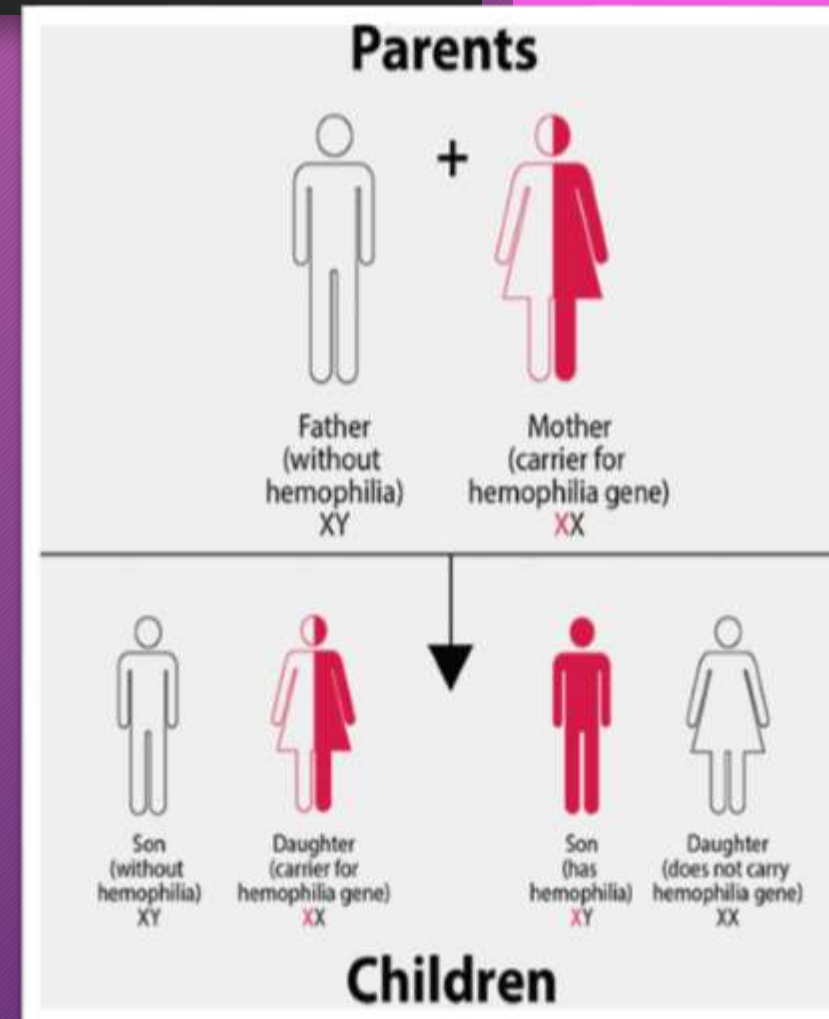
GENETIC DISORDERS (HAEMOPHILIA)

- Exhibit demonstrates how the disease is transferred from one generation to the next.
- An interactive exhibit.



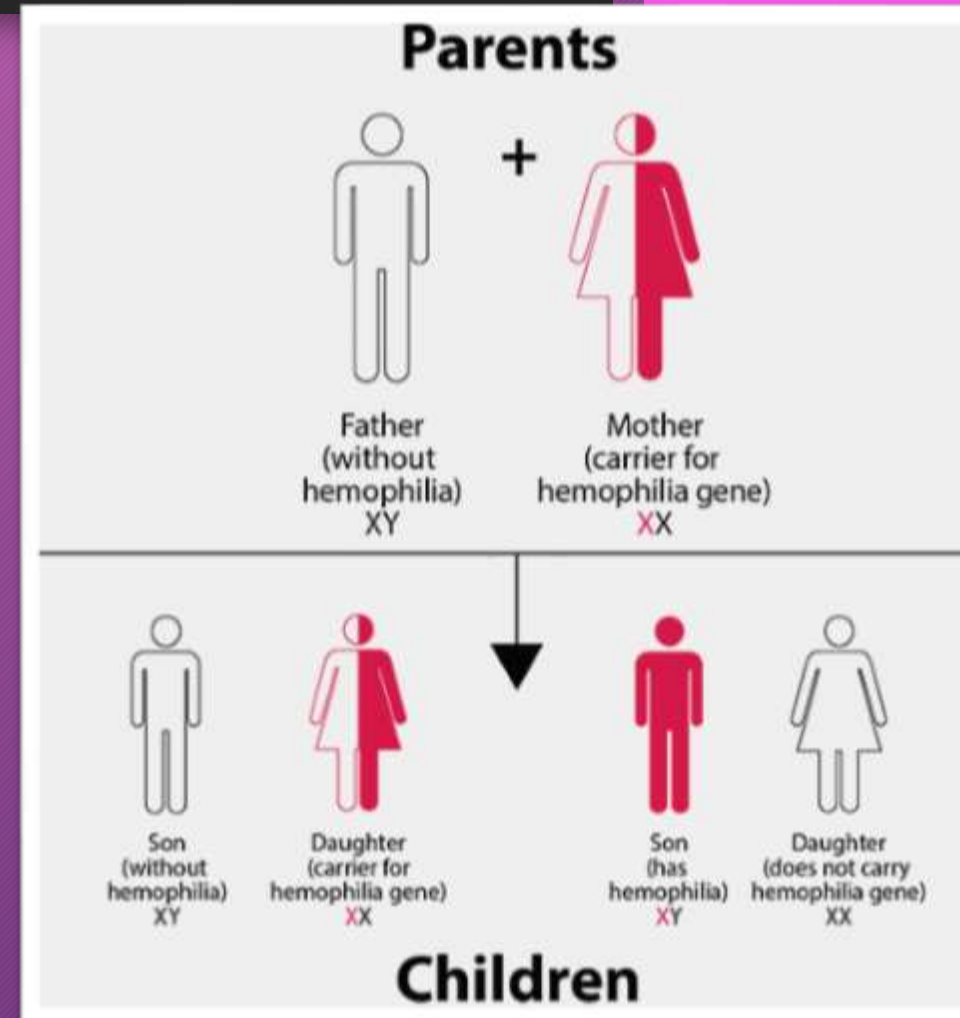
EXPLANATION ABOUT GENETIC DISORDERS (General Information)

- Haemophilia is a disease that prevent the clotting of human blood.
- A genetic disorder caused by one or more abnormalities in the genome.
- It is caused by mutation in a gene on X chromosome. Hence, causing the deficiency of clotting factors (VIII & IX).
- It mainly occurs in males & affecting 1 in every 8000.



EXPLANATION ABOUT GENETIC DISORDERS (Additional Information)

- The genes associated with these conditions are located on the X chromosome, which is one of the two sex chromosomes.
- In males (one X), one altered copy of the gene in each cell will cause the condition.
- In females (two X), a mutation in both copies of the gene will cause the disorder.
- In X-linked recessive inheritance, a female with one altered copy of the gene in each cell is called a carrier.



GENETIC ENGINEERING (TRANSGENIC PLANTS & ANIMALS)

- Exhibit explains applications of Genetic Engineering to develop high quality disease resistant plants and animals.






EXPLANATION ABOUT GENETIC ENGINEERING

- **Genetic Engineering** is the artificial manipulation, modification, and recombination of DNA or other nucleic acid molecules in order to modify an organism or population of organisms.
- **Transgenic Plants:** Plants that have been genetically engineered.
- **Transgenic Animals:** Animals genetically modified for a variety of purposes including new drugs, enhancing yields, disease resistance.

EXPLANATION ABOUT GENETIC ENGINEERING

Some Common Transgenic plants

GMO	Description	Picture
Golden Rice	Rice modified with daffodil genes to have more beta-carotene, which the body converts to Vitamin A	
Flavr Savr Tomatoes	Tomatoes modified by the removal of genes responsible for the softening of fruit, meaning the tomatoes spoil more slowly	
Bt Corn	Corn modified with a bacterial insecticide gene so that it produces insect toxins within its cells, protecting it from pest species	

ABOUT GENETIC ENGINEERING (Additional Information)

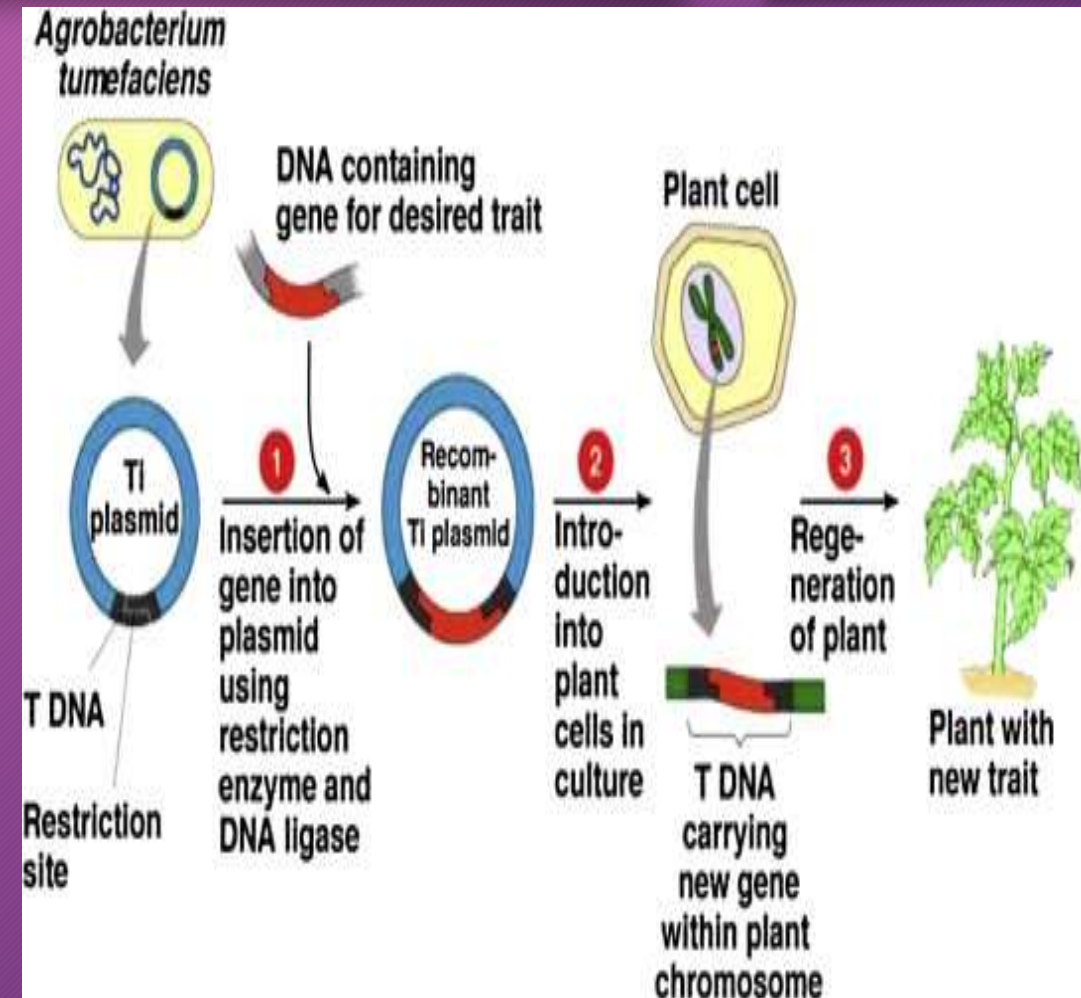
Benefits of Transgenic Plants

1. Increased crop yield, Greater food security
2. Reduced cost of food production
3. Resistance to pests and disease (at least for some time), hence, reduced need for pesticides

Disadvantages of Transgenic Plants

1. Damage to Human health, could cause allergies
2. Damage to Natural environment
3. Reduction in pesticide use temporary as pests develop immunity/mutate
4. Disruption of Traditional practices

All consequences fully not understood



ABOUT GENETIC ENGINEERING (Additional Information)

Transgenic animals

Benefits:

1. Significantly enhance nutrition
2. Decrease livestock diseases
3. Protect the environment
4. Used in testing the safety of vaccines

Risks:

1. Interbreeding with the wild-type may lead to Genetic contamination
2. Competition with Natural Species causing ecological and economic damage
3. Horizontal Transfer of Recombinant Genes to Other Microorganisms
4. Adverse Effects on the Health of People or the Environment

