Cell

The structural and functional unit of all known living organisms. It is the smallest unit of an organism that is classified as living, and also known as the building block of life. *cell* comes from the latin *cellula*, meaning, a small room. Robert hooke first coined the term in his book, microgrphia, where he compared the structure of cork cells viewed through his microscope to that of the small rooms (or monks' "cells") of a monastery.

According to biology, cell is the building block of life that is the basic membrane unit, which contain the fundamental molecules of life.All organisms composed by this membrane

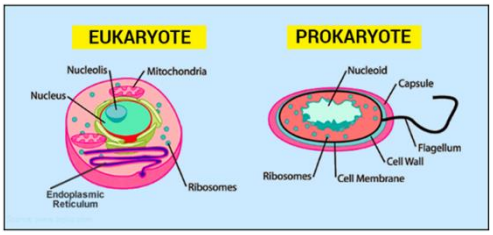
THERE ARE TWO GENERAL TYPES OF CELL

1: Prokryotic cell

2: Eukaryotic cell

Prokaryotic cells are **cells** that do not have a true nucleus or membrane-bound organelles. Organisms within the domains Bacteria and Archaea have **prokaryotic cells**, while other forms of life are eukaryotic.

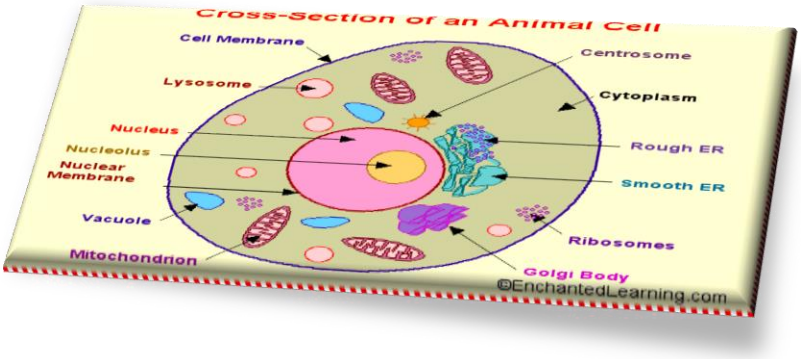
Eukaryotic cells are **cells** that contain a nucleus and organelles, and are enclosed by a plasma membrane. ... **Eukaryotic cells** are larger and more complex than prokaryotic **cells**, which are found in Archaea and Bacteria, the other two domains of life.



Cell is further classified into two types

1.Animal cell

Animal cells, which are the essential blocks of Animal Kingdom, are eukaryotic cells. They have a true membrane which is bounded by the nucleus along with other membrane-bound organelles.plant cells are also eukaryotic cells, the animal cells can be distinguished by them because of the cell walls and chloroplasts. These units are not available in animal



Element of animal cell

1.Cell Membrane:

This is a thin, semi-permeable membrane that envelopes the components of the cell. This would allow some substances to enter into the cell and block others.

2.Cytoplasm:

This is the gel-like substance that is found outside the nucleus of the cell. This is where the other organelles of the cell are suspended.

3:Cytoskeleton:

This is the group of interconnected tubules that are found all over the cytoplasm. The cytoskeleton of the cell has many roles to play in the cell. The main functions include providing the cell support and helping the cell to maintain its shape.

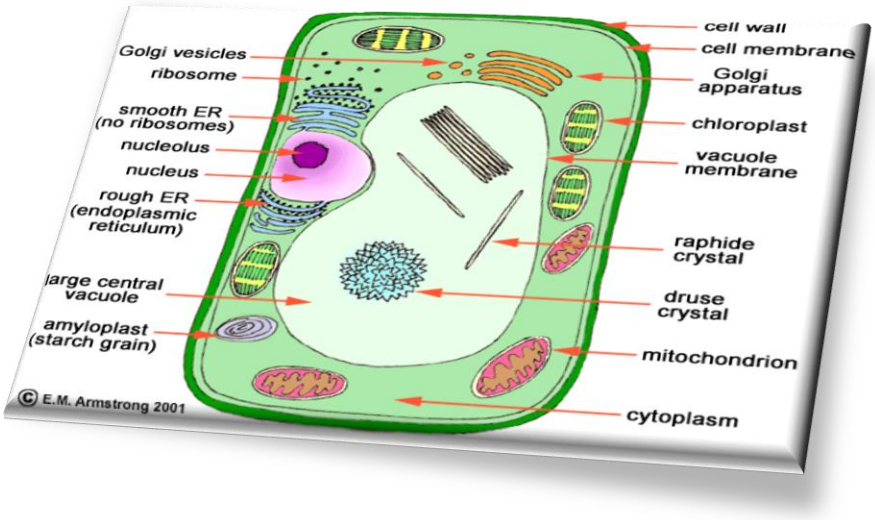
4.Endoplasmic Reticulum:

This is a wider network of membranes having two types of regions: one is with ribosomes and the other is without ribosomes.Ribosomes are the organelles that are needed for protein factory. The elements of ribosomes include RNA and proteins & manufacturing, processing, as well as transporting the chemical compounds that are to be used inside/outside the cell.

2.Plant cells

Plant cells are the basic members of the plant kingdom that are eukaryotic cells. They have a real (membrane-bound) nucleus in them. furthermore to the nucleus ,that is covered by a membrane, the plant cells have also contribution in other organelles. Tiny cellular

structures are used to defined organelles. There are many organelles within a plant cell with each of one have a specific function.



Elements of plant cell:

- Cell walls
- Chloroplasts
- Central vacuole

1: Cell Wall:

It is the outer covering of the plant cell. Its primary function is to protect the inner components of the plant cell. But, this is not its only function. It also give the plant cell its shape. In the plant cell, the components of the cell wall are mainly:

- Cellulose
- Hemicellulose
- Pectin
- Lignins

Although animal cells are also eukaryotic, they do not have a cell wall. Thus, it can be said that cell wall is a main feature of the plant cells. In this there is a primary cell wall – the flexible layer act as outer covering of a developing plant cell and a secondary cell wall – the harder and the thicker layer on the inner side.

2:**Chloroplasts**:

Photosynthesis takes place in the chloroplast. These chloroplasts have chlorophyll – the green pigment that absorb the energy from sunlight. Photosynthesis is a biological process which converts water, light energy and carbon dioxide into plant nutrients. In addition ,chloroplasts are oval in shape with two membranes – the outer and inner one. Inside the chloroplasts, fluid is present called stroma with a circular DNA. There are many smoothened disks within the chloroplasts which is known as thylakoids.

3:Central Vacuole

This is the organelle of the plant cell that is known to provide support to the cell by sustaining the turgid pressure against plant cell wall. In addition, the central vacuole will take part in various cell functions like:

- Storage
- Detoxification
- Protection
- Growth

In a mature plant cell, the central vacuole will occupy 30% to 80% of the total volume of the plant cell. This large vacuole will be surrounded by a membrane called tonoplast. Within the vacuole, there will be fluid, ions, and molecules. Although vacuole is present in the cells of various organisms, the plant cell vacuole is unique because of its larger size.

The comparison is showing all the differences and similarties clearly

Comparison Chart

BASIS FOR COMPARISON	PLANT CELL	ANIMAL CELL
Meaning	The fundamental and functional unit of Kingdom Plantae of the Eukaryotic cells, having true nucleus along with the many organelles, specially the cell wall, chloroplast and the vacuoles.	Animal cells are also the basic unit of life of Kingdom Animalia of the Eukaryotic cells, having all the necessary organelles with specified functions.
Cell Size	Usually larger, which is fixed.	Smaller in size and irregular.
Cell Shape	Rectangular.	Round.

BASIS FOR COMPARISON	PLANT CELL	ANIMAL CELL
Enclosed by	A plant cell is enclosed by rigid cell wall along with the plasma membrane.	The animal cell is enclosed by a flexible, thin plasma membrane only.
Nucleus	Present and lies on one side of the cell.	Present and lies in the centre of the cell wall.
Centrosomes/Centrioles	Absent	Present
Plastids	Present with chloroplast in them.	Plastids are absent.
Cilia	Absent.	Usually present.
Glyoxysomes	May be present.	Absent.
Plasmodesmata	Present.	Absent.
Desmosomes/Tight junction	Absent.	Present.
Mitochondria	Present in fewer number.	Present in large number.

BASIS FOR COMPARISON	PLANT CELL	ANIMAL CELL
Vacuoles	Only one huge vacuole.	Animal cells contain many in numbers.
Lysosomes	Rarely noticed in plant cells.	Present.
Chloroplast	Plant cell contains chloroplast, which they use in storing energy.	Animal cells lack chloroplast and use mitochondria for energy storing purpose.
Reserve food	Present as starch.	Present as glycogen.
Synthesis of nutrients	They can synthesize all amino acids, vitamins and coenzymes.	They are not able to synthesize any amino acids, vitamins and coenzymes required by them.
Cytokinesis	Occurs by cell plate only.	Occurs by furrowing or constrictions.
Hypotonic/Hypertonic Solutions	Plant cell does not burst if placed in hypotonic solution.	Animal cells burst in hypertonic solution as they do not have the cell wall.

chromosomes

- [i] Chromosomes are rod shaped,dark stained bodies seen during mitosis
- A **chromosome** is a DNA(deoxyribonucleicacid) molecule with part or all of the genetic material (genome) of an organisms.

- Chromosomes are normally visible under a light microscope only when the cell is undergoing the metaphase of cell.

- Plants usually have biggest chromosomes than animal cell

Chromosomes are the thread like structure Each chromosome is made up of DNA which is twisted around proteins called histones.

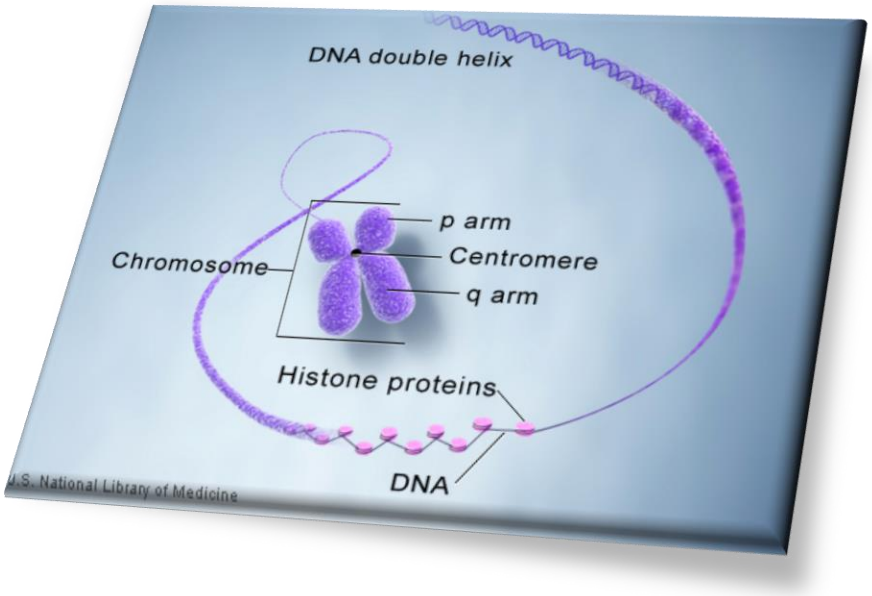
Chromosomes are not visible even by a microscope when they are not divided when they divide they can be scened

Each chromosome has a constriction point called the centromere, which divides the chromosome into two sections, or "arms." The short arm of the chromosome is labeled the "p arm." The long arm of the chromosome is labeled the "q arm." The location of the centromere on each chromosome gives the chromosome its characteristic shape, and can be used to help describe the location of specific genes.

- **History**

Strausberger used discovered chromosomes in 187
The term chromosomes was coiled by welder in 1888

- **Chroma=colour ,soma=body**



Now the question arrive in our mind that how many total chromosomes are present in human body?

In humans, each cell normally contains 23 pairs of chromosomes, for a total of 46. Twenty-two of these pairs, called autosomes, look the same in both males and females. The 23rd pair, the sex chromosomes, differ between males and females. Females have two copies of the x chromosomes, while males have one X and one y chromosomes

NOTE:The X chromosome spans about 155 million DNA building blocks (base pairs) and represents approximately 5 percent of the total DNA
The Y chromosome spans more than 59 million building blocks of DNA (base pairs) and represents almost 2 percent of the total DNA in cells.

Chromosomal conditions involving the sex chromosomes often affect sex determination (whether a person has the sexual characteristics of a male or a female), sexual development, and fertility. The signs and symptoms of these conditions vary widely and range from mild to severe. They can be caused by missing or extra copies of the sex chromosomes or by structural changes in these chromosomes.

Rarely, males may have more than one extra copy of the Y chromosome in every cell (polysomy Y). For example, the presence of two extra Y chromosomes is written as 48,XYYY. The extra genetic material in these cases can lead to skeletal abnormalities, decreased IQ, and delayed development, but the features of these conditions are variable

HERE ARE NUMBERS OF CHROMLSOMES IN COMMON LIVING THINGS:

Sr. no	Scientific name	Common name	Chromosome number	
			Somatic	Gametic
1	*Homo sapiens*	Human	46	23
2	*Oryza sativa*	Rice	24	12
3	*Rattus norvegicus*	rat	42	21
4	*Pisum sativum*	Pea	14	7
5	*Daucus carota*	Carrot	20	10
6	*Allium cepa*	Onion	16	8
7	*Zea mays*	Maize	20	10
8	*Apis mellifera*	Honey bee	32	16
9	*Musca domestica*	House fly	12	6
10	*Felis domesticum*	Cat	38	19
11	*Drosophila melanogaster*	Fruit fly	8	4
12	*Neurospora Crassa*	Bread mold	14	7

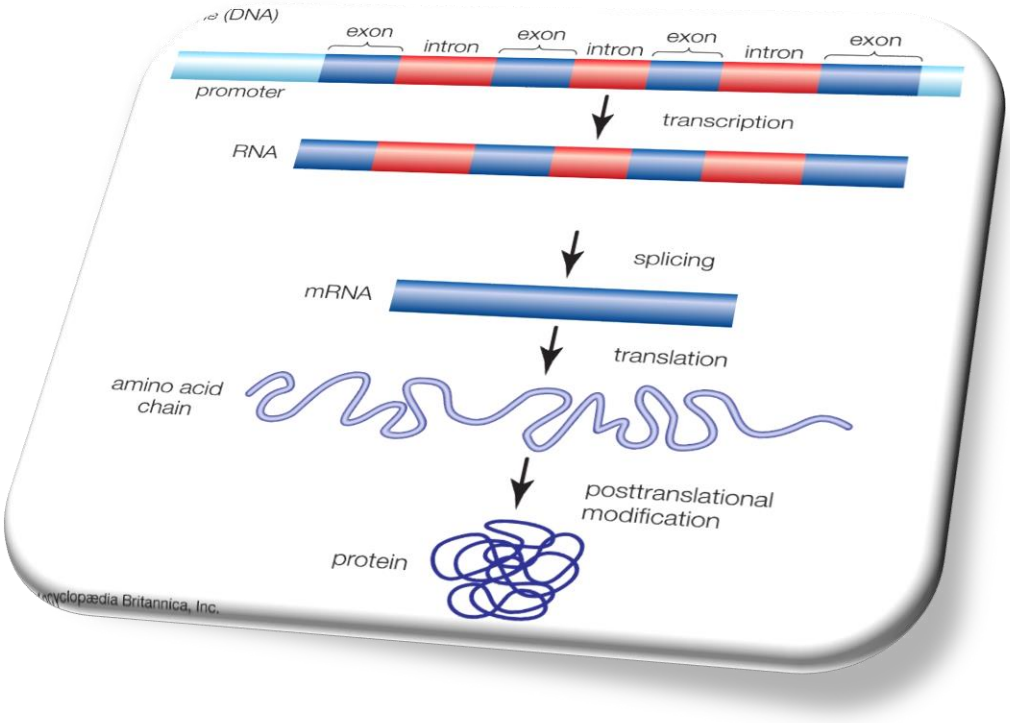
GENES:

- A unit of heredity which is transferred from a parent to offspring and is held to determine some characteristic of the offspring
- A **gene** is the basic physical and functional unit of ancestry. **Genes** are formed by DNA. Some **genes** act as instructions to make molecules called proteins. However, many **genes** do not code for proteins. In humans, **genes** are different in size from a few hundred DNA bases to more than 2 million bases.
- The gene is the unit of genetic information that control the specific aspects of phenotype.
- The gene is the unit of genetic information that control the specifies the synthesis of one polypeptide.
- T.M MORGAN proposed the gene which states that:
  - Chromosome are bearer of hereditary unit and each chromosomes carry hundred of thousands of genes.
  - The genes are arranged in the chromosomes in linear order and on special regions or locus.

HISTORY OF GENES:

- Genes was coined by W Johnsen in 1909
- E R Garrod (1908) proposed one gene_ONE product hypothesis
- Gene theory was proposed by T H Morgan in 1911
- L Pauling and Ingram(1949) established the role of genes in protien synthesis

Genes concept was given by **SUTTON**



Chemical Structure Of Genes

Genes are made up of deoxyribonucleic acid (DNA) excluded in some viruses.A DNA molecule is composed of two chains of nucleotides that wind about each other to resemble a coiled ladder. The parts of the ladder are made up of sugars and phosphates, and the rungs are formed by bonded pairs of nitrogenous bases. These bases
are adenine(A), guanine(G), cytosine (C), and thymine(T). An A on one chain bonds to a T on the other (thus forming an A–T ladder rung); similarly, a C on one chain bonds to a G on the other. If the bonds between the bases are broken, the two chains unwind, and free nucleotides within the cell attach themselves to the exposed bases of the now-separated chains. The free nucleotides line up along each chain according to the base-pairing rule—A bonds to T, C bonds to G. This process results in the creation of two identical DNA

molecules from one original and is the method by which hereditary information is passed from one generation of cells to the nucleous.

CLASSIFICATION OF GENES

Genes are classified as centrons, medons and telons. Rearrangements are classified as: conservative, discordant, disruptive, destructive and incompatible. Chromosomes are also classified depending on their length, arm size and number. These chromosome properties and features now acquire an organizatory meaning which they lacked previously

. **TYPES OF GENES**

House keeping genes: Genes turned on ,in all cells at all times(e.g. transcription machinery, translation machinery,energy conversion ,etc.)

Cell type specific genes: Genes that are turned on ,in each cell that give a cell its special properties and function.

Developmental regulatory genes : Genes specific to certain stages during growth and development of a person

Inducible genes: Genes not normally expressed but can be in response to external(e.g .hormones)

EPISTATIC AND HYPOSTATIC GENES

- **Epistatic genes:**

  When a genes or locus which suppress or mask the phenotypic expressions of another genes at another locus such gene is known as epistatic genes.
  Epistatic is GREEK term and meaning in standing up.
- **Hypostatic genes:**

  The gene or locus which suppress by epistatic genes was called hypostatic genes.

FEATURES OF GENES

- A specific portion of the DNA code is called genes, which has genetic information.
- A unit of genetic material, which is able to replicate.

- It is a unit of recombination or capable of undergoing crossover.
- A unit of genetic material which can undergo mutation.

- A unit of heredity corrected with stomatic structure or function lead to phenotype expression.
- A genes is the basic physical and functional unit of heredity.
- Genes which are made up of DNA,act as RNA instructor to make molecules called protein's.
- Every person has two copies of genes,one inherited from each parent,most genes are the same in all people,but a small number of genes are slightly between people.
- Genes consist of long strand of DNA that contains promotor which contain the activity of genes ,coding and non coding.
- Total set of genes in person are known as genome.

NUCLEIC ACID

Definition:

★ A compounded organic substance present in living organisms, especially DNA or RNA, whose molecules consist of many nucleotides joining in a long chain.

★ **Nucleic acid** is an important class of macromolecules found in all cells and viruses. The **functions** of **nucleic acids** have to do with the storage and expression of genetic information. Deoxyribonucleic **acid** (DNA) encodes the information the cell needs to make proteins.

HISTORY:

It is a long molecule made up of smaller molecules called nucleotides. Nucleic acids were discovered in 1868, when twenty-four-year-old **Swiss physician Friedrich Miescher** isolated a new compound from the nuclei of white blood cells.

FUNCTIONS:

★ Nucleic acid are polymers that consist of nucleotide residues.
★ It is Located in nuclei of cell
★ It determines the Hereditary in living organisms
★ Elemental composition –of nucleic acid contains carbon, hydrogen, oxygen, nitrogen and phosphorus.

- Nucleic acid is the naturally occurring compound.It has a capability of being broken down to yield phosphoric acid sugars, it is a mixture of organic bases (purines and pyrimidines). They are the fandamentals carrier of molecules of the cells by directing the process of protien making they determine the inherited characteristics of every living thing. The two main branches of nucleic acids are deoxyribonucleic acid

- and ribonucleic acid (RNA). DNA is the expert blueprint for life and consist the genetic material in all free-living organisms and most viruses. RNA is the genetic material of certain viruses, and it is also found in all living cells, where it plays an important role in certain processes such as the making of proteins.

Building Blocks Of Nucleic Acids

Basic structure

- Nucleic acids are polynucleotides—that is, long chainlike molecules comprise of a series of identical building blocks called nucleotides.

- Each nucleotide contain nitrogen-consist aromatic base attached to a pentose (five-carbon) sugar, which is in turn attached to a phosphate group. Every nucleic acid contains four of five possible nitrogen.

- Accommodate bases: adenine(A), guanine(G), cytosine (C), thymine(T), and uracil (U). A and G are categorized as purines, and C, T, and U are synthetically called pyrimidines.

- All nucleic acids contain the bases A, C, and G; T,althoug, it is found only in DNA, while U is found in RNA. The pentose sugar in DNA (2'_deoxyribos) different from the sugar in RNA (ribose) by the absence of a hydroxyl group (—OH) on the 2′ carbon of the sugar ring. Without an attached phosphate group, the sugar attached to one of the bases is known as a nucleoside.

- The phosphate group connects succeeding sugar residues by bridging the 5′-hydroxyl group on one sugar to the 3′-hydroxyl group of the next sugar in the chain. These nucleoside linkages are called phosphodiester.

- Each nucleotide is put together from three building blocks

- 1) phosphoric acid
- 2) a monosaccharide
- 3) an organic base

IMPORTANCE:

Nucleic acids are essential for cell functioning, and also for life. RNA & DNA both keep track of hereditary information in a cell so that the cell can maintain itself, grow, create offspring and perform any important functions.
It control the information that makes every cell, and every organism, what it is. They are the only way a cell has to store information on its own processes and to transfer that information to its offspring. When nucleic acids were discovered to be the carriers of hereditary information, scientists were able to explain the structure for Darwin and Wallace's theory of evolution and Mendel's theory of genetics.

Properties of Gene:
Gene has been described by different researchers in various ways.

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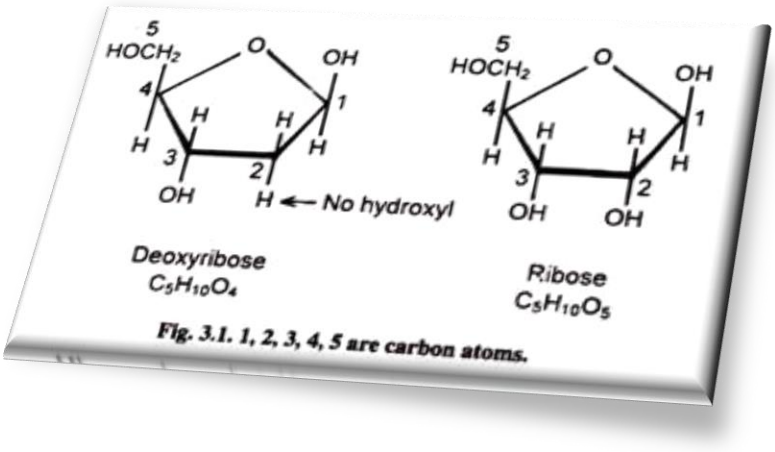

below:

Properties of Gene:

Gene has been described by different researchers in various ways. gene has various structural and functional properties which are briefly described below:

1)**Forms**:

The alternative form of a gene is known as allele. Generally each gene has two allelic forms. One of these forms in known as wild type and the other as mutant type. Allelic forms are known as dominant and recessive. Some genes have multiple allelic forms, but only two of them are present at a time in a true diploid individual.

2. **Location**:

Genes are located on the chromosome in a linear fashion like bead on a string. The position which is occupied by a gene on the chromosome is called locus. Studies on linkage, crossing over, sex chromosomes, sex linkage and bacterial transformation and transduction have clearly demonstrated that genes are located on the chromosomes.

3. Status:

Earlier it was believed that genes are the smallest units of inheritance which cannot be divided further. But Benzer demonstrated in 1955 that gene consists of several units of cistron, recon and muton which are the units of function, recombination and mutation within the genes

4. **Number**:

Each diploid individual has two copies of each gene and gametic cells have one copy of each gene. Each individual has large number of structural and functional features or characters and each character is controlled by one or more genes.

Thus, each individual has large number of genes. The total number of genes in an individual is always higher than the number of chromosomes. Thus, each chromosome has several genes.

5. **Sequence**:

Genes have a specific sequence on the chromosome. The gene sequence is altered by structural chromosomal changes specially translocations and inversions.

6. **Expression**:

Genes express in various ways. They may show incomplete dominance, complete dominance, over dominance and lack of dominance. When there is lack of dominance, the expression is intermediate between the two parents. The gene which is expressed is known as dominant gene and which is suppressed is known as recessive gene. The phenotypic expression of genes depends on allelic and non-allelic interactions.

7. **Composition**:

[1]

Gene is a macro molecule which is composed of DNA. In most of the organisms, gene is made up of DNA. However, the genetic material in some bacteriophages is RNA.

8.**Duplication**:

Each gene is duplicated at the time of chromosome duplication or replication. It is believed that chromosome duplication takes place because of gene duplication.

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[1]