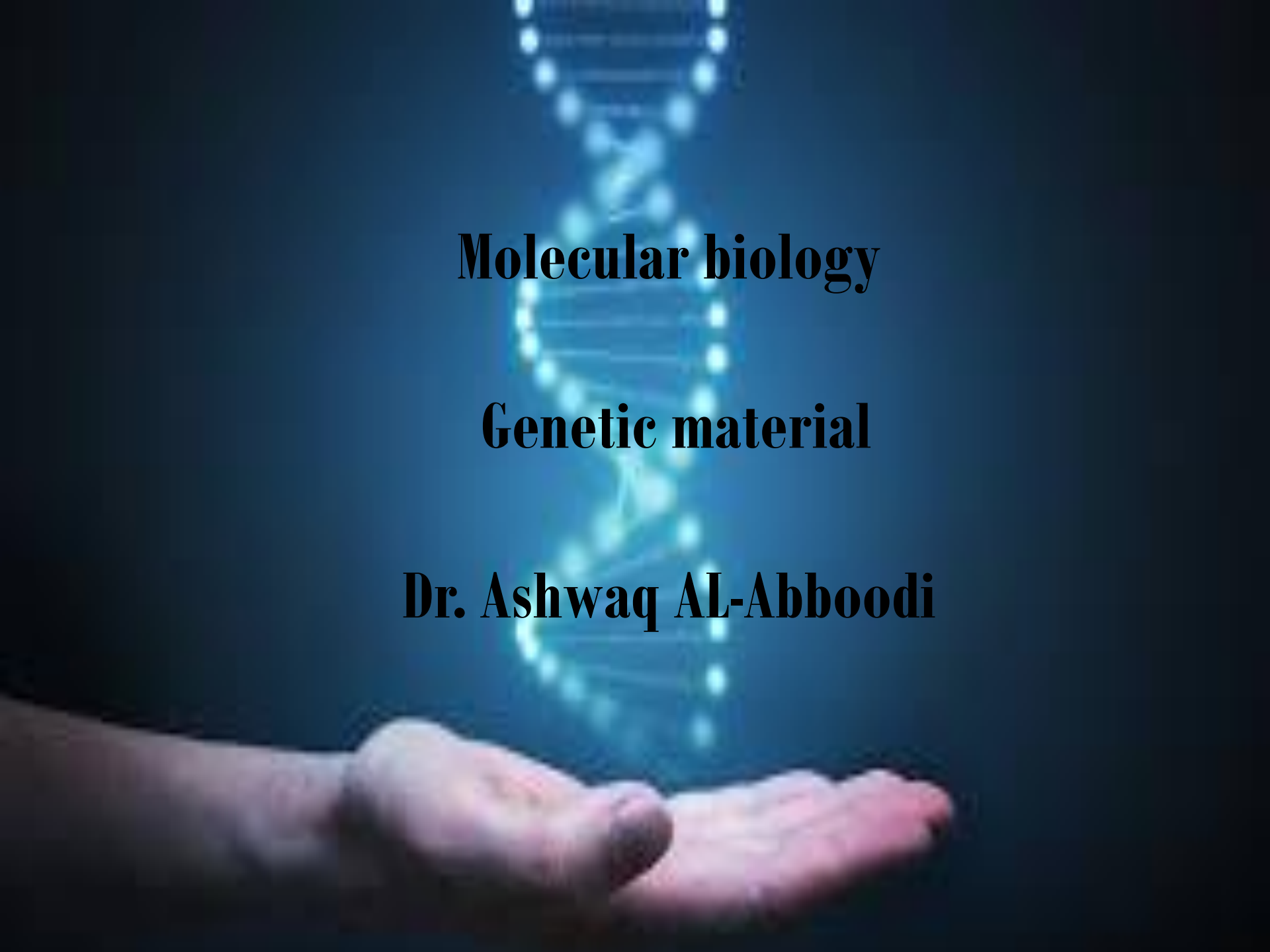

Molecular biology

Genetic material

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Molecular biology

is the branch of biology that studies the composition, structure and interactions of cellular molecules – such as nucleic acids and proteins

molecular biology was established as an official branch of science in the 1938 by Warren weaver

Molecular Biology focuses on the principles of polymer physics and chemistry and their applications to fundamental phenomena in biological sciences.

It examines the structure, synthesis, and function of nucleic acids and proteins, as well as the physicochemical techniques necessary in determining the macromolecular structure, the kinetics and mechanism of enzyme action, the genetics of bacteria and their viruses, and the genetic code.

It also considers the importance of precise quantitative analysis in biochemistry and biophysics, the architecture and function of biological macromolecules, and the unique mechanisms that regulate the cell's biological activity.

what is the genome

❖ Genome :-

- ❖ is the hereditary basis of every living organism.
- ❖ is a long sequence of deoxyribonucleic acid (DNA) that provides the complete set of hereditary information carried by the organism as well as its individual cells.
- ❖ Is simply the sum total of an organism's DNA

The genome includes:-

- Physically, the genome can be divided into a number of different DNA molecules, or chromosomes.
- The ultimate definition of a genome is the sequence of the DNA of each chromosome.
- Functionally, the genome is divided into genes.
- Each gene is a sequence of DNA that encodes a single type of RNA and, in many cases, ultimately a polypeptide.
- Each of the discrete chromosomes comprising the genome can contain a large number of genes.
- Genomes for living organisms might contain as few as about 500 genes (for mycoplasma, a type of bacterium), about 20,000 for humans.

Chromosome

A discrete unit of the genome carrying many genes. Each consists of a very long molecule of duplex DNA, It is visible as a morphological entity only during cell division

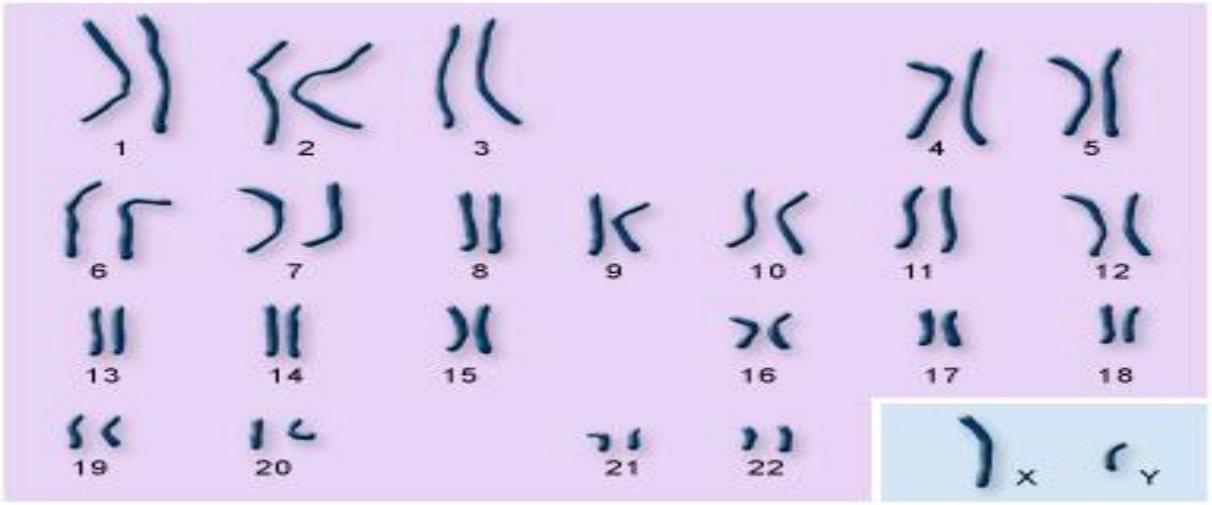
General information :-

- In the nucleus of each cell, the DNA molecule is packaged into thread-like structures called chromosomes. Each chromosome is made up of DNA tightly coiled many times around proteins called histones that support its structure.

- Chromosomes are not visible in the cell's nucleus—not even under a microscope—when the cell is not dividing. However, the DNA that makes up chromosomes becomes more tightly packed during cell division and is then visible under a microscope. Most of what researchers know about chromosomes was learned by observing chromosomes during cell division.

- 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.

- 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 chromosome, while males have one X and one Y chromosome.



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Gene:-

is a sequence of DNA that encodes a single type of RNA and, in many cases, ultimately that passes largely unchanged from parent to progeny polypeptide

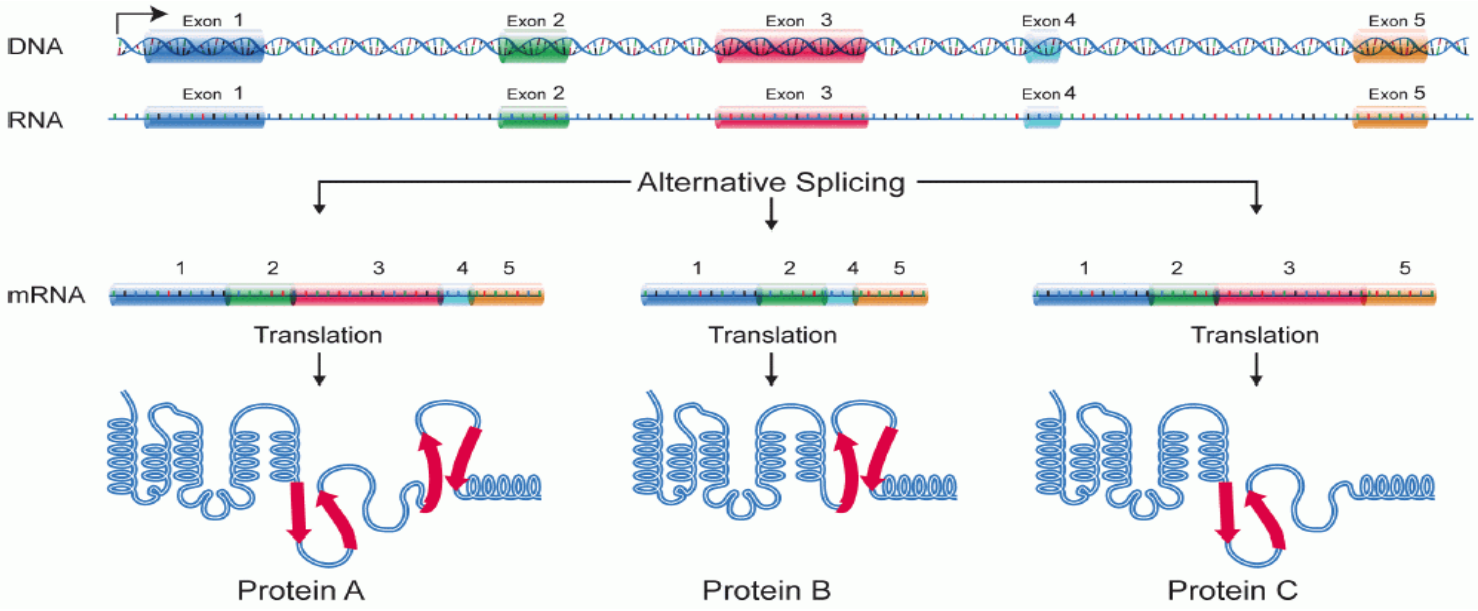
A key feature of the structure of eukaryotic genes is that their transcripts are typically subdivided into exon and intron regions.

Exons are the segments of coding DNA that are transcribed into messenger RNA (mRNA), which then serves as the template from which the amino acid sequence, and ultimately the protein.

Introns are nucleotide sequences in DNA and RNA that do **not** directly code for proteins, and are **removed** during the precursor messenger RNA (pre-mRNA) stage of maturation of mRNA by **RNA splicing**.

Alternative splicing:-

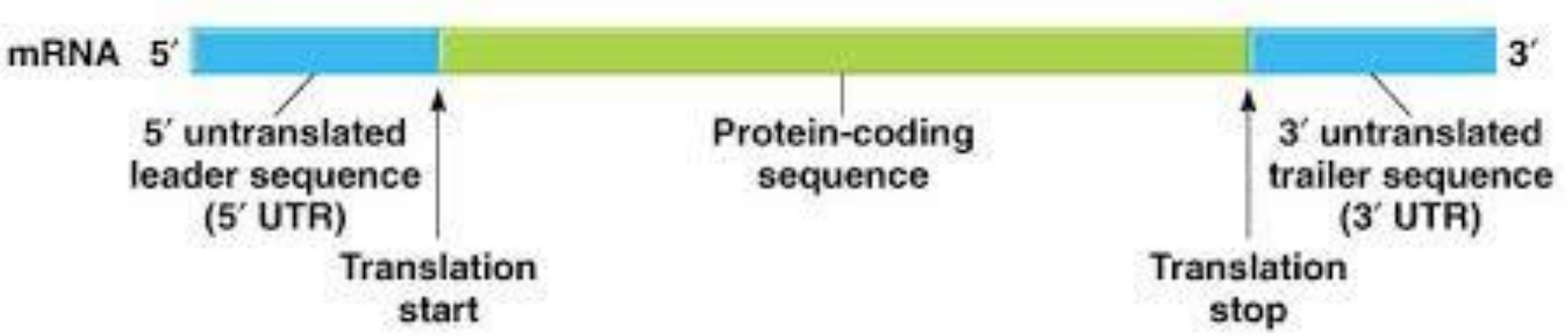
is a regulated process during gene expression that results in a single gene coding for multiple proteins. In this process, particular exons of a gene may be included within or excluded from the final, processed messenger RNA (mRNA) produced from that gene. Consequently, the proteins translated from alternatively spliced mRNAs will contain differences in their amino acid sequence and, often, in their biological functions. Notably, alternative splicing allows the human genome to direct the synthesis of many more proteins than would be expected from its 20,000 protein-coding genes.



there are two regions on the mRNA strand, one on each side. The first one is called 5' UTR (or **leader sequence**) which found on the 5' side or if it is found on the 3' side, it is called the 3' UTR (or **trailer sequence**).

mRNA is RNA that carries information from DNA to the ribosome, the site of protein synthesis (translation) within a cell. The mRNA is initially transcribed from the corresponding DNA sequence and then translated into protein. However, several regions of the mRNA are usually not translated into protein, including the 5' and 3' UTRs.

The 5' UTR is upstream from the coding sequence. Within the 5' UTR is a sequence that is recognized by the ribosome which allows the ribosome to bind and **initiate translation**. The mechanism of translation initiation differs in prokaryotes and eukaryotes. The 3' UTR is found immediately following the translation **stop codon**.



Allele:-

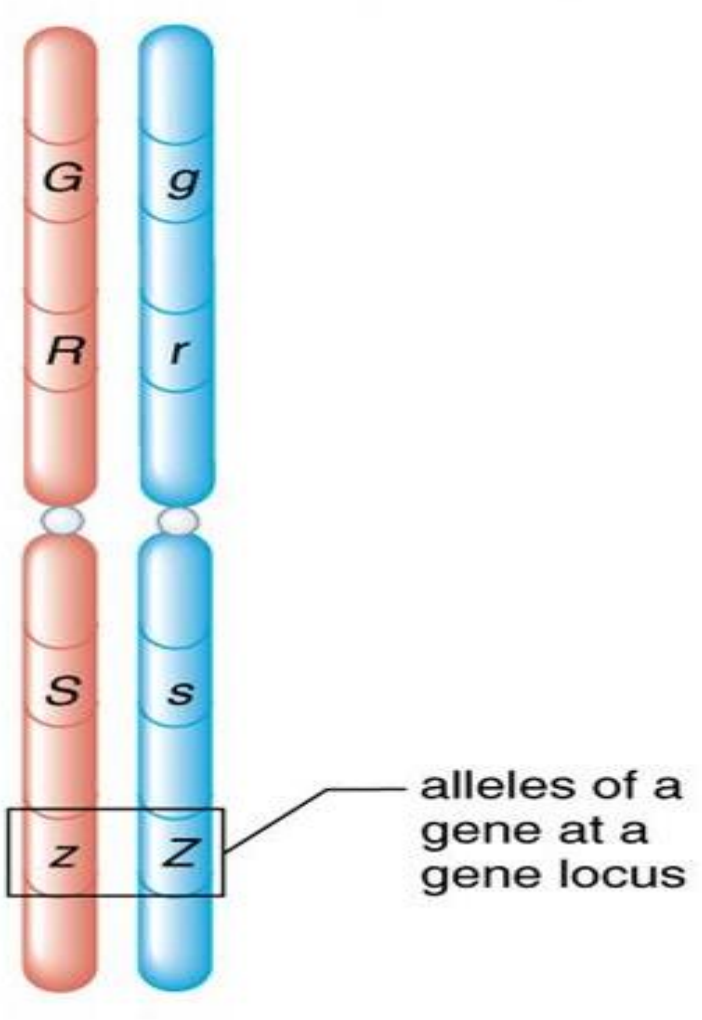
One of several alternative forms of a gene occupying a given locus on a chromosome

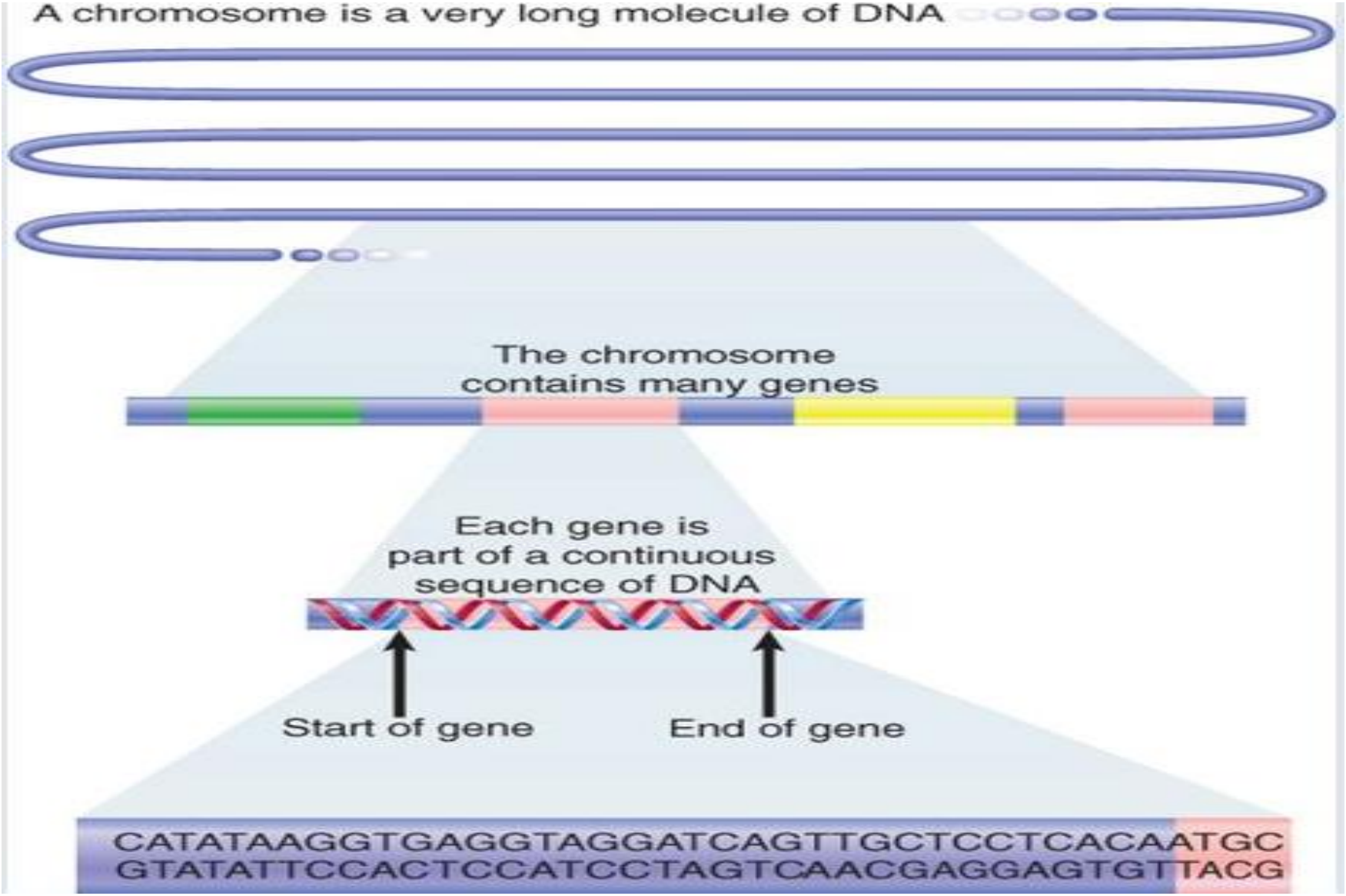
Locus:-

Is a specific, fixed position on a chromosome where a particular gene or genetic marker is located

Each chromosome consists of a linear array of genes, and each gene resides at a particular location on the chromosome. The location is more formally called a genetic

locus.





Each chromosome consists of a single, long molecule of DNA within which are the sequences of individual genes.