1. **What is GENE ? and genome?**

- Region of DNA that controls a hereditary characteristic.

- It usually corresponds to a sequence used in the production of a specific protein or RNA.

- A gene carries biological information in a form that must be copied and transmitted from each cell to all its progeny. This includes the entire functional unit: coding DNA sequences, non-coding regulatory DNA sequences, and introns.

- Genes can be as short as 1000 base pairs or as long as several hundred thousand base pairs.

Genome= total of all chromosomes

2. There are three types of genes:

1. **Protein-coding genes:** these are transcribed into RNA and then translated into proteins.
2. **RNA-specifying genes**: these are only transcribed into RNA.
3. **Regulatory genes:** according to a narrow definition, these include only untranscribed sequences.

The first two types are also called 'structural genes'.

4. **What is the building block of DNA ?**

Nucleotides are the building stones of DNA.

There are 4 different nucleotides:
• dATP : deoxyadenosine triphosphate
• dGTP : deoxyguanosine triphosphate
• dTTP : deoxythymidine triphosphate
• dCTP : deoxycytidine triphosphate

For convenience, these 4 nucleotides are called dNTP's (deoxynucleoside triphosphates). A nucleotide is made of three major parts: a nitrogen base, a sugar molecule and a triphosphate. Only the nitrogen base is different in the 4 nucleotides.

5. **How do the nucleotides form a DNA chain?**

DNA is formed by coupling the nucleotides between the phosphate group from a nucleotide (which is positioned on the 5th C-atom of the sugar molecule) with the hydroxyl on the 3rd C-atom on the sugar molecule of the previous nucleotide. To accomplish this, a diphosphate

molecule is split off (and releases energy). This means that new nucleotides are always added on the 3' side of the chain.

6. **Which organelles contain gene ?**

Eucariotic cells contain several organelles. The nucleus contains most of the DNA in a cell and this DNA is called the **chromosomal DNA**. It is separated from the rest of the cell (cytoplasm) by a double layer of membrane. The mitochondria, which have a role in the oxidative degradation of nutrient molecules, also contain DNA, called the **mitochondrial DNA.** Eucariotic cells that are capable of photosynthesis contain chloroplasts with chloroplast DNA.

GENE (Intron and Exon)

Exon: segment of a eukaryotic gene that corresponds to the sequences in the final processed RNA transcript of that gene. In some species (including humans) exons are separated by long regions of DNA (introns).

Intron: Intervening sequences of DNA bases within eukaryotic genes that are not represented in the mature RNA transcript because they are spliced out of the primary RNA transcript.

TYPES OF RNA

Four different classes of RNA molecules play essential roles in gene expression:

- Messenger RNA (mRNA): intermediaries that carry genetic information from DNA to the ribosomes where proteins are synthesized.
- Transfer RNA (tRNA): small RNA molecules that function as adaptors between amino acids and the codons in mRNA during translation.
- Ribosomal RNA (rRNA): structural components of the ribosomes, the intricate machines that translate nucleotide sequences of mRNAs into amino acid sequences of polypeptides.
- Small Nuclear RNA (snRNA): structural components of spliceosomes, the nuclear structures that excise introns from nuclear genes.

Flow of Genetic Information =The Central Dogma of molecular biology.

DNA contains the complete genetic information that defines the structure and function of an organism. Proteins are formed using the genetic code of the DNA. Three different processes are responsible for the inheritance of genetic information and for its conversion from one form to another:

1. **Replication:** a double stranded nucleic acid is duplicated to give identical copies. This process perpetuates the genetic information.
2. **Transcription:** a DNA segment that constitutes a gene is read and transcribed into a single stranded sequence of RNA. The RNA moves from the nucleus into the cytoplasm.

3. **Translation:** the RNA sequence is translated into a sequence of amino acids as the protein is formed. During translation, the ribosome reads three bases (a codon) at a time from the RNA and translates them into one amino acid.

In eukaryotic cells, the second step (transcription) is necessary because the genetic material in the nucleus is physically separated from the site of protein synthesis in the cytoplasm in the cell. Therefore, it is not possible to translate DNA directly into protein, but an intermediary must be made to carry the information from one compartment to another.

Sketch the pathway of protein synthesis by mentioning process involved; Transcription, Translation:

THE CENTRAL DOGMA OF MOLECULAR BIOLOGY

Genetic information flow:

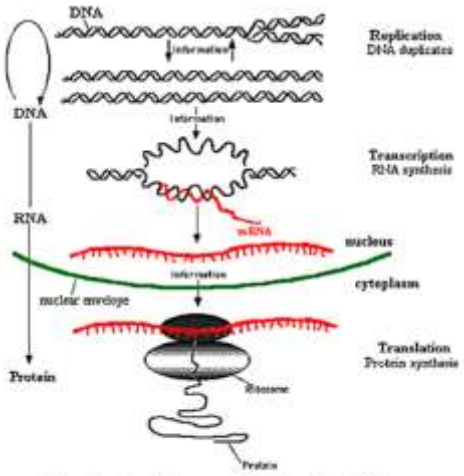
1) From DNA to DNA during its transmission from generation to generation.

2) From DNA to Protein during its phenotypic expression in an organism.

Transcription: DNA to RNA (sometimes reversible).

Translation: RNA to protein (irreversible).

Occassionally, genetic information flows from RNA to DNA (reverse transcription).



The Central Dogma of Molecular Biology