

## CSIR NET Life Science Unit 3

### Gene expression regulation

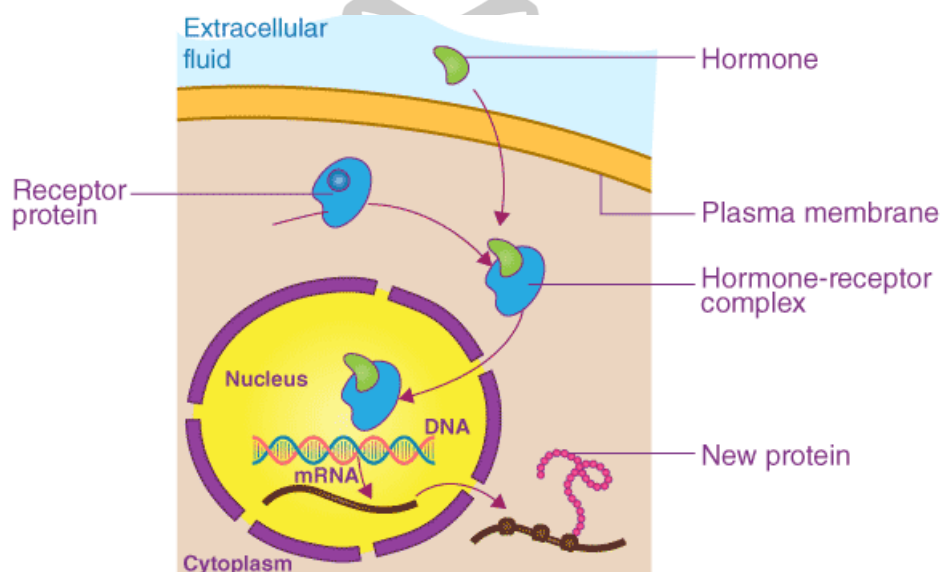
#### Genes

A gene is a part of DNA that codes for a particular protein. DNA is the information database of the cell and exists within the cell nucleus. It carries all the important genetic instructions that produce proteins required by our cells.

Each gene carries a particular set of instructions, which is usually in a coded format, used for an accurate function or for a distinct protein.

The said genes are first transcribed into mRNA and then get converted into a polypeptide chain. A polypeptide is then converted to a protein. All the hidden code inside our genes emerged as our physical traits, which are known as gene expression.

#### Gene Expression

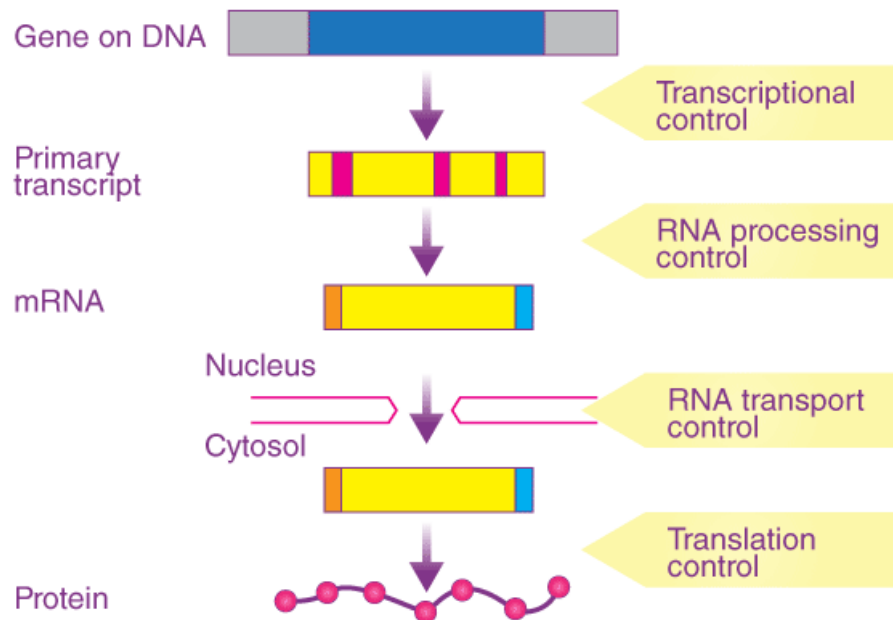


This is a process where the gene's genetic codes are used in managing the protein synthesis that is required for our body to produce the cell structures. Genes that carry information required for the sequences of amino acids are termed structural genes. This process has two main steps:

1. Transcription- In this step, with the help of RNA polymerase enzymes, the messenger RNA is produced, resulting in the processing of mRNA molecules.

2. Translation- The main function of mRNA is to direct the synthesis of a protein resulting in the succeeding post-translational processing of the protein molecules.

### Regulation of Gene Expression



Gene expression is the process by which the instructions present in our DNA are converted into a functional product, such as a protein. This process is a tightly coordinated process which allows a cell to respond to its changing environment.

During gene expression, genetic codes from the DNA code are converted into a protein with the help of translation and transcription. The genetic expression shows the process of the genetic makeup of an organism as its physical traits. In this process, the information flows from genes to proteins.

To understand this topic better, let us take the example of the Keratin genes. Keratin is a protein that helps in the formation of our hairs, nails, and skin. In most cases, these things grow at a continuous speed as our hairs, nails, and skin get worn down over a period of time. The production of excessive keratin could form many hairs on the skin, dry and hard skin, and thick and long nails. To avoid this, it is necessary to regulate the expression of the keratin gene.

Regulation of gene expression includes different mechanisms through which our cells manage the amount of produced protein by our genes.

## Prokaryotic and Eukaryotic Transcription

Regulation of genes occurs differently, depending on the type of organisms- prokaryotic or eukaryotic. Eukaryotes refer to both multicellular and unicellular organisms like- animals, fungi, plants, and protists possessing cells with nuclei and other organelles present within the cell. Prokaryotes are single-celled organisms like bacteria which do not have a well-defined nucleus. Regulation of prokaryotic and eukaryotic transcription is completely different as eukaryotes have a well-defined nucleus and prokaryotes do not.

<b>Prokaryotic Transcription</b>	<b>Eukaryotic Transcription</b>
Occurs in the cytoplasm.	Occurs within the nucleus.
The transcriptional unit has one or more genes	The transcriptional unit has just one gene
Transcription and translation are coupled	Transcription occurs in the nucleus, whereas translation in the cytoplasm
RNAs are released and processed in the cytoplasm	RNAs are processed in the nucleus and then released in the cytoplasm