

Gene structure

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What is a Gene?

- A gene is a specific sequence of DNA containing genetic information required to make a specific protein.
- Prokaryotic gene is uninterrupted.
- In eukaryotic gene **the coding sequences exon** are separated by **non-coding sequences called introns**.
- In complex eukaryotes, introns account for more than 10 times as much DNA as **exons**.

Gene & its role

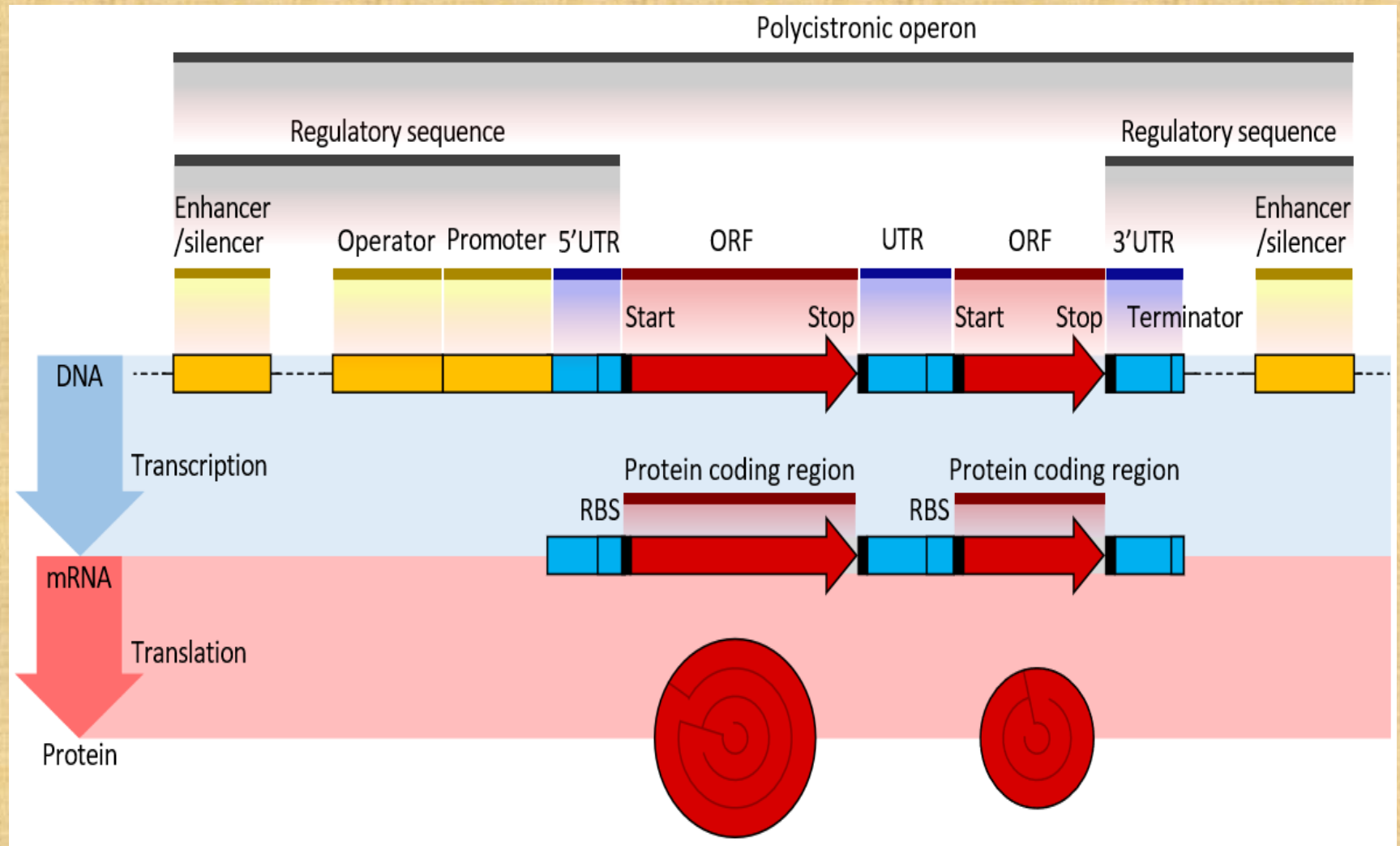
- A gene is a locus (or region) of DNA which is made up of nucleotides and is the molecular unit of heredity.
- Genes, which are made up of DNA, act as instructions to make molecules called proteins.
- Gene code for **RNAs** essential for **protein** synthesis.
- Gene undergo **mutation** and **recombination** to help in evolution.
- Gene transfer the **character** of **parents** to **offspring**.
- Human genome contain most of the non coded gene only the small part like 2% is coded.
- Genome contain all the information required for the growth and development of individual.
- Gene contributes to reproduction through replication.

Types of Gene

- 1) **Constitutive or House-keeping genes**
- 2) **Nonconstitutive genes**
- 3) **Structural genes**
- 4) **Regulatory genes**
- 5) **Operator genes**
- 6) **Promoter genes**
- 7) **Terminator genes**
- 8) **Split genes**
- 9) **Overlapping genes**

Prokaryotic Gene Structure

- **Exons**
- **Promoter sequences**
- **Terminator sequences**
- **Enhancers or silencers regulatory sequences which may be up stream or down stream, near or far from the gene**
- **Signals : - Up stream sequence signal for addition of Cap - Down stream sequence signal for addition of poly A tail**

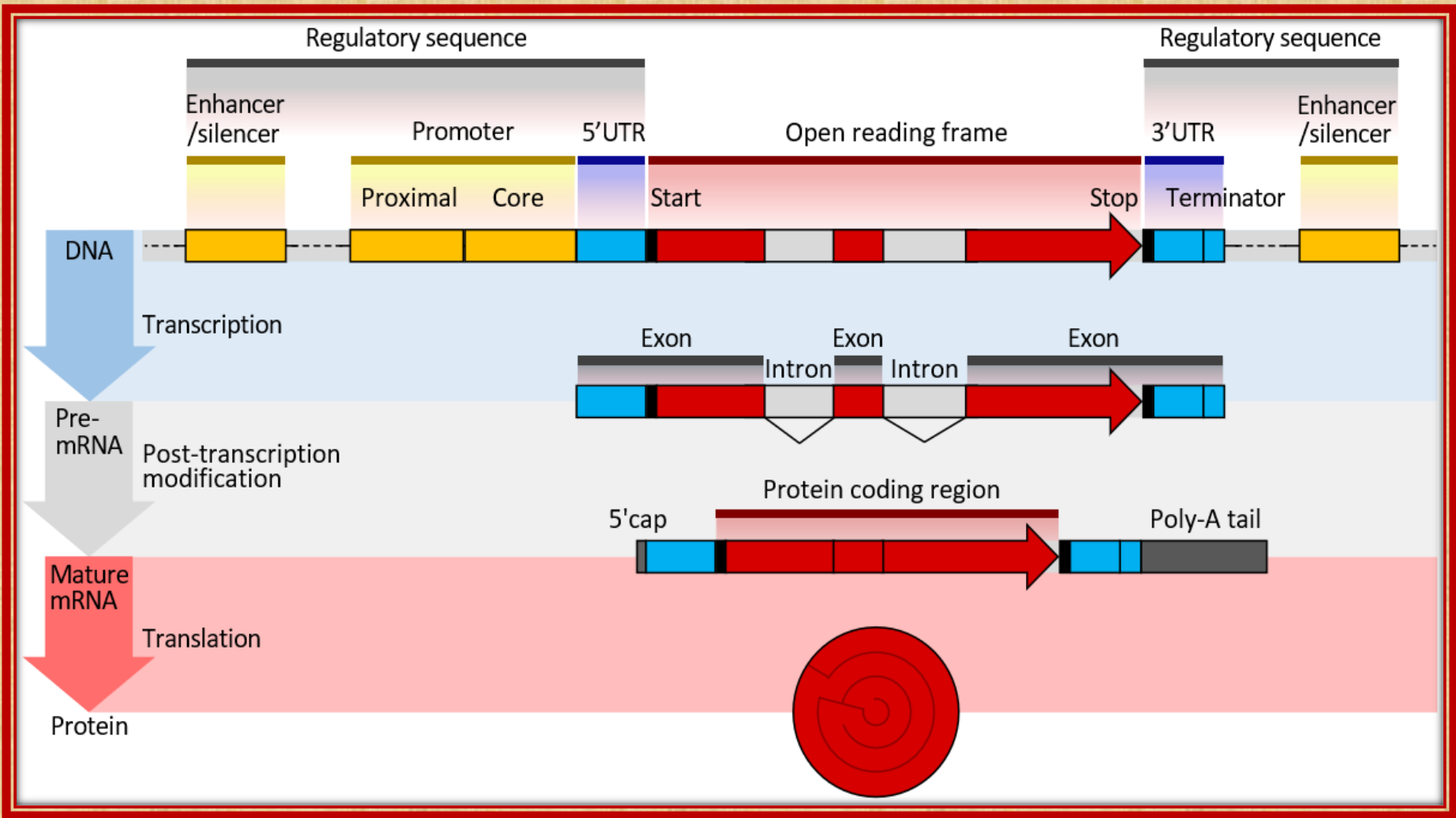


PROKARYOTIC GENE STRUCTURE

Eukaryotic Gene Structure

- **Exons**
- **Introns**
- **Promoter sequences**
- **Terminator sequences**
- **Enhancers or silencers regulatory sequences which may be up stream or down stream, near or far from the gene**
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Eukaryotic Gene Structure



- **The gene is the sequence of chromosomal DNA that is required for production of functional product ; mRNA , tRNA , rRNA , polypeptide.**
- **The sequence of gene consists of :**
- **Exons:-** Coding sequence, transcribed and translated . Coding for the amino acids in the polypeptide chain , vary in number , sequence and length from one gene to another.
- **Introns:-** Non coding sequence transcribed but not translated also vary in sequence, number and length from one gene to another but they are sharing the base sequence GT in the 5` end and AG in the 3` end of all introns .

➤ **Promoters** :- Sequence of DNA nucleotides upstream of the initial base of transcription (at which RNA polymerase binds and initiates transcription), control individual gene expression.

➤ **Two distinct sequences:**

TATA or hogens box:- between 25-35 nucleotides upstream from the transcription site

CAT:- Upstream the TATA box.

These together with general transcription factors are responsible for binding of the enzyme RNA Polymerase II which is responsible for transcription.

Up-stream (5`)

- **Signal for addition of cap (7 methylguanosine) to the 5` end of mRNA . The cap facilitates the initiation of translation through recognition by ribosomes and helps stabilization of mRNA .**
- **Addition of cap and tail to primary RNA (hnRNA) occur after transcription .**

Down stream (3` end)

- **The translation termination codon TAA .**
- **AATAA sequence which is a signal for addition of a polyA tail . The addition of polyA tail makes mRNA more stable and resistant to digestion by endogenous cellular nucleases.**

➤ **Terminator :-**

A DNA sequence just downstream of the coding segment of a gene, which is recognized by RNA polymerase as a signal to stop transcription.

➤ **Enhancer :-**

A regulatory DNA sequence that greatly express the gene expression.

➤ **Silencer:-**

A DNA sequence that helps to reduce or shut off the expression of a nearby gene.

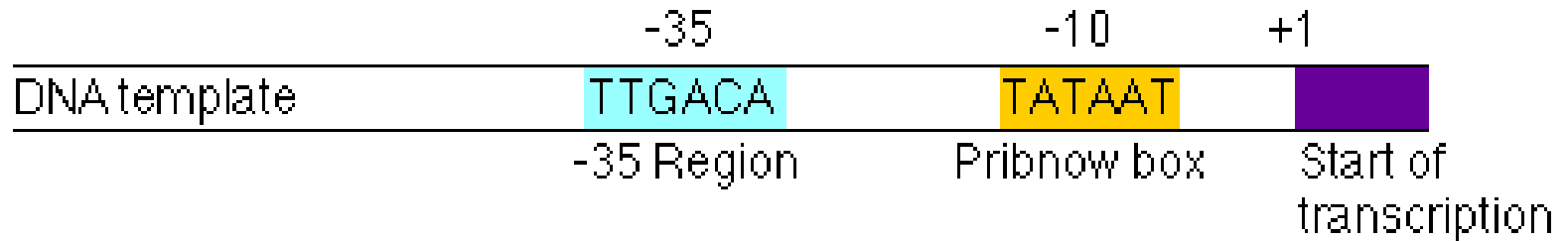
Exons Vs Introns

- **Eukaryotic genes have exons and introns.**
- **Exons contain nucleotides that are translated into amino acids of proteins.**
- **Exons are separated from one another by intervening segments of junk DNA called introns. Introns do not code for protein.**
- **They are removed when eukaryotic mRNA is processed.**
- **Exons make up those segments of mRNA that are spliced back together after the introns are removed**
- **The intron-free mRNA is used as a template to make proteins.**

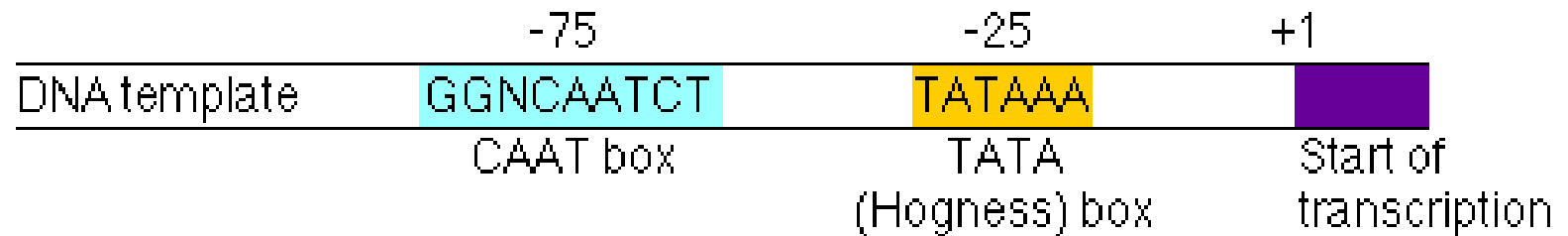
Eukaryotic Vs. Prokaryotic Promoters

- In prokaryotes, the promoter contains a –35 and –10 region upstream of the transcription start site.
- In eukaryotes, the promoter often contains a TATA box, which is where the TATA-binding protein binds.
- In both prokaryotes and eukaryotes, the promoter is located in the 5' direction, upstream from the transcription start site.
- In eukaryotes, the promoter attracts the small and large ribosomal subunits with the help of initiation factors.
- In eukaryotes, the promoter is recognized by a sigma factor subunit, which must bind to the promoter before forming the preinitiation complex.

Prokaryotic promoter site:



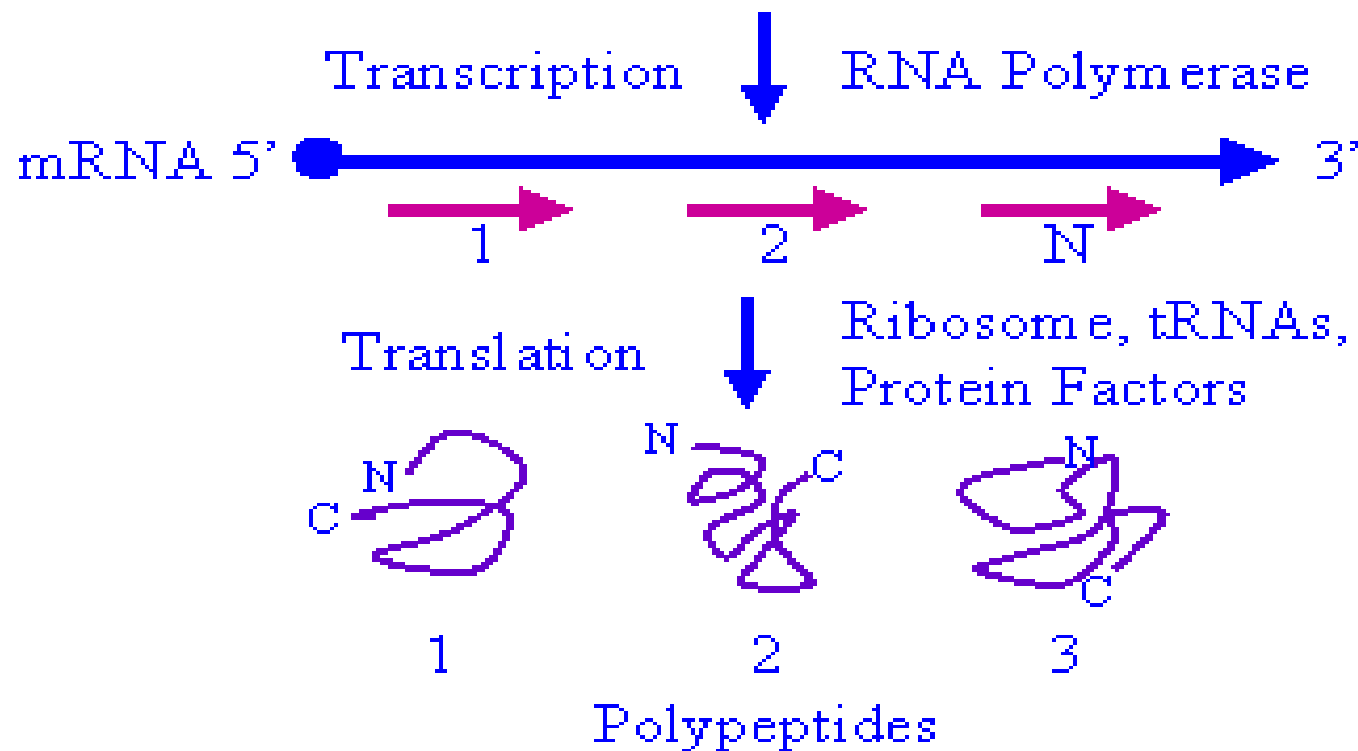
Eukaryotic promoter site:



Promotor sites of DNA

Prokaryotic Gene Expression

Promoter Cistron1 Cistron2 CistronN Terminator



Eukaryotic Gene Expression

