7.2 Transcription and Gene Expression

Articles

4 different groups, each with a different article

Read the article as a group, and create a summary for the article

You are responsible for presenting your article to the class

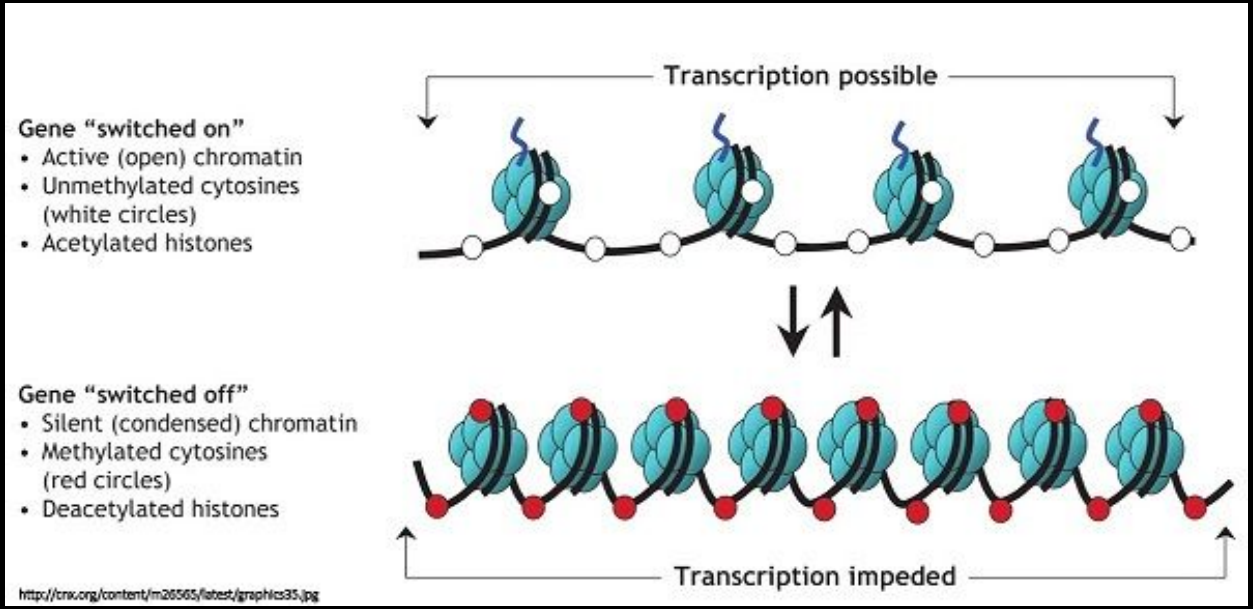
EVERYONE IN YOUR GROUP MUST SHARE SOMETHING RELEVANT IN THE PRESENTATION

Your classmates are using your presentation to answer questions about the 3 articles they didn't read

7.2U The environment of a cell/organism has an impact on gene expression

Pigmentation of Himalayan rabbits is controlled by genes responding to temperature stimuli

7.2S 1 Analysis of changes in DNA methylation patterns



-Direct methylation decreases gene expression

-Addition of methyl group to histones promotes/inhibits gene expression.

Bell Ringer

The central dogma for biology is

A. Protein → RNA → DNA
B. DNA → Protein → RNA
C. DNA → RNA → Protein
D. RNA → DNA → Protein

7.2 TRANSCRIPTION AND GENE EXPRESSION

Understandings:

- Transcription occurs in a 5’ to 3’ direction
- Nucleosomes help to regulate transcription in eukaryotes
- Eukaryotic cells modify mRNA after transcription
- Splicing of mRNA increases the number of different proteins an organism can produce
- Gene expression is regulated by proteins that bind to specific base sequences in DNA
- The environment of a cell and of an organism has an impact on gene expression

Applications:

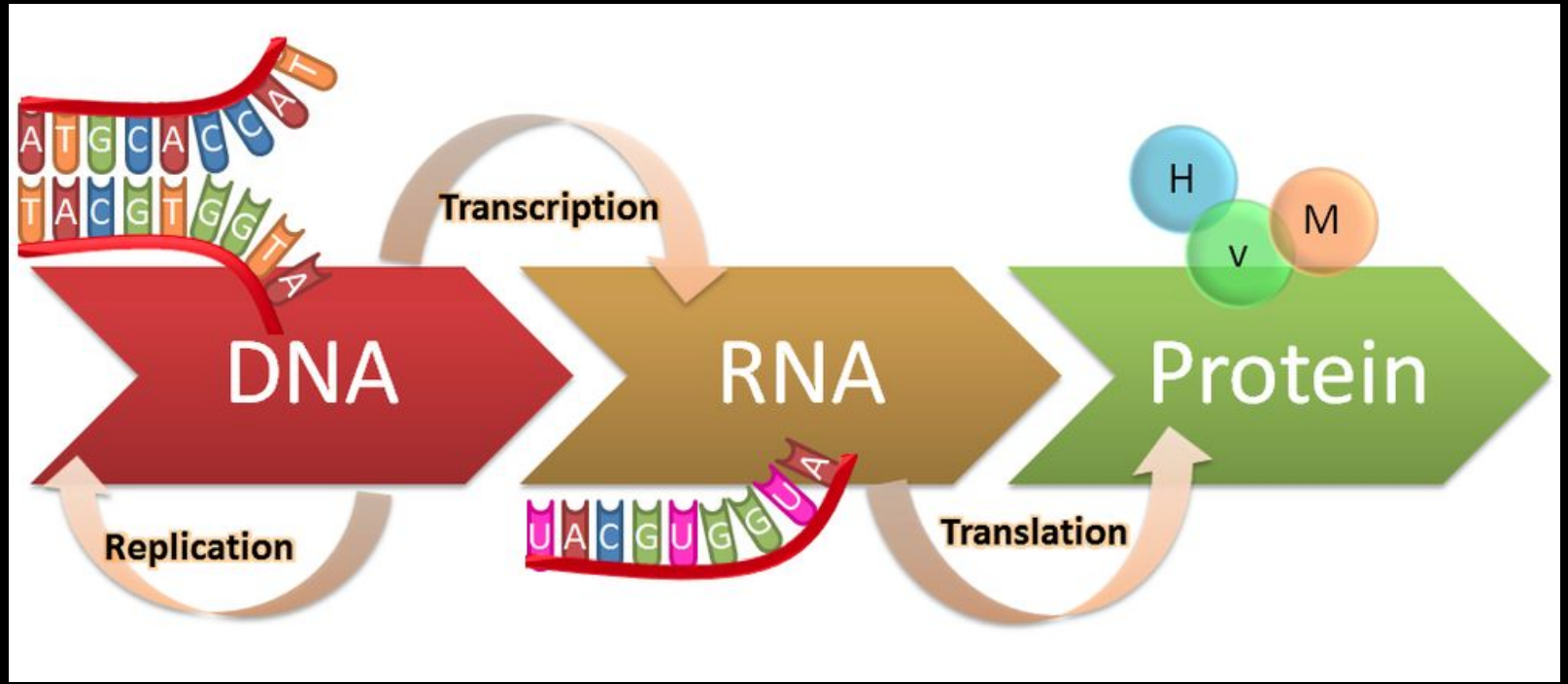
- The promoter as an example of non-coding DNA with a function

Skills:

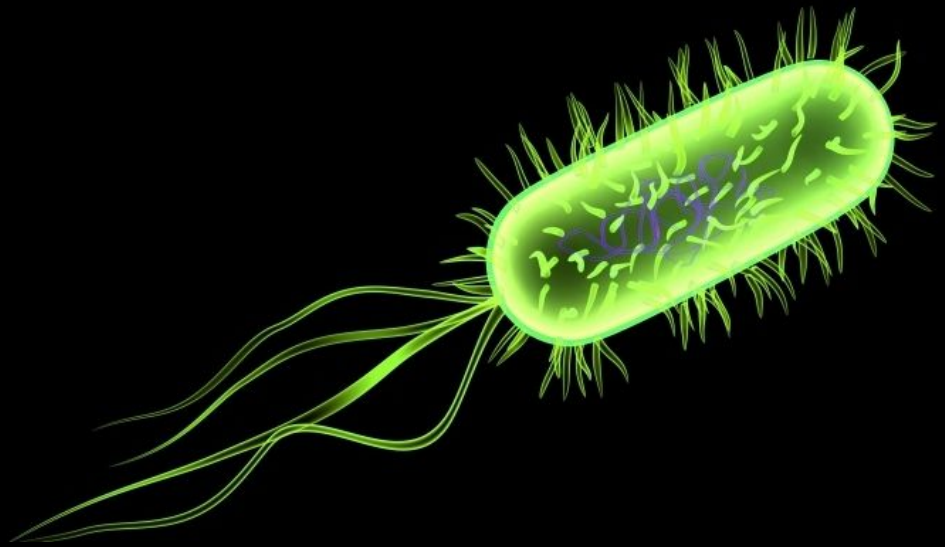
- Analysis of changes in the DNA methylation patterns

Review of DNA processes

Replication → Transcription → Translation



7.2U1: Gene expression is regulated by proteins that bind to specific base sequences in DNA

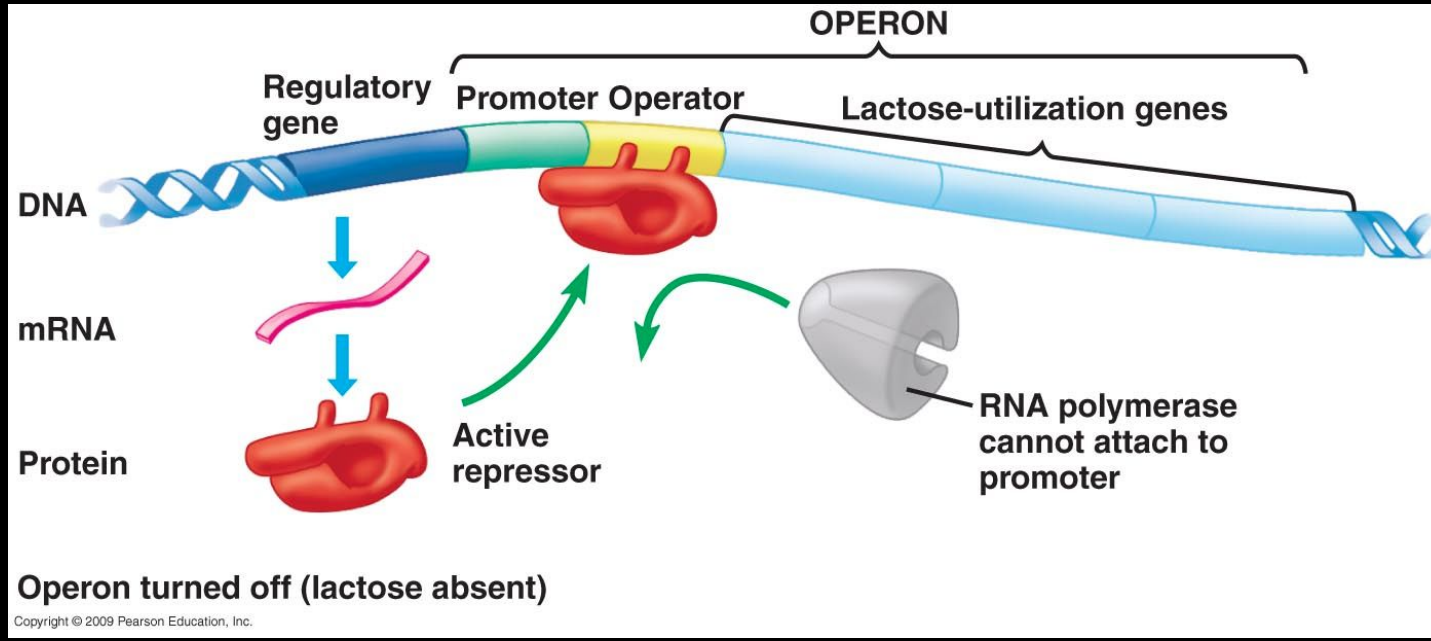


- Organisms don't produce genes that aren't necessary depending on environmental conditions

Example: Lac Operon in *E. coli*

- The lac operon is a series of genes responsible for digesting lactose
- Operates on negative feedback loop
- In presence of lactose, the lac operon genes are expressed because repressor protein is deactivated

- In absence of lactose, repressor gene is not deactivated, and the lac genes are repressed because transcription cannot occur



REVIEW

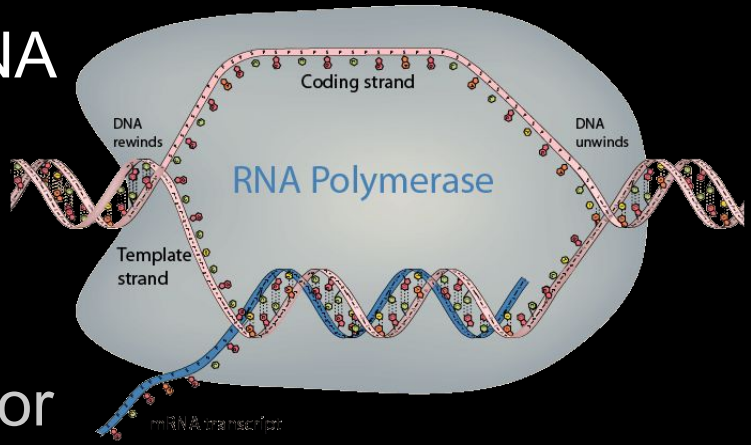
7.1.U6 Some regions of DNA do not code for proteins but have other important functions.

Non-coding regions affect transcription (first step in gene expression)

Promoters are attachment points for RNA polymerase

RNA polymerase make mRNA

mRNA can be transferred to ribosome for translation

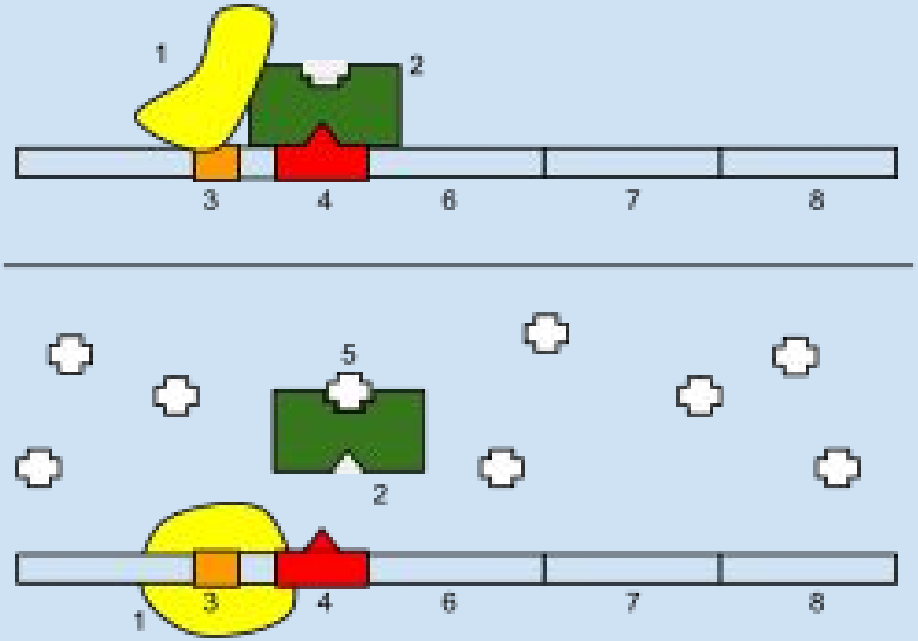


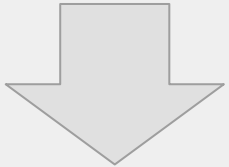
7.2A1 The promoter as an example of non-coding DNA with a function

Promoters are attachment points for RNA polymerase

RNA polymerase make mRNA

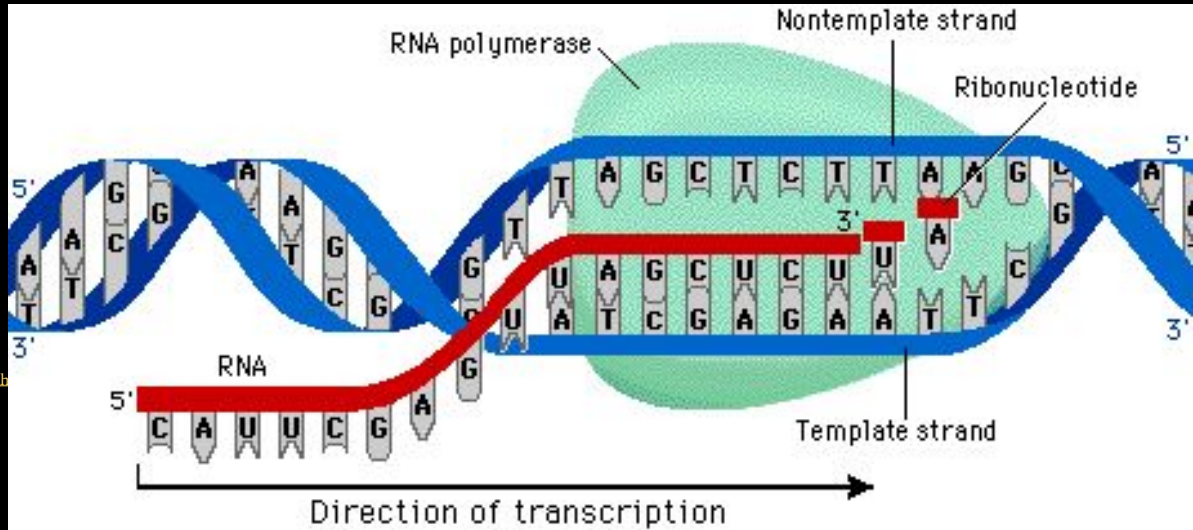
mRNA can be transferred out of the nucleus to express genes (translation)



DNA sequence	*Binding Protein*	*Function*	*Effect on transcription*
Enhancers	Activator	Activator binds to enhancer section of DNA	
Silencers	Repressor	Repressor proteins bind to non-coding regions of DNA	
Promoters	RNA Polymerase	A region of DNA located close to a specific gene that RNA transcribes	

7.2U4 Transcription occurs in a 5’ to 3’ direction

1. *Initiation*- promoter binds to DNA strand so RNA polymerase can attach
2. *Elongation*- RNA polymerase unwinds strand and synthesizes new strand
3. *Termination*



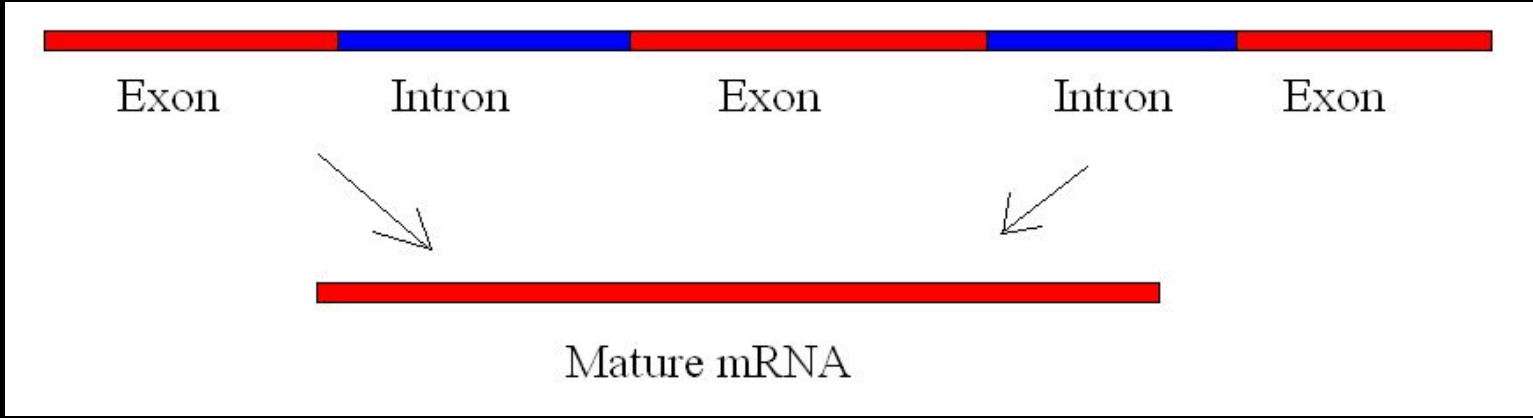
http://ib.bioninja.com.au/higher-level/topic-7-nucleic-acids/72-transcription-and-gene/transcription-hl.h

7.2U3 Eukaryotic cells modify mRNA after transcription

-DNA contain base sequences not translated into polypeptides

- Exons = joined together, exit the nucleus

- Introns = non coding section of gene, cut from mRNA to be broken down



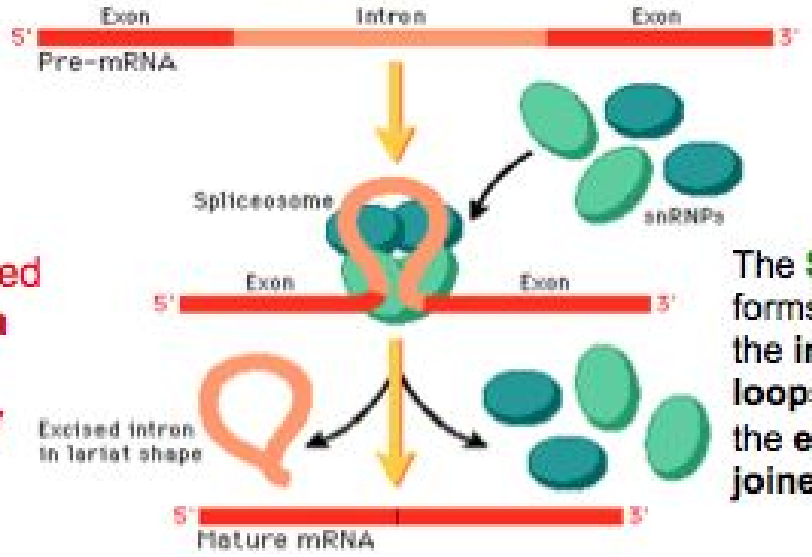
7.2.U3 Eukaryotic cells modify mRNA after transcription.

https://www.dnalc.org/resources/3d/rna-splicing.html

Eukaryotic genes (unlike prokaryote) contain base sequences that are not translated into polypeptides

Introns are non-coding sections of the gene

Exons are **coding sections** of the gene.



Introns are removed then **broken down** back into **nucleotides** ready for use

The **Spliceosome*** forms and causes the **introns** to form **loops** which allows the **exons** to be **joined**

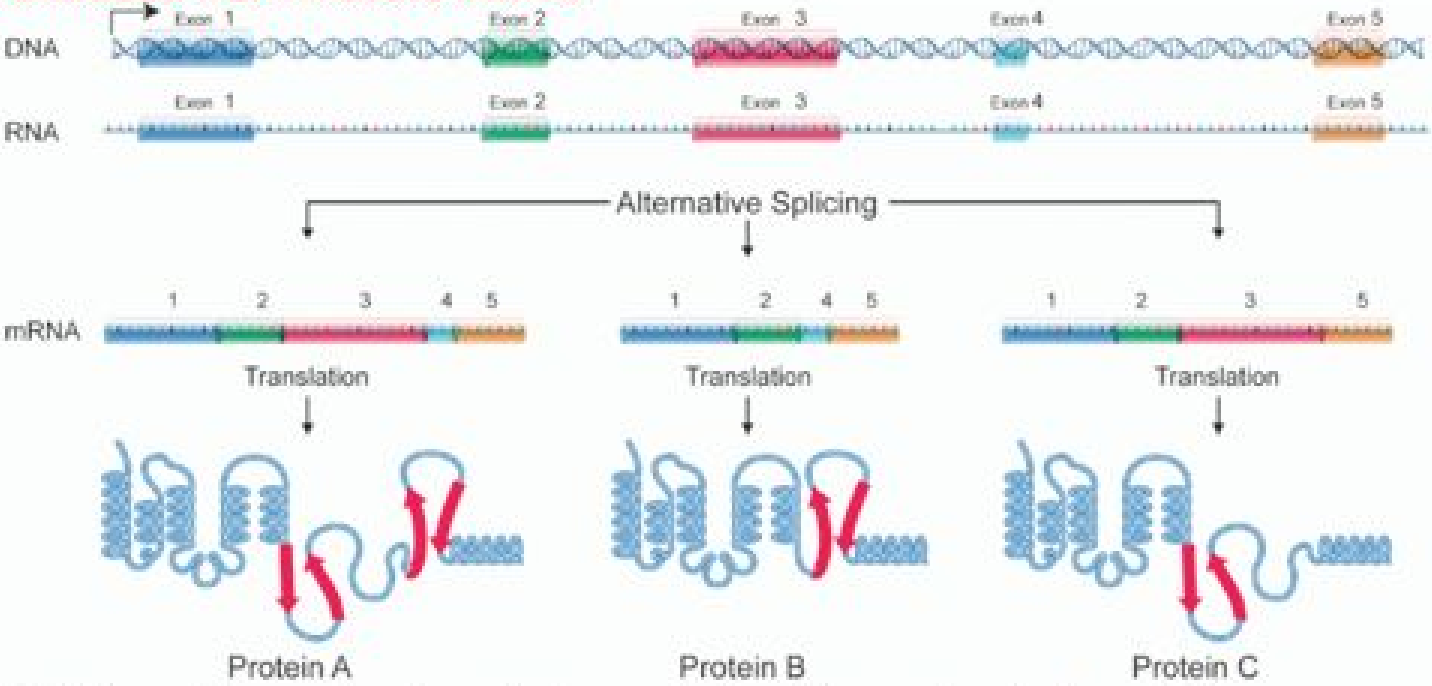
Mature mRNA contains **only exons** leaves the nucleus to be **translated** into **polypeptides**.

*The spliceosome is a complex assembled from small nuclear RNA (snRNA) and proteins.

http://www.phschool.com

7.2.U4 Splicing of mRNA increases the number of different proteins an organism can produce.

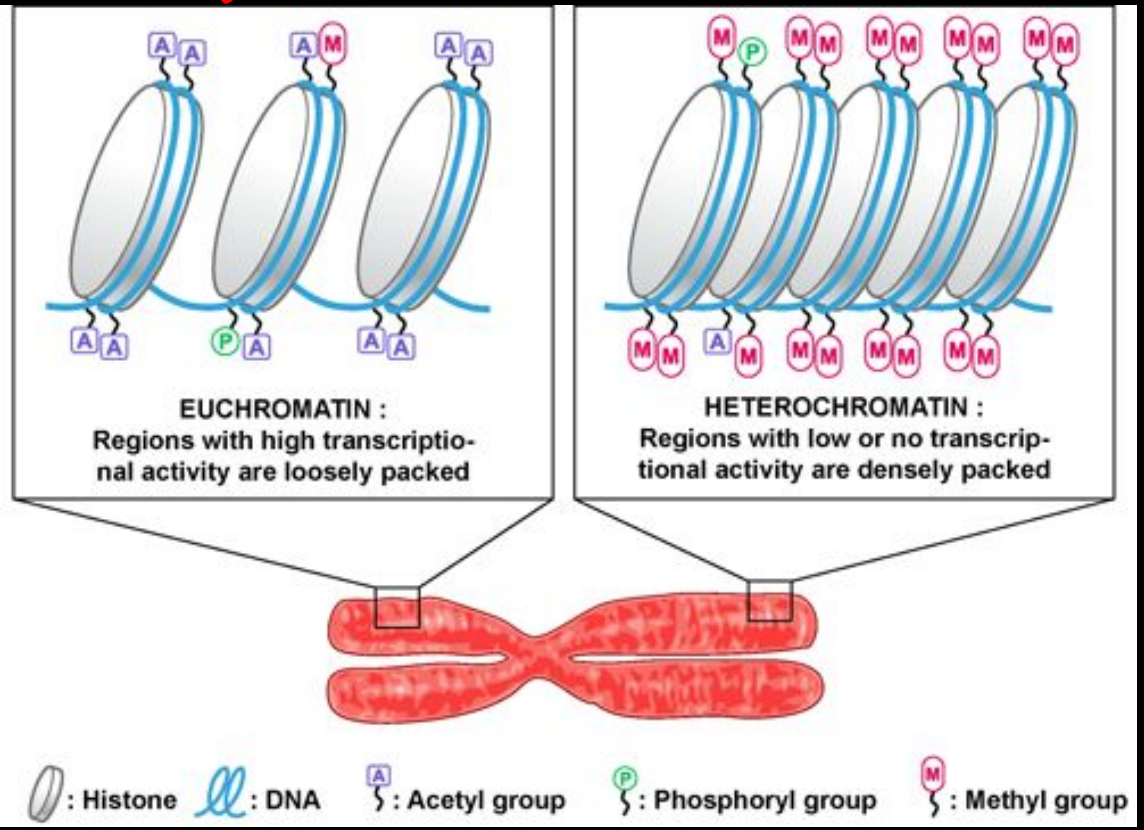
The splicing process above can happen in different ways to the same gene. particular exons (of a gene) may be included within or excluded from mature mRNA



Multiple proteins produced by a single gene. Each proteins produced will vary in it's biological function. An example of this is the IgM gene which produces different immunoglobulins (antibodies) to fight different pathogens.

https://commons.wikimedia.org/wiki/File:DNA_alternative_splicing.gif

7.2U3 Nucleosomes help to regulate transcription in eukaryotes



- Methyl groups attach to nucleosome and inhibit transcription
- DNA is more densely packed
- Transcription activity can't occur