

CONCEPT: EUKARYOTIC POST-TRANSCRIPTIONAL REGULATION

•Eukaryotes regulate gene expression at the post-transcriptional level in _____ ways:

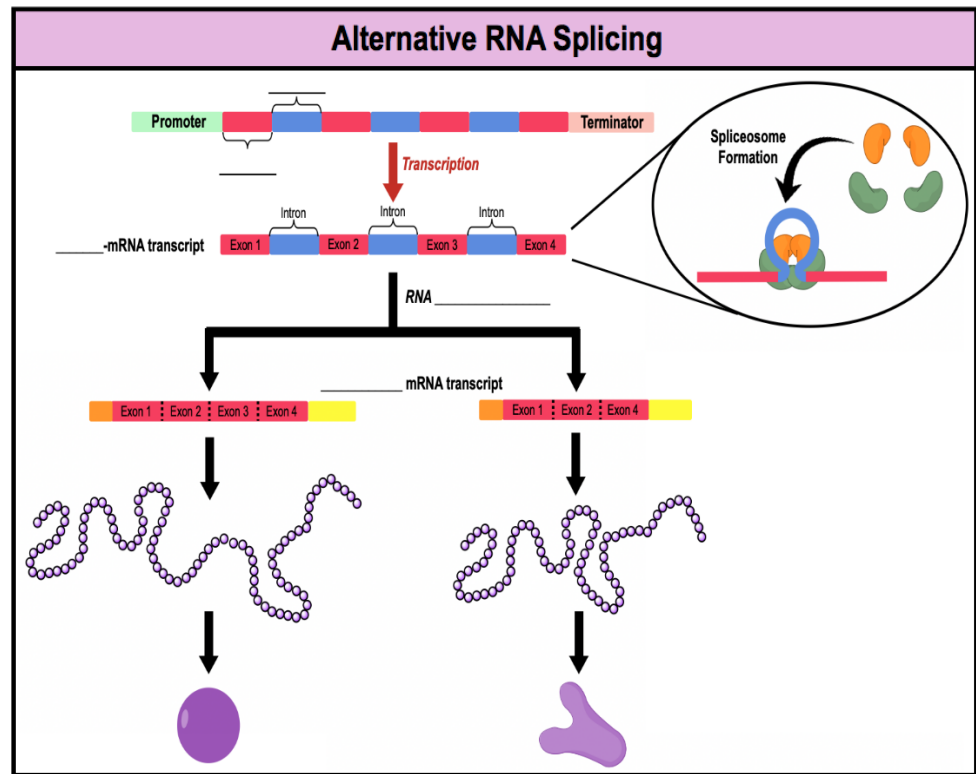
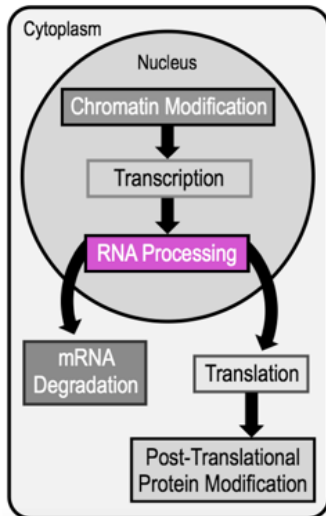
- ① Alternative RNA _____ results in different protein products from the same mRNA transcript.
- ② RNA processing adds a 5' _____ & poly-_____ tail to mRNA for protection from RNA degrading enzymes.
- ③ mRNA can be tagged for degradation or transcription is blocked by small noncoding _____ molecules.

1) Alternative RNA Splicing

•*Recall:* Eukaryotes require _____-transcriptional modifications like *RNA splicing* which can alter gene expression.

- **Alternative splicing:** when different mRNA molecules are produced from the _____ premature RNA.
- The _____: the RNA-protein complex that removes introns from premature RNA.

EXAMPLE: Alternative RNA splicing results in different protein products from the same premature RNA.



PRACTICE Alternative RNA splicing has been estimated to occur in more than 95% of multi-exon genes. Which of the following is **not** an evolutionary advantage of alternative RNA splicing?

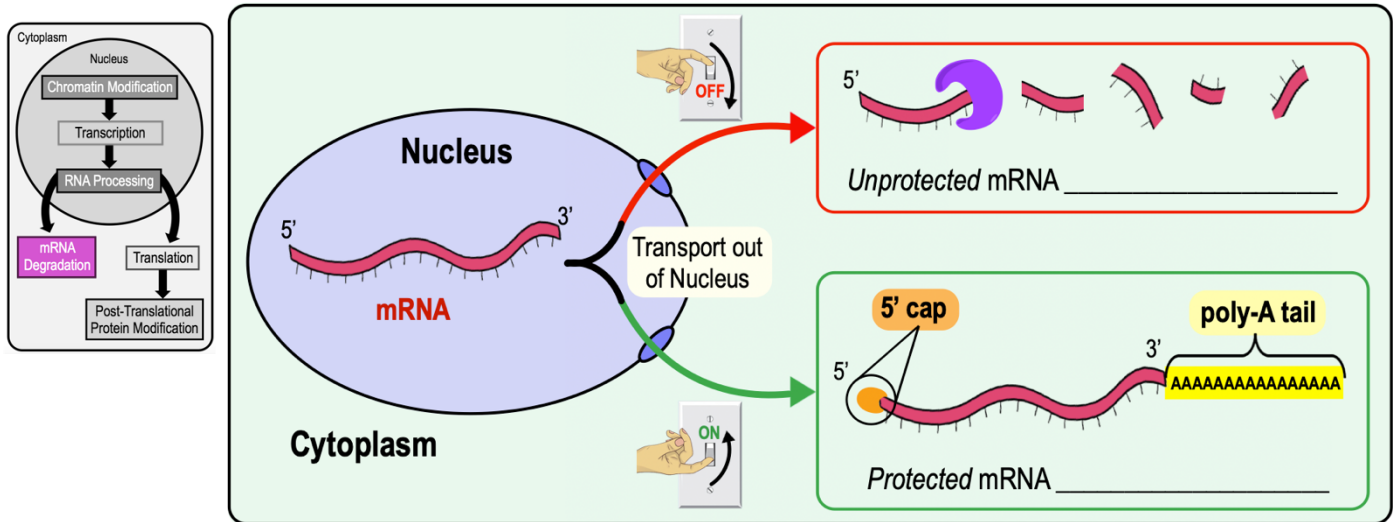
- a) Alternative RNA splicing increases diversity without increasing genome size.
- b) Different protein variants can be expressed by the same gene in different tissues.
- c) Alternative RNA splicing creates shorter mRNA transcripts.
- d) Different protein variants can be expressed by the same gene during different stages of development.

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2) mRNA Protection in the Cytoplasm

- mRNA transcripts must be transported to the _____ where they can be translated by ribosomes.
 - The cytoplasm has many RNA degrading enzymes destroy *foreign* viral RNA molecules.
- The _____ ' cap & poly-A _____ of mRNA molecules _____ the mRNA from degradation by enzymes.

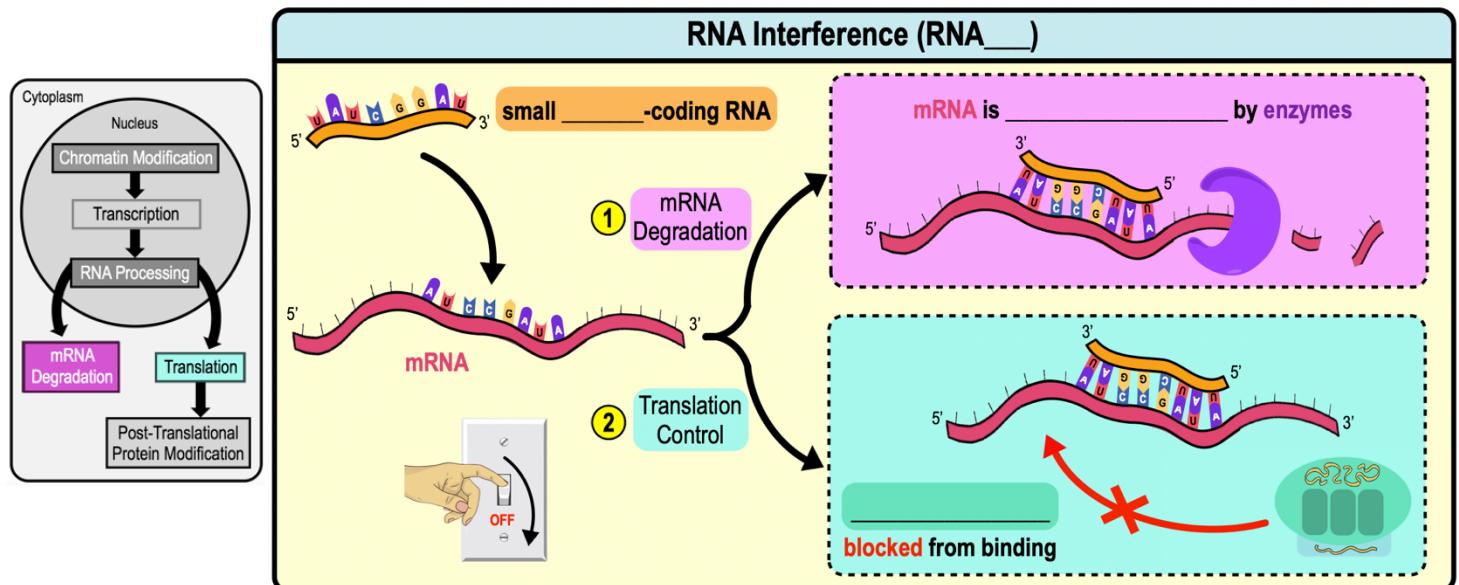
EXAMPLE: mRNA is protected from degradation by cytoplasmic enzymes with a 5' cap and poly-A tail.



3) RNA Interference

- RNA _____ (RNA _____): process of small noncoding RNAs blocking translation of target mRNA molecules.
 - **Small noncoding RNA:** short strands of RNA that have a *complementary sequence* to their mRNA target.
- There are _____ possible scenarios that turn gene expression **OFF**:
 - ① mRNA is _____ OR
 - ② Ribosome is _____ from binding

EXAMPLE: RNA Interference can block ribosome binding or recruit cellular enzymes for mRNA degradation.



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PRACTICE: Which of the following statements best describes the function of RNAi?

- a) Small RNA molecules interfere with translation by targeting ribosomes for degradation.
- b) Small DNA molecules interfere with mRNA molecules by blocking their ability to bind to a ribosome.
- c) Small RNA molecules interfere with translation by targeting specific tRNA molecules
- d) Small RNA molecules interfere with translation by blocking a target mRNA's ability to bind to a ribosome.

Types of Small Noncoding RNAs

• There are _____ classes of RNAs involved in RNAi:

① _____ RNAs

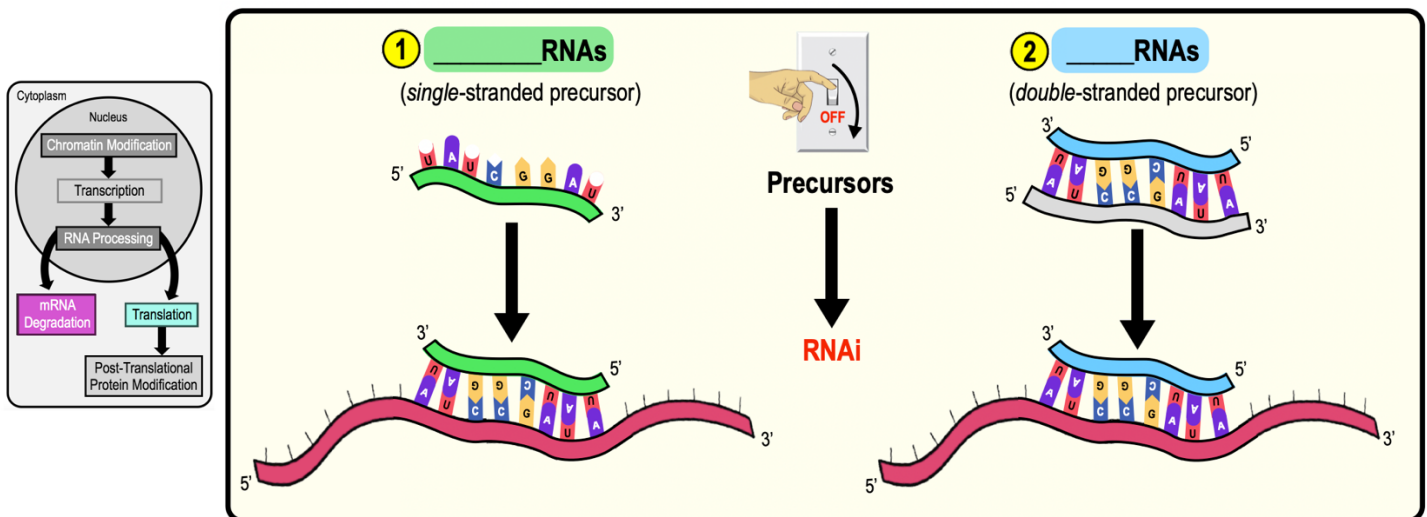
② small interfering RNAs (_____)

□ BOTH types bind to a target mRNA by complimentary base pairing & turns _____ expression of that gene.

• The only difference between microRNAs & siRNAs is the structure of their precursor form:

□ *microRNAs* have a _____-stranded precursor & *siRNAs* have a _____-stranded precursor

EXAMPLE: RNA interference by two types of small noncoding RNAs (microRNAs & siRNAs).



PRACTICE: Which of the following best describes siRNA?

- a) A short double-stranded RNA with one strand that can complementarily bind to and inactivate an mRNA.
- b) A single-stranded RNA with internal complementary base pairs that allow it to fold into a cloverleaf pattern.
- c) A portion of rRNA which is a component of the large and small ribosomal subunits.
- d) A molecule, known as Dicer, that can degrade or cut RNA sequences.