

Transcription and Translation Notes

- **Transcription:** process by which mRNA is made from a gene's DNA sequence.
 - mRNA stands for messenger RNA.
 - occurs in the nucleus of eukaryotic cells (prokaryotes don't have a nucleus so transcription and translation both take place in the cytoplasm)
- **Translation:** process by which a protein is made from an mRNA sequence.
- So, transcription happens first, and is followed by translation. I remember this in two ways: first - the words definitions themselves help me out. To transcribe something means to make a copy of it. mRNA is a copy of a gene, whereas translating something means to convert it to a new language - in this case, to translate from the language of nucleic acids that use nucleotides into the language of proteins, which uses amino acids as its letters. The other way I remember that transcription comes first is that they both start with trans, but transcription has a "c" next, which comes before "l" in the alphabet!

TRANSCRIPTION

Each strand of DNA contains many genes. Transcription is making a copy of one of these genes that can then be used as the directions for the amino acid order in a protein.

RNA Polymerase

- Molecular machine
- binds to the promotor region of a gene - this area becomes available for binding based on epigenetics.
 - There are thousands of proteins (called transcription factors) that either make it easier for RNA polymerase to bind, or those that inhibit its ability to bind this promoter (often by a process called methylation). This will ultimately determine when and how often this particular gene gets transcribed and is a vastly fascinating area of research right now.
 - Gene regulation manages which of these genes are expressed in any given cell in your body.
- unwinds DNA
- adds RNA nucleotides to a template strand of DNA
 - RNA uses uracil in place of thymine.
 - RNA uses a ribose sugar in its backbone instead of the deoxyribose used in DNA.
- pre-mRNA has the potential to code for multiple proteins, depending on how it is edited.
- Once the RNA polymerase reaches the end of the gene, the sequence triggers release of the mRNA transcript. This sequence is composed of codons - three nucleotides that code for one of the 20 different kinds of amino acids.
- Genetic code - the amino acids that match with each code.
- All mRNA transcripts start with the codon AUG that codes for the amino acid methionine.
- Processed mRNA transcripts leave the nucleus through nuclear pores

TRANSLATION

- occurs in the cytoplasm on ribosome machines.

Ribosome

- Composed of two pieces, or subunits

- mRNA transcript fits in between these pieces.
- mRNA is “read” one codon at a time.
- Once the ribosome reads the codon, it is matched to the correct **tRNA** (or transfer RNA) **anticodon**.
- The **anticodon** must be complementary to the codon in order for the ribosome to let it bind.
- The ribosome continues adding amino acids to the chain until it reaches a stop codon.
- The stop codon causes the ribosome to release the tRNAs it is still holding, as well as the mRNA transcript.

tRNA

- Each tRNA carries an amino acid.
- The tRNA that matches the AUG codon ALWAYS carries the amino acid methionine.
- Once a second correct tRNA is matched to the next codon, the ribosome forms a peptide link between the two amino acids. Now the amino acids are covalently bonded together.
- The ribosome can only work with two tRNAs at once, so the first one leaves its methionine behind and the empty tRNA is released.
- The released tRNA picks up another amino acid in the cytoplasm; in this case, it will pick up another methionine.
- The next codon is read, which tells the ribosome which tRNA to bring in, and then it covalently links the next two amino acids together, and a growing polypeptide chain develops.
- Degenerate triplet - when more than one codon codes for the same amino acid.

Completed Proteins

- Vary greatly in length, from as tiny as 8 amino acids to 1000's of amino acids in length.
- They must be folded properly before they are able to carry out their functions.