Section 14.2
Ribosomes and Protein Synthesis
Standard

**LS1.4** Demonstrate how DNA sequence information is decoded through transcriptional and translational processes within the cell in order to synthesize proteins. Examine the relationship of structure and function of various types of RNA and the importance of this relationship in these processes.
I Can...

• **LS 1.4** I can model transcriptional and translational processes used to make proteins.
Key Questions

1. How does the genetic code work?
2. What role does the ribosome play in assembling proteins?
3. How does molecular biology relate to genetics?
Vocabulary

- Polypeptide
- Genetic code
- Codon
- Translation
- Anticodon
The Genetic Code

• The first step in decoding genetic messages is *transcription* (copying a DNA sequence into mRNA).
• The next steps lead to the assembly of a protein.
• Proteins are made by joining *amino acids* together into chains called *polypeptides*.
• 20 different amino acids are commonly found in polypeptides.
• The specific order in which amino acids are joined together determines the protein’s shape, chemical properties, and function.
The Genetic Code

• The four bases of RNA (A, C, G, and U) are known as the **genetic code**.
  • Read 3 bases at a time
  • 3 bases code for *one* amino acid
  • This 3-base “word” is known as a **codon**
How to Read Codons

• There are 64 possible codons in the genetic code.
• Most amino acids can be specified by more than one codon.
• Start in the middle of the circle and work your way out.
Start and Stop Codons

- Start codon
  - AUG

- Stop codons
  - UAG
  - UAA
  - UGA
Translation

• The decoding on an mRNA message into a protein is a process known as **translation**.

• Ribosomes use the sequence of codons in mRNA to assemble amino acids into polypeptide chains.

• Once the polypeptide is complete, it folds into its final shape and/or joins with other chains to become a functional protein.
Steps in Translation

• Ribosome attaches to an mRNA molecule in the cytoplasm.
• tRNA molecules bring the proper amino acids into the ribosome.

• How does tRNA “know” which amino acid to bring?
  • Each tRNA carries just one kind of amino acid.
  • tRNA has an **anticodon** that is complementary to the mRNA codon.
• Translation begins at AUG, the “start” codon.

• Each tRNA has an anticodon complementary to the codon.
• The ribosome helps form a covalent bond, called a **peptide bond**, between the first and second amino acid.

• The first tRNA molecule leaves the ribosome.

• The ribosome moves along the mRNA code.
• The process continues until the ribosome reaches a “stop” codon.
The Roles of RNA in Translation

**Amino acid**

**Transfer RNA**
Carries amino acids to the ribosome and matches them to the coded mRNA message.

**Messenger RNA**
Carries instructions for polypeptide synthesis from nucleus to ribosomes in the cytoplasm.

**Ribosome**

**Ribosomal RNA**
Forms an important part of both subunits of the ribosome.
Molecular Genetics

• The central dogma of molecular biology is that information is transferred from DNA → RNA → protein.
• When a gene (segment of DNA code) is used to build a protein, that gene has been expressed.

• Near-universal nature of the genetic code in all organisms
  • Code is always read 3 bases at a time
  • Always in the same direction
  • Always translated
  • Despite enormous diversity in form and function, all living things display unity at life’s most basic level, the gene.
Molecular Genetics

• Molecular biology provides a way to understand the link between genes and the characteristics they influence.

• Examples-
  • A gene that codes for an enzyme to produce pigment can control the color of a flower.
  • A gene that produces proteins that regulate patterns of tissue growth in a leaf.
Section 14.2 Exit Ticket

1. What is transcription? What is translation? How are the two processes connected?
2. What are the “words” of the genetic code?
3. How are proteins and genes related?
The End 😊