

Animation Script for Translation

The numbers on the text passages below correspond to numbered frames in the animation. Look for these numbers in the upper left corner of the animation window.

- 1.** In translation, the cell uses an mRNA strand as a template to assemble proteins. The cell has just transcribed this mRNA strand from its DNA, and it now translates the mRNA's nucleotide sequence into a chain of amino acids. This chain, called a polypeptide, forms the basic structure of a protein.
- 2.** A cellular component called a ribosome coordinates the translation process. A ribosome is a molecular machine that synthesizes proteins in the cell. It consists of two main parts, a large and small subunit.
- 3.** The ribosome brings together the mRNA to be translated and a set of molecules called transfer RNAs, or tRNAs, which are floating in the cell. tRNAs are adapter molecules that coordinate between the mRNA and the polypeptide chain that the cell needs to build. Each tRNA is designed to carry a specific amino acid that it can add to a polypeptide chain.
- 4.** tRNAs bring their amino acids to the mRNA in a specific order. This order is determined by the attraction between a codon, a sequence of three nucleotides on the mRNA, and a complementary nucleotide triplet on the tRNA, called an anticodon. This anticodon also specifies the particular amino acid that the tRNA carries. Only the tRNA carrying the next amino acid in the polypeptide chain has the anticodon that binds to the appropriate location on the mRNA. This system ensures that amino acids are added to the chain in the correct order.
- 5.** At the beginning of translation, the ribosome and a tRNA attach to the mRNA. The tRNA is located in the ribosome's first docking site.
- 6.** This tRNA's anticodon is complementary to mRNA's initiation codon, where translation starts.
- 7.** The tRNA carries the amino acid that corresponds to that codon.
- 8.** The next mRNA codon is now exposed in the ribosome's other docking site. A tRNA with the complementary anticodon is attracted to the ribosome and binds to this codon. The tRNA carries the next amino acid in the polypeptide chain.
- 9.** The first tRNA transfers its amino acid to the amino acid on the newly arrived tRNA, and a chemical bond is made between the two amino acids.
- 10.** The tRNA that has given up its amino acid is released. It can bind to another molecule of the amino acid and be used again later in the protein-making process.
- 11.** Using a ratcheting mechanism, the ribosome advances the mRNA, three nucleotides at a time. The ribosome also shifts the tRNA carrying the polypeptide chain into its recently vacated docking site.
- 12.** A tRNA whose anticodon is complementary to this next mRNA codon is attracted to the ribosome and the mRNA.
- 13.** Once again, the polypeptide chain is transferred to the new tRNA, the empty tRNA is released and the ribosome ratchets through the mRNA another three nucleotides, simultaneously shifting the tRNA as well. As this process continues, the polypeptide chain grows longer.

- 14.** Translation continues until the ribosome encounters a stop codon in the mRNA. This nucleotide triplet signals that the polypeptide chain is complete.
- 15.** The stop codon causes all the components of translation to separate. The ribosome can disassemble and be used again. The mRNA is discarded by being degraded back into its building blocks, the nucleotides. New mRNA can be synthesized via transcription when more of that protein is needed.
- 16.** The cell has now successfully translated one of its genes into a polypeptide chain, the raw material of a protein. This chain will be further processed and folded into a protein. Every protein-encoding gene in the cell is transcribed and translated in this manner so that the cell can create the thousands of proteins that it needs to carry out all of its essential functions.
- 17.** Translation, then, is one stage in the process in which the cell's genetic information is used to create proteins. The cell's DNA is first transcribed in a temporary copy (mRNA), which is then translated into the amino acid sequence of a protein.