

Chapter Six: Genes and DNA

Section 2: How DNA Works

DNA is often wound around proteins, coiled into strands, and then bundled up even more.

In a cell that **has** a nucleus, the strands of DNA and proteins are bundled into chromosomes.

In a cell that **lacks** a nucleus, each strand of DNA forms a loose loop within the cell.

Gene: consists of a string of nucleotides that give the cell information about how to make a specific trait

- Humans have at least 30,000 genes

DNA code is read like a book – from one end to the other and in one direction.

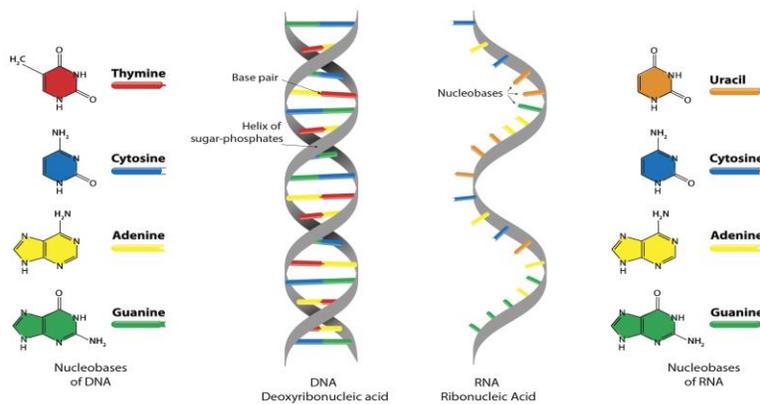
- Groups of three bases are the codes for specific amino acids
 - CGA = amino acid proline or AGC = amino acid serine
- A long string of amino acids forms a protein
- Proteins are found throughout cells and cause most of the differences you see among organisms
 - Determine how tall you grow, what colors you see, or whether your hair is curly or straight
 - Limitless variety

RNA: stands for **Ribonucleic Acid**

- Similar to DNA and can serve as a temporary copy of a DNA sequence.

Making a protein:

1. Copy one side of the DNA containing a gene
 - a. *Messenger RNA (mRNA)*: a mirrorlike copy of the DNA segment
 - b. Moves out of the nucleus and into the cytoplasm of the cell

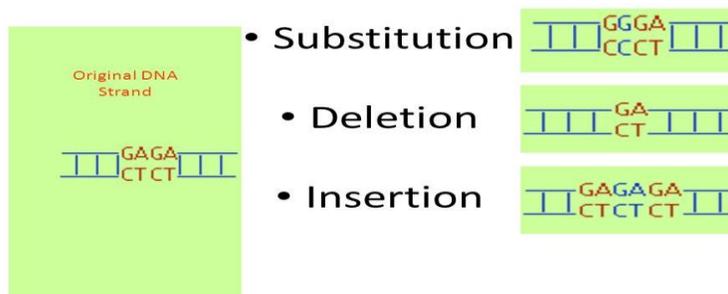


2. *mRNA* is fed through a protein assembly line
 - a. **Ribosome:** a cell organelle composed of RNA and protein
 - b. *mRNA* is fed through the ribosome 3 bases at a time
 - c. Molecules of *transfer RNA* (*tRNA*) translate the RNA message
 - i. deliver amino acids from the cytoplasm to the ribosome
 - ii. Match up like pieces of a puzzle
 - d. The amino acids become linked and grow into a protein
 - e. <https://www.youtube.com/watch?v=oCp9IK6iBTo&t=9s>
 - f. <https://www.youtube.com/watch?v=gG7uCskUOrA>

Mutations: changes in the number, type, or order of bases on a piece of DNA

- *Deletion:* a base is left out
- *Insertion:* an extra base is added
- *Substitution:* the most common change where the wrong base is used

Types of Gene Mutations



There are three possible consequences to changes in DNA:

- an improved trait
- no change
- a harmful trait.
- Fortunately, cells can detect errors in DNA and are usually fixed

Mutagen: any physical or chemical agent that can cause a mutation in DNA

- Examples include high-energy radiation, UV radiation, asbestos, or chemicals in cigarette smoke

Sickle Cell Anemia: a disease that affects red blood cells.

- Caused by a substitution
 - Instead of the DNA sequence GAA, a substitution of GTA is done
- Not as good at carrying oxygen as normal red blood cells
- Causes painful and dangerous clots

Genetic Engineering: where scientists can manipulate individual genes within organisms.

DNA fingerprinting: identifies the unique patterns in an individual's DNA

- Used as evidence in crimes
- Can be used to identify family relations or hereditary diseases

Twins have identical DNA

- *Clone*: a new organism that has an exact copy of another organism's genes
 - Example was Dolly (sheep) born in 1996