

Gene Regulation Introduction

Background:

Every diploid cell in our body has an identical copy of our genome. Each of these cells has 46 chromosomes which carry the genes that determine our traits. While every cell has a copy of our genome, each cell uses the DNA slightly differently. Depending upon the type of cell and its location in the body, the cell will transcribe different genes that will be translated into particular proteins. Think of the genome like a textbook with chapters where each type of cell reads a different section.

Instructions:

Each station in this lab represents a different type of tissue. As you visit each station, write down the function of the tissue and predict which types of proteins your cell would need to translate in order to function properly. Choose from the list of proteins below. At some stations, you may only need one protein. Other stations, your cell may need multiple proteins.

Proteins that are coded in our genome

Serotonin- a neurotransmitter that causes neurons to send messages to one another.

Keratin- a fibrous protein that is necessary in the epidermis, hair, and nails

Lactase- a digestive enzyme that breaks down the carbohydrate lactose

Hemoglobin- a protein that readily binds to oxygen and carbon dioxide molecules

Actin- a protein involved in muscle contraction

Myosin- another protein involved in muscle contraction

Antibody- a Y-shaped protein that is produced by B-cells to attack bacteria and viruses

Collagen- a protein found in tissues such as tendons, ligaments, and the skin

Protease- a digestive enzyme that breaks down proteins

Insulin- a hormone that converts glucose in the blood to glucagon to decrease our blood sugar

Glucagon- a hormone that converts glucagon to glucose to increase our blood sugar

Stations	Protein(s) that your cells will need to translate/express	When will these cells need these proteins?
1. Stomach Cells		
2. Pancreatic Cells		
3. Prefrontal Cortex Cells		
4. Muscular Cells		
5. Epidermal Cells		
6. Immune Cells (ex. B-Cells)		
7. Red Blood Cells		
8. Hair Cells		

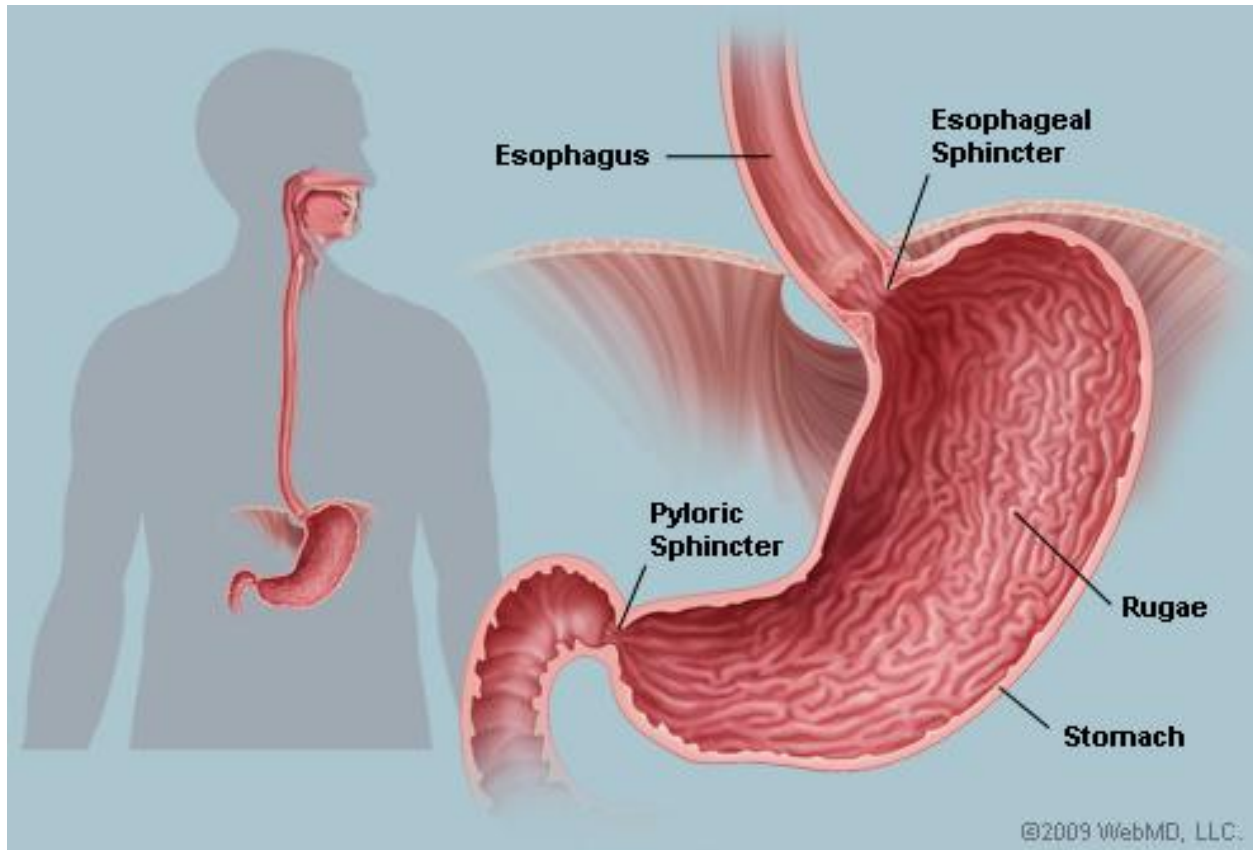
Analysis Questions:

1. Do all cells use the information carried in their DNA in the same way? Why or why not?

2. Why do all diploid cells in our bodies have an identical copy of DNA?

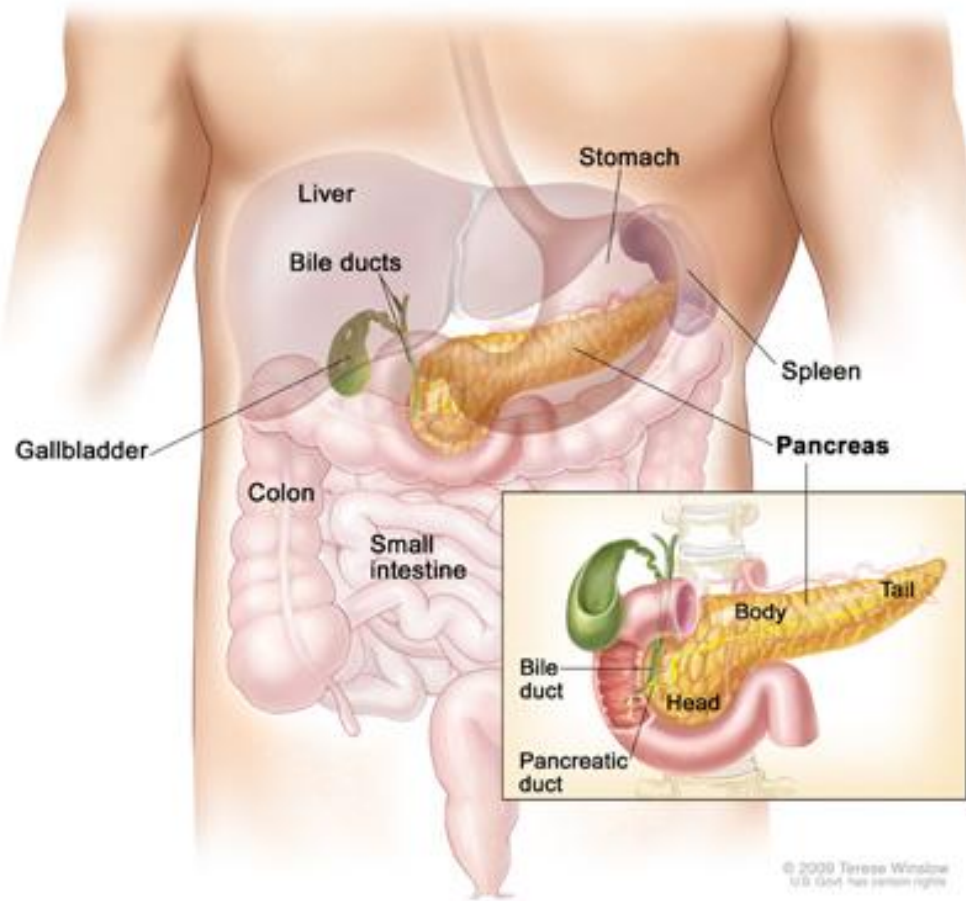
3. Why wouldn't a cell make all of the proteins that it has information to make?

STATION I: Stomach Cells



FUNCTIONS: The stomach secretes digestive enzymes and hydrochloric acid to break down foods such as carbohydrates and lipids. Once these molecules are digested they can be absorbed into the blood and used to generate energy.

STATION 2: Pancreatic Cells



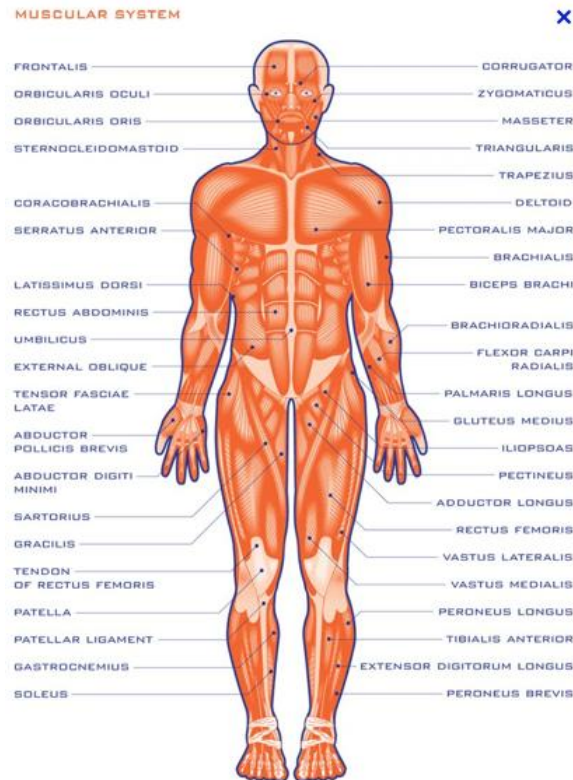
FUNCTIONS: The pancreas is an endocrine gland that produces hormones that regulate levels of sugar dissolved in the blood.

STATION 3: Prefrontal Cortex Cells



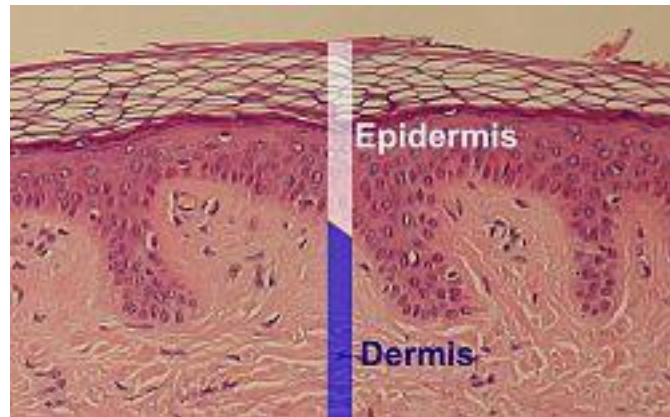
FUNCTIONS: The prefrontal cortex is an area of the brain that is responsible for complex cognitive behavior, personality traits, and social behavior. The brain is made of neurons which send messages to one another with chemicals called neurotransmitters.

STATION 4: Muscular Cells



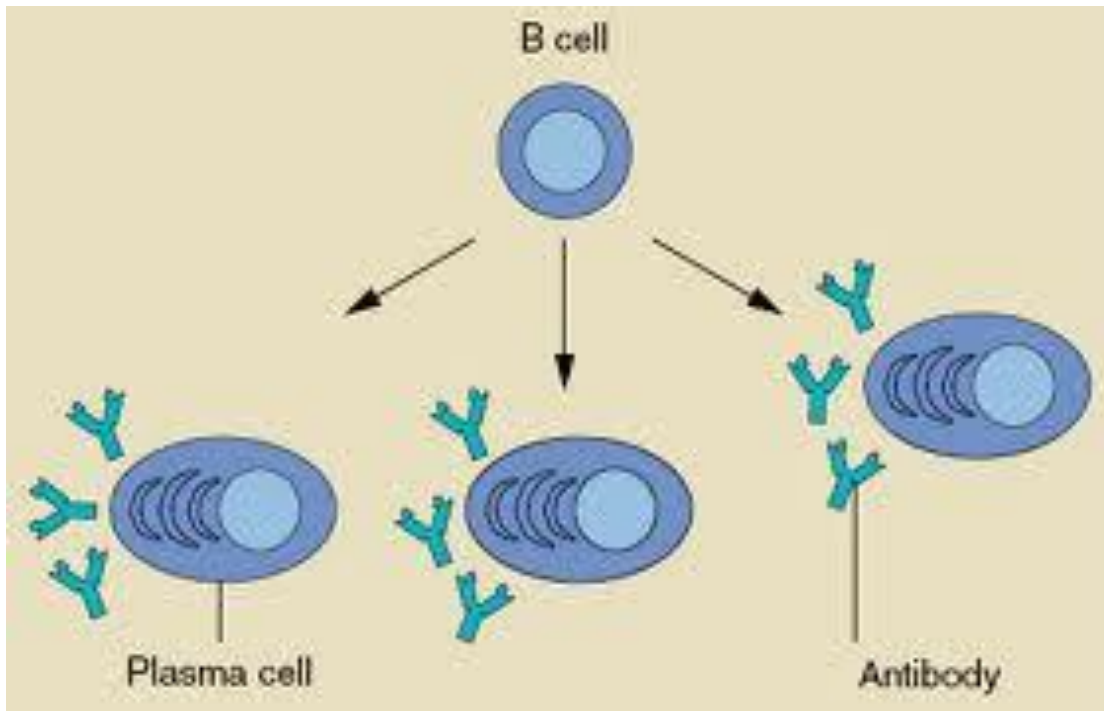
FUNCTIONS: The muscular system is responsible for relaxing and contracting muscles to facilitate movement. Skeletal muscles attach to bones with tendons and ligaments; they help us move. Smooth muscles help us move food through our digestive tracts. Cardiac muscles help are heart pump blood.

STATION 5: Epidermal Cells



FUNCTIONS: The epidermis is a layer of cells on our skin. It helps protect our bodies from infection by providing a barrier between our environment and our other organs.

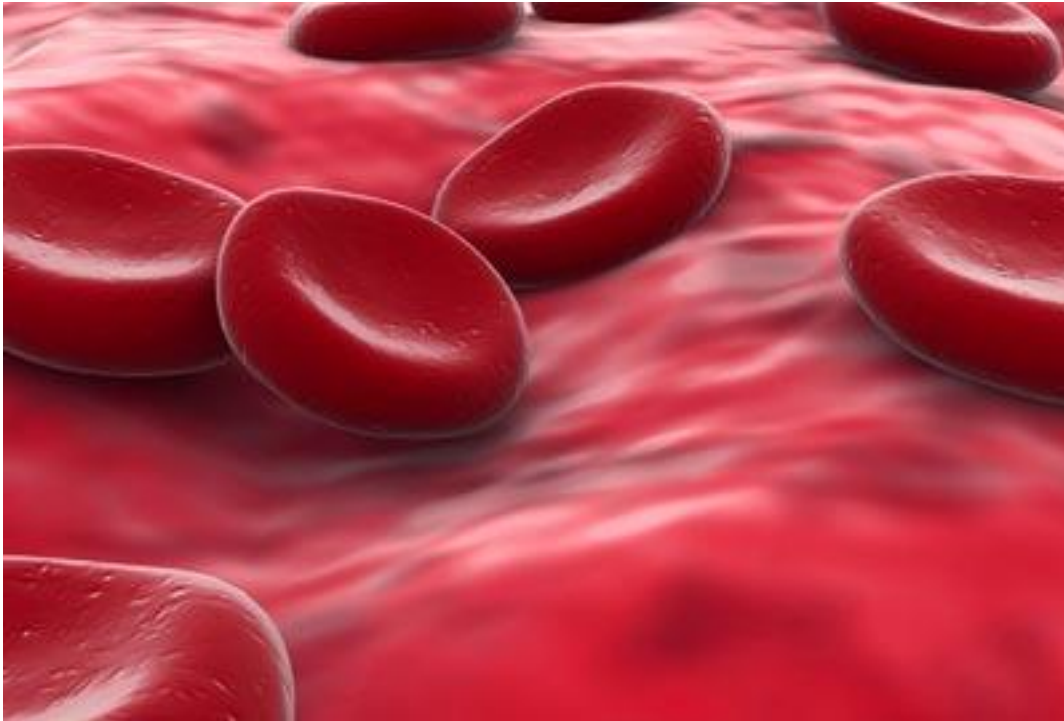
Station 6: Immune Cells (ex. B-Cells)



Functions: Immune cells, such as B-cells are responsible for fighting infections from pathogens such as bacteria and viruses.

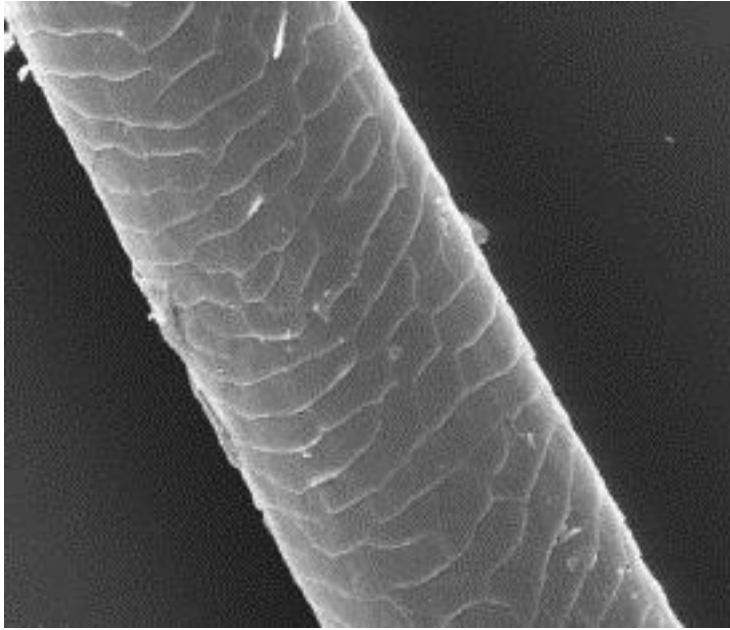
They produce antibodies that help attack specific species of pathogens. Other white blood cells help destroy the pathogens when they are surrounded by antibodies.

Station 7: Red Blood Cells



functions: Red blood cells help transport oxygen from the lungs to all the cells in the body. They also transport carbon dioxide from the body cells back to the lungs, so that it can be exhaled.

Station 8: Hair



Functions: Hair helps mammals protect their skin and stay warm. It is primarily composed of a fibrous protein called keratin.