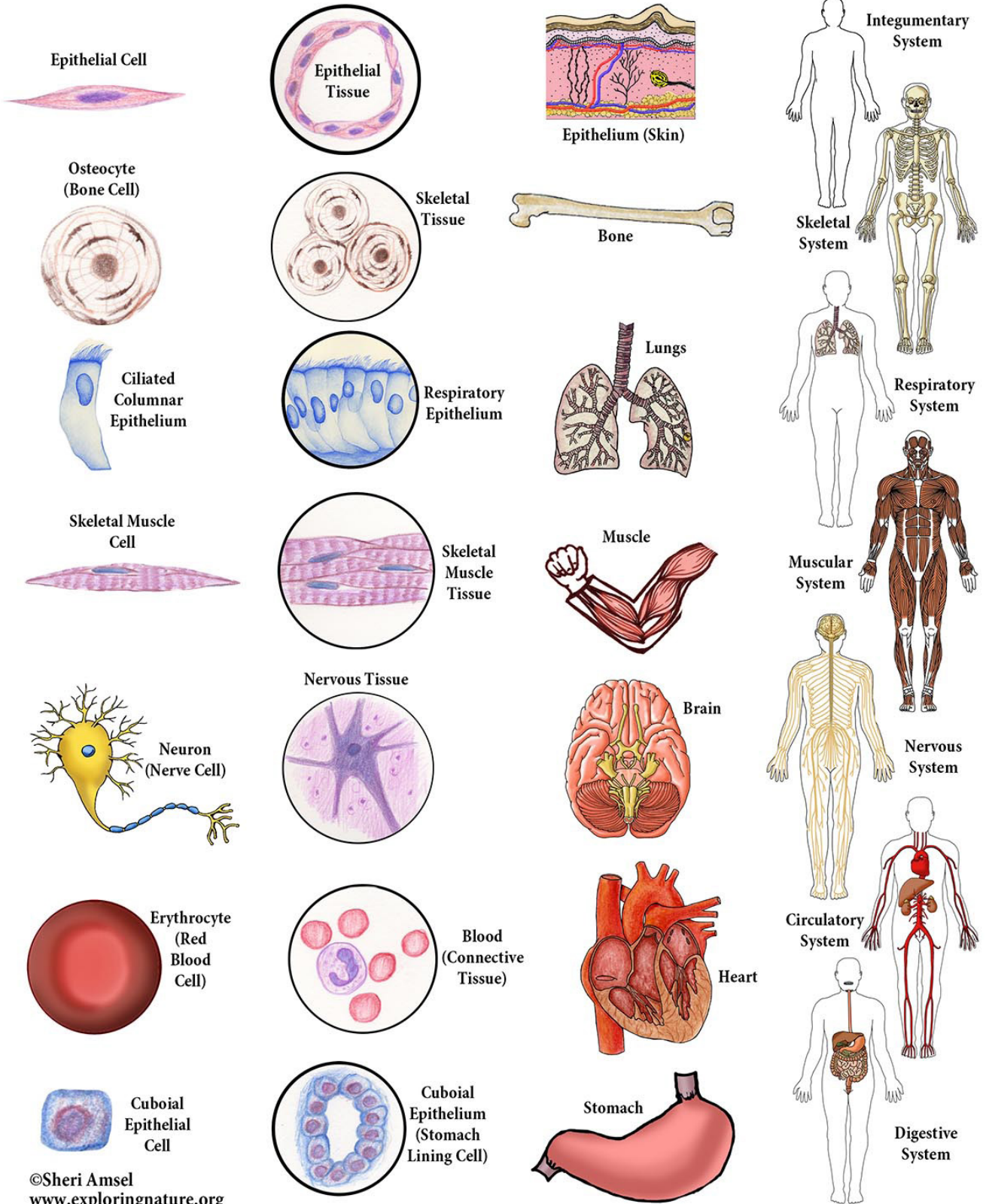


# Bundle for 9-12 NGSS

## Structure and Function in Humans

Cell → Tissue → Organ → Body System

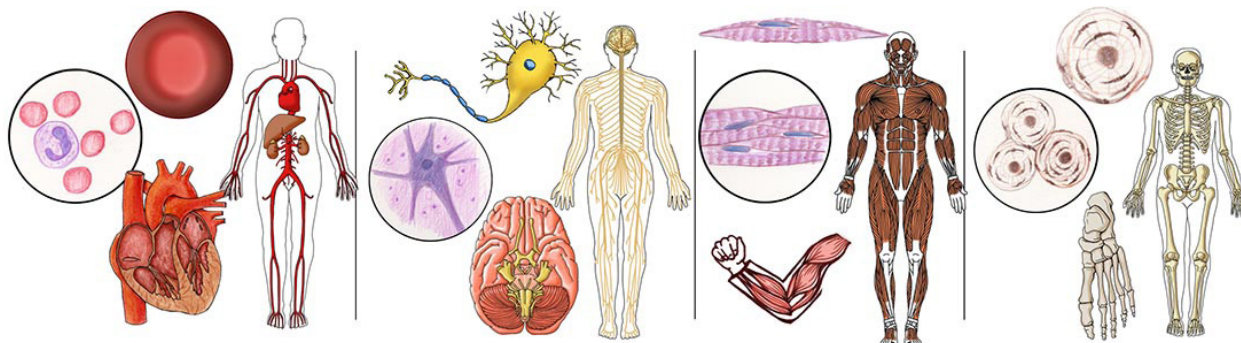


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# LS1.A: Structure and Function - Grades 9-12

From Molecules to Organisms: Structures and Processes

Addressing: 5 DCI (Disciplinary Core Ideas) and 3 Performance Expectations

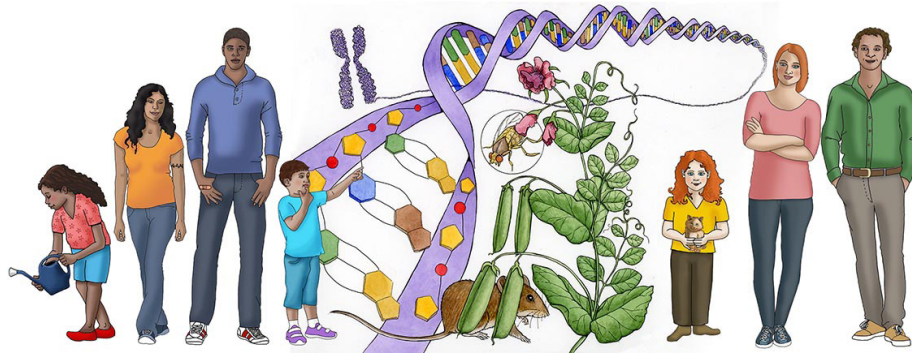


This bundle includes 28 resources for grade 9-12 about **Structure and Function** including: Reading, Color Diagrams, and NGSS Performance Tasks (49 pages total). Copyright © 2021 Sheri Amsel • All rights reserved by author. Permission to copy for classroom use only. Electronic distribution limited to classroom use only.

## Resources included in this Next Generation Science Standards Bundle:

- Cells, DNA, and Proteins - Next Generation Science Standards and Rubric Building Resource (2 Pages)
  - 1) Cells, DNA, and Protein Synthesis - Reading (1 Page)
  - 2) DNA, Chromosomes, and Genes - Reading (1 Page)
  - 3) The Location of DNA, Chromosomes, and Genes - Diagram (1 Page)
  - 4) How the Structure of DNA Determines the Structure of Proteins - Diagram (1 Page)
  - 5) Replication - Reading and Diagram (1 Page)
  - 6) Transcription - Reading and Diagram (1 Page)
  - 7) Translation - Reading and Diagram (1 Page)
  - 8) Transcription to Protein Synthesis Diagram (1 Page)
  - 9) DNA to Protein Molecule - Reading and Illustrated Diagram (1 Page)
  - 10) The Genetic Code - What Exactly is it? - Reading and Diagram (1 Page)
  - 11) DNA to Protein Molecule - Vocabulary Assessment with Answer Key (2 pages)
  - 12) DNA Structure and Proteins Synthesis - Info-Poster Making Activity (1 Page)
- Modeling the Organization of the Body - Next Generation Science Standards and Rubric Building Resource (2 Pages)
  - 13) Hierarchical Organization of Interacting Organ Systems - Reading (1 Page)
  - 14) The Four Basic Tissue Types Of The Human Body - Diagram (1 Page)
  - 15) Organization of the Body - Body Systems Diagram (1 Page)
  - 16) Organization and the Structure and Function of the Integumentary System - Reading and Diagram (2 Pages)
  - 17) Organization and the Structure and Function of the Skeletal System - Reading and Diagram (2 Pages)
  - 18) Organization and the Structure and Function of the Muscular System - Reading and Diagram (2 Pages)
  - 19) Organization and the Structure and Function of the Nervous System - Reading and Diagram (2 Pages)
  - 20) Organization and the Structure and Function of the Digestive System - Reading and Diagram (2 Pages)
  - 21) Organization and the Structure and Function of the Respiratory System - Reading and Diagram (2 Pages)
  - 22) Organization and the Structure and Function of the Circulatory System - Reading and Diagram (3 Pages)
  - 23) Interacting Body Systems - Model Making Activity with Key/Diagram (2 Pages)
- Feedback Mechanisms - Next Generation Science Standards and Rubric Building Resource (2 Pages)
  - 24) Feedback Mechanisms Maintain Living Systems - Reading and Diagram (1 Page)
  - 25) Feedback Response - Withdrawal Reflexes (1 Page)
  - 26) Feedback Mechanism - Investigation (1 Page)
  - 27) Feedback Mechanisms that Lower and Raises Blood Sugar (Glucose) - Diagrams/Answer Keys to Assignment (2 Pages)
  - 28) Feedback Mechanisms for Body Cooling and Preserving Body Heat - Diagrams/Answer Keys to Assignment (3 Pages)

# Cells, DNA, and Protein Synthesis



Living things have common characteristics in their structure and function. Some organisms are more complex than others. The most basic structural units of all living things are **cells**. An organism can be made up of a single cell (unicellular microorganisms) such as an amoeba or millions upon millions cells (multicellular organisms) as found in plants, animals, fungi, etc.

Large groups of structurally similar cells (specialized cells) form **tissues** (e.g. skin tissue, muscle tissue, etc). Multiple types of tissues together form **organs**. And multiple types of organs work together to form functioning **organ systems**. For example, muscles cells form muscle tissue, which works together with other tissues – epithelial tissue, connective tissue, nervous tissue, etc. to form the heart and blood vessels, which are the organs of the circulatory system. The organ systems (respiratory, digestive, nervous, muscular, skeletal, etc.) each have a specialized function, but are made up of many types of cells and tissues working together for a common purpose (respiration, digestion, movement, support, etc.).

Just as cells support the functioning processes of an organism, there are structures inside cells – the **organelles**, which support how the cells themselves function. They power the cell, perform chemical reactions, remove waste, and select what can enter and exit the cell.

Within the nucleus, each cell contains **DNA** molecules wound up into 23 pairs of **chromosomes** (46 total). On each chromosome is a number of **genes** which carry the instructions for the development of the proteins. These proteins are the structural components of the body. They also complete and maintain essential life functions, including regulating cellular activities that work to keep the body in **homeostasis**.

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These resources, through reading, illustrated diagrams, investigations, and critical thinking activities will help students with the following Next Generation Science Standard:

**Performance Expectations:** Students who demonstrate understanding can:

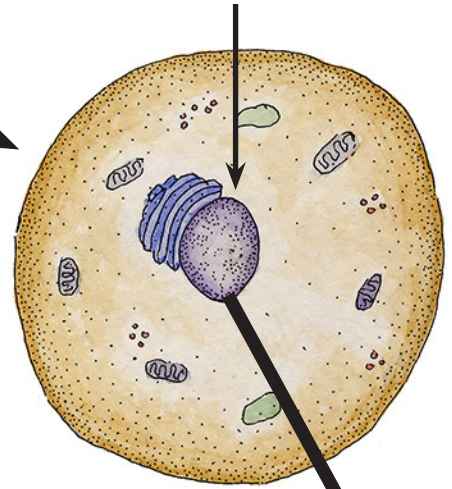
**HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.** *[Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]*

# The Location of DNA, Chromosomes, and Genes

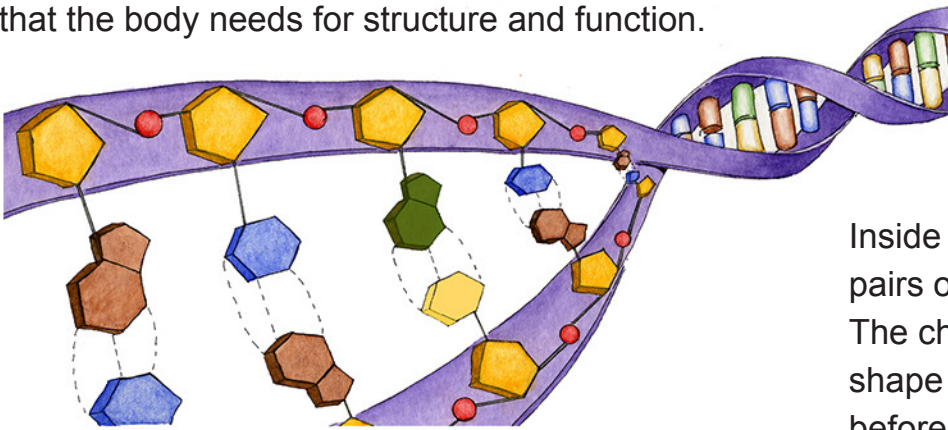
The human body is made up of millions of **cells**.



Inside our cells is a **nucleus**.



DNA is made up of tiny molecules called **nucleotides** that are hooked together. Their order, or **sequence**, is the **code** for the **proteins** that the body needs for structure and function.



Inside every nucleus is 23 pairs of **chromosomes (46)**. The chromosomes' butterfly-shape is best seen right before the cells divide.



Every chromosome is made up of a very long strand of **DNA**, sections of which are **genes**.

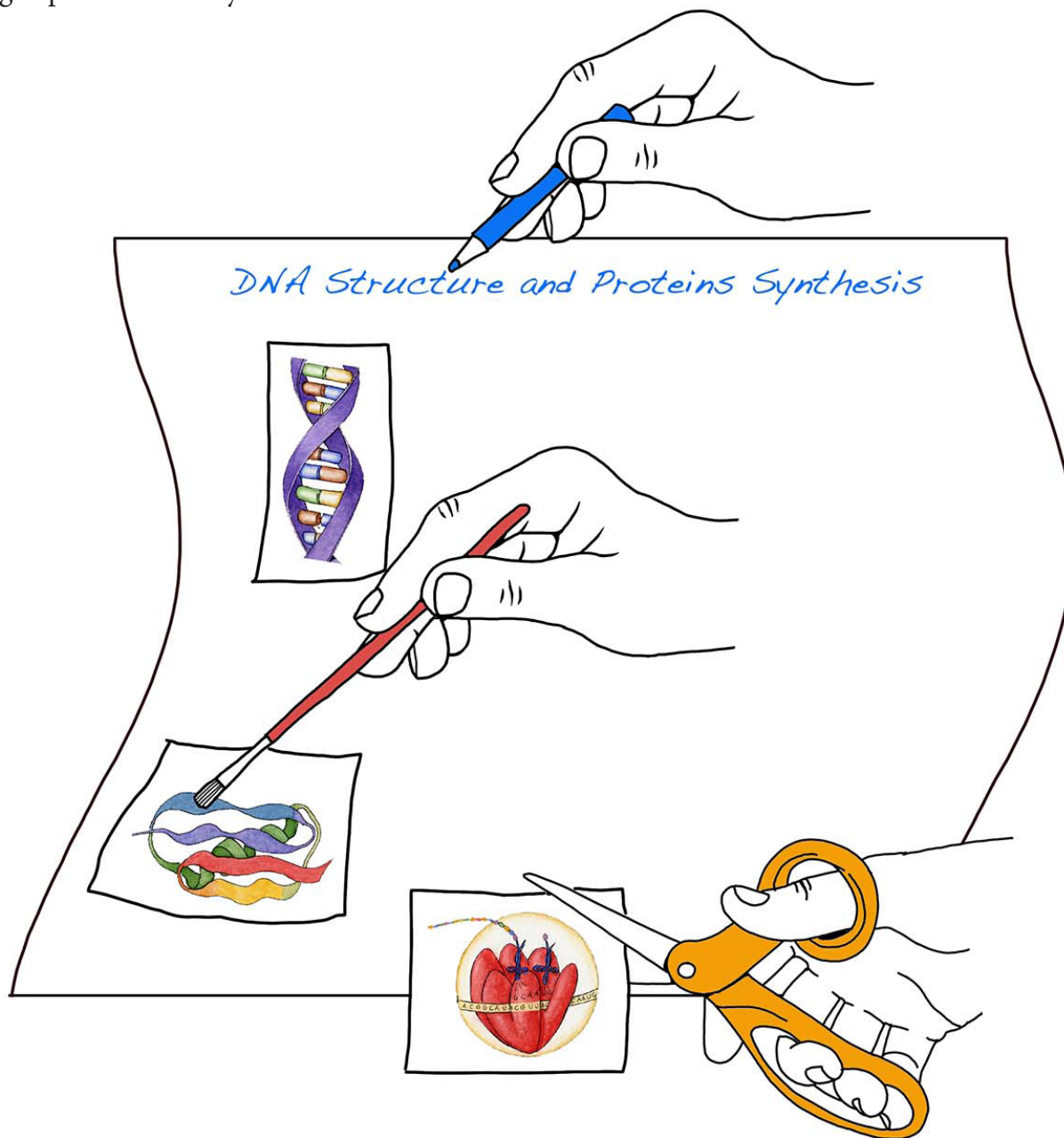


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**LS3.A: Structure and Function** – All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.

## DNA Structure and Proteins Synthesis - Info-Poster Making Activity

Study the Central Dogma of Genetics and the specialized cells that make up body tissues, organs and systems. Then create an informational poster that shows the process of how the structure of DNA determines the structure of proteins and how those proteins carry out the essential functions of life through specialized body cells.



**Performance Expectations:** Students who demonstrate understanding can:

**HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.**

*[Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]*

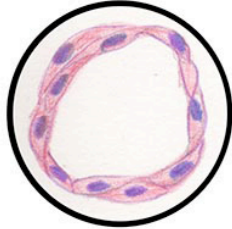
# The Four Basic Tissue Types Of The Human Body: Epithelium, Connective Tissue, Nervous Tissue, and Muscle

## EPITHELIUM

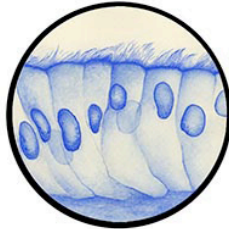
Cuboidal Epithelium



Simple Squamous Epithelium



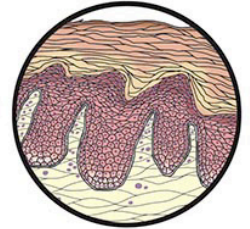
Columnar Epithelium



Pseudostratified Epithelium



Stratified Squamous Epithelium

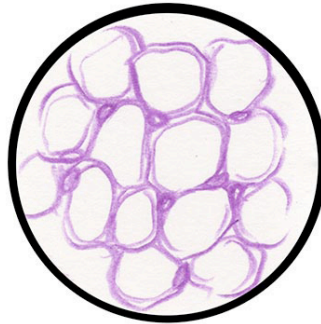


## CONNECTIVE TISSUE

Dense Connective Tissue



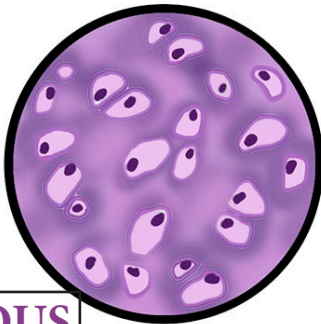
Adipose Tissue (Connective Tissue)



Areolar Tissue (Connective Tissue)



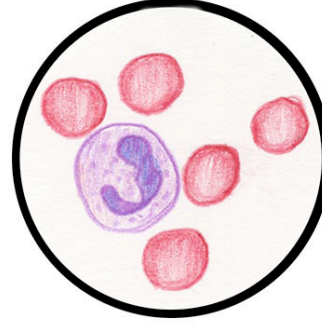
Hyaline Cartilage (Connective Tissue)



Compact Bone (Connective Tissue)



Blood (Connective Tissue)



## NERVOUS TISSUE

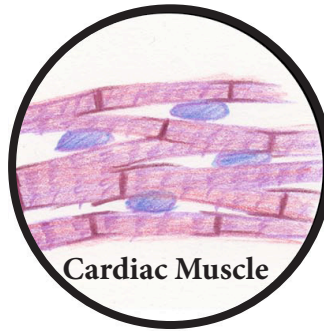
## MUSCLE TISSUE



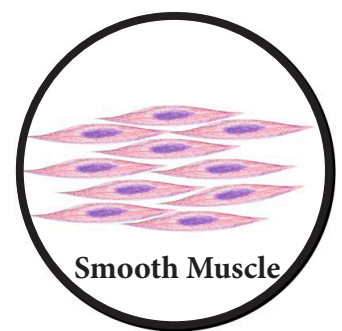
Neuron



Striated Muscle



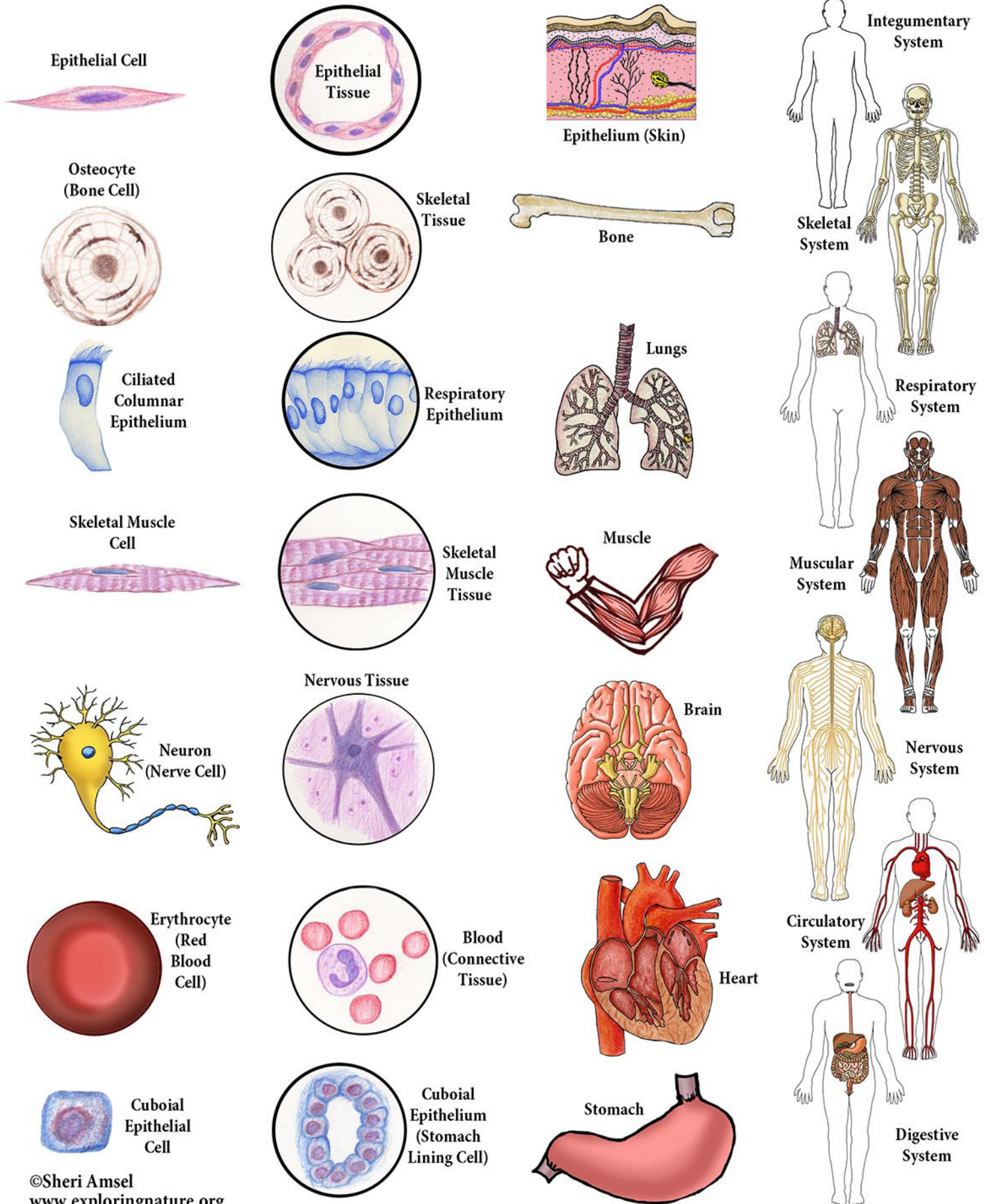
Cardiac Muscle



Smooth Muscle

# Organization of the Body

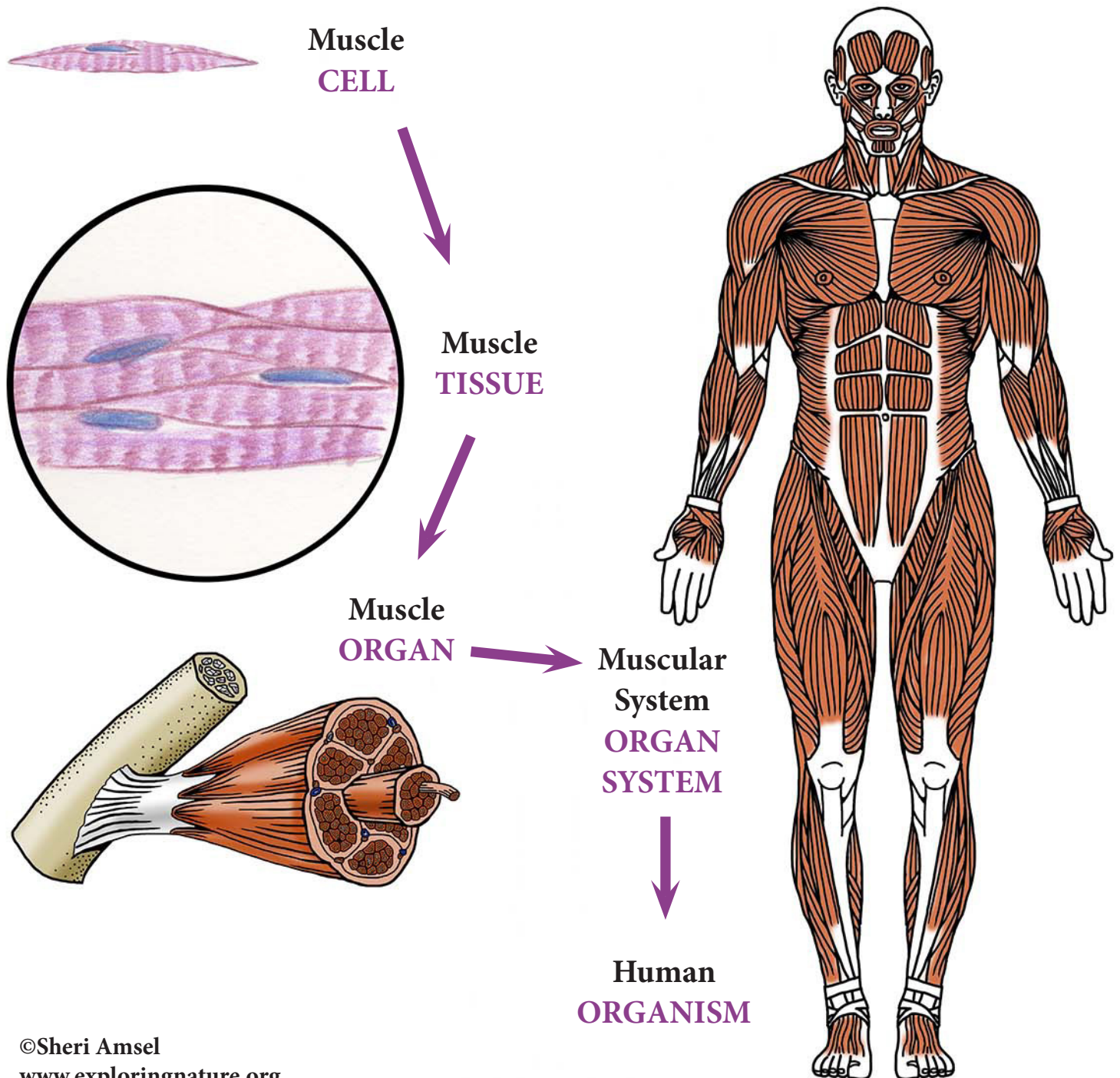
Cell → Tissue → Organ → Body System



# Organization of the Body - The Muscular System

The muscular system has four roles:

1. They are responsible for our **movement** - by contracting and relaxing.
2. They **stabilize our joints**.
3. They **keep us warm** – generate heat when contracting.
4. They help us hold our position while sitting – our **posture**.



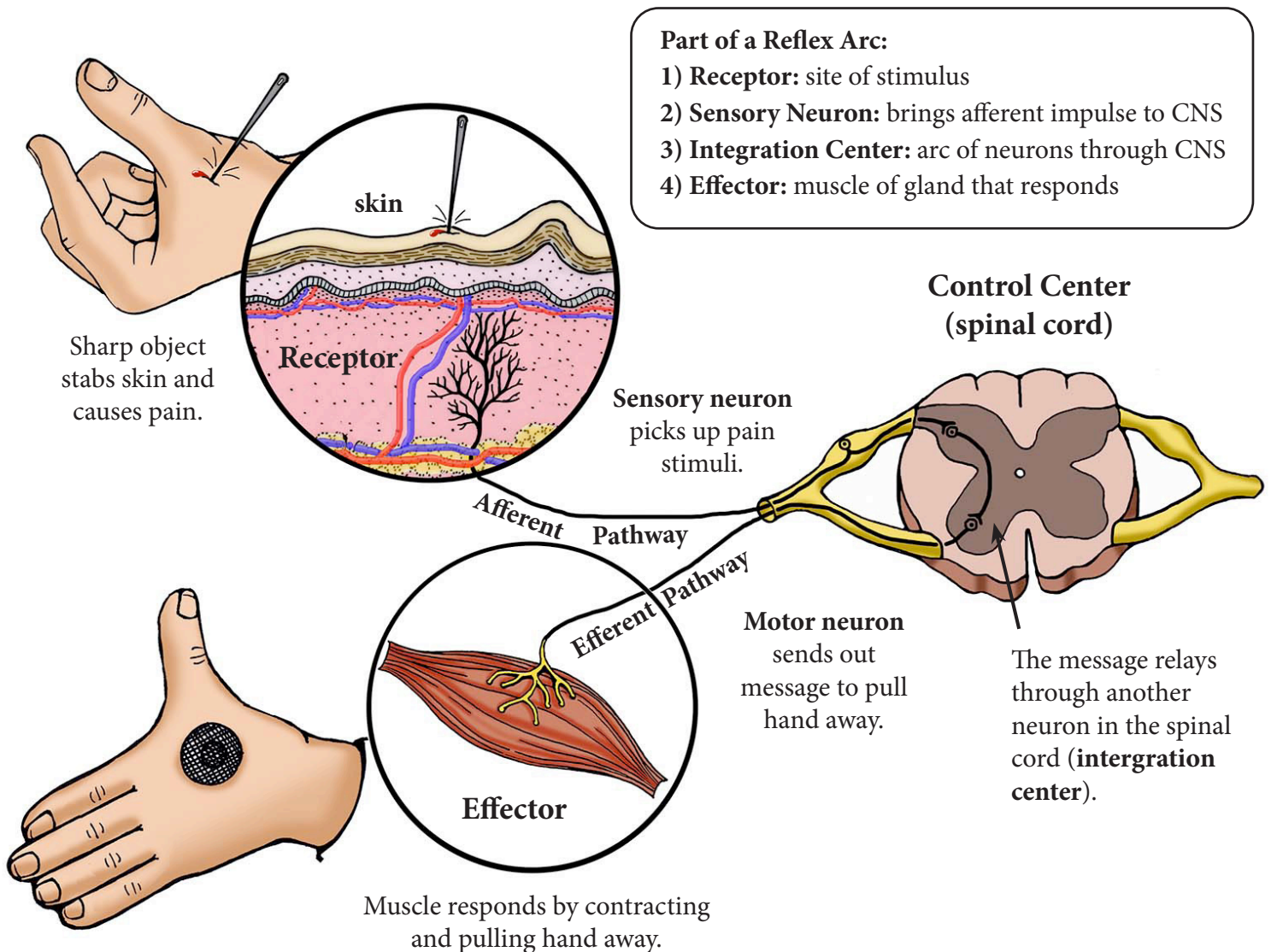


# Feedback Response - Withdrawal Reflexes

Sometimes messages coming into the nervous system need a very quick feedback response. A **reflex** is a rapid, predictable motor response to a stimulus. It is **involuntary**. You do not have to learn how to do it or think about it. It is a message that doesn't reach your brain before you act. Think about how fast you move when you touch a hot stove. The stimuli flies through the spinal cord and back out to give a quicker motor response. This is called a **spinal reflex** or a **simple reflex arc**. This is an important feedback response to an emergency moment when your body needs to respond quicker than the brain can act.

Some reflexes do develop from practice. They are acquired reflex responses. They include situations where you can react quickly because of repetitive practice. Some examples of this are handling a sailboat in high winds, driving a car, and even playing tennis.

## Spinal Reflex (Simple Reflex Arc)



# Feedback Mechanisms that Promote Preserving Body Heat

When the temperature around us (environmental temperature) drops, the brain triggers several physiological changes to keep the body core at about 98.6°F (37°C). Blood vessels (capillaries) in the skin constrict and the blood is diverted deeper into the core of the body. If the cold persists, the brain triggers shivering, which produces heat. We also are motivated to take voluntary action: putting on a coat, drinking hot cocoa, jumping up and down, finding a heat source (fire, heater, go inside!), etc.

