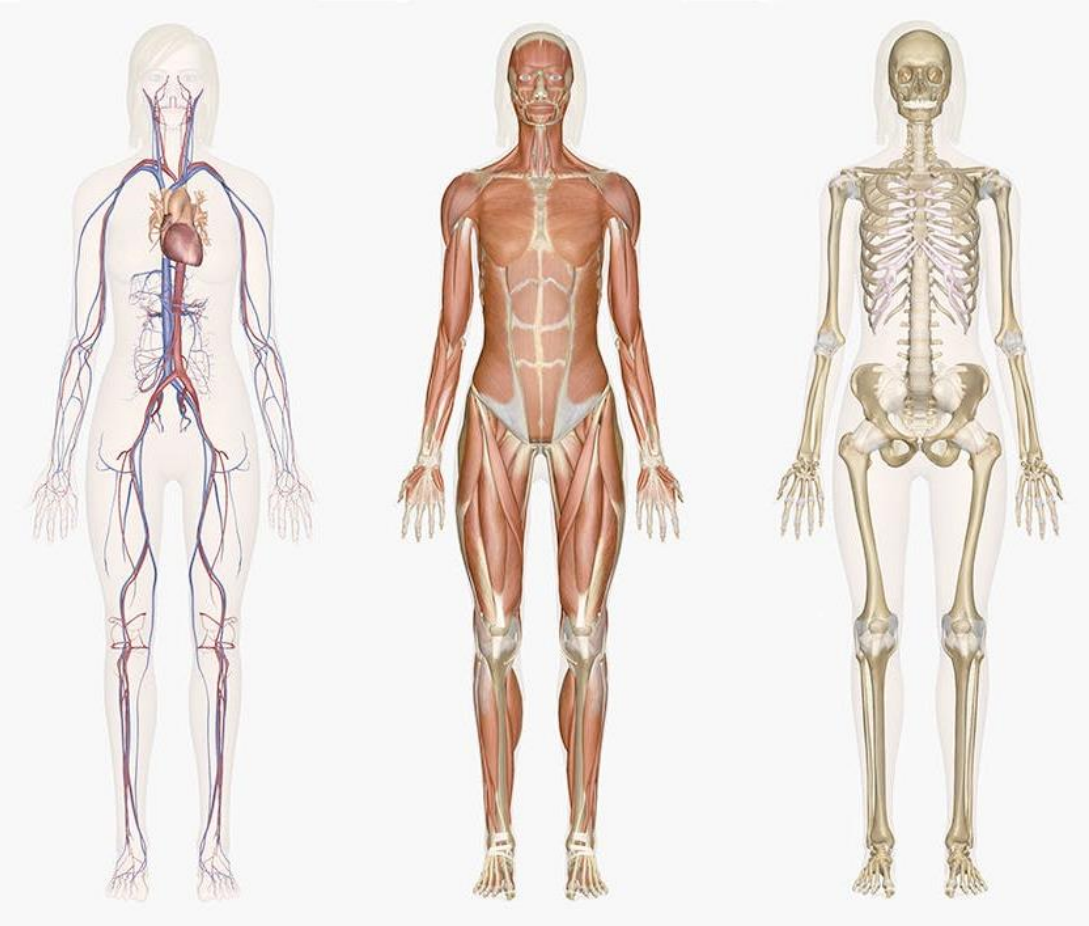
Go to the "Slide Show" shade above

Click on "Play from Beginning"

Human Anatomy and Physiology

Skin, Muscle, Bone

Chapter 30



WARM-UP

List as many muscles in your body as you can.

List as many bones in your body as you can.

What is the function of skin?

WARM-UP

List as many muscles in your body as you can.

Bicep, tricep, quads, hamstrings, gluteus, deltoids, pects

List as many bones in your body as you can.

cranium, femur, tibia, fibula, vertebrae, sternum, rib cage, humorous

What is the function of skin?

protection, regulates body temperature

Lesson Objectives

By the end of this lesson, you should be able to:

- Recognize the hierarchy of levels of organization for humans (cells, tissues, organs, systems).
- Identify characteristics and define the purpose of the four types of human tissues, emphasizing:
  - Skin (Epithelial tissue)
  - Skeleton (Connective tissue)
  - Muscle tissue
  - Nervous tissue (next lesson)
- Understand how Organ Systems work together to perform life's functions.
- Describe regulation of the internal environment (homeostasis).
- **Science Practice: Labelling Skin, Muscle, and Bones**

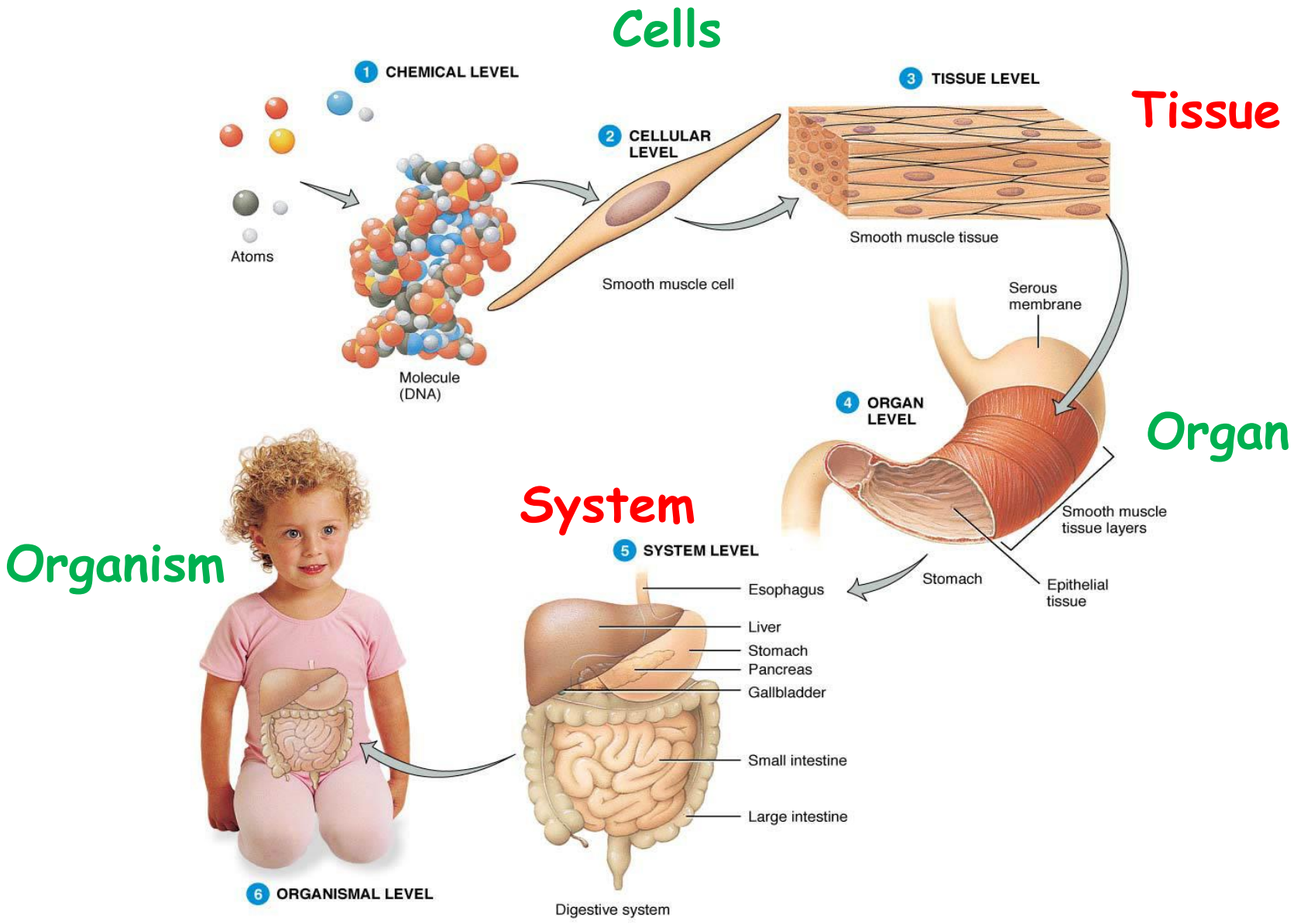
Human Anatomy & Physiology

Anatomy:
Study of Structure

Physiology:
Study of Function

"Structure fits Function"

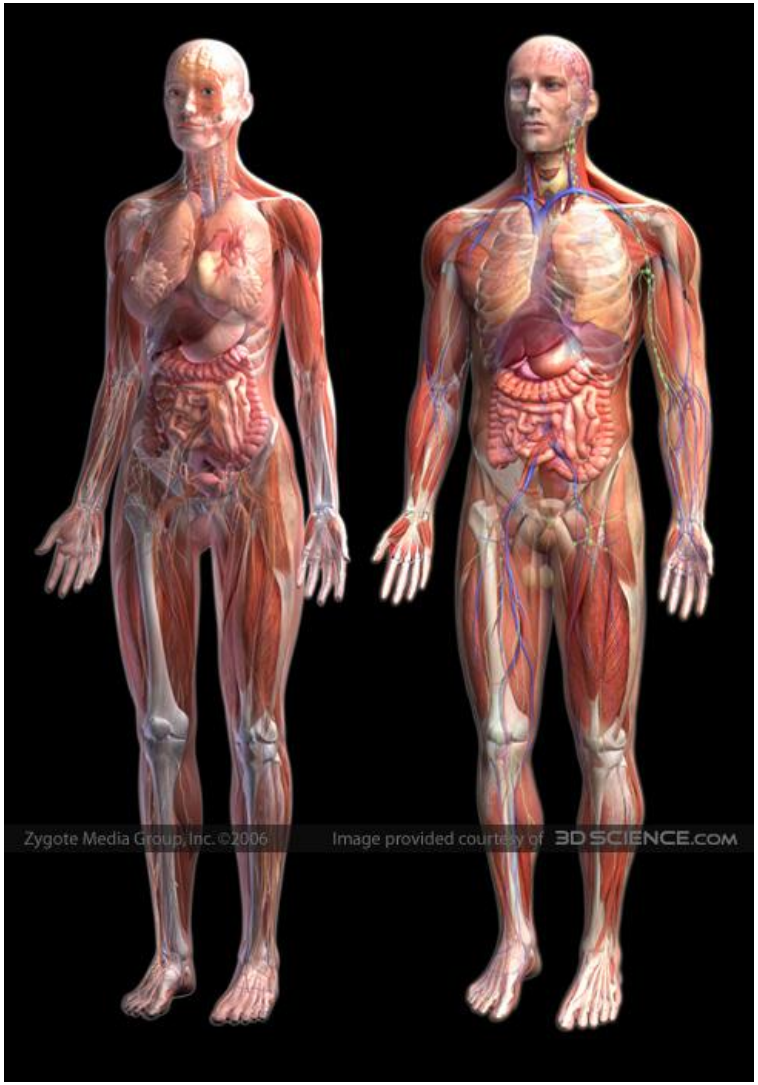
The Human Body consists of a HIERARCHY of levels of organization:



Human Being

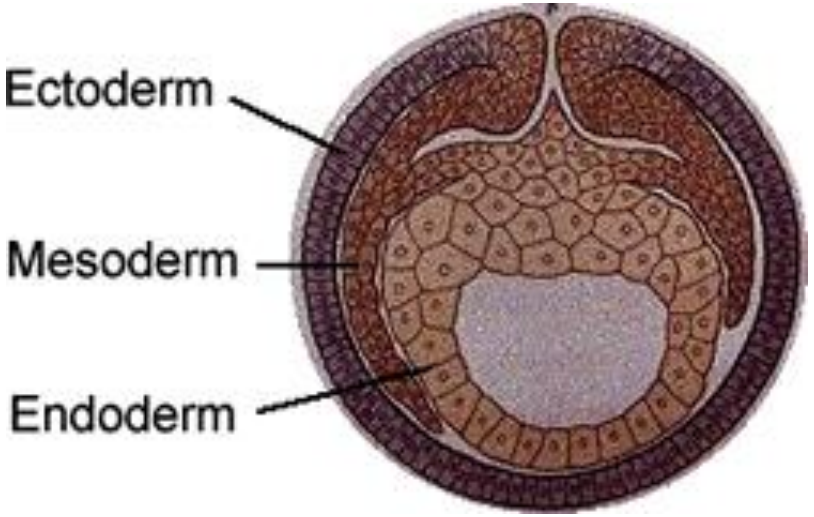
"…fearfully and wonderfully made."

(Psalm 139:14)



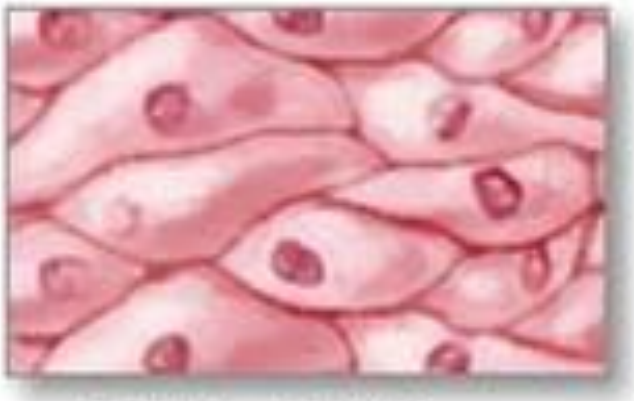
Germ Layers

"Triploblastic"

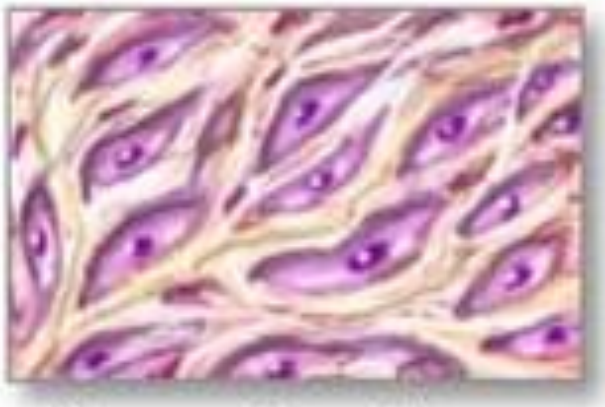


GERM LAYER DERIVATIVES		
ECTODERM	MESODERM	ENDODERM
brain	heart	lining of the respiratory system
spinal cord	kidneys	lining of the digestive tract
nerves	bones	liver
skin	cartilage	pancreas
nails	muscles	bladder
hair	blood cells	
	blood vessels	

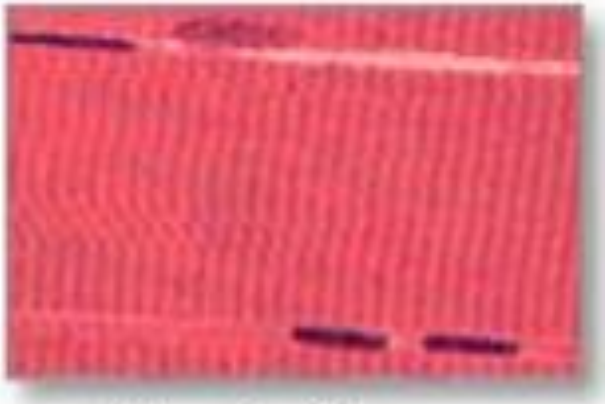
4 Main Types of Tissues



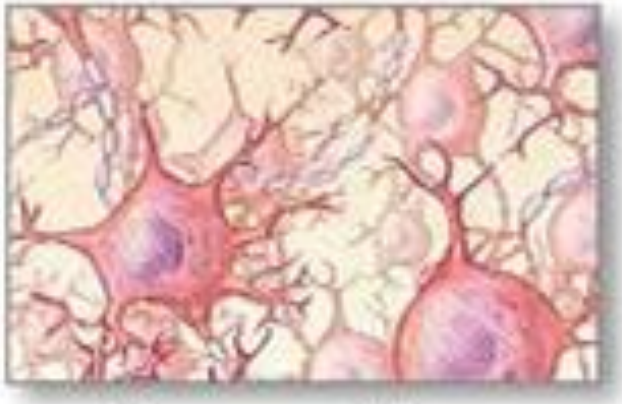
Epithelial tissue



Connective tissue



Muscle tissue

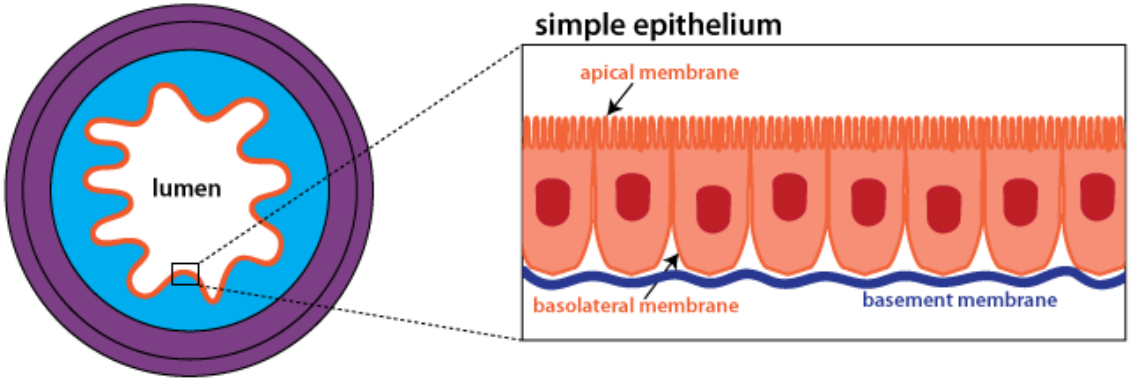


Nervous tissue

Epithelial Tissue

Cover body surfaces, lining internal organs & cavities.

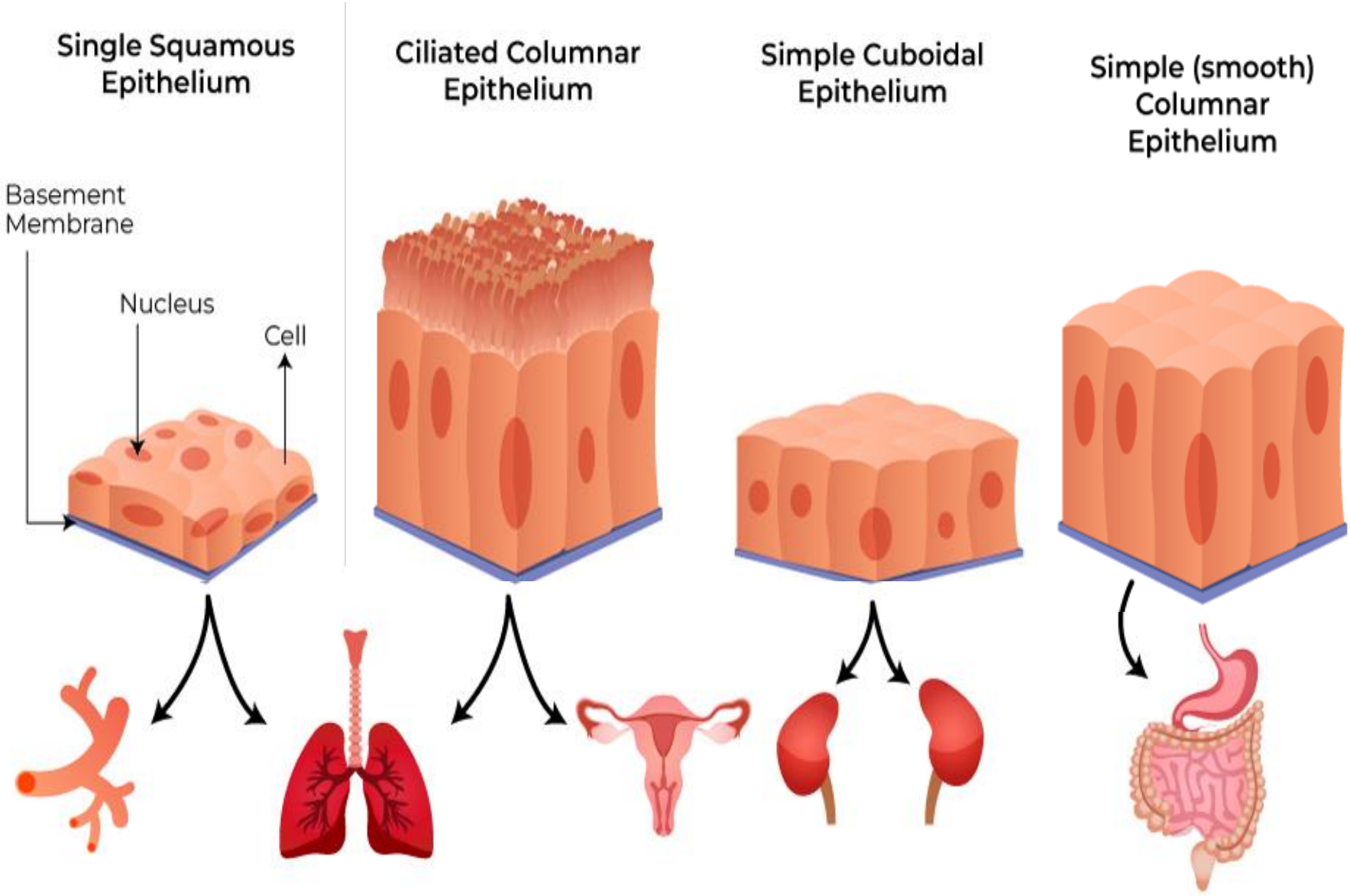
- Apical cells face the interior cavity.



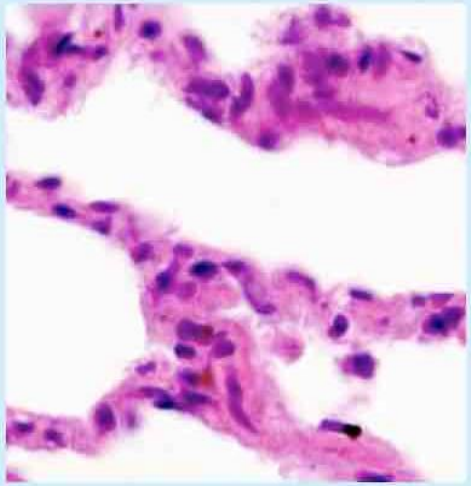
Epithelial cells come in three shapes:

1. **Squamous**, like a fried egg.
2. **Cuboidal**, as tall as they are wide.
3. **Columnar**, taller than they are wide.

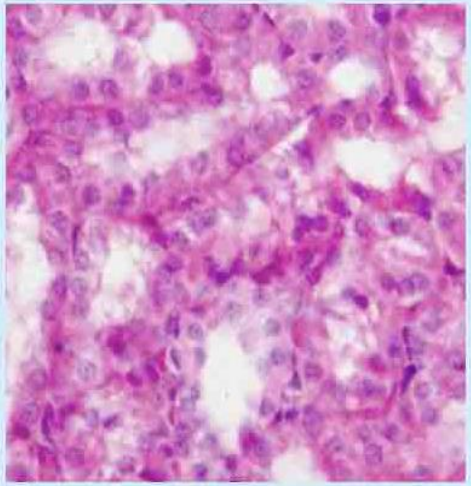
Epithelial Cells



8 TYPES OF EPITHELIAL TISSUES

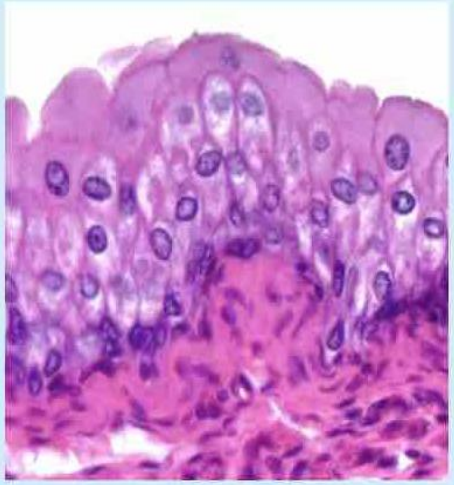


Simple Squamous
(Alveoli)



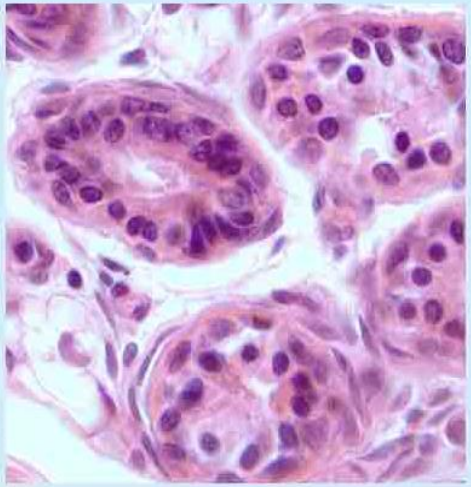
Simple Cuboidal
(Kidney)

Simple Columnar
(Stomach)

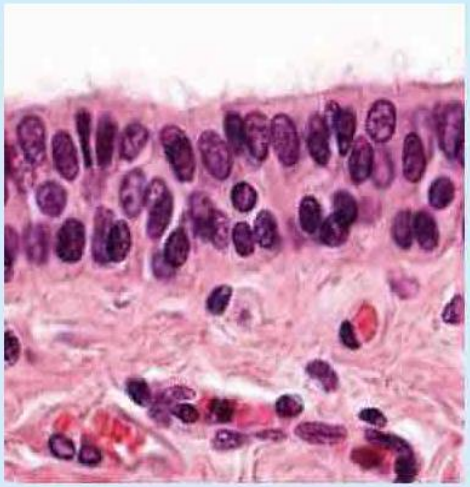


Transitional
(Bladder)

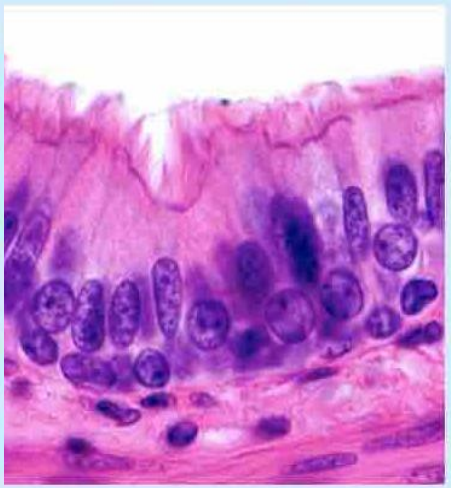
Stratified Squamous
(Esophaqus)



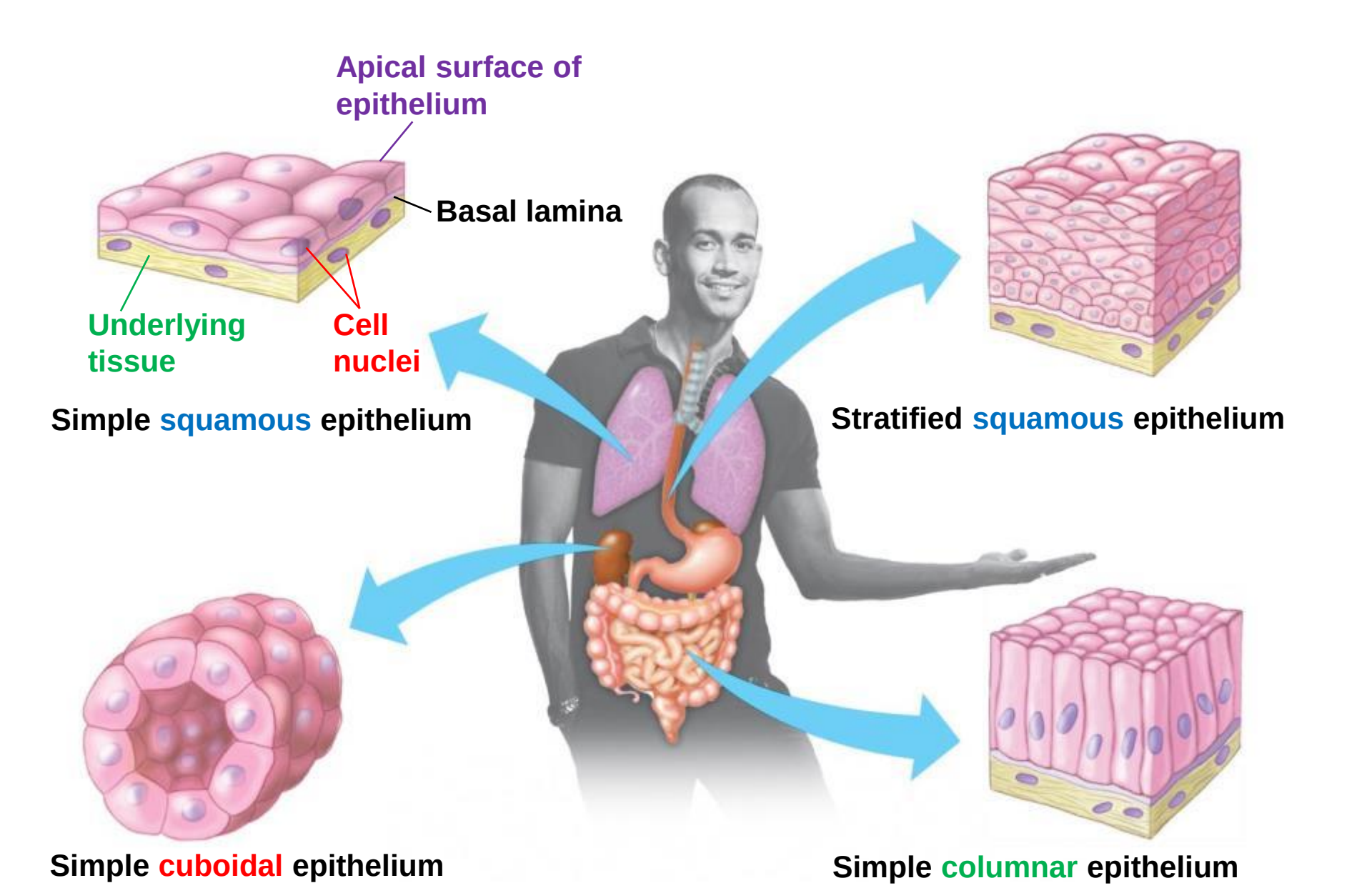
Stratified Cuboidal
(Sweat gland)



Stratified Columnar
(Salivary duct)

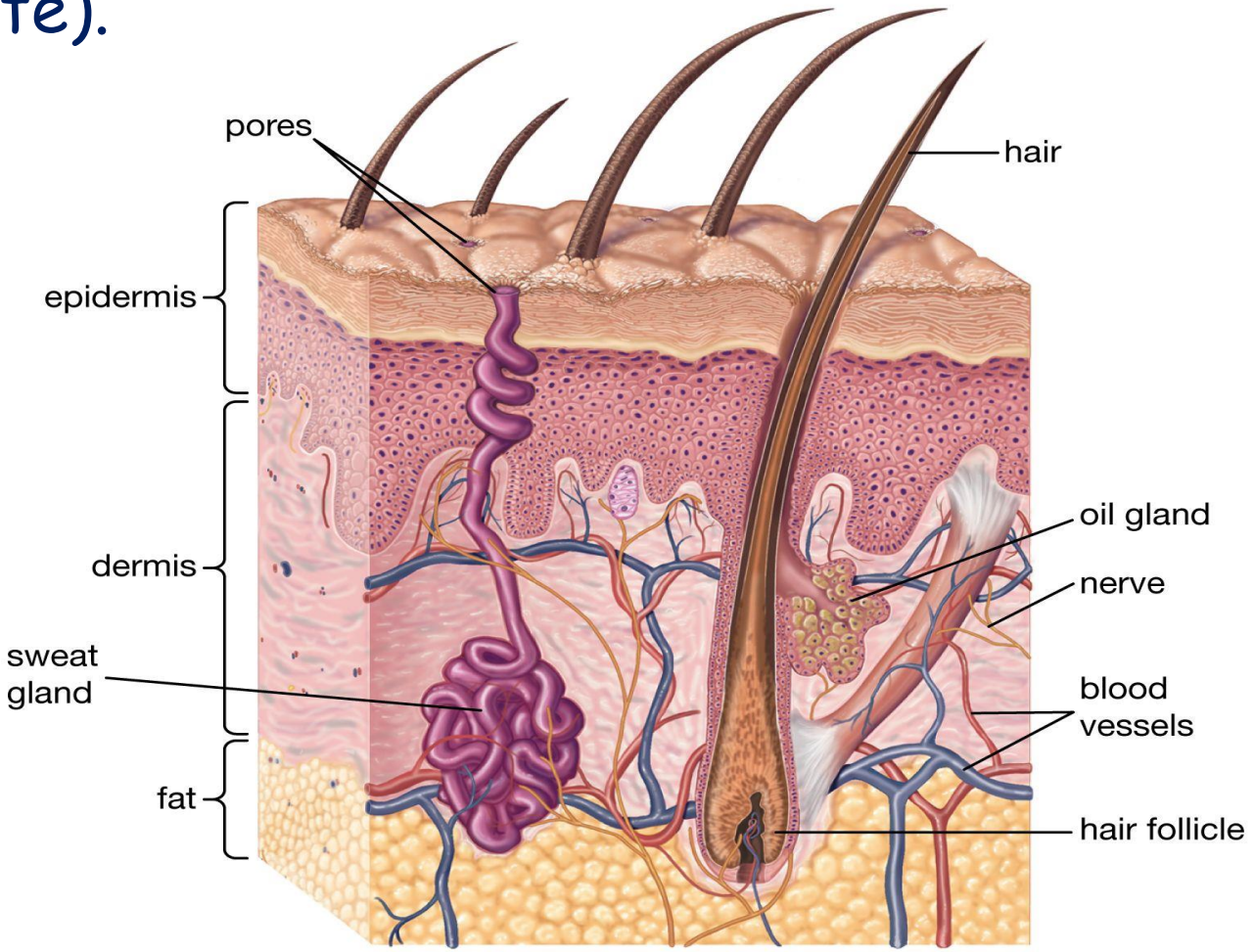


Pseudostratified
Columnar (Trachea)

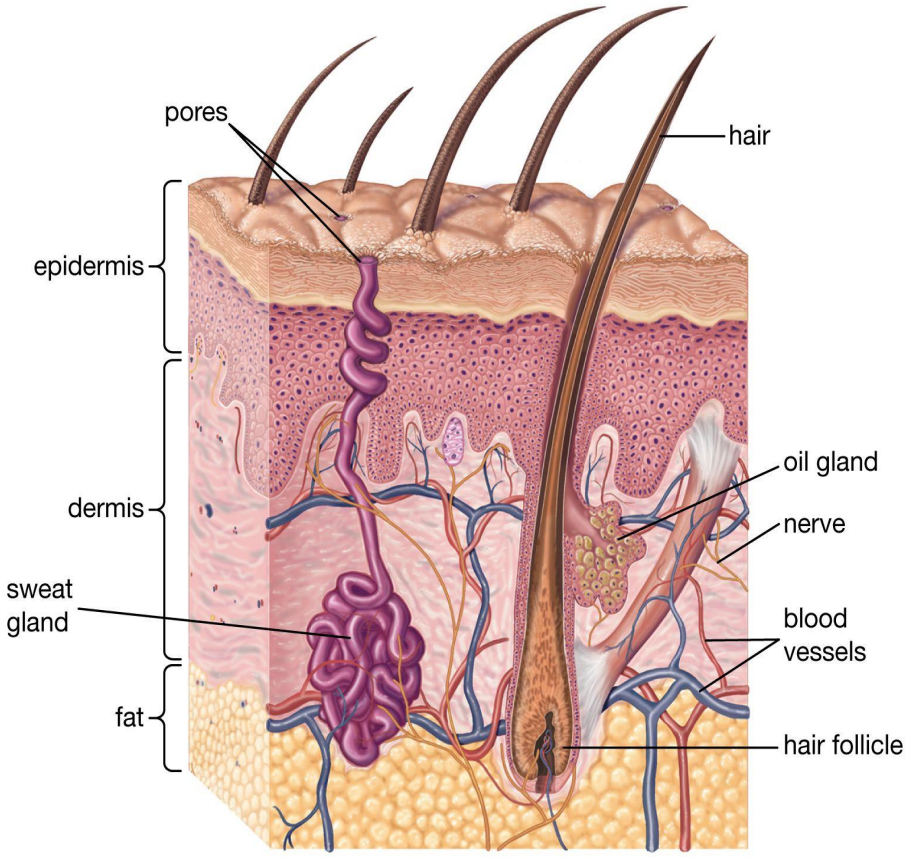

Apical surface of epithelium
Basal lamina
Underlying tissue
Cell nuclei
Simple squamous epithelium
Stratified squamous epithelium
Simple cuboidal epithelium
Simple columnar epithelium

Epithelial Tissue: SKIN

Part of integumentary system. Skin protects internal organs, regulates body temperature, and excretes sweat (liquid waste).



Epithelial Tissue: SKIN



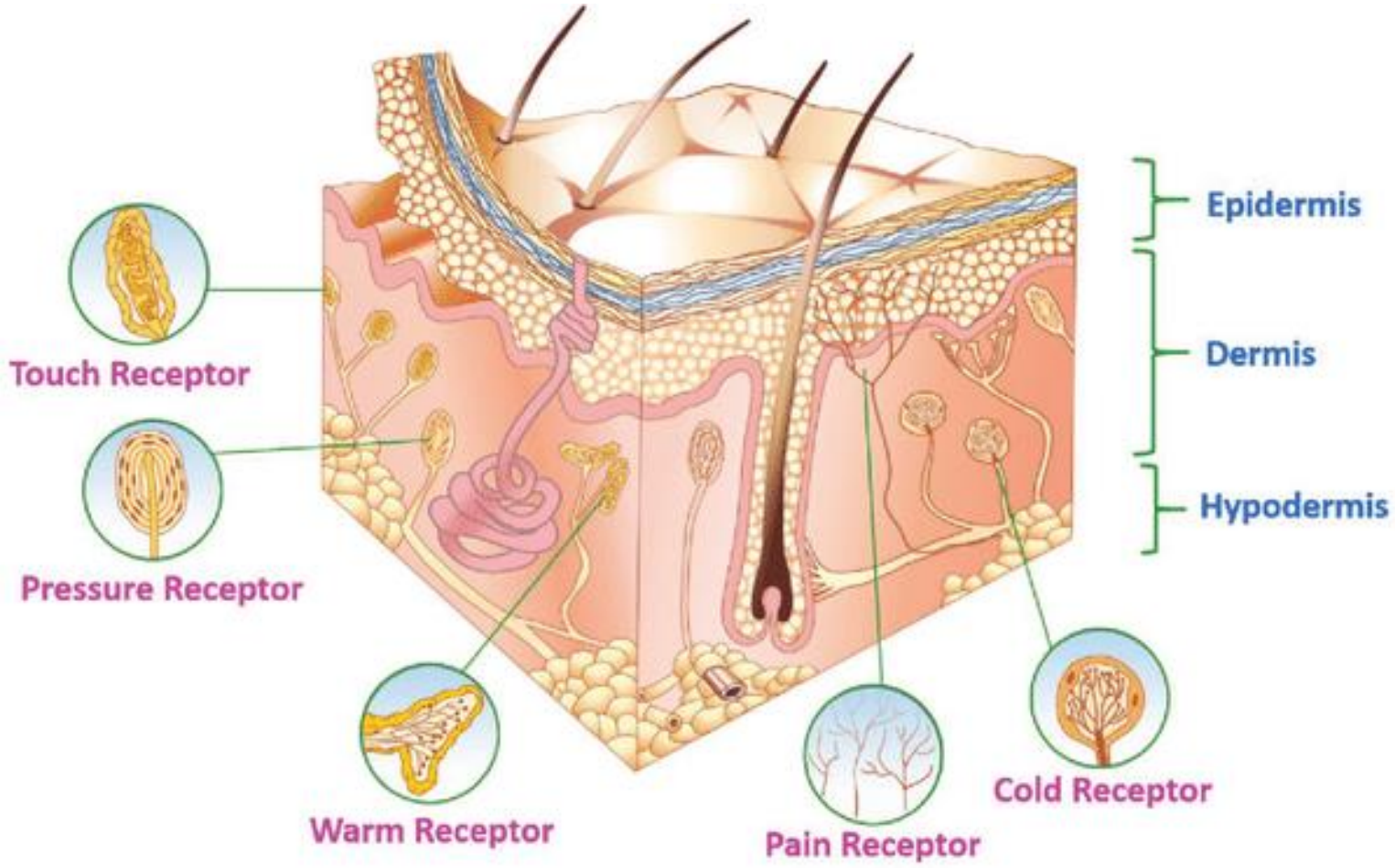
Skin **oil** protects from pathogens (bacteria, fungi) & hydrates the skin.

Sweat glands control body temperature (forehead, armpits, palms, soles).

Skin **pigmentation** is determined by melanin.

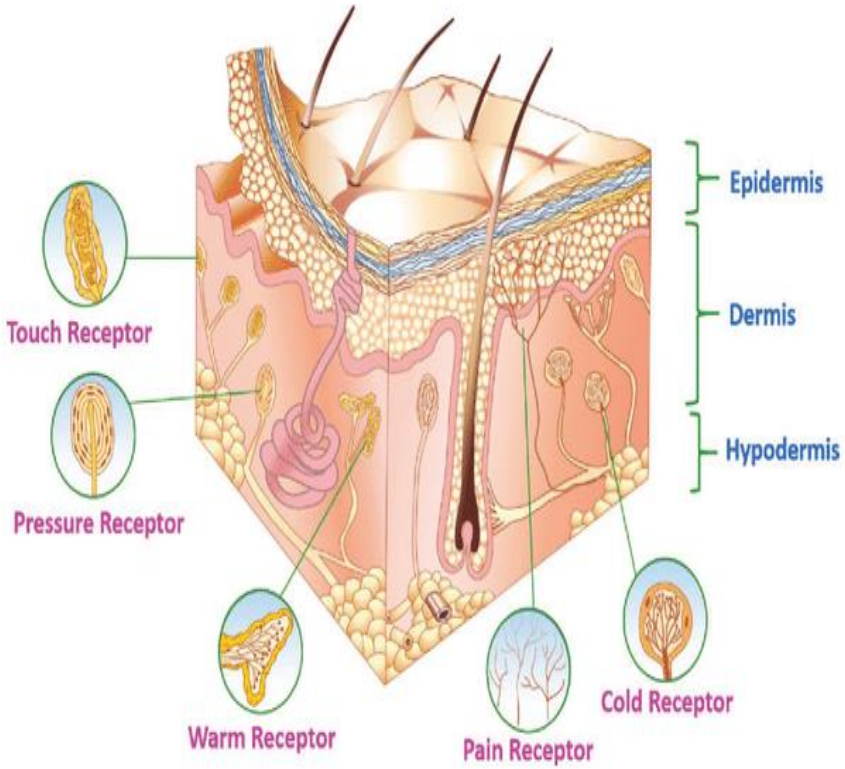
Hair serves as protection (from sun), sensory input & detection, thermoregulation, communication, and beauty.

Epithelial Tissue: SKIN



Special sensory cells in the **DERMIS**
detect pain, heat, cold, pressure and touch.

Epithelial Tissue: SKIN



The heat receptors are near the sweat glands.

Cold and touch receptors are near the hair follicle ("goose bumps").

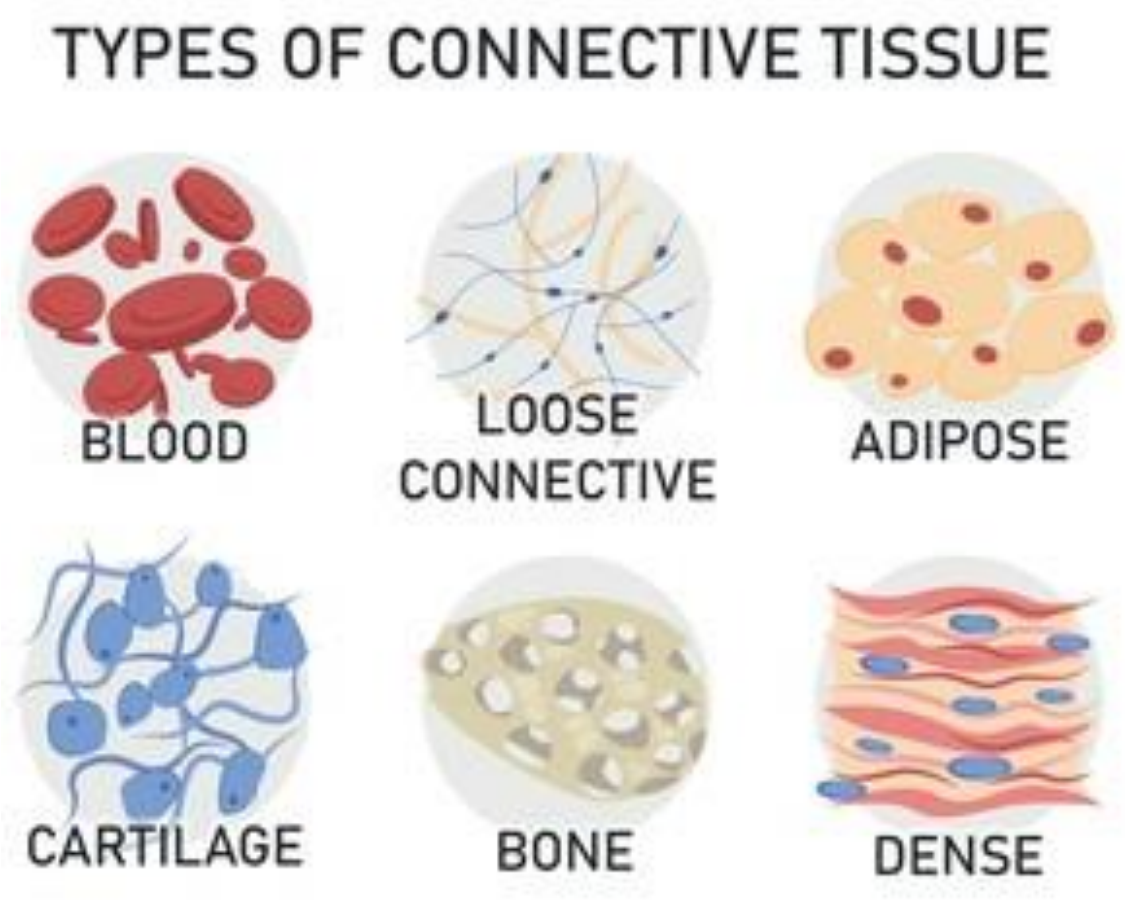
Pain receptors are embedded in the fat layer.

Touch, pain, and cold are nearer the epidermis while pressure receptors are deeper in the dermis.

Connective Tissue

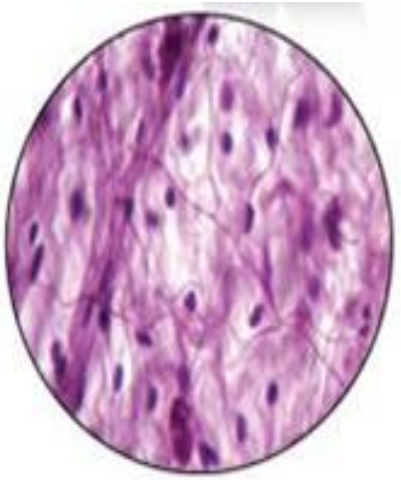
Binds and supports other tissues

Six major types:



Connective Tissue binds and supports other tissues

1. Loose Connective Tissue



- is the most widespread.
- consists of ropelike collagen and elastic fibers that are strong and resilient.
- helps to join skin to underlying tissues.

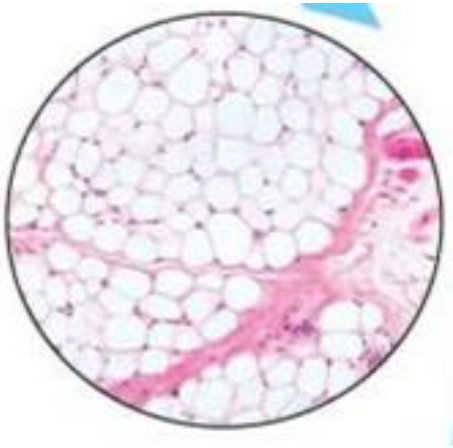
2. Fibrous Connective Tissue

- has **DENSELY** packed collagen fibers.
- forms **Tendons** that attach muscle to bone

Connective Tissue binds and supports other tissues

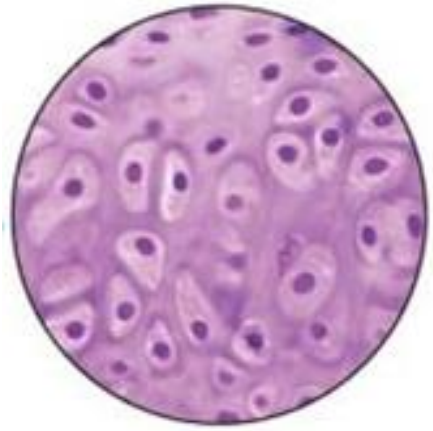
3. Adipose Tissue

- stores **fat** in large, closely packed cells held in a matrix of fibers.



4. Cartilage

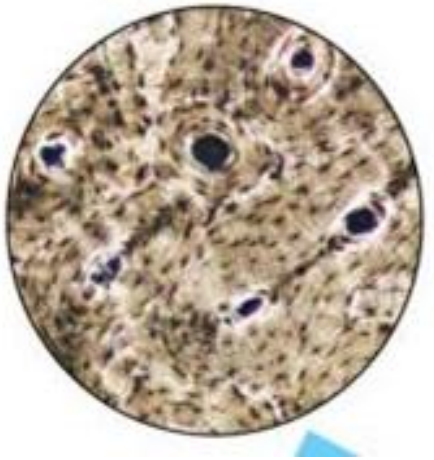
- is a strong and flexible skeletal material.
- commonly surrounds the **ends of bones**.



Connective Tissue binds and supports other tissues

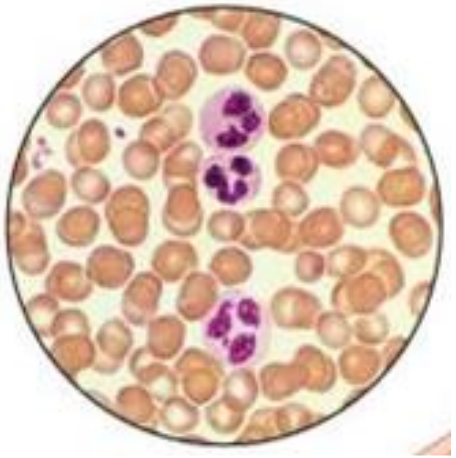
5. Bone

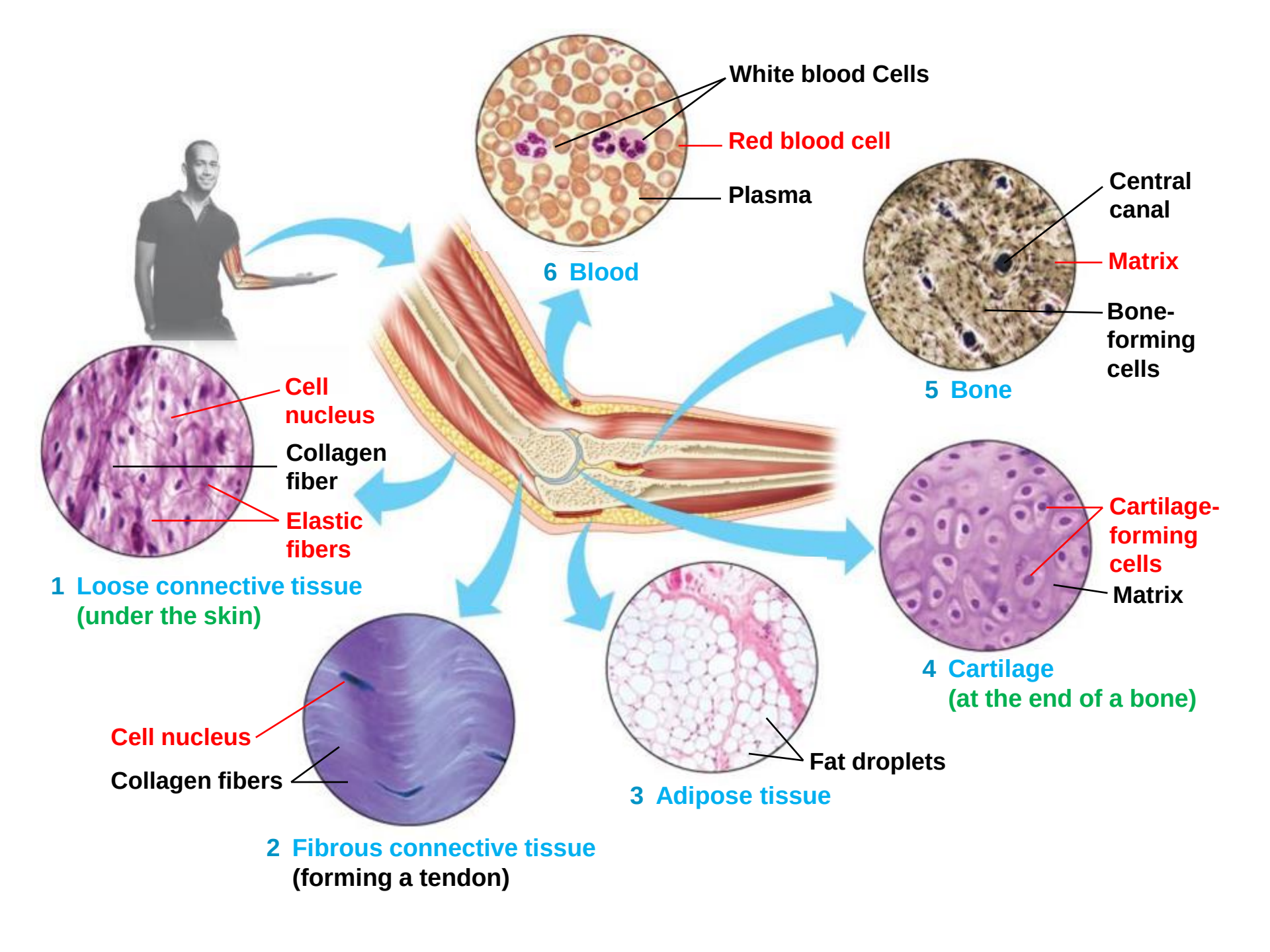
- **Osteoblasts** secrete **collagen fibers** embedded in a **hard mineral substance** containing **calcium, magnesium,** and **phosphate.**



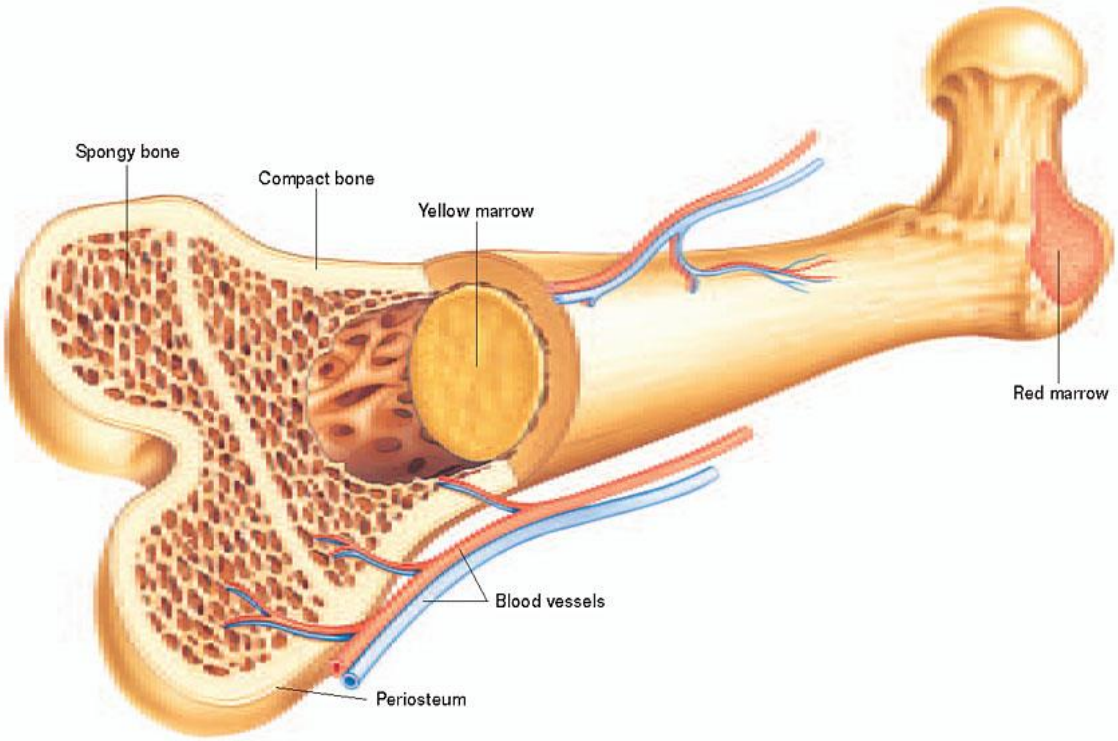
6. Blood

- transports substances throughout the body.




White blood Cells
Red blood cell
Plasma
6 Blood
Central canal
Matrix
Bone-forming cells
5 Bone
Cell nucleus
Collagen fiber
Elastic fibers
1 Loose connective tissue (under the skin)
Cartilage-forming cells
Matrix
4 Cartilage (at the end of a bone)
Cell nucleus
Collagen fibers
2 Fibrous connective tissue (forming a tendon)
Fat droplets
3 Adipose tissue

Connective Tissue: Skeleton



Periosteum
Soft, thin covering; protection.

Compact Bone
Touch, hard; regrows.

Spongy Bone
Contains red marrow; red blood cells (RBC's).

Red Bone Marrow
Red & White blood cells, platelets.

Yellow Bone Marrow
Fat & mineral storage, stem cells → cartilage, fat, bone cells.

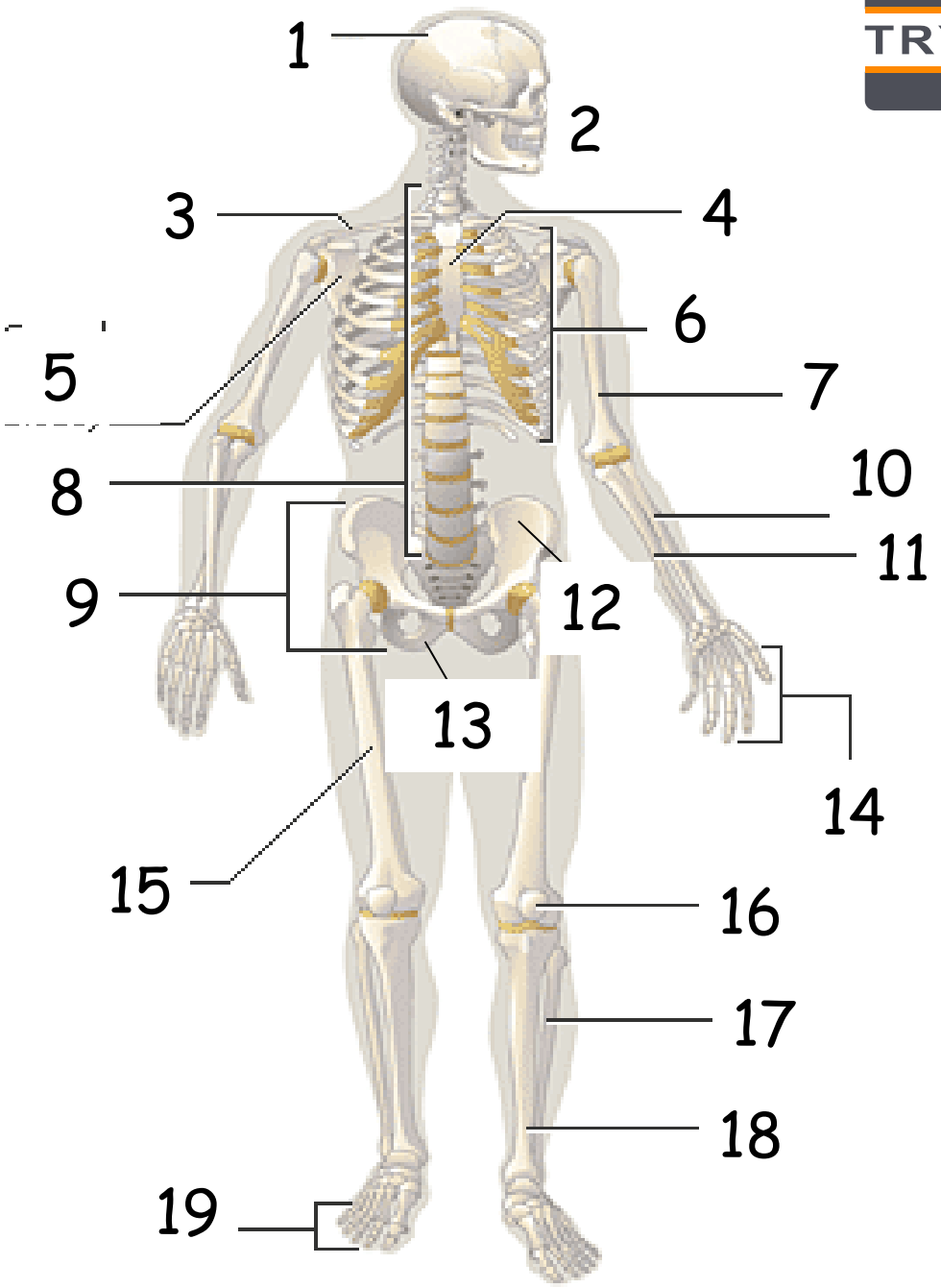
Marrow
Soft, inner center; blood vessels, fat.

Connective Tissue: Skeleton

The skeletal system works as a support structure for the body.

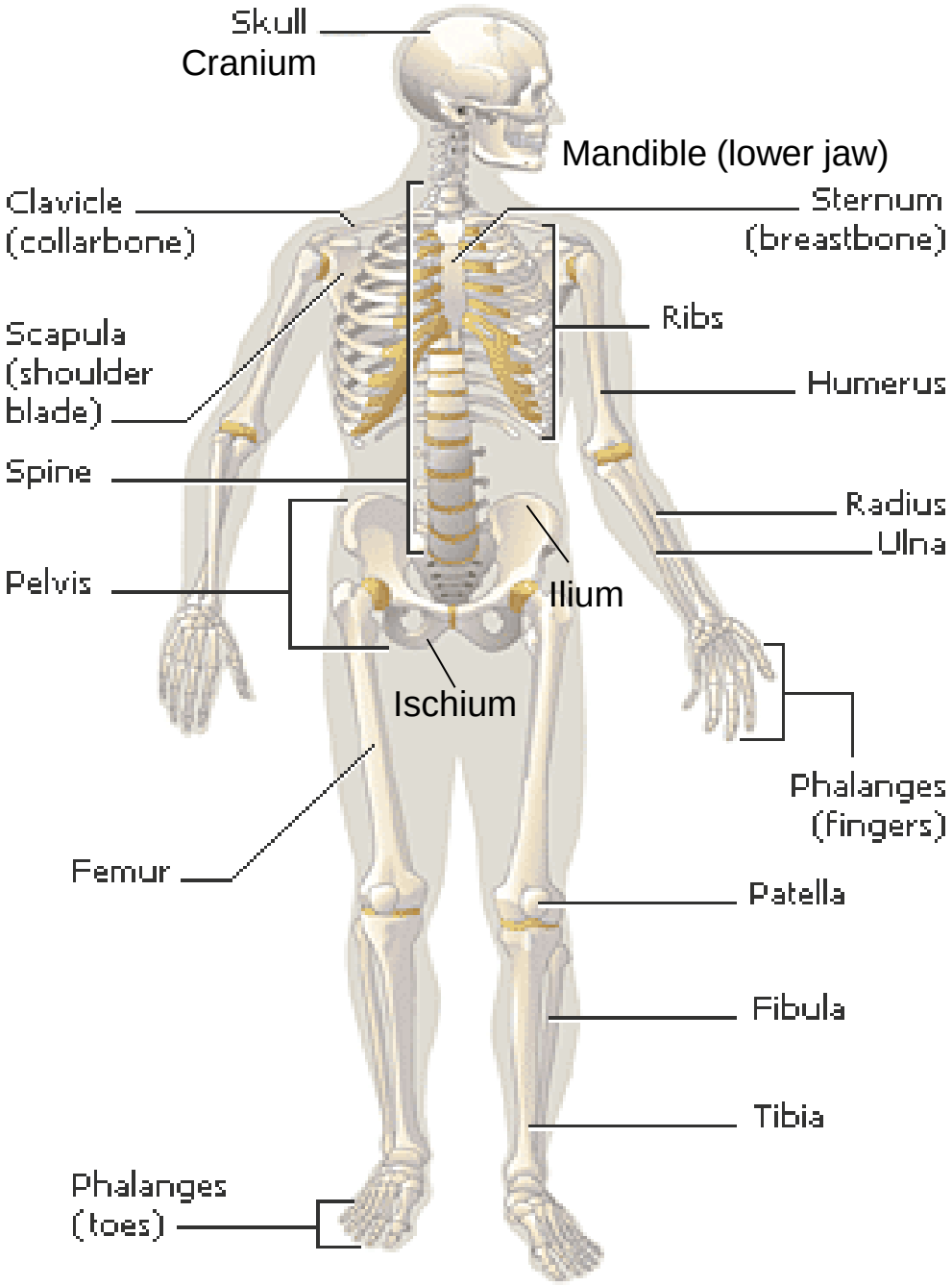
It gives the body its shape, allows movement, makes blood cells, provides protection for organs and stores minerals.

The skeletal system is also called the musculoskeletal system.



Connective Tissue:
Skeleton

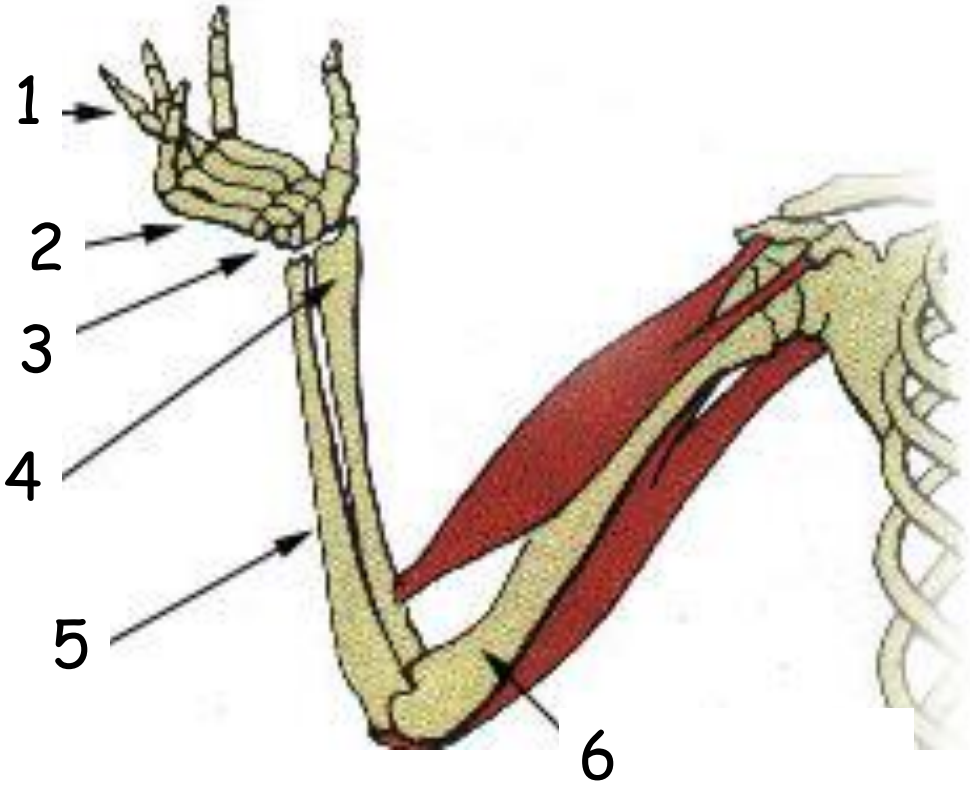
TRY IT



Connective Tissue: Skeleton

TRY IT

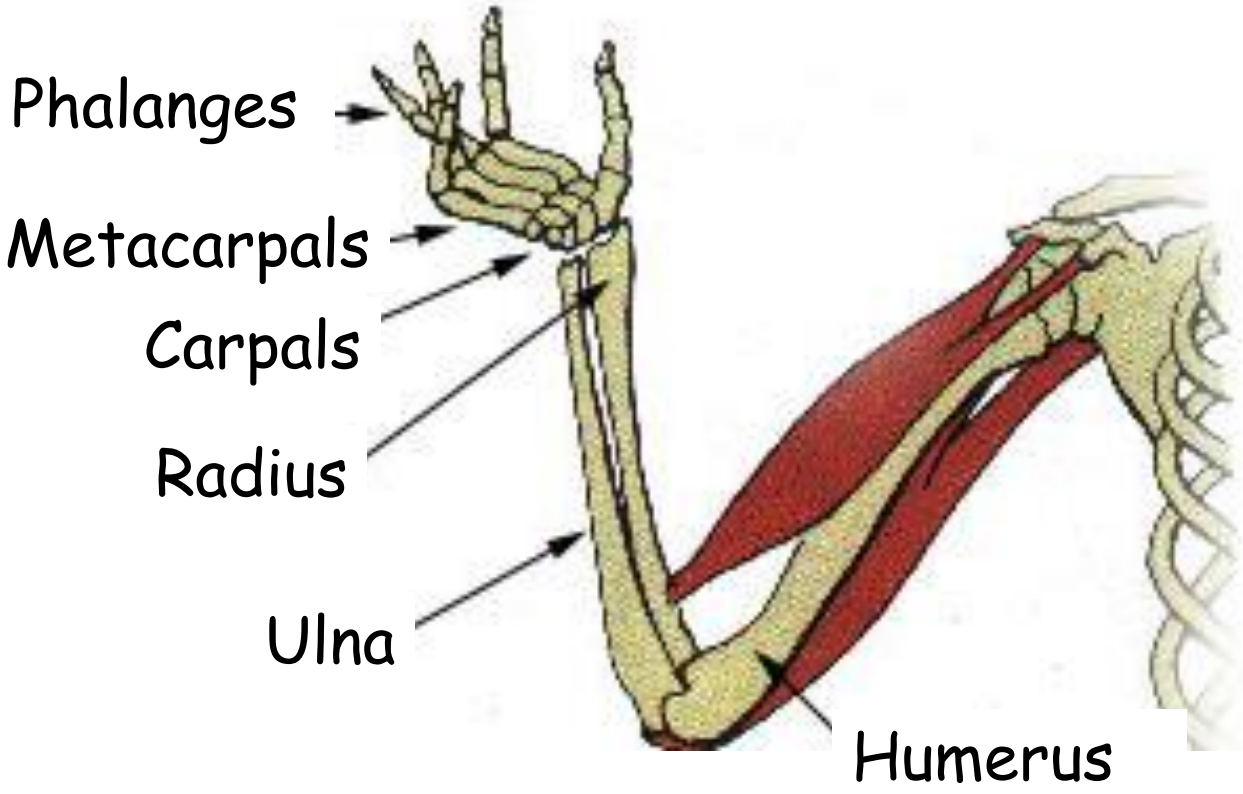
Human Arm



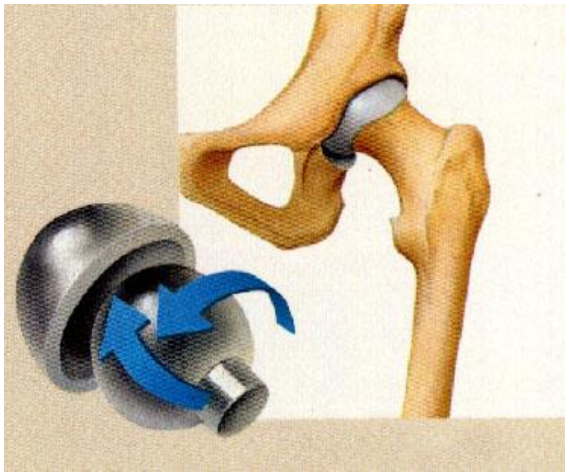
Connective Tissue: Skeleton

TRY IT

Human Arm

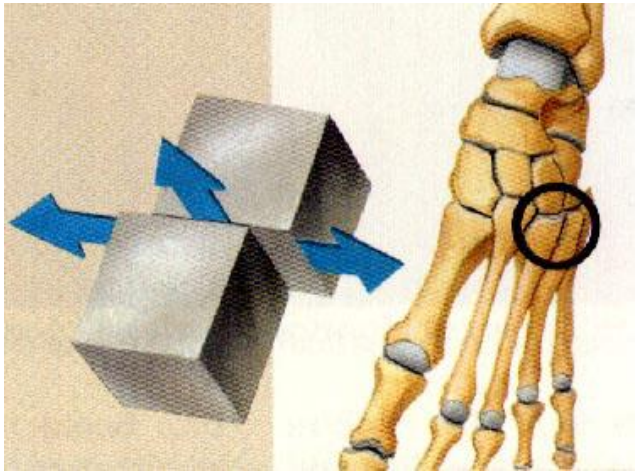


Joints



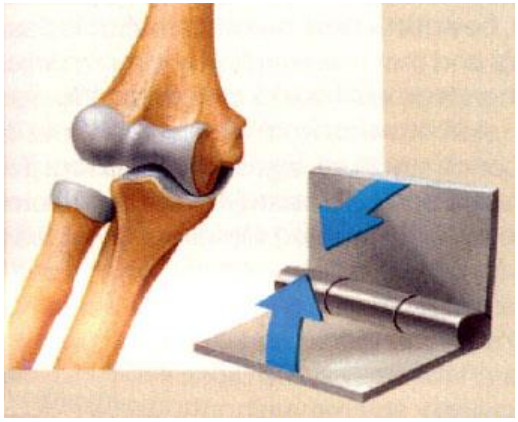
Ball & Socket

Shoulder, hip; greatest movement



Gliding

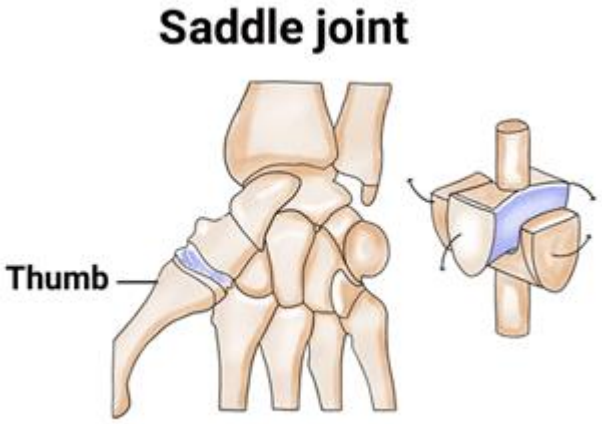
Wrist; foot; bones slide over each other.



Hinge

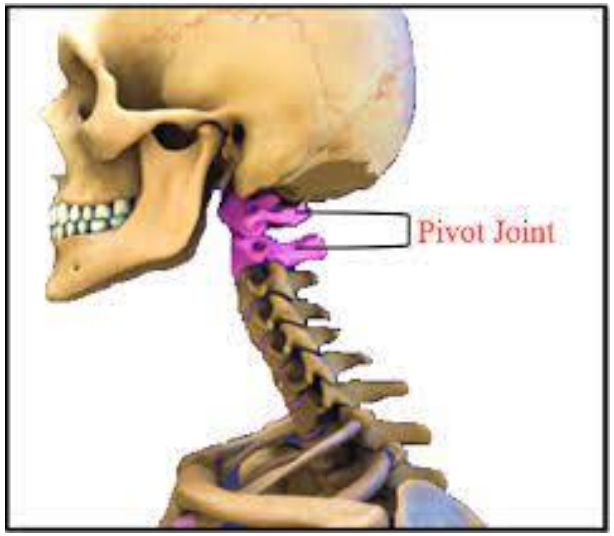
Elbow, knee; one plane

Joints



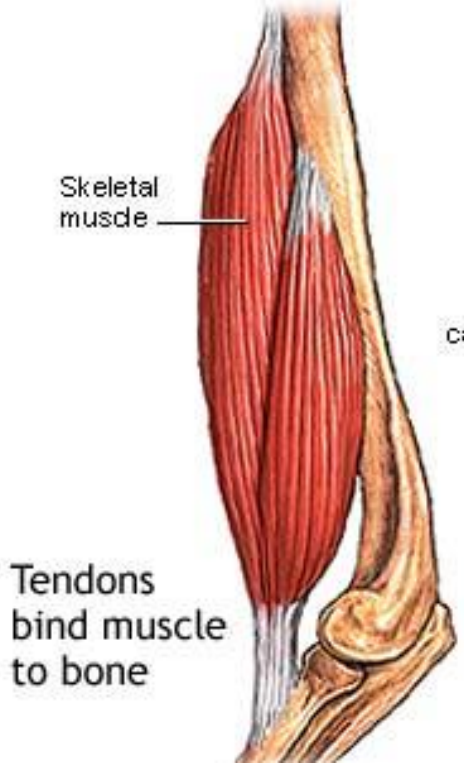
Saddle

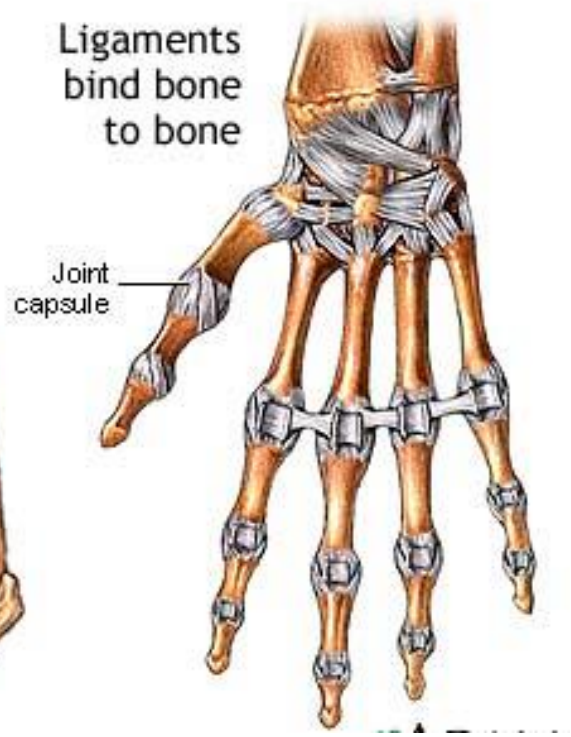
Thumb; middle ear; sterno-clavicle joint of thorax; heel; stability; flexibility



Pivot

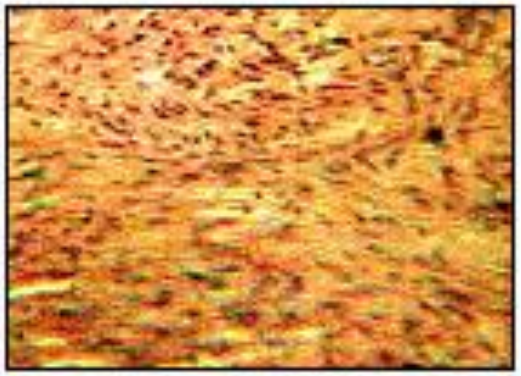
Vertebrae; rotary movement



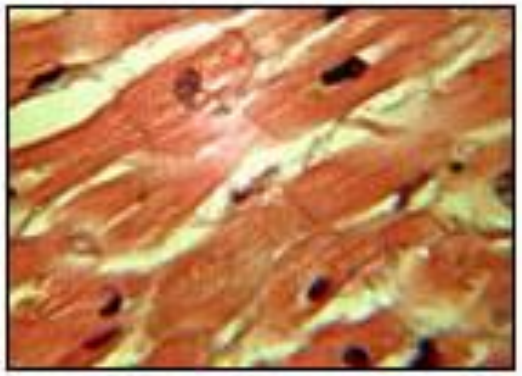


Muscle Tissue

Skeletal muscle



Smooth muscle



Cardiac muscle

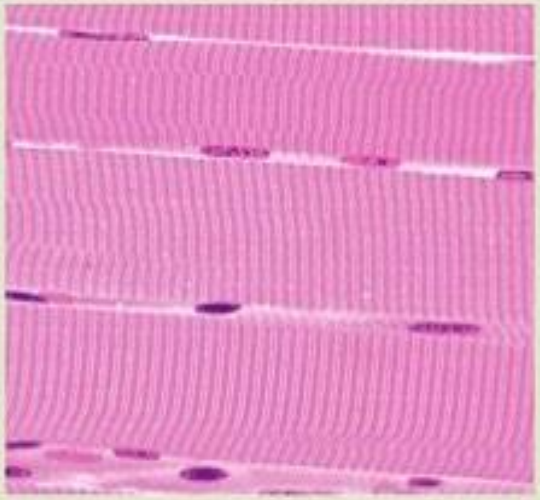
The muscular system is responsible for the movement of the human body. There are three (3) main types of muscle tissue.

Attached to the bones of the skeletal system are about 700 named muscles that make up roughly half of a person's body weight. Each of these muscles is a discrete organ constructed of skeletal muscle tissue, blood vessels, tendons, and nerves.

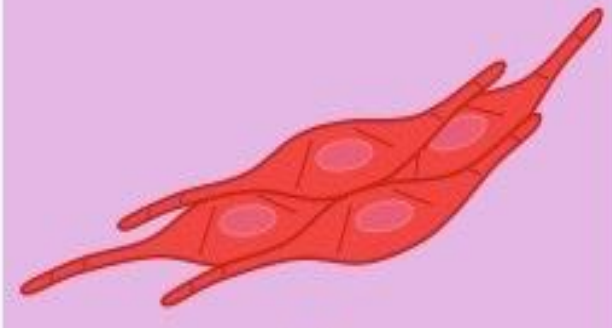
Muscle tissue is also found inside of the heart, digestive organs, and blood vessels. In these organs, muscles serve to move substances throughout the body.

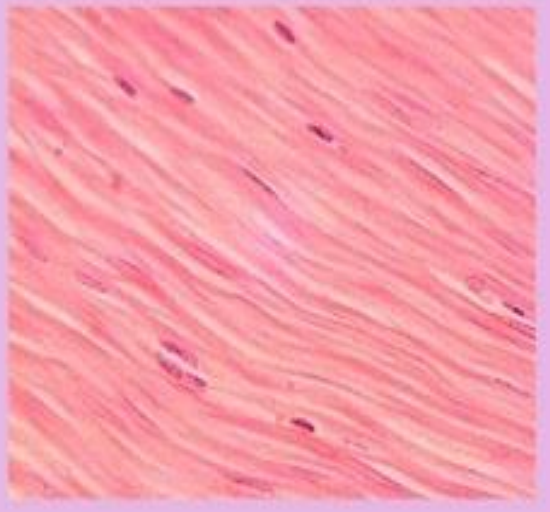
Muscle Tissue

Skeletal Muscle

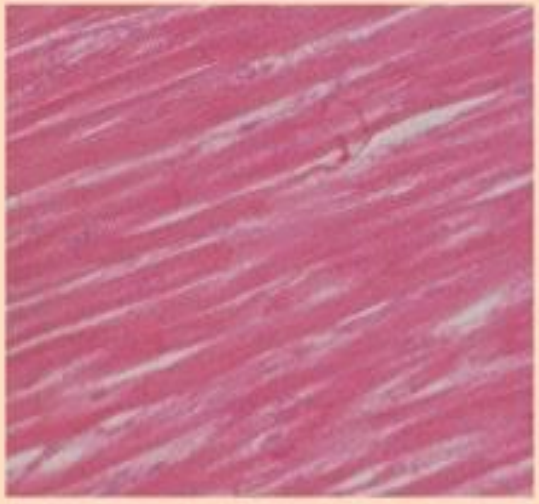


Smooth Muscle

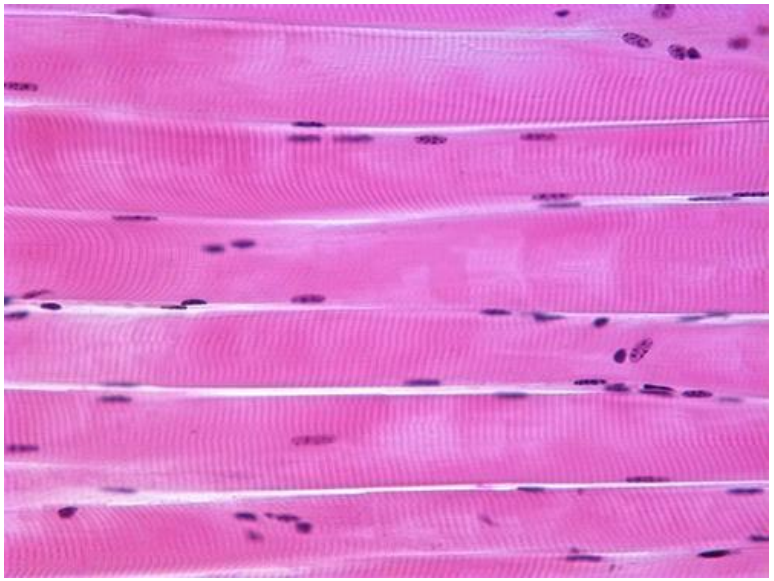




Cardiac Muscle



Skeletal Muscle



Skeletal muscle is the only VOLUNTARY muscle tissue in the human body — it is controlled consciously.

Every physical action that a person consciously performs (e.g. speaking, walking, or writing) requires skeletal muscle.

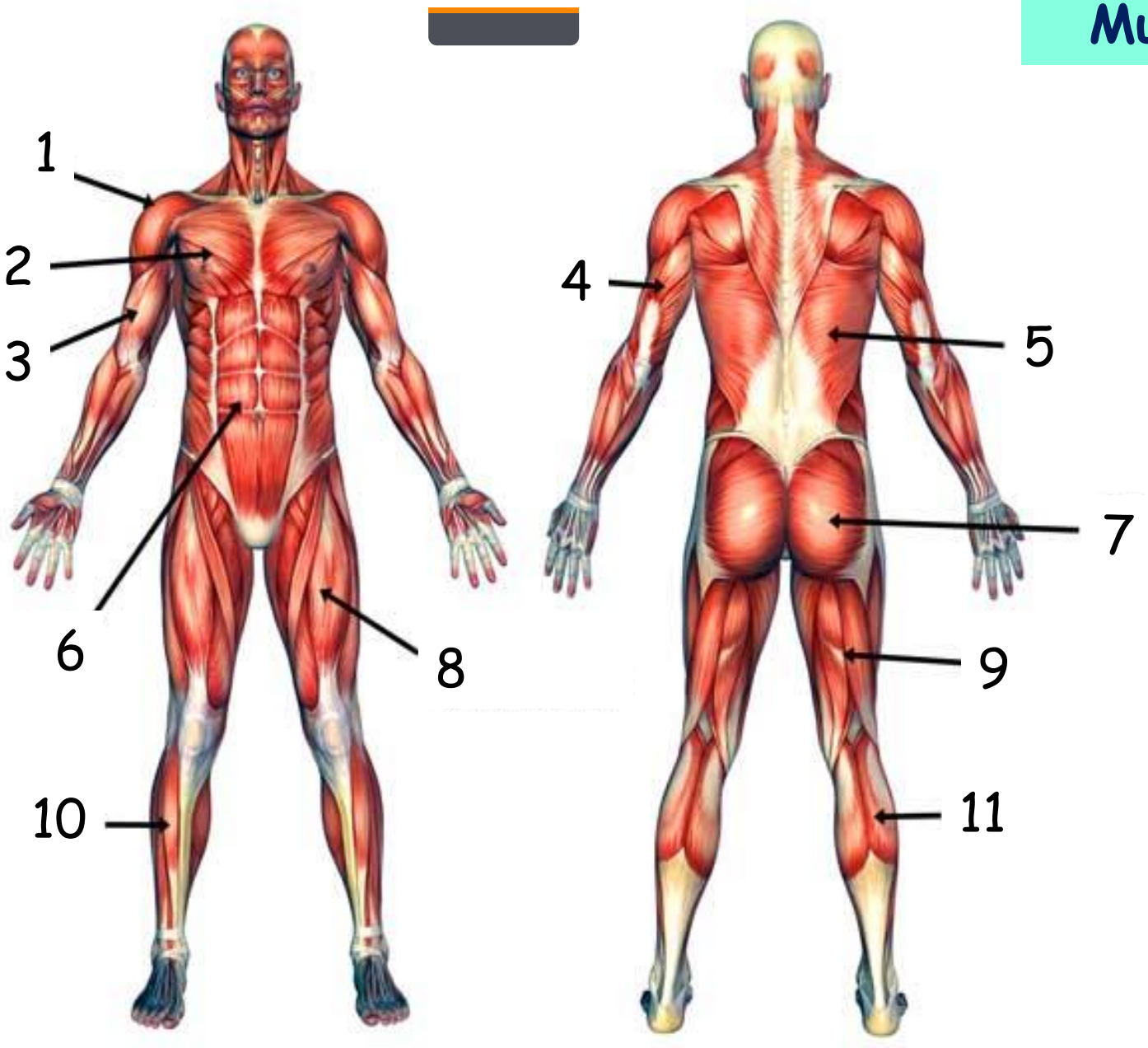
Skeletal muscle is anchored by tendons to bone and is used to affect skeletal movement such as locomotion and in maintaining posture.

Most skeletal muscles are attached to two bones across a joint.

An average adult male is made up of 40–50% of skeletal muscle and an average adult female is made up of 30–40%.

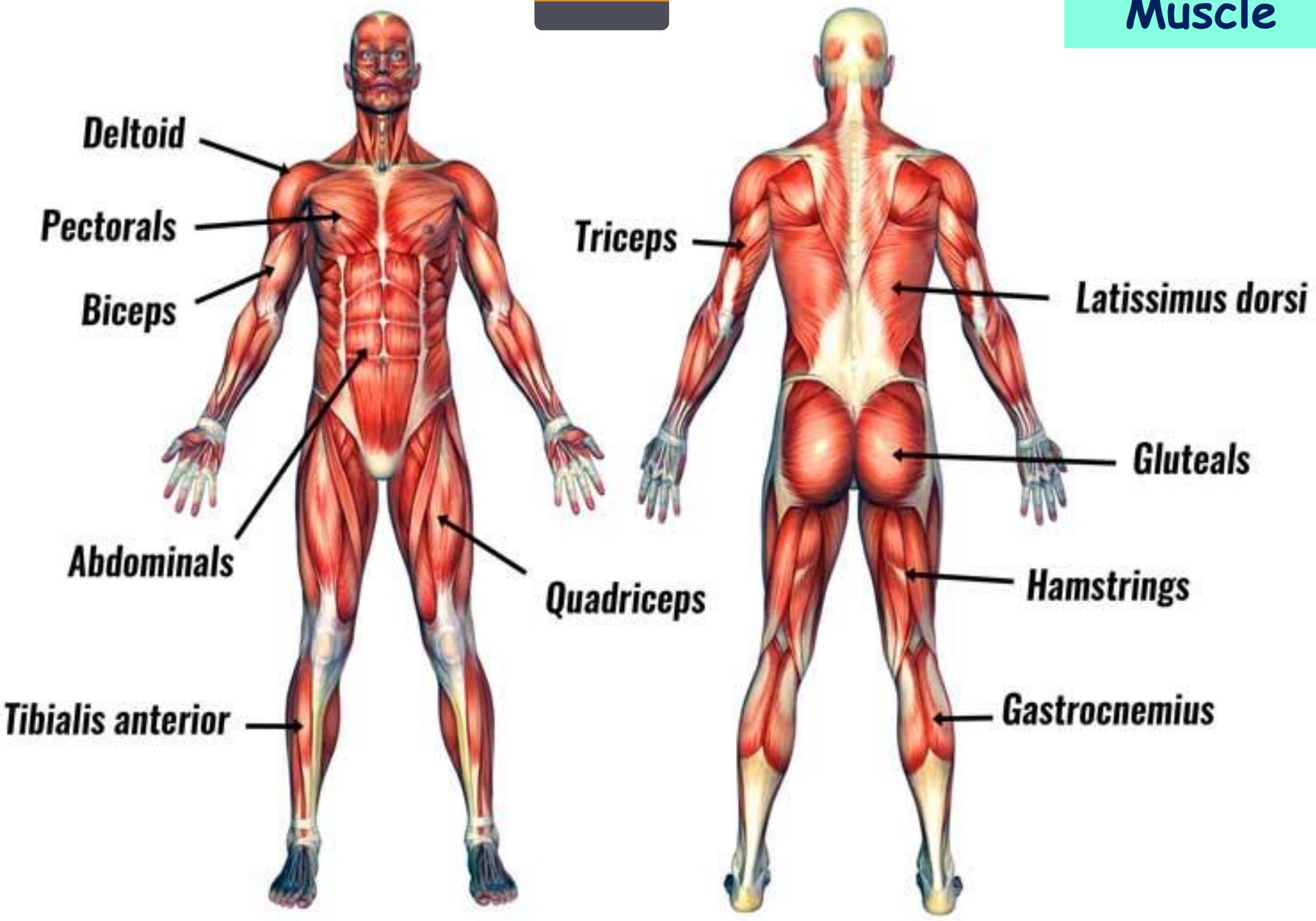
TRY IT

Skeletal Muscle



TRY IT

Skeletal Muscle



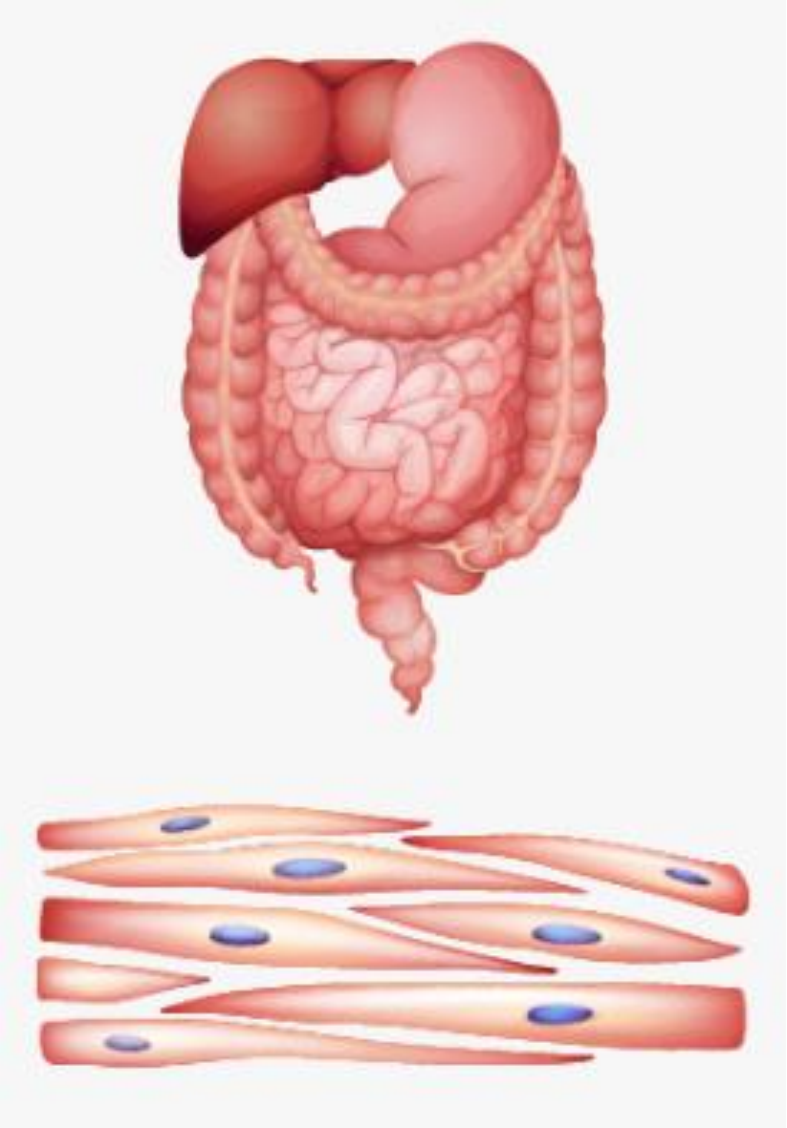
Visceral "Smooth" Muscle

Visceral muscle is found inside of organs like the esophagus, stomach, intestines, bronchi, urethra, & blood vessels.

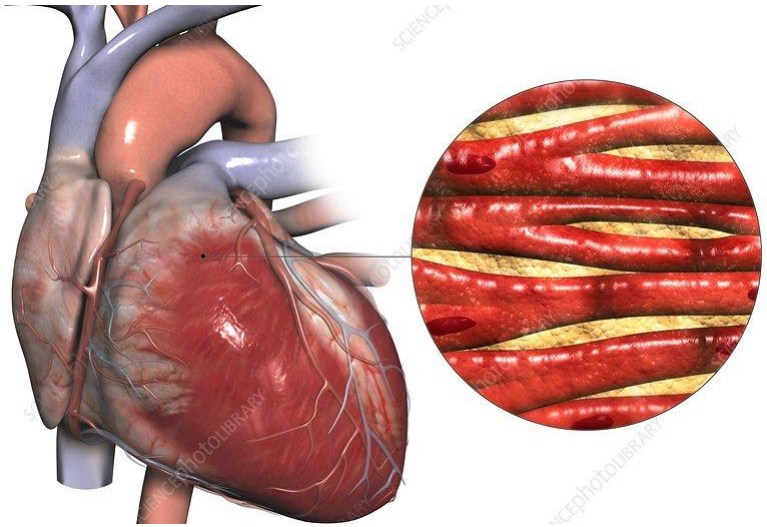
The weakest of all muscle tissues, visceral muscle makes organs contract to move substances through the organ.

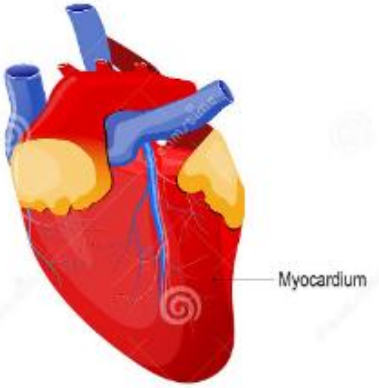
Because visceral muscle is controlled by the unconscious part of the brain, it is known as INVOLUNTARY muscle—it cannot be directly controlled by the conscious mind.

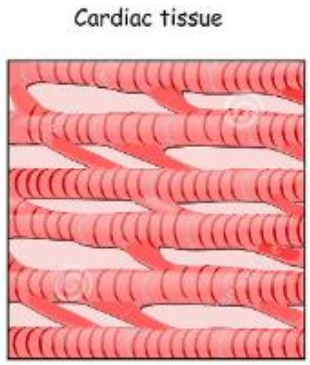
The term "smooth muscle" is often used to describe visceral muscle because it has a very smooth, uniform appearance when viewed under a microscope.



Cardiac Muscle







Found only in the heart, cardiac muscle is responsible for pumping blood throughout the body.

Cardiac muscle tissue cannot be controlled consciously, so it is an involuntary muscle.

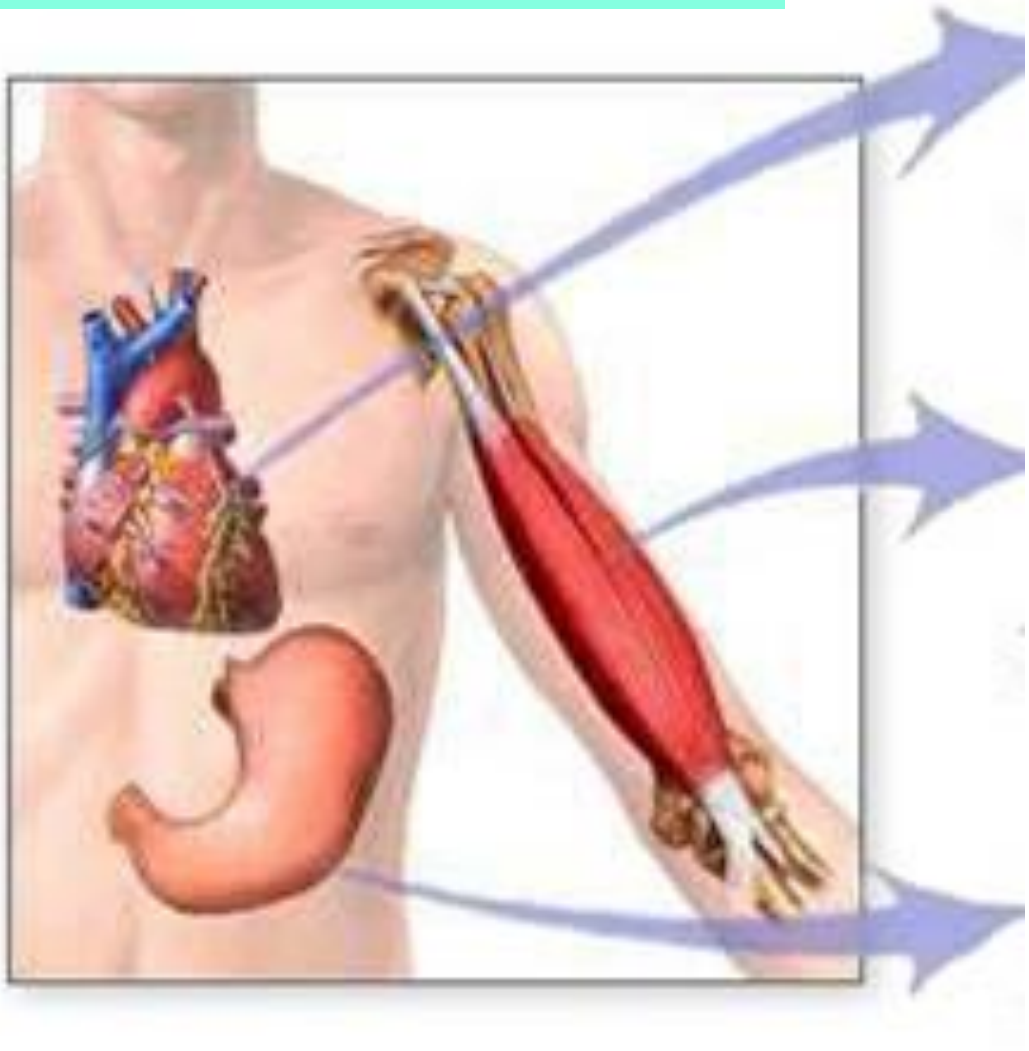
The cells of cardiac muscle tissue are striated — that is, they appear to have light and dark stripes when viewed under a light microscope.

Striations indicate that a muscle cell is very strong, unlike visceral muscles.

Muscle Tissue

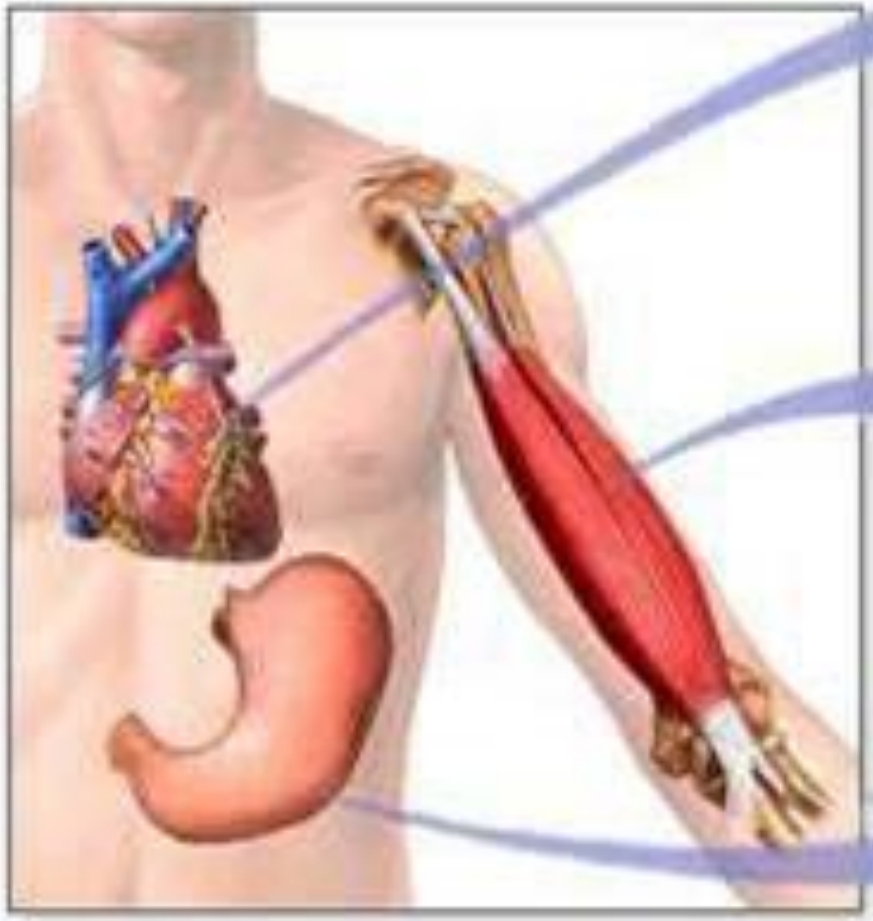
TRY IT

Give the type & location.



Muscle Tissue

TRY IT



Cardiac muscle cell

Only in the Heart

Skeletal muscle cell

Voluntary Movements

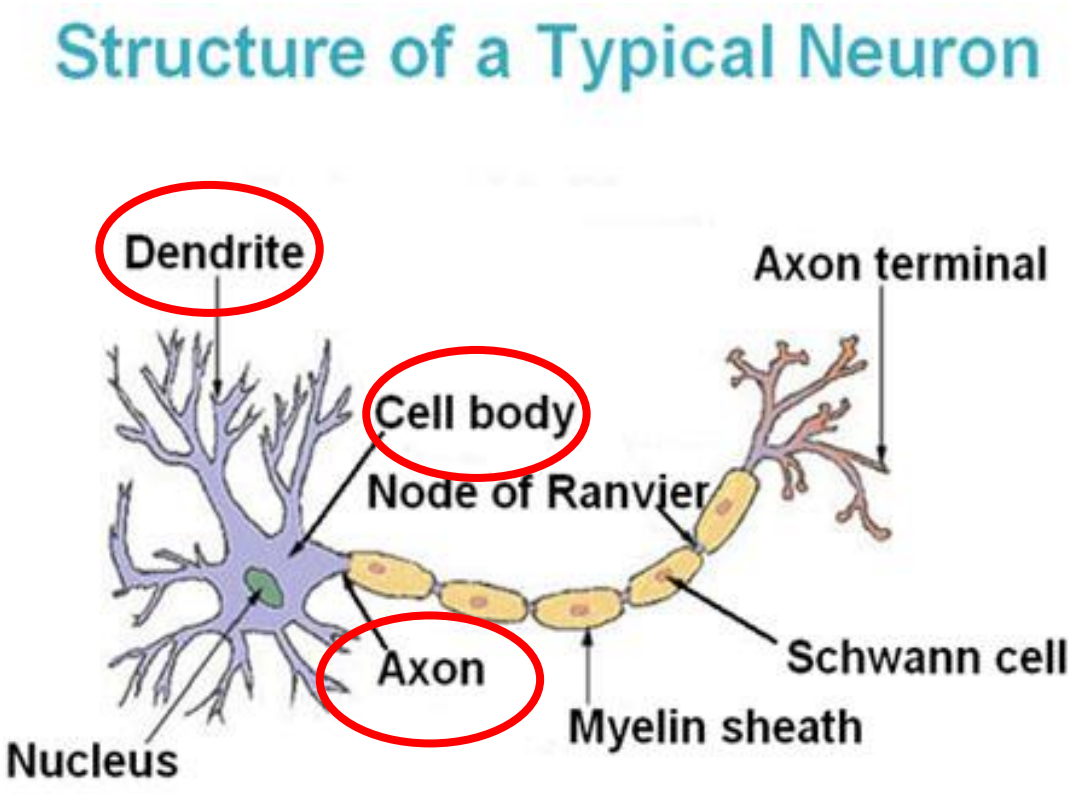
Smooth muscle cell

Involuntary Movements
(Ex. Digestion)

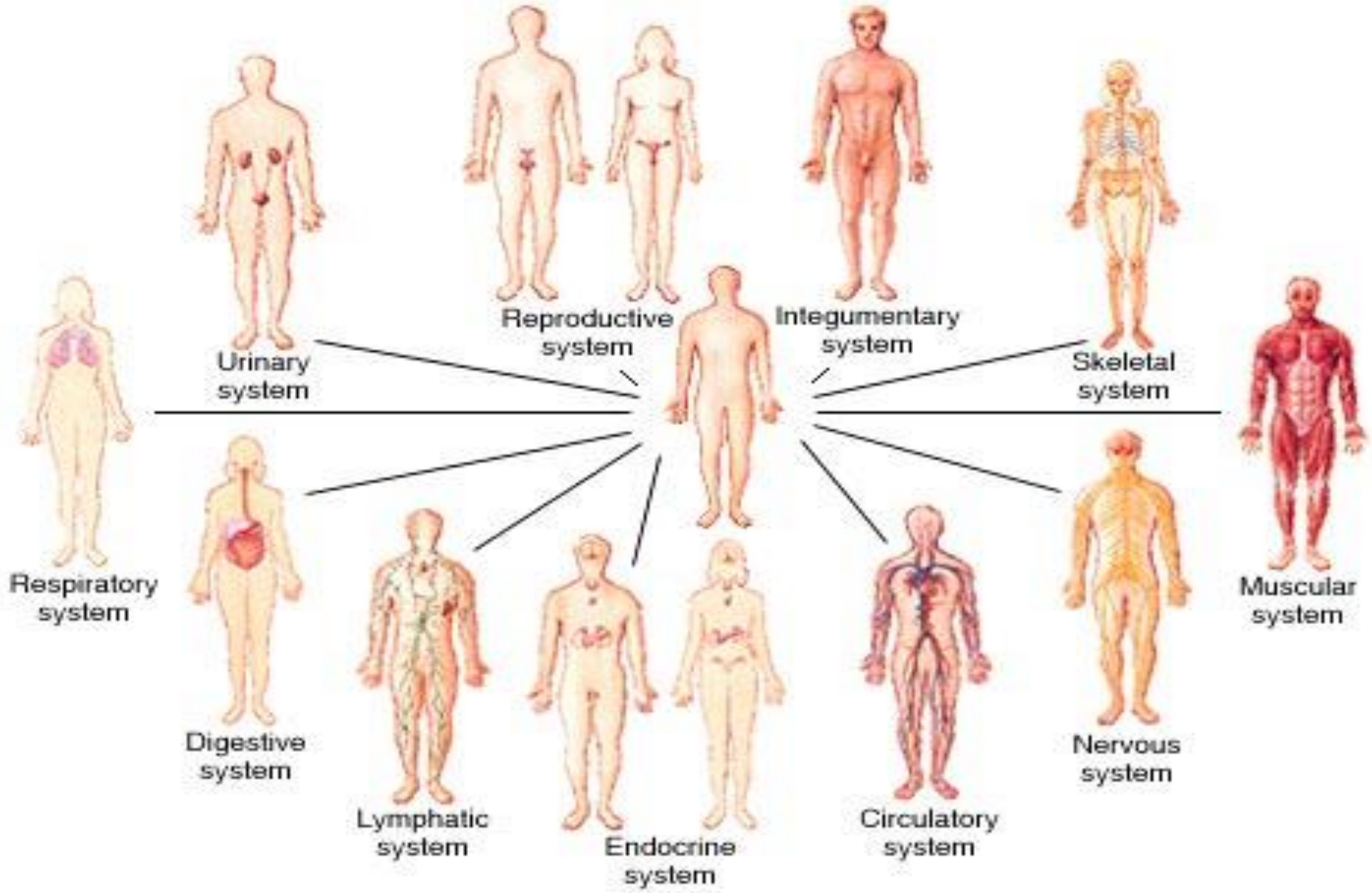
Nervous Tissue

Communication with other tissues through electrical signals (Action Potentials).

Neuron: Basic Unit of Nervous System.



Organ Systems



Organ Systems
work together to perform life's functions

The Circulatory System

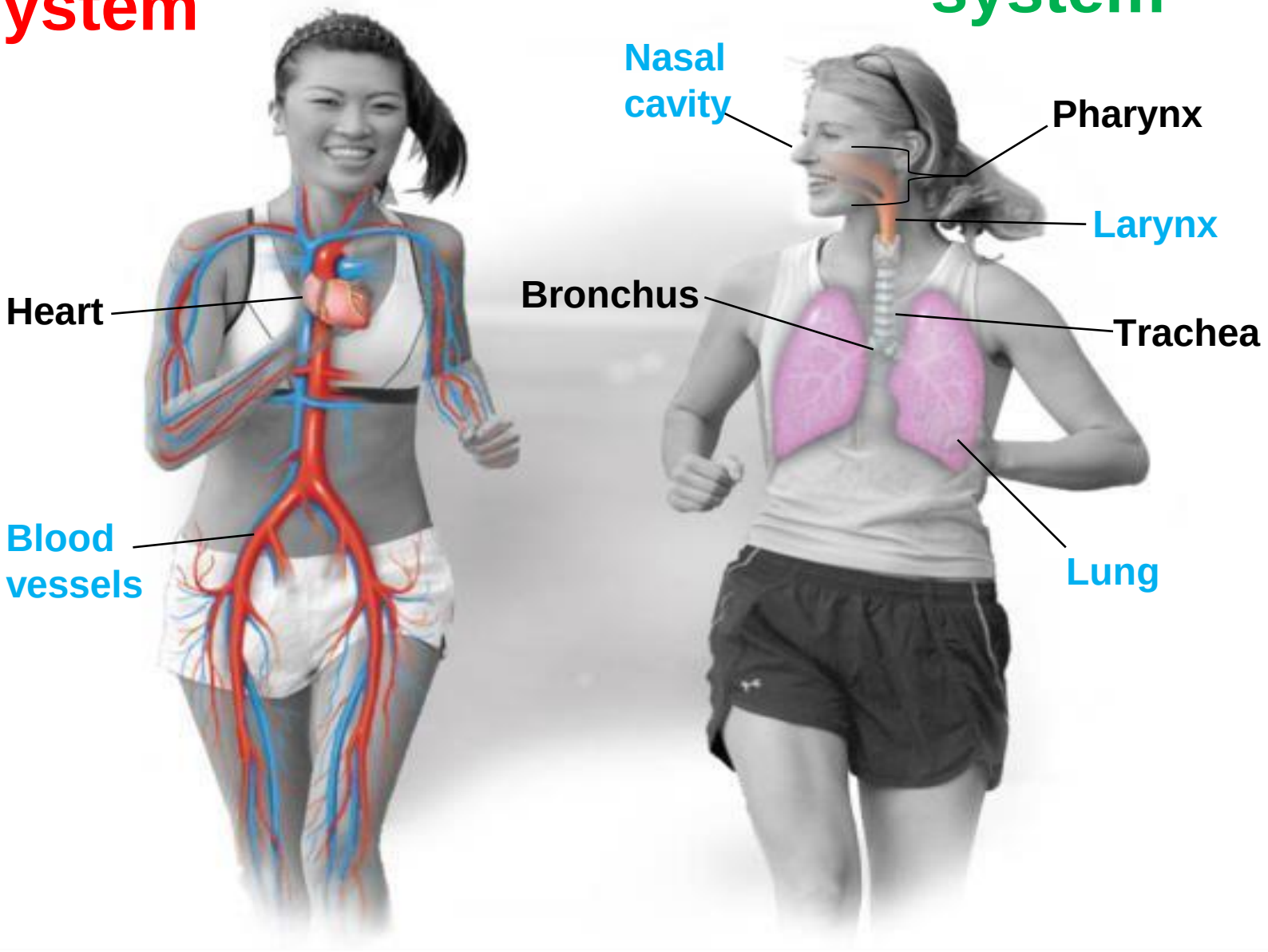
- delivers oxygen and nutrients to body cells.
- transports carbon dioxide to the lungs.
- carries metabolic wastes to the kidneys.

The Respiratory System

- exchanges gases with the environment.
- supplying the blood with oxygen.
- disposing of carbon dioxide.

Circulatory system

Respiratory system



Organ Systems
work together to perform life's functions

The Integumentary System

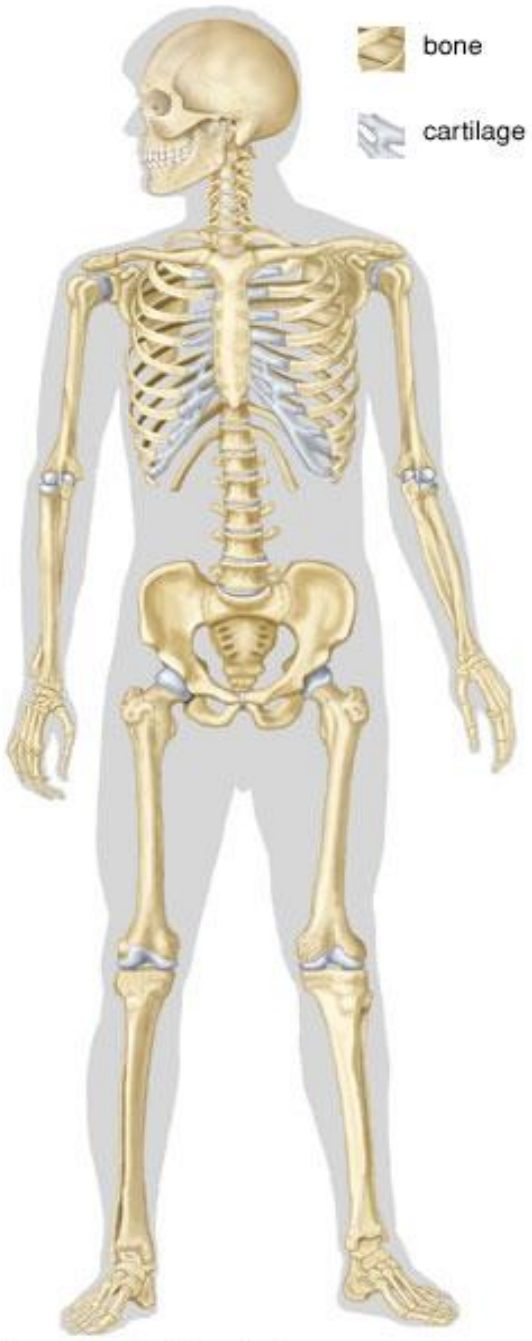
(outer layer of skin, nails, hair) which acts as a physical barrier, protecting against

- physical injury.
- Infection (bacteria, fungus).
- excessive heat or cold.
- drying out.

Organ Systems
work together to perform life's functions

The Skeletal System

- supports the body.
- protects organs such as the brain and lungs.
- provides the framework for muscle movement.



Organ Systems
work together to perform life's functions

The Muscular System

- moves the body.
- maintains posture.
- produces heat.

Organ Systems
work together to perform life's functions

The Urinary System

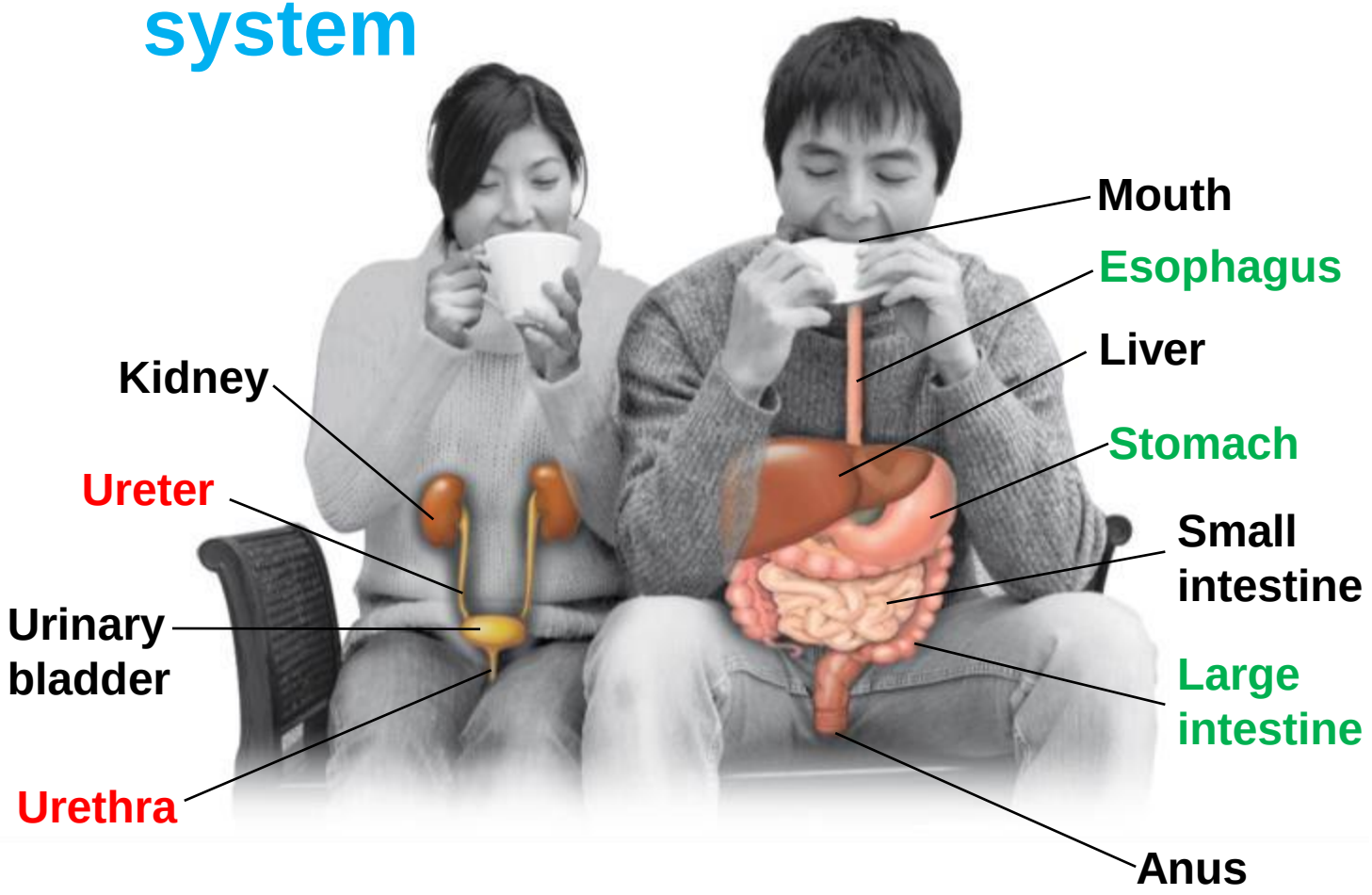
- removes waste products from the blood.
- excretes urine.
- regulates the chemical makeup, pH, and water balance of blood.

The Digestive System

- ingests and breaks down food.
- absorbs nutrients.
- eliminates undigested material.

Urinary system

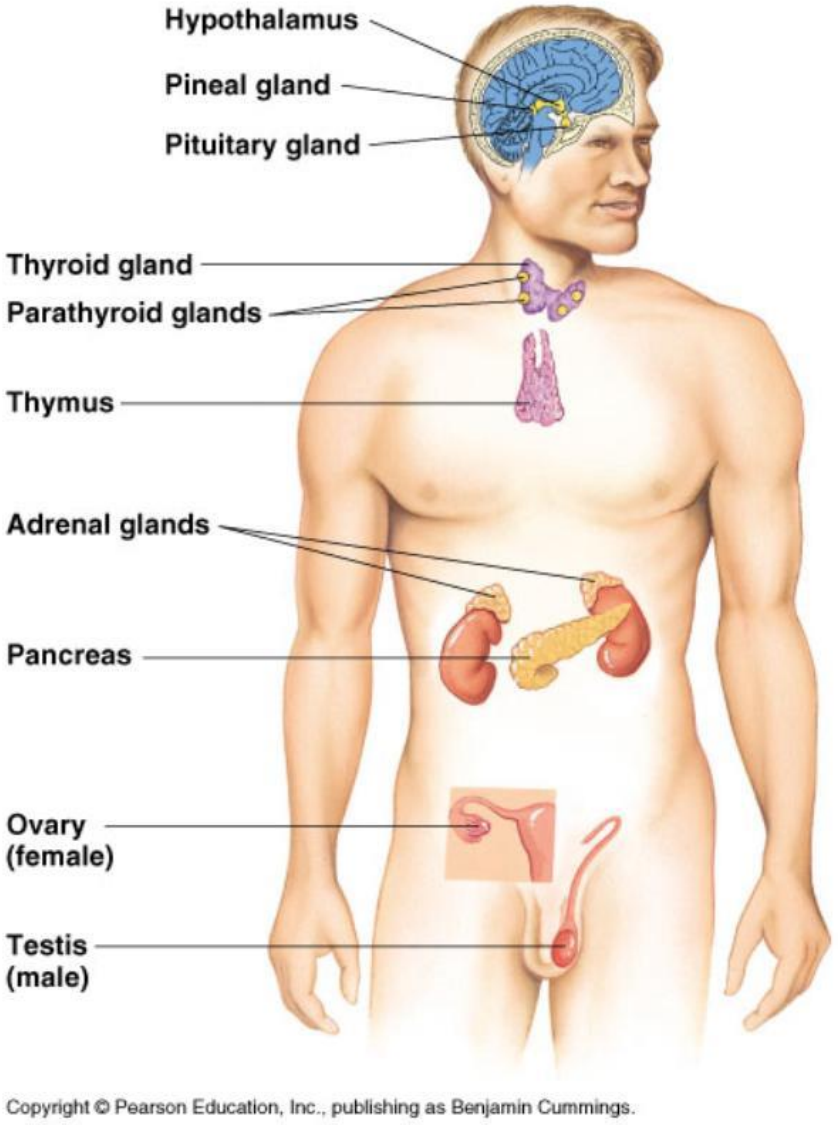
Digestive system



Organ Systems
work together to perform life's functions

The **Endocrine System**

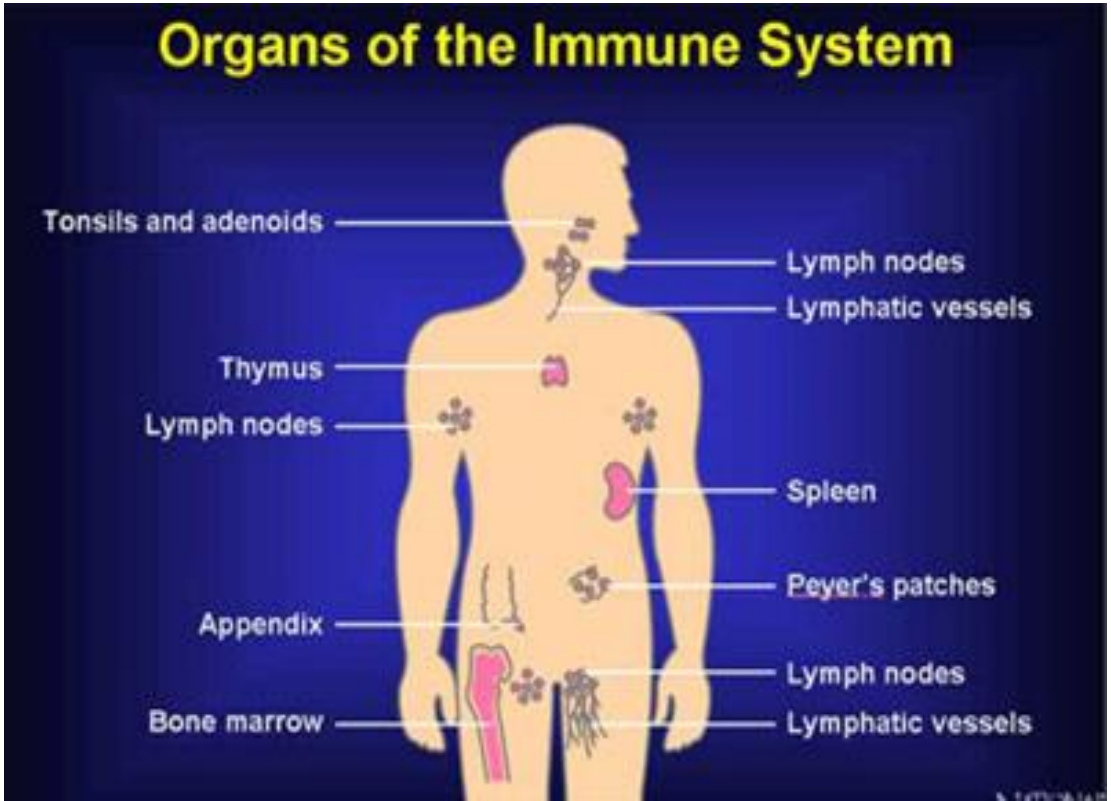
secretes hormones that regulate body activities.



Organ Systems
work together to perform life's functions

The **Lymphatic** and **Immune Systems** protect the body from infection and cancer.

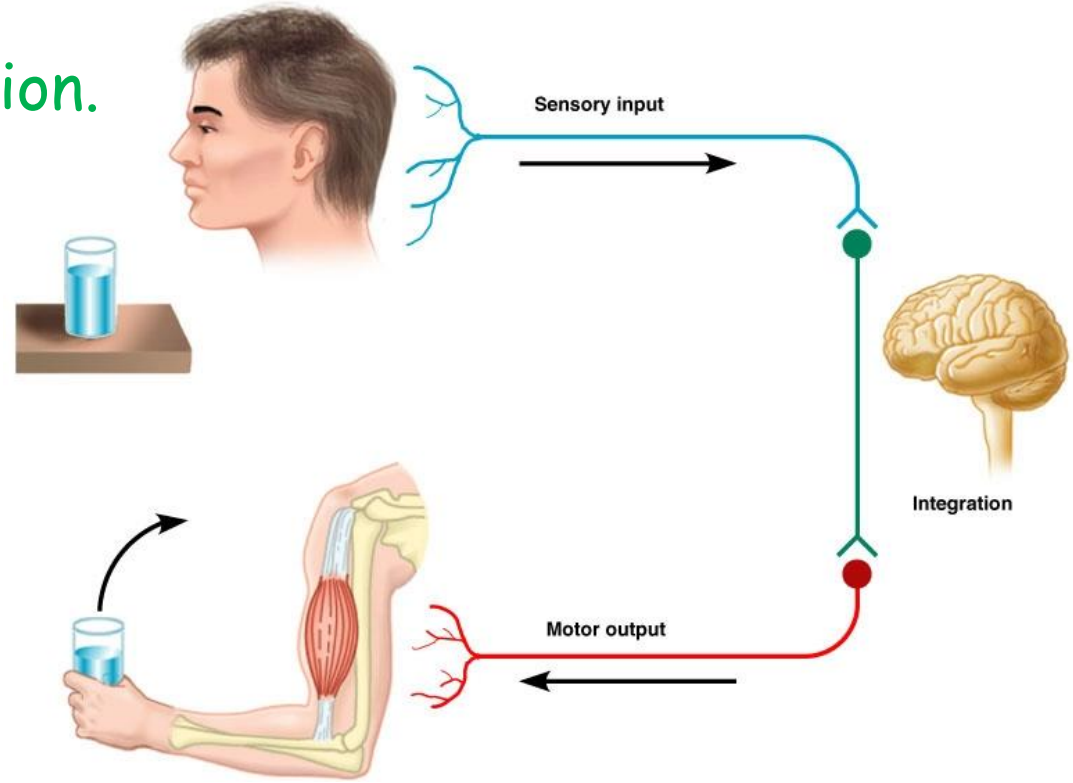
The lymphatic system also returns excess body fluid to the circulatory system.



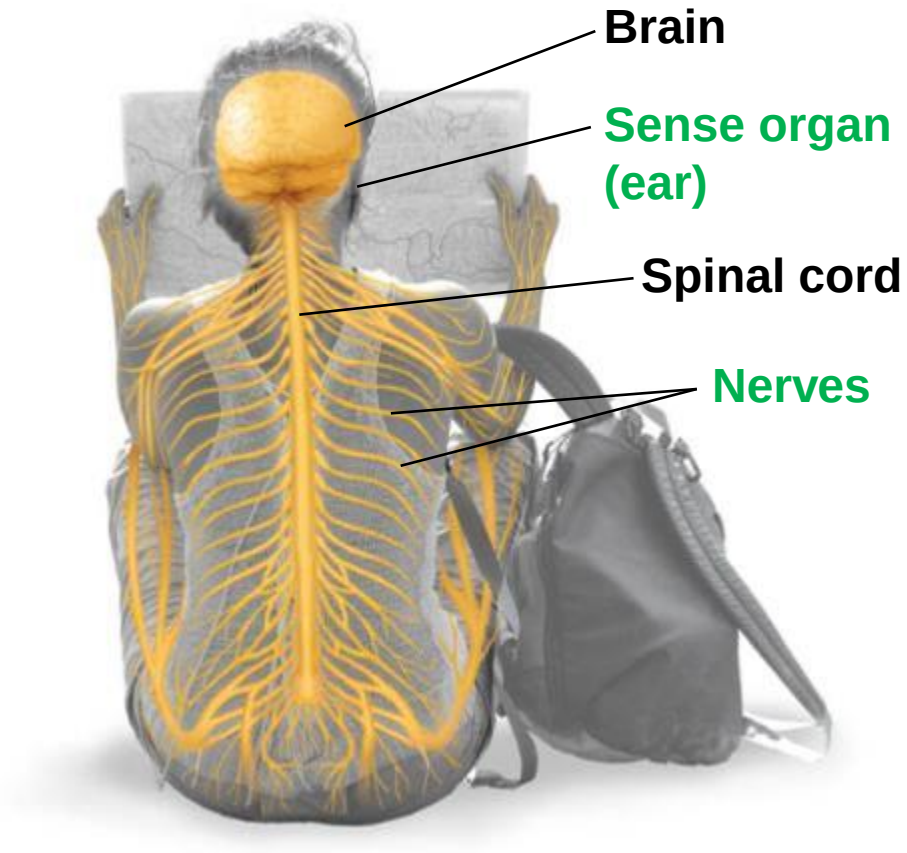
Organ Systems
work together to perform life's functions

The **Nervous System** coordinates body activities by

- detecting stimuli.
- integrating information.
- directing responses.



Nervous system



Organ Systems work together to perform life's functions

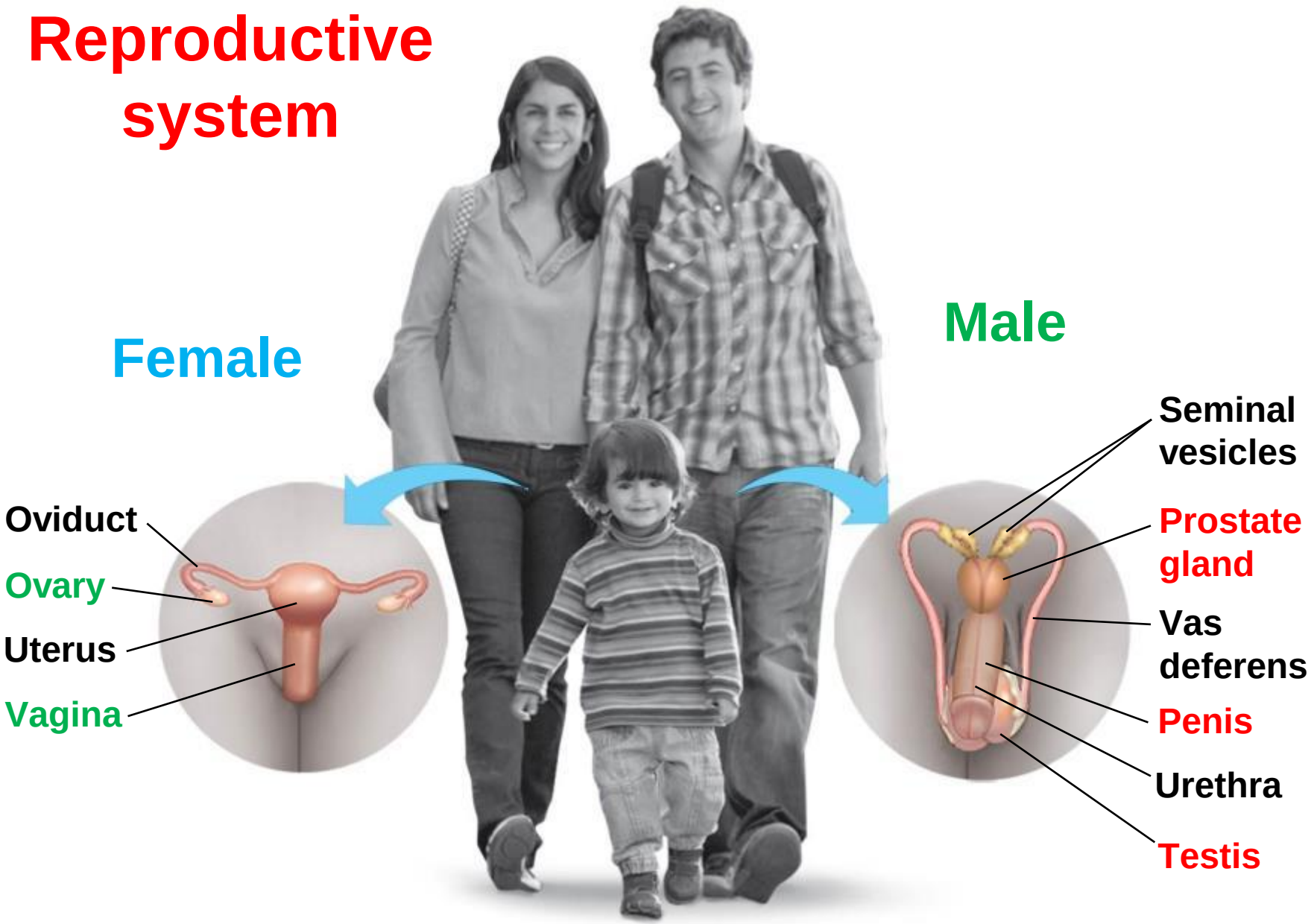
The **Reproductive System** produces

- gametes (eggs and sperm cells).
- sex hormones.

The **Female Reproductive System**

- supports a developing embryo.
- produces milk.

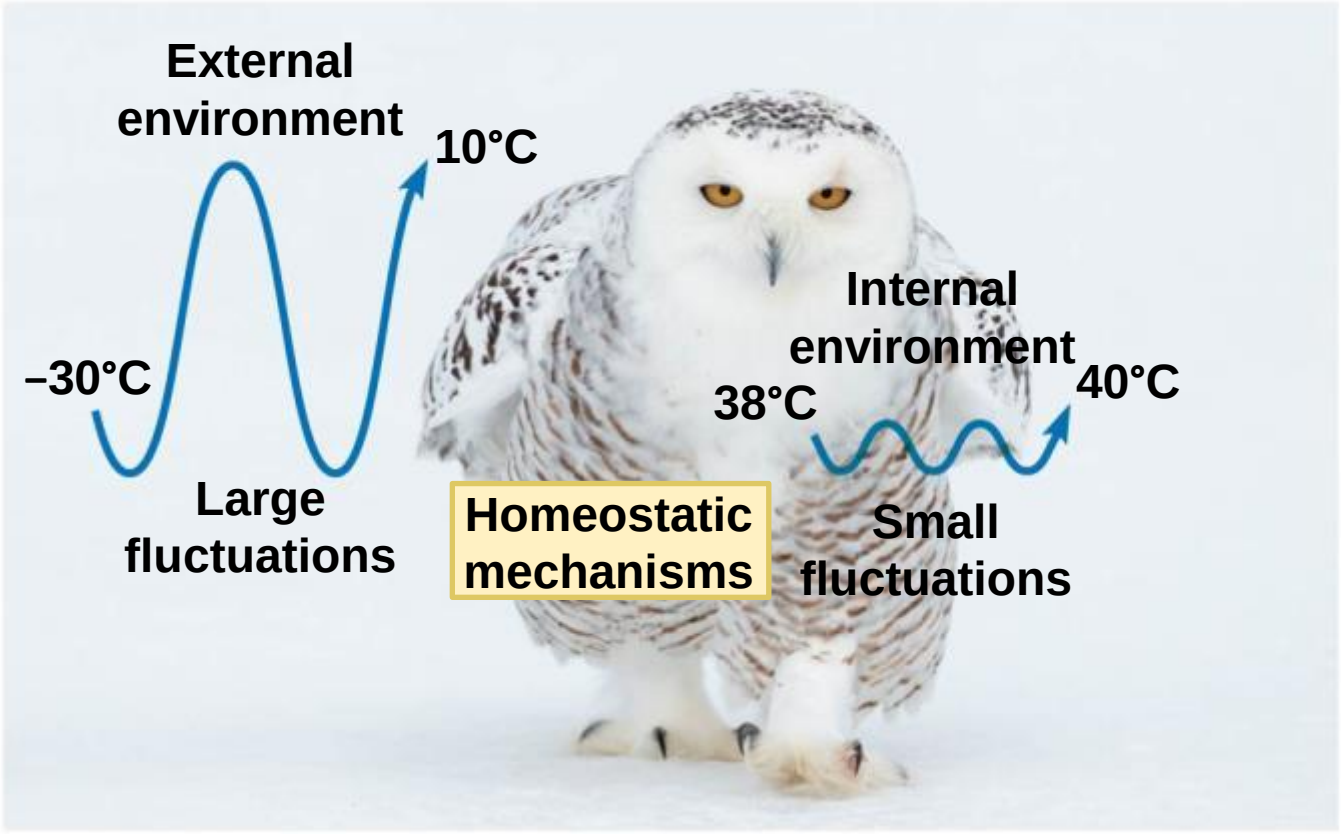
Reproductive system



Regulating Internal Environment

HOMEOSTASIS

- is the active maintenance of a **steady state** within the body especially related to temperature, pH, and physiological functions.
  - External environmental conditions may fluctuate wildly.
  - Homeostatic mechanisms regulate internal conditions.

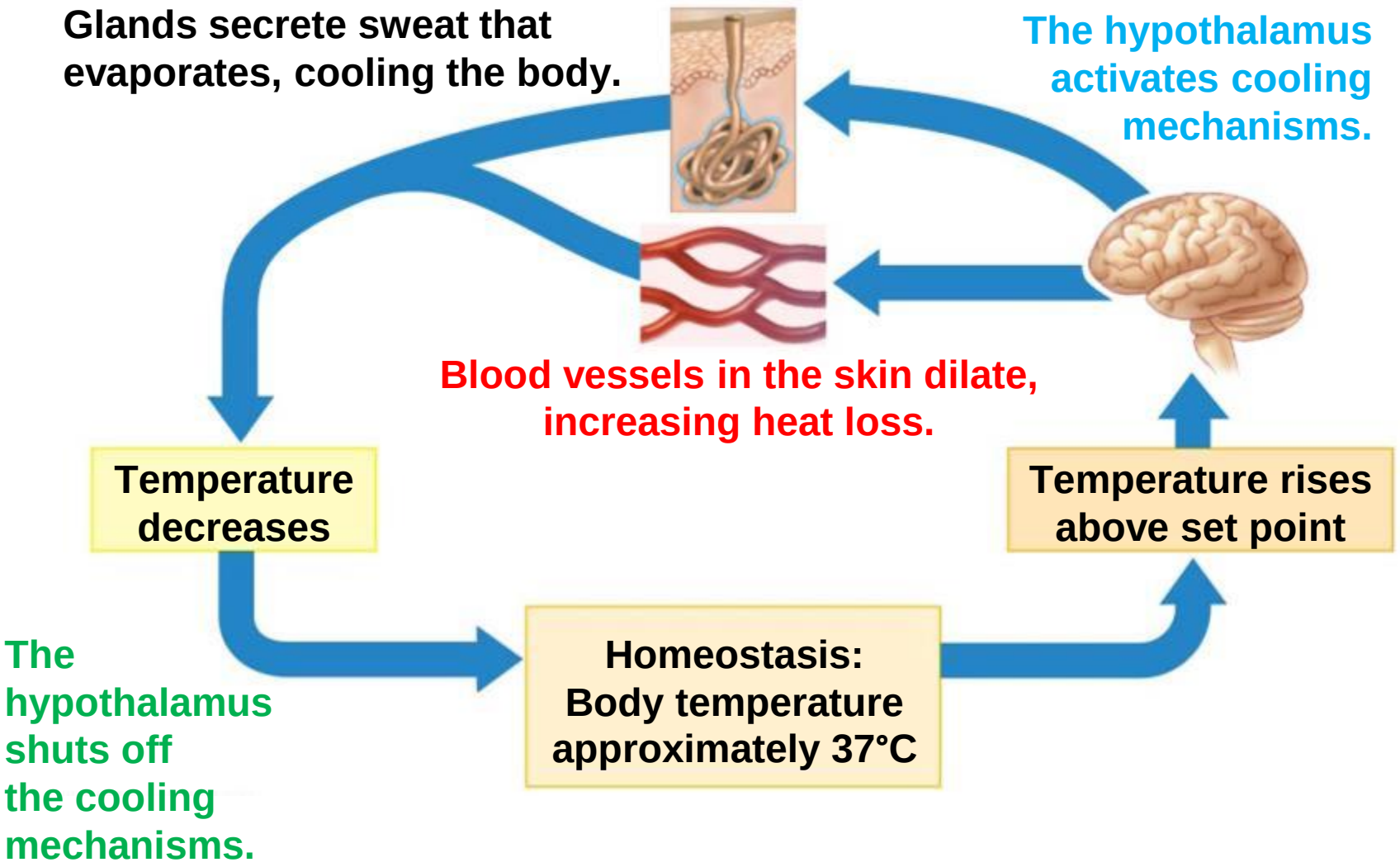

External environment
10°C
–30°C
Large fluctuations
Homeostatic mechanisms
Internal environment
38°C
40°C
Small fluctuations

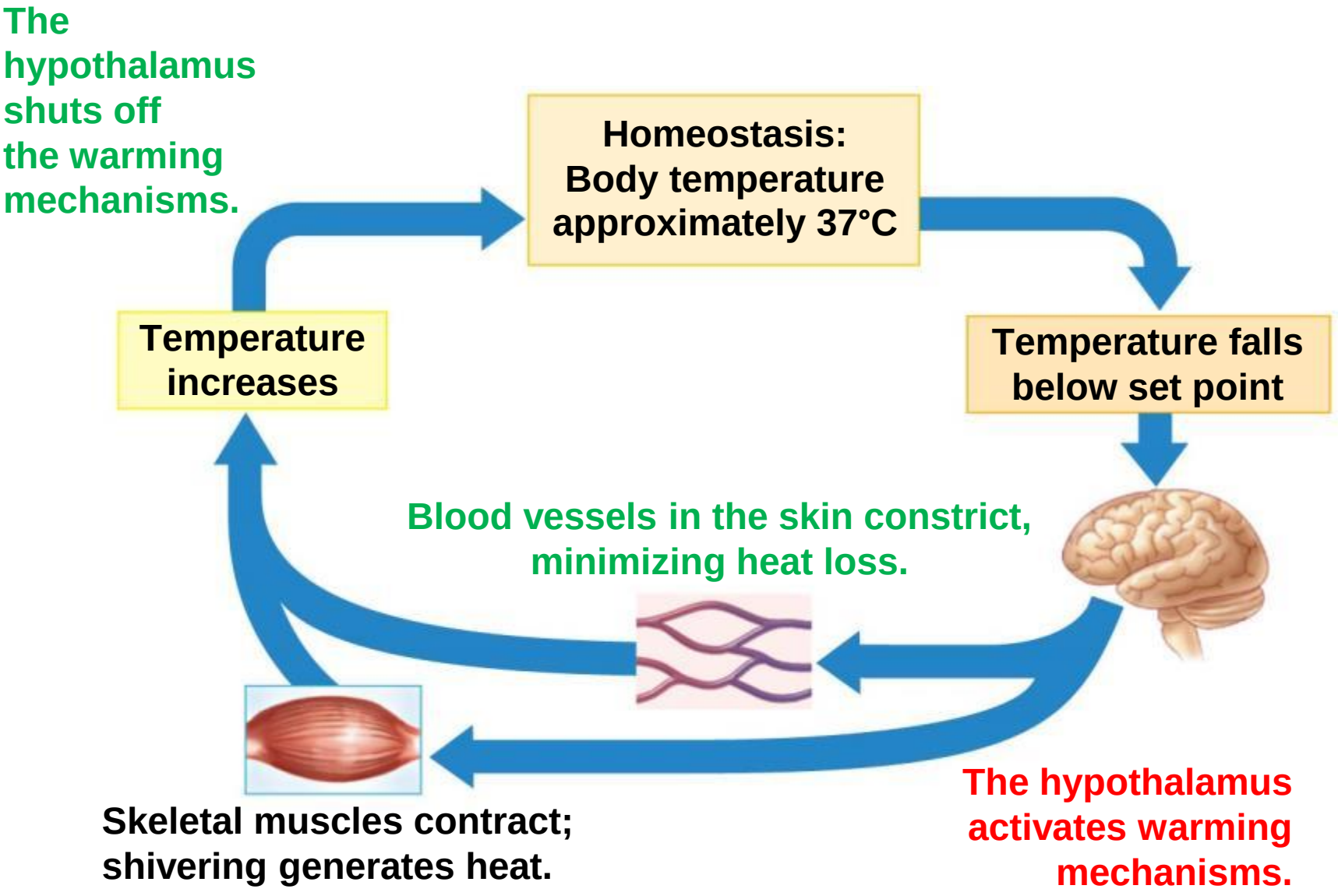
Homeostasis depends on Negative Feedback

- Control systems
  - detect change.
  - directs responses.

Negative-Feedback mechanisms

- keep internal variables steady.
- permit only small fluctuations around set points.


Glands secrete sweat that evaporates, cooling the body.
The hypothalamus activates cooling mechanisms.
Blood vessels in the skin dilate, increasing heat loss.
Temperature decreases
Temperature rises above set point
Homeostasis: Body temperature approximately 37°C
The hypothalamus shuts off the cooling mechanisms.


The hypothalamus shuts off the warming mechanisms.
Homeostasis: Body temperature approximately 37°C
Temperature falls below set point
Blood vessels in the skin constrict, minimizing heat loss.
The hypothalamus activates warming mechanisms.
Skeletal muscles contract; shivering generates heat.
Temperature increases