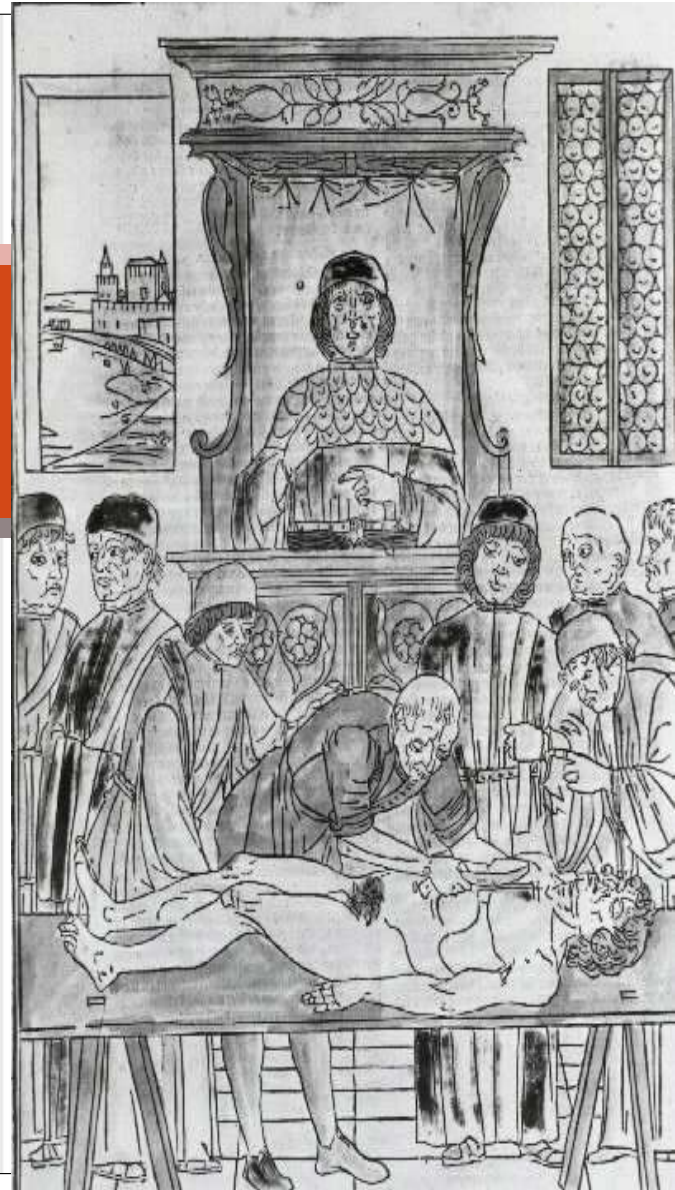
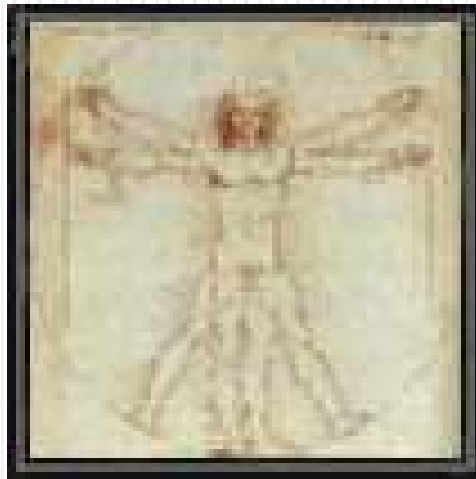


# Introduction to Anatomy Physiology

Danil Hammoudi.MD



"Dispel from your mind the thought that an understanding of the human body in every aspect of its structure can be given in words; the more thoroughly you describe the more you will confuse... I advise you not to trouble with words unless you are speaking to blind men."

*Leonardo da Vinci*



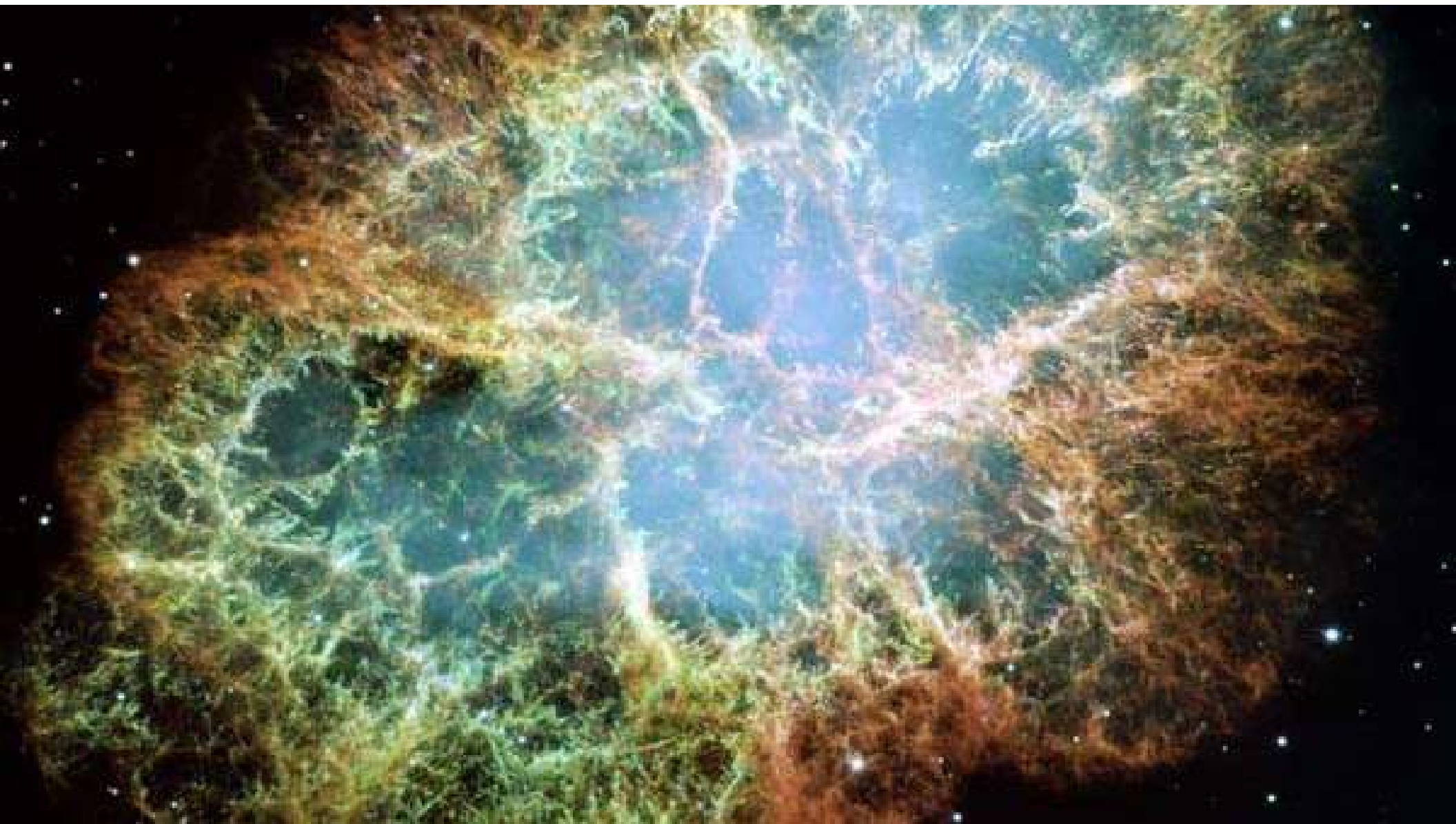




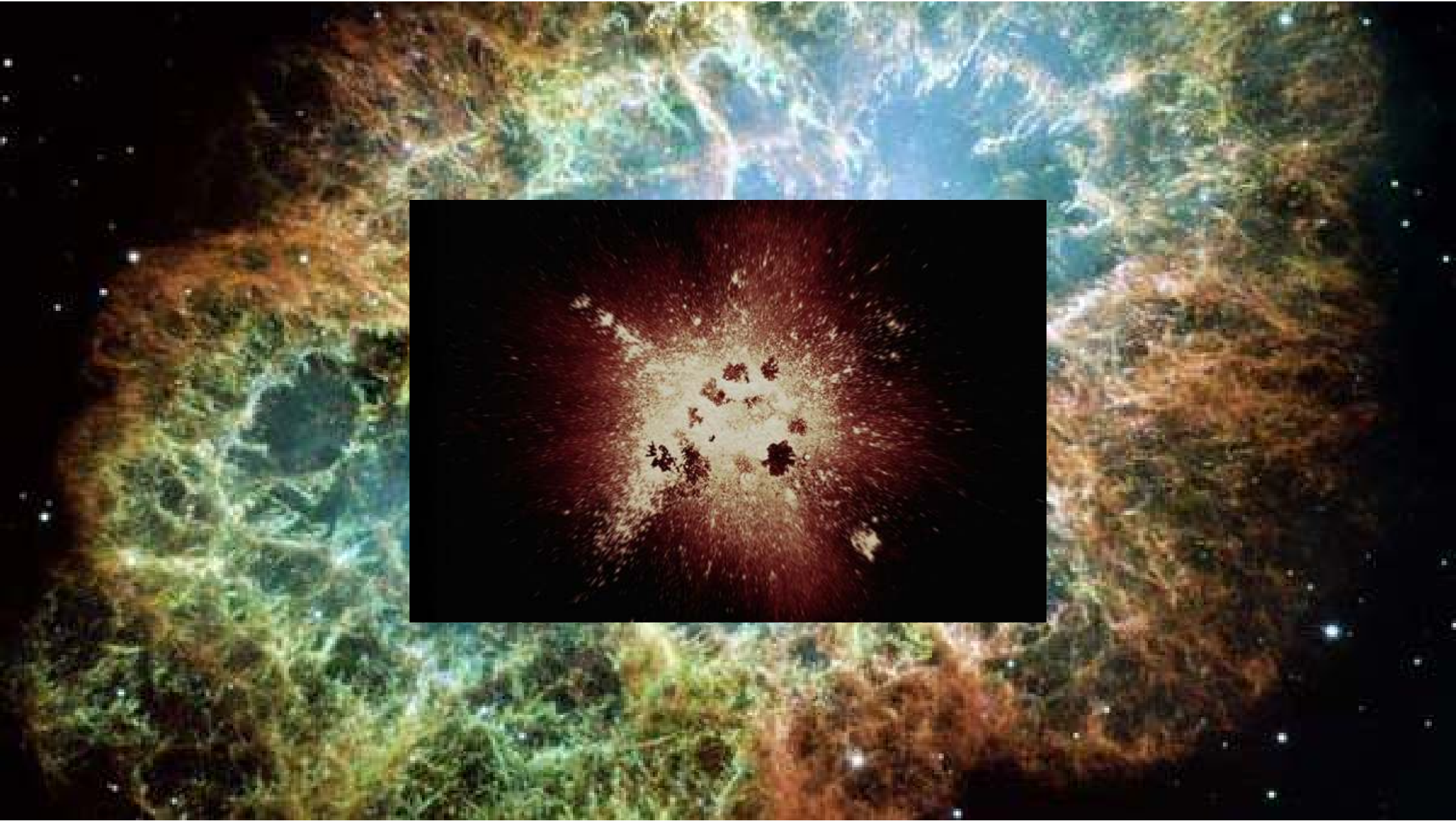








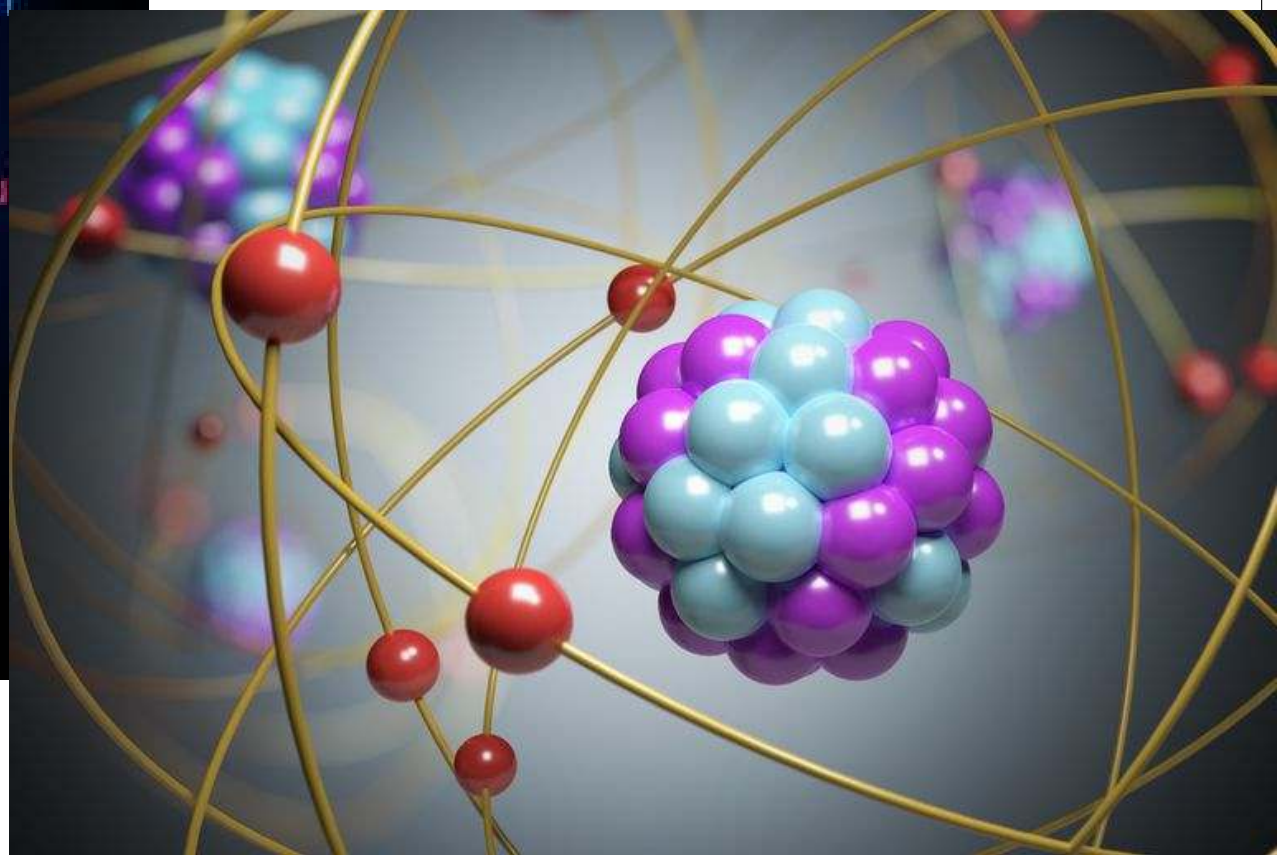
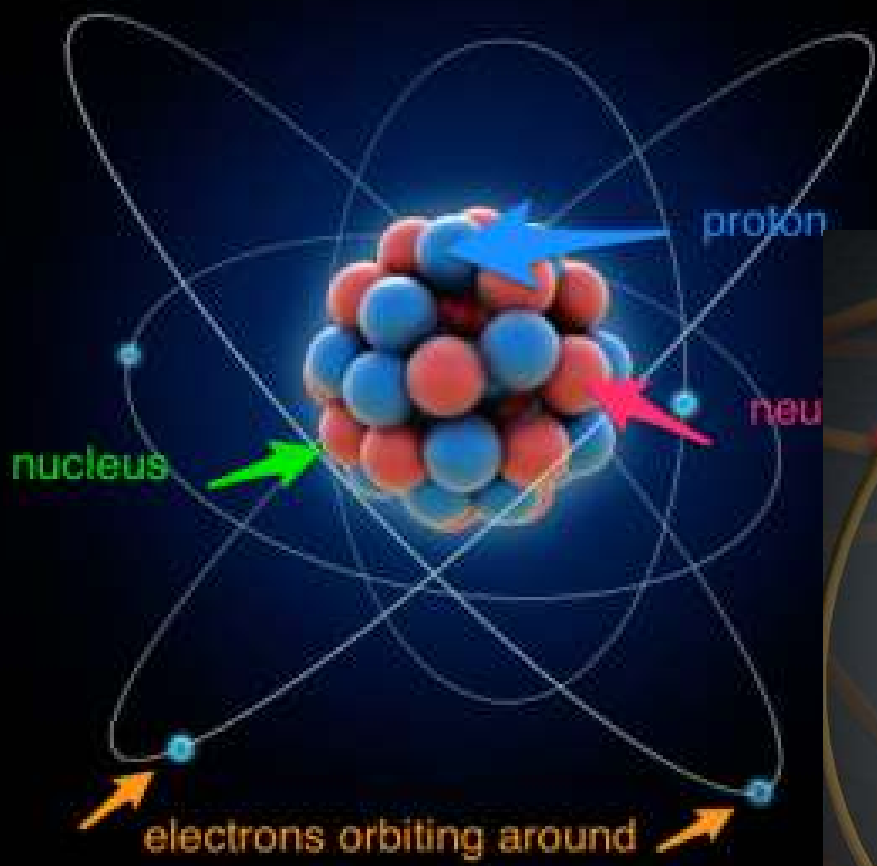


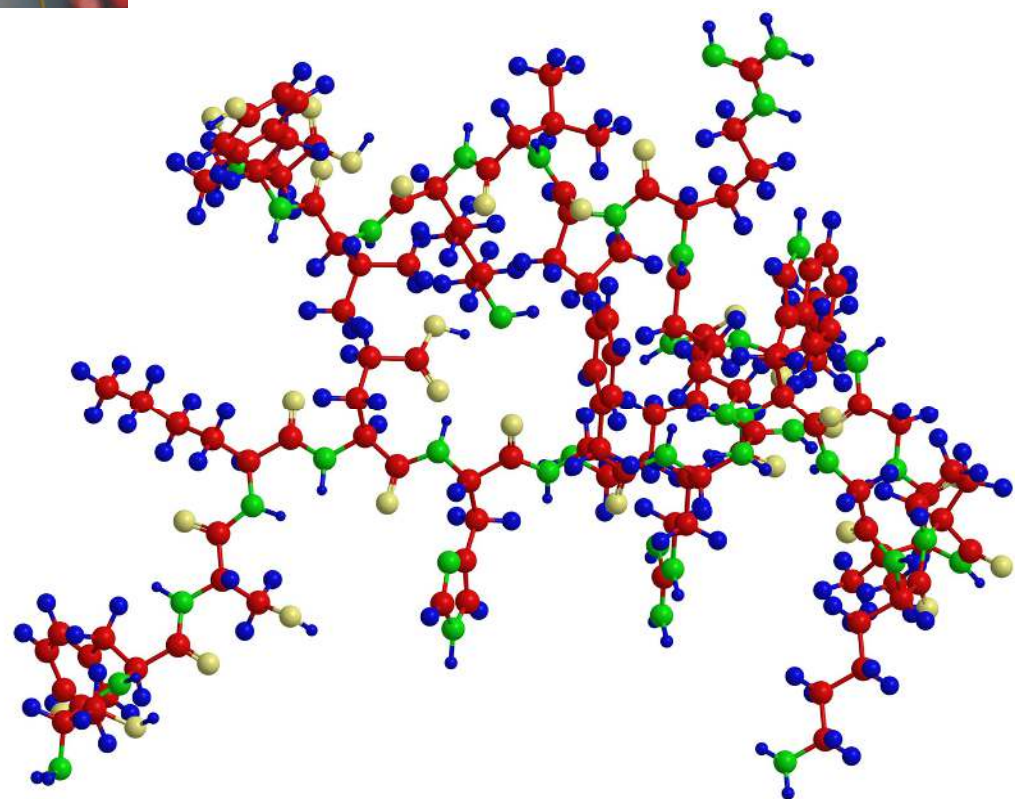
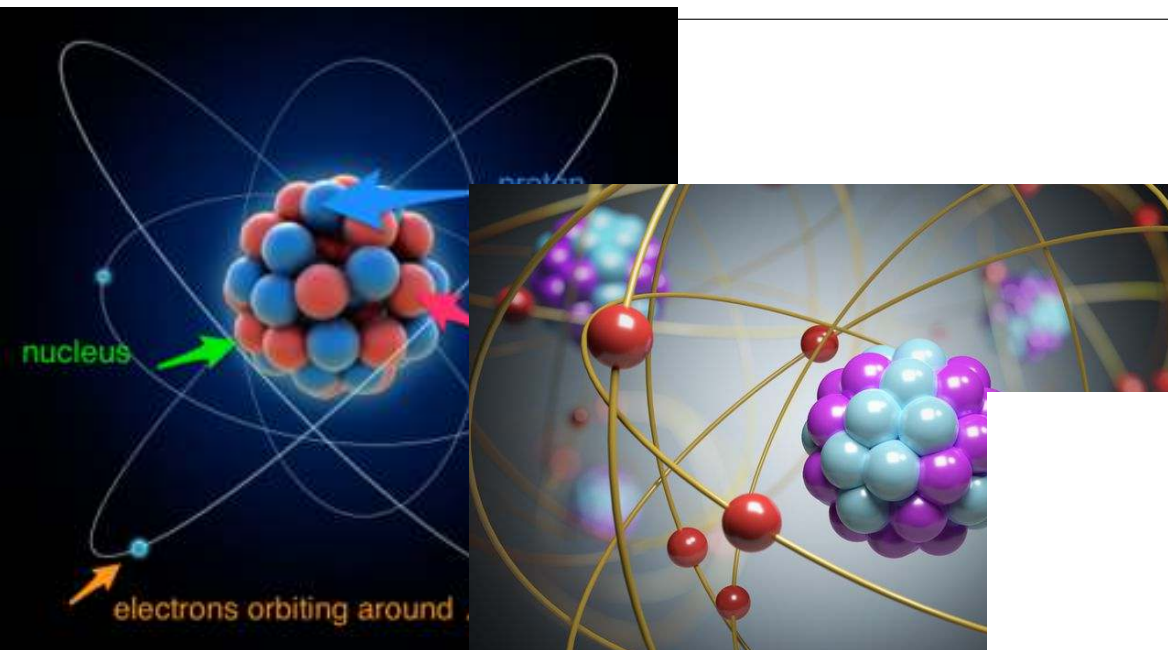






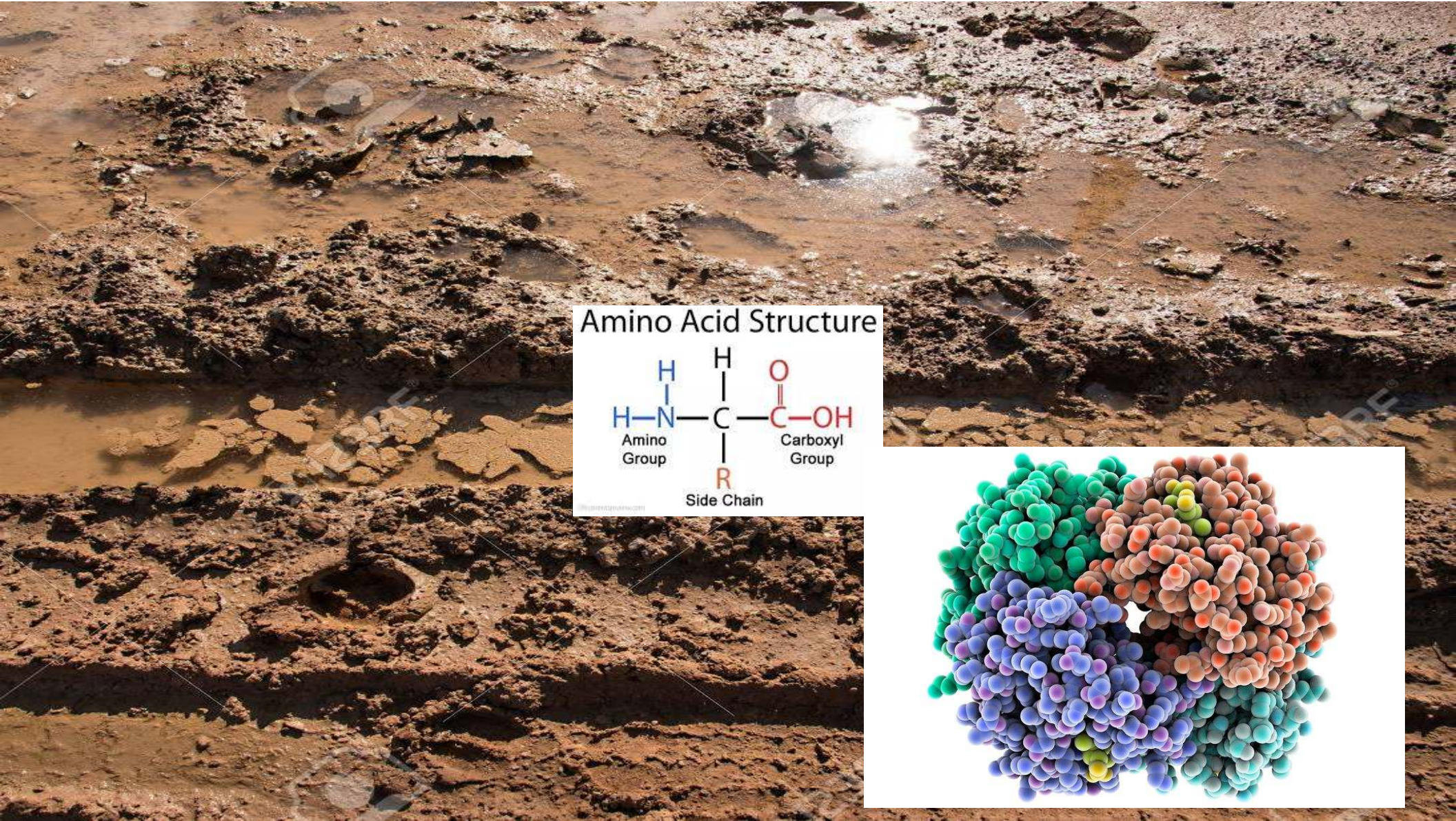




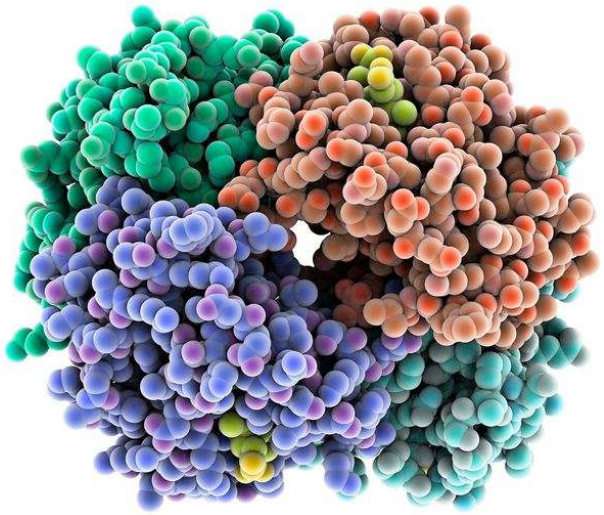
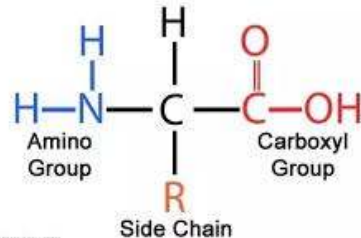




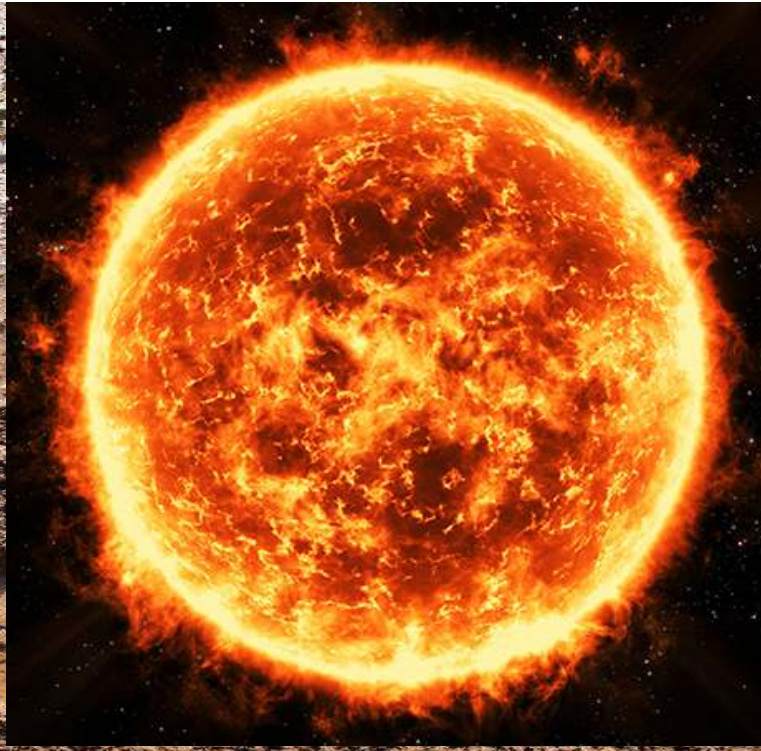




### Amino Acid Structure







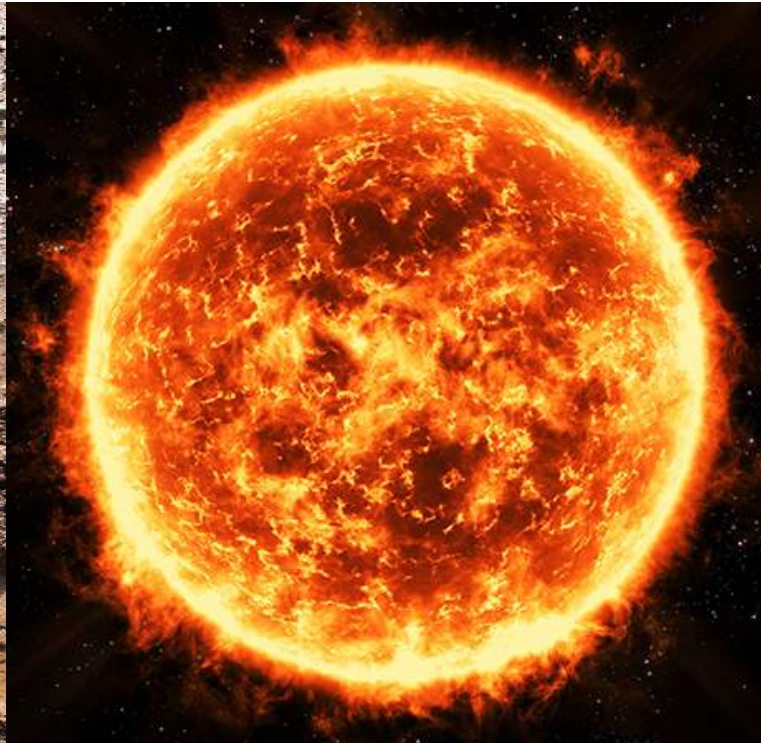
### Organic Molecules

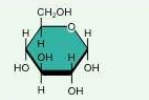
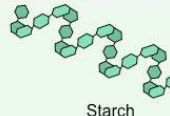

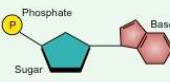
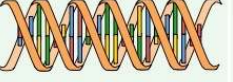



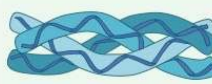
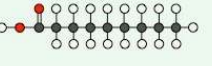

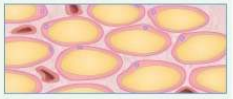
carbohydrate

protein

fat





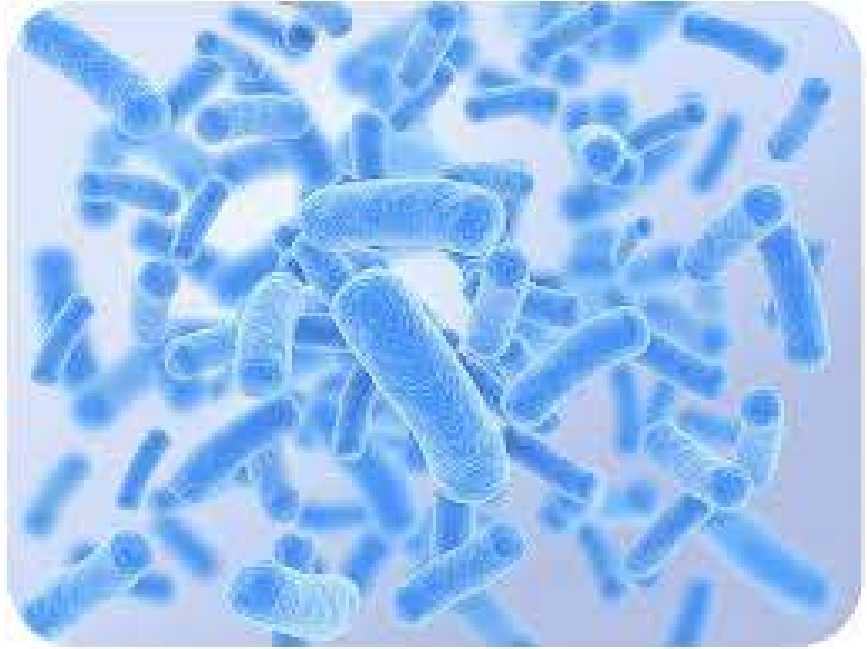
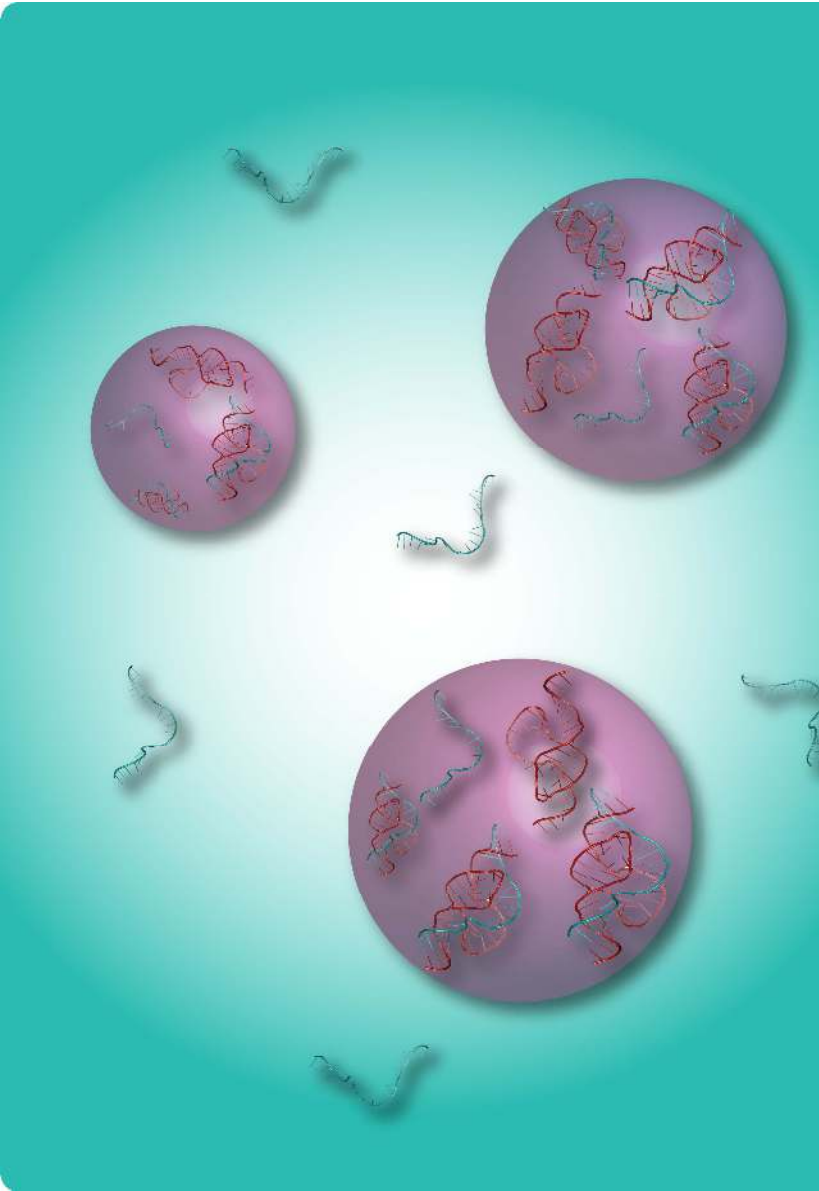
	Monomer / Subunit	Polymer	Cellular Structure
Carbohydrate	 <p>Monosaccharide</p>	 <p>Starch</p>	 <p>Granules in Chloroplasts</p>
Nucleic Acid	 <p>Nucleotide</p>	 <p>Double Helix (DNA)</p>	 <p>Chromosome</p>
Protein	 <p>Amino Acid</p>	 <p>Polypeptide</p>	 <p>Intermediate Filaments</p>
Lipid	 <p>Fatty Acid</p>	 <p>Triglyceride</p>	 <p>Adipose Cells</p>

Biochemistry  
chemistry

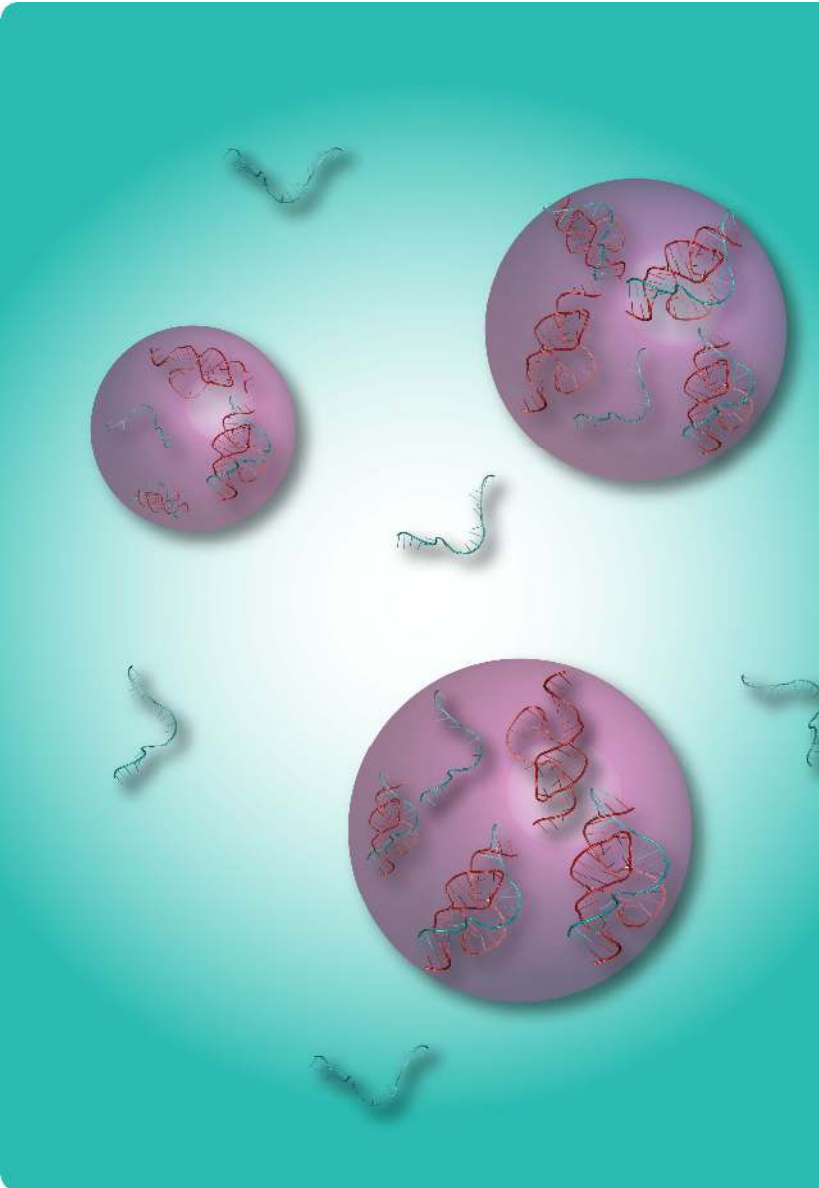
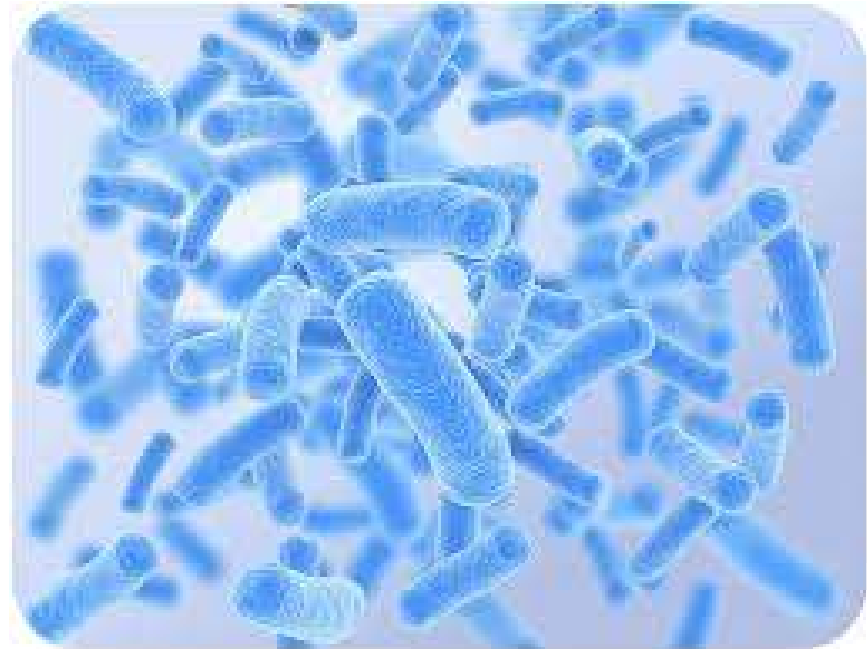


Cytology  
Microbiology

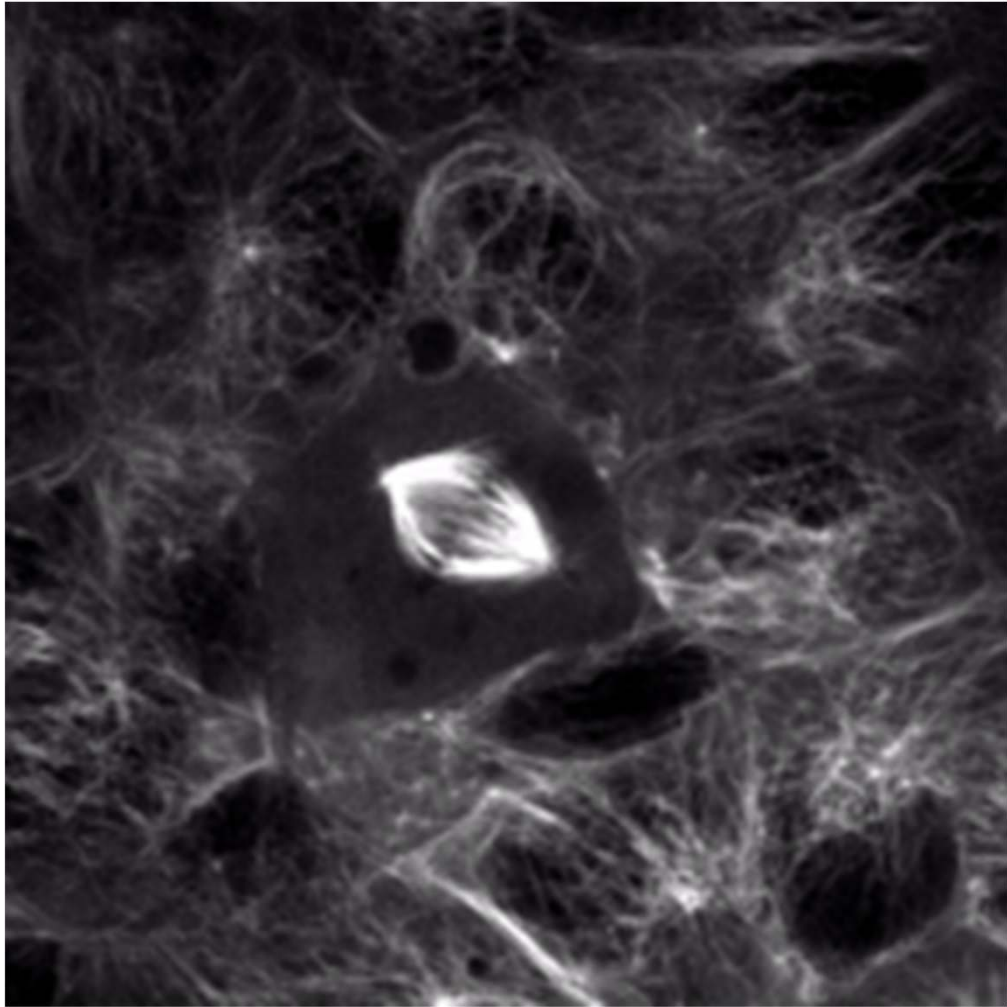




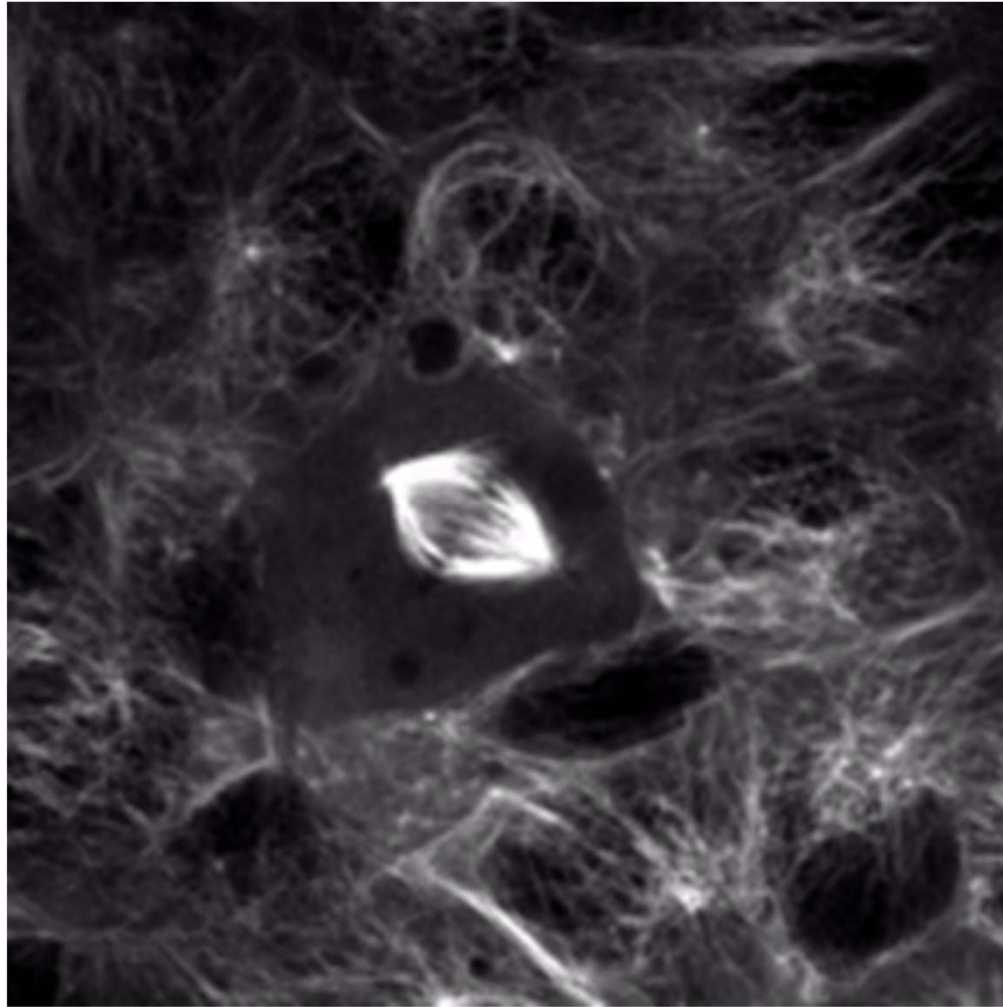
Microbiology : bacteriology , virology, mycology,  
Molecular biology  
genetics

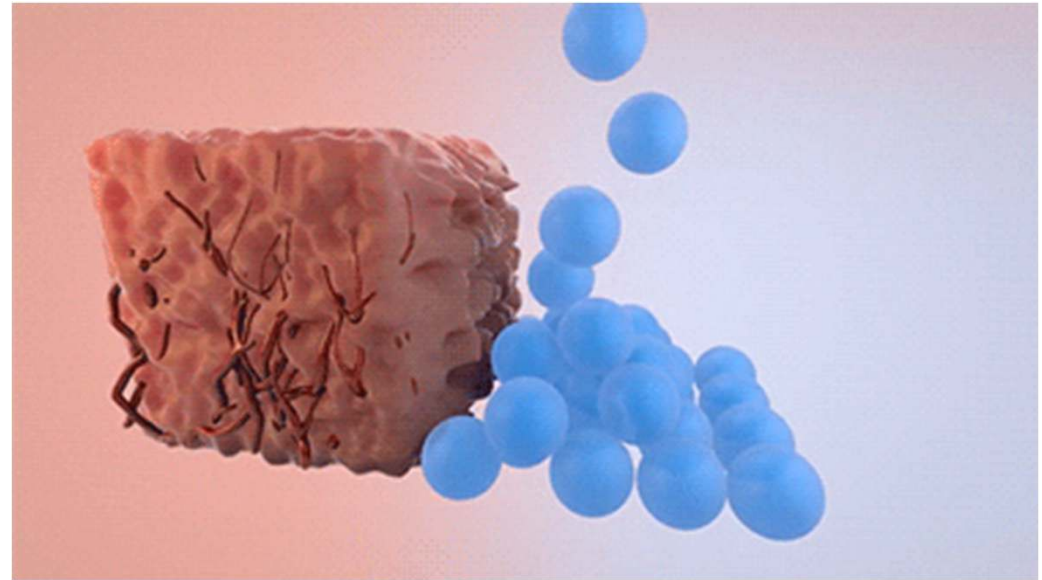
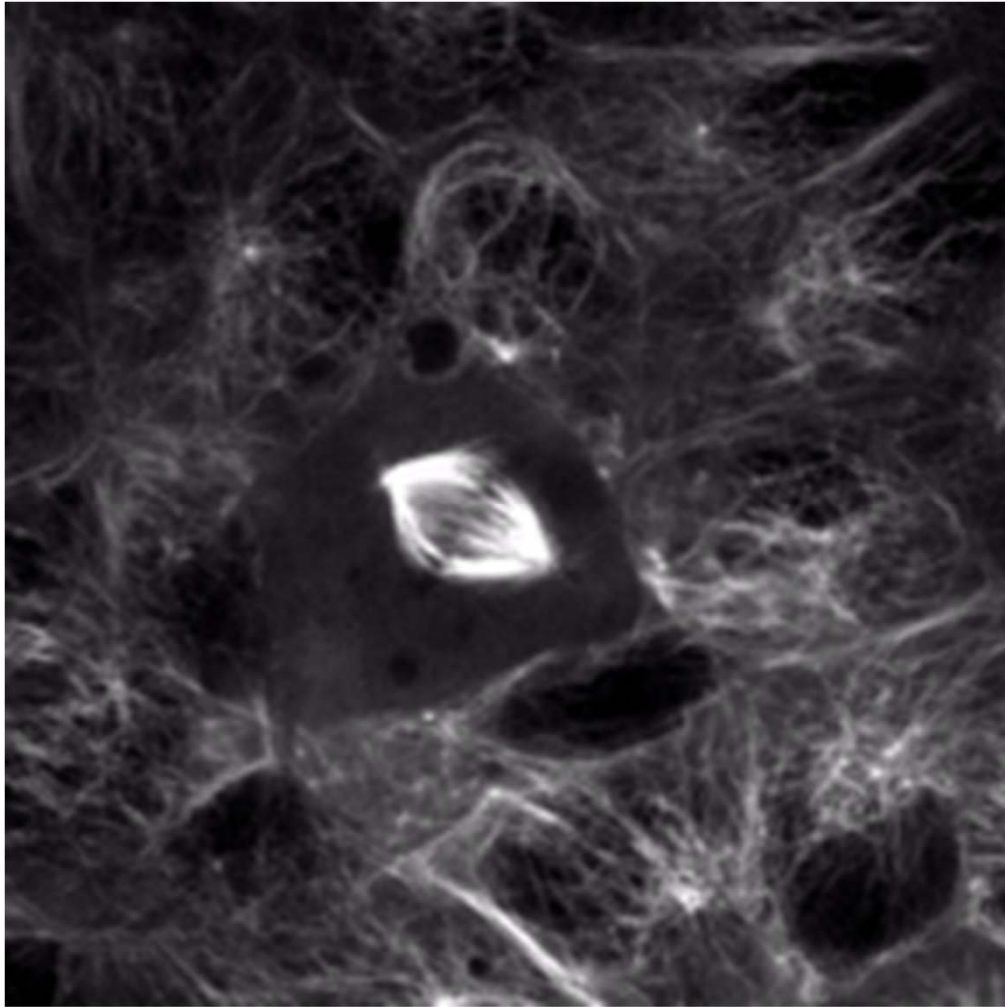


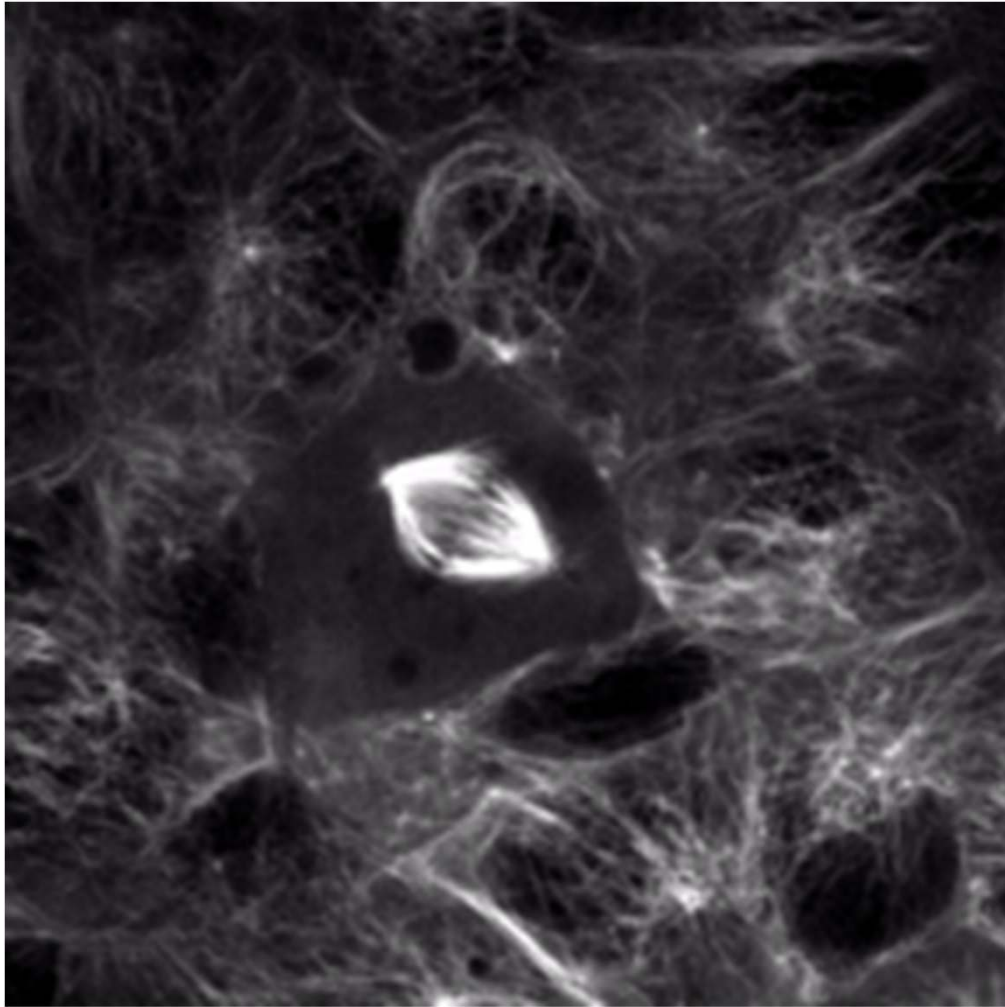
biology



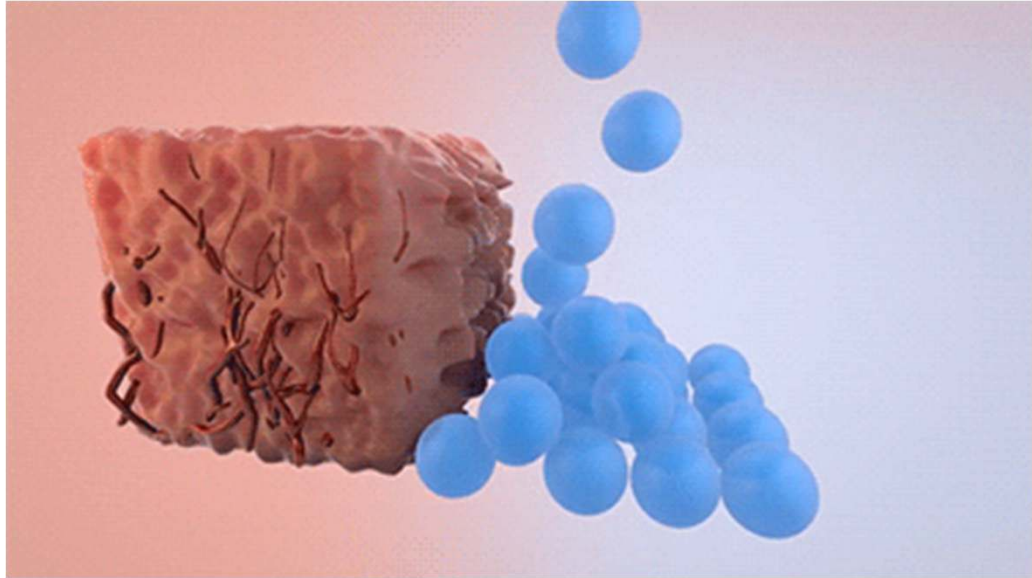




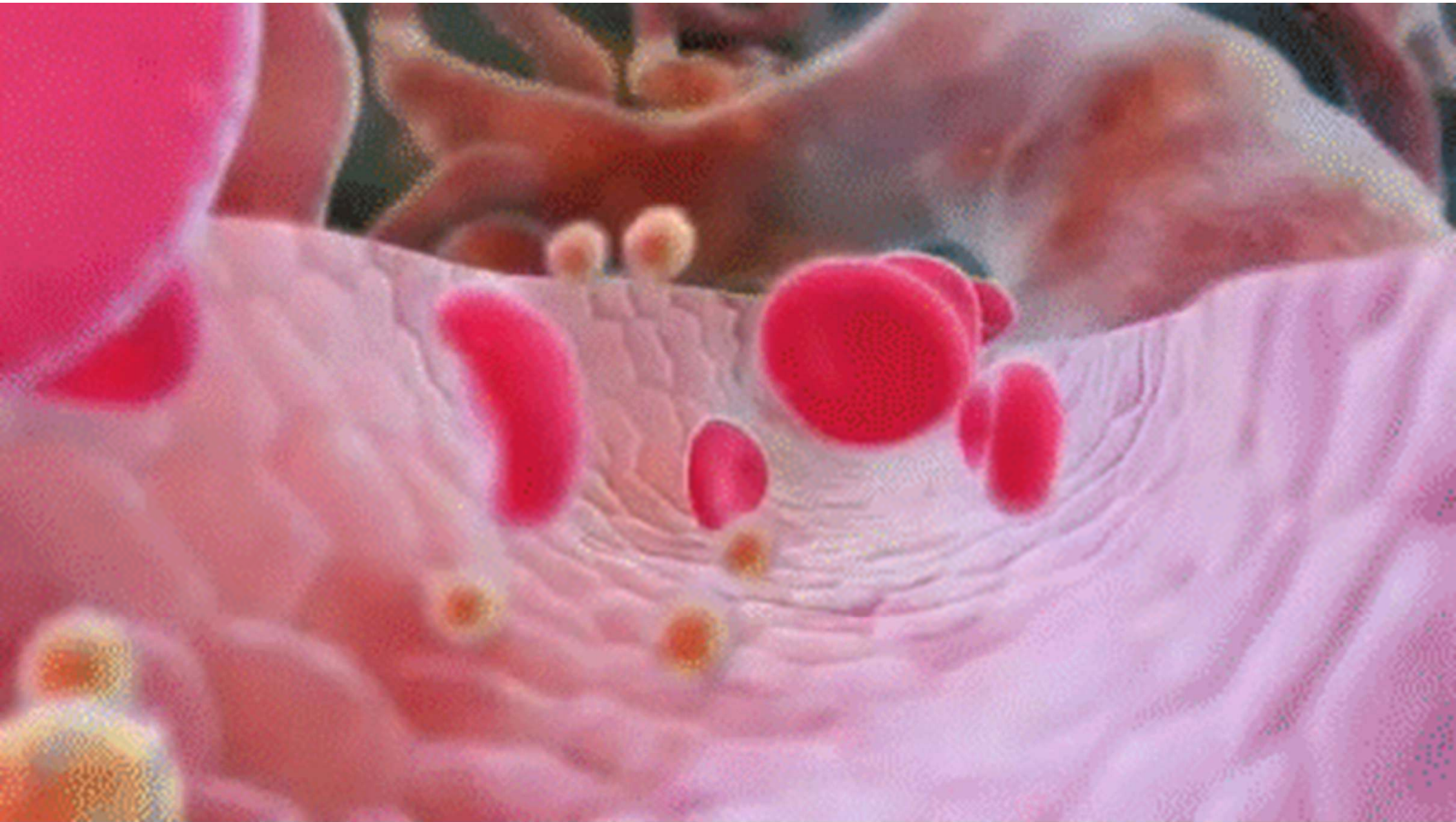




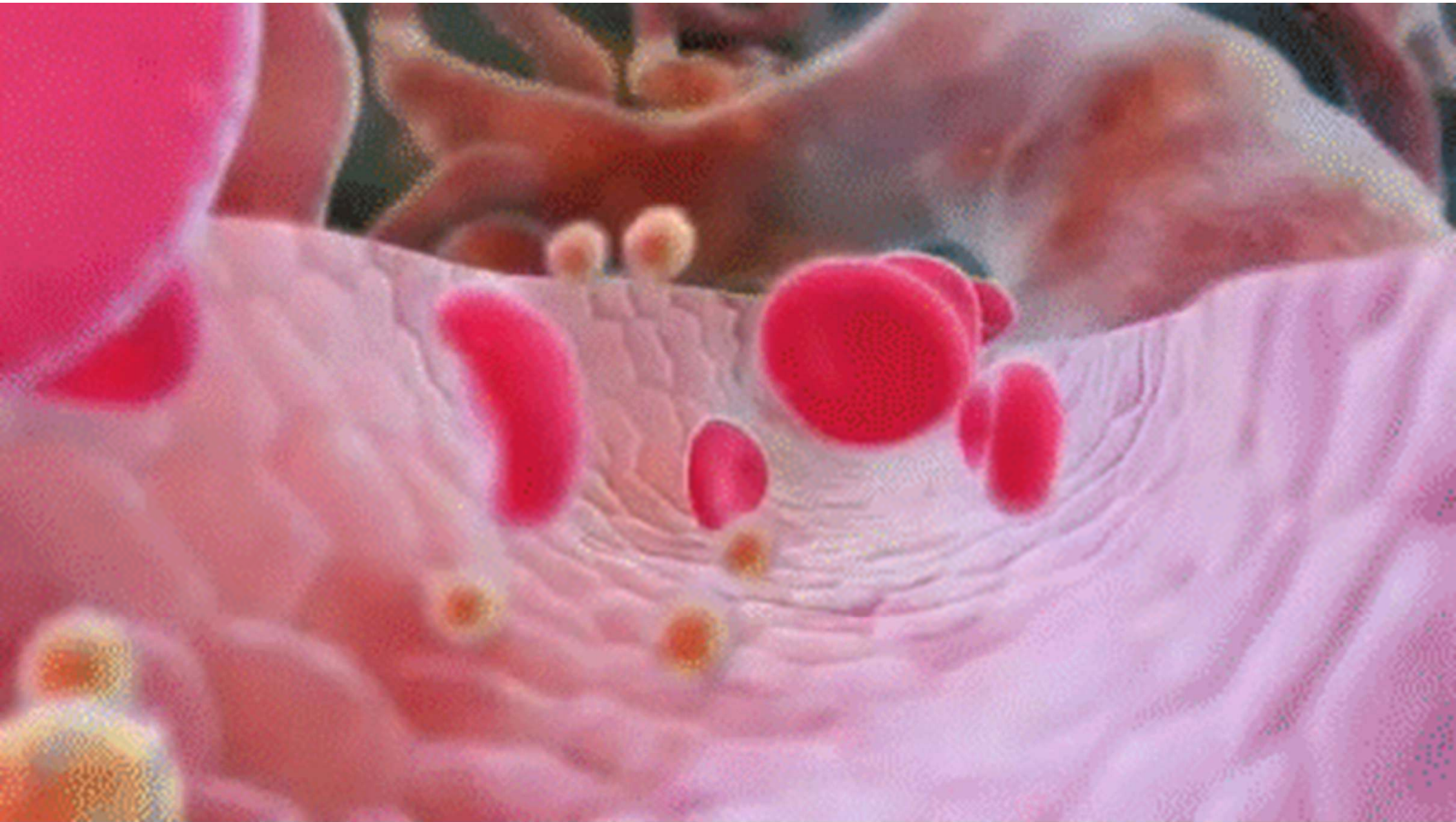
Histology



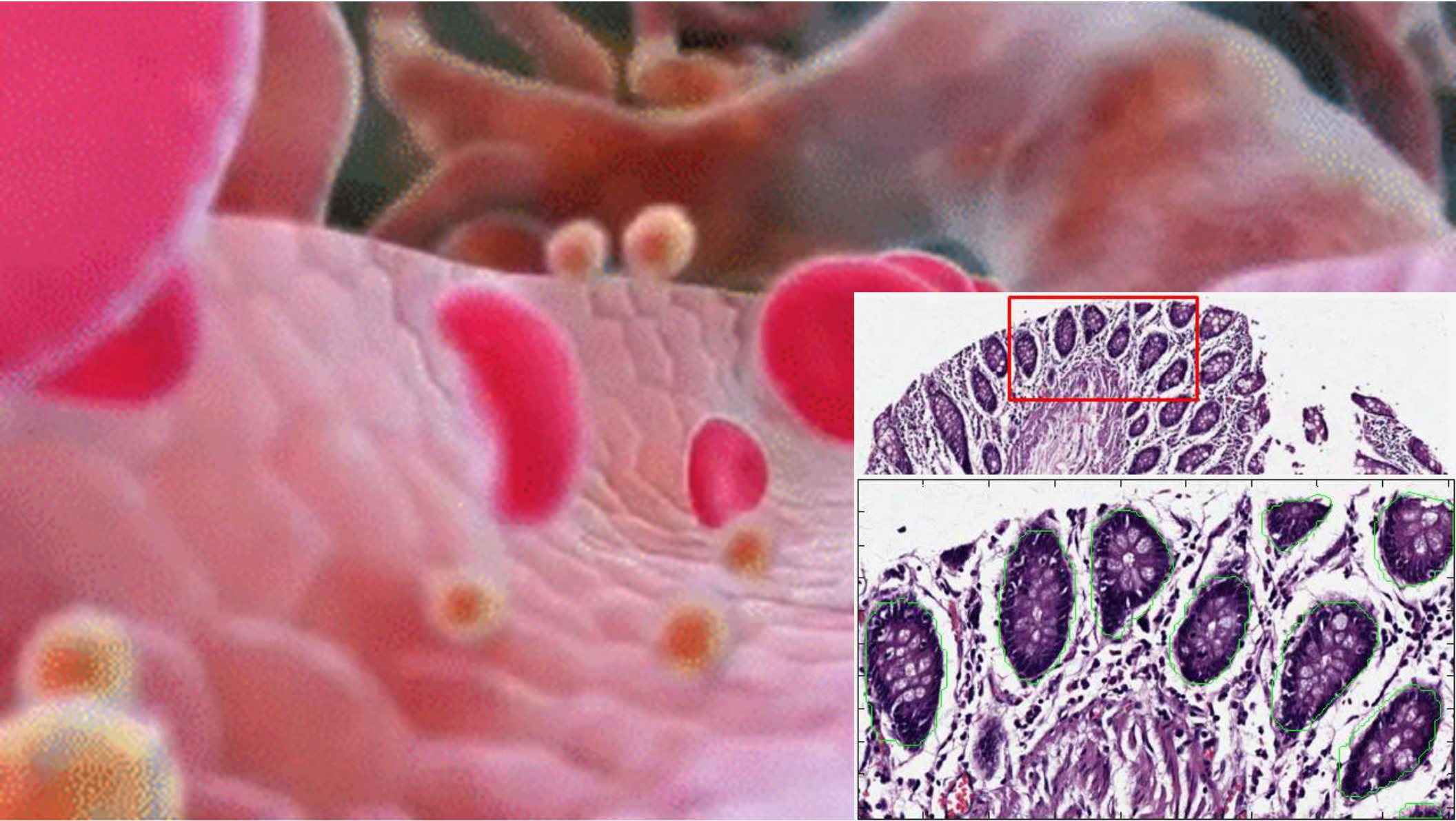




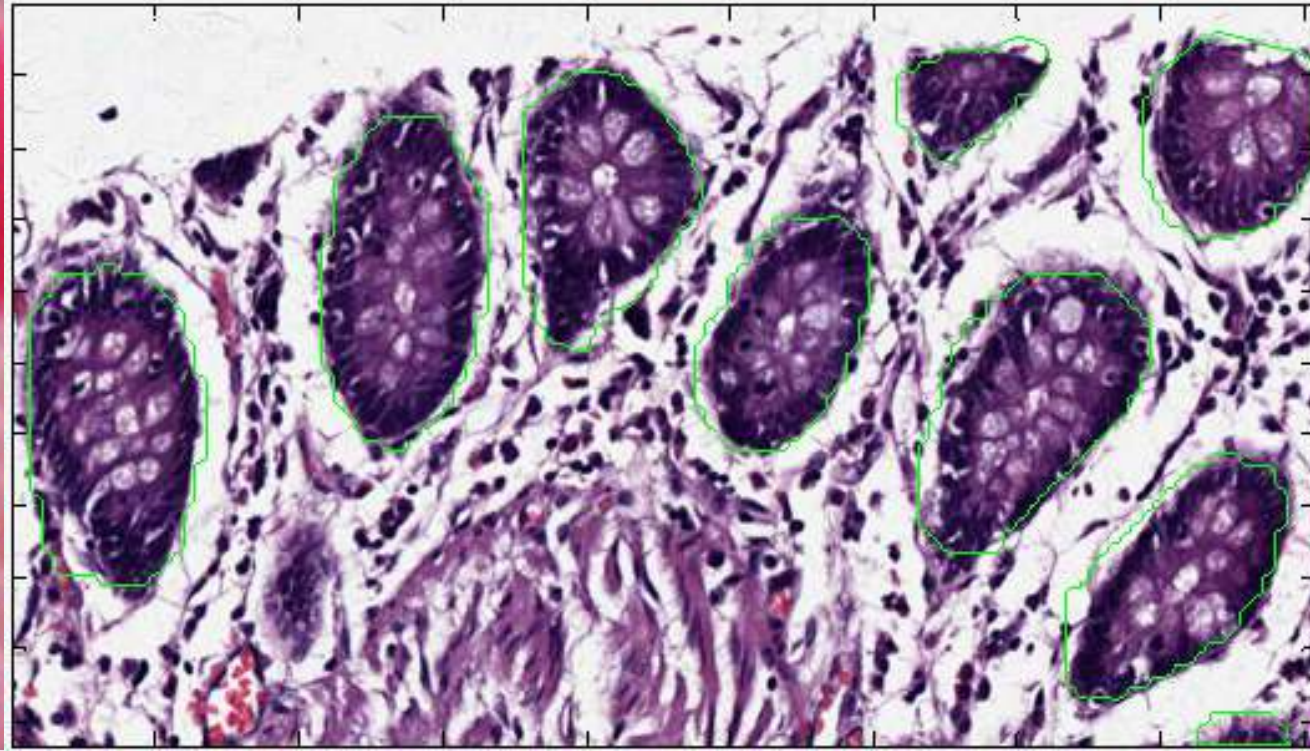
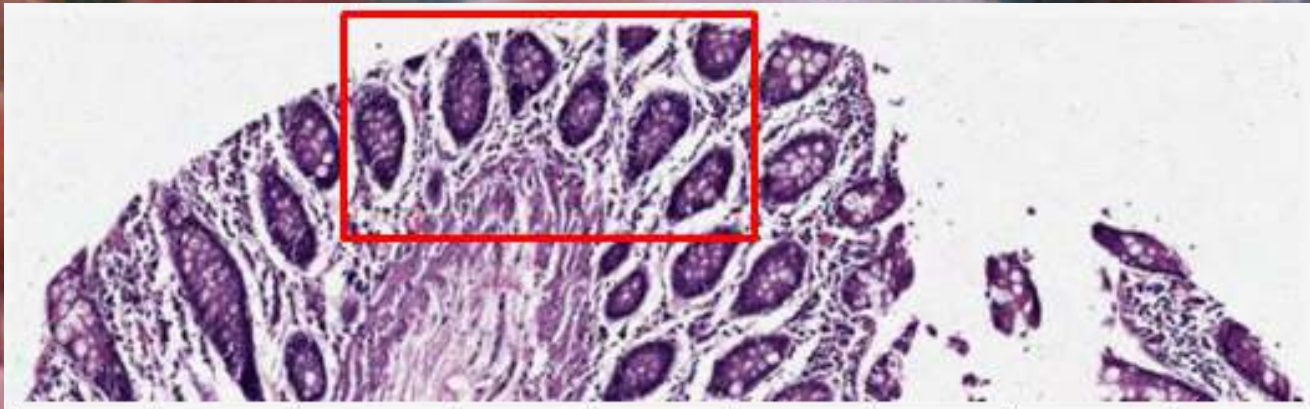




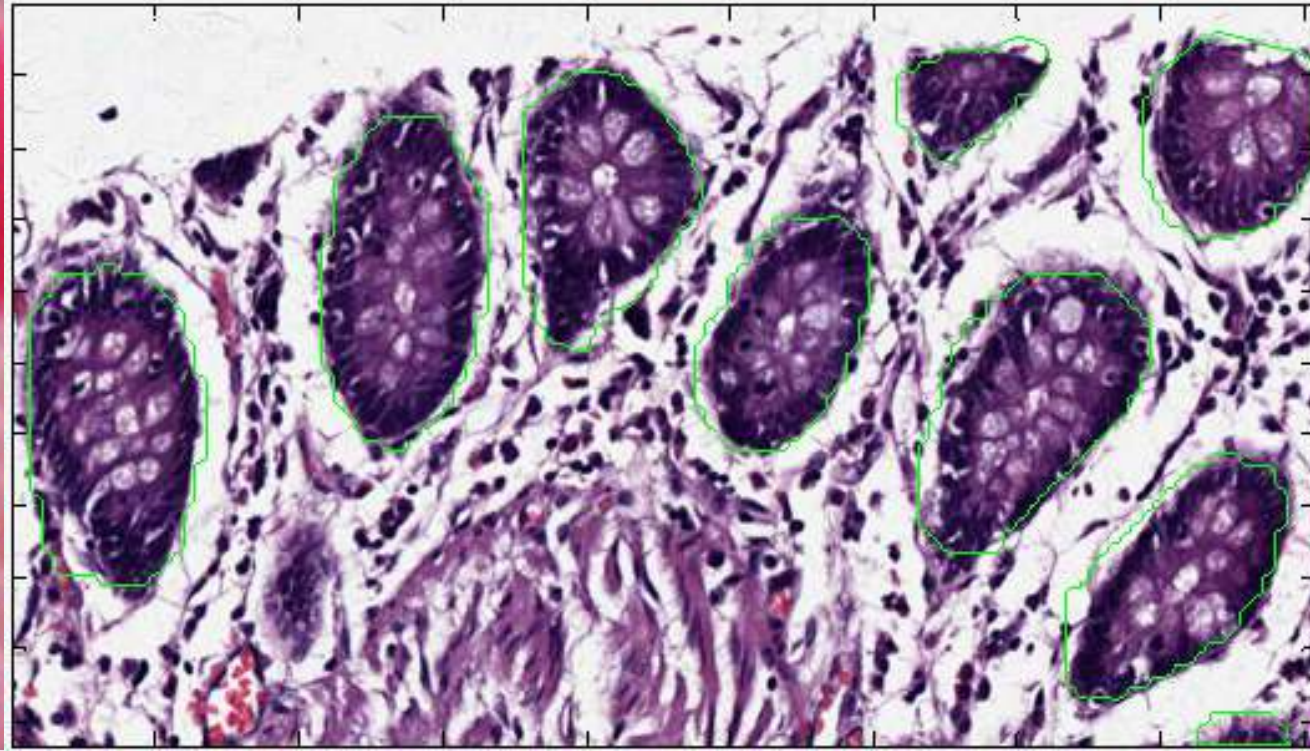
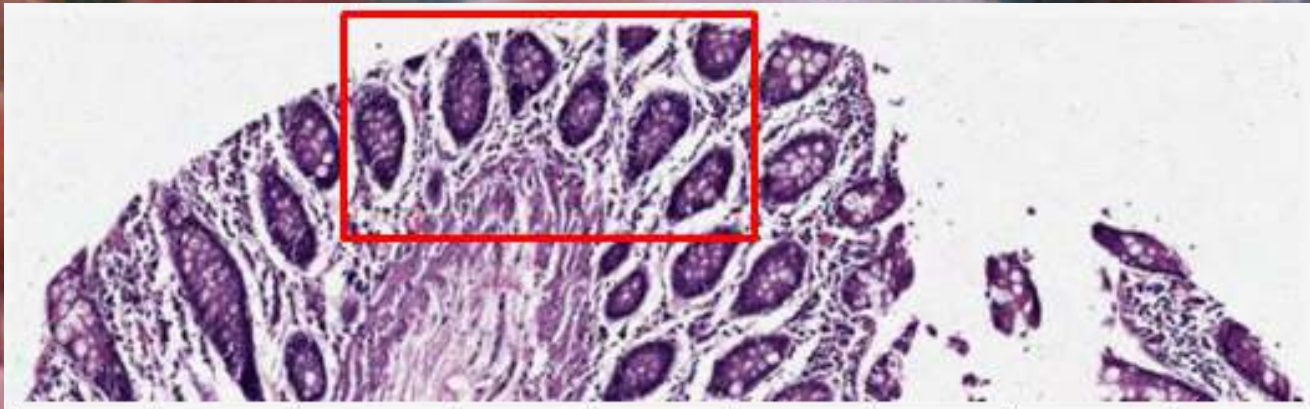






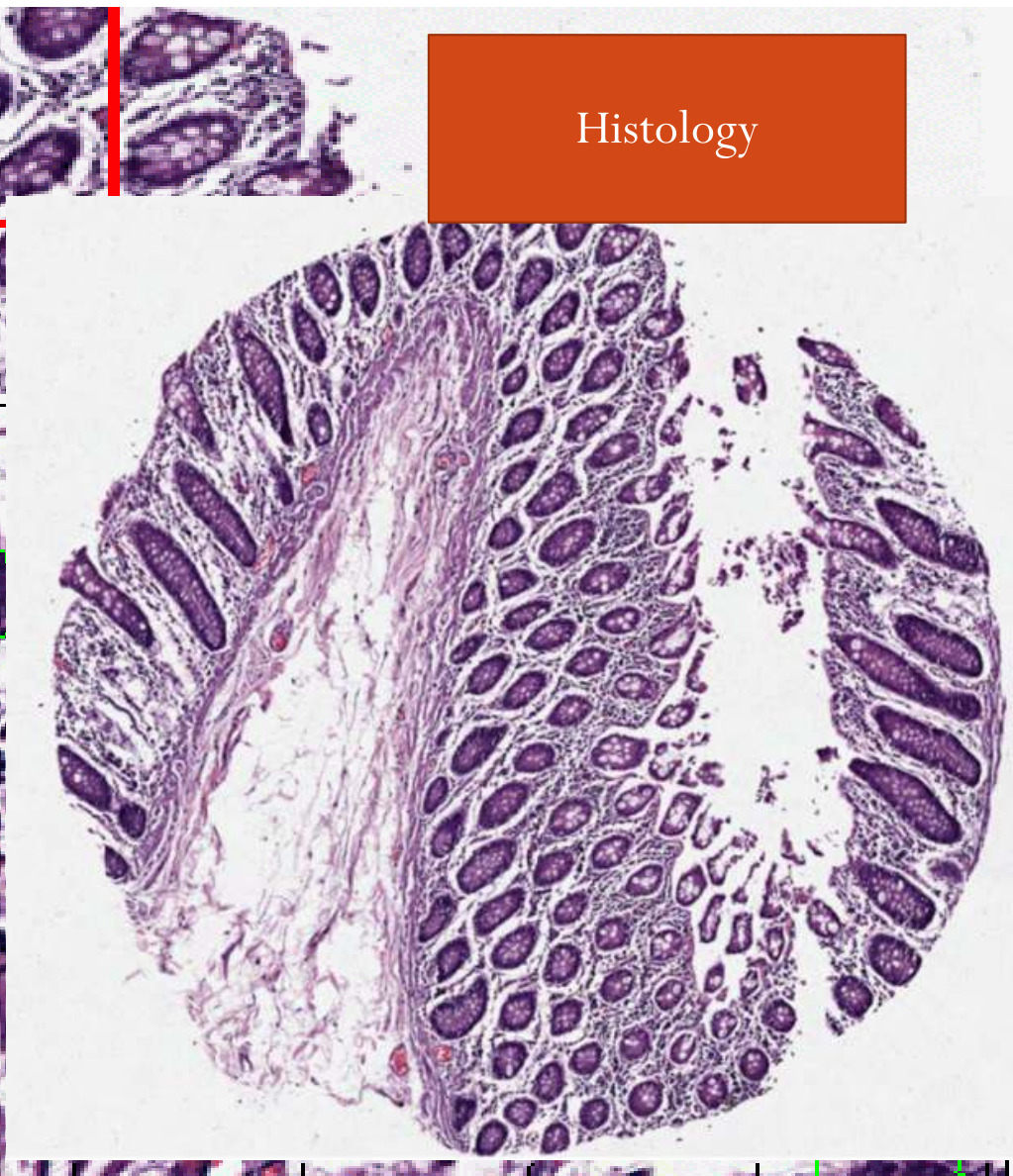
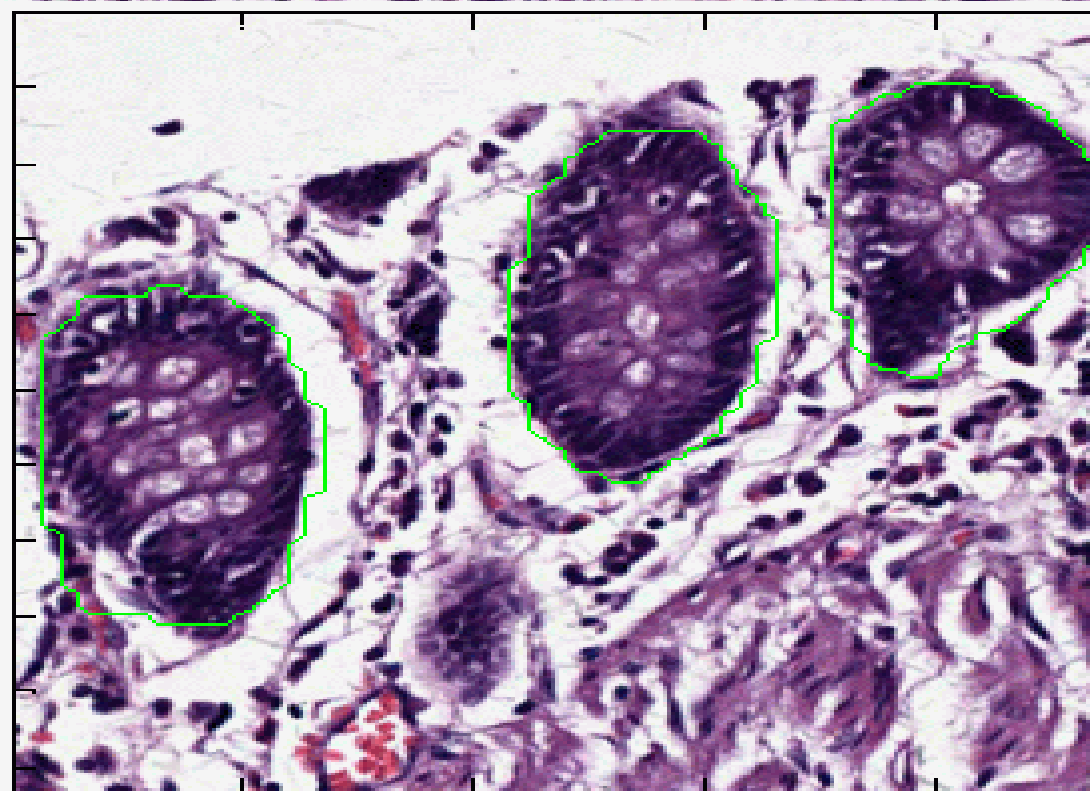


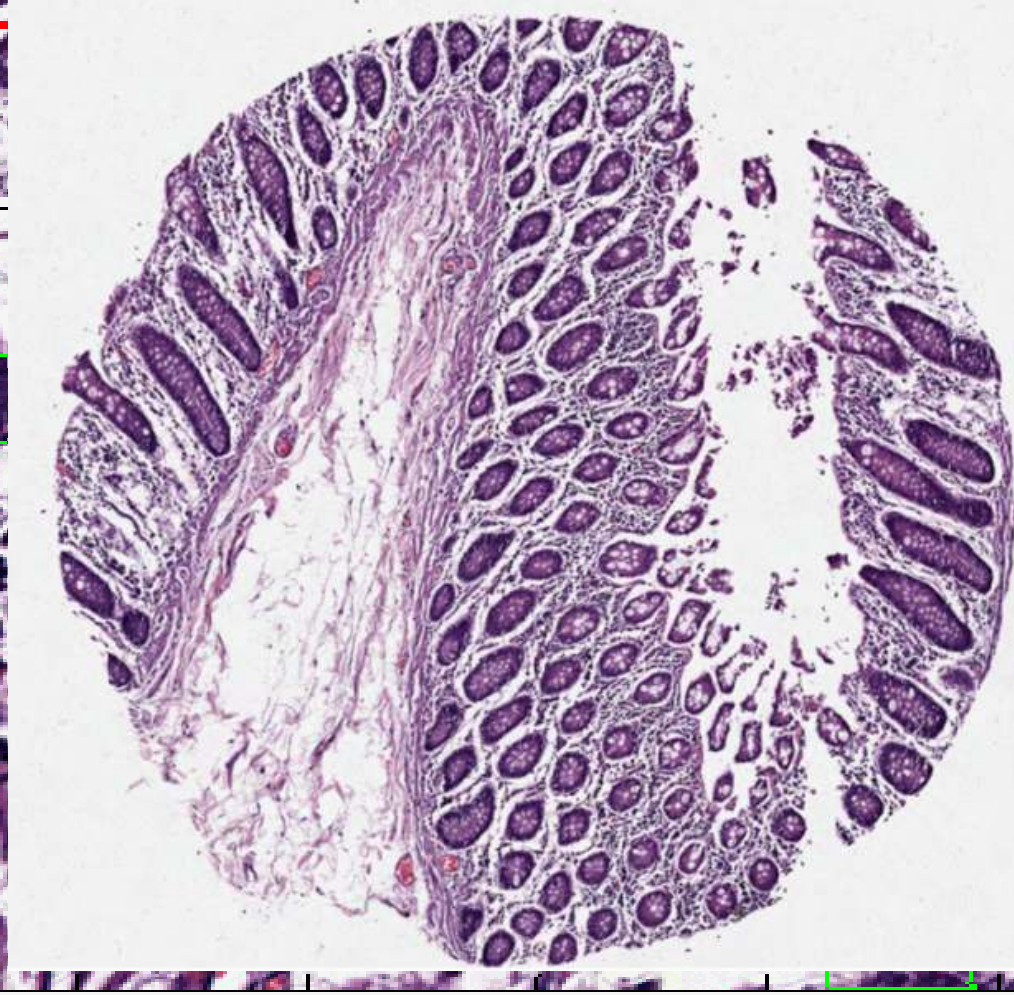
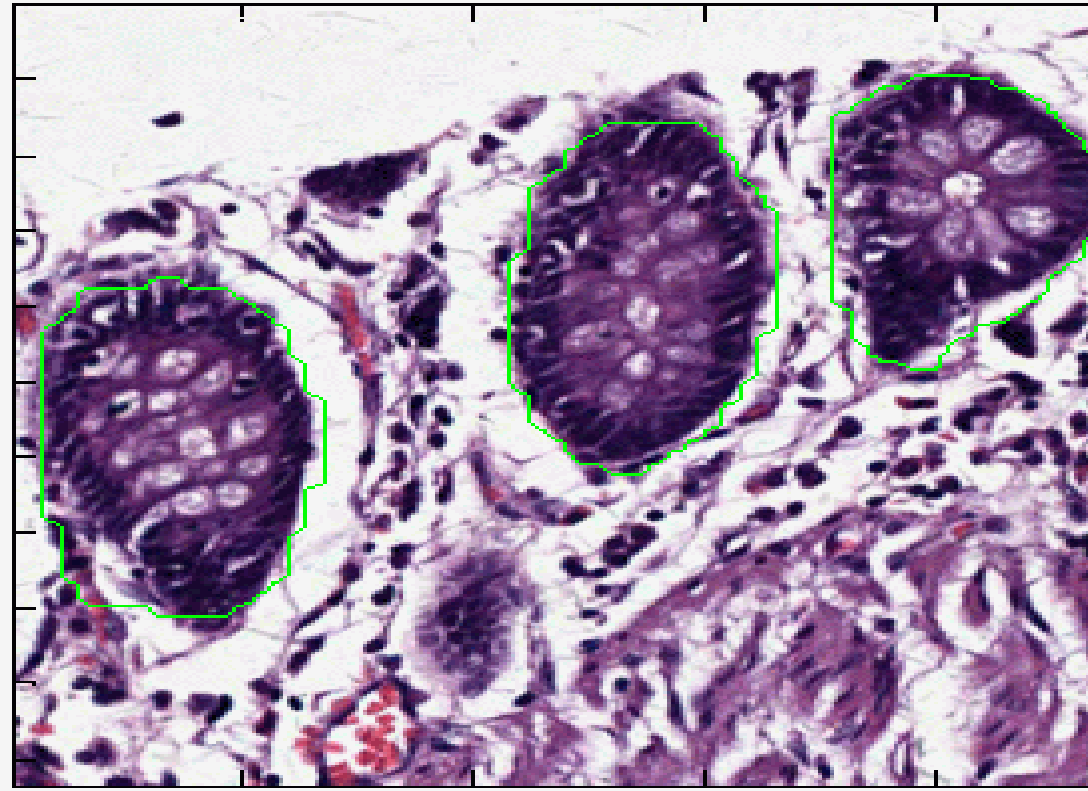
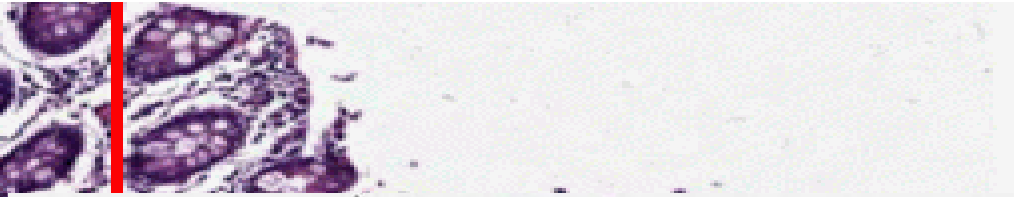
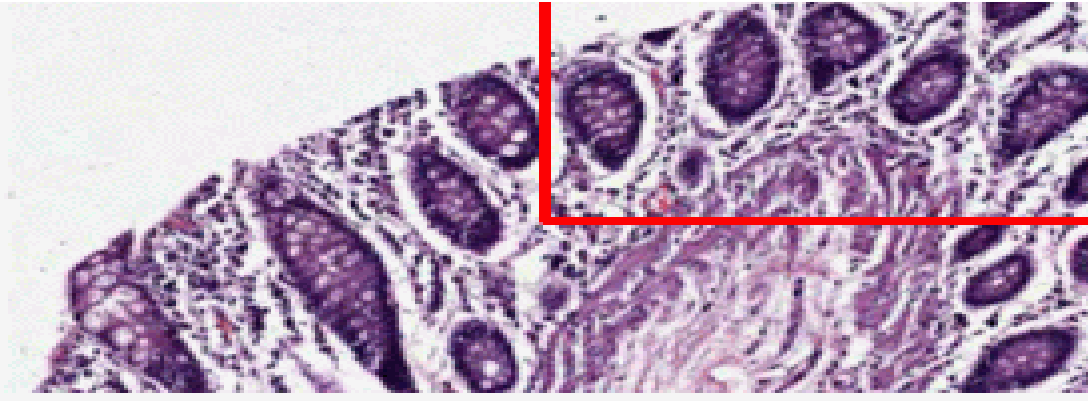




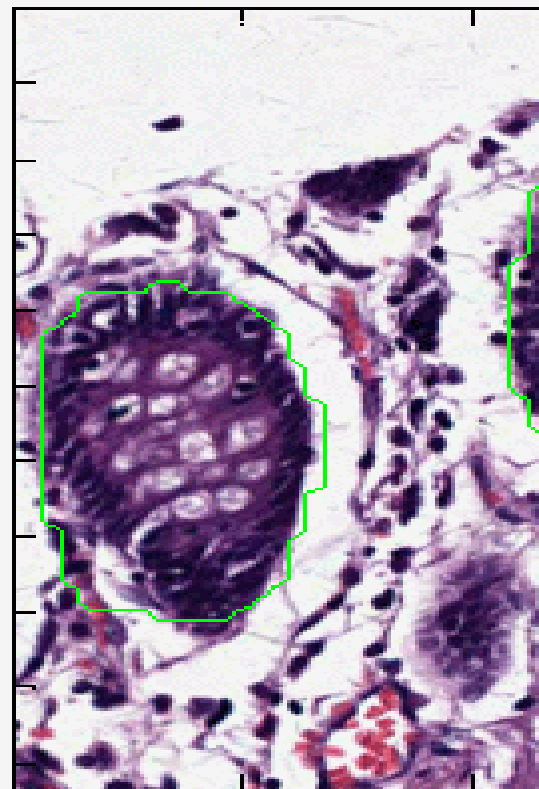
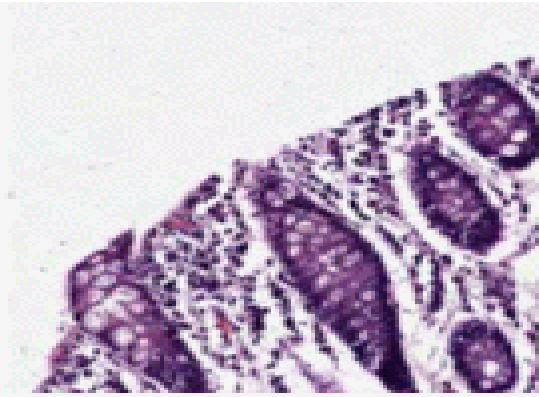


Histology

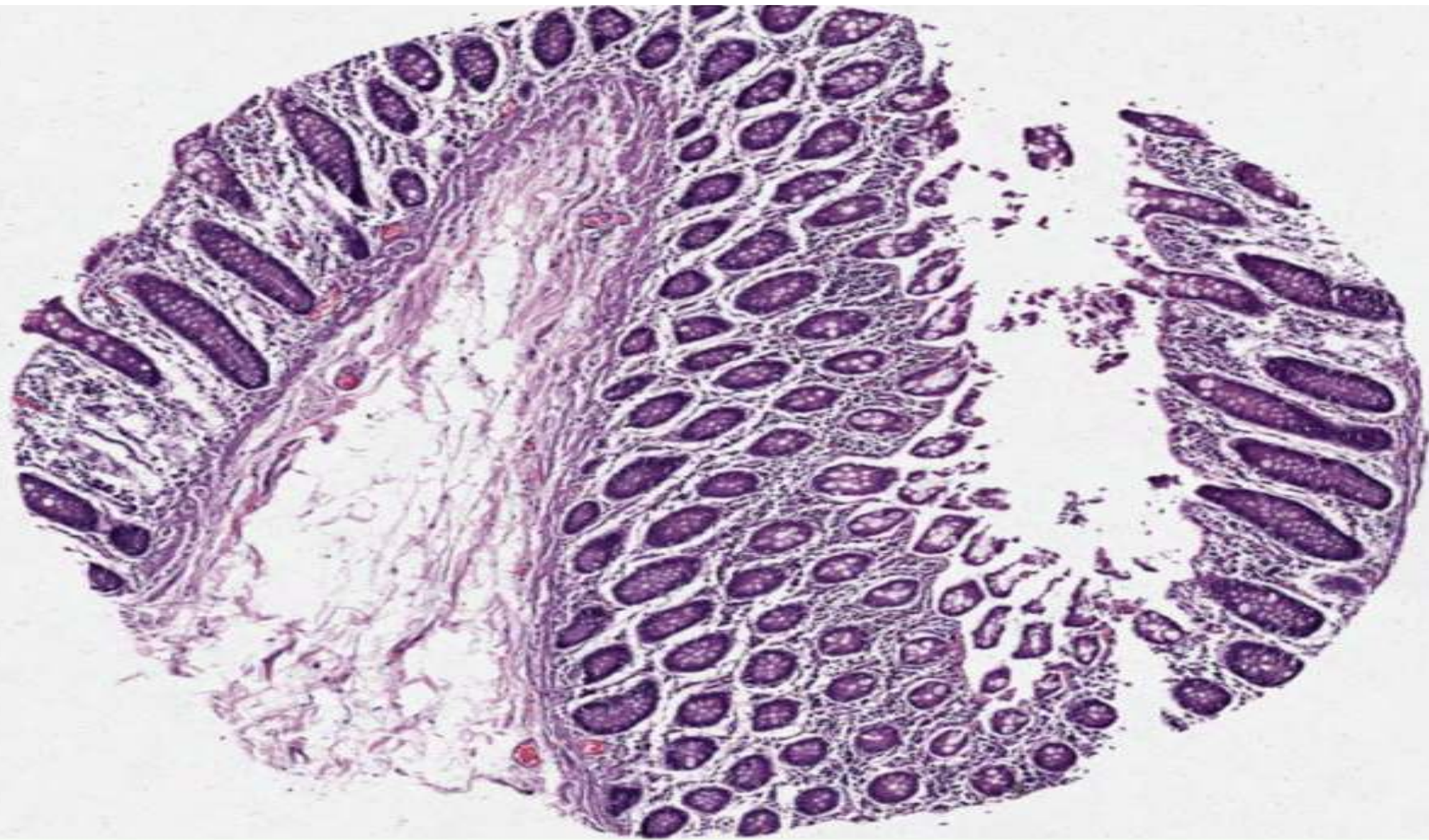






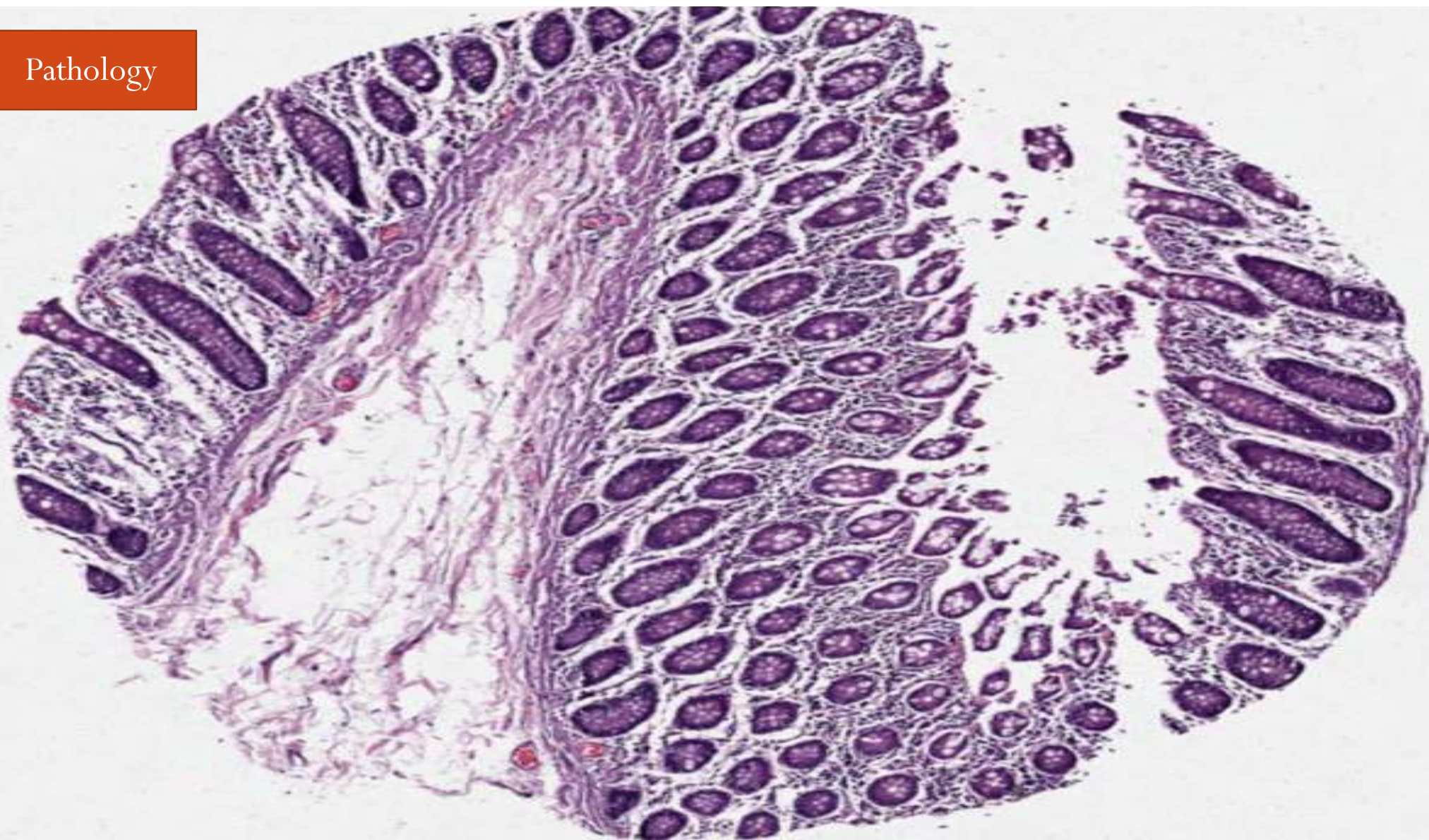






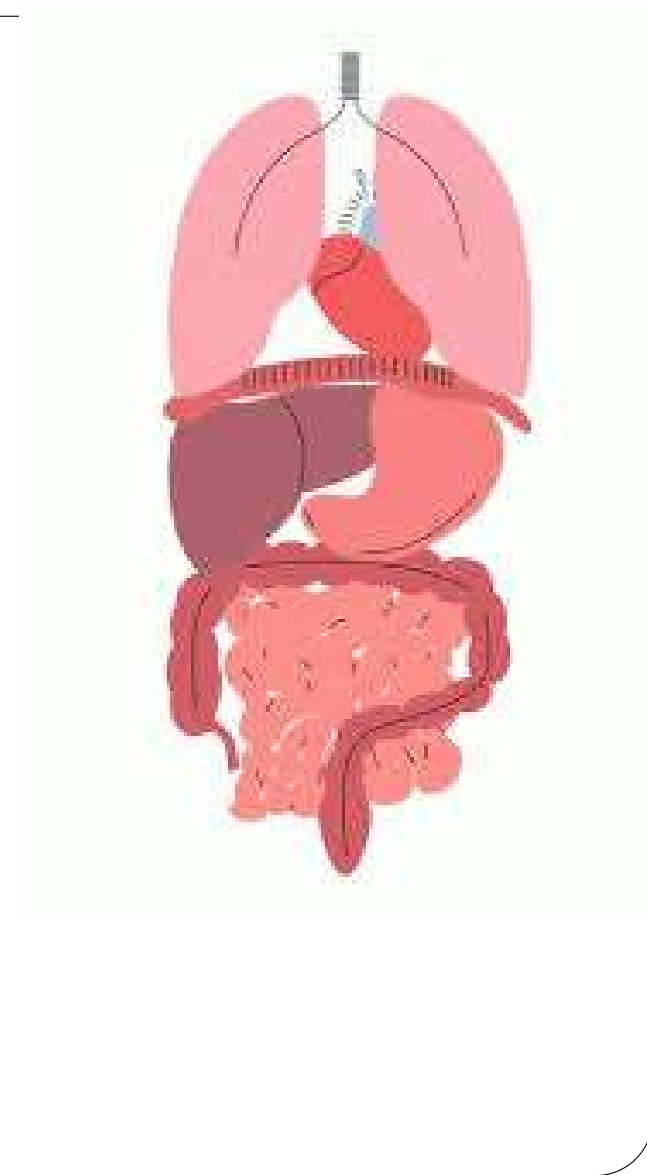


Pathology

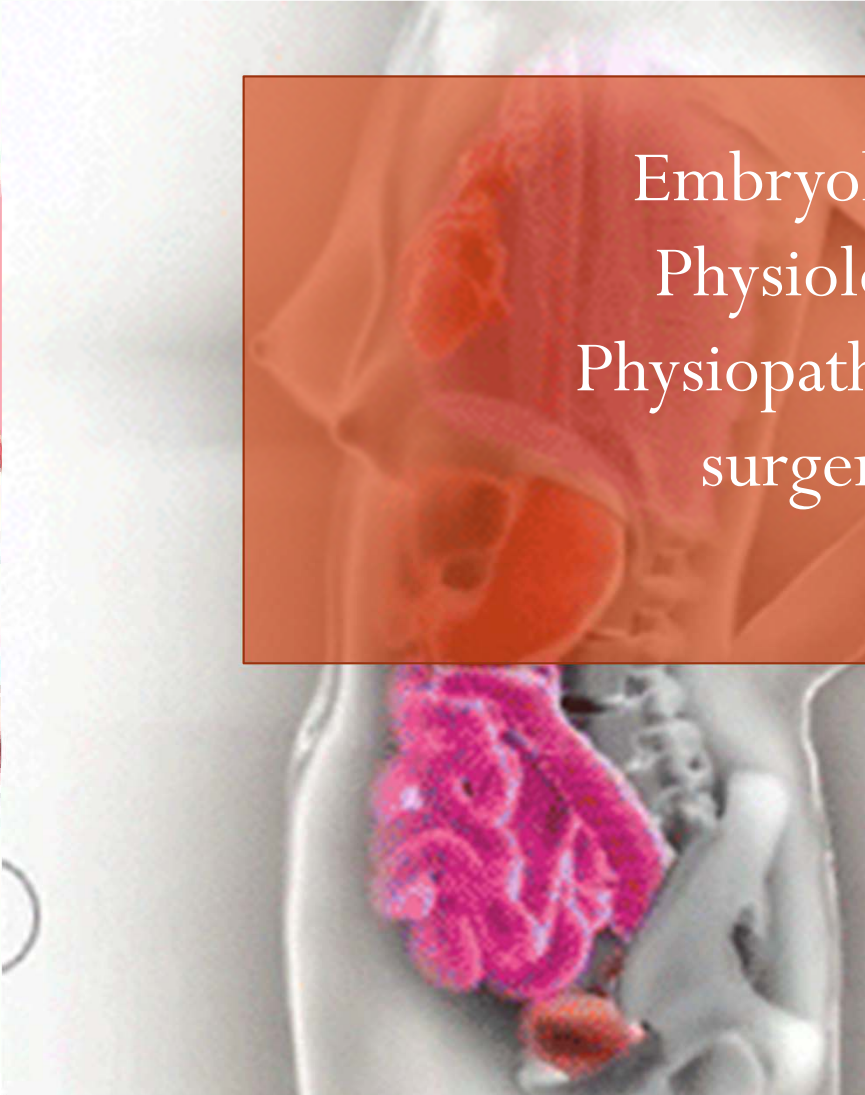




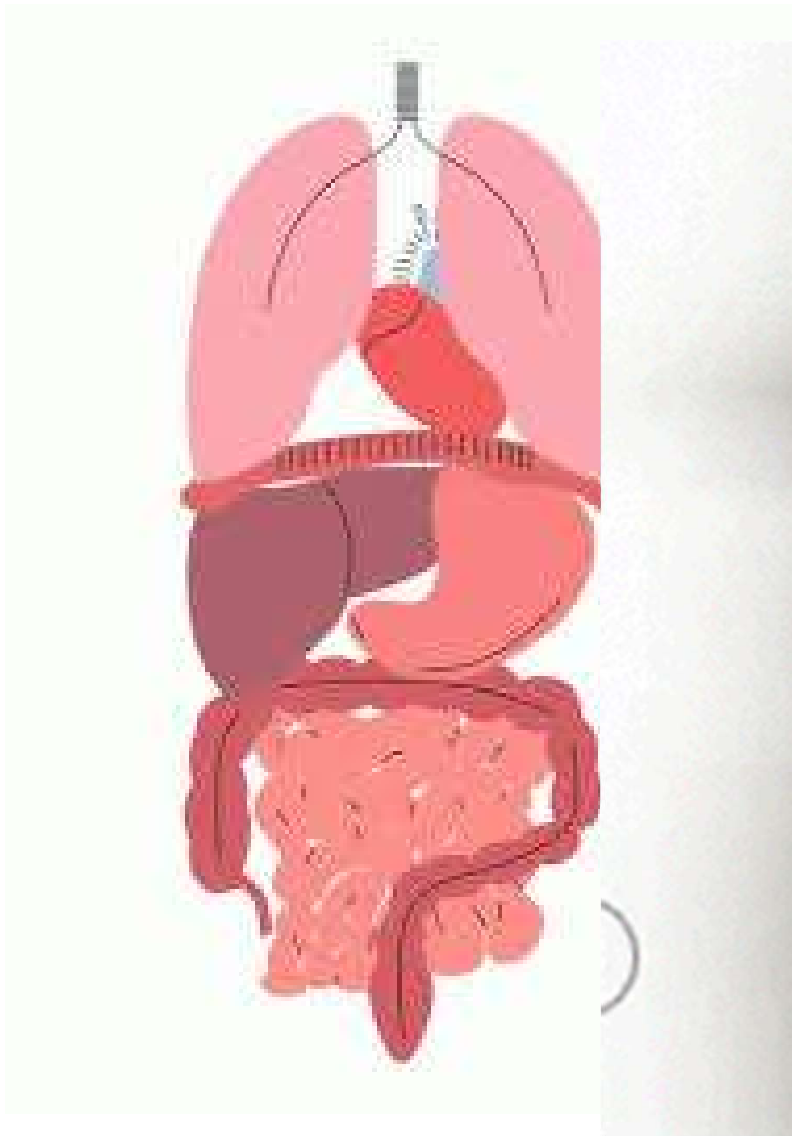
Radiology  
Surgical pathology  
Medical specialty  
surgery



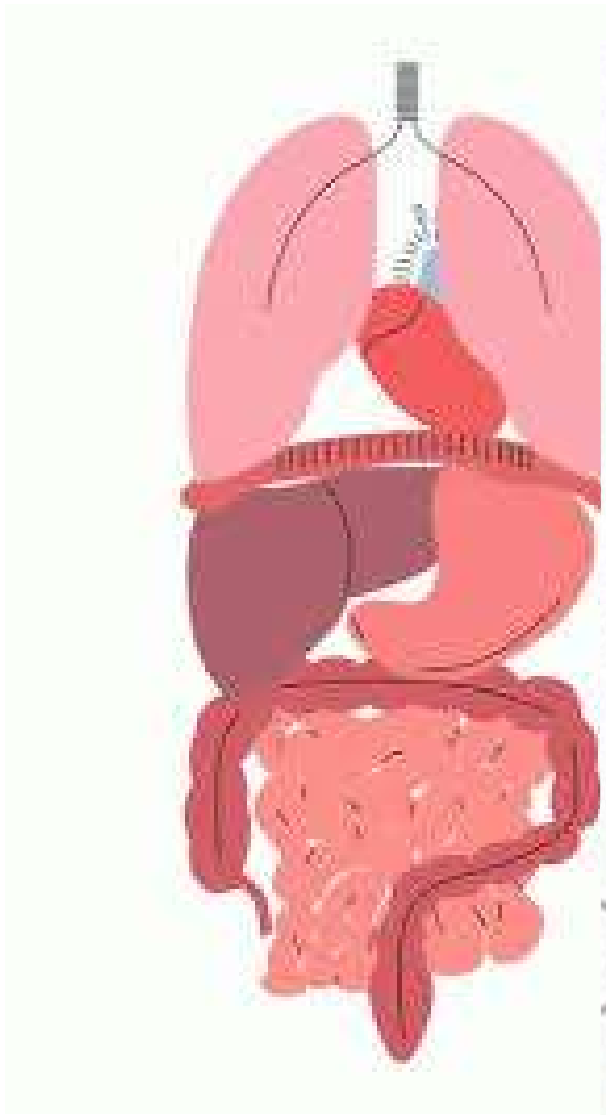


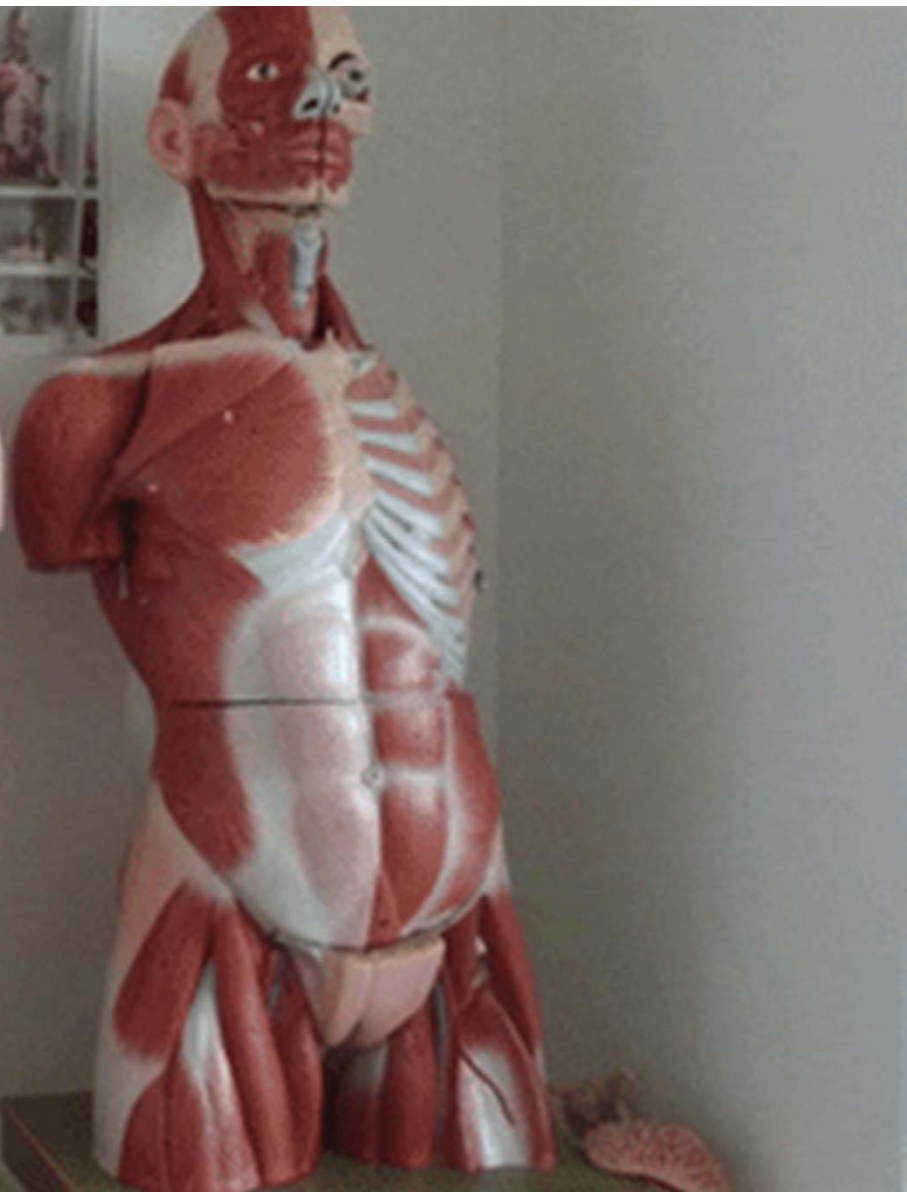
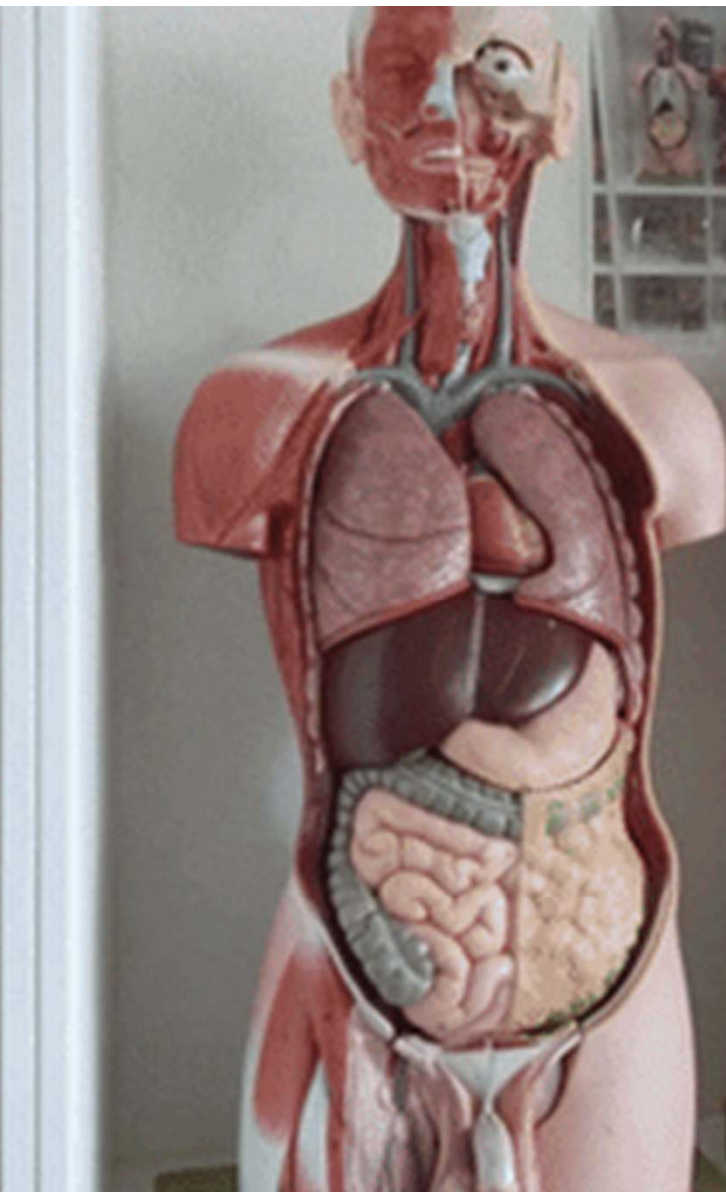


Embryology  
Physiology  
Physiopathology  
surgery











Anatomy is the study of the structure of the human body.

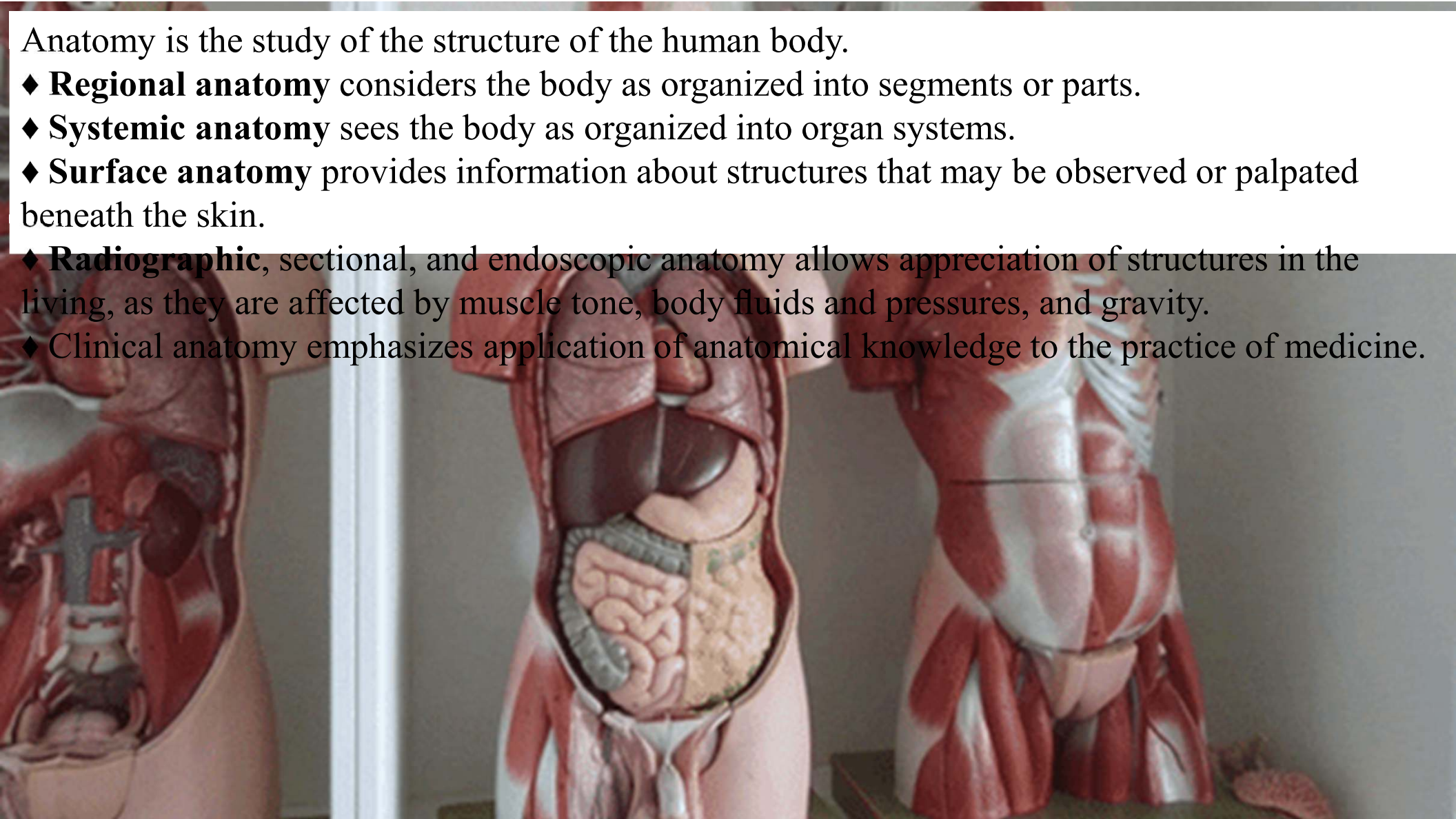
◆ **Regional anatomy** considers the body as organized into segments or parts.

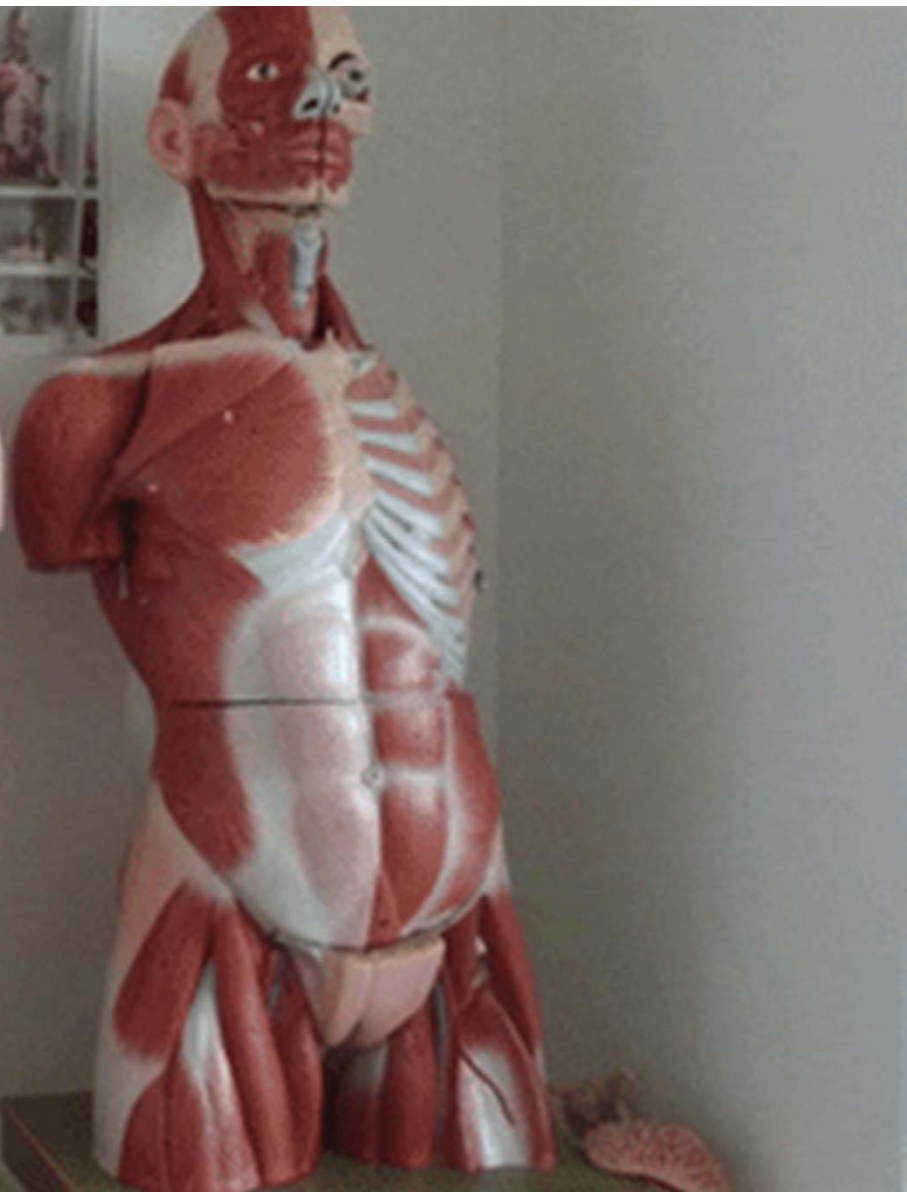
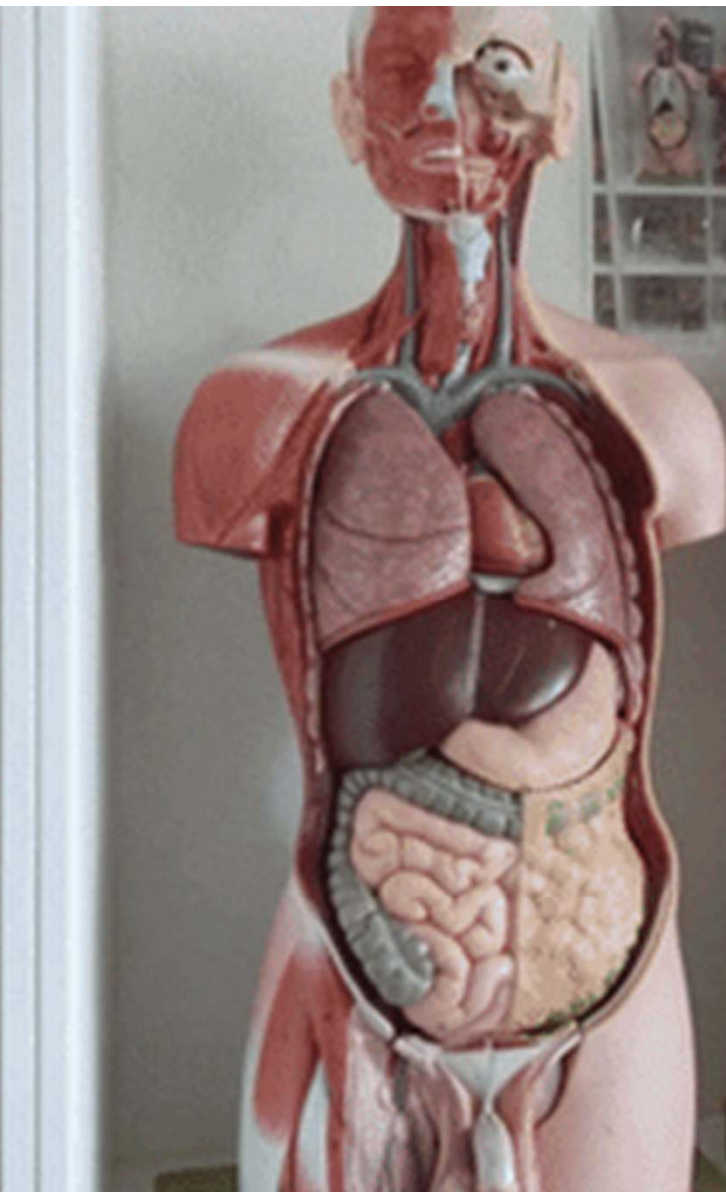
◆ **Systemic anatomy** sees the body as organized into organ systems.

◆ **Surface anatomy** provides information about structures that may be observed or palpated beneath the skin.

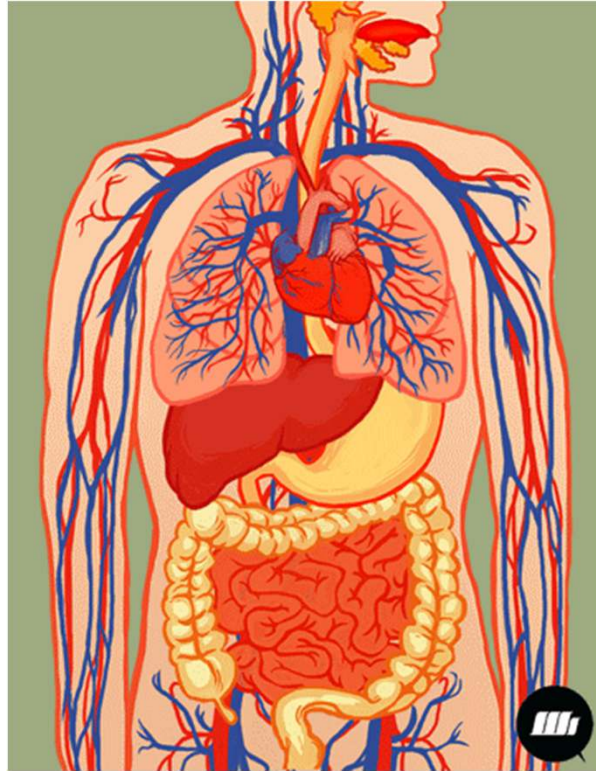
◆ **Radiographic, sectional, and endoscopic anatomy** allows appreciation of structures in the living, as they are affected by muscle tone, body fluids and pressures, and gravity.

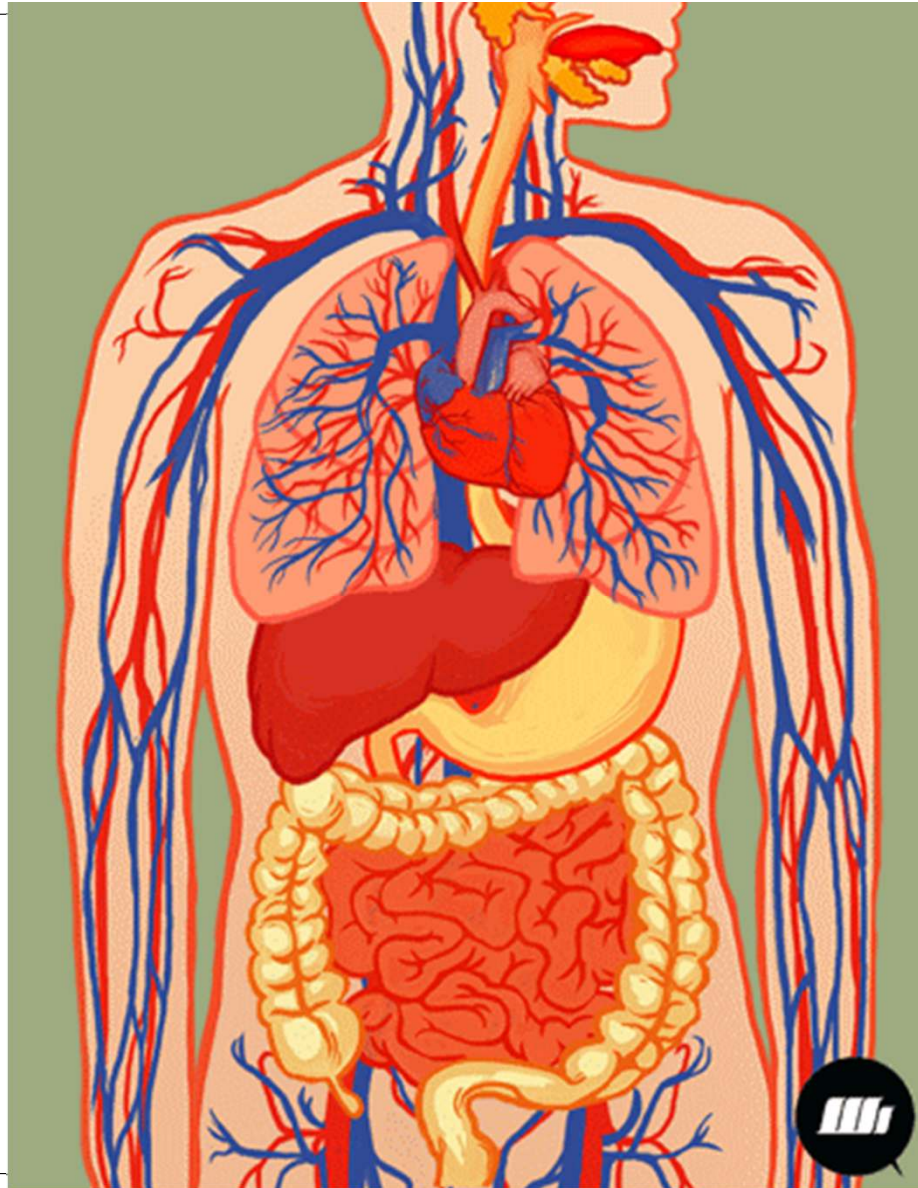
◆ **Clinical anatomy** emphasizes application of anatomical knowledge to the practice of medicine.









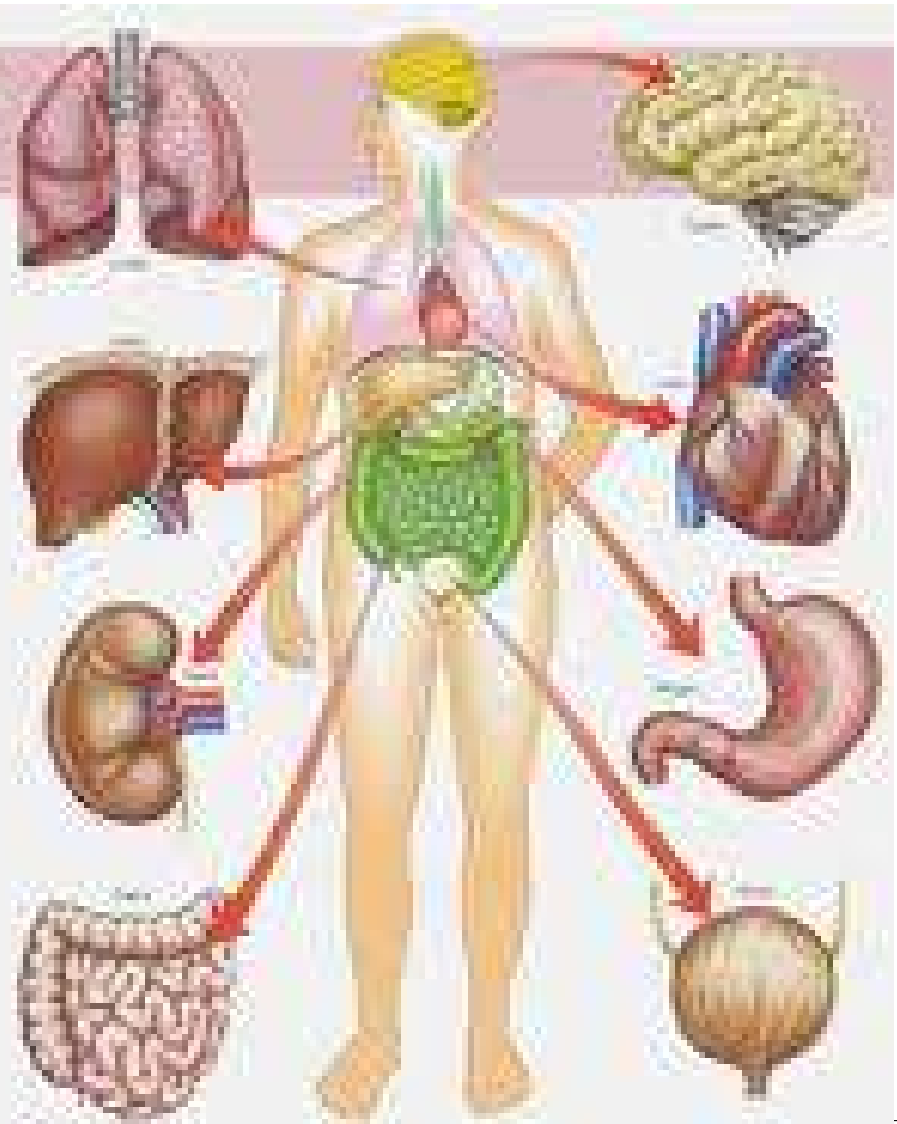






# Organ system

circulatory system  
respiratory system  
digestive system  
nervous system  
excretory system  
skeletal system

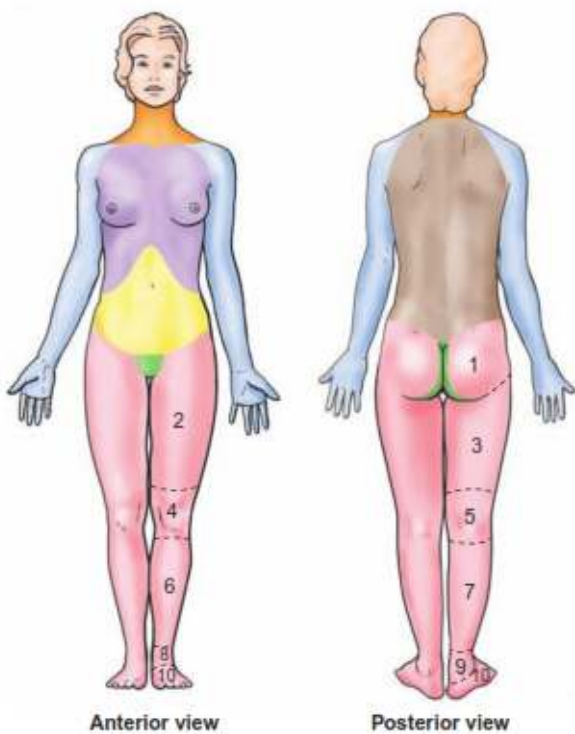




2 more immunology system ,  
hematology system

**Key Major Parts of the Body**

- |      |        |                 |            |
|------|--------|-----------------|------------|
| Head | Thorax | Abdomen         | Lower limb |
| Neck | Back   | Pelvis/perineum | Upper limb |

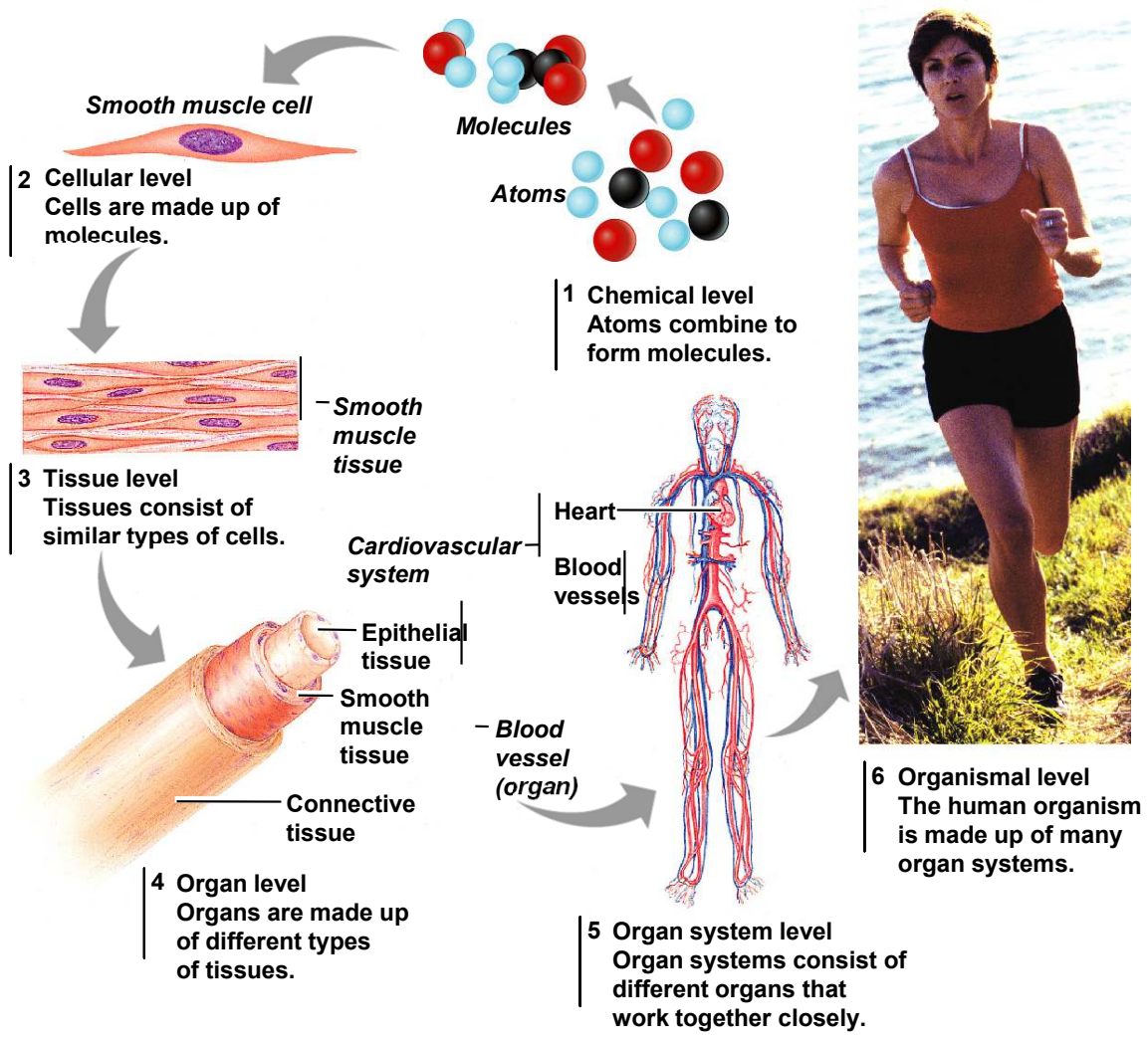


**Key Regions of Lower Limb**

- |                            |  |
|----------------------------|--|
| 1 = Gluteal region         | 6 = Anterior leg region                |
| 2 = Anterior thigh region  | 7 = Posterior leg region               |
| 3 = Posterior thigh region | 8 = Anterior talocrural (ankle) region |
| 4 = Anterior knee region   | 9 = Posterior talocrural region        |
| 5 = Posterior knee region  | 10 = Foot region                       |

**FIGURE 1.1.** Major parts of the body and regions of the lower limb. Anatomy is described relative to the anatomical position illustrated here.





## Levels of Structural Organization

Figure 1.1

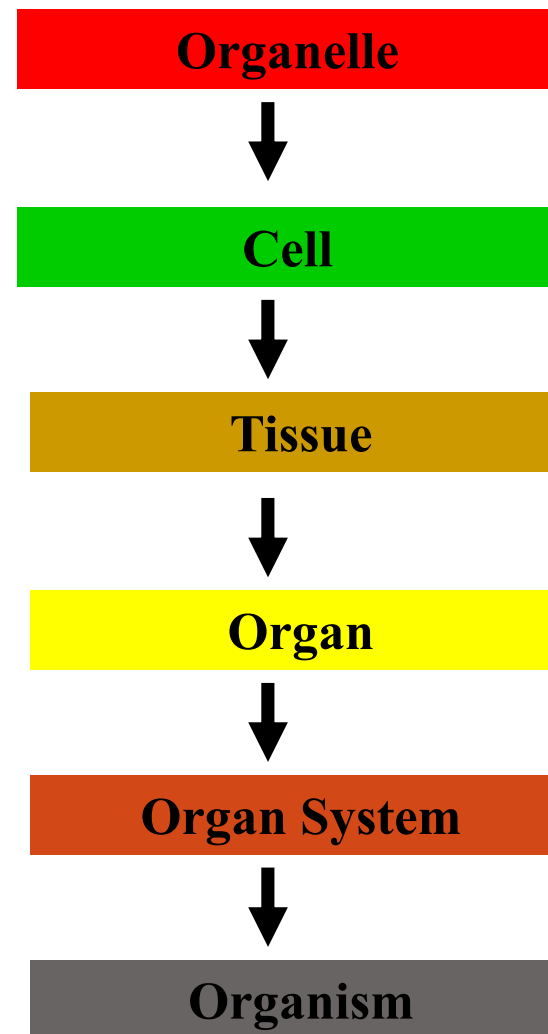
# Levels of Structural Organization

- Chemical – atoms combined to form molecules
- Cellular – cells are made of molecules
- Tissue – consists of similar types of cells
- Organ – made up of different types of tissues
- Organ system – consists of different organs that work closely together
- Organismal – made up of the organ systems



## Levels of Structure

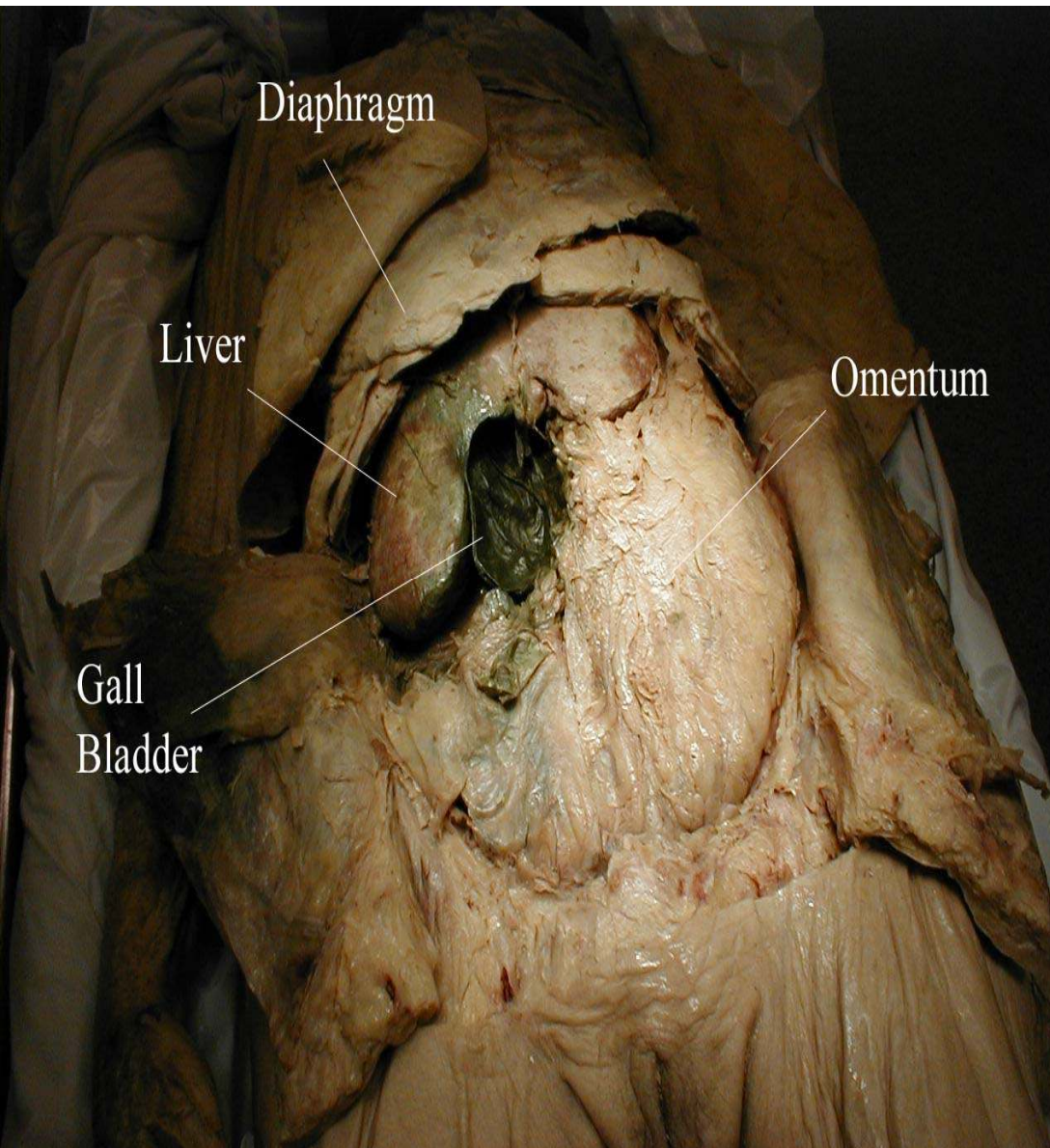
- In order to understand how something is built and how something works, you must look at all of its components and analyze them both individually and together.
- In doing these collective and separate analyses, you must examine things at multiple structural levels, i.e., one must break them down from large to small – *this is called reductionism*
- An organism (such as a human being) may be broken down as illustrated on the left.



# Overview of Anatomy and Physiology

- Anatomy – the study of the structure of body parts and their relationships to one another
  - Gross or macroscopic
  - Microscopic
  - Developmental
- Structure refers to
  - the shapes,
  - sizes,
  - and characteristics of the components of the human body.
- The word anatomy comes from 2 words:
  - *Ana* which means “up or apart”
  - *Tomos* which means “to cut”





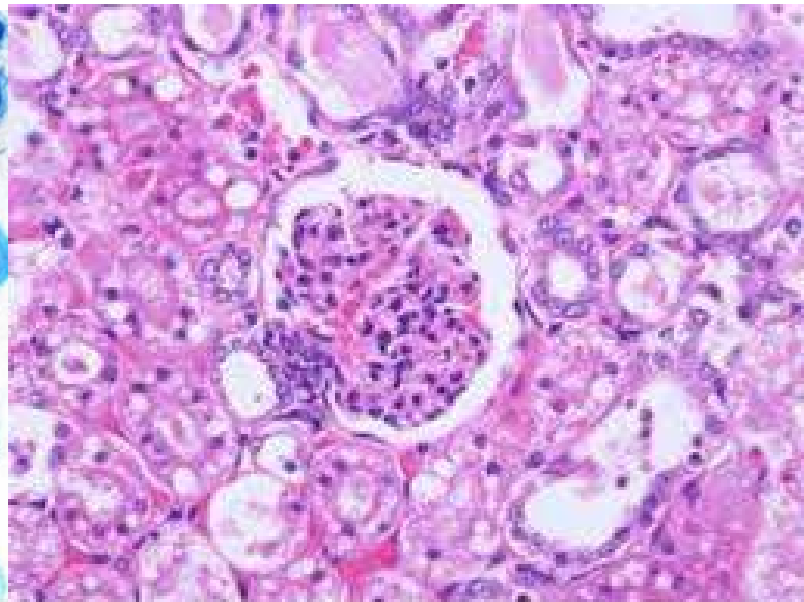
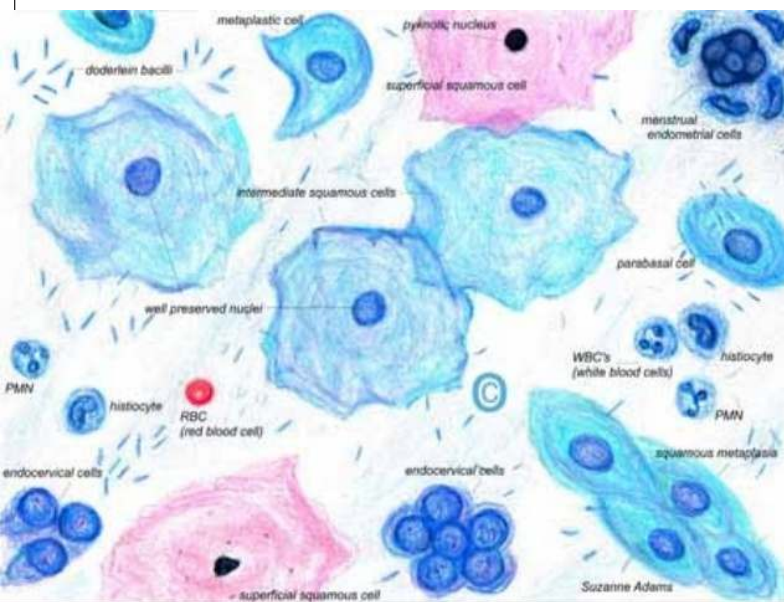
# Gross Anatomy

Study of stuff seen by the naked eye  
(*Gross Anatomy*).

- **Regional** – all structures in one part of the body  
(such as the abdomen or leg)
- **Systemic** – gross anatomy of the body studied by system
- **Surface** – study of internal structures as they relate to the overlying skin

# Microscopic Anatomy

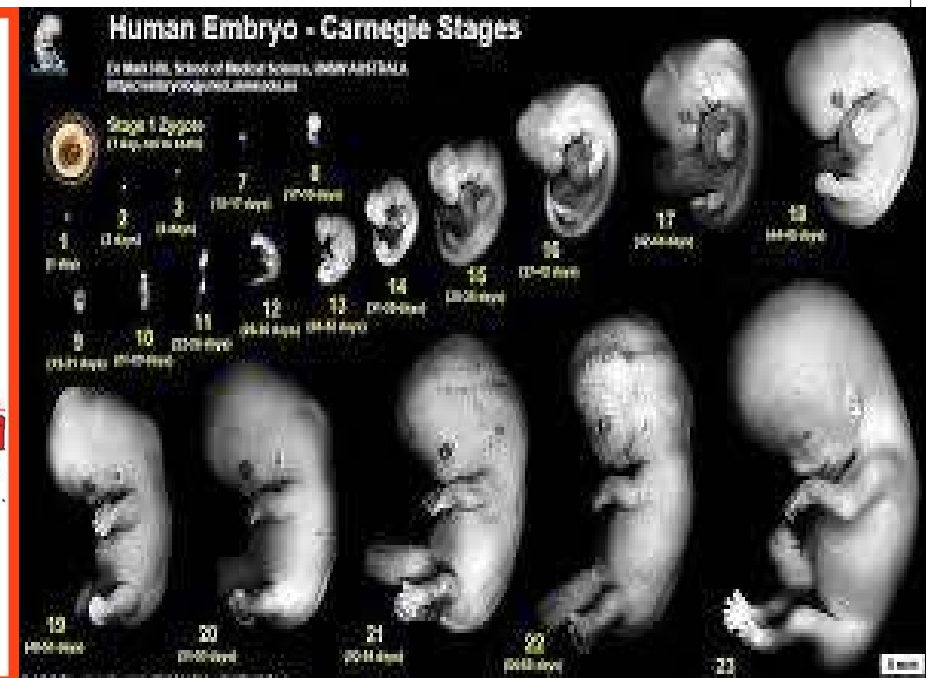
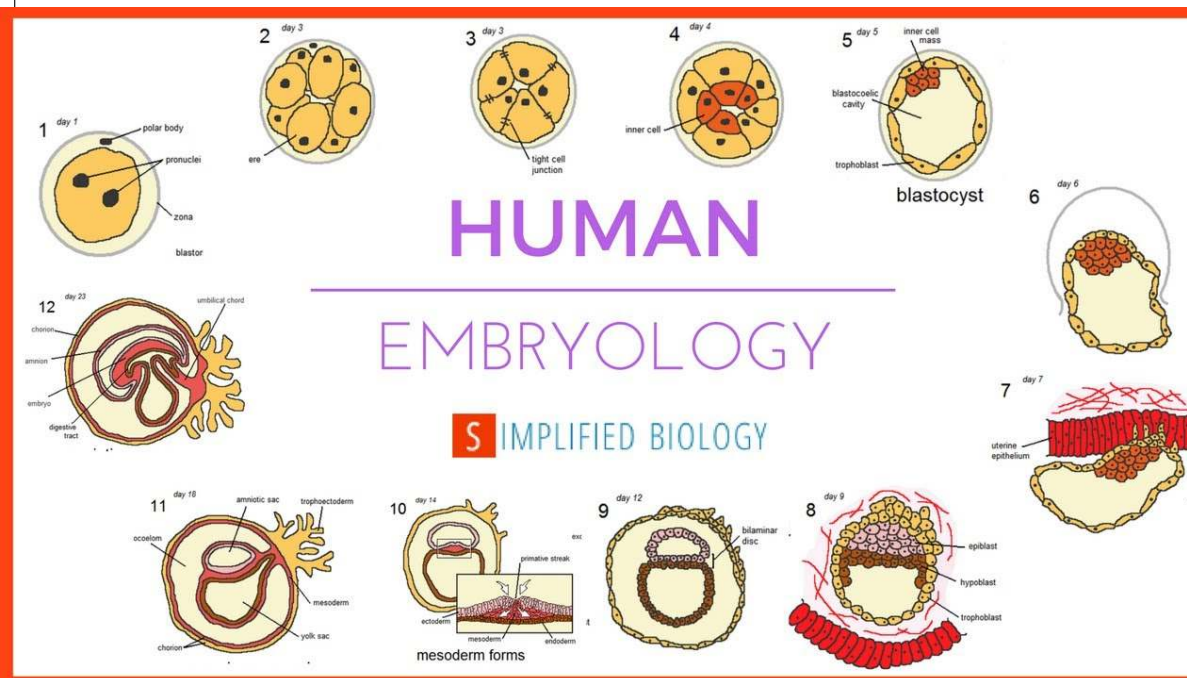
- **Cytology** – study of the cell
- **Histology** – study of tissues





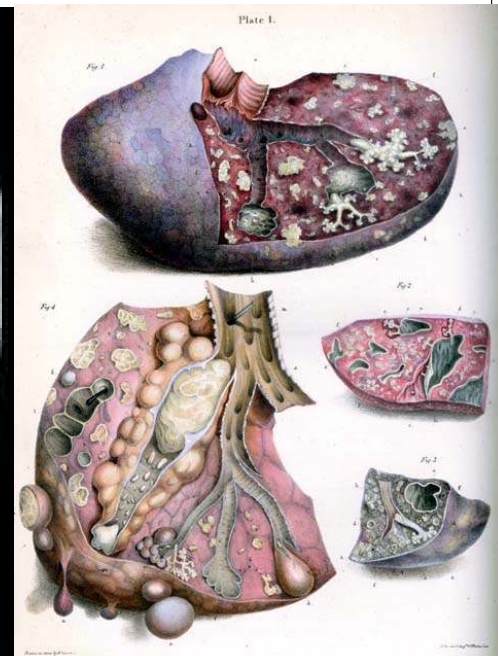
# Developmental Anatomy

- Traces structural changes throughout life
- **Embryology** – study of developmental changes of the body before birth



# Specialized Branches of Anatomy

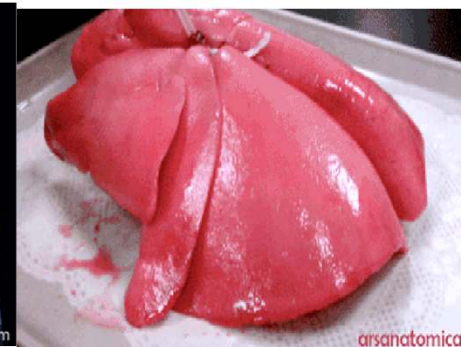
- **Pathological anatomy** – study of structural changes caused by disease
- **Radiographic anatomy** – study of internal structures visualized by specialized scanning procedures such as X-ray, MRI, and CT scans
- **Molecular biology** – study of anatomical structures at a subcellular level





# Physiology

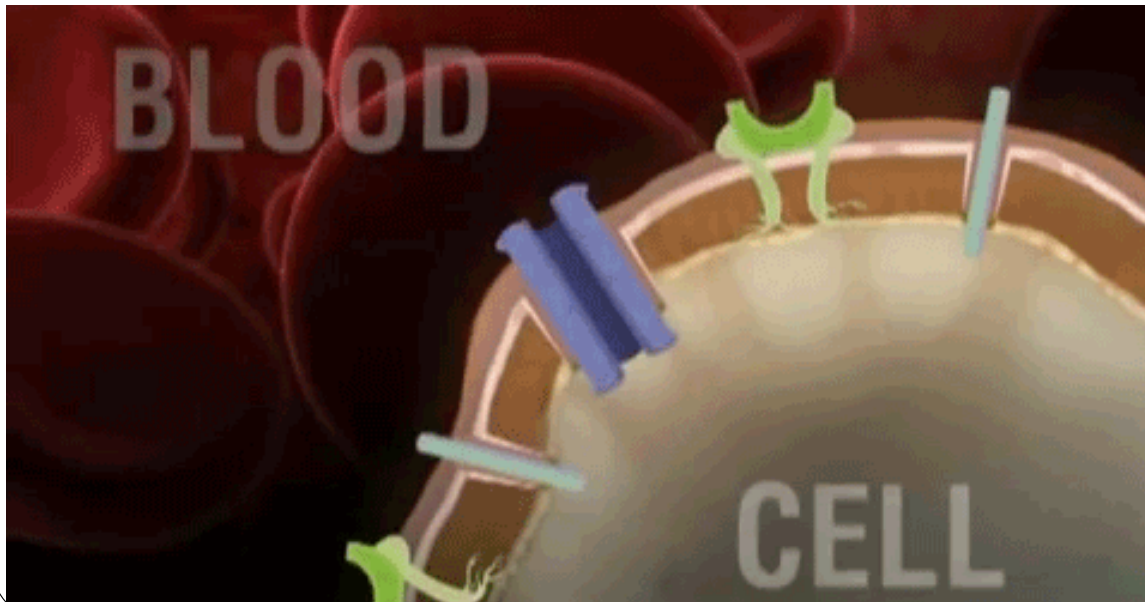
**Physiology** – the study of the function of the body's structural machinery



- Physiology is defined as the study of function – so human physiology attempts to explain how and why humans function.
- Physiology is where we figure out how stuff works.
  - How do muscles contract?
  - How do we run?
  - How does our heart beat?
- Considers the operation of specific organ systems
  - Renal – kidney function
  - Neurophysiology – workings of the nervous system
  - Cardiovascular – operation of the heart and blood vessels
- Focuses on the functions of the body, often at the cellular or molecular level

# Physiology

- Understanding physiology also requires a knowledge of physics, which explains
  - electrical currents
  - blood pressure
  - the way muscle uses bone for movement





# Principle of Complementarity

- Function always reflects structure
- What a structure can do depends on its specific form

## Principle of Complementarity of Structure and Function

- The form of each body structure allows that structure to carry out its specific task
  - Function follows form, and form follows function
    - Function always reflects structure
    - What a structure can do depends on its specific form



## COMPLEMENTARITY OF STRUCTURE AND FUNCTION

- Function always reflects structure
  - What a structure can do depends on its specific form
- hard mineral deposits* → *bone* → *support body***
- valves in the heart* → *prevent blood backflow* → *one direction blood flow***
- Think about more examples in your body.....***

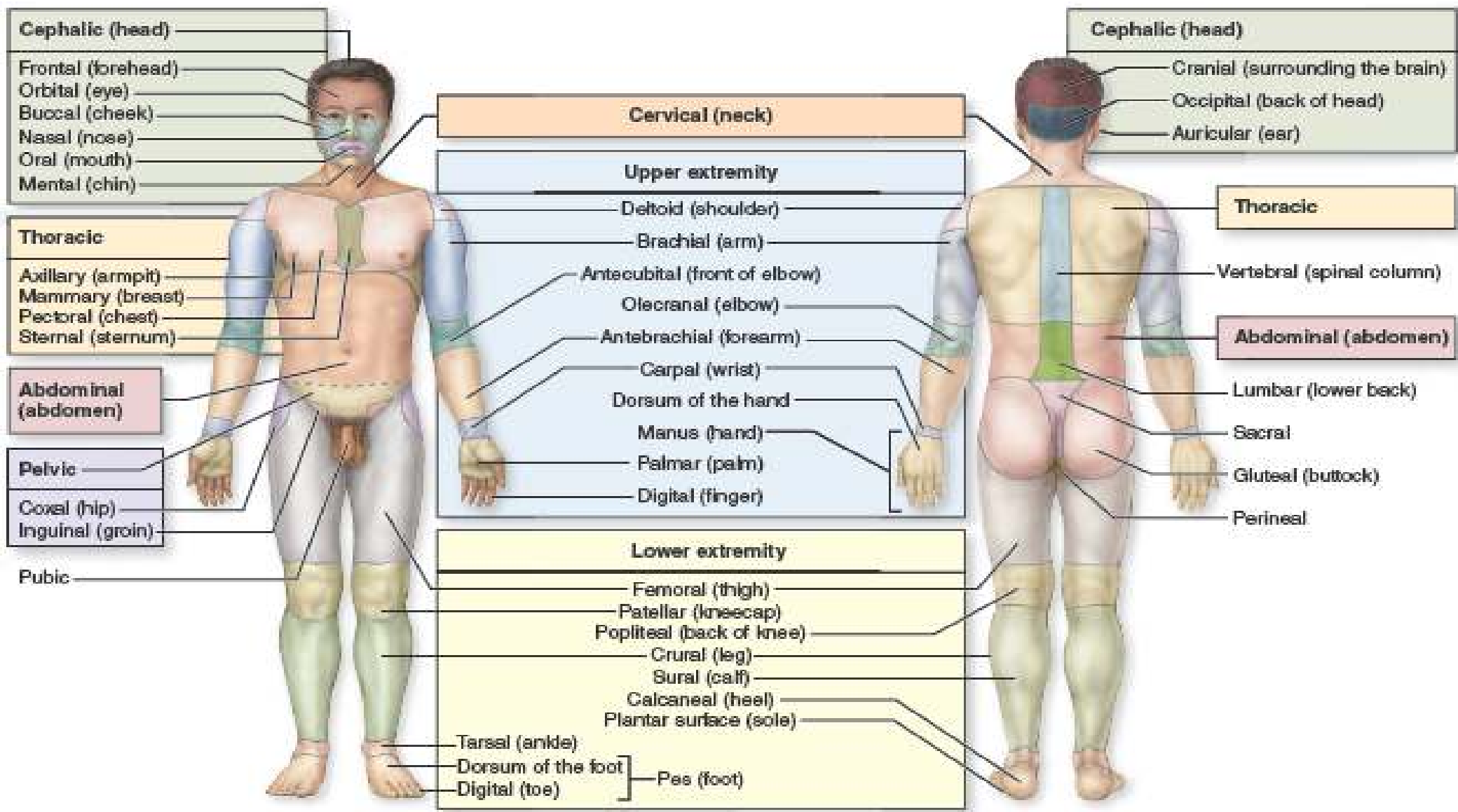
# Can Anatomy & Physiology Be Separated?

- NOOOOOOOO!!!! Absolutely not!
- Structure and function are undeniably connected. We cannot divorce them.
- What do we mean by this?
  - Can you eat soup with a fork?
  - Find 2 everyday items and determine whether/how their structure (anatomy) relates to their function (physiology)



***When you consider the structure of an organ, cell, or anything for that matter you must also consider its function!***

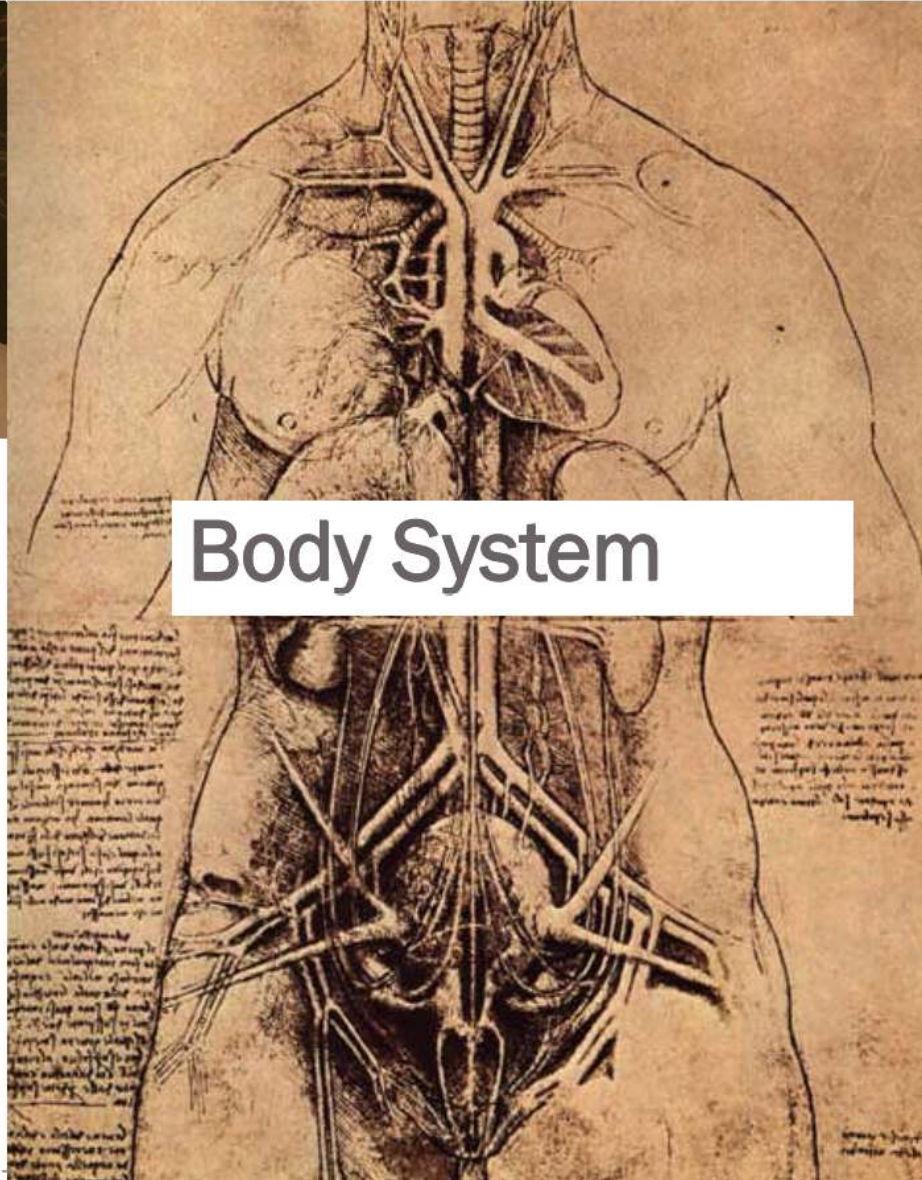
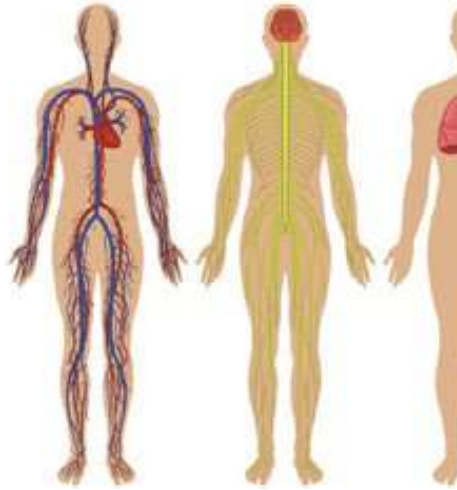




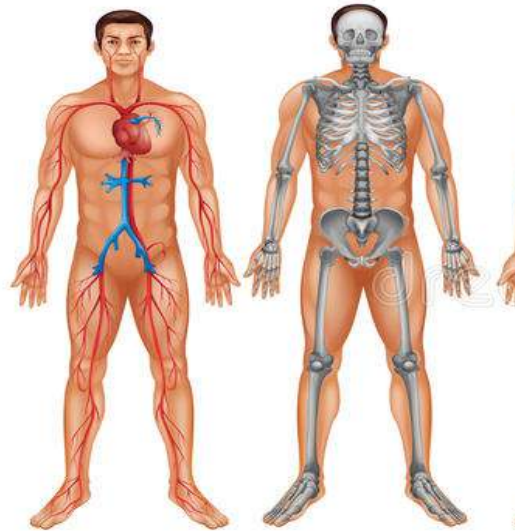
(a) Anterior view

(b) Posterior view

Nervous System



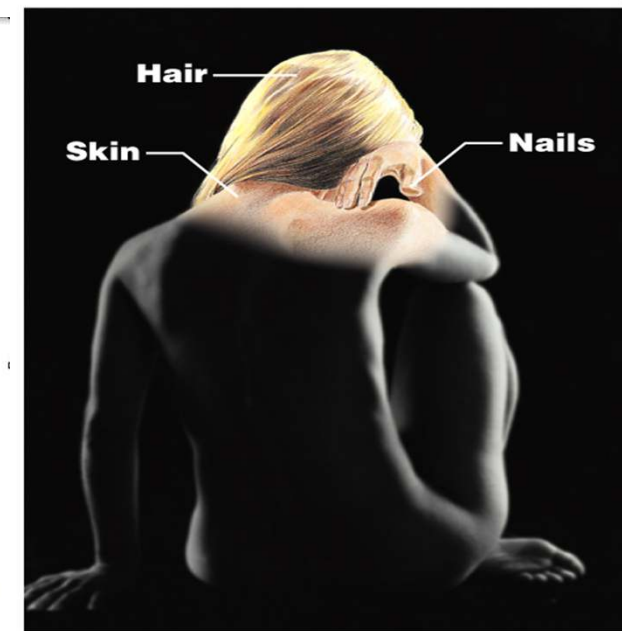
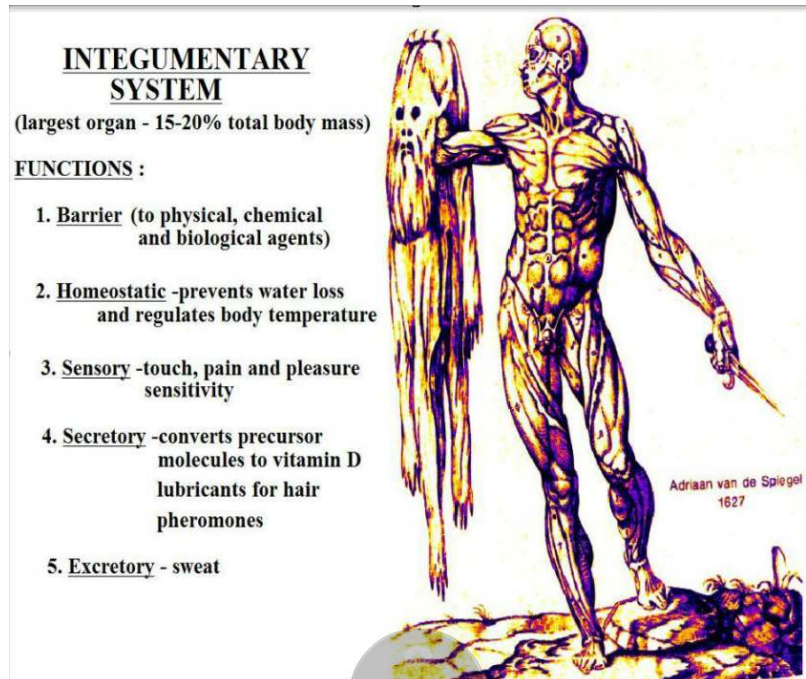
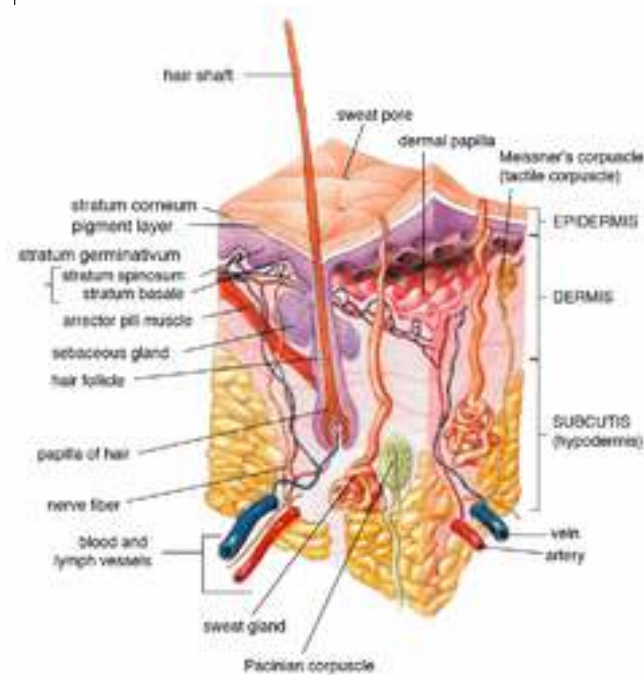
Body System





# Integumentary System

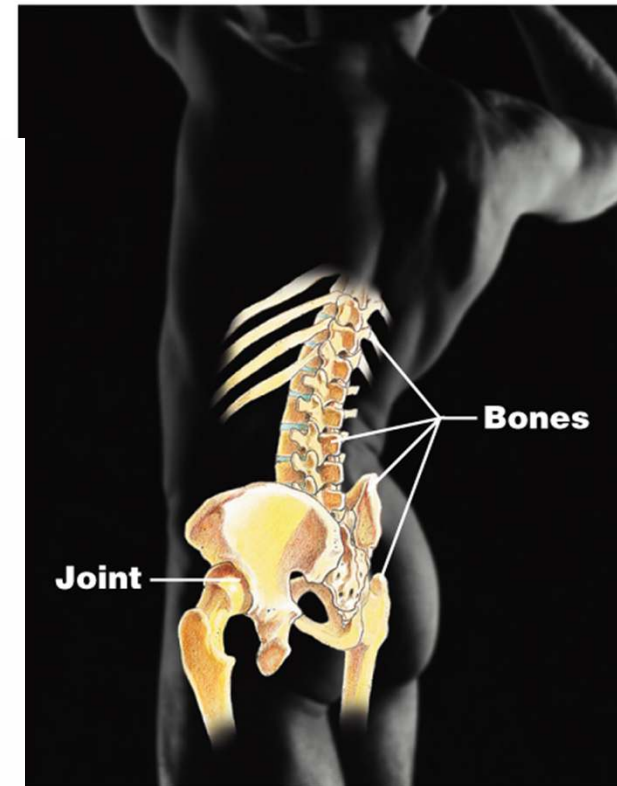
- Forms the external body covering
- Composed of the skin, sweat glands, oil glands, hair, and nails
- Protects deep tissues from injury and synthesizes vitamin D



(a) Integumentary System

# Skeletal System

- Composed of bone, cartilage, and ligaments
- Protects and supports body organs
- Provides the framework for muscles
- Site of blood cell formation
- Stores minerals

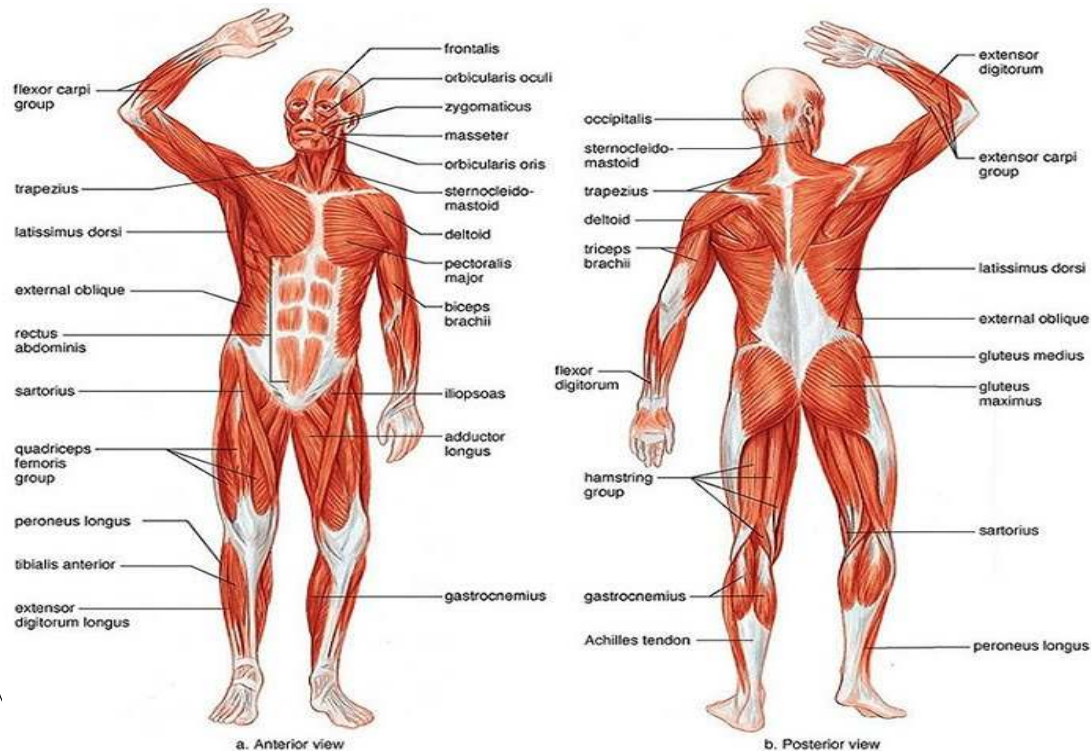


**(b) Skeletal System**



# Muscular System

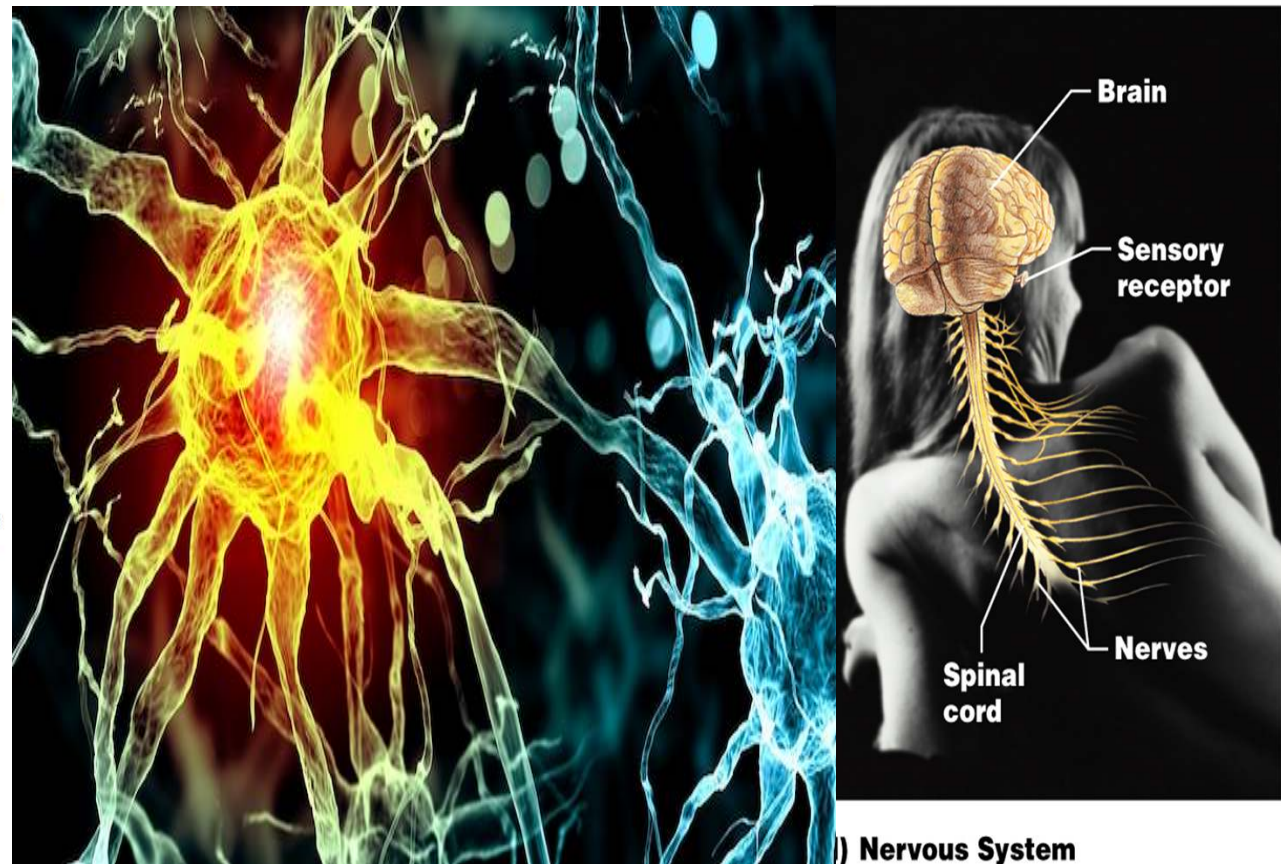
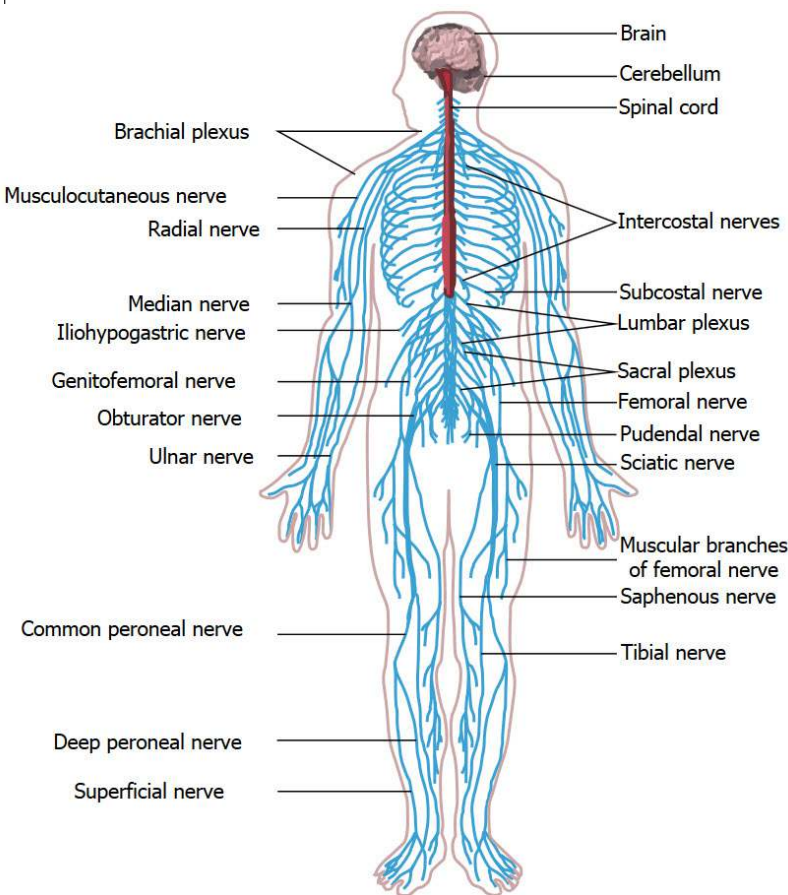
- Composed of muscles and tendons
- Allows manipulation of the environment, locomotion, and facial expression
- Maintains posture
- Produces heat



(c) Muscular System

# Nervous System

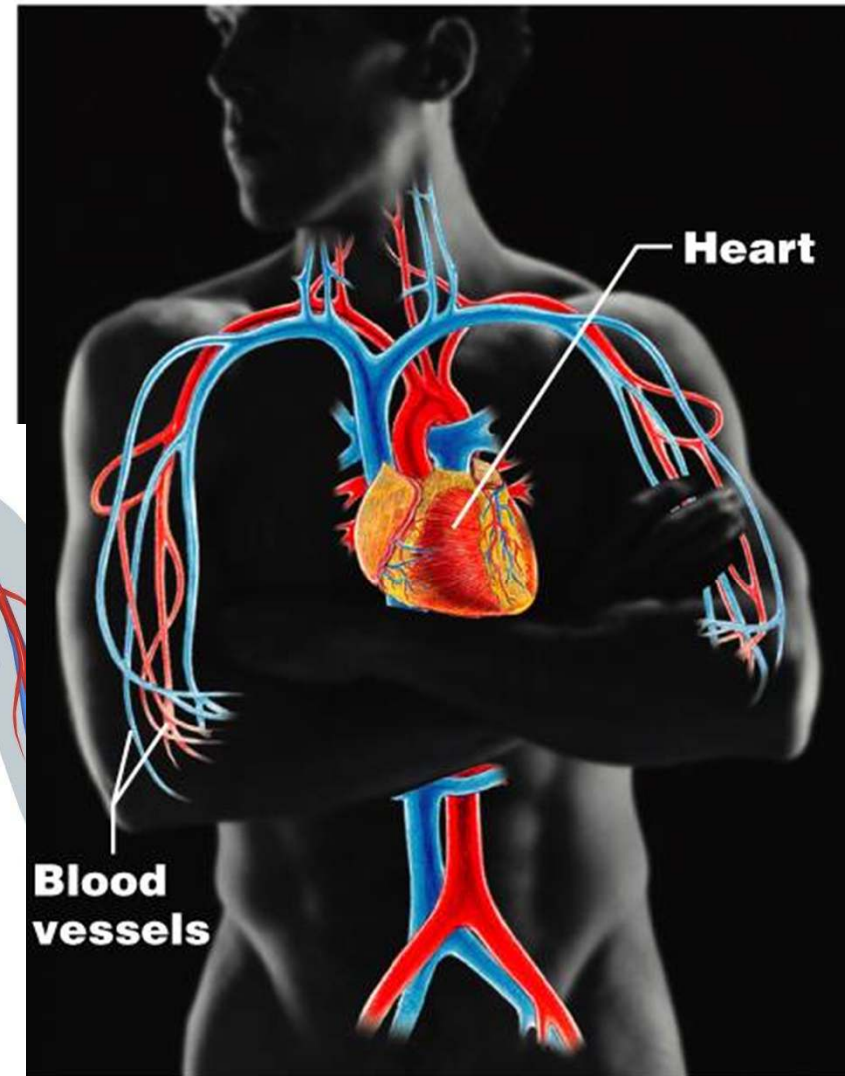
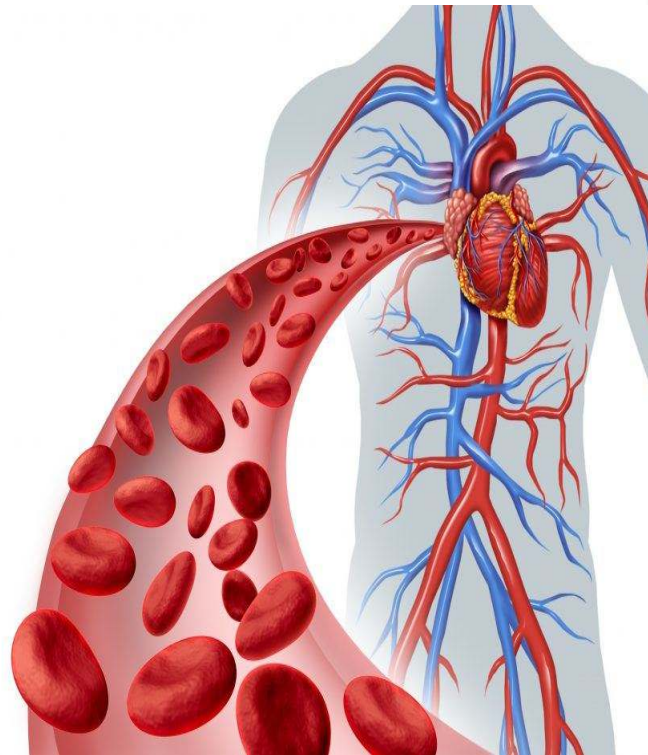
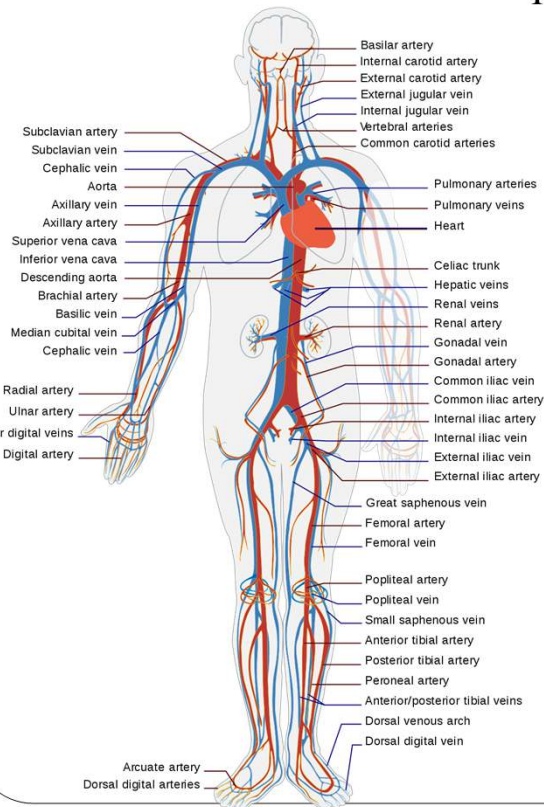
- Composed of the brain, spinal column, and nerves
- Is the fast-acting control system of the body
- Responds to stimuli by activating muscles and glands





# Cardiovascular System

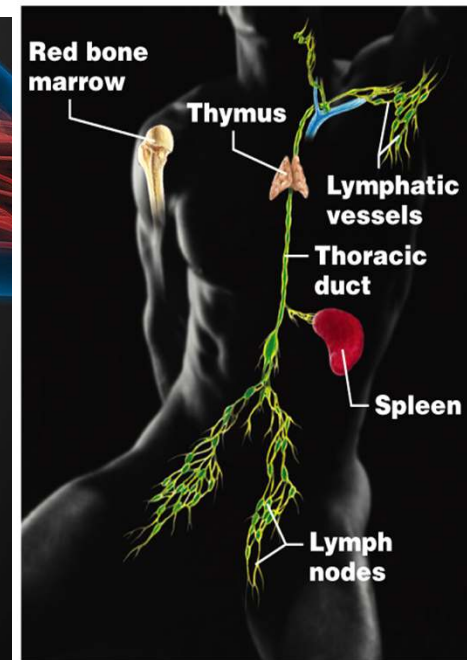
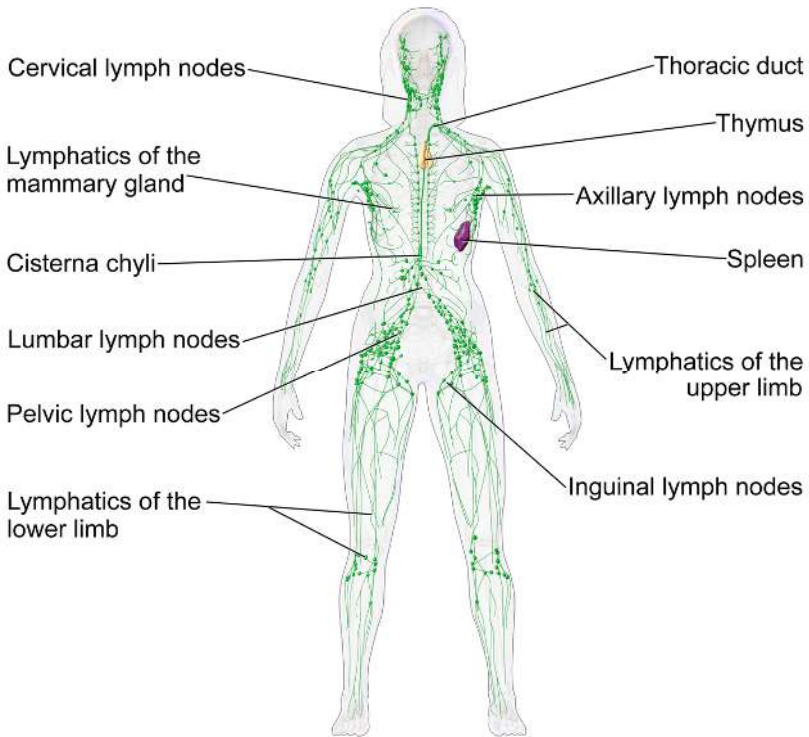
- Composed of the heart and blood vessels
- The heart pumps blood
- The blood vessels transport blood throughout the body



**(f) Cardiovascular System**

# Lymphatic System

- Composed of red bone marrow, thymus, spleen, lymph nodes, and lymphatic vessels
- Picks up fluid leaked from blood vessels and returns it to blood
- Disposes of debris in the lymphatic stream
- Houses white blood cells involved with immunity

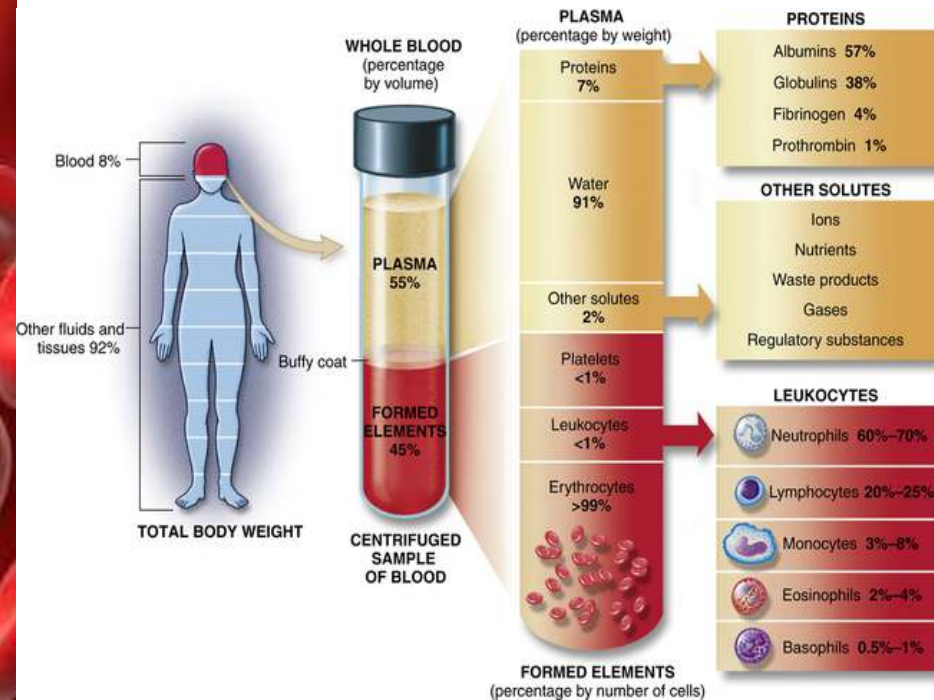
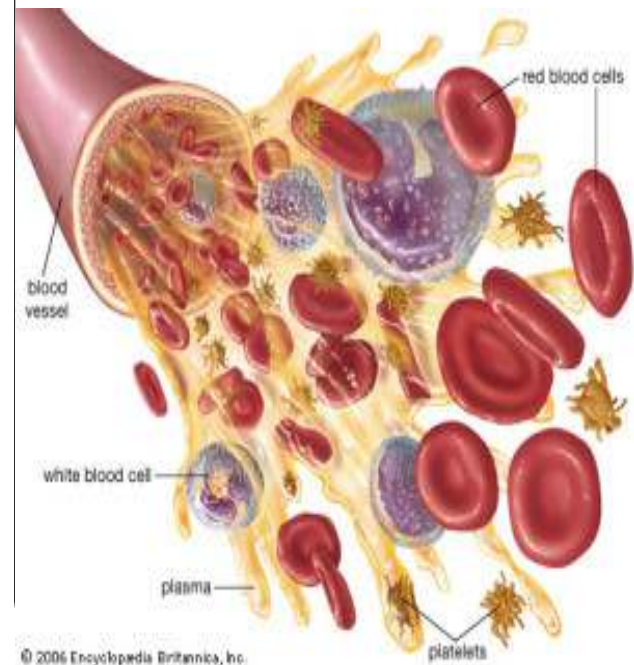


(g) Lymphatic System/Immunity



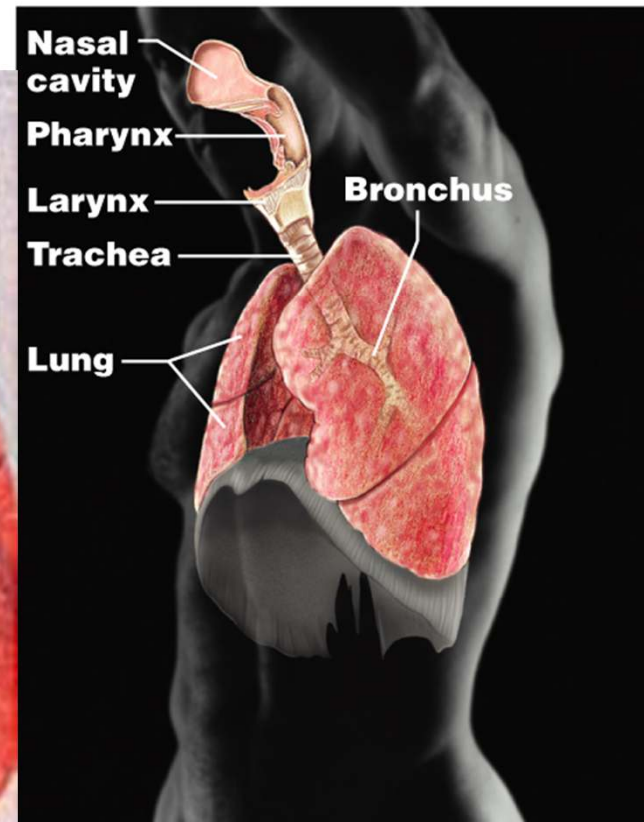
# Hematological system /hematopoietic system

- include the blood, blood vessels, and blood-forming organs (bone marrow, spleen, liver, lymph nodes, and thymus gland).
- The hematologic system also plays an important role in hormone transport, the inflammatory and immune responses, temperature regulation, fluid-electrolyte balance, and acid-base balance.



# Respiratory System

- Composed of the nasal cavity, pharynx, trachea, bronchi, and lungs
- Keeps blood supplied with oxygen and removes carbon dioxide

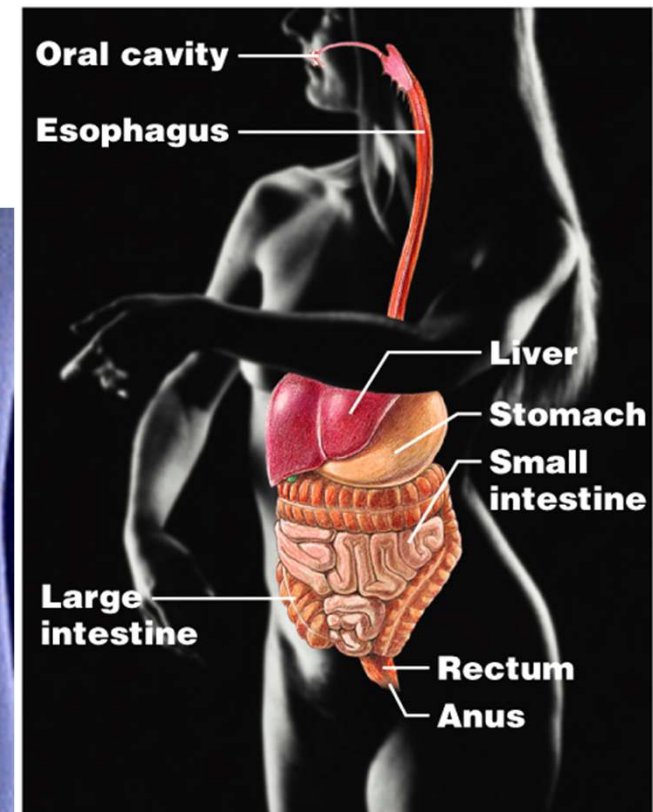
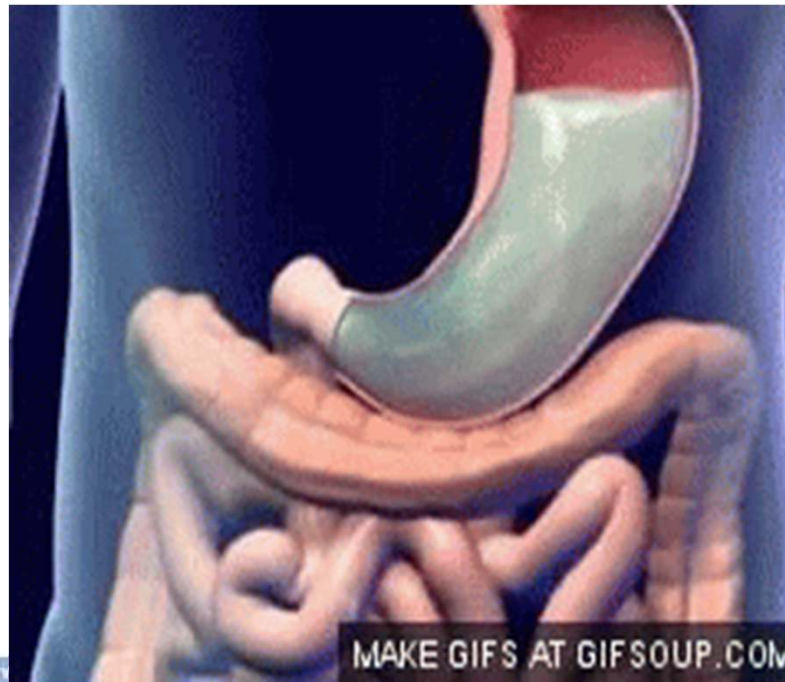
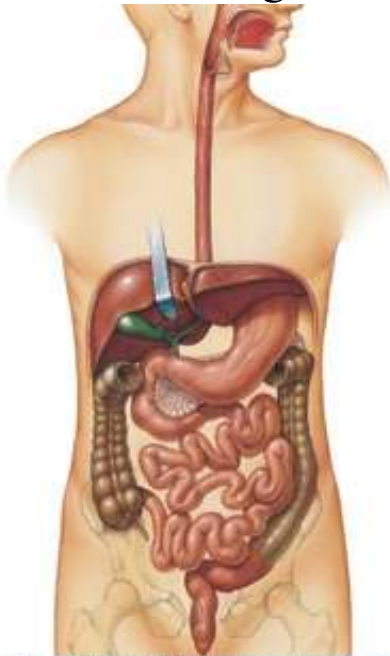


**(h) Respiratory System**



# Digestive System

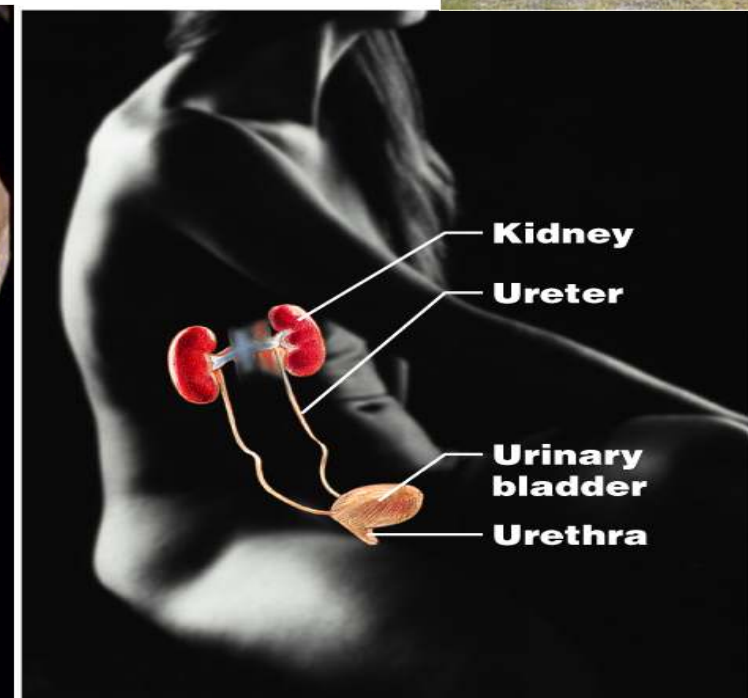
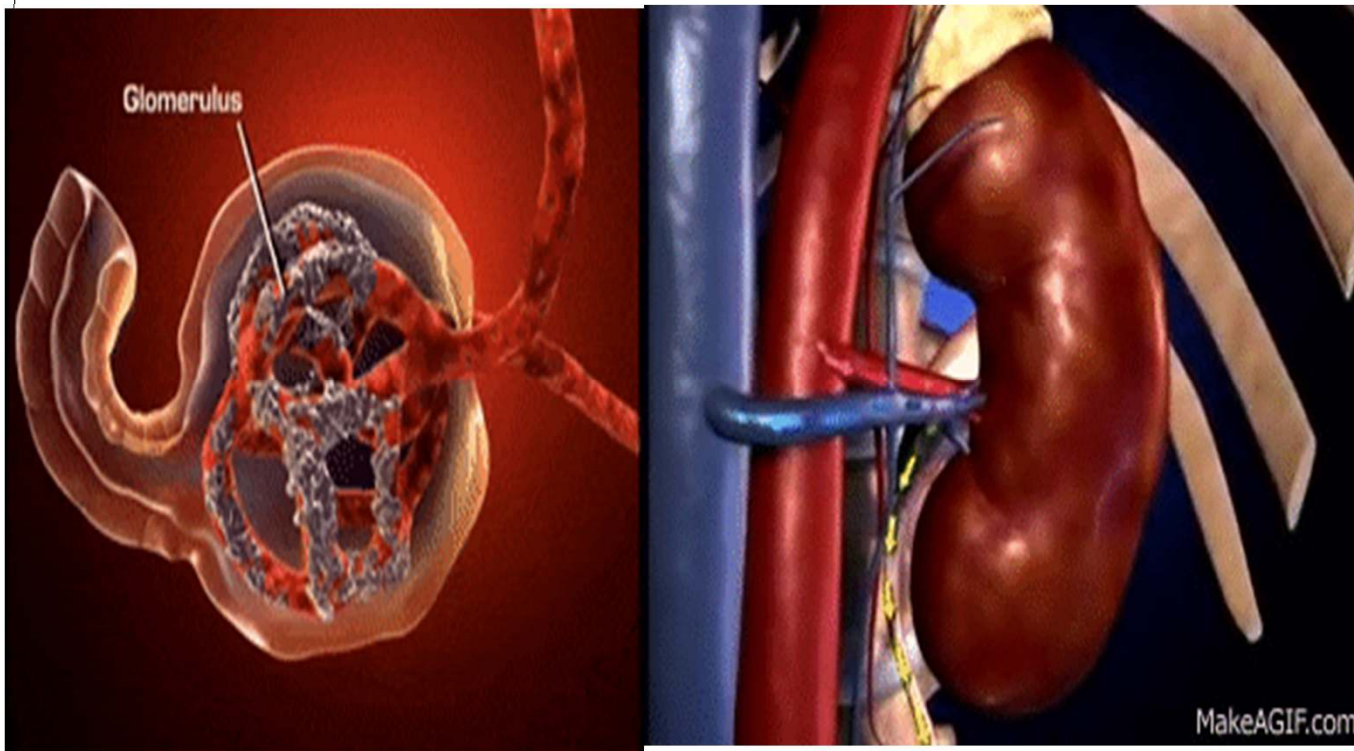
- Composed of the oral cavity, esophagus, stomach, small intestine, large intestine, rectum, anus, and liver
- Breaks down food into absorbable units that enter the blood
- Eliminates indigestible foodstuffs as feces



(i) Digestive System

# Urinary System

- Composed of kidneys, ureters, urinary bladder, and urethra
- Eliminates nitrogenous wastes from the body
- Regulates water, electrolyte, and pH balance of the blood

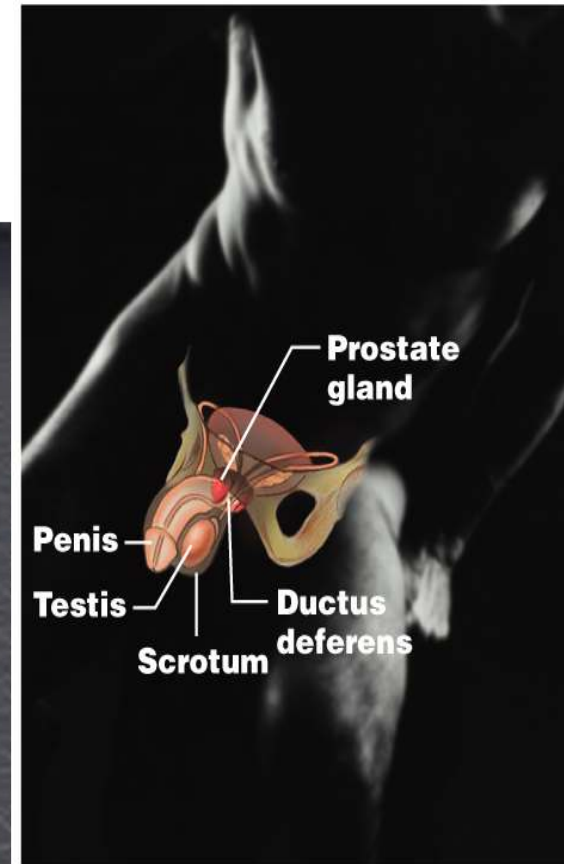
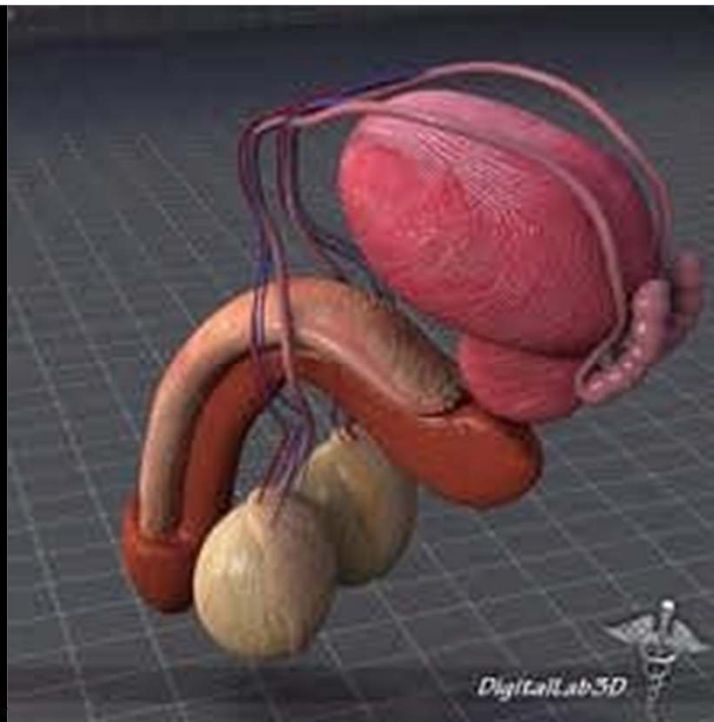


**(j) Urinary System**



# Male Reproductive System

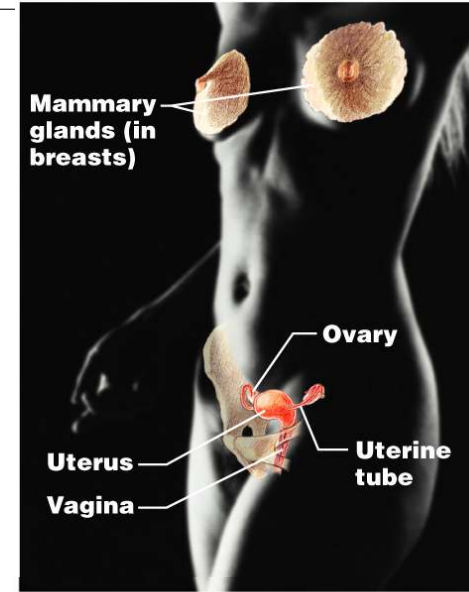
- Composed of prostate gland, penis, testes, scrotum, and ductus deferens
- Main function is the production of offspring
- Testes produce sperm and male sex hormones
- Ducts and glands deliver sperm to the female reproductive tract



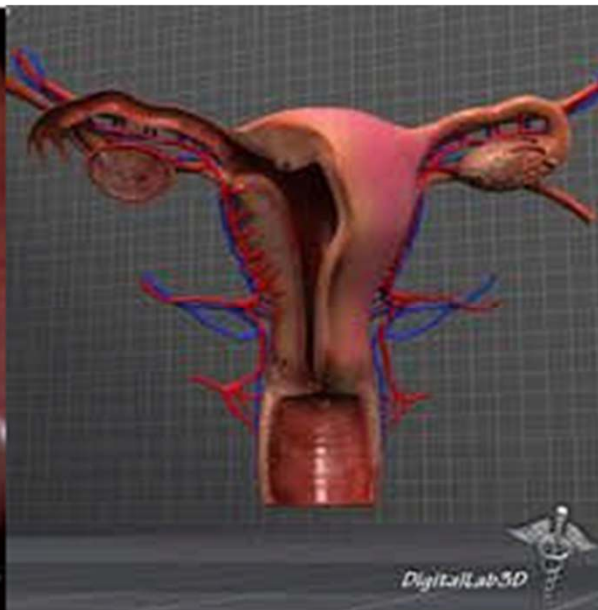
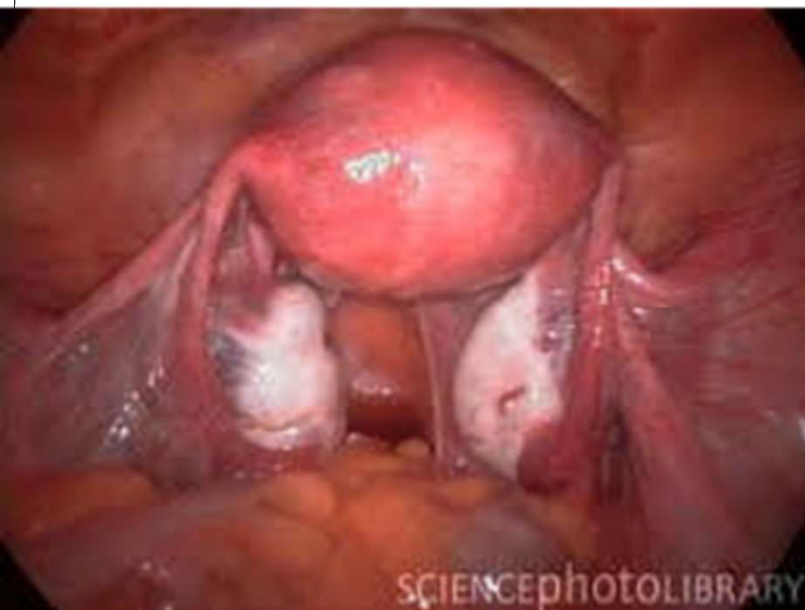
**(k) Male Reproductive System**

# Female Reproductive System

- Composed of mammary glands, ovaries, uterine tubes, uterus, and vagina
- Main function is the production of offspring
- Ovaries produce eggs and female sex hormones
- Remaining structures serve as sites for fertilization and development of the fetus
- Mammary glands produce milk to nourish the newborn



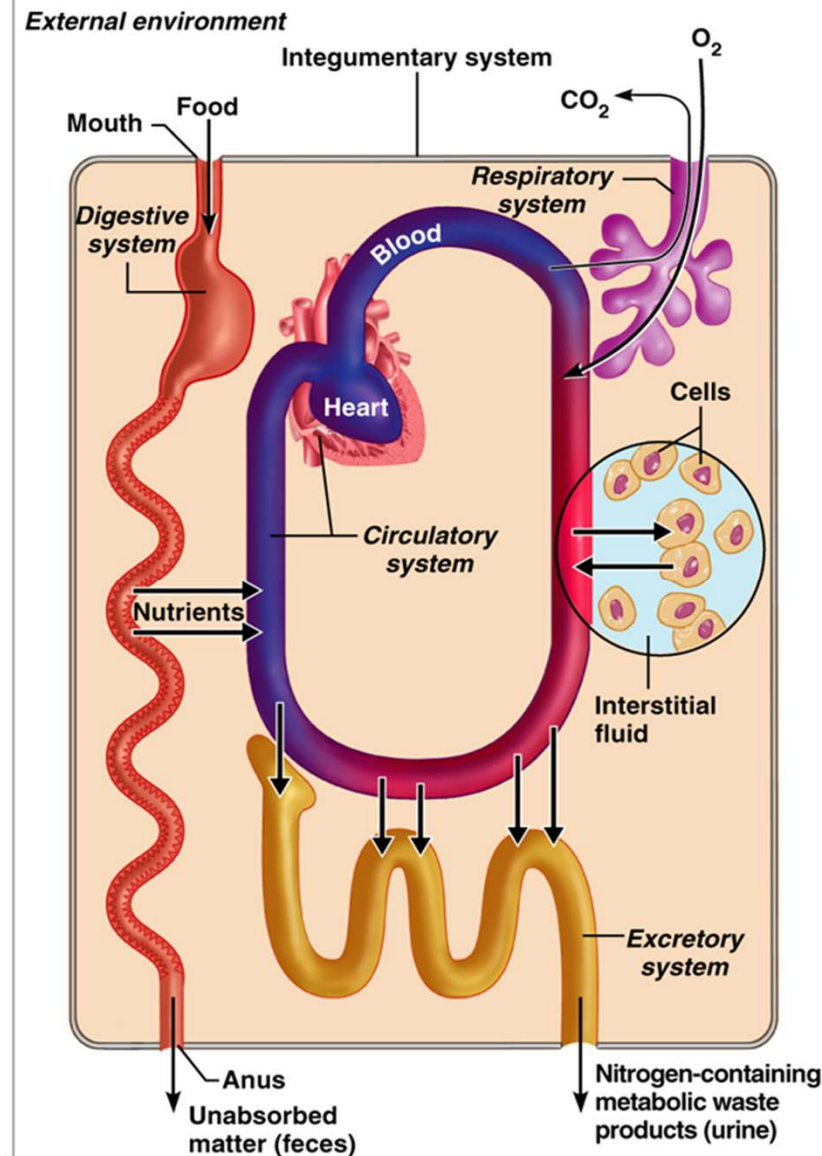
(I) Female Reproductive System





# Organ Systems Interrelationships

- The integumentary system protects the body from the external environment
- Digestive and respiratory systems, in contact with the external environment, take in nutrients and oxygen
- Nutrients and oxygen are distributed by the blood
- Metabolic wastes are eliminated by the urinary and respiratory systems



# Necessary Life Functions

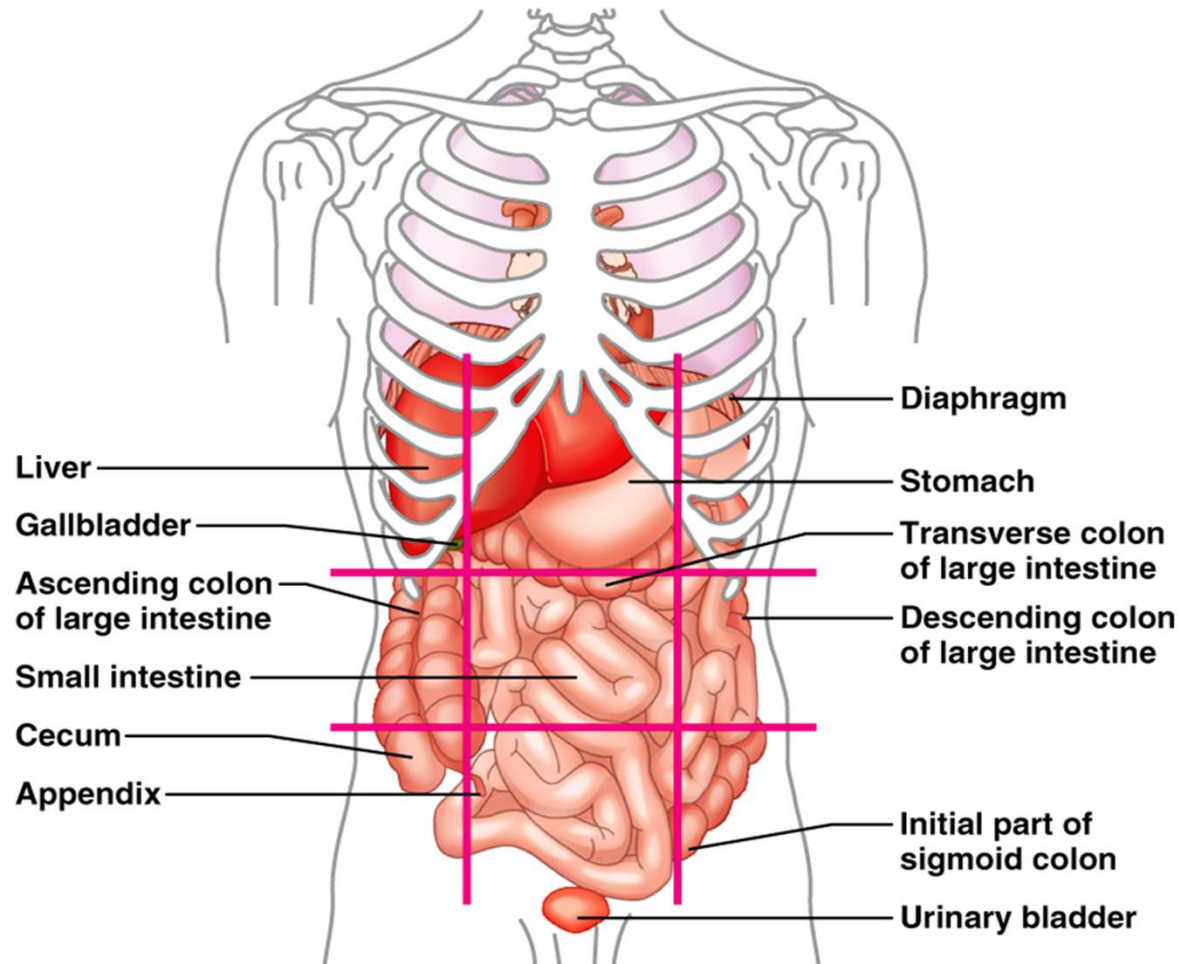
- **Maintaining boundaries** – the internal environment remains distinct from the external environment
  - **Cellular level** – accomplished by plasma membranes
  - **Organismal level** – accomplished by the skin
- **Movement** – locomotion, propulsion (peristalsis), and contractility
- **Responsiveness** – ability to sense changes in the environment and respond to them
- **Digestion** – breakdown of ingested foodstuffs
- **Metabolism** – all the chemical reactions that occur in the body
- **Excretion** – removal of wastes from the body
- **Reproduction** – cellular and organismal levels
  - **Cellular** – an original cell divides and produces two identical daughter cells
  - **Organismal** – sperm and egg unite to make a whole new person
- **Growth** – increase in size of a body part or of the organism



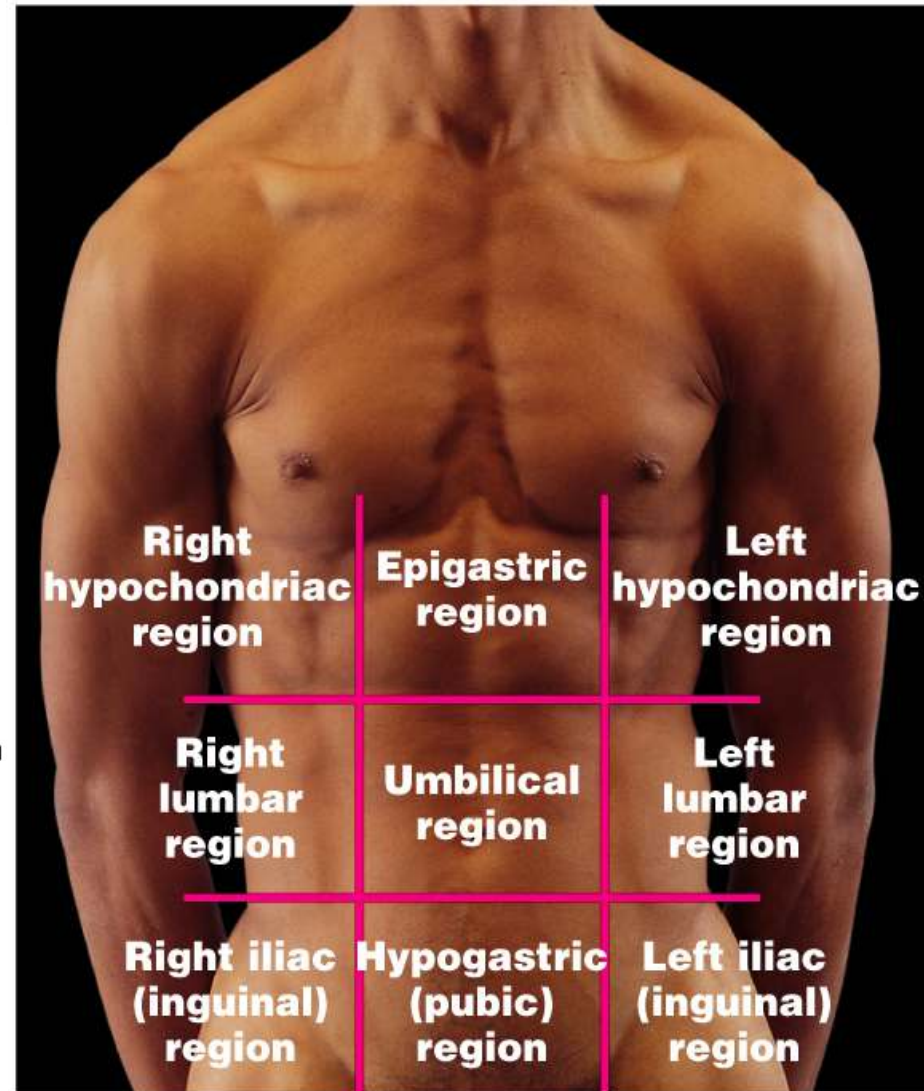
# Survival Needs

- **Nutrients** – needed for energy and cell building
- **Oxygen** – necessary for metabolic reactions
- **Water** – provides the necessary environment for chemical reactions
- **Normal body temperature** – necessary for chemical reactions to occur at life-sustaining rates
- **Atmospheric pressure** – required for proper breathing and gas exchange in the lungs

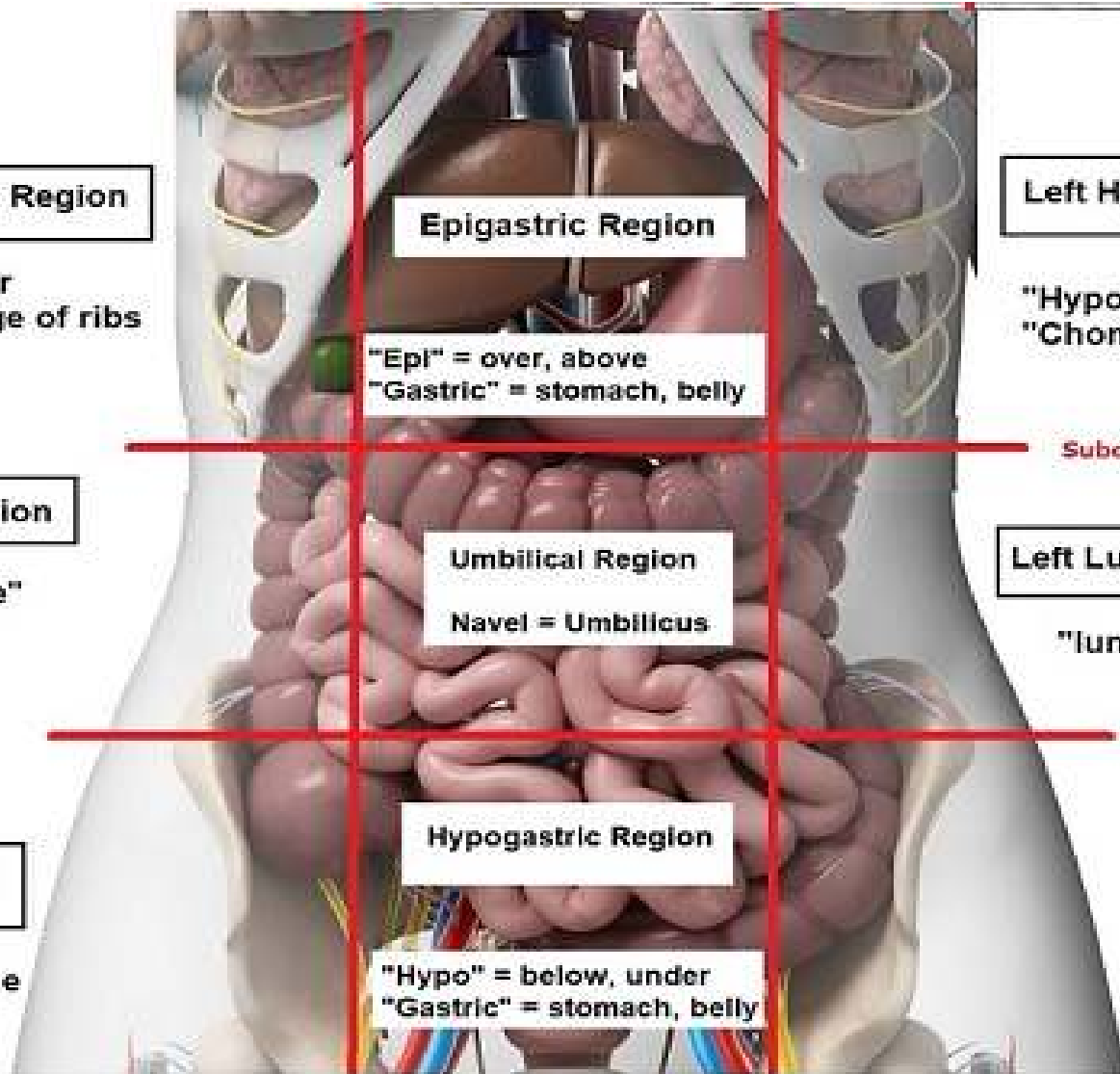
# Abdominopelvic Regions



(b)



(a)



**Right Hypochondriac Region**

"Hypo" = below, under  
"Chondriac" = cartilage of ribs

**Epigastric Region**

"Epi" = over, above  
"Gastric" = stomach, belly

**Left Hypochondriac Region**

"Hypo" = below, under  
"Chondriac" = cartilage of ribs

**Right Lumbar Region**

"lumbar vertebrae"

**Umbilical Region**

Navel = Umbilicus

**Left Lumbar Region**

"lumbar vertebrae"

**Right Iliac Region**

"iliac crest" on hip bone

**Hypogastric Region**

"Hypo" = below, under  
"Gastric" = stomach, belly

**Left Iliac Region**

"iliac crest" on hip bone

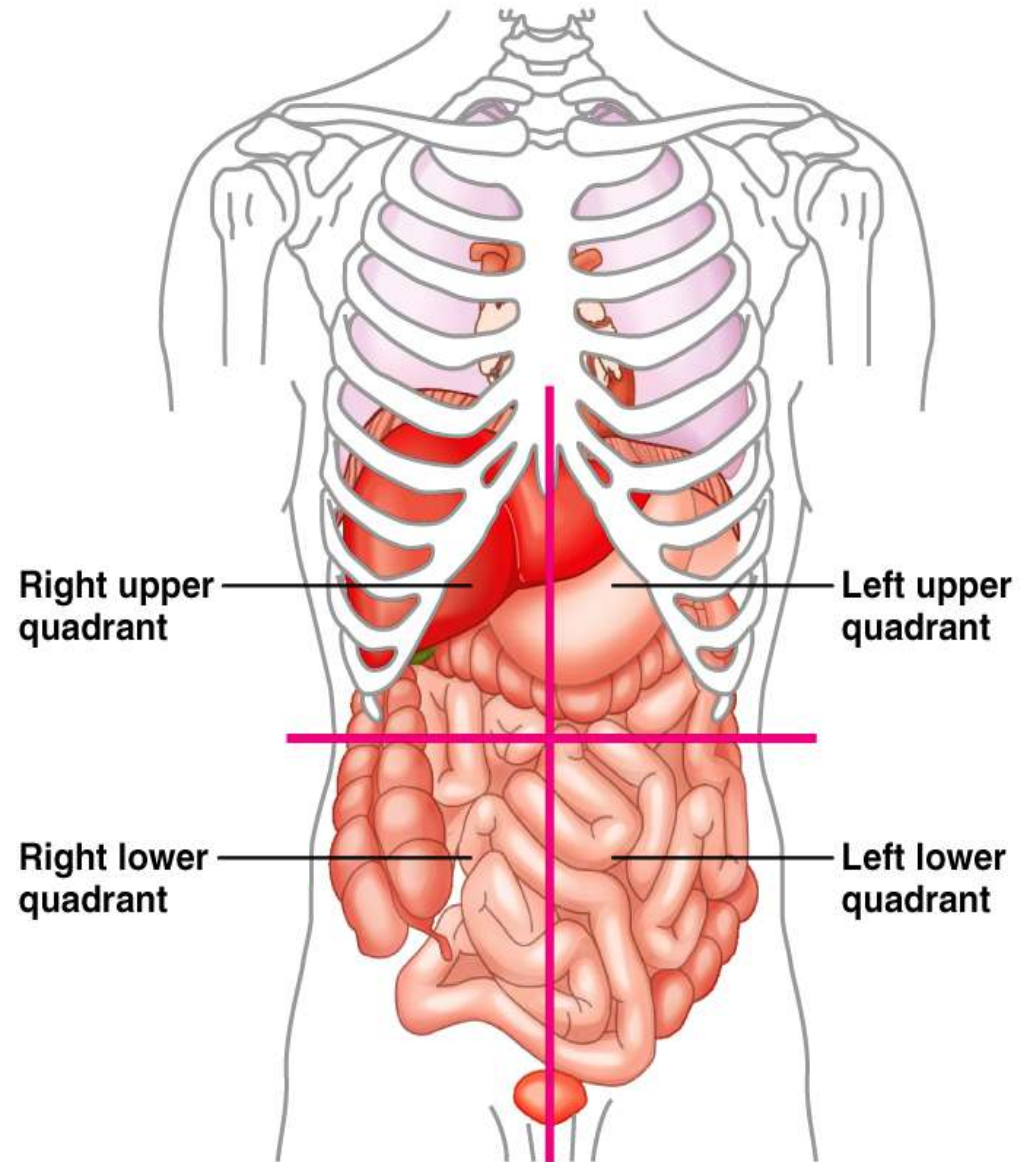
Subcostal Plane

Intertubercular Plane



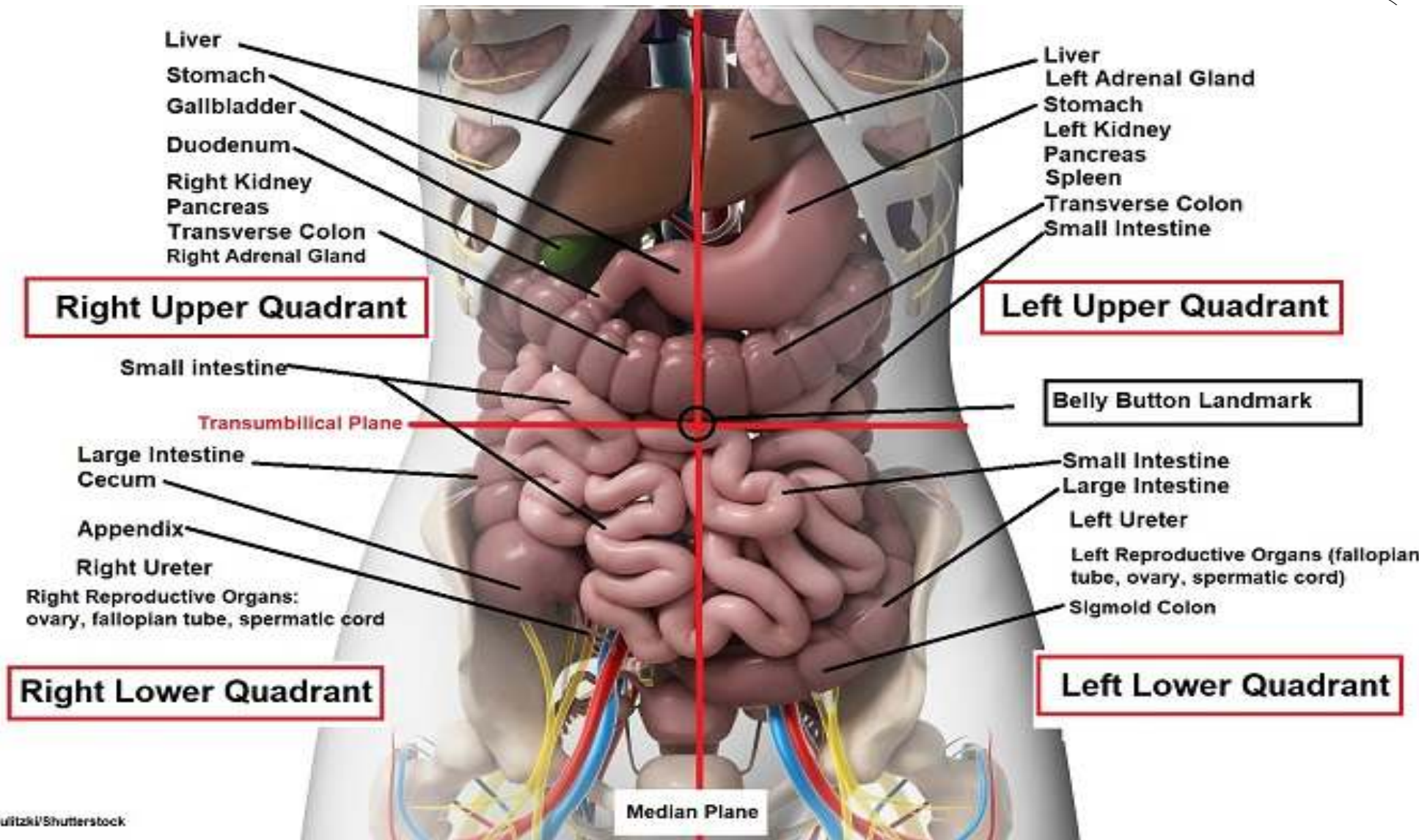
# Abdominopelvic Quadrants

- Right upper
- Left upper
- Right lower
- Left lower



## Abdominal quadrants **ORGANS**

Right upper quadrant	Left upper quadrant
<p>Liver right lobe</p> <p>Gallbladder, stomach, pylorus, duodenum, Pancreas head, R suprarenal gland, R kidney, R colic flexure, Ascending colon superior part, Transverse colon R half.</p>	<p>Liver left lobe</p> <p>Spleen, stomach, jejunum, prox ileum, pancreas body and tail, left kidney, L suprarenal, left colic flexure, Transverse colon left part, descending colon superior part.</p>
Right lower quadrant	Left lower quadrant
<p>Cecum, Appendix, Ileum, Asc. Colon, R ovary, R uterine tube, R ureter, R spermatic cord, Uterus, Urinary bladder (full)</p>	<p>Sigmoid colon, Desc. Colon, L ovary, L uterine tube, L ureter, L spermatic cord, Uterus enlarge, Urinary bladder ( full).</p>



Liver  
Stomach  
Gallbladder  
Duodenum  
Right Kidney  
Pancreas  
Transverse Colon  
Right Adrenal Gland

**Right Upper Quadrant**

Liver  
Left Adrenal Gland  
Stomach  
Left Kidney  
Pancreas  
Spleen  
Transverse Colon  
Small Intestine

**Left Upper Quadrant**

Small intestine  
Transumbilical Plane

**Belly Button Landmark**

Large Intestine  
Cecum  
Appendix  
Right Ureter  
Right Reproductive Organs:  
ovary, fallopian tube, spermatic cord

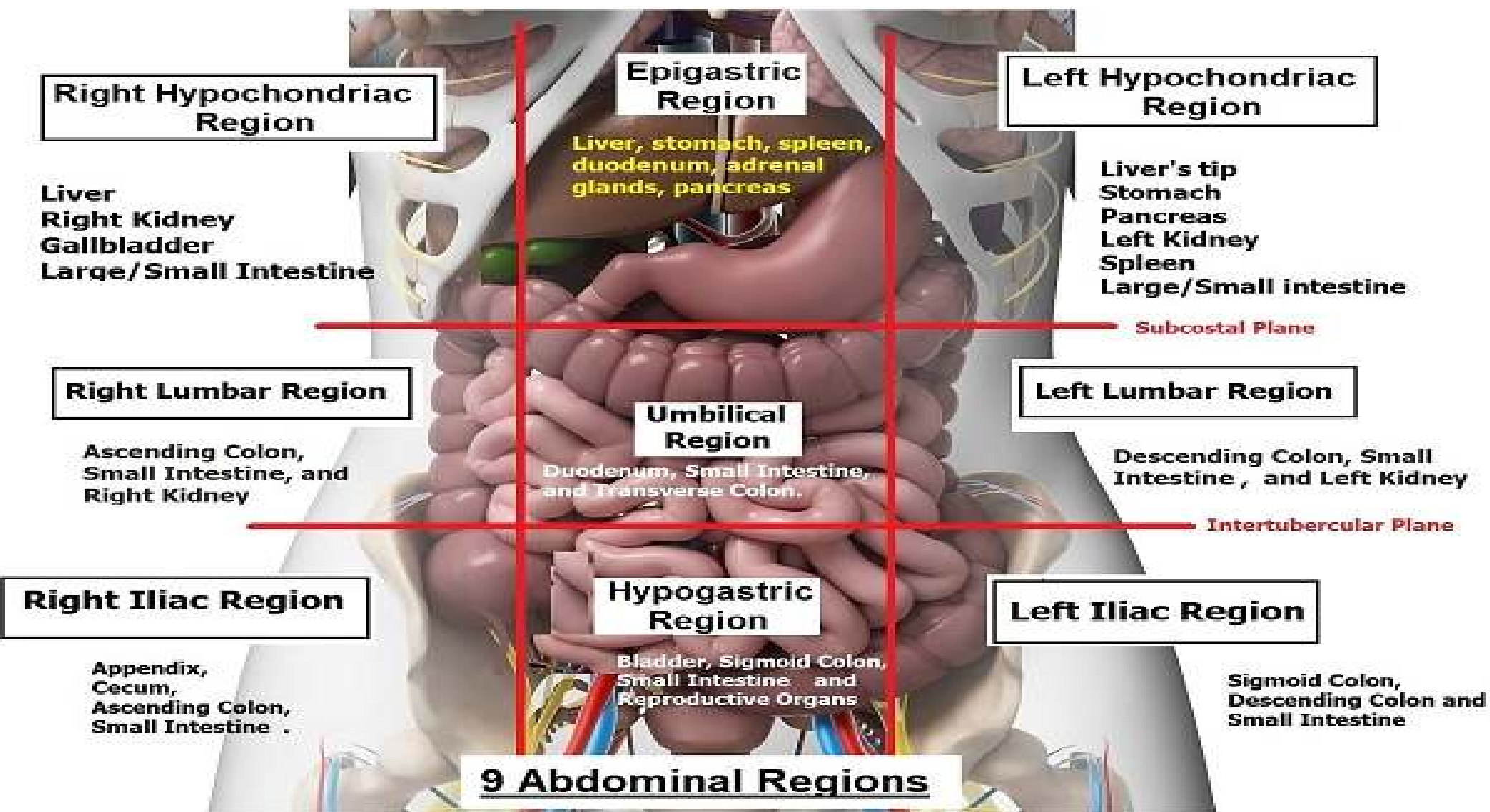
Small Intestine  
Large Intestine  
Left Ureter  
Left Reproductive Organs (fallopian  
tube, ovary, spermatic cord)  
Sigmoid Colon

**Right Lower Quadrant**

**Left Lower Quadrant**

**Median Plane**

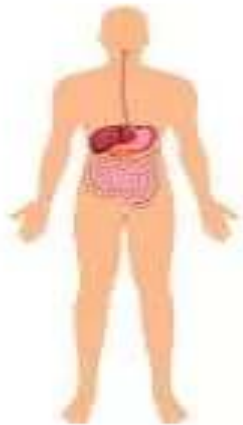




## 9 Abdominal Regions

Right Hypochondriac	Epigastric	Left Hypochondriac
Ascending Colon	Esophagus	Descending Colon
Gall Bladder	Liver	Left Kidney
Liver	Pancreas	Liver
Right Kidney	Right & Left Adrenal Glands	Pancreas
Small Intestine	Right & Left Kidneys	Small Intestine
Transverse Colon	Small Intestine	Spleen
	Spleen	Stomach
	Stomach	Transverse Colon
	Transverse Colon	
Right Lumbar	Umbilical	Left Lumbar
Ascending Colon	Cisterna chyli	Descending Colon
Gall Bladder	Pancreas	Left Kidney
Liver	Right & Left Kidneys	Small Intestine
Right Kidney	Right & Left Ureters	
Small Intestine	Small Intestine	
	Stomach	
	Transverse Colon	
Right Iliac	Hypogastric	Left Iliac
Appendix	Prostate	Left Fallopian Tube (F)
Cecum & Ascending Colon	Rectum	Left Ovary (F)
Right Fallopian Tube (F)	Right & Left Fallopian Tubes (F)	Small Intestine
Right Ovary (F)	Right & Left Ovaries (F)	Descending Colon
Small Intestine	Right & Left Ureters	Sigmoid Colon
	Seminal Vesicle (M)	
	Sigmoid Colon	
	Small Intestine	
	Urinary Bladder	
	Uterus (F)	
	Vas Deferens (M)	

# HUMAN BODY ORGAN SYSTEMS



Digestive System



Muscular System



Integumentary System



Lymphatic System



Endocrine System



Nervous System



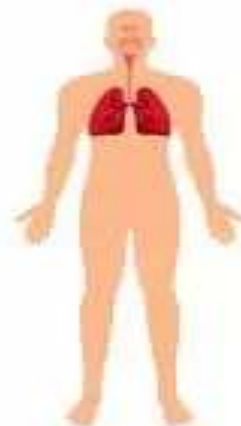
Skeletal system



Male Reproductive System



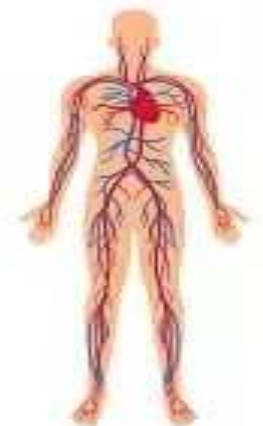
Female Reproductive System



Respiratory system

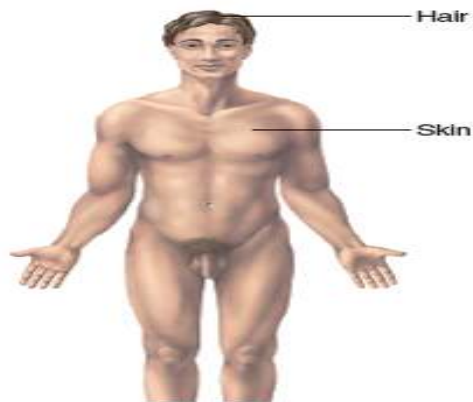


Urinary System



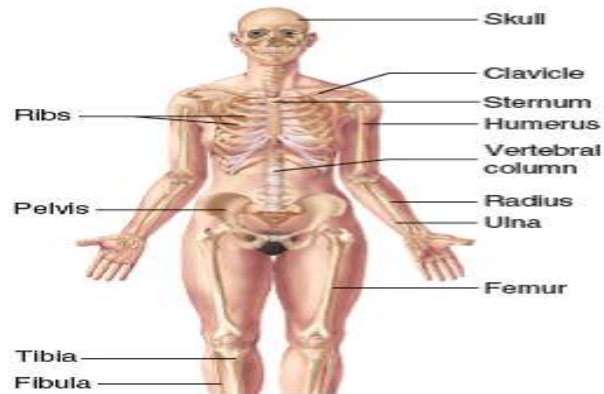
Circulatory system





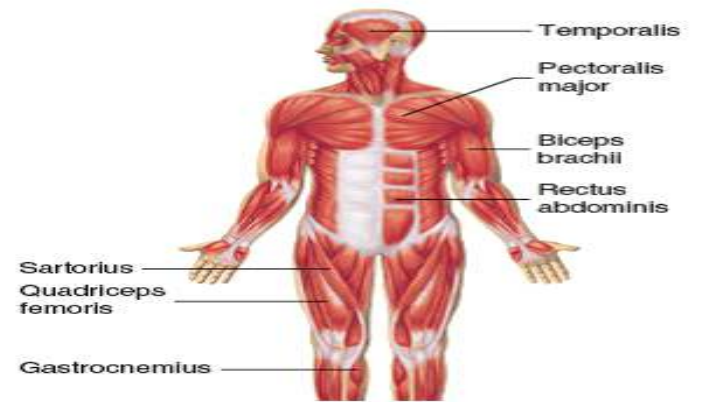
### Integumentary System

Provides protection, regulates temperature, prevents water loss, and helps produce vitamin D. Consists of skin, hair, nails, and sweat glands.



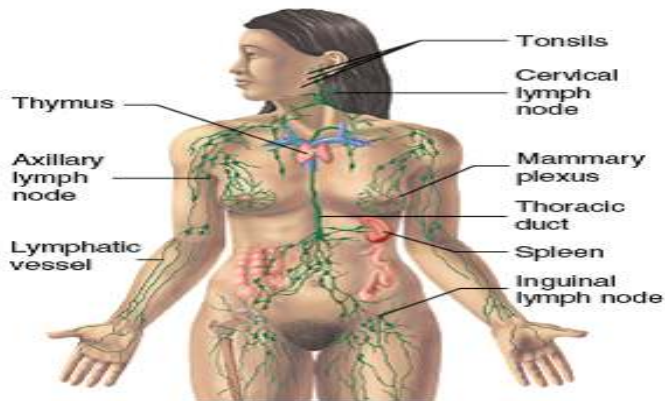
### Skeletal System

Provides protection and support, allows body movements, produces blood cells, and stores minerals and fat. Consists of bones, associated cartilages, ligaments, and joints.



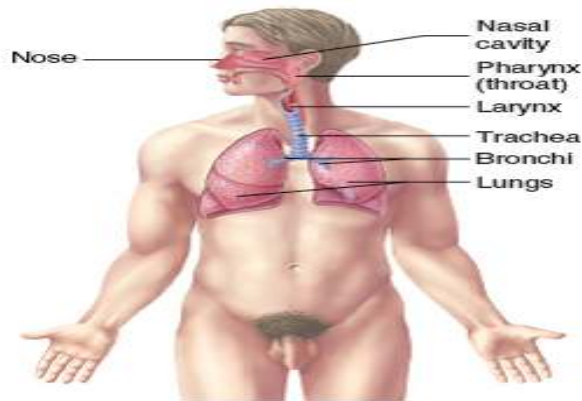
### Muscular System

Produces body movements, maintains posture, and produces body heat. Consists of muscles attached to the skeleton by tendons.



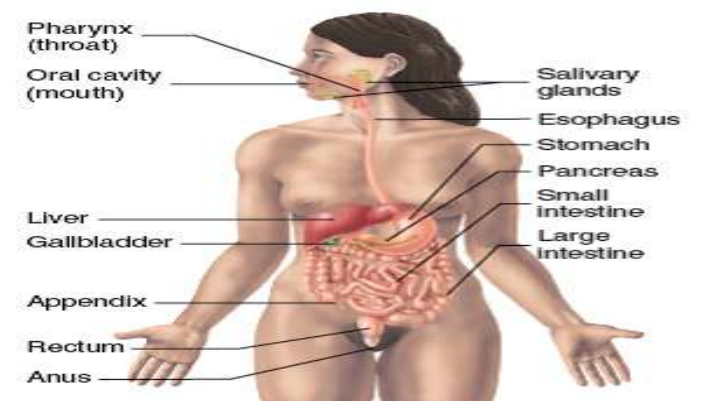
### Lymphatic System

Removes foreign substances from the blood and lymph, combats disease, maintains tissue fluid balance, and absorbs fats from the digestive tract. Consists of the lymphatic vessels, lymph nodes, and other lymphatic organs.



### Respiratory System

Exchanges oxygen and carbon dioxide between the blood and air and regulates blood pH. Consists of the lungs and respiratory passages.



### Digestive System

Performs the mechanical and chemical processes of digestion, absorption of nutrients, and elimination of wastes. Consists of the mouth, esophagus, stomach, intestines, and accessory organs.

## Systemic Anatomy

Systemic anatomy is the study of the body's organ systems that work together to carry out complex functions. The basic

systems and the field of study or treatment of each (in parentheses) are:

- **The integumentary system** (dermatology) consists of the skin (L. integumentum, a covering) and its appendages—

hair, nails, and sweat glands, for example—and the subcutaneous tissue just beneath it. The skin, an extensive sensory

organ, forms the body's outer, protective covering and container.

- **The skeletal system (osteology)** consists of bones and cartilage; it provides our basic shape and support for the

body and is what the muscular system acts on to produce movement. It also protects vital organs such as the heart, lungs, and pelvic organs.

- **The articular system (arthrology)** consists of joints and their associated ligaments, connecting the bony parts of

the skeletal system and providing the sites at which movements occur.

-

**The muscular system (myology)** consists of skeletal muscles that act (contract) to move or position parts of the Body (e.g., the bones that articulate at joints), or smooth and cardiac muscle that propels, expels, or controls the flow of fluids and contained substance.

- **The nervous system (neurology)** consists of the central nervous system (brain and spinal cord) and the peripheral nervous system (nerves and ganglia, together with their motor and sensory endings). The nervous system controls and coordinates the functions of the organ systems, enabling the body's responses to and activities within its environment. The sense organs, including the olfactory organ (sense of smell), eye or visual system (ophthalmology), ear (sense of hearing and balance—otology), and gustatory organ (sense of taste), are often considered with the nervous system in systemic anatomy.



- **The circulatory system (angiology)** consists of the cardiovascular and lymphatic systems, which function in parallel to transport the body's fluids.
- **The cardiovascular system (cardiology)** consists of the heart and blood vessels that propel and conduct blood through the body, delivering oxygen, nutrients, and hormones to cells and removing their waste products.
- **The lymphatic system** is a network of lymphatic vessels that withdraws excess tissue fluid (lymph) from the body's interstitial (intercellular) fluid compartment, filters it through lymph nodes, and returns it to the bloodstream.

- **The alimentary or digestive system (gastroenterology)** consists of the digestive tract from the mouth to the anus, with all its associated organs and glands that function in ingestion, mastication (chewing), deglutition (swallowing), digestion, and absorption of food and the elimination of the solid waste (feces) remaining after the nutrients have been absorbed.
- **The respiratory system (pulmonology) consists of the air** passages and lungs that supply oxygen to the blood for cellular respiration and eliminate carbon dioxide from it. The Diaphragm and larynx control the flow of air through the system, which may also produce tone in the larynx that is further modified by the tongue, teeth, and lips into speech.
- **The urinary system (urology) consists of the kidneys,** ureters, urinary bladder, and urethra, which filter blood and subsequently produce, transport, store, and intermittently excrete urine (liquid waste).
- **The genital (reproductive) system (gynecology for females; andrology for males)** consists of the gonads (ovaries and testes) that produce oocytes (eggs) and sperms, the ducts that transport them, and the genitalia that enable their union. After conception, the female reproductive tract nourishes and delivers the fetus.

- **The endocrine system (endocrinology) consists of specialized** structures that secrete hormones, including discrete ductless endocrine glands (such as the thyroid gland), isolated and clustered cells of the gut and blood vessel walls, and specialized nerve endings.

**Hormones** are organic molecules that are carried by the circulatory system to distant effector cells in all parts of the body. The influence of the endocrine system is thus as broadly distributed as that of the nervous system. Hormones influence metabolism and other processes, such as the menstrual cycle, pregnancy, and parturition (giving birth).