Readings

VLAJ0121 ANGLIČTINA 1

1. HUMAN ANATOMY

1. The human body is a remarkably complex and efficient machine. It takes in and absorbs oxygen through the respiratory system. Then the oxygen-enriched blood is distributed through the cardiovascular system to all tissues. The digestive system converts digestible food to energy and disposes of the rest. The musculoskeletal system gives form to the body. And covering almost the entire mass is the skin, the largest organ of the body. The science of the structure of this complicated "machine" is called ***anatomy***.

2. One of the major systems is the **musculoskeletal system**. The body is supported and given shape by this structure, it consists of more than 200 bones and the muscles and **tendons** which are connected to them. Bones are strong and can bend at their **joints**. They also serve as a shield, protecting the vital internal organs from injury.

3. **Bones** are as strong as steel but much lighter and more flexible. They are composed of minerals, organic matter, and water, held together by a cement-like substance called **collagen**, and are filled with red and yellow **bone marrow**. The red marrow produces the red blood cells used throughout the body to transport oxygen, while the yellow marrow consists primarily of fat cells. A tough membrane called the **periosteum** covers most of the bone surface and allows bones to be nourished by blood.

4. A major bone structure in the body is the **vertebral (spinal) column**. It runs up and down the back and protects the **spinal cord**, where many of the major nerves are located. It is composed of bony **vertebrae** which are held together by ligaments of connective tissue and separated from each other by spinal **discs**. At the top of the vertebral column, there is the **skull**, which surrounds and protects the brain. Twelve pairs of **ribs**, comprising the **rib cage,** are attached to the vertebral column below the neck. At the bottom is the **sacrum**, which connects the vertebral column to the **pelvis**. Bones are united by joints and held together by **ligaments**.

5. **Muscles** are special fibrous tissues found throughout the body. They control movement and many organic functions by contracting in response to nerve signals. Skeletal muscles are called **voluntary** because they can be consciously controlled. They are attached to bones by tough fibrous tissues called tendons. Other muscles, such as the stomach muscles and the heart, are **involuntary** and are operated automatically by the central nervous system

6. When a muscle becomes fatigued, it sometimes contracts violently and painfully. This condition is known as **cramping**. Too much strenuous activity may produce a **strain**.

7. The most important muscle in the body is the **heart**. Without the heart and its **cardiovascular (circulatory) system**, human life would not be possible. The heart is roughly the size of a **fist**. It contracts at an average rate of 72 times per minute or nearly 38,000,000 times in a year. These rhythmic contractions are called the **pulse rate** and can be felt in the radial artery of the **wrist**.

8. The human heart consists of four chambers, two **atria** (or auricles) and two **ventricles.** Each is made up of several **layers** of cardiac muscle arranged in circles and spirals. During the contraction phase, called the ***systole,*** oxygenated blood is pumped out of the left ventricle into the **aorta** and from there through the arteries to all organs of the body. Carbon dioxide, a **waste product** of this process, is collected in the blood. The blood is passed back to the right atrium through the veins and the *vena cava* during the ***diastole*** (or relaxation) period of the heart. From there, it is pumped into the right ventricle and to the pulmonary artery to be sent to the lungs, where carbon dioxide is removed and oxygen is added.

9. The rest of the system consists of **arterioles** (small arteries), **venules** (small veins), and capillaries, the smallest of blood vessels. In total, there are more than 70,000 miles of blood vessels in the human body!

10. The cardiovascular system also carries **hormones** which are secreted by **glands** of the **endocrine system** directly into the bloodstream. These hormones control many functions of the body. The **thyroid gland**, for example, secretes thyroxin, which controls the rate at which energy is produced (the metabolic rate).

11. The blood is made up of two parts - plasma and **blood cells**. The plasma is a clear, yellowish liquid which transports the 25 trillion red blood cells (**erythrocytes**) and the many fewer white cells (**leukocytes**). The red cells carry the protein **hemoglobin**, which carries oxygen to the body cells. The white cells are important in fighting disease. **Platelets** (thrombocytes) in the blood permit clotting to take place at the site of a wound, thus preventing excessive bleeding.

12. The **respiratory system** starts at the nasal passages (nose), where air is breathed in during inspiration. There the air is filtered and its temperature regulated. It then passes through the **larynx** (voice box) and **trachea** (windpipe) into the **bronchi** and **bronchioles**, and ends in little air pockets called ***alveoli*** within the **lungs**. The used blood is cleansed of carbon dioxide, which is expelled in the process known as *expiration.* The cleansed blood is then oxygenated and redistributed along the circulatory system. The entire process is called ***respiration*** and occurs at the rate of about 16 to 20 times per minute.

13. The largest organ in the body is the outer covering called **skin** plus its associated structures (hair, **nails**, **sebaceous** and **sweat glands**, and specialized sensory receptors that enable the body to be aware of touch, cold, heat, pain, and pressure. They altogether make up the **integumentary system**. Skin protects the body from microbes and other impurities, prevents the loss of body fluids, and regulates body temperature. Three layers of tissue make up the skin - the **epidermis**, the **dermis**, and the **subcutis** (subcutaneous layer). The epidermis is in constant growth, with its outer layer of dead cells continuously being replaced as new cells are formed in the lower layer. Hair, fingernails, and toenails are specialized forms of epidermis. The coloring pigment called *melanin* is also found in the epidermis. The middle layer (or dermis) is the location for two main types of glands: sweat glands and oil glands. The innermost subcutis contains fat cells, blood vessels, and nerves.

14. Another major body complex is the **digestive system**, which processes the food so that it can be used for energy. The process begins in the **mouth**, where food is chewed by the teeth. In the mouth **saliva**, excreted by the salivary glands, provides enzymes that help to break down the food's carbohydrates.

15. After food has been chewed, it passes through the esophagus in the **stomach**. Peristaltic movements in the walls of the **esophagus** help push the food along the **alimentary canal**. The muscular walls of the stomach continue the mixing process while secreting hydrochloric **acid** from 35,000,000 glands in the stomach lining. After 30 minutes to three hours the stomach, the food is converted into a semiliquid state and passes into **small intestine**, a tube about 20 feet long located in the lower abdomen. Here, enzymes from pancreatic fluid and **bile** from the **liver** complete digestive process. Nutrients are absorbed into the blood through the **villi** which line the walls of the digestive organs. These nutrients are either used maintaining the body or are burned for energy. What cannot be absorbed passed out through the **large intestine** as **feces**.

16. Liquid wastes are eliminated through the **urinary system**. They are picked up by the blood and removed by the **kidneys**. From there they pass through the **ureter**, **bladder**, and **urethra**, and are excreted from the body as urine. Closely associated with the urinary system is the **reproductive system**, by which human life is carried on to future generations. Sperms are produced in the **testicles** of the male. The **fertilization** of the female's ovum (egg) by male's sperm is called **conception**. It usually occurs in one of the **fallopian tubes**, which the sperm reaches through active movement from the place deposition. Normally, the fertilized egg then travels to the **uterus** where it becomes an **embryo**, is implanted, and develops for about 280 days (until the childbirth).

17. The **nervous system** controls all other systems and bodily moments. Nerves carry sensory impulses to the central nervous system and motor impulses from the central nervous system. Motor impulses control muscles. Sensory impulses affect the senses that enable human beings to feel, see, taste, and so forth.

18. The nervous system is divided into the **central nervous system** (the brain and spinal cord) and the **peripheral nervous system,** which consists of the nerves that connect muscles and sensory organs with the central nervous system. The central nervous system is responsible for sending impulses to the voluntary muscles. The autonomic system, a part of the peripheral nervous system, regulates the involuntary muscles and organs.

19. The **brain** is not only the most important component of the nervous system; it is also the controlled of all bodily activities, thoughts, and emotions. It is composed of the **pons, medulla oblongata, cerebellum, a cerebrum**. The cerebellum is the area of the brain that coordinates the voluntary muscles; the medulla oblongata controls the involuntary muscles; the pons is where many important nerves originate.

20. It is the **cerebrum** that gives humans their ability to think, remember, and conceptualize. It is divided vertically into two halves known as the left and right **hemispheres**. The left hemisphere processes verbal functions, while the right hemisphere is involved in nonverbal activities and is the seat of human creativity. Many scientists believe that, in each individual, one of the two hemispheres is dominant.

21. It is amazing how well each system functions and coordinates with other systems to enable humans to live, reproduce, and create.

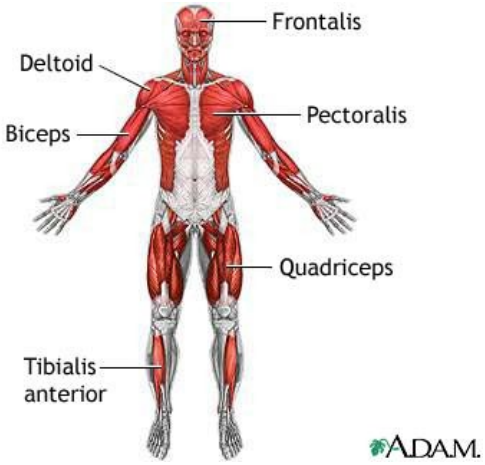
Questions:

Give names of all the systems in human body.
Explain the terms cramps and strain.
What are some important functions of the skin?
Which tissue enables the body to move?
Which vessels carry blood to the heart, and which carry it away?
What does a gland do?
What is the difference between and endocrine and exocrine gland?
Which system controls breathing? What are its organs?
Which system contains the genital organs?
What is conception?
What do we call the tissue that connects muscle to bone?

2A. MUSCULAR SYSTEM

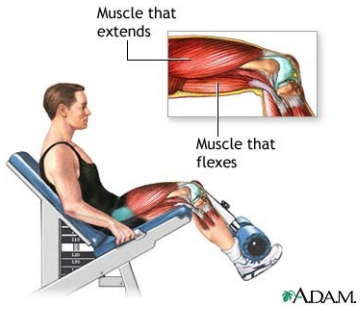
Skeletal Muscles

There are over 600 **skeletal muscles** that serve for **body movement** through **contraction** and **relaxation**. These muscles are **voluntary** (under conscious control), made up of **striated muscle fibres** (of two types: fast-twitch and slow-twitch), and attached to bones by **tendons**.



The kinds of body movement include **locomotion**, **facial expressions**, **posture**, and other movements. Skeletal muscles also have **muscle tone** (partial contraction), maintained by ongoing signals from the nervous system, which helps maintain body posture and readiness for physical activity. Muscles account for approximately 40 per cent of body weight and the metabolism that occurs in this large mass produces the heat that is essential to the maintenance of body temperature.

Skeletal muscles form largely a system of pairs of muscles that contract and relax to move or bend a joint. For instance, when the anterior thigh muscle (the **quadriceps**) contracts, the knee straightens whilst the posterior thigh muscle (the **biceps**) relaxes. In this instance, the quadriceps of the thigh is referred to as the **agonist** (or prime mover), i.e. the muscle in state of contraction producing the prime, first motion. To bend the knee back again and return it to its original bent position, the biceps of the thigh contracts (pulls) whilst the quadriceps relaxes. Then, the contracting biceps is termed the **antagonist** as it produces the opposing motion. Similar opposition is found in the upper arm between the biceps and the triceps (they bend the elbow joint). There are also **synergists**, muscles that help other skeletal muscles in their actions, and **fixators**, muscles that stabilise, or fix, ends of other muscles. Some skeletal muscles are also classified for their ability to straighten (**extend**) or bend (**flex**) joints, and thus whole limbs, as **extensors** and **flexors**, respectively.



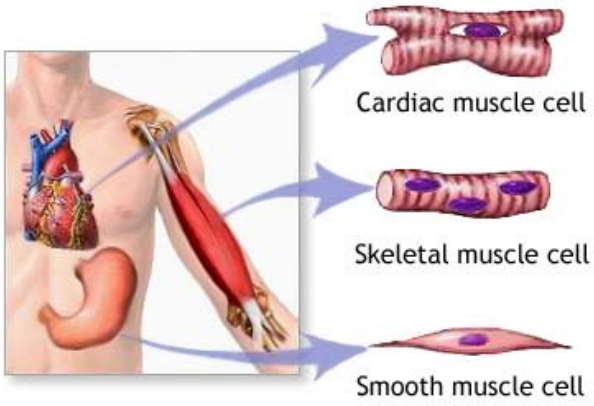
The Cardiac Muscle

The cardiac muscle (or **myocardium**, the middle muscular layer of the heart) is found only in the heart and it forms the **atria** (sing. atrium) and **ventricles**, i.e. the walls of the organ. Like the

skeletal muscles, the cardiac muscle contains **striated fibres**, but unlike the skeletal muscles it is **involuntary** (not under conscious control). The muscle cells of the myocardium maintain a consistent **heartbeat** (or **heart rate**). The heart rate as observed in the arteries of the body is termed **pulse rate**, and it is recorded as the number of **beats per minute**.

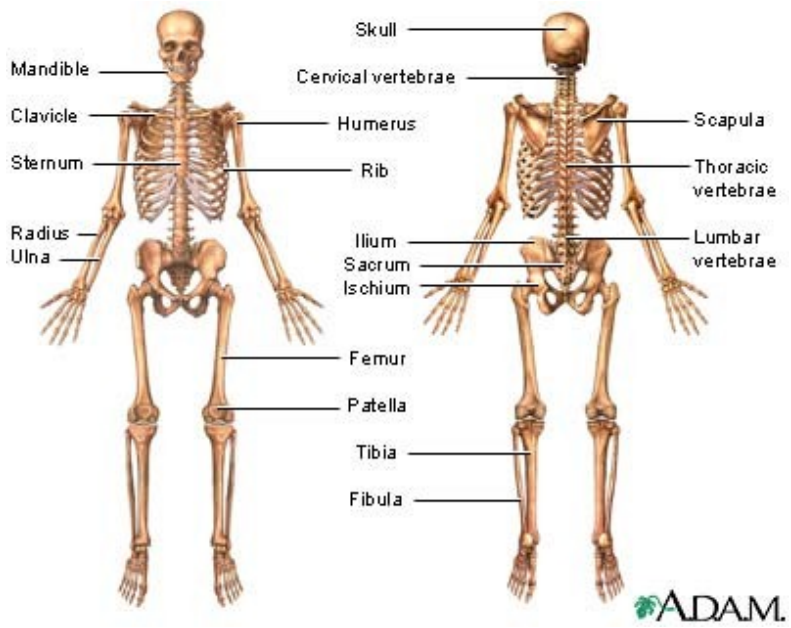
Smooth Muscles

Smooth muscles are found throughout the body: in **internal organs**, **blood vessels**, and various **glands**. Similarly to the cardiac muscle, smooth muscles are **involuntary**, but in contrast to skeletal muscles and the cardiac muscle, they are not striated (or **nonstriated**). Smooth muscles within the walls of the digestive tract organs cause **peristalsis** (or vermiculation) which is the wave-like, worm-like movement of the intestine consisting of alternate circular contractions that aids in intestinal digestion and transport of food. Other examples of involuntary activities of smooth muscles are constriction (closing) of the bronchioles, pupils of the eye or skin contraction in cold conditions (called colloquially **gooseflesh** or **goose pimples**; also goose bumps in American English).



2B. SKELETAL SYSTEM

This system has circa **206 bones**, plus associated structures like **tendons** and **ligaments**, and it serves many important functions. Since bones are rigid, they support the body, give it its shape, and protect its vital organs against injury. Bones provide points for **muscle attachments**, and, together with the movable **joints**, they form a system of levers upon which muscles act to produce contraction and thus body movement. A joint is a place where bones meet, or articulate. Bones also function as a site for **mineral storage** (mainly **calcium** and **phosphorus**) and blood cell formation (**haematopoiesis**). Tendons and ligaments are strong bands of fibrous **connective tissue** that attach, or link, muscles to bones (tendons), and bones to bones (ligaments).

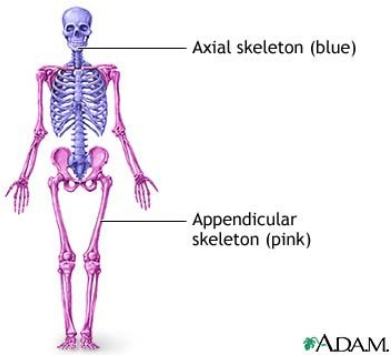


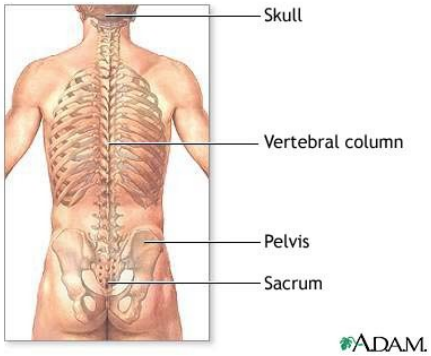
Skeleton

The skeleton has two parts: the **axial** skeleton and the **appendicular** skeleton.

The axial skeleton includes the **skull**, the **hyoid bone**, the **vertebral column**, and the **thorax**. Its components are aligned along the axis of the body.

The appendicular skeleton includes the bones of the **upper** and **lower extremities** (or **limbs**), the **pectoral** (or **shoulder**) **girdle**, and the **pelvic** (or **hip**) **girdle**. Its components are outside the body main axis.

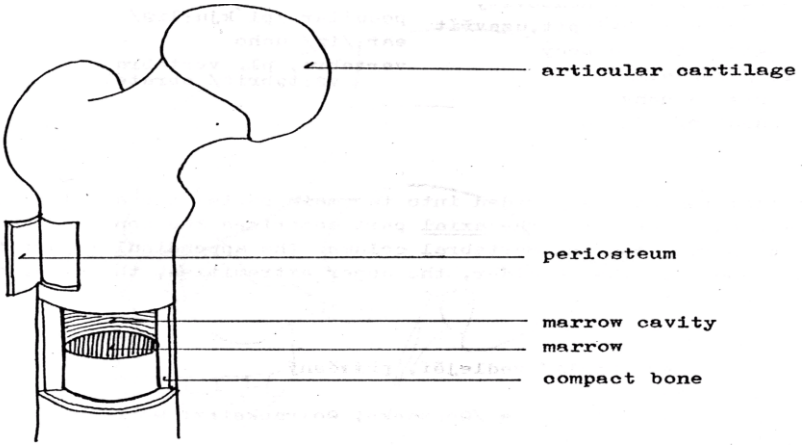




Bones

There are four main categories of bones: **long**, **short**, **flat** and **irregular**.

Long bones form the extremities (**arms** and **hands**, **legs** and **feet**) and consist of a **diaphysis**, two bulbous **epiphyses** (sing. epiphysis), **articular cartilage** and **periosteum**. Periosteum is a dense fibrous membrane of connective tissue covering the surface of bones (except at the joint ends where the bone is covered by cartilage) that contains numerous blood and lymph vessels, and nerves. Dense and hard **compact bone** is the main building material of long bones and in their hollow centre they contain **yellow bone marrow**. The epiphyses are mostly formed by **spongy**, or **cancellous**, bone material.



Short bones are of irregular, cubic shape and they are found in the wrists and ankles of the upper and lower limbs, respectively. Their core is typically made up of spongy bone.

Flat bones provide broad surfaces for attachment of muscles and protection for internal organs. Examples of flat bones are bones of the skull, ribs, shoulder blades, the breastbone and pelvis.

Irregular bones are all the others; for instance vertebrae (bones of the spine), and bones of the ear and face. They are of various shapes and sizes.

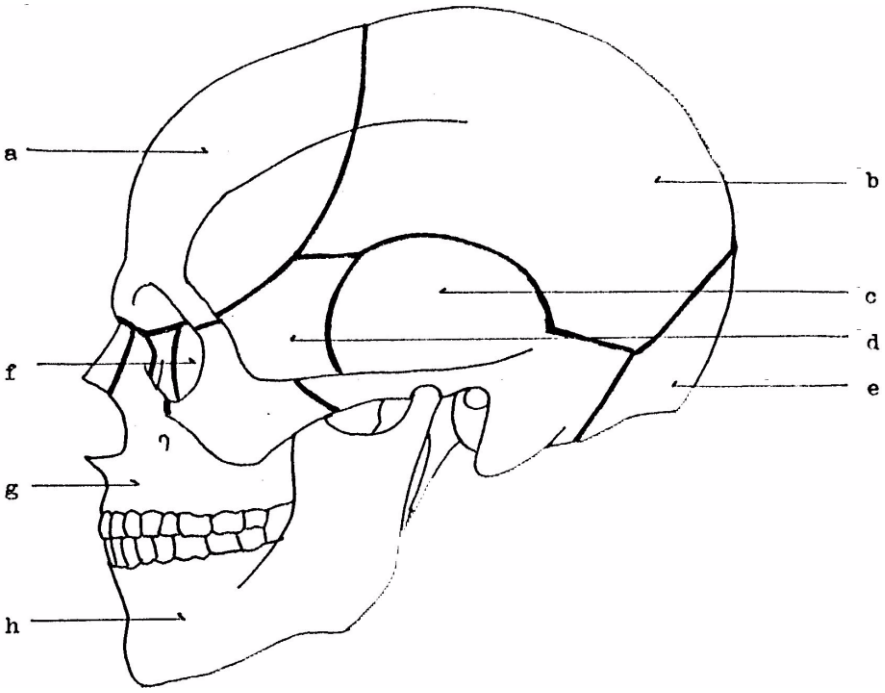
The cavities of the spongy bone in some flat and irregular bones contain **red bone marrow**, a kind of connective tissue in which blood cells are produced.

Ossification is the medical term for bone growth. Bone is a living tissue that is being renewed throughout life and three types of bone cells participate in this process: **osteoblasts** (bone-building cells), **osteocytes** (mature bone cells), and **osteoclasts** (bone-destroying cells).

The Skull

The skull (or **cranium**) is the bony framework of the head. Bones of the skull comprise **cranial bones** and **facial bones**. Cranial bones are flat, rounded (curved), and fused together to protect the brain which is situated in the **brain case** (or cranium in its restricted sense). The six cranial bones are the **frontal** (a), **parietal** (b), **temporal** (c), **sphenoid** (d), **occipital** (e), and **ethmoid** (f). These bones meet at zigzag lines called **sutures** which are in fact immoveable joints.

Of the bones of the face, the upper jaw (or **maxilla**; g), the lower jaw (or **mandible**; h), the **zygomatic bone** (or cheek bone), and the **nasal bone** are the most prominent. The maxilla, zygomatic and nasal bones are two in number (right and left), and the mandible is the only separate and moveable bone of the skull. Besides the brain case, a number of other cavities are found in the skull: **eye-sockets** (or **orbits**), the **nasal cavity**, and **sinuses**.



The Vertebral Column

The vertebral column (also called spinal column, spine, or backbone) is composed of 33 **vertebrae** (sing. vertebra). Its main function is the support of the skull and **trunk** (or **torso**) and protection of the **spinal cord** (or chord) located in the **spinal canal**. The spine also provides attachment sites for the ribs, and muscles of the trunk. In adults, three groups of vertebrae and two sets of fused bones form the backbone: seven **cervical** (neck) vertebrae, twelve **thoracic** (upper back) vertebrae, and five **lumbar** (lower back) vertebrae. Five (or sometimes four) fused vertebrae form the **sacrum** (sacral vertebrae) and from three to five fused small vertebrae form the **coccyx** (or tail bone; coccygeal vertebrae). The first cervical vertebra that articulates with the skull is called the **atlas**, the second cervical vertebra is called the **axis**. The atlas allows the head to nod, the axis allows it turn.

A typical vertebra consists of a **body**, **arch** and **processes** (or **projections**). The prominent upward projection of the axis is called the odontoid process due to its toothlike shape. The 26 moveable vertebrae are separated by **intervertebral discs** which function as shock absorbers.

These discs contain a lot of water the content of which decreases with age, resulting in loss of height.

Looking at it from the side, the backbone has the form of a long S: there are four curves and two basic types of curvature. The congenital (inborn) backward (posterior) **curvature** of the thoracic and sacral spine is called **kyphosis**, whilst the natural forward (anterior) curvature affecting the cervical and lumbar spine develops during infancy and childhood, respectively; it is called **lordosis**. **Scoliosis** – one or more lateral curves of the spinal column – may also occur.

The Thorax

The thorax (or **rib cage**) is primarily built up of twelve pairs of **ribs** that articulate with the thoracic vertebrae posteriorly and the **sternum** (or **breast bone**) anteriorly. The 24 ribs are long, flat, curved bones that form, together with the sternum and thoracic vertebrae, a protective cage for the heart, lungs, and other internal organs. They give the chest its shape. There are three kinds of ribs: **true ribs** are the upper seven pairs; they attach directly to the breast bone. **False ribs** (the next three pairs below) are only indirectly attached to the sternum; in fact, they are interconnected by their common cartilage (called **costal**) and attached to the lowest pair of true ribs. The last two pairs of ribs are called **floating ribs**, as they are not connected to either the sternum or other ribs in front. The spaces between the ribs (**intercostal spaces**) are filled with muscles that help you breathe.

The Upper Extremities

The upper limbs are a part of the appendicular skeleton. They are attached to the axial skeleton by the pectoral girdle on each side, the bones of which include two **scapulae** (or **shoulder blades**; sing. scapula) and two **clavicles** (or **collar bones**). The scapula is located in the upper back and articulates with it by muscles and with the humerus in the **shoulder joint**. The clavicle is connected to the sternum and the whole shoulder girdle is fixed by muscles.

Beginning in the shoulder joint, the (**upper**) **arm** (or **brachium**) extends down to the **elbow** joint and is formed by a long single bone called the **humerus**. The upper epiphysis, or end, of the humerus is characterised by its hemispherical smooth **joint head**, fitting in the shoulder **joint socket**. The **forearm** begins at the elbow. The forearm is composed of two long bones, the **radius** on the thumb side, and the **ulna** on the little finger side.

The forearm articulates with the **hand** at the **wrist** (or **carpus**). The wrist consists of eight small bones arranged in two irregular rows called **carpal bones** (or just **carpals**). They are tightly bound together by ligaments. The five **metacarpal bones** (or just **metacarpals**) that form the framework of the palm project from the carpus. The bones of the **fingers** are referred to as

phalanges (sing. phalanx). They articulate directly with the metacarpals and are three in number in each of the fingers, and two in the **thumb**. The individual names of the fingers are as follows: **forefinger** (or **index finger**), **middle finger**, **ring finger**, and **little finger** (or **pinkie**).

The Lower Extremities

The lower limbs, appendages of the axial skeleton, are attached to the trunk by the pelvic girdle. It is composed of two **coxal** (or **hip**) **bones** (also called **coxae**, sing. coxa, or **innominate bones**). In adults, each of the coxae consists of three fused bones: the **pubis** (or **pubic bone**), **ilium** and **ischium**. Together with the **sacrum** (pl. sacra) and **coccyx** (pl. coccyges), segments of the vertebral column, the coxal bones form the **pelvis** (pl. pelves). The pelvis is a bowl-shaped 'basin' of bones, broader in women, that protects and supports many internal, abdominal organs (or viscera, sing. viscus), and the spinal column.

The pelvic girdle articulates with the **femora** (sing. femur), or **thigh bones**, at the **hip joint**. The thigh bone is the longest, strongest and heaviest bone in the body, and one of the 30 bones that constitute a leg (an arm also consists of 30 bones), or lower extremity. The **thigh** (or upper leg) is the region of a leg above the **knee** (or knee joint), below the knee there is the **shin** (the anterior portion) and **calf** (pl. calves; the posterior portion). The framework of the lower leg is formed by the **tibia** (or **shin bone**) in front, and the **fibula** at the back. These two long bones articulate with the thigh bone at the knee which is protected anteriorly by the **patella** (or **knee-cap**).

The **feet** (sing. **foot**) extend from the **ankle** downwards, so they are the inferior ends of the lower limbs. They bear the whole weight of the body and the strength of the foot bones corresponds to that fact. The seven **tarsal bones** (or just **tarsals**) are the bones of the ankle and the proximal region of the foot (they are the equivalent of the carpals in the hand). Amongst these, the **calcaneus** (pl. calcanei), or heel bone, and the **talus** (pl. tali), or ankle bone, are the largest and most prominent. The tarsal bones together with the **metatarsal bones** (or just **metatarsals**) form the **instep**, or the major arch of the foot; the bottom of the foot is called the **sole**. The **toes**, like the fingers of the hand, consist of bones called phalanges. The **big toe** has only two of them.

3. DISORDERS OF THE SKELETAL SYSTEM

The skeletal system is constructed to **withstand** the pressures and stresses of daily activities, protecting the body's delicate inner organs in the process. Sometimes, however, the system can be stressed beyond its capacity and injuries can **result**.

A common but serious skeletal injury is a **fracture**, a complete or incomplete break in a bone. A fracture usually occurs when excessive force is applied in some manner to the bone. Sports activities such as football, skiing, and skating often **jeopardize** (pose a threat to) the bones, putting them at risk for fractures. Car accidents and falls also **take their toll** on bones. As an individual ages, the bones become thin and weak, and fractures **occur** more easily. Some common kinds of fractures include:
comminuted - bone has been broken into many fragments,
compound - bone has been broken and an end or ends of the bone **protrude** through the skin, nowadays it is often **referred to as** an open fracture;
compression - bone has been **crushed**;
greenstick - bone has not been broken completely, but only partly across its shaft, similar to the way a green stick or twig breaks, nowadays it is often referred to as an incomplete fracture;
impacted - bone has been broken and a fragment of the bone has been firmly driven into another fragment;
simple - bone has been broken cleanly and does not penetrate or break the skin, nowadays often referred to as a closed fracture.
When excessive force is applied to a joint, the ligaments that hold the bones together in the area may be **torn** or damaged. This results in a **sprain**. Its seriousness depends on how badly the ligaments are torn. Any joint can be sprained (**twisted**), but the most frequently injured joints are the ankle, knee, and finger.

A violent movement at a joint may also cause a **dislocation**, a condition in which a bone is forced out of its normal position in the joint cavity. When a bone is dislocated, its ligaments are often torn or overstretched in the process. Nerves in the area may also be **pinched**, causing pain. In a severe dislocation, small chips of bone may be torn away.

A **herniated** or "slipped" disc occurs when any direct and forceful pressure is applied to a vertebral disc (such as when lifting a heavy object), causing it to rupture. This most often occurs to a disc in the lumbar region of the vertebral column. When the disc is ruptured, pressure is placed on the spinal cord, causing considerable pain and damage to the nerve.

The following are just a few of the more serious disorders and diseases that can **impair** the functioning of the skeletal system or its parts.

Arthritis is a general term meaning an **inflammation** of a bone joint. Since the areas most commonly involved are the hands, arms, shoulders, hips, and legs, any action requiring movement of these parts becomes difficult. Arthritis is usually a chronic condition, meaning it **persists** throughout a person's life. In all its forms, arthritis is the most **widespread**, crippling disease in the United States.

Osteoarthritis occurs as a result of aging or injury. It is characterized by **deterioration** of the cartilage covering the bones in the joints of the body. It is most often seen in people who are forty years of age or older. Causes of osteoarthritis include **wear and tear** due to aging or overuse, injury, **hereditary factors**, and obesity. The wearing away of the **cartilage** results in the bones rubbing against each other, causing among others the deep joint pain characteristic of this disease. The joints most commonly **affected by** osteoarthritis are those of the knees, hips, and fingers. Other areas can be affected by injury or overuse. The condition can cause minor **stiffness** and pain, or it can result in severe disability. Treatment of osteoarthritis includes the use of anti-inflammatory drugs such as aspirin to reduce pain and **swelling**; supportive devices such as a **brace**, walker, or **crutches**; massage; moist heat; and rest.

Osteoporosis (which literally means "porous bones") occurs when a body's blood **calcium level** is low and calcium from bones is **dissolved** into the blood to maintain a proper balance. Over time, bone mass and bone strength **decrease**. As a result, bones become dotted with pores. Weak and fragile, they break easily. Even a **sneeze** or a sudden movement can cause a fracture in someone with severe osteoporosis. There is **no cure** for osteoporosis, but drugs are available that stop further bone loss and even help build new bone tissue. For some people, though, these drugs may not help build enough bone to replace that already lost in the body. The best way to prevent osteoporosis is to **maintain** a healthy lifestyle throughout one's life: **adhering to** a diet with the proper amounts of calcium and vitamin D, **avoiding** smoking and heavy alcohol drinking, and exercising regularly.

Scoliosis is a sideways **curvature** of the spine or vertebral column. Normally, the spine has a set of front-to-back curves. When viewed from rear, a normal spine usually appears straight.

A small degree of lateral (sideways) curvature in the spine does not cause any medical problems, but larger lateral curves can cause imbalance and **lead to** muscle fatigue and pain. More severe scoliosis can **interfere with** breathing and lead to arthritis of the spine.

Treatment for scoliosis **depends on** the degree of curvature. If the curvature is moderate, a **brace** may be worn. Bracing cannot correct curvature, but may be effective in halting or slowing the **progression** of the curve. Surgery is often required if the curvature is severe, if the curve has progressed despite bracing, or if there is significant pain. During surgery, the spine is straightened as much as possible, then vertebrae are **fused together** to prevent further curvature. Spinal fusion leaves the involved area of the vertebral column permanently stiff.

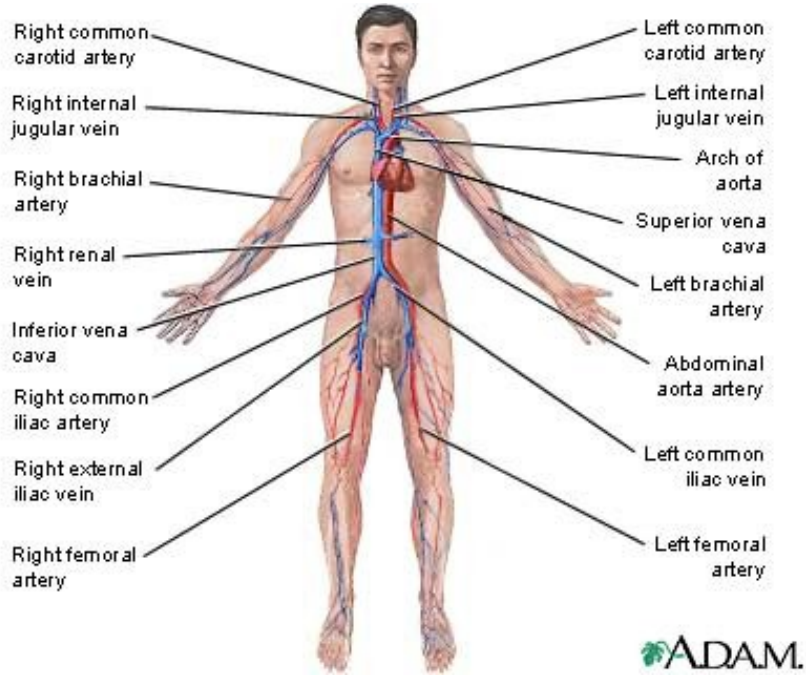
Spina bifida

Spina bifida is the common name for a range of **birth defects** caused by problems with the early development of the vertebral column or spine. The main defect of spina bifida is an abnormal opening somewhere along the vertebral column due to a failure of the vertebrae to **wrap** completely **around** the **spinal cord**. This leaves the spinal cord unprotected and vulnerable to either injury or infection.

Treatment for spinal bifida is aimed first at surgically closing the spinal defect to prevent infection. Further operations are often necessary to repair the hip dislocations, scoliosis, or other conditions. The success of treatments is still dependent on the severity of the original spinal defect.

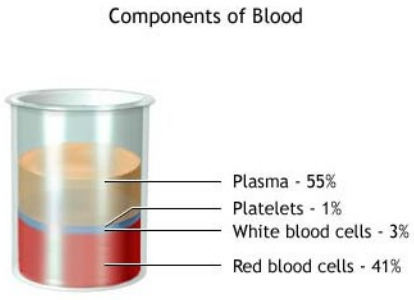
4. CARDIOVASCULAR SYSTEM

Good Cardiovascular health is important in **maintaining** overall health and wellness. Cardiovascular Health is a new section, which will teach you how your heart and cardiovascular system work when healthy, and what happens when diseased. We will also explore disease **prevention**, therapeutic drug treatment, minimally invasive surgical procedures and open surgical procedures for treating diseases, which **affect** the heart and cardiovascular system.



The main role of the cardiovascular system in the body is to transport oxygen to all **tissues** in the body and to remove, from these same tissues, metabolic waste products. The system itself consists of the blood, the medium for exchanging oxygen, **nutrients** and waste products throughout the body, the blood vessels, the pipes through which the blood flows and the heart, the pump which forces blood to flow through the blood vessels. First, let's take a closer look at the components of blood.

Components of Blood

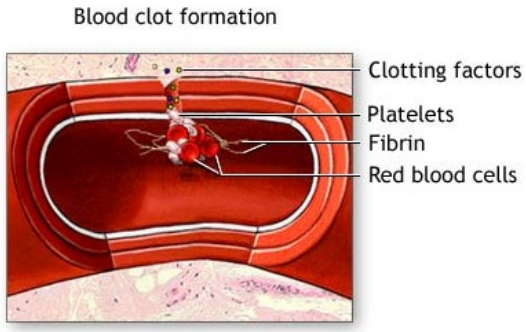


The average adult has between 5 to 6 litres of blood or blood volume. The blood carries oxygen and essential nutrients to all of the living cells in the body, and also transports waste products to systems that eliminate them. Most of the blood is made up of a watery, protein-laden **fluid** called plasma. A little less than half of this blood volume is composed of red and white blood cells (erythrocytes and leukocytes respectively), and other solid elements called **platelets** (thrombocytes).

Platelets are responsible for **coagulation** of blood at the point of an injury to a blood vessel. Without platelets, our blood would not be able to **clot** and **haemorrhaging** (uncontrolled bleeding) would result. **Haemophilia** is a genetic condition which results in individuals with no ability to clot. Also called bleeders, these individuals must periodically administer a clotting factor to their blood to prevent the constant bleeding which occurs.

How Blood Clots

Let's examine how platelets work to form clots. Here's a cut section of a small artery. The traffic going by includes red blood cells carrying oxygen; platelets, which come from white blood cell fragments; and clotting factors, which help the blood to clot. When a blood vessel becomes damaged, as shown here, the blood cells and plasma begin oozing out into the surrounding tissue.



This begins the clotting process. Platelets immediately begin to adhere to the cut edges of the artery; they release chemicals to attract even more platelets. Eventually a platelet plug is formed, and the external bleeding stops.

Inside, the clotting factors take a much more active role by creating a cascade of clotting activity. The clotting factors cause strands of blood-borne material, called **fibrin**, to stick together and seal the inside of the **wound**. Eventually, the cut blood vessel heals, and the blood clot **dissolves** after several days.

While platelets play an important role in clotting, red blood cells carry on the important job of carrying oxygen and other nutrients to all the tissues of the body and carrying waste products to the organs which remove them from the body.

How Red Blood Cells Carry Oxygen

Red blood cells are the oxygen carriers. As they travel away from the heart, they traverse smaller and smaller arteries, finally arriving at the collections of microscopic blood vessels known as capillaries. Here, they exchange nutrients and oxygen for cellular waste products. The waste products are eventually eliminated from the blood stream through the urinary and respiratory systems.

The exchange of oxygen and nutrients between the red blood cells and the surrounding tissues occurs through a process called **diffusion**. In diffusion, when capillaries contain a high concentration of oxygen and nutrients, while the surrounding tissues contain a lower concentration. Oxygen and nutrients leave the capillaries and enter the tissues.

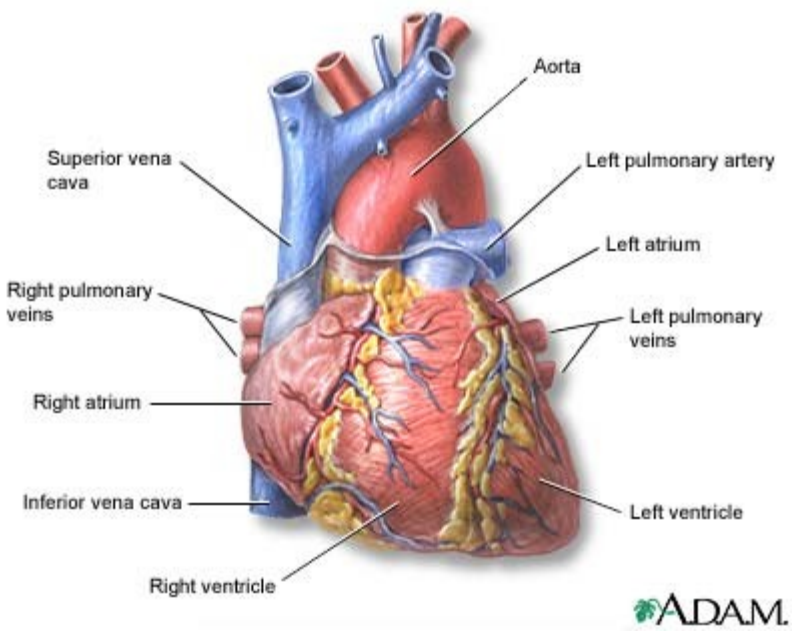
Conversely, when body tissues contain high concentrations of carbon dioxide and metabolic waste, while the capillaries contain a lower concentration, the waste products diffuse from the tissues into the capillaries and from there are carried by the venous system back toward the heart.

Blood Pressure

The red blood cells transport oxygen and waste products by flowing through the **blood vessels**. What causes blood to flow through the vessels is **blood pressure**. Just as water flows through pipes from areas of greater pressure to lesser, so too the blood flows through the body from areas of higher pressure to areas of lower pressure. Blood pressure is measured both as the heart contracts, which is called systole, and as it relaxes, which is called diastole. A systolic blood pressure of 120 millimetres of **mercury** is considered right in the middle of the range of normal blood pressures, as is a diastolic pressure of eighty. In common terms, this normal measurement would be stated as "120 over 80".

Normal blood pressure is important for proper blood flow to the body's organs and tissues. Each heartbeat forces blood to the rest of the body. The force of the blood on the walls of the arteries is called blood pressure. Blood pressure moves from high pressure near the heart to low pressure away from the heart. Blood pressure depends on many factors, including the amount of blood pumped by the heart. The diameter of the arteries through which blood is pumped is also an important factor. Generally, blood pressure is higher when more blood is pumped by the heart, and the diameter of an artery is narrow.

Systolic pressure is measured when the heart ventricles contract. Diastolic pressure is measured when the heart ventricles relax. Stressful situations can result in a temporary increase in blood pressure. If an individual were to have a consistent blood pressure reading of 140 over 90, he would be evaluated for having high blood pressure. If left untreated, high blood pressure can damage important organs, such as the brain and kidneys as well as lead to a **stroke**.



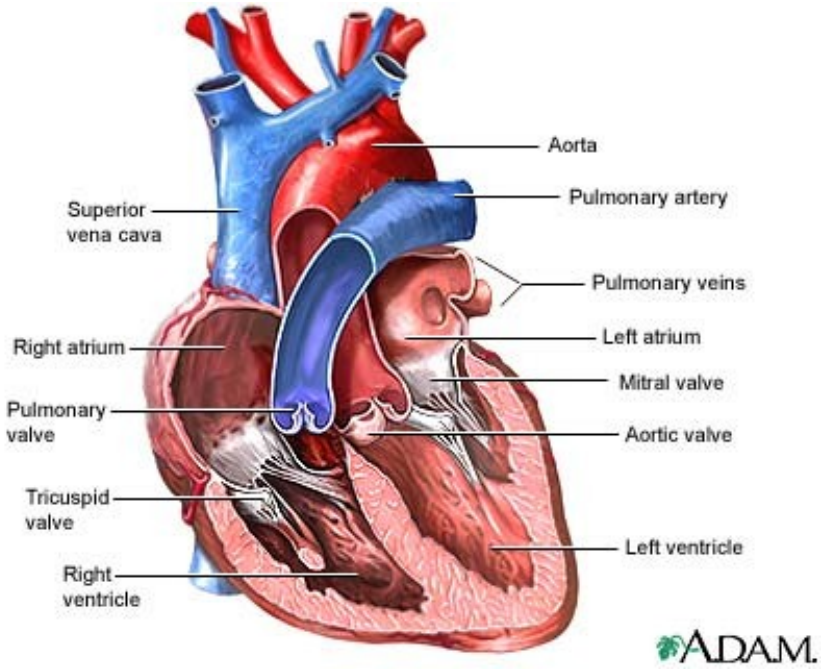
The Heart

The pressure and flow of the blood arise from the beating heart muscle, which is the pump of the cardiovascular system. To understand how the heart works let's take a brief look at the anatomy of the beating heart.

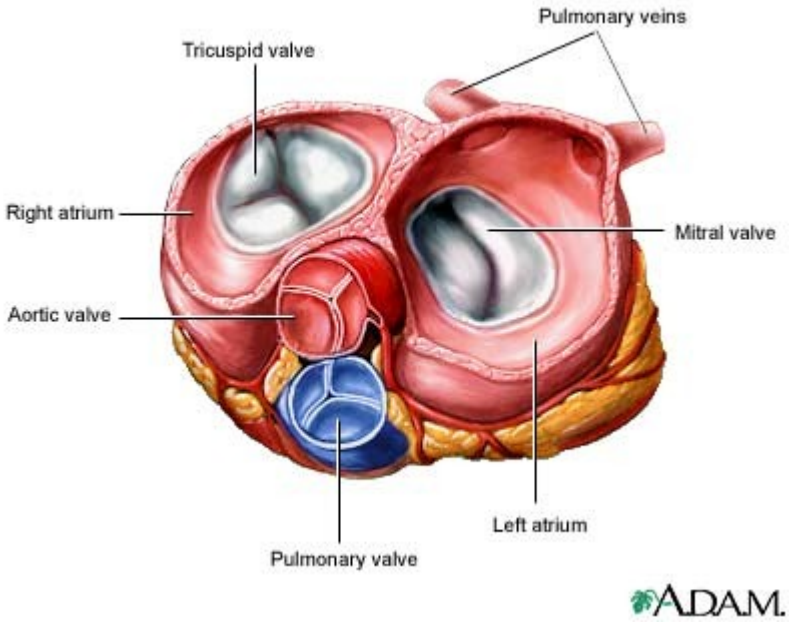
The heart is a four-**chambered** organ with four main vessels, which either bring blood to or carry blood away from the heart. The four chambers of

the heart are: the right **atrium**, the right **ventricle**, the left atrium, and the left ventricle.

The great vessels that you see include the **superior** and **inferior vena cava**, which bring blood from the body to the right atrium. The pulmonary artery, which transports blood from the right ventricle to the lungs, and the **aorta**, the body's largest artery, which transports oxygen-rich blood from the left ventricle to the rest of the body.



If you look carefully, you can see a series of one-way **valves** that keep the blood flowing in one direction. The blood first enters the heart into the right atrium. A contraction of the right atrium then forces blood through the **tricuspid valve** and into the right ventricle. When the right ventricle contracts, the muscular force pushes blood through the pulmonary **semilunar valve** into the pulmonary artery. The blood then travels to the lungs, where it receives oxygen. Next, it drains out of the lungs via the pulmonary veins, and travels to the left atrium. From the left atrium, the blood is forced through the **bicuspid valve** into the critically important left ventricle. The left ventricle is the major muscular pump that sends the blood out to the body systems. When the left ventricle contracts, it forces the blood through the aortic semilunar valves and into the aorta. From here, the aorta and its branches carry blood to all the tissues of the body.



5A. DISORDERS OF THE CARDIOVASCULAR SYSTEM

The following are just a few of the many diseases and disorders that can **impair** the cardiovascular system or its parts.

Atherosclerosis is a general term for **hardening** of the arteries. Atherosclerosis is a condition in which **fatty material** and other substances accumulate on and in the walls of large arteries, impairing the flow of blood. Cholesterol, a fatlike substance produced by the liver, is an essential part of cell membranes and body chemicals. Normally, the body produces all the cholesterol it needs. Eating foods high in saturated fats (found mostly in animal products such as **egg yolks**, fatty meats, and whole milk dairy products) can cause an increase in blood cholesterol levels. The **excess** cholesterol not taken up by the cells accumulates on the walls of arteries. There it combines with fatty materials, cellular waste products, calcium, and fibrin to form a waxy build-up known as **plaque**, which can either partially or totally **obstruct** blood flow.

Coronary artery disease arises when atherosclerosis occurs in the coronary (heart) arteries. When the blood flow in these arteries is restricted, the heart muscles do not receive the proper amount of blood and oxygen. **Chest pain** or pressure, called **angina**, may occur. If the blood flow is blocked, cardiac muscle cells begin to die and a **heart attack** may result. If blood flow is blocked in any cerebral (brain) arteries, brain cells quickly begin to die and a **stroke** may result. Depending on what area of the brain has been affected, a stroke may cause memory loss, speech **impairment**, paralysis, coma, or death.

Heart attack or myocardial infarction (MI) or acute myocardial infarction (AMI) is the interruption of **blood supply** to part of the heart, causing some heart cells to die. This is most commonly due to **occlusion** (blockage) of a coronary artery following the **rupture** of atherosclerotic plaque in the wall of an artery. The resulting **ischemia** (restriction in blood supply) and oxygen **shortage**, if left untreated for a sufficient period of time, can cause damage or death (infarction) of heart muscle tissue (myocardium). Classical symptoms of acute myocardial infarction include sudden chest pain (typically radiating to the left arm or left side of the neck), **shortness of breath**, **nausea**, vomiting, palpitations, **sweating**, and **anxiety**. Approximately one quarter of all myocardial infarctions are silent, without chest pain or other symptoms. A heart attack is a medical emergency.

Heart failure is a condition that can **result from** any structural or functional cardiac disorder that impairs the ability of the heart to fill with or pump a **sufficient** amount of blood throughout the body therefore leading to the heart and body's **failure**.

Hypertension is high blood pressure. It is normal for blood pressure to be **elevated** for brief periods because of exercise, emotional stress, or a fever. Consistent arterial blood pressure measuring 140/90 or higher, however, is hypertension. The condition, the most common one affecting the cardiovascular system, is a serious one. Although it shows no symptoms, hypertension should be treated. If left unchecked, it can lead to atherosclerosis, heart attack,

stroke, or kidney damage. Hypertension most often **strikes** African Americans, middle-aged and elderly people, obese people, heavy alcohol drinkers, and people suffering from diabetes or kidney disease.

Ischaemic heart disease (IHD), or myocardial ischaemia, is a disease characterized by reduced blood supply to the heart muscle, usually due to coronary artery disease (atherosclerosis of the coronary arteries). Its risk increases with age, smoking, hypercholesterolaemia (high cholesterol levels), diabetes, hypertension (high blood pressure) and **is more common in** men and those who have close relatives with ischaemic heart disease. Symptoms of stable ischaemic heart disease include angina (characteristic chest pain on exertion and decreased exercise tolerance). Unstable IHD presents itself as chest pain or other symptoms at rest. Diagnosis of IHD is with an electrocardiogram, blood tests, cardiac stress testing or a coronary angiography. Depending on the symptoms and risk, treatment may be with medication or coronary artery **bypass surgery**.

Inflammatory heart disease involves inflammation of the heart muscle and/or the tissue surrounding it.

Endocarditis – inflammation of the inner **layer** of the heart, the endocardium. The most common structures involved are the heart **valves**.

Inflammatory cardiomegaly, pathological **enlargement** of the heart due to different reasons

Myocarditis – inflammation of the myocardium, the muscular part of the heart.

Obstructions:

Thrombosis is the formation of a **blood clot** (thrombus) inside a blood vessel, obstructing the flow of blood through the circulatory system. When a thrombus occupies more than 75% of surface area of the lumen of an artery, blood flow to the tissue supplied is reduced enough to cause symptoms. More than 90% of obstruction can result in a complete lack of oxygen, and infarction, a type of cell death.

Embolism occurs when an object (embolus) migrates from one part of the body (through circulation) and causes a blockage (occlusion) of a blood vessel in another part of the body. This is in contrast with a thrombus, which forms at the blockage point within a blood vessel and is not carried from somewhere else.

Valvular heart disease is disease process that affects one or more valves of the heart. The valves in the right side of the heart are the tricuspid valve and the pulmonic valve. The valves in the left side of the heart are the mitral valve and the aortic valve.

Aortic valve stenosis (AS) is a valvular heart disease caused by the incomplete opening of the aortic valve. The aortic valve controls the direction of blood flow from the left ventricle to the aorta. When in good working order, the aortic valve does not impede the flow of blood between these two spaces. Under some circumstances, the aortic valve becomes narrower than normal, impeding the flow of blood.

5B. LYMPHATIC SYSTEM

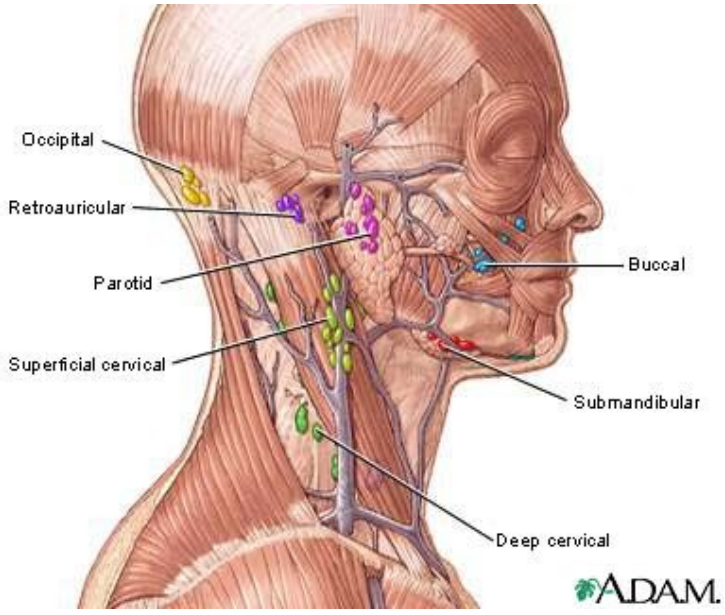
As blood circulates, some of its fluid components push out of the capillary bed into the surrounding tissue. This material forms lymph, a special protein-containing tissue fluid that bathes the cells. Lymphatic vessels **reabsorb** part of this lymph to return it to the circulation, thereby **maintaining** tissue fluid balance. The lymphatic system also **engages in** absorption of fats and other substances from the **digestive tract**. Lymph node structures along the route of the lymphatic system filter out foreign materials and disease-causing agents from the general circulation. Other lymphatic system structures include the tonsils, spleen, and thymus.

Lymph vessels

Lymph travels through the lymph capillaries to small lymph vessels. Like veins, the walls of lymph vessels have **smooth muscle** that contracts and propels lymph away from the tissues. Lymph vessels contain valves that prevent lymph from flowing backward.

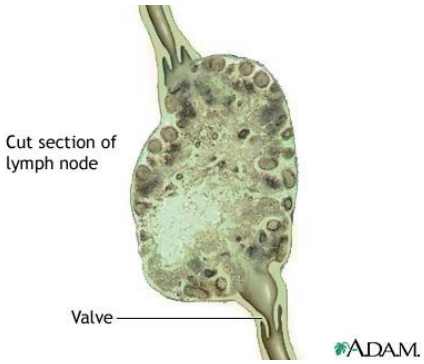
Lymph organs: nodes, nodules, spleen, thymus gland, tonsils

The lymphoid organs are the lymph nodes, spleen, thymus, and groups of **lymph nodules** in both the **oral cavity** (tonsils) and **small intestine**, and appendix (Peyer's patches). A connective tissue capsule surrounds the lymph nodes. The nodes have an outer **cortex** and inner **medulla**. Within the medulla is the germinal center that produces lymphocytes. These infection-fighting white blood cells produce antibodies that identify and destroy antigens.

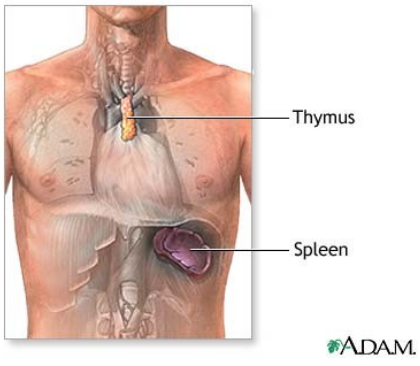


Designed like filters, lymph nodes remove antigens (foreign bodies) from lymph. Each lymph node has several sinuses (inner chambers) that contain lymphocytes. Lymph nodes also contain macrophages that help clear the lymph of bacteria, cellular **debris**, and other foreign material. Macrophages attack, ingest (engulf), then kill antigens in a process called phagocytosis. Small extensions of the macrophage pull the antigen inside.

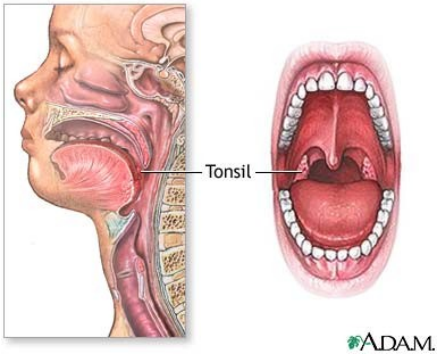
Lymph nodules are groups of lymphocytes arranged in round **clusters**. Many lymph organs contain lymph nodules within their substances. Unlike lymph nodes, they cannot filter lymph.



The **spleen** is the largest lymphoid organ. It has two types of tissue: the red **pulp**, which contains many red blood cells (erythrocytes), and macrophages; and the white pulp, which stores lymphocytes. The macrophages in the red pulp remove foreign substances and damaged or dead erythrocytes and platelets from the blood. And, the red pulp stores platelets, which are important for blood clotting. The lymphocytes within the white pulp are used for the body immune system.



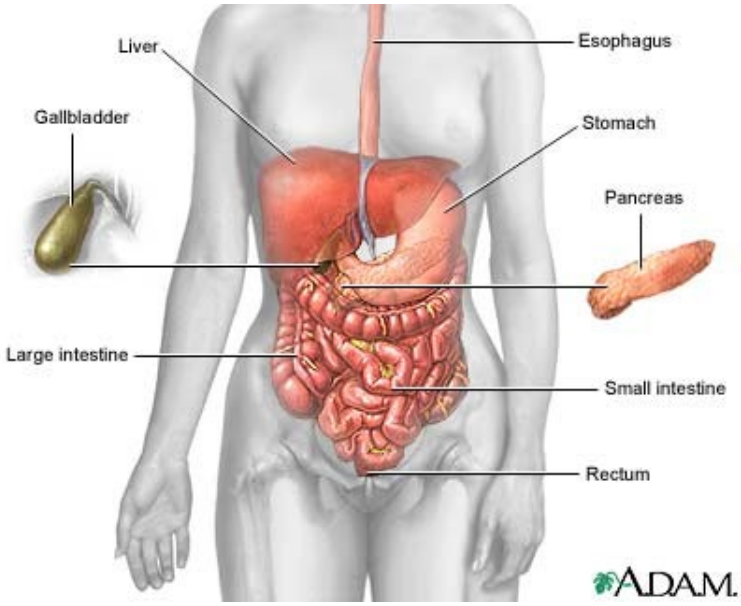
In the **thymus gland** lymphocytes become specialized.



The **tonsils** are paired lymph nodules in the oral cavity. These patches of lymph tissue produce lymphocytes. The tonsils protect the throat and respiratory system. Sometimes, the tonsils cannot remove all the invading microorganisms and become infected. If the infection is severe and chronic, the tonsils may require tonsillectomy (surgical removal).

6. DIGESTIVE SYSTEM

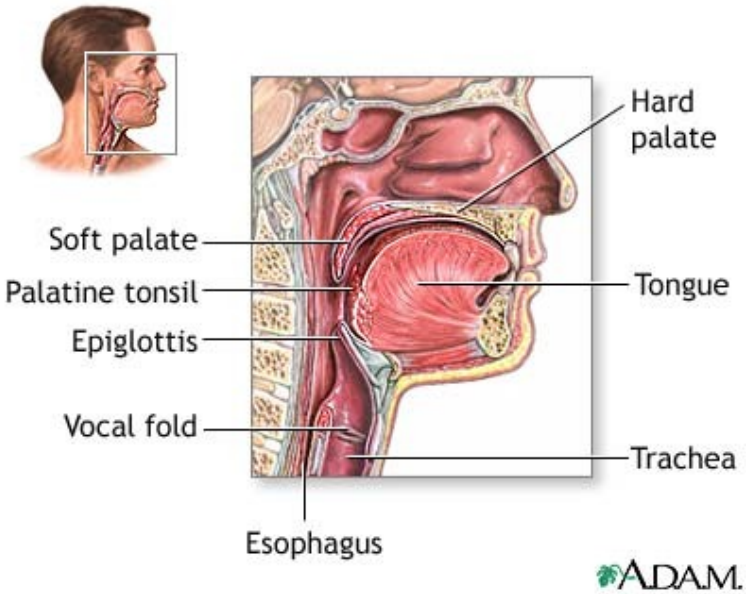
Nutrition permits us to take in and use food substances that the body converts to energy and body structure. The digestive system includes all the organs and **glands** involved in this process of eating and digesting. Starting in the mouth, a long muscular tube provides continual fluid and vital **nutrients**. The coiled **intestines** alone are about 24 feet long. After we consume food, the body mechanically and chemically breaks it down, then transports it for absorption and **defecation** (final waste removal). The digestive glands (**salivary glands**, pancreas, liver, and gallbladder) produce or store secretions that the body carries to the digestive tract in ducts **and breaks down** chemically.



Ingestion

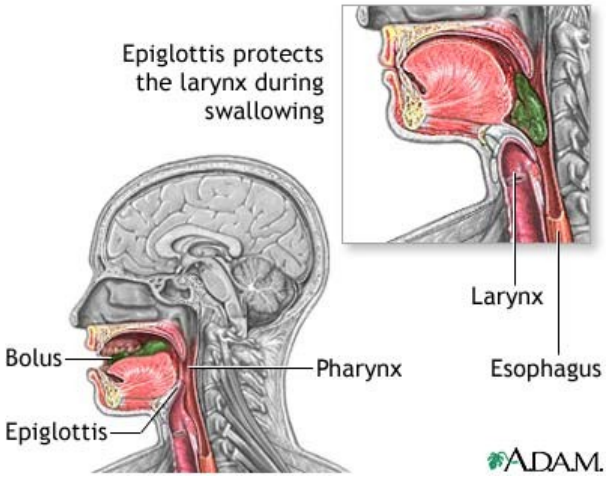
Food processing begins with ingestion (eating). The teeth aid in mechanical digestion by masticating (**chewing**) food. Mastication permits easier deglutition (**swallowing**) and faster chemical breakdown in the digestive tract. During mastication, salivary glands secrete saliva to soften the food into a bolus (semi-solid lump). Saliva contains the salivary amylase enzyme, which digests carbohydrates (**starches**), and **mucus** (a thick liquid), which softens food into a bolus. Ingestion starts both chemical and mechanical digestion.

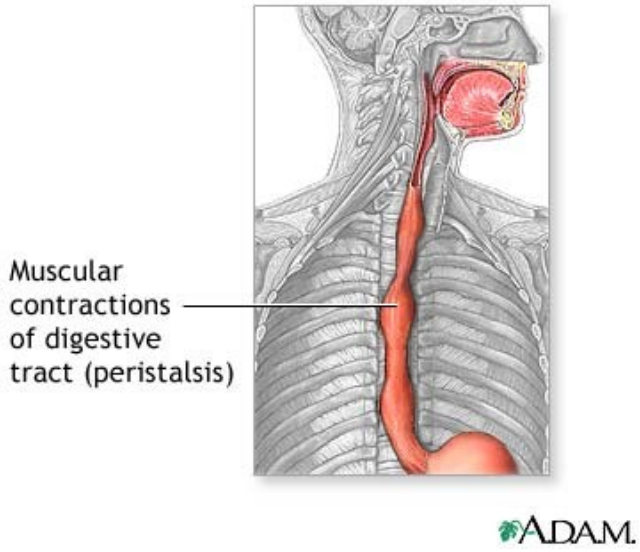
In deglutition, the tongue pushes the bolus toward the **pharynx** (throat) and into the **esophagus** (gullet), a muscular tube that leads from the throat to the **stomach**. To prevent food or liquid from entering the **trachea** (windpipe), the epiglottis (a small flap of tissue) closes over the opening of



the larynx (voice box) during deglutition.

Upon entering the esophagus, **peristalsis** (wave-like contractions) of smooth muscle carries the bolus toward the stomach. Two layers of smooth muscle, the outer longitudinal (lengthwise) and inner circular, contract rhythmically to squeeze food through the esophagus. Throughout the digestive tract, smooth muscle peristalsis aids in transporting food.





From the esophagus, the bolus passes through a **sphincter** (muscular ring) into the stomach. All sphincters located in the digestive tract help move the digested material in one direction. When the stomach is empty, the walls are folded into rugae (stomach folds), which allow the stomach to expand as more food fills it.

Digestion: stomach

In the stomach, food undergoes chemical and mechanical digestion. Here, peristaltic contractions (mechanical digestion) churn the bolus, which mixes with strong **digestive juices** that the stomach lining cells secrete (chemical digestion). The stomach walls contain three layers of smooth muscle arranged in longitudinal, circular, and oblique (diagonal) rows. These muscles allow the stomach to **squeeze** and **churn** the food during mechanical digestion.

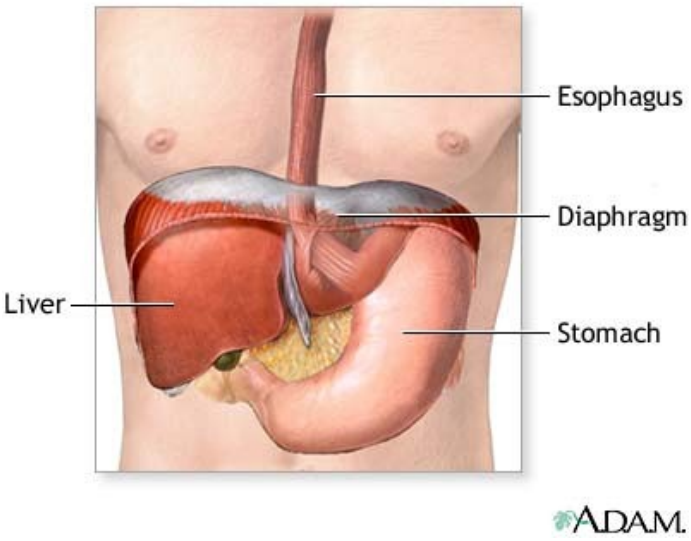
Powerful hydrochloric acid in the stomach helps break down the bolus into a liquid called **chyme**. A thick mucus layer that lines the stomach walls prevents the stomach from digesting itself. When mucus is limited, an **ulcer** (erosion of tissue) may form.

Food is digested in the stomach for several hours. During this time, a stomach enzyme called pepsin breaks down most of the protein in the food. Next, the chyme is slowly transported from

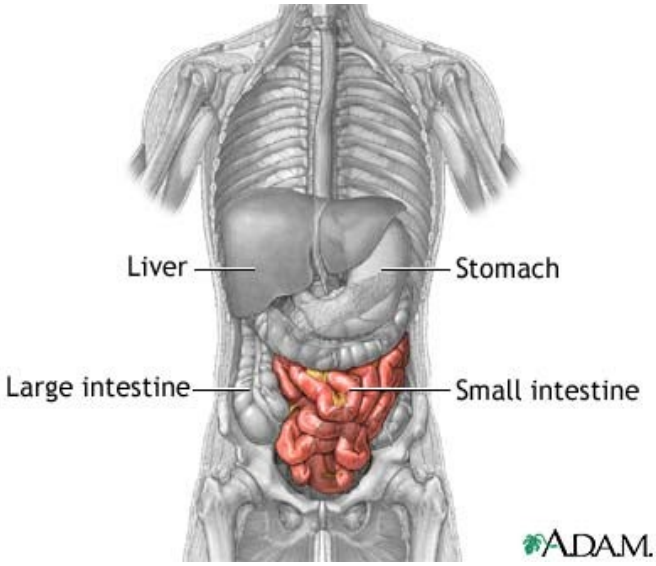
the pylorus (end portion of the stomach) through a sphincter and into the small intestine where further digestion and nutrient absorption occurs.

Digestion and absorption: small intestine

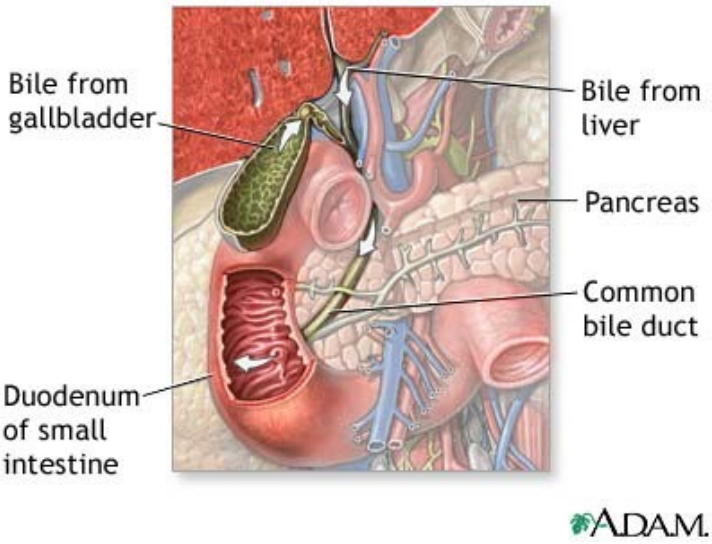
The small intestine is about 20 feet (6 meters) long and has three parts: the duodenum, jejunum, and ileum. The **duodenum** is where most chemical digestion takes place. Here, **bile** from the **gallbladder** and enzymes from the **pancreas** and intestinal walls combine with the chyme to begin the final part of digestion.



Bile liquid is created in the liver and stored in the gallbladder. Bile emulsifies (breaks into small particles) lipids (fats), which aids in the mechanical digestion of fats. The pancreas and gland cells of the small intestine secrete digestive enzymes that chemically break down complex food molecules into simpler ones. These enzymes include trypsin (for protein digestion), amylase (for carbohydrate digestion), and lipase (for lipid digestion). When food passes through the duodenum, digestion is complete.



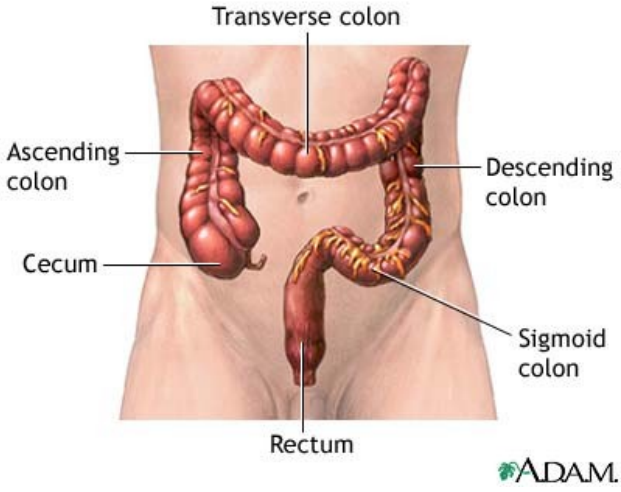
From the duodenum, chyme passes to the jejunum and ileum. Here, tiny **villi** (finger-like projections) cover the walls of the small intestine. The cells that line the villi are covered with small projections called microvilli (brush border). These projections increase the surface area of the



small intestine, allowing the chyme to contact more of the small intestine wall. The increased contact causes more efficient food absorption.

During food absorption, food molecules enter the bloodstream through the intestinal walls. Capillaries (microscopic blood vessels) within the villi absorb products of protein and carbohydrate digestion. Lymph vessels (lacteals) within the villi absorb products of fat digestion and eventually lead to the bloodstream.

From the small intestine, digested products travel to the liver, one of the body's most versatile organs. Hepatocytes (liver cells) detoxify (filter) blood of harmful substances such as alcohol and ammonia. And, hepatocytes store **fat-soluble** vitamins and excess substances such as glucose (sugar) for release when the body requires extra energy.



Absorption: large intestine

Once food has passed through the small intestine, it is mostly indigestible material and water. It enters the **colon** (large intestine), named for its wide diameter. The large intestine has six parts: the cecum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum.

The large pouch-shaped cecum marks the beginning of the colon. Attached near the cecum bottom is the vermiform (worm-like) appendix (**blind gut**). The appendix contains lymphoid tissue and intercepts pathogenic microorganisms that enter the digestive tract. Sometimes, fecal matter may become trapped in the appendix, resulting in appendicitis (infection and inflammation).

The other parts of the colon absorb water and minerals from the undigested food and compact the remaining material into **feces**. Defecation is the digestive process final stage: feces (undigested waste products) are carried to the **rectum** through peristalsis and eliminated through the **anus**.

7. DISORDERS OF THE DIGESTIVE SYSTEM

As an individual ages, the activity of the digestive system slows down. Fewer digestive juices are produced and secreted. Peristalsis slows. The sensations of taste and smell **wane**, and eating becomes less **appealing**. When less food is ingested, the body receives fewer nutrients. All body systems then weaken and become **susceptible to** disease. The following are just a few of the number of diseases that can **affect** the many parts of the digestive system.

Appendicitis

Appendicitis is an inflammation of the appendix. It is the most common abdominal emergency found in children and young adults. Because of the appendix's position at the bottom of the cecum, scientists believe one of the main causes of appendicitis is an invasion of bacteria. When infected with bacteria, the appendix may become **swollen** and filled with **pus**. It may then eventually rupture. Symptoms of the condition include pain that begins above or around the **navel**. The pain, which may be severe or only slight, then moves into the right corner of the abdomen. In this position, the pain often becomes more steady and severe. If left untreated, appendicitis is fatal. The treatment for the condition is an immediate **appendectomy** or surgical removal of the inflamed and ruptured appendix.

Bulimia

Bulimia is an eating disorder that occurs chiefly in women in their teens and twenties. Bulimia comes from the Greek word *boulimos* , meaning "great hunger." Individuals who are bulimic go on eating binges (often desiring **junk food**), then purge their bodies of the food by making themselves **vomit** or by taking large amounts of **laxatives** (medicines or foods that stimulate bowel movements).

The self-induced vomiting after a **binge** can cause damage to the stomach and esophagus. Acid in the vomit from the stomach can irritate the throat and erode **tooth enamel**. Blood vessels in the eyes can burst. The overuse of laxatives can cause muscle **cramps**, stomach pains, dehydration, and even poisoning. Over time, bulimia causes vitamin deficiencies and an imbalance of critical body fluids. **Seizures** and kidney failure can ultimately result.

Bulimics know that their eating habits are abnormal. They often suffer from depression. Bulimics may also suffer from anxiety and low self-esteem. Most research on bulimia, however, focuses on psychological factors. Treatment for bulimia generally involves psychotherapy and, sometimes, the use of antidepressant medications.

Cavities

A dental cavity or **tooth decay** is the destruction of the enamel or outer surface of a tooth. It is a common health problem, second only to the common cold. It results from the action of bacteria that live in **plaque**. Plaque is a whitish film that forms on teeth, composed of a protein in saliva, sugars from foods, and bacteria. The bacteria use the sugars and **starches** from pieces of food in the mouth to produce acid that disrupts tooth enamel, creating cavities or holes. If the decay reaches deep, the tooth becomes sensitive to temperature and touch. If the decay reaches the **pulp cavity**, inflammation and pain (toothache) develop.

If left untreated, the decay can eventually destroy the entire tooth. Usually, a dentist is able to treat most cases of tooth decay by removing all decayed parts of the tooth and then filling the cavity with a hard material (so called **filling**).

Cirrhosis

Cirrhosis is a chronic disease in which cells of the liver are damaged and then replaced by **scar** tissue. The disease obviously affects the liver's ability to perform its many functions. The condition worsens over time and may lead to death. **Long-term** alcoholism is the primary cause of cirrhosis in the United States. Throughout the digestive system, alcohol **interferes with** the absorption of nutrients. Alcohol provides calories but no **nourishment** to the body. Because alcohol is detoxified within the liver, a constant level of alcohol in the organ severely affects it. During the **early stages** of cirrhosis, the liver enlarges. The **palms** of the hands then turn red. Other symptoms include **constipation** or **diarrhea**, dull abdominal pain, fatigue, loss of appetite, nausea, vomiting, weakness, and weight loss. If left untreated, the symptoms increase and worsen, leading to liver failure and death.

Diabetes

Diabetes mellitus is a complex, long-term metabolic disorder. A person suffering from it can not effectively use a natural chemical called insulin. Management of diabetes mellitus requires an effective healthy regular lifestyle including a regular balanced diet, regular exercise and sensible weight control.

Diabetes mellitus patients break down stored fat for energy with difficulty. They also have a difficult time breaking down proteins. The difficulty in breaking down fats can lead to production of acids and poisonous chemical substances called ketones, a condition known as ketoacidosis. It is a severe condition which can lead to coma.

When diabetes mellitus is detected, your doctor is sure to tell you to make changes in your eating habits: as a diabetes mellitus patient, you should try to reduce overall fat. Refined carbohydrates and sugar from your diet should be avoided as they increase the blood sugar immediately. Fruit should be the major source of sweetness in your diet. Glycemic Index shows how much your

blood sugar increases after eating different foods. Higher glycemic index means that the food you had eaten increases your blood sugar. With the help of it, you can always keep the blood sugar level under control. Protein should be minimized from your diet. Instead, use meat substitutes or non-animal protein foods such as tofu. Red meat should be avoided and fish should be increased in your diet. Some vegetables such as celery, bitter melon, onion, garlic, asparagus and spinach are vegetables that lessen diabetes mellitus.

Gallstones

Gallstones are solid crystal **deposits** that form in the gall bladder. They can vary in size from as small as a **grain of sand** to as large as a golf ball. Eighty percent of all gallstones are composed of cholesterol, a fatlike substance produced by the liver. They usually develop in adults between the ages of twenty and fifty. The condition of developing gallstones tends to **run in families**. In addition, high levels of estrogen (female hormones), insulin (hormone that regulates sugar levels), and cholesterol in the body **increase the risk** of developing gallstones. A diet high in fat and low in fiber, heavy drinking, and smoking may also play a part. Gallstones may block the common **bile duct**, preventing bile from flowing into the duodenum. Symptoms of a gallbladder attack include pain that begins in the abdomen and moves to the chest and back, **chills** and **sweating**, nausea and vomiting, and **gas** and **belching**. Gallstones of a small size may pass out of the body through the urine. So they may more easily pass out, doctors may use high-frequency sound waves to break up the gallstones. To treat painful, severe cases, doctors may surgically remove the gall bladder and gallstones.

Hepatitis

Hepatitis is an often fatal disease that causes inflammation of the liver. There are various types of hepatitis, most of which are caused by a virus. The viral forms include hepatitis A, B, C, D, E, and G. The assorted symptoms marking hepatitis include **jaundice** (yellowing of the skin), nausea, vomiting, fever, weakness, loss of appetite, abdominal and joint pain, and cirrhosis (scarring of the liver).

Two viral forms of hepatitis are most common: A and B. Hepatitis A (commonly known as infectious hepatitis) is spread through direct contact with contaminated excrements, food, or water. Once infected, an individual usually recovers within two months. Hepatitis B (commonly called serum hepatitis) is much more severe. It is transmitted by sexual activity, blood transfusions, and the use of shared syringes by drug uses. Hepatitis B may destroy the liver through cirrhosis or it may lead to cancer of the liver.

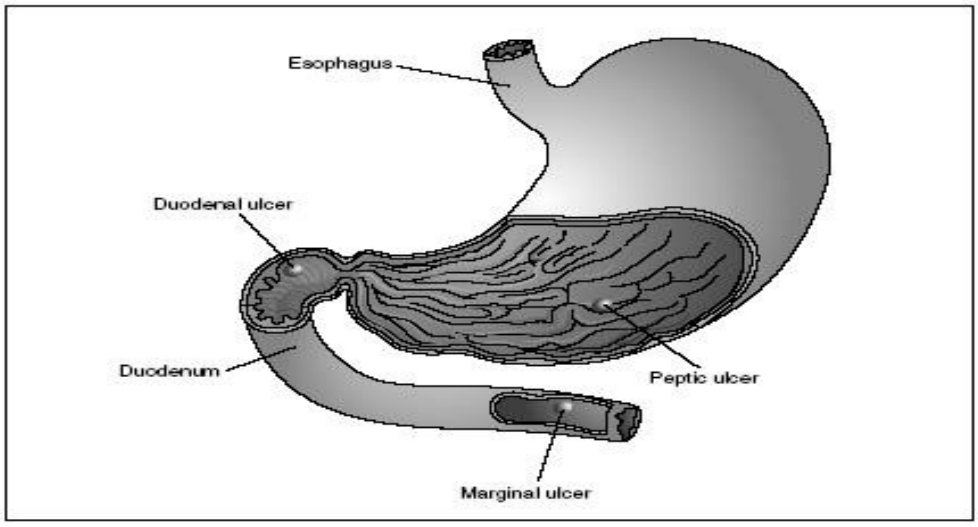
Hepatitis C causes acute (rapidly developing) and chronic (long-term) disease. It is spread mainly through blood transfusions. Medical researchers believe hepatitis C may be caused by several

viruses. As with hepatitis B, hepatitis C may lead to cirrhosis of the liver and, eventually, liver cancer.

Ulcers (digestive)

A digestive ulcer is any **sore** that develops in the lining of the stomach or duodenum (sores in the lower esophagus occur less frequently). Because these sores form in areas where gastric juice is present, they are generally referred to as **peptic ulcers** (pepsin is an enzyme in gastric juice). Peptic ulcers found in the stomach are more specifically called gastric ulcers. Those in the duodenum are called duodenal ulcers. Of the two, duodenal ulcers are the most common type, accounting for about 80 percent of all digestive ulcers. They **tend to** be smaller than gastric ulcers and heal more quickly. Any ulcer that heals leaves a scar.

The symptoms for gastric ulcers include feelings of **heartburn**, nausea, weight loss, and stomach pain. Citrus juices, coffee, and aspirin bring on pain more quickly. Before the 1980s, physicians believed ulcers were caused by several factors—including stress and a poor diet—that resulted in excess stomach acid. Medical research has since shown that a certain bacterium that can live undetected in the **mucous membrane** of the digestive tract is the **culprit**. This bacterium irritates and weakens the lining, making it more **susceptible to**

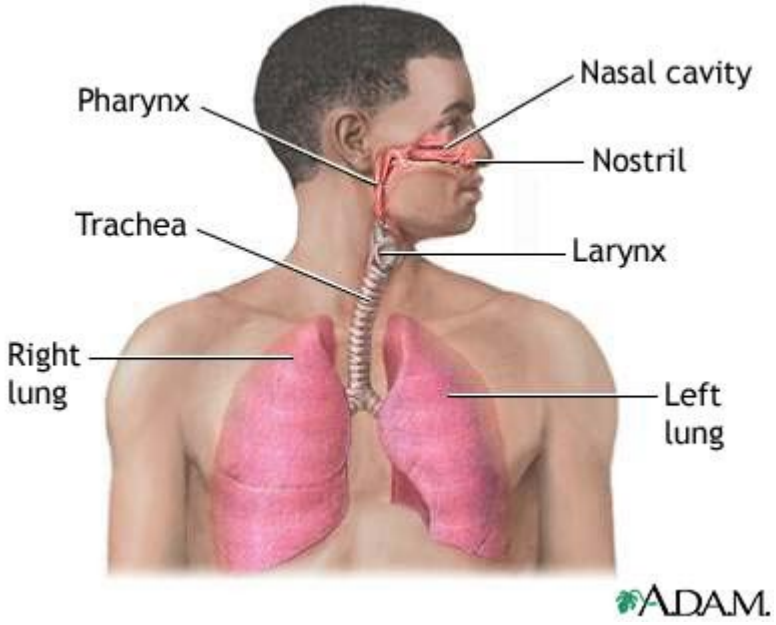


Common sites of ulcers in the human stomach.

damage by gastric juice. About 95 percent of duodenal ulcers and 70 percent of gastric ulcers are caused by this bacterium. Treatment for peptic ulcers includes antibiotics to eliminate the bacterium and other drugs to reduce the amount of gastric juice secreted in the stomach.

8. RESPIRATORY SYSTEM

All the body cells metabolically consume oxygen, and **discharge** carbon dioxide. To cover this need, respiration takes place internally (at the cellular level) and externally (ventilation/breathing). **Ventilation** involves the **inhalation** of atmospheric air into the lungs via the nose and mouth through branching passageways, and the **exhalation** of carbon dioxide. The lung **key function** is to bring air and blood into intimate contact in **the alveolar air sacs** so that oxygen can enter the blood, and carbon dioxide can leave. **At rest**, humans breathe about twelve times a minute, bringing in approximately a pint of air. Exercise and certain diseases result in a marked increase of breathing. The respiratory system also is vital in maintaining normal blood pH and body temperature.



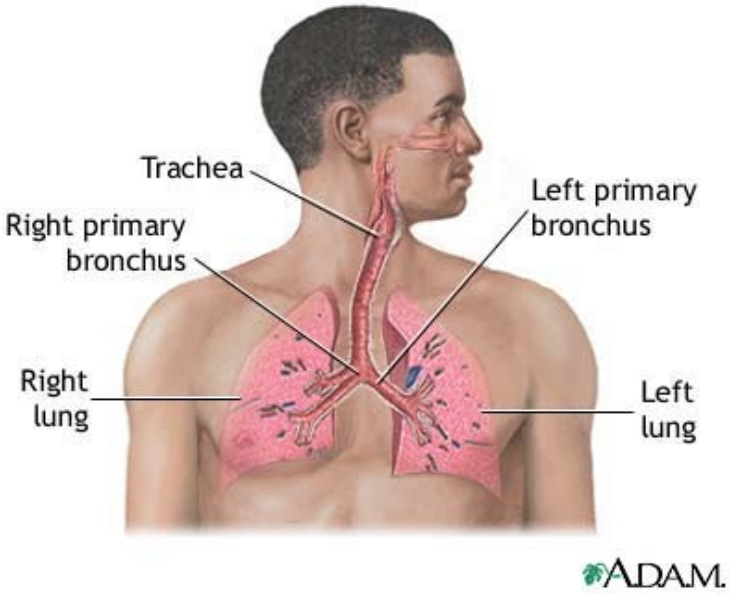
Lungs and air passages

The lungs are paired organs that lie on either side of the heart and fill up the thoracic (chest) cavity. Inferior to (below) the lungs is the **diaphragm**, a broad thin muscle that separates the thoracic cavity from the abdominal (**gut**) cavity. On the medial (inner) surface of each lung is the **hilus**, where blood vessels, nerves, and **bronchi** (air passages) enter the lungs.

The lungs differ in size and shape. Because the heart is slightly larger on the left side, the left lung has a **cardiac notch** (indented border). The left lung is also slightly smaller than the right. Each lung is divided into **lobes** (partitions) by **fissures**. The right lung has three lobes: lower,

middle, and upper. These horizontal and oblique fissures create these lobes. The left lung has upper and lower lobes that are divided by the oblique fissure.

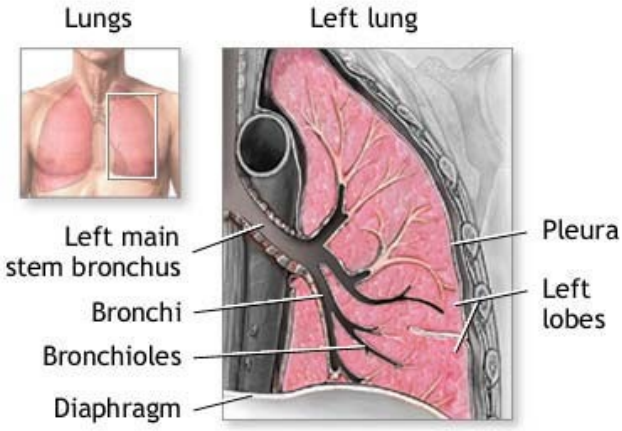
Air enters the body through the mouth or nose. In the nose, thick hairs lining the **nostrils** prevent small objects from entering the **nasal cavity**. This cavity is lined with cells that produce **mucus**. Small foreign matter that enters the nasal cavities is trapped in the mucus, while tiny cilia (small hair-like projections) push the mucus to the pharynx (throat), where it is swallowed and digested in the stomach or **expectorated**.



From the **pharynx**, the air passes to the **larynx**, which is called the **voice box** because it contains the **vocal cords**. To prevent food or liquid from entering the larynx, the **epiglottis** (a small flap of tissue) closes over the opening of the larynx during **deglutition** (swallowing). If this process works improperly, a cough reflex **expels** the foreign material.

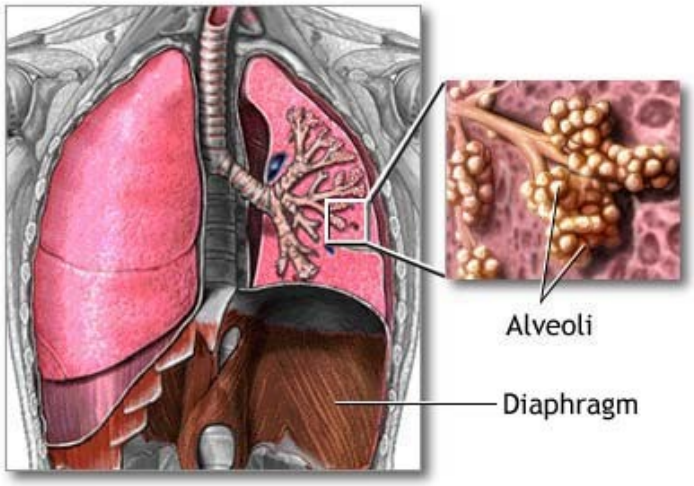
When air travels past the larynx, it enters the **trachea (windpipe**). The trachea is a strong tube containing rings of **cartilage** that prevents it from collapsing. The **mucosa** that lines the airway warms and **moistens** the air before it reaches the trachea.

Within the lungs, the trachea **branches into** a left and right **bronchus**, which divide into increasingly smaller branches called **bronchioles**. The smallest bronchioles end in a cluster of air sacs, collectively called an **acinus**. The acinus comprises individual air sacs called **alveoli**. Alveoli are like small balloons that **inflate** and deflate with air during respiration.



Gas exchange

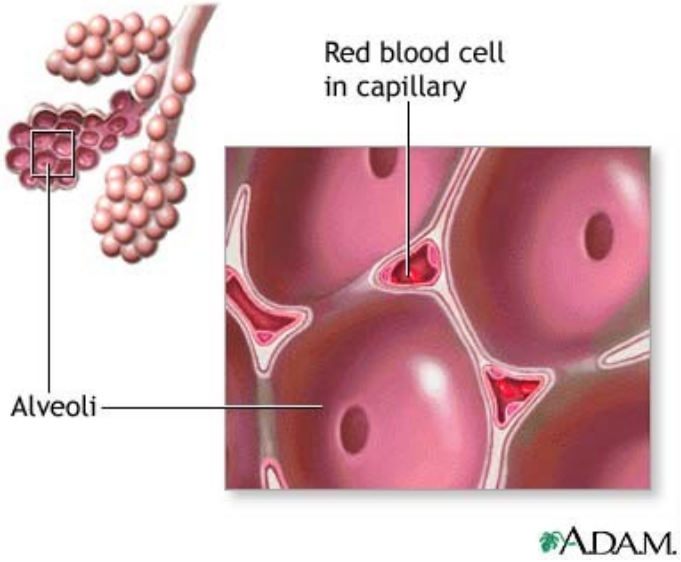
Gas exchange occurs in the lungs between the alveoli and a capillary network within the alveolar wall. Capillaries are microscopic blood vessels that exchange material between the blood and body tissues. In the lung capillaries, blood from tissues where cellular metabolism is occurring is called deoxygenated blood because it contains many carbon dioxide molecules and few oxygen molecules.



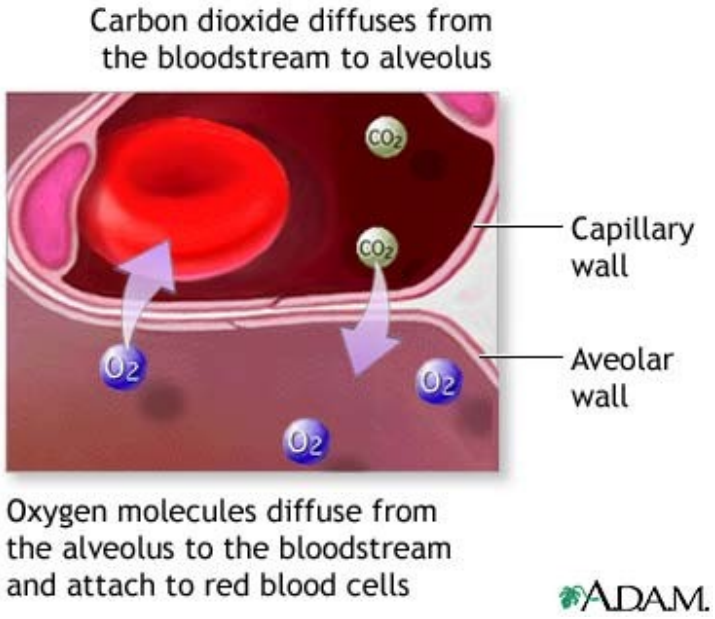
Respiration

The respiration process has two parts: **inspiration** (inhaling) and **expiration** (exhaling). During inspiration, the **diaphragm** contracts, moves downward, and causes the **thoracic cavity** volume to increase. Because the lungs are closely associated with the interior chest wall, they expand as

the thoracic cavity expands. When the diaphragm relaxes (upward position), the thoracic volume decreases and the lungs partially **deflate**. This process is called expiration. The elastic recoil of the expanded thoracic wall and lungs also helps expiration.



After inhalation, the alveoli contain many oxygen molecules. The alveoli are in close contact with the capillary network. This **proximity** enables the **minuscule** oxygen molecules to diffuse (pass freely) from the alveolus to the bloodstream, flowing from a region of higher concentration to a region of lower concentration. In the bloodstream, the oxygen attaches to red blood cells and is transported to the rest of the body. Likewise, carbon dioxide diffuses from the bloodstream into the alveolus where it is transported out of the body during exhalation.



During respiration, the **pleurae** (pleural membranes) help the lungs to expand and contract. These membranes are sacs that tightly cover the lungs and the chest inside wall. Between these two linings is a space called the **pleural cavity** that contains a thin layer of fluid. This fluid allows the lungs to move freely against the thoracic cavity inside.

9. DISORDERS OF THE RESPIRATORY SYSTEM

Common Cold, also called: Coryza, is a viral infection of your upper respiratory tract – your nose and throat. A common cold is usually harmless, although it may not feel that way. If it's not a **runny or stuffy nose**, **itchy** or **sore throat** and **cough**, it's the watery eyes, **sneezing** and **congestion, s**light body aches or a mild headache, low-grade fever (up to 102 F, or 39 C), mild fatigue – or maybe all of the above. In fact, because any one of more than 200 viruses can cause a common cold, symptoms tend to vary greatly. Symptoms of a common cold usually appear about one to three days after **exposure** to a cold virus. The **discharge** from your nose may become thicker and yellow or green in color as a common cold runs its course. What makes a cold different from other viral infections is that you won't generally have a high **fever**. You're also unlikely to experience significant **fatigue** from a common cold.

Most adults are likely to have a common cold two to four times a year. Children, especially preschoolers, may have it as many as six to ten times **annually**. Most people **recover from** a common cold in about a week or two. If symptoms don't improve, see your doctor.

Pneumonia, also called: Bronchopneumonia, is an inflammation of the lung, usually caused by an infection. Three common causes are bacteria, viruses and **fungi**. You can also get pneumonia by accidentally inhaling a liquid or chemical. People most **at risk** are older than 65 or younger than 2 years of age, or already have health problems.

If you have pneumonia, you may have difficulty breathing and have a cough and a fever. A physical exam and history as well as chest **x-rays** and blood tests can help **determine** if you have pneumonia. Treatment depends on what made you sick. If bacteria are the cause, antibiotics should help. Viral pneumonia may get better with rest and drinking liquids.

Preventing pneumonia is always better than treating it. The best **preventive measures** include washing your hands frequently, not smoking, and wearing a mask when cleaning dusty or **moldy** areas. There is a vaccine for pneumococcal pneumonia, a bacterial infection which accounts for up to a quarter of all pneumonias.

Asthma is a chronic disease that affects your airways. Your airways are tubes that carry air in and out of your lungs. If you have asthma, the inside walls of your airways become **sore** and swollen. That makes them very sensitive, and they may react strongly to things that you are allergic to or find **irritating**. When your airways react, they get narrower and your lungs get less air. This can cause **wheezing**, coughing, **chest tightness** and trouble breathing, especially early in the morning or at night.

When your asthma symptoms become worse than usual, it's called an asthma attack. In a **severe** asthma attack, the airways can close so much that your vital organs do not get enough oxygen. People can die from severe asthma attacks. Asthma is treated with two kinds of medicines: **quick-relief medicines** to stop asthma symptoms and long-term control medicines to prevent symptoms.

Bronchitis is an inflammation of the main air passages (bronchi) to your lungs. It causes a cough, shortness of breath and chest tightness. Coughing often brings up yellow or greenish **mucus**. There are two main types of bronchitis: acute and chronic.

Acute bronchitis is often caused by the same viruses that cause colds. It usually starts as a **sore throat**, runny nose or sinus infection, then spreads to your airways. It can cause a lingering **dry cough**, but it usually goes away on its own.

Chronic bronchitis is one type of COPD (chronic obstructive pulmonary disease). The inflamed bronchi produce a lot of mucus. This leads to cough and difficulty getting air in and out of the lungs. Cigarette smoking is the most common cause. Breathing in other **fumes** and dusts over a long period of time may also cause chronic bronchitis. Treatment will help your symptoms, but chronic bronchitis is a long-term condition that keeps coming back or never goes away completely.

Emphysema is a type of chronic obstructive pulmonary disease (COPD) involving damage to the air sacs (alveoli) in the lungs. As a result, your body does not get the oxygen it needs. Emphysema makes it hard to catch your breath. You may also have a chronic cough and have trouble breathing during exercise.

The most common cause is cigarette smoking. If you smoke, **quitting** (giving up) can help **prevent** you **from** getting the disease. If you already have emphysema, not smoking might keep it from getting worse. Treatment is based on whether your symptoms are mild, moderate or severe. Treatments include **inhalers**, oxygen, medications and sometimes surgery to relieve symptoms and prevent complications.

Lung Cancer, also called Bronchogenic carcinoma, is one of the most common cancers in the world. It is a **leading cause** of cancer death **in** men and women in the United States. Cigarette smoking causes most lung cancers. The more cigarettes you smoke per day and the earlier you started smoking, the greater your risk of lung cancer. High levels of pollution, radiation and asbestos exposure may also increase risk. Common symptoms of lung cancer include: a cough that doesn't go away and gets worse over time; constant chest pain, **coughing up** blood, shortness of breath, wheezing, or **hoarseness**; repeated problems with pneumonia or bronchitis; swelling of the neck and face; loss of appetite or weight loss.

There are many types of lung cancer. Each type of lung cancer grows and spreads in different ways and is treated differently. Treatment also depends on the **stage**, or how **advanced** it is. Treatment may include chemotherapy, radiation and surgery.

Sinusitis means your **sinuses** are infected or inflamed. Your sinuses are hollow air spaces within the bones surrounding the nose. They produce mucus, which drains into the nose. If your nose is swollen, this can block the sinuses and cause pain and infection.

Sinusitis can be acute, lasting for less than four weeks, or chronic, lasting much longer. Acute sinusitis often starts as a cold, which then turns into a bacterial infection. Allergies, pollutants, nasal problems and certain diseases can also cause sinusitis.

Symptoms of sinusitis can include fever, weakness, fatigue, cough and **congestion**. There may also be mucus drainage in the back of the throat, called **postnasal drip**. Treatments include antibiotics, **decongestants** and **pain relievers**. Using heat pads on the inflamed area, **saline nasal sprays** or **drops** and vaporizers can also help.

10. Integumentary System

The skin is the largest organ in the body: 12-15% of body weight, with a surface area of 1-2 meters. Skin is continuous with, but structurally distinct from **mucous membranes** that line the mouth, anus, urethra, and vagina. Two distinct layers occur in the skin: the dermis and epidermis. The basic cell type of the **epidermis** is the keratinocyte, which contain keratin, a fibrous protein. **Basal cells** are the innermost layer of the epidermis. **Melanocytes** produce the pigment melanin, and are also in the inner layer of the epidermis. The dermis is a connective tissue layer under the epidermis, and contains **nerve endings**, **sensory receptors**, capillaries, and elastic fibers.

The integumentary system has multiple roles in homeostasis, including protection, temperature regulation, sensory reception, biochemical synthesis, and absorption. All body systems work in an interconnected manner to maintain the internal conditions essential to the function of the body.

Follicles and Glands

Hair follicles are lined with cells that synthesize the proteins that form hair. A **sebaceous gland** (that secretes the oily coating of the hair shaft), **capillary bed**, nerve ending, and small muscle are associated with each **hair follicle**. If the sebaceous glands becomes plugged and infected, it becomes a skin **blemish** (or **pimple**). The **sweat glands** open to the surface through the skin pores. **Eccrine glands** are a type of sweat gland linked to the sympathetic nervous system; they occur all over the body. **Apocrine glands** are the other type of sweat gland, and are larger and occur in the **armpits** and **groin** areas; these produce a solution that bacteria act upon to produce "body odor".

Hair and Nails

Hair, **scales**, feathers, **claws**, horns, and nails are animal structures derived from skin. The hair shaft extends above the skin surface, the hair root extends from the surface to the base or **hair bulb**. Genetics controls several features of hair: **baldness**, color, texture.

Nails consist of highly keratinized, modified epidermal cells. The nail arises from the nail bed, which is thickened to form a lunula (or little moon). Cells forming the **nail bed** are linked together to form the nail.

Skin and Homeostasis

Skin functions in homeostasis include protection, regulation of body temperature, sensory reception, water balance, synthesis of vitamins and hormones, and absorption of materials. The skin's primary functions are to serve as a barrier to the entry of microbes and viruses, and to prevent water and extracellular fluid loss. Acidic secretions from skin glands also retard the growth of **fungi**. Melanocytes form a second barrier: protection from the damaging effects of **ultraviolet radiation**. When a microbe penetrates the skin (or when the skin is **breached by** a cut) the inflammatory response occurs.

Heat and cold receptors are located in the skin. When the body temperature rises, the hypothalamus sends a nerve signal to the sweat-producing skin glands, causing them to release about 1-2 liters of water per hour, cooling the body. The hypothalamus also causes **dilation** of the blood vessels of the skin, allowing more blood to flow into those areas, causing heat to be conducted away from the skin surface. When body temperature falls, the sweat glands **constrict** and sweat production decreases. If the body temperature continues to fall, the body will engage in thermogenesis, or heat generation, by raising the body's **metabolic rate** and by **shivering**.

Water loss occurs in the skin by two routes.

1. evaporation
2. sweating

In hot weather up to 4 liters per hour can be lost by these mechanisms. Skin damaged by burns is less effective at preventing fluid loss, often resulting in a possibly life threatening problem if not treated.

Skin and Sensory Reception

Sensory receptors in the skin include those for pain, pressure (touch), and temperature. Deeper within the skin are Meissner's **corpuscles**, which are especially common in the tips of the fingers and **lips**, and are very sensitive to touch. Pacinian corpuscles respond to pressure. Temperature receptors: more cold ones than hot ones.

Skin and Synthesis

Skin cells synthesize melanin and carotenes, which give the skin its color. The skin also assists in the synthesis of vitamin D. Children lacking sufficient vitamin D develop bone abnormalities known as **rickets**.

Skin Is Selectively Permeable

The skin is selectively **soluble** to fat-soluble substances such as vitamins A, D, E, and K, as well as steroid hormones such as estrogen. These substances enter the bloodstream through the capillary networks in the skin. **Patches** have been used to deliver a number of therapeutic drugs in this manner. These include estrogen, scopolamine (motion sickness), nitroglycerin (heart problems), and nicotine (for those trying to quit smoking).

11. DISORDERS OF THE INTEGUMENTARY SYSTEM

Unlike some other body systems, the integumentary system quickly shows when it is **struck by** an injury or disorder. Over one thousand different disorders can affect the skin. The most common skin disorders are those caused by allergies or bacterial or **fungal infections**. Burns and skin cancers, although less common, are more dangerous. In some cases, they can be **lethal**.

The following are just a few of the many disorders that can target the integumentary system.

Acne

Acne is a skin disease marked by **pimples** on the face, chest, and back. The most common skin disease, acne, affects an estimated 17 to 28 million people in the United States. Although it can strike people at any age, acne usually begins at puberty and worsens during adolescence.

At puberty, increased levels of androgens (male hormones) cause the **sebaceous glands** to secrete an excessive amount of sebum into **hair follicles**. The excess sebum combines with dead, sticky skin cells to form a hard plug that blocks the follicle. Bacteria that normally lives on the skin then invades the blocked follicle. Weakened, the follicle bursts open, releasing the sebum, bacteria, skin cells, and white blood cells into the surrounding tissues. A pimple then forms.

Treatment for acne depends on whether the condition is mild, moderate, or severe. The goal is to reduce sebum production, remove dead skin cells, and kill skin bacteria. In very mild cases, keeping the skin clean by washing with a mild soap is recommended. In other cases, medications applied directly to the skin or taken orally may be prescribed in combination with gentle cleansing.

Athlete's foot

Athlete's foot is a common fungus infection in which the skin between the toes becomes **itchy** and **sore**, **cracking** and **peeling away**. Properly known as tinea pedis, the infection received its common name because the infection causing fungi grow well in warm, damp areas such as in and around swimming pools, showers, and locker rooms (areas commonly used by athletes).

The fungi that cause athlete's foot are unusual in that they live exclusively on dead body tissue (hair, the outer layer of skin, and nails). Researchers do not know exactly why some people develop the condition and others do not. It is known that sweaty feet, tight shoes, and the failure to dry feet well after swimming or bathing all contribute to the growth of the fungus.

Symptoms of athlete's foot include itchy, sore skin on the toes, with scaling, cracking, inflammation, and **blisters**. If the blisters break, raw patches of tissue may be exposed. If the infection spreads, itching and burning may increase.

Athlete's foot usually responds well to treatment. Simple cases are treated with antifungal creams or sprays. In more severe cases, an oral antifungal medication may be prescribed.

Burns

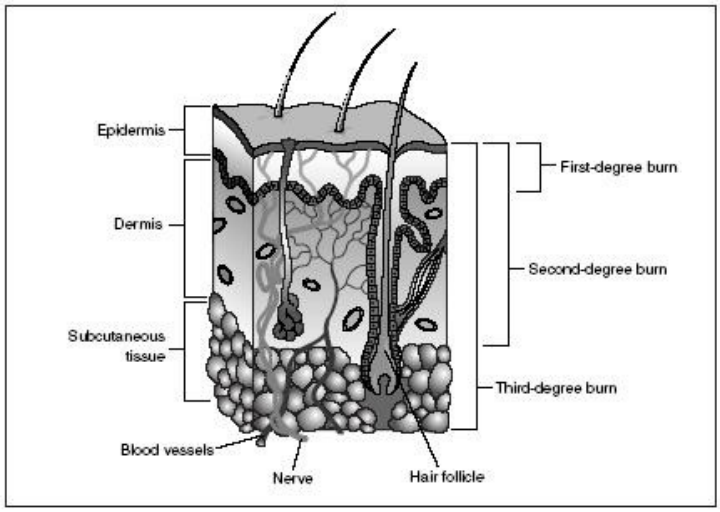
There are few threats more serious to the skin than burns. Burns are injuries to tissues caused by intense heat, electricity, UV radiation (sunburn), or certain chemicals (such as acids). When skin is burned and cells are destroyed, the body immediately loses its precious supply of fluids. Dehydration can follow, leading to a failure of the kidneys, a life-threatening condition. Infection of the dead tissue by bacteria and viruses occurs one to two days after skin has been burned. Infection is the **leading cause** of death in burn **victims**.

Burns are classified according to their severity or depth: first-, second-, or third-degree burns.

First-degree burns occur when only the epidermis is damaged. The burned area is painful, the outer skin is reddened, and slight swelling may be present. **Sunburns** are usually first-degree burns. Although they may cause discomfort, these minor burns are usually not serious and heal within a few days.

Second-degree burns occur when the epidermis and the upper region of the dermis are damaged. The burned area is red, painful, and may have a wet, shiny appearance because of exposed tissue. **Blisters** may form. These moderate burns take longer to heal. If the blisters are not broken and care is taken to prevent infection, the burned skin may regenerate or regrow without permanent **scars**.

Third-degree burns occur when the entire depth of skin is destroyed. Because **nerve endings** have been destroyed, the burned area has no sensitivity. The area may be blackened or gray-white in color. Muscle tissue and bone underneath may be damaged. In these serious to critical burns, regeneration of the skin is not possible. **Skin grafting** –taking a piece of skin from an unburned portion of the burn victim's body and transplanting it to the burned area – must be done to cover the exposed tissues. Third-degree burns take weeks to heal and will leave permanent scarring.



Dermatitis

Dermatitis is any inflammation of the skin. There are many types of dermatitis and most are characterized by a pink or red **rash** that **itches**. Two common types are contact dermatitis and seborrheic dermatitis.

Contact dermatitis is an allergic reaction to something that **irritates** the skin. It usually appears within forty-eight hours after touching or brushing against a substance to which the skin is

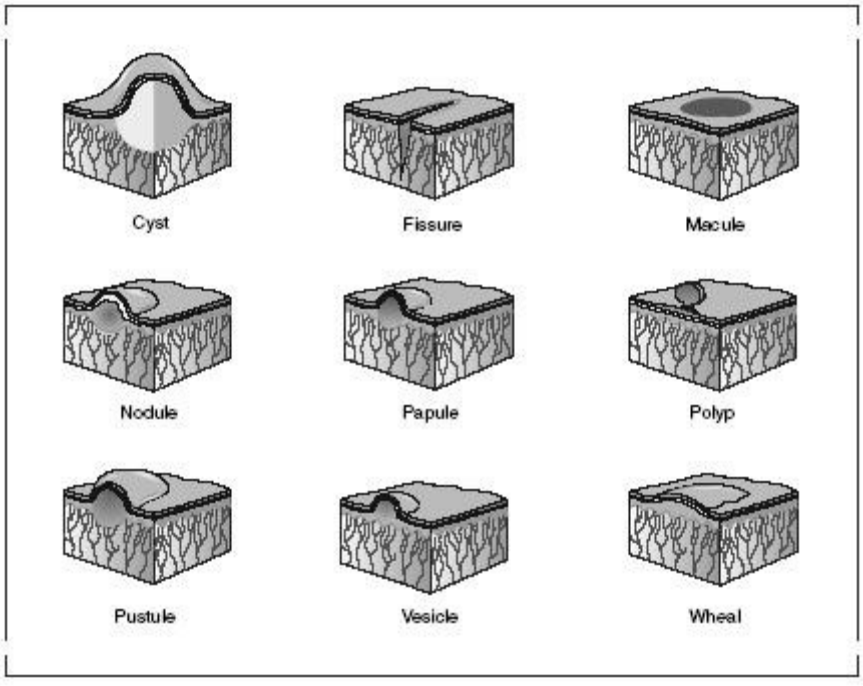
sensitive. For example, the resin in poison ivy is the most common source of contact dermatitis. The skin of some people may also be irritated by certain flowers, herbs, and vegetables. Chemical irritants that can cause contact dermatitis include chlorine, cleaners, detergents and soaps, fabric softeners, perfumes, glues, and topical medications (those applied on the skin). Contact dermatitis can be treated with medicated creams or **ointments** and oral antihistamines and antibiotics.

Seborrheic dermatitis, known commonly as seborrhea, appears as red, inflamed skin covered by **greasy or dry scales** that may be white, yellow, or gray. These scaly **lesions** appear usually on the **scalp**, hairline, and face. **Dandruff** is a mild form of seborrheic dermatitis. Medical researchers do not know the exact cause of this skin disease. They believe that a high-fat diet, alcohol, stress, oily skin, infrequent shampooing, and weather extremes (hot or cold) may play some role. The disease may be treated with special shampoos that help soften and remove the scaly lesions. In more severe cases, medicated creams or shampoos containing coal tar may be prescribed.

Psoriasis

Psoriasis is a chronic (long-term) skin disease characterized by inflamed lesions with silvery-white **scabs** of dead skin. The disease affects about four million people in the United States, women slightly more than men. It is most common in **fair-skinned** people.

Normal skin cells mature and replace dead skin cells every twenty-eight to thirty days. Psoriasis causes skin cells to mature in less than a week. Because the body cannot shed old skin as fast as new cells are rising to the surface, raised **patches** of dead skin develop. These patches are seen on the arms, back, chest, elbows, legs, folds between the buttocks, and scalp.



The cause of psoriasis is unknown. In some cases, it may be hereditary or inherited. Attacks of psoriasis can be **triggered by** injury or infection, stress, hormonal changes, exposure to cold temperature, or steroids and other medications.

The treatment for psoriasis depends on its severity. Steroid creams and ointments are commonly used to treat mild or moderate psoriasis. If the case is more severe, these

medications may be used in conjunction with ultraviolet light B (UVB) treatments. Strong medications are reserved for those individuals suffering from extreme cases of psoriasis.

Various types of skin lesions. Skin ailments such as dermatitis, psoriasis, and acne are characterized by the size, shape, and texture of lesions present at **outbreak**.

Skin cancer

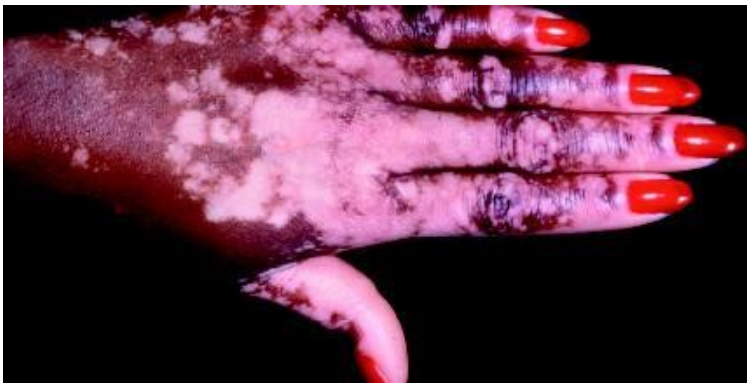
Skin cancer is the growth of abnormal skin cells capable of invading and destroying other cells. Skin cancer is the single most common type of cancer in humans. The cause of most skin cancers or carcinomas is unknown, but **overexposure** to ultraviolet radiation in sunlight is a risk factor.

Basal cell carcinoma is the most common form of skin cancer, accounting for about 75 percent of cases. It is also the least **malignant** or **cancerous** (tending to grow and spread throughout the body). In this form of skin cancer, basal cells in the epidermis are **altered** so that they no longer produce keratin. They also spread, invading the dermis and subcutaneous layer. Shiny, dome-shaped lesions develop most often on sunexposed areas of the face. The next most common areas affected are the ears, the backs of the hands, the shoulders, and the arms. When the lesion is removed surgically, 99 percent of patients recover fully.

Squamous cell carcinoma affects the cells of the second deepest layer of the epidermis. Like basal cell carcinoma, this type of skin cancer also involves skin exposed to the sun: face, ears, hands, and arms. The cancer presents itself as a small, scaling, raised **bump** on the skin with a **crusting** center. It grows rapidly and spreads to **adjacent lymph nodes** if not removed. If the lesion is caught early and removed surgically or through radiation, the patient has a good chance of recovering completely.

Malignant melanoma accounts for about 5 percent of all skin cancers, but it is the most serious type. It is a cancer of the melanocytes, cells in the lower epidermis that produce melanin. In their early stages, melanomas resemble **moles**. Soon, they appear as an expanding brown to black patch. In addition to invading surrounding tissues, the cancer spreads aggressively to other parts of the body, especially the lungs and liver. Overexposure to the Sun may be a cause of melanomas, but the greatest risk factor seems to be genetic. Early discovery of the melanoma is key to survival. The primary treatment for this skin cancer is the surgical removal of the tumor or diseased area of skin. When the melanoma has spread to other parts of the body, it is generally considered **incurable**.

Vitiligo



Vitiligo is a skin disorder in which the loss of melanocytes (cells that produce the color pigment melanin) results in patches of smooth, milky white skin. This often inherited disorder affects about 1 to 2 percent of the world's population. Although it is more easily observed in people with darker skin, it affects all races. It can begin at any age, but in 50 percent of the cases it starts before the age of twenty.

Medical researchers do not know the exact cause of the disorder. Some theorize that nerve endings in the skin may release a chemical that destroys melanocytes. Others believe that the melanocytes simply self-destruct. Still others think that vitiligo is a type of autoimmune disease, in which the body **targets** and destroys its own cells and tissues.

Vitiligo cannot be cured, but it can be managed. Cosmetics can be applied to blend the white areas with the surrounding normal skin. **Sunscreens** are useful to prevent the burning of affected areas and to prevent normal skin around the patches from becoming darker.

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Warts

Warts are small growths caused by a viral infection of the skin or mucous membrane. The virus infects the surface layer. Warts are **contagious**. They can easily pass from person to person. They can also pass from one area of the body to another on the same person. Affecting about 7 to 10 percent of the population, warts are particularly common among children, young adults, and women. Common warts include hand warts, foot warts, and flat warts.

Hand warts grow around the nails, on the fingers, and on the backs of the hands. They appear mostly in areas where the skin is broken.

Foot warts (also called plantar warts) usually appear on the ball of the foot, the **heel**, or the flat part of the toes. Foot warts do not stick up above the surface like hand warts. If left untreated, they can grow in size and spread into clusters of several warts. If located on a pressure point of the foot, these warts can be painful.

Warts are caused by viral infections of the skin.

Flat warts are smaller and smoother than other warts. They grow in great numbers and can erupt anywhere on the body. In children, they appear especially on the face.

Many **nonprescription** wart **remedies** are available that will remove simple warts from hands and fingers. Physicians use stronger chemical medications to treat warts that are larger or do not respond to **over-the-counter treatments**. Freezing warts with liquid nitrogen or burning them with an electric needle are advanced treatment methods.

Herpes Infections

Cold sores are a very common health problem. More than 60 percent of Americans have had a cold sore. Nearly 25 percent of these individuals have repeated **outbreaks** of cold sores. Cold sores are also known as fever blisters or oral herpes. They are usually caused by herpes simplex virus 1 (HSV1).

Most people are first infected with HSV1 before the age of ten. Once the virus enters the body, it remains there for life. Cold sores are painful blisters filled with fluid. They usually occur on the lips. By contrast, **canker sores** usually occur on the tongue, inside the cheeks, or elsewhere inside the mouth.

Genital herpes are also painful blisters filled with fluid. They are caused by a close relative of HSV1, herpes simplex virus 2 (HSV2). A common **rule of thumb** is that HSV1 causes infections above the waist and HSV2 causes infections below the **waist**. But that rule is not completely true. Either virus can cause infections above or below the waist. Still, the rule is a good general guideline as to where each virus is most likely to be active.

Viruses that enter the body often go through a **latency period**. A latency period is a stage during which the virus goes into hiding. It can be found in cells, but it is not active. There are no external symptoms that the virus is in the body.

At some point, however, the virus becomes active again. Any number of factors can cause reactivation of the virus. Physical or emotional shock is a common cause. When the virus becomes active again, symptoms of the infection **reappear**.

This pattern explains why cold sores and genital herpes commonly appear and then disappear. Each new appearance does not mean a new infection. It means that the virus has emerged from its latency period and become active again.