**Cardiovascular, Respiratory, and Digestive Systems**

**Why Does Blood Circulate?**

Your heart pumps blood through the body 24 hours a day. It also does these important tasks:

* Carrying oxygen from the lungs to body cells
* Absorbing nutrients from food and delivering nutrients to body cells
* Carrying carbon dioxide, a waste gas, from your cells back to your lungs to be exhaled
* Delivering other waste products to the kidneys for removal from the body
* Helping the white blood cells fight disease by attacking infectious organisms

**The Heart:**

-Makes the cardiovascular system work; inside the heart are four chambers two top are the atria, two bottom are the ventricles. The septum which is a wall of tissue separates the four chambers.

-Valves between the atria and ventricles allow blood to flow through the chambers

- the top right of the atrium is an area of muscle that acts as a pacemaker for the heart.

-Electrical impulses stimulate the atria to contract, forcing blood into the ventricles.

-These electrical impulses travel through the heart to an area between the two ventricles. There they stimulate the muscles of the ventricles to contract, pumping blood out of the heart.

**Pulmonary Circulation-** process by which blood moves between the heart and the lungs. During this process, blood that has lost oxygen and picked up carbon dioxide and wastes receives fresh oxygen in the lungs. The oxygen rich blood is then circulated again through the body.

**Blood-** is the fluid that delivers oxygen, hormones, and nutrients to the cells and carries away wastes. Blood is made up of:

**Plasma:** 55 percent of total blood volume consists of this. This is a fluid which other parts of the blood are suspended. Plasma is mainly water, but it also contains nutrients, proteins, salts, and hormones.

**Red blood Cells:** make up about 40 percent of normal blood. They contain hemoglobin ( the oxygen carrying protein in blood.) It contains iron that binds with oxygen in the lungs and releases the oxygen in the tissues. It also combines with carbon dioxide, which is carried from the cells to the lungs.

**White Blood Cells:** These cells protect the body against infection. Some white blood cells surround and ingest the organisms that cause disease. Other form antibodies that provide immunity against a second attack from that specific disease. Other types can fight allergic reactions.

**Platelets:** are types of cells in the blood that cause blood clots to form. When the wall of a blood vessel tears, platelets collect at the tear. They release chemicals that stimulate the blood to produce small thread-like fibers that trap nearby cells and help to form a clot. The clot blocks the flow of blood and dries to form a scab.

-All humans have one of four types of blood A, B, AB, and O. Each blood type is determined by the presence or absence of certain substances called antigens. Blood Types A,B, or AB possess antigens, and a person must receive blood from someone with the same antigen. He or she can receive type O blood, because it contains no antigens. People with O blood time are known as universal donors, anyone can receive their blood.Blood also contains the Rh factor if your blood contains it you are Rh positive if not you are Rh negative.

**Blood Vessels:**

**Arteries-** blood vessels that carry oxygenated blood away from the heart. Arteries have vessels that branch into progressively smaller vessels called arterioles, these deliver blood to capillaries.

**Capillaries-** small vessels that carry blood from arterioles and to small vessels called venules, which empty into veins. These form vast networks network throughout tissues and organs in the body, reaching almost all body cells. Capillaries near the skin can also dilate allowing heat to escape the body through the skin.

**Veins-** are blood vessels that return blood to the heart. The walls of veins are thinner and less elastic than those of the arteries; they are still able to withstand the pressure exerted by blood flowing through them. The large veins (vena cava) carry deoxygenated blood to the right atrium of the heart. Pulmonary veins carry oxygenated blood to the left atrium. Many veins in the body especially those in the legs have valves that help to prevent backflow of blood as it is pumped back to the heart.

**Lymph Circulation**

**Lymph-** the clear fluid that fills the spaces around body cells. Like plasma, lymph contains water and proteins. It also contains fats and specialized white blood cells called lymphocytes. Like white blood cells these cells protect the body against pathogens.

**Pathogen-** a microorganism that causes disease.

**-Two types of lymphocytes B cells and T cells.**

-B cells multiply when they come in contact with a pathogen, the new B cells produce antibodies to fight the pathogen. Other B cells creat an immune response by preventing a second attack of the same disease.

-T cells have two main types killer cells and helper cells. T cells multiply and enlarge when they come in contact with a pathogen.

-Killer T cells release toxins that prevent infections from spreading. Another type of T cell, the helper T cell activates both the B cells and Killer T cells.

-Lymph is filtered by lymph nodes (small bean shaped organs found in lymph vessels.) White blood cells found within lymph nodes trap and destroy pathogens.

- Smooth muscles lining the walls of lymph vessels and surrounding skeletal muscles contract to move lymph toward the heart. The two large lymphatic ducts empty lymph into veins close to the heart where the lymph is returned to the blood.

-Lymphatic system also contains organs like the spleen, thymus gland, tonsils, adenoids, and appendix to protect the body from infection.

**Blood Pressure** is a measure of the amount of force that the blood places on the walls of blood vessels, particularly larger arteries, as it is pumped through the body.

-Blood pressure reading includes two numbers systolic pressure (the maximum pressure as your heart contracts to push blood into your arteries.) And the diastolic pressure (pressure at its lowest point when your ventricles relax)

-Healthy person’s blood pressure will vary within a normal range of below 120/80. Blood pressure that is above 140/90 is considered high and is a strain on the heart.

**Cardiovascular System Problems:**

* **Congenital heart defects**: conditions of the heart that are present at birth. Septal defect is a hole in the septum that allows oxygenated blood to mix with oxygen-depleted blood. Can also result from poor health of a baby’s mother during pregnancy.
* **Heart Murmurs:** caused by a hole in the heart, or a leaking or malfunctioning valve.
* **Anemia**: condition in which the ability of the blood to carry oxygen is reduced. The blood may contain low numbers of red blood cells or low concentrations of hemoglobin. Common cause Iron deficiency
* **Hemophilia:** an inherited disorder. The blood does not clot properly. Bruising and uncontrolled bleeding may occur spontaneously or due to injury.
* **Leukemia:** form of cancer in which white blood cells are produced excessively and abnormally. This causes the person to be susceptible to infection, severe anemia, and possibly uncontrolled bleeding. Chemotherapy, radiation, and bone marrow transplant are all treatment options.

**Lymphatic System Problems**

* **Tonsillitis:** your tonsils help reduce the number of pathogens entering the body through the respiratory system. If the tonsils become infected, tonsillitis results. Antibiotics or surgery for treatment.
* **Immune Deficiency:** results if the immune system is weakened and can no longer protect the body against infection. It may be a congenital condition in which the body cannot make specialized white blood cells, limiting protection against infection. Other causes include HIV, chemotherapy, and aging.
* **Hodgkin’s Disease-**  AKA Hodgkin’s lymphoma, this type of cancer affects the lymph tissue found in lymph nodes and the spleen. Early detection and treatment is essential for recovery. Treatment may include removal of lymph nodes, radiation, and chemotherapy.

**Respiratory System**

-Removes carbon dioxide from the body and provides it with fresh oxygen. Inhaling and exhaling causes the lungs to expand and deflate slightly

**External respiration**- oxygen moves from the lungs into the blood, and carbon dioxide moves from the blood into the lungs.

**Internal respiration**- oxygen moves from the blood into the cells, and carbon dioxide moves from the cells into the blood.

**\*\*\*Essential for Survival oxygen fuels the brain and allows your body to metabolize food for energy\*\*\***

**How Respiration works**

**Diaphragm-** muscle that separates the chest from the abdominal cavity. As you inhale, the diaphragm and the muscles between your ribs contract.

**The Lungs-** the structure of th lungs can be compared to the structure of a tree.

**Trachea-** air moves through this to the lungs. This is your windpipe. Trachea branches out into tow bronchi.

**Bronchi-** the main airways that reach into each lung, they become smaller as they branch out deeper into the lungs.

**Bronchioles-** network of tubes that bring air closer to the site of external respiration.

**Aveoli-** microscopic structures at the end of the Bronchioles. Thin-walled air sacs covered with capillaries. Gas exchange takes place as oxygen and carbon dioxide spread across the walls of the capillaries and alveoli.

**Cilia-** hairlike structures that line the nose, these produce mucus to keep dust, bacteria, and viruses from moving deeper into the respiratory system.

**Pharynx-** throat

**Trachea-** windpipe

**Epiglottis-** flap of tissue located above the larynx. Folds down to close off the entrance to the larynx and trachea.

**Maintain Respiratory Health:**

* Do not smoke (single most important decision)
* Regular Physical Activity
* Wash hands regularly.

**Respiratory Problems:**

 **-Sinusitis-** an inflammation of the tissues that line the sinuses, air filled cavities above the nasal passages and throat.

- **Bronchitis-** an inflammation of the bronchi caused by infection or exposure to irritants such as tobacco smoke or air pollution. The membranes that line the bronchi produce excessive amounts of mucus in the airways. This blocks the airway leading to coughing, wheezing, and shortness of breath.

-**Asthma-**  is an inflammatory condition in which the trachea, bronchi, and bronchioles become narrowed, causing difficulty breathing.

**Pneumonia-** an inflammation of the lungs commonly caused by a bacterial or viral infection.

**-Tuberculosis-** a contagious bacterial infection that usually affects the lungs. When infected your immune system will surround infected area and isolate it. In the inactive stage which can last for years there will be no symptoms. If immune system is weakened the infection can be active, symptoms include cough, fever, fatigue, and weight loss.

-**Emphysema-**  a disease that progressivelydestroys the walls of the alveoli. Symptoms include breathing difficulty and chronic cough. Symptoms can be treated but tissue damage is permanent.

**Digestive System**

**Functions can be divided into three main processes:**

1. **Digestion-** the mechanical and chemical breakdown of foods within the stomach and intestines for use by the body cells.
2. **Absorption-** is the passage of digested food from the digestive tract into the cardiovascular system.
3. **Elimination-** the body’s expulsion of undigested good or body wastes.

**How Digestion Works**

**-Teeth:** break food into smaller pieces. **Mastication-**process of chewing. This prepares food to be swallowed.

**-Salivary Glands-** produce digestive juices. Saliva contains an enzyme that begins to break down the starches and sugars in food into smaller particles.

**-Tongue**- prepares chewed food for swallowing by shaping it. The uvula a small flap of tissue at the back of the mouth prevents food from entering the nasal passages. The epiglottis prevents food from entering the respiratory system.

**Esophagus:** when food is swallowed it enters this. This is a muscular tube about 10 inches long that connects the pharynx with the stomach. Food is moved through the esophagus, stomach, and intestine through peristalsis.

**Peristalsis-** a series of involuntary muscle contractions that moves food through the digestive tract.

**Stomach-** hollow, sac like organ enclosed in a wall of muscles. Muscles are flexible and allow the stomach to expand when you eat.

**Gastric juices-** are secretions from the stomach lining that contain hydrochloric acid and pepsin, an enzyme that digest protein. The hydrochloric acid kills bacteria taken in with good and creates an acidic environment for pepsin to do its work. Mucus produced by the stomach forms a protective lining so that the gastric juices do not harm the stomach.

* Stomach holds food for further digestion before it is moved into the small intestine.
* As food is digested in the stomach, it is converted to chime, a creamy, fluid mixture of food and gastric juices.
* As food is digested in the stomach it gets converted to chime (a creamy fluid mixture of good and juice.)
* Peristalsis moves the chime into the small intestine through an opening controlled by sphincter muscle

**Pancreas-** produces enzymes that break down the carbohydrates, fats, and proteins in good.

**Bile-**  a yellow-green, bitter fluid important in the breakdown and absorption of fats. (liver produces this) this is stored in the gallbladder between meals. At meal time it is secreted into the bile duct to reach the intestine and mix with fats in food. This acid dissolves the fats into watery contents of the intestine. After the fat is dissolved, it is digested by enzymes from the pancreas and the lining of the intestine.

**Small Intestine-** this is 20-23 feet in length and 1 inch in diameter. It consists of three parts: the duodenum, jejunum, and the ileum. 90% of all nutrients are absorbed through the small intestine. It contains millions of finger like projections called villi. The villi are lined with capillaries that absorb the nutrients. Unabsorbed material leaves the small intestine in the form of liquid and fiber and moves into the large intestine. Undigested parts of food pass into the colon or large intestine.

**Large intestine-** about 2.5 inches in diameter and 5 to 6 feet in length. Its function is to absorb water, vitamins, and salts and to eliminate waste.

**Digestive System Problems**

**Indigestion:** a feeling of discomfort in the upper abdomen, sometimes with gas and nausea. This can be caused by eating too much food, eating too quickly, eating spicy or high-fat goods. Stomach disorders or stress.

**Constipation:** causes the feces to become dry and hard, making bowel movements difficult. Causes can include not drinking enough water, or not consuming enough fiber.

**Heartburn:** a burning sensation in the center of the chest that may rise up to the throat. It results from acid reflux, or the backflow of stomach acid into the esophagus. Using tobacco, alcohol, and aspirin, or eating spicy or greasy foods.

**Gas:** produced from the breakdown of food is normal. Excessive gas can result in cramps or an uncomfortable feeling of fullness in the abdomen.

**Nausea:**  the feeling of discomfort that sometimes precedes vomiting. Motion sickness, pathogens, some medications, and dehydration can result in nausea.

**Diarrhea:** the frequent passage of watery feces. Can be caused by bacterial or viral infections, some medications, a changein eating style, overeating, emotional turmoil, or nutritional deficiencies. Dehydration can occur.

**Structural Problems**

**Tooth Decay:** may make it difficult to chew foods thoroughly. Brushing and flossing daily can help prevent it along with regular dental checkups.

**Gastritis:** an inflammation of the mucous membrane that lines the stomach acid, use of tobacco or alcohol, bacterial or viral infections and some medications. Symptoms: Pain, indigestion, decrease appetite, nausea.

**A Peptic Ulcer:** sore in the lining of the digestive tract. Can be caused by a bacterial infection or overuse of aspirin. Symptoms include abdominal pain, nausea, and vomiting and can cause stomach bleeding.

**Gallstones:** form when cholesterol in bile crystallizes. Can block the bile duct between gallbladder and small Intestie. Symptoms pain in upper right part of abdomen, nausea, vomiting and fever.

**Appendicitis:** inflammation of the appendix. 3-4 inch tube at tip of large intestine. Can be caused by blockage or bacterial infection. Symptoms include pain in lower right abdomen and fever. Can burst which can spread infection throughout abdomen and lead to death.

**Colitis:** the inflammation of the large intestine, or colon. Can be caused by bacterial or viral infections. Symptoms can be fever, abdominal pain, and diarrhea that may contain blood.

**Colen Cancer:** 2nd leading cause of cancer death. Usually develops in the lowest part of the colon near the rectum. Low fat, high-fiber eating plan decreases the risk.

**Hemorrhoids:** veins in the rectum and anus that may become swollen and inflamed. This can occur with constipation, during pregnancy, and after childbirth.

**Crohn’s Disease:** causes inflammation of the lining of the digestive tract. Symptoms include diarrhea, weight loss, fever and abdominal pain.

**Cirrhosis:** or scarring of the liver tissue. Caused by prolonged heavy alcohol use and can lead to failure or death.

**Excretory System**

**Liver-** plays an important role in the digestive system, and also removes certain toxins from the blood. It is the first organ to receive chemicals absorbed from the small intestine. The liver detoxifies the body by processing and excreting into bile such things as drugs, alcohol, and some cellular waste products.

**Urinary system-**  consists of the kidneys, bladder, ureters, and urethra. Main function is to filter waste and extra fluid from the blood.

**Kidneys-** bean shaped organs about the size of a fist. They are near the middle of the back just below the rib cage, one on each side. They remove waste products from the blood through tiny filtering units called nephrons (functional units of kidneys.) Each one contains more than a million. Each nephron consists of a ball formed of small blood capillaries called a glomerulus which is attached to a small renal tubule that acts as a filtering funnel. Kidneys adjust the amount of salts, water, and other materials excreted according to the body’s needs.

**Ureters-** from the kidneys urine travels to the bladder through the ureters. Each tube is 8-10 inches long.

**Bladder and Urethra-** bladder is a hollow muscular organ located in the pelvic cavity. Bladder is held in place by ligaments attached to other organs and the pelvic bones. Urethra is a tube that leads from the bladder to the outside of the body.

**Maintaining Excretory Health**

* Drink at least eight 8 ounce glasses of water each day.
* Limit intake of caffeine and soft drinks which can increase amount of water lost through urination.
* Follow well balanced eating plan.
* Practice good hygiene to prevent harmful bacteria from causing an infection.
* Get regular medical checkups.

**Excretory System Problems**

**Cystitis:** an inflammation of the bladder, most often caused by a bacterial infection. If left untreated can spread to kidneys.

**Urethritis:** an inflammation of the urethra; can cause bacterial infection.

**Nephritis-** an inflammation of the nephrons. Symptoms include change in the amount of urine produced, fever, and swelling of body tissues.

**Kidney Stones-** form when salts in the urine crystallize into solid stones. Kidney stones can move into the ureter, causing pain. May also block passage of urine.

**Uremia-** a serious condition associated with decreased blood filtration by the kidneys, leading to abnormally high levels of nitrogen waste products remaining in the blood. These wastes are poisonous to body cells and can cause tissue damage or death.

**Kidney Failure**- occurs when kidneys lose ability to function.

**Hemodialysis-** is a technique in which an artificial kidney machine removes waste products from the blood.

**Peritoneal dialysis-** uses the peritoneum a thin membrane that surrounds the digestive organs to filter blood. Substances that promote the removal of toxins enter into the abdomen through the catheter and are drained after filtration is complete.

**Kidney Transplant-** another treatment option for chronic kidney failure. This involves the replacement of a nonfunctioning kidney with a healthy kidney from an organ donor.