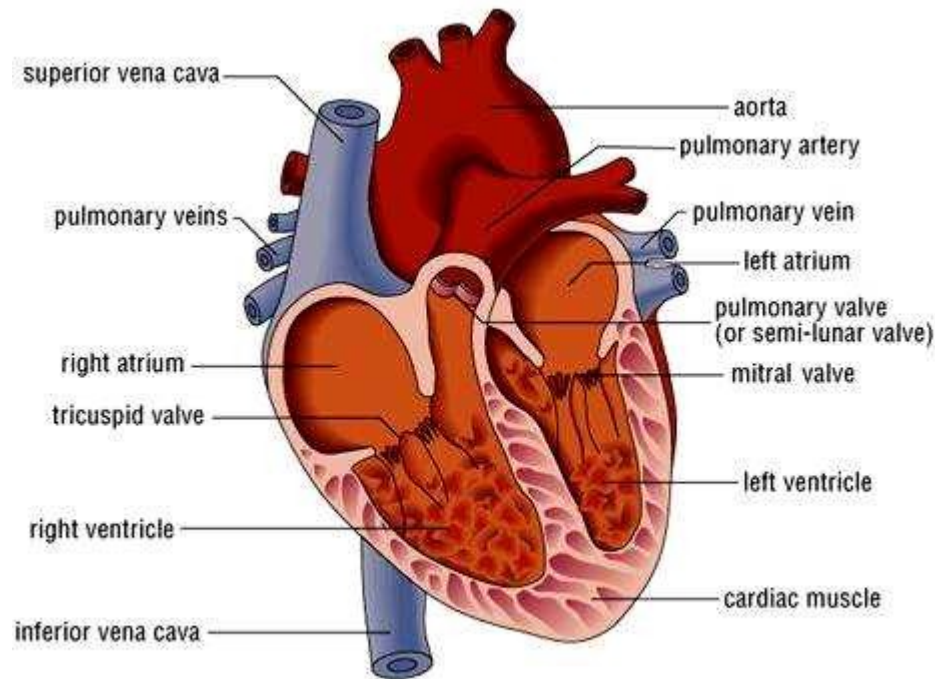


<p>What does our circulatory system do?</p>	<p>Carries nutrients (like glucose), wastes (like ammonia), gasses (like oxygen), and chemicals (like hormones); fights infection, maintains our pH; maintains a constant body temperature; assists in digestion, breathing, and nerves.</p>
<p>What types of circulatory systems are there?</p>	<p><u>Open</u>: blood is not always in vessels- sometimes it goes into cavities, known as hemocels or sinuses (sinuses usually secrete and store liquid). This type of system is found in <u>crustaceans</u> and <u>bugs</u>, mostly. It is fairly inefficient as blood slows down as it enters cavities.</p> <p><u>Closed</u>: in <u>vertebrae</u> (and <u>earthworms</u>). The blood is contained within vessels. This type of system is more efficient because the blood is always under pressure.</p> <p>All circulatory systems contain a pump (heart), fluid (blood), and a series of vessels (veins, arteries, and capillaries).</p>
<p>Do simple organisms (100ish cells) have circulatory systems? Do flat or porous organisms?</p>	<p>No. All of the oxygen they need is absorbed through the surface and diffuses around the organism.</p>
<p>What are fish hearts like?</p>	<p>They have two chambers. The upper chamber, or atrium/auricle, gets oxygen rich blood from the gills, but also deoxygenated (actually carbon dioxide rich) blood that has been through the body. The blood passes through a valve, into the lower chamber, called the ventricle. This mix of blood is taken to the gills and the body.</p> <p>This system is inefficient because oxygenated and deoxygenated blood are mixed, which allows less oxygen to reach the body cells.</p>
<p>What are amphibian hearts like?</p>	<p>They have three chambers. Oxygenated blood from the gills/lungs enters one auricle, while deoxygenated blood from the body enters another. These two auricles are separated by a septum. Blood passes through two separate valves, into a common ventricle.</p> <p>This system is as inefficient as the fish because blood is still mixed.</p>
<p>What are reptile hearts like?</p>	<p>They have 3 ½ chambers. Separate bloods enter separate auricles, pass through separate valves, and enter into a common</p>

	<p>chamber with a partial septum. This system is still inefficient, as blood is still mixed.</p>
<p>What are bird and mammal hearts like?</p>	<p>They have four chambers. Separate bloods are carried in separate vessels, enter separate auricles, pass through separate valves, enter separate ventricles, and are carried out in separate vessels. Oxygenated and deoxygenated bloods never mixed. This is very efficient, since the blood that is delivered to the body has the most oxygen possible, and the least carbon dioxide possible.</p>
<p>What are arteries?</p>	<p>Vessels of the venal system which carry blood away from the heart. They mostly carry oxygenated blood, to the body tissues. These are highly elastic and very muscular, to accommodate the pressure that blood is pumped at. These expand and contract with the expansions and contractions of the left ventricle of the heart.</p>
<p>What are veins?</p>	<p>Vessels of the venal system which carry blood to the heart. These are not as strong as arteries, since they carry blood that is under very little pressure. They mostly carry deoxygenated blood, which is taken to the lungs to be re-oxygenated.</p>
<p>What are capillaries?</p>	<p>These vessels are the “middlemen” between the venal and arterial blood systems. They are only one cell thick. <u>These are the functional units of the circulatory system.</u> Cells can never be more than one cell away from capillaries, since nutrients diffuse into cells from capillaries and wastes diffuse out.</p> <p style="text-align: center;">artery < > capillary < > vein</p>
<p>How are arteries, veins, and capillaries made up?</p>	<p>The opening- the lumen- is surrounded by smooth muscle, of which we cannot control. They are porous, to allow for easy diffusion.</p>
<p>How does the lymph system work with capillaries?</p>	<p>When capillaries “switch” (arteries to veins and vice versa) the plasma moves out of the capillaries, into lymph vessels, leaving the solids: red and white blood cells platelets, and blood proteins (albumins, globulins, and fibrinogens). The lymph vessels move the fluid back to the capillaries so the solids can move.</p>
<p>What is plasma?</p>	<p>Blood fluid- about 90% water, with the remnant being dissolved gasses, salts, nutrients, enzymes, hormones, waste products, and plasma proteins. These proteins are divided into three categories:</p>

	<p><u>Albumins</u> keep blood at a good viscosity.</p> <p><u>Globulins</u> produce antibodies.</p> <p><u>Fibrinogen</u> is the protein responsible for blood clotting.</p>
What do red blood cells do?	<p>Red blood cells, or erythrocytes, transport oxygen. The protein hemoglobin, which is on the surface of a red blood cell, and which contains 4 iron, binds to oxygen from the lungs and then releases it to body cells.</p> <p>Red blood cells are shaped like disks with thick edges and thinner centers. They are produced from cells in red bone marrow. They are filled with hemoglobin as they mature, and it eventually forces out all their organelles, even nuclei. Hemoglobin also gives blood its red color.</p> <p>After about 120 days of circulation, blood cells are worn out from squeezing through narrow capillaries. They rupture in the liver or spleen.</p>
What do white blood cells do?	<p>White blood cells, or leukocytes, fight foreign substances or organisms. There are several types, which attack foreigners different ways.</p> <p>White blood cells grow from red bone marrow, but have nuclei and no hemoglobin. They live from several days to several months.</p>
What are platelets, and do they do?	<p>Platelets originate from bone marrow cells that break into thousands of pieces. Each fragment of cytoplasm that is incased in cell membrane is a platelet.</p> <p>Platelets are responsible for blood clotting. When a blood vessel breaks, they become very sticky, and cluster around the rupture. They then release proteins known as clotting factors.</p> <p>The clotting factor thromboplastin converts prothrombin, which is in plasma, into thrombin. Thrombin, an enzyme, converts the plasma protein fibrinogen into fibrin filaments, which stop the bleeding by producing a cut.</p>
What are vasoconstrictors?	<p>These substances cause blood vessels to squeeze closed, restricting blood flow. They are the hormone <u>adrenaline</u>, <u>caffeine</u>, and <u>nicotine</u>.</p>
What are vasodilators?	<p>These substances cause blood vessels to open, speeding blood flow. They are the hormone <u>adrenaline</u> and <u>alcohol</u>.</p>



<p>What are the vena cavas?</p>	<p>These veins bring deoxygenated blood from the body, to the heart. The superior vena cava is in the upper right part of the heart, and the inferior vena cava is in the lower right part of the heart.</p>
<p>What is the pulmonary artery?</p>	<p>This artery brings deoxygenated blood from the right ventricle to the lungs. This is, in fact, the only artery that carries deoxygenated blood. After blood enters it from the heart, it splits, leading to each lung. Gradually, it splits into capillaries which surround the alveoli.</p>
<p>Where does deoxygenated blood go?</p>	<p>When deoxygenated blood is brought in through the vena cavas to the right auricle, it relaxes and fills with blood, then contracts, pumping blood through the tricuspid valve into the right ventricle. This contracts, pumping blood through the pulmonary valve (a semilunar valve), into the pulmonary artery. This artery splits into capillaries, and oxygen diffuses into them. These capillaries gradually become the pulmonary vein, which brings this newly oxygenated blood to the left auricle. This blood is not under pressure. This is the <u>pulmonary circuit</u>, and the right auricle/ventricle is</p>

	the <u>pulmonary pump</u> . (Pulmonary=lung).
Where does oxygenated blood go?	After it is delivered to the left auricle, it is pumped through the mitral valve, into the strongest pump of the heart- the left ventricle. From there, it is pumped through the the aortic valve, into the aorta. From there, it branches into arteries and arterial capillaries that deliver blood to the entire body. This blood is pumped under pressure. This makes up the <u>systemic circuit</u> that delivers blood to the entire body.
What are heart valves like?	<u>Atri-Ventricular</u> : these valves separate between auricles and ventricles. Right pump: 3-flapped tricuspid valve. Left pump: 2- flapped bicuspid valve, AKA mitral valve. <u>Semi-Lunar</u> : these valves are at the mouths of the pulmonary artery and the aorta to prevent back-flow.
What is a septum?	A wall that divides between heart chambers.
How does human blood circulate?	<ol style="list-style-type: none"> 1. Deoxygenated blood enters the right auricle from the superior and inferior vena cavas, which bring blood from the entire body. 2. This blood is pumped through the tricuspid valve, into the right ventricle. 3. This blood is pumped through the semi-lunar valve, into the pulmonary artery. 4. The pulmonary artery divides, all the way into capillaries, near the lungs. 5. The blood is oxygenated, through diffusion. 6. The capillaries gradually become the pulmonary veins. 7. Blood enters the left auricle. 8. Blood is pumped through the mitral valve, into the left ventricle. 9. Blood is pumped through the semilunar valve, into the aorta. 10. Blood is delivered to the body.
Why are respiratory systems needed?	Oxygen is needed so cells can do work- cellular respiration- to release ATP. Waste (carbon dioxide) must also be removed.
What are the respiratory	The cell is surrounded by liquid, so they just let materials

systems on one-celled organisms like?	diffuse in and out.
What are the respiratory systems of two-layered, multicellular organisms like?	All of the cells are still bordered by liquid, since these organisms (coelenterates- jellyfish, sea anemone, hydra) have hollow tubes- gastrovascular cavities- that fill with liquid, bringing it to the outside cells. From there, every cell carries out diffusion/respiration independently.
What are the respiratory systems of three-layered organisms like?	These organisms (flatworms- planarian) have holes in their middles so that liquid borders two layers. The middle layer is close enough that materials can be diffused into and out of it. Usually, the inside of the inner layer- which borders the hole, so it directly touches the liquid- is highly branched, to create a high surface area to volume ratio.
What is the simplest body-level respiratory system like?	Breathing through the skin (worms). Capillaries border the skin, so gasses are exchanged there, and transported to the skin and to the body also by the capillaries.
How do fish breathe?	Water enters the mouth and is forced through the gills, which operate the same as worms- the gill skin is bordered by capillaries which transport gasses and allow them to be exchanged.
How do arthropods (insects, crustaceans) breathe?	These organisms have very slow, open circulatory systems, so their respiration is separate from it. Air goes in the spiracle- a chest opening- and down a tracheal tube. This tube branches, bringing oxygen to the body cells. The system also works in reverse for waste gasses.
How do mammals breathe?	Air enters the mouth and goes through a series of tubes until it reaches the alveoli, which are surrounded by capillaries. Oxygen is brought to body cells, and then this occurs in reverse for waste gasses.
How do amphibians breathe?	The same way mammals do, but also through their skin.
What are the advantages of breathing through the nose?	<ol style="list-style-type: none"> 1. Mucus/hairs trap lint, dust, germs, etc. 2. Air is brought to body temperature 3. Moisture is added to air
What is the pharynx?	A respiratory tube in the neck region. Air moves from the mouth and the nose here.

What is the larynx?	The voice box, that houses the vocal cords.															
What is the trachea?	The respiratory tube that takes air from the pharynx to the lungs.															
What is the epiglottis?	A piece of tissue that protects the trachea by keeping food from going down it.															
What are the bronchial tubes?	The trachea branches into these two tubes. They subdivide into bronchioles, and then into alveoli.															
What are alveoli?	The functional units of the respiratory system. These tiny air sacs are surrounded by capillaries. Gas is exchanged between the capillaries and alveoli. Because there are so many of them, they increase the surface area of the lungs, rendering them extremely efficient.															
What is the medulla oblongata?	The part of the brain that controls breathing and the heart, over which people have no conscious control (the autonomic nervous system). This measures whether a breath is needed or not by the carbon dioxide levels in the blood.															
What is the diaphragm?	The muscle between the upper and lower chests. It causes breath. When the diaphragm contracts and forces the ribs outward, chest volume increases, so chest pressure decreases. A partial vacuum is formed, since the atmospheric pressure is greater than the chest pressure, and air is forced in. The opposite happens to exhale.															
What do humans inhale and exhale?	<table border="1"> <thead> <tr> <th></th> <th><u>Inhale</u></th> <th><u>Exhale</u></th> </tr> </thead> <tbody> <tr> <td><u>Oxygen</u></td> <td>20.96%</td> <td>14.2%</td> </tr> <tr> <td><u>Carbon Dioxide</u></td> <td>0.4%</td> <td>5.5%</td> </tr> <tr> <td><u>Nitrogen</u></td> <td>78%</td> <td>80% (?)</td> </tr> <tr> <td><u>Trace Elements</u></td> <td>1%</td> <td>.3% (?)</td> </tr> </tbody> </table> <p>(if you're sure the question marks are right or wrong, let me know)</p>		<u>Inhale</u>	<u>Exhale</u>	<u>Oxygen</u>	20.96%	14.2%	<u>Carbon Dioxide</u>	0.4%	5.5%	<u>Nitrogen</u>	78%	80% (?)	<u>Trace Elements</u>	1%	.3% (?)
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How do humans breathe?	<ol style="list-style-type: none"> 1. The diaphragm contracts and forces the ribs outward 2. Chest volume increases 3. Chest pressure decreases 4. Air is forced into the mouth/nose 5. Air moves into pharynx 6. Air moves into tracheal 7. Trachea branches into bronchial tubes 8. Each bronchial tube branches into bronchioles 															

	<p>9. Bronchioles branch into alveoli</p> <p>10. Gas is exchanged between alveoli and capillaries</p> <p>11. Diaphragm expands and forces ribs inward</p> <p>12. Chest volume decreases</p> <p>13. Chest pressure increases</p> <p>14. Waste gasses move up into pharynx and are exhaled</p>
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What is digestion?	The breakdown of large food molecules into smaller ones.
	<u>Mechanical</u> : Chewing. This creates more surface area for enzymes to act upon. It also prevents choking.
	<u>Chemical</u> : Enzyme breakdown
How are foods broken down?	Proteins become amino acids
	Lipids become fatty acids and glycerol
	Carbohydrates become simple sugars (monosaccharides)
Why are foods digested?	Large molecules can't fit into cells, so their energy cannot be released.
How do single-celled organisms (amoeba, paramecium, etc.) digest?	They engulf food and form a vacuole. Digestive enzymes diffuse into the vacuole from the cytoplasm and chemical digestion takes place. Then the vacuole dissolves and the food/energy is distributed. This is intracellular digestion.
How do coelenterates digest?	(Jellyfish, sea anemone, hydra) These organisms have poison darts that are tethered to them. They bring food through their mouths to their gastrovascular cavities. This extracellular digestion allows food to be broken down into smaller pieces before it is engulfed by the first layer of cells. Intracellular digestion takes place and some food diffuses to the outer layer of cells.
How do 3-cell-thick (flatworm) organisms digest?	The skin bordering their gastrovascular cavity is extremely branched, so there is a huge amount of surface area. Food is absorbed and mostly intracellular digestion takes place; then food diffuses to other layers of cells. Waste also leaves from this opening.
How do parasitic roundworm digest?	Food enters through a mouth, is digested, and waste leaves thorough an anus. There are no digestive organs because parasites get "already been chewed and partially digested" food from their hosts.

<p>How do annelids (segmented worms- earthworms) digest?</p>	<ol style="list-style-type: none"> 1. Food enters the mouth. 2. Food moves down the pharynx. Food is moved because the pharynx is mucus lined, so it is slippery, and because the pharynx muscles contract to move the food. 3. Food moves down the esophagus. 4. Food arrives at the calciferous glands, where chemicals neutralize the acid in food (annelids eat decaying protein, which is very acidic). 5. Food arrives at the crop, which is a sac that distends to store rapidly eaten food. 6. Food moves down to the gizzard, where rocks are used to grind the food into small pieces, with more surface area for enzymes to act upon. 7. Food enters the intestine. The epithelium (surface) secretes enzymes that digest the food. 8. The enzyme cellulase is released to digest cellulose into simple sugars. 9. Capillaries that surround the earthworm absorb the digested food and take it to the body cells. <p style="text-align: center;"><u>This is completely extracellular digestion.</u></p>
<p>What animals also have gizzards?</p>	<p>Birds.</p>
<p>How are carnivore teeth modified for eating specific foods?</p>	<p>Carnivores have canine teeth in front, for ripping and tearing meat. Their flat molars in back are used, in conjunction with their strong jaw muscles, to crush bones and release the marrow. Carnivores eat very quickly and digest very slowly.</p>
<p>What about herbivore teeth?</p>	<p>Herbivores have incisors in front for ripping and tearing leaves. They have smooth molars in back to grind their food. They chew slowly and repeatedly. This, along with "gut" bacteria, allows them to digest cellulose.</p>
<p>What are human mouths like?</p>	<p>Humans are omnivores. We eat everything, and can digest all of it except cellulose. We have molars in the back, incisors in front, and canines in the middle. We also have three pairs of salivary glands- in the cheek, under the tongue, and at the angle of the jaw.</p>
<p>How does human digestion</p>	<p>In the mouth. Food is chewed. Then, salivary amylase is</p>

<p>begin?</p>	<p>released. This enzyme breaks down starch into maltose, which is a disaccharide. (Carbohydrate digestion begins here). Saliva also contains mucin- a binding agent, so food is in one wad, and a lubricant, to make swallowing easier. Food is swallowed by an involuntary muscle contraction/relaxation, known as <u>peristalsis</u>. It takes about 3-4 seconds for food to move down the esophagus.</p>
<p>What happens in the stomach?</p>	<p>Food enters the stomach through the cardiac sphincter- a valve right behind the heart. Stomach cells produce gastric juice- enzymes, like pepsin, which breaks down proteins into amino acids- and hydrochloric acid. (They also produce mucus to protect the stomach from the acid.) The stomach muscles churn the food with these, and it is broken down further. (Protein digestion begins here). The compound that leaves the stomach for the small intestine is known as <u>chyme</u>. (List of enzymes in yellow handbook, page 80)</p>
<p>What is the duodenum, and what happens there?</p>	<p>This is the first 6' of the 20' small intestine. Chyme enters through the pyloric sphincter- gradually- here. Bile, an emulsifier that breaks down oil and fat, increases the surface area of lipids, and enzymes and other digestive juices are added, to break them down. This continues throughout the entire small intestine.</p>
<p>Where does bile come from?</p>	<p>Bile is produced in the liver, and stored in a sac below it- the gallbladder.</p>
<p>Where does chemical digestion begin and end?</p>	<p><u>Carbohydrate</u> digestion begins in the mouth. <u>Protein</u> digestion begins in the stomach. <u>Lipid</u> digestion begins in the duodenum. <u>All</u> digestion ends in the small intestine.</p>
<p>How is food absorbed into the bloodstream?</p>	<p>Villi stick out of the small intestine, into the space within it. Capillaries and lymph vessels are embedded within it.</p>
<p>What happens in the large intestine?</p>	<p>Waste moves into the large intestine. Here, water from saliva, the hydrochloric acid, and the food is removed. The anal sphincter is at the end of the large intestine. We have full control over this muscle. Waste is released from our bodies here.</p>