FUNCTION OF THE CIRCULATORY SYSTEM (1)

Transport Materials

- LUNGS (OXYGEN, CO₂, WASTES)
- HORMONES (ADRENAL GLAND)
- WASTE (KIDNEYS)
- NUTRIENTS (SMALL INTESTINE)
- VITAMINS, H₂O
- LARGE INTESTINE
- HEART (PUMP)
- ANTIBODIES
- WASTE, ENZYMES, GLYCOGEN (LIVER)
Regulate Body Temperature
**BLOOD**

Red Blood Cells

*Carry oxygen to all cells in the body*

White Blood Cells

*Fight infections*

Platelets

*Help to clot the blood*

Plasma

*The liquid part of the blood...mostly water*
Blood from heart
Capillaries
Oxygenated Blood
(blood from heart)
Capillaries
Deoxygenated Blood
(blood to heart)
OXYGENATED (red)
ALL ARTERIES EXCEPT 2

DEOXYGENATED (BLUE)
ALL VEINS EXCEPT 2

Note: The Pulmonary Arteries which carry blood to the lungs are the only arteries that carry deoxygenated blood.

The Pulmonary veins which carry blood from the lungs to the heart are the only veins that carry oxygenated blood.
THERE ARE OVER 60,000 MILES OF BLOOD VESSELS IN YOUR BODY
Figure 23.1 Distribution of body water. The extracellular space includes the vascular compartment and the interstitial spaces.

Blood cells are made in the bone marrow.
Red Blood Cells (RBCs)

*Live 4 months*

*No Nucleus*

*Small size*

*Make up approximately 40% of Blood volume*

*Carry oxygen to the cells of your body*

*Return to the lungs to excrete carbon dioxide.*
White Blood Cells (WBCs)

Largest of the three types of cells

**Responsible for fighting infections or germs. White Blood cells**

Rather short life cycle, living from a few days to a few weeks.

**One drop of Blood can contain from 7,000 to 25,000 white Blood cells.**

If an invading infection fights back and persists, that number will significantly increase.
Plasma

Is a sticky, pale yellow fluid mixture of water, protein and salts.

It is 95% water.

The other 5% is made up of nutrients, proteins and hormones. Blood Plasma constitutes 55% of the volume of human Blood.

Plasma helps maintain Blood pressure, carries Blood cells, nutrients, enzymes and hormones, and supplies critical proteins for Blood clotting and immunity.

Plasma can be collected from a normal healthy donor twice weekly (max. every 48 hours).
**Platelets**

Small Blood cells that assist in the process of Blood clotting helping those with leukemia and other cancers, controlling bleeding.

The smallest of the Blood cells

**Make up 5% to 7% of total Blood volume.**

Platelets form a 'mesh' net to form clots in the Blood to help stop bleeding.
BLOOD FACTS

Blood makes up about 7% of your body's weight.

An average adult has about 14 to 18 pints of Blood.

One standard unit or pint of Blood equals about two cups.

Blood carries oxygen and nutrients to all of the body.

Blood carries carbon dioxide and other waste products back to the lungs, kidneys and liver for disposal.

Blood fights against infection and helps heal wounds.

One unit of donated whole Blood is separated into components before use (red Blood cells, white Blood cells, plasma, platelets, etc.)

There are four main Blood types: A, B, AB and O.

Each Blood type is either Rh positive or negative.

The three main types of cells making up our Blood are the White Blood cells, Red Blood cells and Platelets
The Double Pump

LUNG LOOP

BODY LOOP

head

lungs

heart

liver

gut

rest of body
Cardiac Muscle

Cardiac muscle cell

Skeletal muscle cell

Smooth muscle cell

[Image of muscle cells and diagram showing cardiac, skeletal, and smooth muscle cells]
Lung Tissue
HEART PARTS

Make sure you label the highlighted parts.

Descending aorta
Path of Blood Through Heart

- oxygenated blood to body
- deoxygenated blood to lungs
- oxygenated blood from lungs
- deoxygenated blood from body
HEART FACTS

Your system of blood vessels – arteries, veins and capillaries – is over 60,000 miles long. That's long enough to go around the world more than twice!

The adult heart pumps about 5 quarts of blood each minute – approximately 2,000 gallons of blood each day – throughout the body.

When attempting to locate their heart, most people place their hand on their left chest. Actually, your heart is located in the center of your chest between your lungs. The bottom of the heart is tipped to the left, so you feel more of your heart on your left side of your chest.

The heart beats about 100,000 times each day.

In a 70-year lifetime, the average human heart beats more than 2.5 billion times.

An adult woman’s heart weighs about 8 ounces, a man’s about 10 ounces.

A child’s heart is about the size of a clenched fist; an adult’s heart is about the size of two fists.

Blood is about 78 percent water.

Blood takes about 20 seconds to circulate throughout the entire vascular system.

The structure of the heart was first described in 1706, by Raymond de Viessens, a French anatomy professor.

The electrocardiograph (ECG) was invented in 1902 by Dutch physiologist Willem Einthoven. This test is still used to evaluate the heart’s rate and rhythm.

The first heart specialists emerged after World War I.
EXTERNAL HEART (Model)

External Heart Anatomy

- brachiocephalic trunk
- left common carotid artery
- left subclavian artery
- superior vena cava
- aorta
- right pulmonary arteries
- left pulmonary arteries
- pulmonary trunk
- left pulmonary veins
- left atrium
- left cardiac vein
- right atrium
- right coronary artery
- left coronary artery
- right ventricle
- left ventricle
- inferior vena cava

View of Coronary Arteries and Cardiac Veins

- superior vena cava
- aorta
- pulmonary trunk
- right cardiac vein
- left coronary artery
- left cardiac vein
- right coronary artery
- inferior vena cava
Internal View of Heart

- brachiocephalic trunk
- superior vena cava
- right pulmonary arteries
- right pulmonary veins
- right atrium
- atrioventricular (tricuspid) valve
- chordae tendineae
- right ventricle
- inferior vena cava
- left common carotid artery
- left subclavian artery
- aorta
- left pulmonary arteries
- pulmonary trunk
- left pulmonary veins
- left atrium
- semilunar valves
- atrioventricular (mitral) valve
- left ventricle
- septum

Descending aorta

HEART MODEL
THE RESPIRATORY SYSTEM

Nasal cavity
Nose hairs
Epiglottis
Larynx
Trachea
Paranasal sinuses
Respiratory center
Pharynx
Esophagus
Left lung
Right lung
Bronchi
Heart
Pleural membrane
Diaphragm
Pulmonary vessels
Ribs
Intercostal muscles
Muscles attached to diaphragm
The Respiratory System - Glossary

**Bronchi:** The two main air passages into the lungs.

**Diaphragm:** The main muscle used for breathing; separates the chest cavity from the abdominal cavity.

**Epiglottis:** A flap of cartilage that prevents food from entering the trachea (or windpipe). Prevents you from choking on food.

**Esophagus:** The tube through which food passes from the mouth down into the stomach.

**Heart:** The muscular organ that pumps blood throughout the body.

**Intercostal muscles:** Thin sheets of muscle between each rib that expand (when air is inhaled) and contract (when air is exhaled).

**Larynx:** Voice box.

**Lungs:** The two organs that extract oxygen from inhaled air and expel carbon dioxide in exhaled air.

**Muscles attached to the diaphragm:** These muscles help move the diaphragm up and down for breathing.

**Nasal cavity:** Interior area of the nose; lined with a sticky mucous membrane and contains tiny, surface hairs called cilia.

**Nose hairs:** Located at the entrance of the nose, these hairs trap large particles that are inhaled.

**Paranasal sinuses:** Air spaces within the skull.

**Pharynx:** The throat.

**Pleural membrane:** Covering the lung and lining the chest cavity, this membrane has 2 thin layers.

**Pulmonary vessels:** Pulmonary arteries carry deoxygenated blood from the heart and lungs; pulmonary veins carry oxygenated blood back to the heart.

**Respiratory center:** Area of the brain that controls breathing.

**Ribs:** Bones attached to the spine and central portion of the breastbone, which support the chest wall and protect the heart, lungs, and other organs in the chest.

**Trachea:** Tube through which air passes from the nose to the lungs (also known as the windpipe).
LUNG MODEL

FIGURE A

FIGURE B

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Air Exchange in the Lungs

Alveoli - Oxygen enters the blood and Carbon Dioxide enters the lungs
Air Exchange in the Lungs
What Carries OXYGEN?

Hemoglobin - a polypeptide molecule in the blood that absorbs oxygen.
To CLOT or NOT

Red blood cell
Platelet
Broken blood vessel wall
Activated platelet
Clot
Fibrin
A heart attack occurs when a coronary artery is blocked.

Blood supply is cut off from the heart muscle, and the heart muscle dies.

The severity of the heart attack is determined by the size of the artery blocked.

If someone has a mild heart attack, it can be treated with an angioplasty, more severe heart attacks may require a bypass, and if the damage is severe a transplant.
An angiogram is a test done by a radiologist (doctor specializing in X-rays) to study blood vessels and identify blockages in arteries.

The doctor uses a special X-ray machine and a contrast that is injected into the bloodstream through a tube which is placed in an artery in the groin.

This allows the doctor to see the blood vessels.
Angioplasty is the stretching of an artery that is narrowed. This narrowing causes slow blood flow or no blood flow through the artery which could compromise the function of vital organs.

During an angioplasty, a small balloon catheter is guided into the narrowed artery and the balloon is inflated to open up the narrowed artery to allow for increased blood flow to the affected organ.
Fixing a Blockage with BYPASS Surgery

Increasing blood flow to the heart muscle can relieve chest pain and reduce the risk of heart attack.

Bypass with a pump oxygenator (heart-lung machine) is used for most coronary bypass graft operations.

The arteries that bring blood to the heart muscle (coronary arteries) can become clogged by plaque (a buildup of fat, cholesterol and other substances). This can slow or stop blood flow through the heart's blood vessels, leading to chest pain or a heart attack.
Surgeons take a segment of a healthy blood vessel from another part of the body and make a detour around the blocked part of the coronary artery. 

- An artery may be detached from the chest wall and the open end attached to the coronary artery below the blocked area.
- A piece of a long vein in your leg may be taken. One end is sewn onto the large artery leaving your heart—the aorta. The other end of the vein is attached or "grafted" to the coronary artery below the blocked area.
- Either way, blood can use this new path to flow freely to the heart muscle.
Artificial Heart Systems

The AbioCor Artificial Heart System

JARVIK 2000 A miniature pump to assist or replace the function of the left ventricle, the heart’s main pumping chamber

THE PUMP Electric coils cause a rotor with an embedded magnet to spin. Fins on the rotor push oxygen-rich blood (red arrows) from the heart through a tube into the aorta.

Right atrium
Right ventricle
The blades and bearings that hold the rotor in place have been designed to function immersed in blood

Left atrium
Left ventricle
Connector tube

Power wire
Motor coils
Rotor with magnet inside

Plug
Controls
Battery pack

ABIMED ARTIFICIAL HEART A battery-powered replacement heart to allow patients to resume most normal activities

THE PUMP A hydraulic pump in the center of the artificial heart pumps a fluid back and forth between two membranes, forcing the blood alternately out of the left and right chambers, creating a pulse.

1 Oxygen-poor blood pumped to lungs
2 Oxygen-rich blood pumped to body

Aorta

One-way valves
Flexible membranes

 Coil
Internal battery
Battery pack

THE POWER A battery pack, worn on a belt, transmits power for up to eight hours across the unbroken skin to a coil and battery implanted in the abdomen. Because no wires penetrate the skin, the potential for infection is eliminated.
Smoking?

SMOKER'S LUNG

HEALTHY LUNG
Additives in Cigarettes

Acetone - A flammable, colorless liquid used as a solvent. It's one of the active ingredients in nail polish remover. The tobacco industry refuses to say how acetone gets into cigarettes.

Ammonia - A colorless, pungent gas. The tobacco industry says that it adds flavor, but scientists have discovered that ammonia helps you absorb more nicotine - keeping you hooked on smoking.

Arsenic - A silvery-white very poisonous chemical element. This deadly poison is used to make insecticides, and it is also used to kill gophers and rats.

Benzene - A flammable liquid obtained from coal tar and used as a solvent. This cancer-causing chemical is used to make everything from pesticides to detergent to gasoline.

Benzoapyrene - A yellow crystalline carcinogenic hydrocarbon found in coal tar and cigarette smoke. It's one of the most potent cancer-causing chemicals in the world.

Butane - A hydrocarbon used as a fuel. Highly flammable butane is one of the key ingredients in gasoline.

Cadmium - A metallic chemical element used in alloys. This toxic metal causes damage to the liver, kidneys, and the brain; and stays in your body for years.

Formaldehyde - A colorless pungent gas used in solution as a disinfectant and preservative. It causes cancer; damages your lungs, skin and digestive system. Embalmers use it to preserve dead bodies.

Lead - A heavy bluish-gray metallic chemical element. This toxic heavy metal causes lead poisoning, which stunts your growth, and damages your brain. It can easily kill you.

Propylene Glycol - A sweet hygroscopic viscous liquid used as antifreeze and as a solvent in brake fluid. The tobacco industry claims they add it to keep cheap "reconstituted tobacco" from drying out, but scientists say it aids in the delivery of nicotine (tobacco active drug) to the brain.

Turpentine - A colorless volatile oil. Turpentine is very toxic and is commonly used as a paint thinner.

The toxic chemicals mentioned above are what you are putting into your body when you smoke, and when you draw this smoke into your lungs, your body has absolutely no chance to defend itself from these chemicals.
Lymph System
Lymph System

Fluid moves out of the Cardiovascular System

The LYMPHATIC SYSTEM is a network of vessels that return this fluid to the blood and carries antibodies throughout the body.

The fluid is called LYMPH.

LYMPH NODES are small knobs that filter the lymph. They produce antibodies to help fight infections causing them to become enlarged.
A chest x-ray is required by some hospitals before admitting a patient. Doctors can tell many things about your health from looking at your lungs.

White areas might indicate a problem such as pneumonia, tuberculosis and tumors.

On this x-ray:

A is the Heart

B are the ___________________

C is the Stomach
Heart Disease

Heart disease is a number of abnormal conditions affecting the heart and the blood vessels in the heart. Types of heart disease include:

- **Coronary artery disease (CAD)** is the most common type and is the leading cause of heart attacks. When you have CAD, your arteries become hard and narrow. Blood has a hard time getting to the heart, so the heart does not get all the blood it needs. CAD can lead to:
  
  - **Angina.** Angina is chest pain or discomfort that happens when the heart does not get enough blood. It may feel like a pressing or squeezing pain, often in the chest, but sometimes the pain is in the shoulders, arms, neck, jaw, or back. It can also feel like indigestion (upset stomach). Angina is not a heart attack, but having angina means you are more likely to have a heart attack.
  
  - **Heart attack.** A heart attack occurs when an artery is severely or completely blocked, and the heart does not get the blood it needs for more than 20 minutes.

- **Heart failure** occurs when the heart is not able to pump blood through the body as well as it should. This means that other organs, which normally get blood from the heart, do not get enough blood. It does NOT mean that the heart stops. Signs of heart failure include:
  
  - **Shortness of breath (feeling like you can't get enough air)**
  
  - **Swelling in feet, ankles, and legs**
  
  - **Extreme tiredness**

- **Heart arrhythmias** are changes in the beat of the heart. Most people have felt dizzy, faint, out of breath or had chest pains at one time. These changes in heartbeat are, for most people, harmless. As you get older, you are more likely to have arrhythmias. Don't panic if you have a few flutters or if your heart races once in a while. If you have flutters AND other symptoms such as dizziness or shortness of breath (feeling like you can't get enough air), call 911 right away.