

5 **CAPILLARIES**

CELLS

Capillary

Oxygen

Cell waste

Carbon dioxide

Food

Body cell

Red blood cell

LUNG

Gas Exchange

alveolus

diffusion of O₂

diffusion of CO₂

capillary

From the following figure, note the direction of gas exchange in the pulmonary capillary.

6 **OXYGENATED Blood** (oxygen rich)

DEOXYGENATED Blood (oxygen poor)

AORTA

LEFT ATRIUM

PULMONARY ARTERY

LEFT VENTRICLE

RIGHT ATRIUM

RIGHT VENTRICLE

Spong. Bone

Yellow Marrow

Compact Bone

Blood cells are made in the bone marrow.

7 **Red Blood Cells**

Plasma (55%)
White blood cells and platelets (1%)
Red blood cells (44%)

Acc.V. Spot Magn Det WD Exp
30.0kV 3.0 113794 SE 8.0 3

2 µm

red blood cells

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.

8 **White Blood Cells**

PLATELET

White blood cell

RBC

WBC

Apoptotic cell

Plasma (55%)
White blood cells and platelets (1%)
Red blood cells (44%)

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.

9 **Plasma**

Plasma (55%)
White blood cells and platelets (1%)
Red blood cells (44%)

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).

10 **Platelets**

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.

Plasma (55%)
White blood cells and platelets (1%)
Red blood cells (44%)

11 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

12 The Double Pump

LUNG LOOP

13 Cardiac Muscle

Cardiac muscle cell

Skeletal muscle cell

Smooth muscle cell

#ADAM

14 Lung Tissue

Source: Emerg Infect Dis © 2004 Centers for Disease Control and Prevention (CDC)

15 HEART PARTS

Make sure you Label the Hightlighted parts

Internal View of Heart

16 BLOOD FLOW IN THE HEART

Path of Blood Through Heart

oxygenated blood to body

deoxygenated blood to lungs

oxygenated blood from lungs

deoxygenated blood from body

17

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.

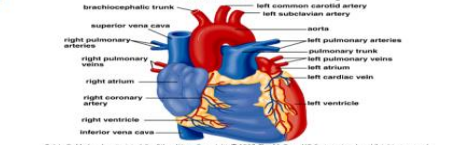
The electrocardiograph (ECG) was invented in 1902 by Dutch physiologist Willem Einthoven. This test is still used to evaluate the heart's rate and rhythm.

The first heart specialists emerged after World War I.

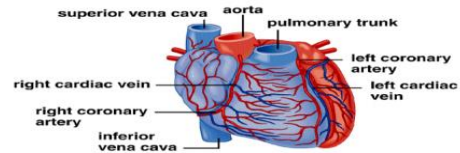
EXTERNAL HEART (Model)

18

External Heart Anatomy



View of Coronary Arteries and Cardiac Veins

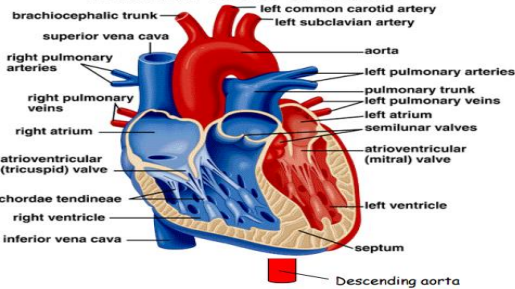


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INTERNAL HEART

Stacy S. Meder, Inquiry into Life, 6th edition. Copyright © 2007 The McGraw-Hill Companies, Inc. All rights reserved.

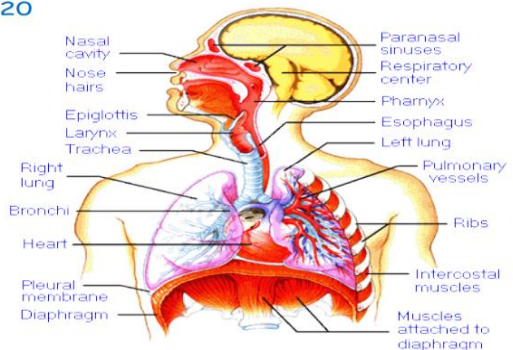
Internal View of Heart



HEART MODEL

THE RESPIRATORY SYSTEM

20



21

THE RESPIRATORY SYSTEM

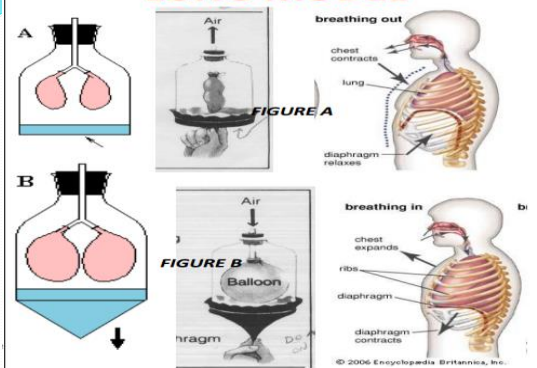
The Respiratory System - Glossary

- 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).

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<https://www.youtube.com/watch?v=CBvzBqqAYdE>

LUNG MODEL



23 Air Exchange in the Lungs

The diagram illustrates the process of gas exchange in the lungs. It shows a pair of lungs with bronchial trees. A detailed view of an alveolus shows air entering from the respiratory bronchiole. Inside the alveolus, oxygen diffuses into a nearby capillary, while carbon dioxide diffuses out. Labels include: Gas Exchange, alveolus, diffusion of O_2 , diffusion of CO_2 , capillary, Oxygen moving into blood, Carbon dioxide moving into alveolus, Red blood cell, and Air in alveolus.

Alveoli - Oxygen enters the blood and Carbon Dioxide enters the lungs

24 Air Exchange in the Lungs

This anatomical diagram shows the respiratory system. Labels include: THE LUNGS, Right bronchus, Left bronchus, Right lung with its 3 lobes, Left lung with its 2 lobes, Trachea, Heart, Bronchioles, Alveolar duct, Section of alveolus cut open, Respiratory bronchiole, Terminal bronchiole, Pulmonary vein, and Pulmonary artery.

25 What Carries OXYGEN?

Hemoglobin Molecule

The diagram shows a red blood cell containing hemoglobin molecules. A detailed view of a hemoglobin molecule shows it consists of two α chains and two β chains, each with an iron atom and a heme group. The polypeptide chains are in a helical shape.

Hemoglobin - a polypeptide molecule in the blood that absorbs oxygen.

26 To CLOT or NOT

The diagram illustrates the stages of blood clotting. It starts with a broken blood vessel wall where red blood cells and platelets are present. Activated platelets aggregate to form a primary clot, which is then reinforced by a network of fibrin fibers to form a secondary clot.

27 Heart Attack

A NEW LOOK AT PLAQUE

The diagram shows the progression of plaque formation in an artery. It starts with a normal artery, then shows the accumulation of lipids and the formation of a fibrous cap. A heart attack occurs when a blood clot forms on top of the plaque, completely blocking the artery.

Coronary Artery Bypass

Plaque (blockage) in artery

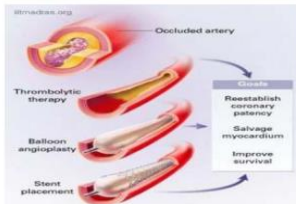
A heart attack occurs when a coronary artery is blocked. Blood supply is cut off from the heart muscle, and the heart muscle dies. The severity of the heart attack is determined by the size of the artery blocked. If someone has a mild heart attack, it can be treated with an angioplasty, more severe heart attacks may require a bypass, and if the damage is severe a transplant.

28 Finding a Blockage: Angiogram

The angiogram shows the coronary arteries. Labels include: External Carotid, Internal Carotid, and Carotid Artery.

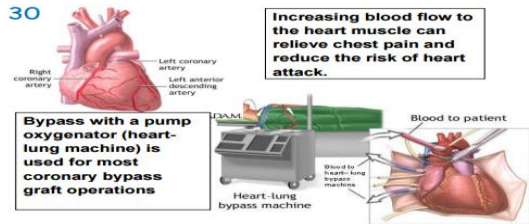
An angiogram is a test done by a radiologist (doctor specializing in X-rays) to study blood vessels and identify blockages in arteries. The doctor uses a special X-ray machine and a contrast that is injected into the bloodstream through a tube which is placed in an artery in the groin. This allows the doctor to see the blood vessels.

29 Fixing a Blockage ANGIOPLASTY



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.

30 Fixing a Blockage with BYPASS Surgery



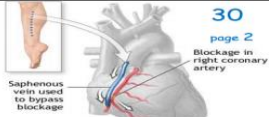
Bypass with a pump oxygenator (heart-lung machine) is used for most coronary bypass graft operations



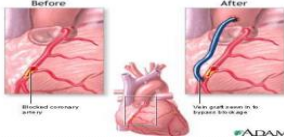
Increasing blood flow to the heart muscle can relieve chest pain and reduce the risk of heart attack.

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

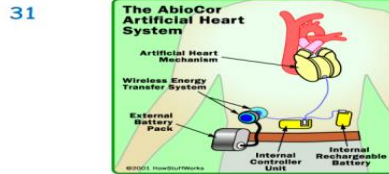
Surgeons take a segment of a healthy blood vessel from another part of the body and make a detour around the blocked part of the coronary artery.



- 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



JARVIK 2000 A substitute 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. This coil in the rotor creates an electric field around the rotor. When a rotor coil passes over a fixed coil, an electric field is induced through a hole in the rotor, which causes the rotor to spin.

ABIOCOR ARTIFICIAL HEART A battery-powered replace-ment heart to allow patients to resume normal activities. **THE PUMP** A hydraulic pump in the center of the artificial heart. **THE POWER** A rechargeable battery pack that provides power to the pump. **THE CONTROLLER** A computer chip that controls the pump's operation. **THE BATTERY** A rechargeable battery pack that provides power to the pump. **THE WIRELESS ENERGY TRANSFER SYSTEM** A system that allows the battery pack to be recharged without the need for wires.

32 Smoking?

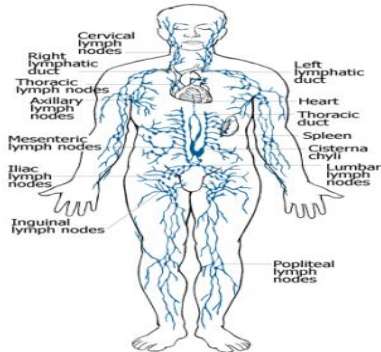


32 p2 Additives in Cigarettes

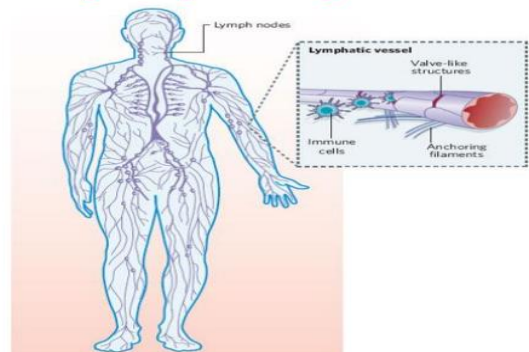
- Acetone** - A flammable, colorless liquid used as a solvent. It's one of the active ingredients in nail polish remover. The tobacco industry refuses to say how acetone gets into cigarettes.
- Ammonia** - A colorless, pungent gas. The tobacco industry says that it adds flavor, but scientists have discovered 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.
- Benzoprene** - 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.
- Calcium** - 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's 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.

33 Lymph System



33 p2 Lymph System



33 p3 Lymph System

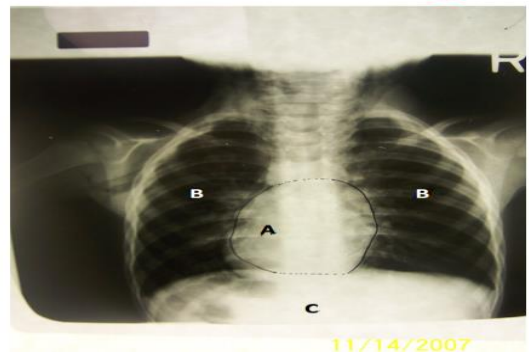
Fluid moves out of the Cardiovascular System

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.

34 Chest X-Ray



34 p2 Chest X-Ray

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

35 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:
 - o 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.
 - o 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:
 - o Shortness of breath (feeling like you can't get enough air)
 - o Swelling in feet, ankles, and legs
 - o 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 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.