# Human Anatomy and Physiology

1. The Circulatory System

# Anatomy and Physiology Tutorials

## Circulatory System

### Tour of the System

The easiest way to see how the circulatory system works is by taking a tour with erythrocytes (red blood cells) through the system:

The erythrocytes start in the *left ventricle* of the heart.

They then move through the *aortic valve* into the *aorta*.

As the aorta branches into smaller arteries, the erythrocytes move into an *artery* then split into smaller blood vessels known as *arterioles*.

From arterioles, the erythrocytes pass into a capillary, or capillary bed.

*Capillaries* are tiny blood vessels and it is in these vessels that the exchange of oxygen, nutrients and carbon dioxide takes place.

After this exchange, the erythrocytes are de-oxygenated (oxygen has been removed from the erythrocyte).

Blood that contains these de-oxygenated erythrocytes is also known as *venous blood*.

The erythrocytes, which now contain carbon dioxide and other waste products, pass from the capillaries into *venules*.

Venules come together to form veins.

From the veins, the erythrocytes flow into the superior vena cava, and into the right atrium. They pass through the tricuspid valve into the right ventricle.

The erythrocytes pass through the pulmonary valve and into the pulmonary artery on their way to the lungs. The pulmonary artery is the only artery that carries deoxygenated blood.

In the lungs, the erythrocytes give up their carbon dioxide and absorb oxygen. Now the blood goes back to the left atrium, through the mitral valve and into the left ventricle, ready to start its journey once again.

The movement of the blood to and from the heart is the systemic circulation and the movement of the blood from the heart to the lungs and back again is the pulmonary

circulation.

The blood pressure in arteries is regulated by muscular contraction or expansion of the arterial walls, according to need.

The circulatory system also consists of the lymphatic system, which has the job of distributing lymph throughout the body. This is how lymph moves through the system:

In capillaries, the serum, or the liquid part of the blood, seeps through the tissues.

If tissues are inflamed, the capillaries are more permeable and so seepage is faster.

This serum is called lymph.

Lymph makes its way through tissues, until it collects in the lymphatic ducts.

Once in the ducts, lymph begins to make its way back to the venous blood stream.

As lymph moves, lymph nodes filtered it.

These lymph nodes contain leukocytes (white blood cells) which are ready to attack bacteria or viruses.

## Functions

The circulatory system has several key functions, including:

- Controlling the movement of blood and lymph through the body
- Exchanging gases (oxygen and carbon dioxide) with other cells and tissues in the body
- Exchanging nutrients (such as amino acids and electrolytes) with other cells and tissues
- Helping with immune responses
- Helping with clotting
- Helping in the maintenance of body temperature and pH (maintaining homeostasis)

## Components

**Heart:** This is what pumps blood around the body. Because the heart is a muscle, it also needs oxygen, so it has its own circulatory system known as the *coronary circulation*, which takes blood to and from the heart.

**Aorta:** This is the main artery that receives blood from the heart. It is a very tough, muscular artery.

**Arteries:** These blood vessels also contain muscle to make them elastic. This helps to move the blood along.

**Arterioles:** Also muscular these smaller vessels contract to deliver blood to the capillaries.

**Capillaries:** These are the diameter of a single cell, making exchange of gases and other products from erythrocytes easy.

**Venules:** Many of these small blood vessels come together to form a vein.

**Veins:** Unlike arteries, these do not contract. With a tube-like structure, they contain valves to prevent blood from flowing backwards.

**Lymph ducts:** These empty lymph into the veins.

**Lymph nodes:** These act as filters for the lymph and are very important in the immune system. Inflammation of these usually shows infection in the body.

## Common Diseases and Disorders

**Angina:** Is a type of chest pain that often radiates down the arm. Angina is caused when the heart cannot receive the blood and oxygen that it needs (usually because the coronary arteries are blocked with plaque).

**Cardiac Arrest**: The heart stops pumping blood around the body. Unlike a heart attack, this can happen suddenly without a known cause (such as coronary heart disease).

**Coronary heart disease:** Coronary arteries (which supply the heart with blood) are narrowed because of plaque deposits on their walls. These deposits prevent enough oxygen from reaching the heart.

**Heart Attack or Myocardial Infarction**: When the coronary arteries (which supply blood the heart muscle with blood) become blocked with plaque, blood flow to the heart muscles is reduced. This causes damage to the heart muscle as well as increasing the risk of part of the heart muscle dying.

**Phlebitis**: This is inflammation of a vein. A common place is in the legs, where the veins

swell and block the blood, so the leg swells markedly.

**Varicose veins**: Unnaturally swollen veins caused by faulty valves. These are usually in the legs.

## Medical Terminology

**Blood pressure:** This is how much pressure there is against the walls of the main arteries. The systolic pressure is when the ventricles of the heart contract and the diastolic pressure is when ventricles relax and refill. The classic blood pressure measurement is 120/80 (120 is the systole value and 80 is the diastole value).

**Erythrocytes:** These red blood cells carry oxygen, carbon dioxide and other products through the circulatory system.

**Hypertension:** High blood pressure

**Hypotension: L**ow blood pressure

**Leukocytes:** There are several different kinds of white blood cells and they play a key role in the immune system.

**Platelets:** Platelets are cell fragments found in the blood. They are essential for blood clotting.

**Pulse rate/heart rate:** The number of times the heart beats per minute.

The circulatory system is also important when *assessing a person's color*. The color changes when a greater or lesser quantity of blood diverts to the skin, so color is a good indicator of health.

**Terms to denote a lack of color include:** pale, ashen, pallid, sallow, white, colorless, white as a ghost, blanched.

**Terms to denote too much color include:** florid, flushed, crimson, ruddy, feverish.

There are also *trauma terms* for the circulatory system:

**Bleeding:** Blood coming from a lesion. Internal bleeding is bleeding inside the body, often caused by an injury or disease. Blood may sometimes leak from an opening such as the mouth or anus.

**Bleeding nose (Epistaxis):** Blood coming from the nose, usually due to trauma. A bleeding nose can sometimes start spontaneously due to increased blood pressure.

**Bruised:** Discolored due to a blow. Usually the skin is not broken (a bruise is also called a contusion).

**Cut or Incision:** A clean-cut wound or slit such as one caused by a knife.

**Crush:** Caused by pressure a crush is a contusion or bruise, showing internal bleeding.

**Gash or laceration:** A wound that is torn or ragged.

**Scrape:** An abrasion or graze caused by scraping off the upper tissues of the skin.

**Swollen:** Bigger than usual, often through accumulation of fluid.

**Throbbing:** When used with pain, it means that the pain gets worse in a rhythmic pattern (with the heartbeat).

Other miscellaneous medical and trauma terms include:

**Blood blister:** A dark swelling of the skin caused by pinching, which breaks a small blood vessel. The skin remains unbroken.

**Blood tests:** A variety of tests carried out with a blood sample. A blood test can check for many disorders including anemia, infections or even liver damage.

**Blood in the urine:** Shows problems with the bladder, kidneys or prostate gland.

**Hemangioma (blood spot or birthmark):** Is a dark red discoloration of the skin.

**Occult blood:** "Occult" means hidden. To detect colon cancer, feces is checked for occult blood.

**Palpitations or bumping:** This refers to an irregular heartbeat, often experienced by the patient as a "bumping in the chest."

**Tarry stools:** These are feces that dark in color, like tar, caused by old blood in the digestive tract. Tarry stools can show internal bleeding.

**Transfusion:** Transfusing, or giving of blood taken from a blood donor.

# The Digestive System

## Tour of the System

The digestive system is an extensive system that begins at the lips and ends at the anus. The easiest way to explore the digestive system is on a journey with a peanut butter and jelly sandwich (PB&J):

The PB&J passes through the lips and into the mouth (oral cavity).

The oral cavity contains teeth and the tongue. Beneath the tongue is the floor of the mouth and above the tongue, the hard palate.

The soft palate (which does not contain bone) is at the back of the mouth.

The PB&J is *masticated* (chewed) by the teeth.

# ANATOMY & PHYSIOLOGY PRACTICE

Anatomy & Physiology I

Anatomy & Physiology II

Medical Surgical and Diagnostic Procedures

How to Study Anatomy and Physiology

## Basic Science Practice

Biology

Chemistry

Scientific Reasoning and Method

Physics

Basic Physics

Molarity

Speed, Acceleration and Force

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TEAS -- HESI -- DET -- CMA -- NLN PAX -- RMA