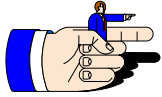


Chapter 2: Understanding the Human Body

Introduction 2.1 Introduction



One of the first steps to achieve good health **knows the importance of caring for your body systems**. Are you familiar with those systems? Do you know when your body is not functioning as it should? Your body has many systems that work together. Broadly speaking, you can divide body systems as the following:

1-Support and Control Systems include:

- The skeletal and muscular systems.
- The integumentary system [skin].
- The nervous system.

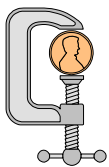
2-Energy and Transport Systems include:

- The digestive system.
- The circulatory system.
- The respiratory system.
- The urinary system.

3-Endocrine and Reproductive Systems:

- The endocrine system.
- The male and female reproductive systems.

Support and Control System



2.2 Support and Control Systems

Objectives: you will be able to describe the functions of the skeletal and muscular systems and their relationship to health.

Think about a **car**. It is made of **many different parts**. The **framework** gives the car a **definite style** and also protects the engine and other inner structures. The car has an **ignition system** for **starting the engine**. **Other systems** work together to keep the **engine running smoothly**. Some **mechanical parts** in the car are capable of **motion**. These parts will move only if other factors are present and functioning properly. One of these factors is a source of energy, which is gasoline in most cars. Another factor is the engine. In the engine, the **stored chemical energy** in the **gasoline** is converted to **mechanical energy**, as a result the car moves.

Skeletal and
Muscular
Systems



2.2.1 Skeletal and Muscular Systems

Your body's mechanical parts are bones and muscles. Your body also has a **source of energy**. It is **food**. Food provides the energy necessary to move the mechanical parts of your body.

The Skeletal
System

The Skeletal System



The skeletal system consists of **bones, ligaments and cartilages**. Your body has over **200 bones**, each serving many purposes, as shown in Figure 2.1. Bones serve as a **framework for your body**. Your **bones work** in harmony with your **muscles**. Bones also protect you. **Ribs and breast bones protect the heart and lungs**. The **skull protects the brain**.

Bone marrow is a special kind of tissue in the **hollow center area of some bones**. **Red blood cells** are produced **in marrow**.

At birth, most skeletal system was composed of **cartilage**. *Cartilage is a connective tissue that is rigid but softer than bone.* As you grew older, *ossification took place*. Ossification is a process by which **bone cells and minerals replace cartilage**. This process continues through childhood and into early adulthood. However after ossification is complete, **some body parts remain as cartilage**; e.g. *the tip of nose and outside of ears*. Cartilage is also present as a **cushion in many joints**.

The Skeletal
System and
the Health

The Skeletal System and the Health

Bones must receive sufficient amount of minerals; e.g. *calcium and phosphorous to help bone formation*. They need **vitamin d and some hormones and regular exercise** to help bone formation and to keep bones strong.

Osteoporosis is a bone disease in which bone tissue becomes **brittle and porous** due to deficiency of many nutrients and lack of exercise, as a result bone fractures are likely to occur.

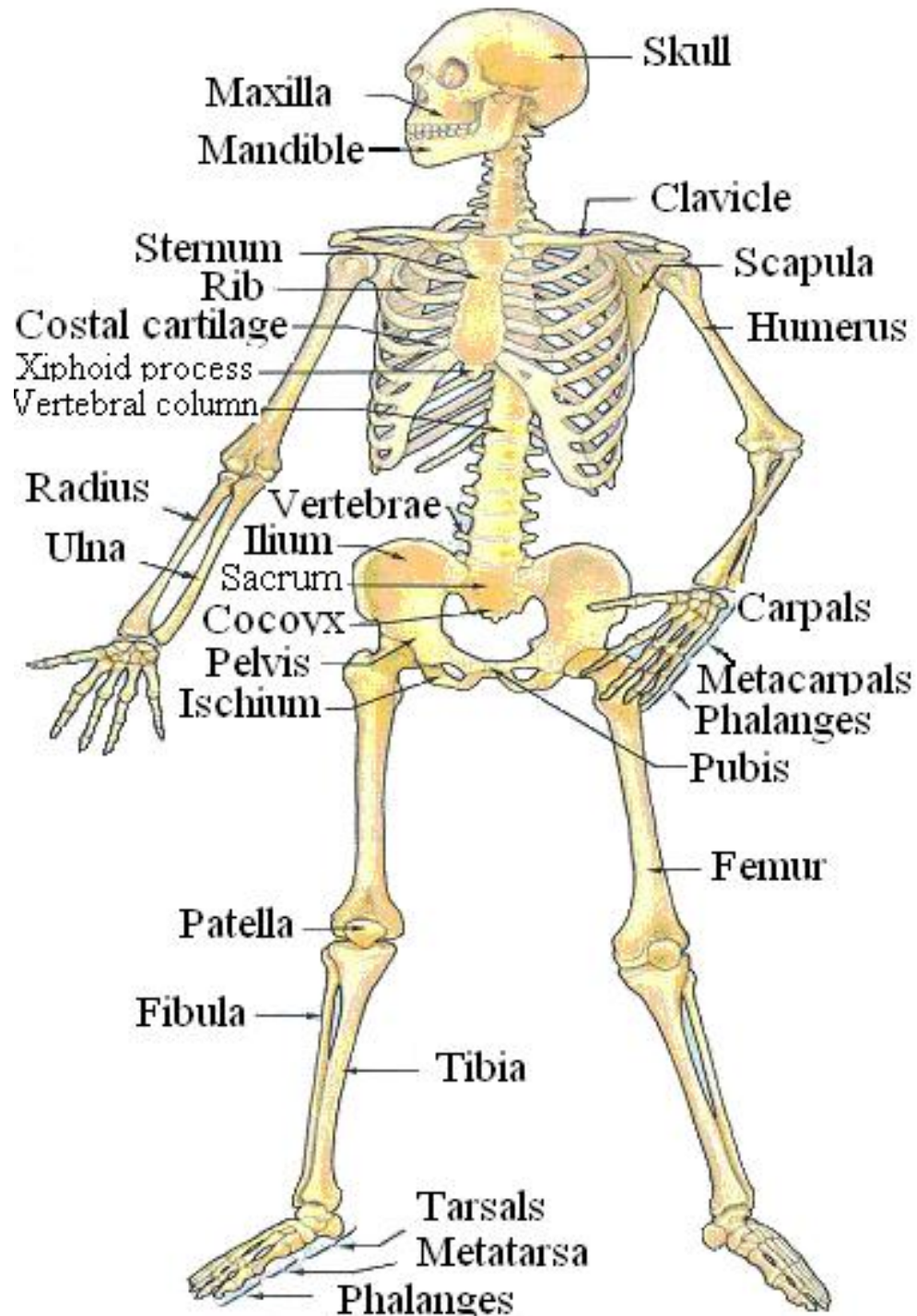


Figure 2.1: Skeletal system

The
Muscular
System



2.2.2 The Muscular System

Body movement is controlled by a network of over **600 muscles**. These muscles make up the **muscular system**; see Figure 2.2. All muscle tissue **doesn't have the same appearance**. However, all muscles have **one unique characteristic**, *the ability to shorten, or contract*, this ability allows body movement. There are **three types of muscles** in your body: **skeletal, smooth and cardiac muscles**:

- **Skeletal muscles** move the bones of the skeleton, they are **attached to bones by** tough bands of tissue called **tendons**, they are voluntary, and i.e. person has control over them.
- **Smooth muscles** form the walls of many internal organs such as **the stomach**, their action is **involuntary**, and you have no control over them.
- **Cardiac muscle** has character of skeletal and smooth muscles, but it is regarded as a distinct kind of muscle. Cardiac muscle is also involuntary muscle. It **pumps blood** at an average of **70 times/min.**, **40 million times a year** for a life time.

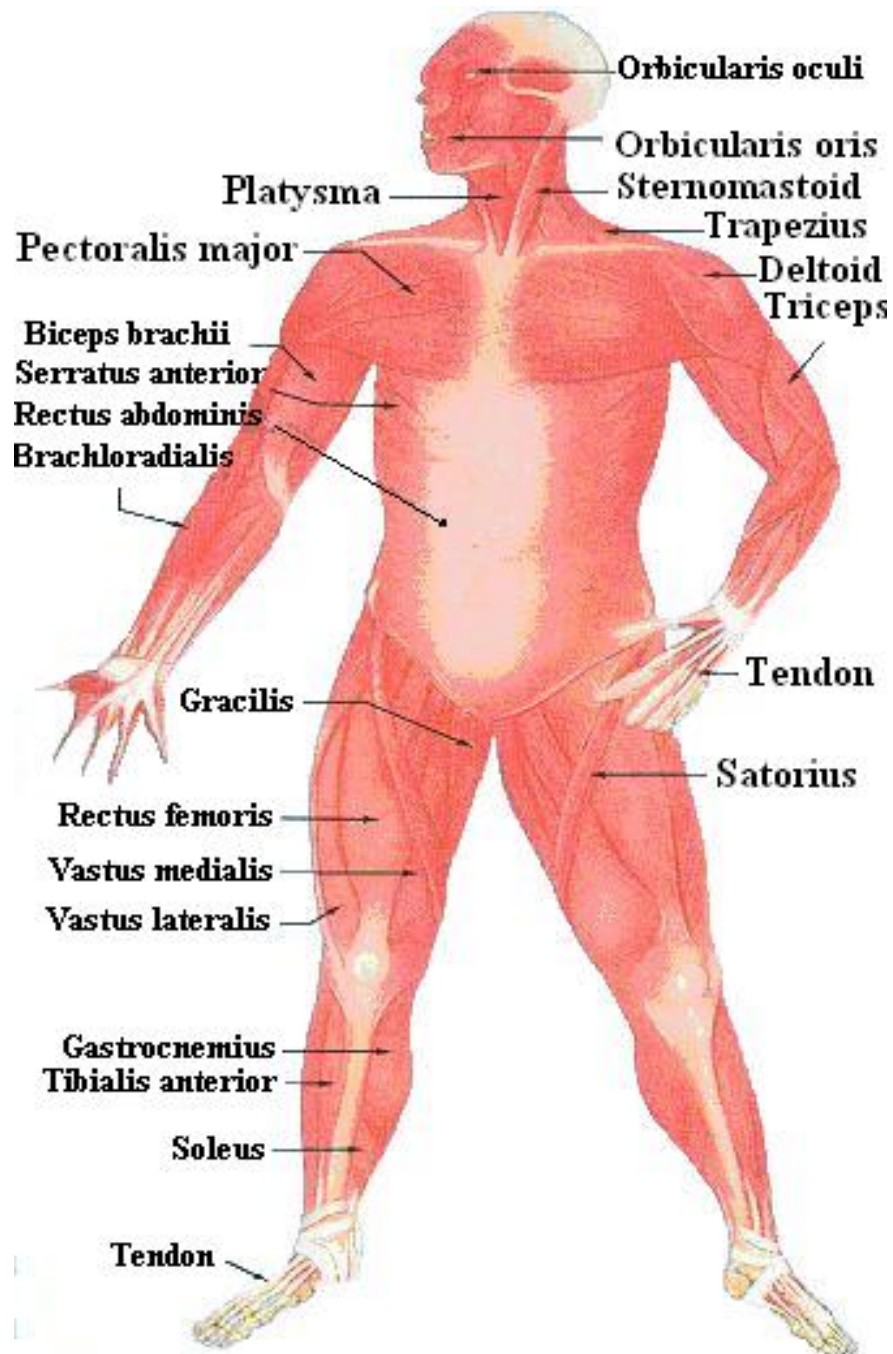
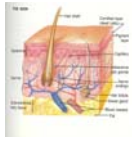


Figure 2.2: Muscular system

The
Integumentary
System
(Skin)



2.2.3 The Integumentary System (Skin)

The system that **covers and protects the body** is the integumentary system, see Figure 2.3. It is composed of **skin, hair follicles, nails, glands** that are **outgrowths of the skin layers**. The skin is the largest organ in the body consisting of **epidermis and dermis**. The skin protects by preventing **harmful micro organisms from entering the body** and by **regulating body temperature**. Skin contains nerve endings. Some **nerve endings** make you aware of **changes in your environment**. Other nerve endings are sensitive to **pressure, pain and temperature**.

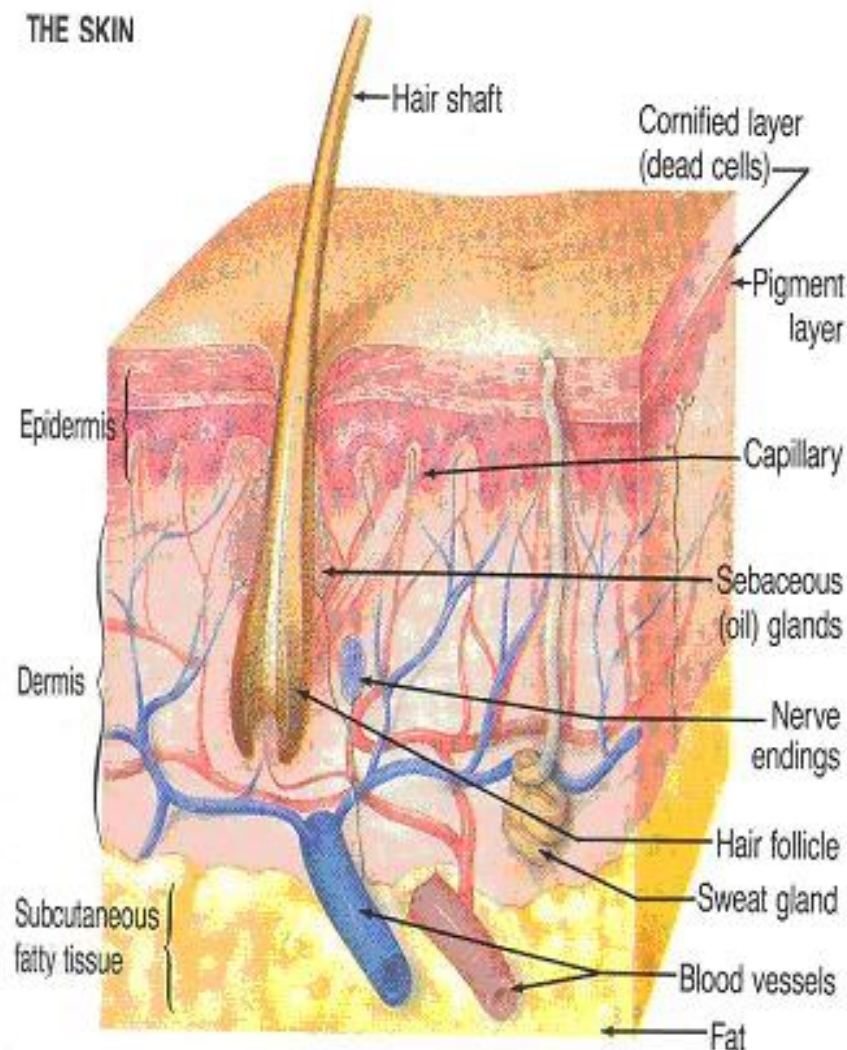
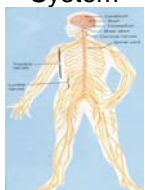


Figure 2.3: Cross section of the layers of the skin

The Nervous
System



2.2.4 The Nervous System

It is the network of **nerve cells** that **carries messages or impulses to and from the brain and spinal cord to all parts of the body**. The nervous system is divided into **two major parts**, the **central and the peripheral nervous systems** as shown in Figure 2.4.

- **Central nervous** system is composed of **brain and spinal cord**. The **brain** is the **most complex part** of the central nervous system and is protected in many ways from injury. It has its **own kind of helmet** called the **cranium**. Brain is also **protected** and nourished by **three cushions** called **meninges**. **Spaces between meninges** all filled with **cerebrospinal fluid**. **Inner spaces** of the brain are called **ventricles**, it also hold fluid that protects the brain. The **spinal cord** is like a thin cable that **extends from the base of the brain**.
- **Peripheral nervous** system consists of many nerves that **branch from the brain and spinal cord** to the periphery of the body. **Twelve pairs of cranial nerves**. **Thirty -one pairs of spinal nerves**. The **peripheral nervous** system can be further **subdivided into two main divisions**; the **somatic** and **autonomic** nervous systems. The **somatic** is concerned with a **person's external environment**. This system consists of **sensory and motor neurons**. The **autonomic** involves a **person's internal environment**. This part of peripheral nervous system **controls involuntary actions** and **regulates heart rate and body temperature**. The **autonomic** system is a **two-part system**. One part, the **sympathetic** nervous system, prepares the body for emergencies. The other part, **parasympathetic** system, **counterbalances** the **sympathetic system**. This system **maintains the body's normal state** and restores balance after an emergency.

Sense
Organs

Sense Organs

Your body senses play a role in everything you do. There are **five senses**. You are able to experience each sense because of **special neurons** that act as **receptors**. Receptor neurons receive information and transmit it on sensory neurons to your spinal cord and brain. Your brain sends back impulses on motor neurons and you respond to the initial information. The **five senses** are **vision, hearing, taste, smell and touch**.

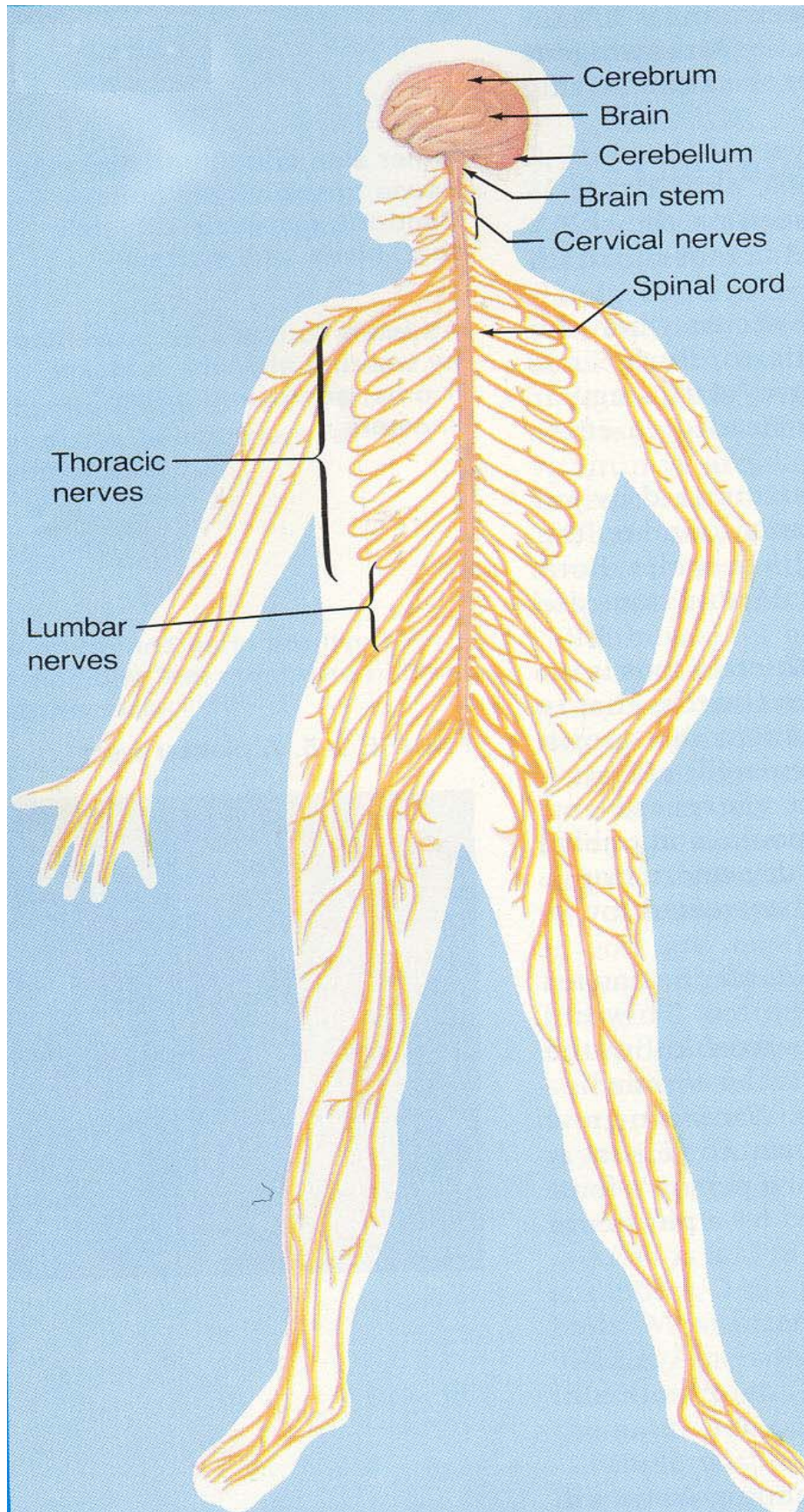
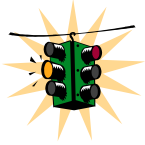


Figure 2.4: Nervous system

Energy and
Transport
Systems

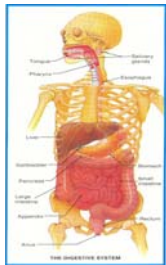


2.3 Energy and Transport Systems

The body has systems that are involved with the use of **energy and the disposal of waste** products in the body cells.

- Digestive system
- Circulatory system
- Respiratory system
- Urinary system

Digestive
System



2.3.1 Digestive System

All cells need energy in order to function. **Energy comes from fuel.** The fuel your body uses for energy **is food.** Food must be processed in your body to **provide nutrients.** **Digestion** is the process in which **food is chemically changed to** a form that can pass through cell membrane, see Figure 2.5. When you **chew solid food, teeth** in your mouth help **break the food into smaller pieces.** As food is chewed, it is **mixed with saliva.** Saliva **moistens** the food and helps **break down food** into **simpler substances.**

After **food** is chewed and swallowed, it **moves** through the **esophagus** by **peristalsis into the stomach.** The **stomach** is like an **elastic pouch** that acts as a **temporary storage place for food.** **Food remains** in the stomach about **four hours.** The **churning action** of peristalsis and the digestive juices **change the food** into a **thick paste called chyme.** **Food** in this state moves into **the small intestine.**

Digestion is completed in the **small intestine.** The small intestine is a **coiled tube measuring about 7 meters (23 feet) in length.** **Additional enzymes are produced in glands** in the lining of small intestine. **The lining** of the small intestine also contains **millions of tiny finger-like projections called villi,** which **increase its surface area.** Digested food is absorbed into **blood vessels of the villi.**

Food that is **not digested pass** into the **large intestine (colon),** where water is absorbed. **The remaining material** forms a semisolid mass called **feces.** **The expelling of feces** from the rectum is called a **bowel movement (defecation).** **Other organs** involved in digestion and not part of the digestive tract are **liver, pancreas and gall bladder.**

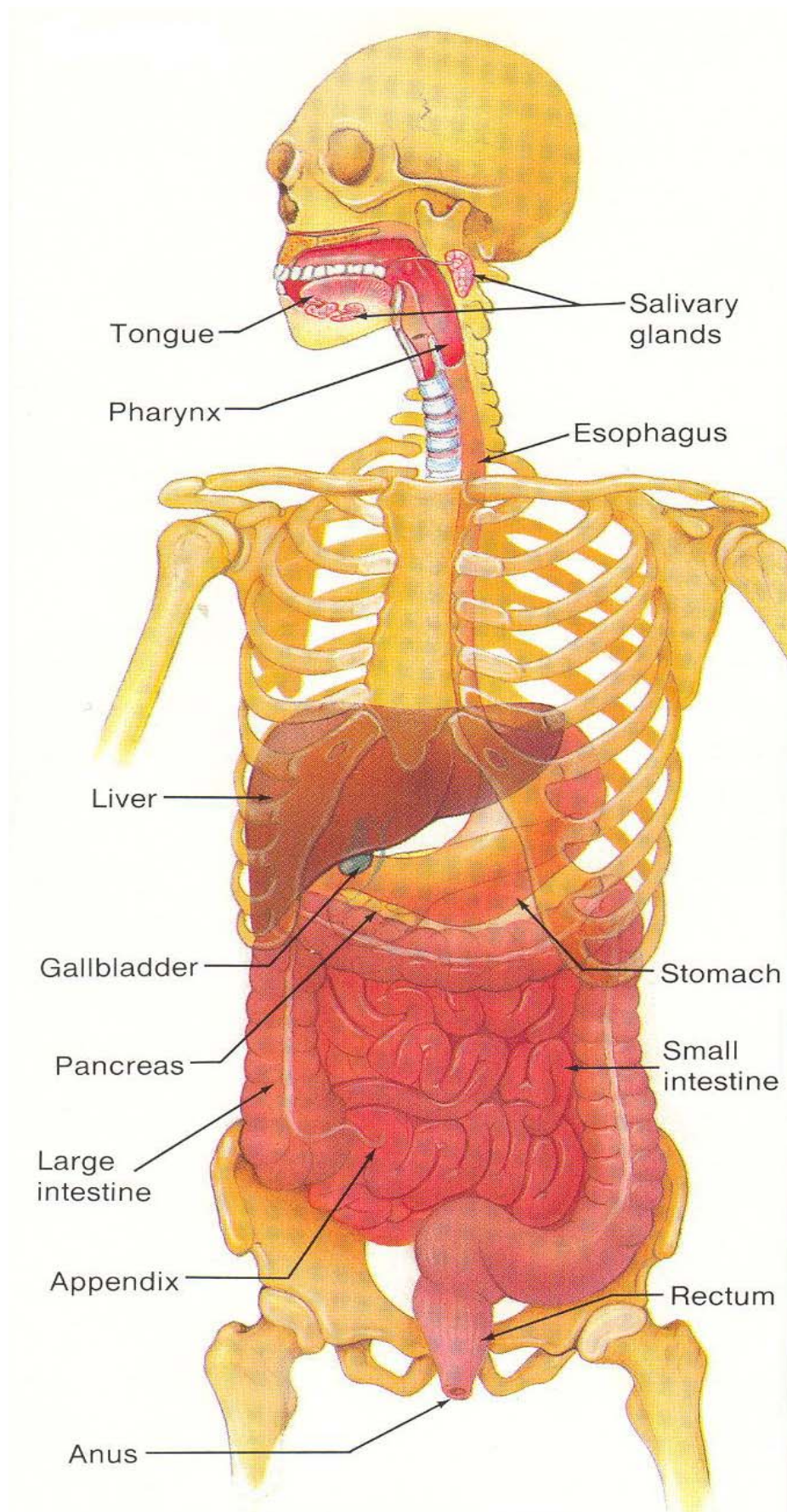


Figure 2.5: Digestive system

The
Digestive
System and
Health

The Digestive System and Health

There are many **common disorders** that **affect the digestive system**. Many are **minor conditions that can be treated**. Some are serious and should be treated **by a physician**. Whether minor or serious, any thing that upsets the body's ability to process food has a holistic effect.

Indigestion (dyspepsia) can be caused **by gastric conditions** such as **gastritis, gastric ulcer** whether peptic or malignant. **Hyper acidity and duodenal ulcer** are causes. Also **gallbladder diseases**, colonic conditions are causes.

Appendicitis – constipation –diarrhea –hemorrhoids (piles) are other examples and will be discussed in the lecture.

Circulation
System

2.3.2 Circulatory System

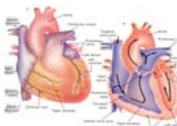
Each body cell **receives needed materials and releases waste products**. The transport of these materials to and from each body cell is the function of the **circulatory system**, which is formed from the **heart, blood vessels and blood**.

Blood is the fluid by which essential **substances are transported to cells throughout the body and by which waste materials are removed from the body cells** and transported to specific organs for disposal.

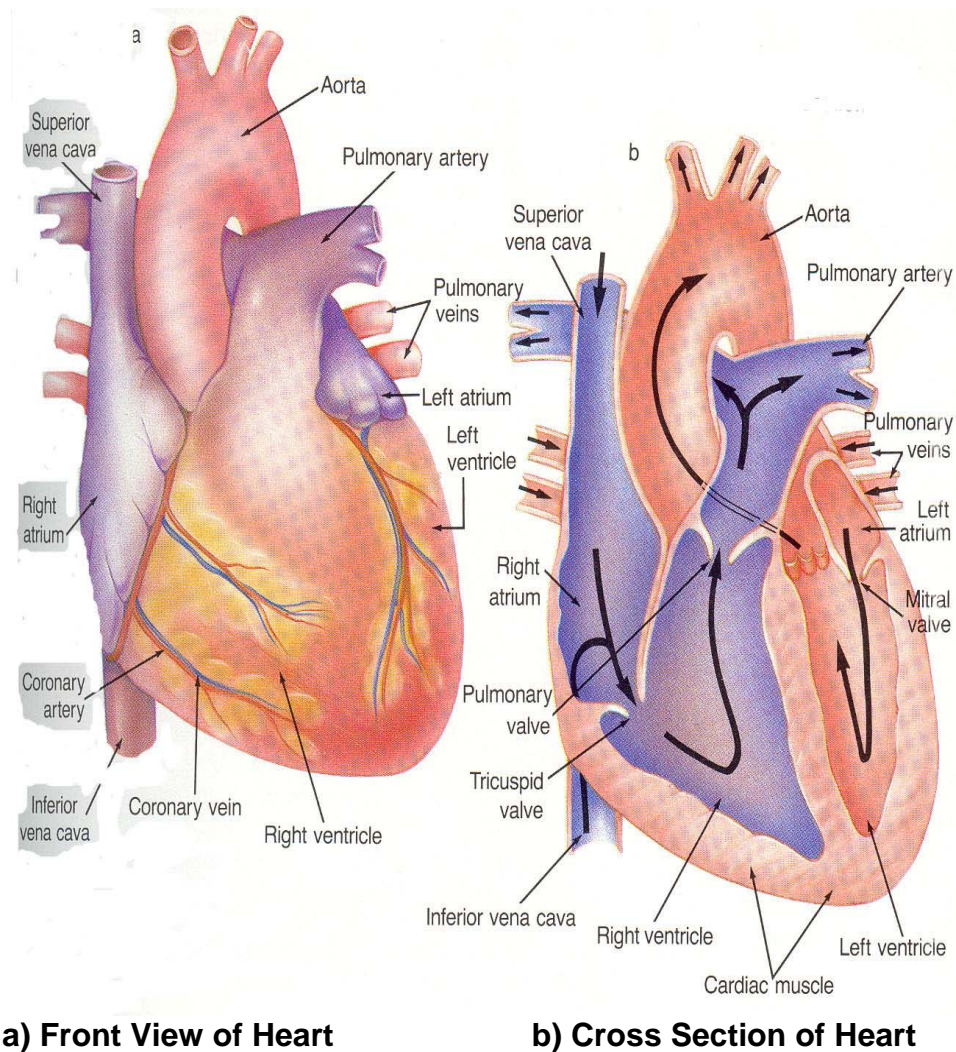
The **liquid part of blood** is called **plasma**. it is about **90% water and contains dissolved materials, including nutrients**. **Plasma also contains blood cells**. There are **three kinds of blood cells**, each with its own unique function. These are **red cells, white cells and platelets**.

The Heart

The Heart



The **human heart** is an incredible organ that **beats between 70 and 80 times each minute, or about 100 000 times each day**. The heart is a **strong muscle that lies under the sternum between lungs**, as shown in Figure 2.6. The **myocardium** is the **muscular wall of the heart**. Within the heart are **four chambers; two atria and two ventricles**.

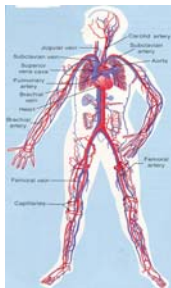


a) Front View of Heart

b) Cross Section of Heart

Figure 2.6: Heart

Blood Vessels



Blood Vessels

Blood is continually **circulating in a series of closed tubes** that carry it from the heart to all body cells and back to the heart again. These tubes are called **blood vessels**. There are three main types of vessels- **arteries, capillaries and veins**, see Figure 2.7.

Arteries carry blood from the heart to **all parts of the body**. Away from the heart **arteries** continually **subdivide into smaller arteries** called **arterioles**. **Arterioles** further subdivide to form **capillaries**. **Capillaries** connect arterioles to small veins called **venules**. Blood flowing through **venules and veins** is on its way back to the heart. As blood flows through capillaries, **some liquid** enters into spaces between **body cells**. The clear liquid is **lymph**. Lymph belongs to a part of circulatory system called **lymphatic system**. The lymphatic system contains **lymph nodes** which filter harmful organisms in the body.

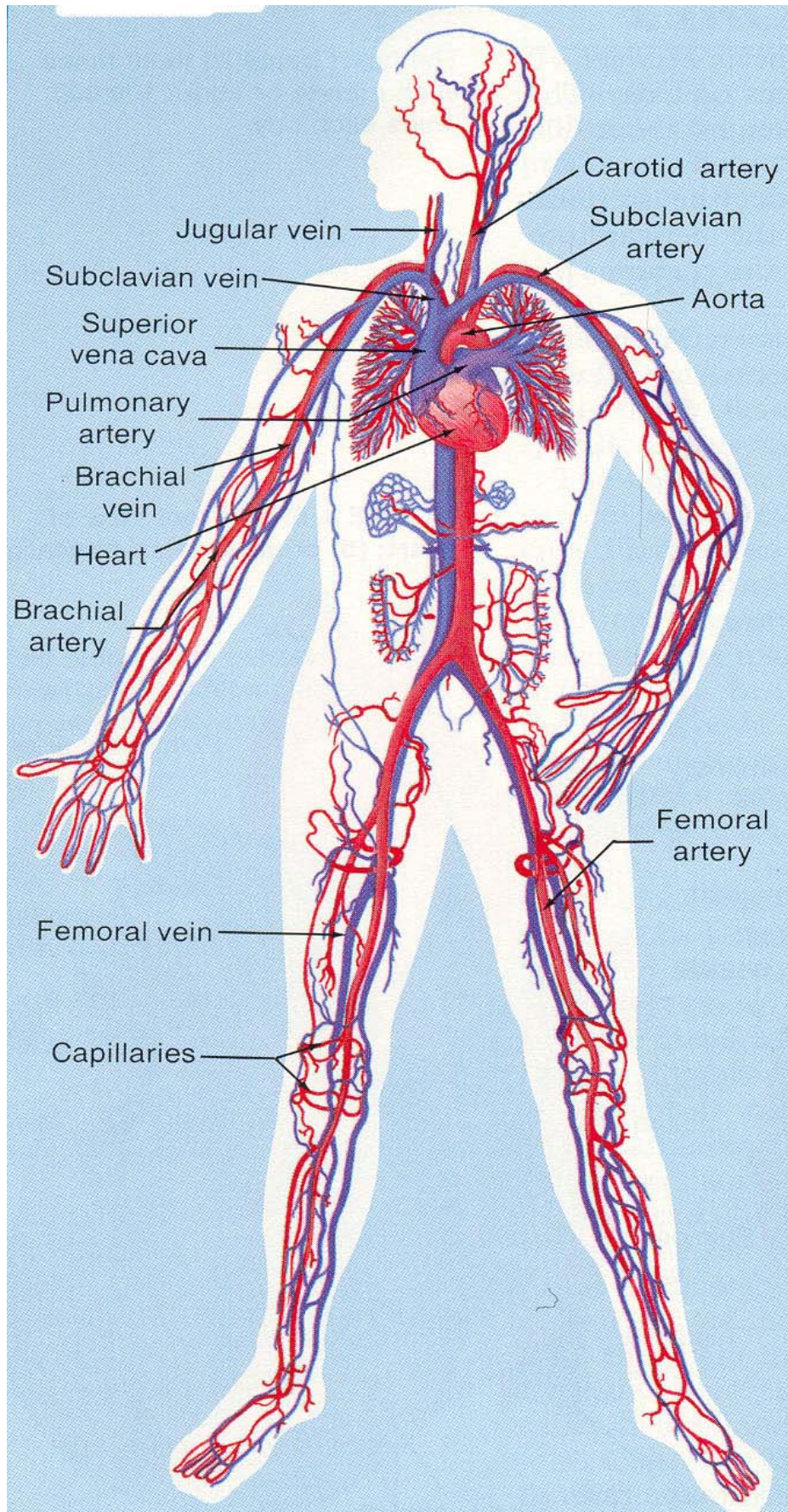


Figure 2.7: Circulatory system

Blood Pressure

Blood pressure is the **force** exerted by the flowing blood **against the walls of the arteries**. The pumping action of the heart creates the force. Every time the **heart beats, the pressure increases** (called **systolic** pressure). When the **heart relaxes** between beats, the **pressure decreases (called diastolic pressure)**. When a physician measures your blood pressure, a measurement is taken of both the **upper and lower pressures**.

A **sphygmomanometer** is an instrument that measures blood pressure.

A **stethoscope** is an instrument that enables a physician to sound inside a person's body.

For **young adults**, normal **systolic** blood pressure is **110-140**; normal **diastolic** blood pressure is **65-90**.

Blood Pressure and Health

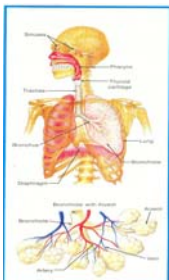
Blood Pressure and Health

Hypertension is the increase in blood pressure. It occurs when you are **angry or stressful** or after **vigorous exercise**. You may have high blood pressure without knowing it. **Continued high blood pressure is the most common disease affecting the heart and blood vessels** and can lead to serious complications. The **only way to know** for sure that your blood pressure is not high is to have it measured regularly.

- **Healthful behaviors** for heart and blood vessels include:

- **Avoid** smoking.
- **Reduce** the amount of fat and salt in your diet.
- **Practice** healthful ways to deal with stress.
- **Get** enough exercise and rest.

Respiratory System

2.3.3 Respiratory System

Cells to release energy from nutrients **need the chemical action of oxygen**. In this process, **carbon dioxide is produced as a waste product**. The respiratory system is involved in **making oxygen available** to the cells and is **ridding the body of carbon dioxide**.

Respiration is exchange of gases between a living organism and its environment. It takes place in two stages; external and internal, see Figure 2.8.

- **External respiration** takes place as oxygen and carbon dioxide are exchanged between blood and the air **in the lungs**.

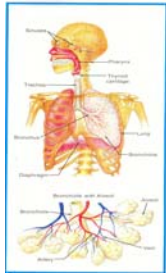
- **Internal respiration** takes place as oxygen and carbon dioxide are exchanged between **body cells and blood circulating** near them.

Mechanics of Breathing

Mechanics of Breathing

An adult inhales about **12 times each minute at rest**. The process of taking air into the lungs is called **inspiration**. The process of forcing air out of the lung is called **exhaling or expiration**.

The Respiratory system and Health



The Respiratory System and Health

Emphysema is a **serious lung disease** that results from the **destruction of the lung tissue**. The lungs lose their elasticity and do not function efficiently. This disease is common in people who **smoke and who regularly inhale polluted air**.

Lung cancer is a leading cause of **cancer death in males**. The main cause of lung cancer is cigarette smoking. Heavy smokers are 20 times more likely to develop lung cancer than non smokers.

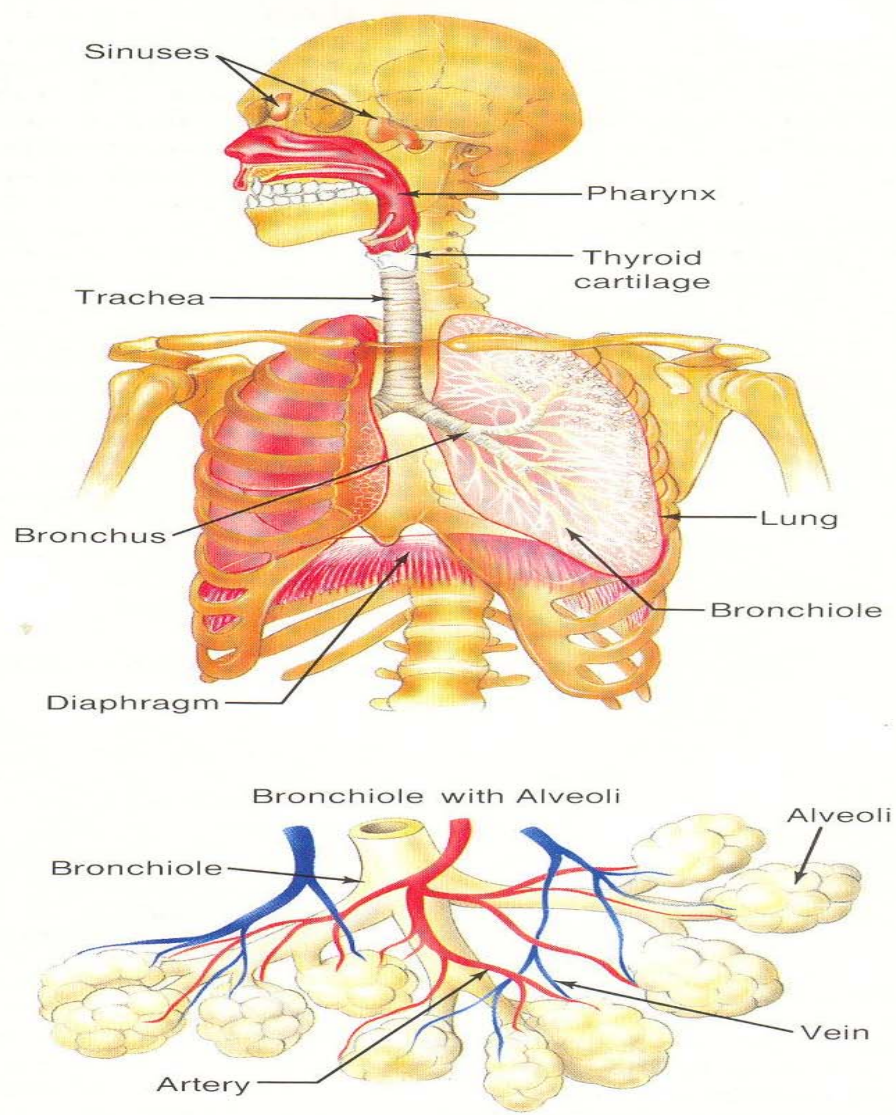


Figure 2.8: Respiratory system

Urinary System

2.3.4 Urinary System

This system **removes wastes from the blood** and helps **control the amount of fluid in the body**. The organs of the urinary system are the **kidneys, ureters, bladder, and urethra**, see Figure 2.9.

The **kidneys** lie near the **lowest ribs in the back**. Connected to each kidney are an **artery and vein**. As blood circulates through each kidney, the kidney acts as a **filter**. Waste materials that are filtered out form **urine**. Urine is about **95% water** in which solid wastes are dissolved. Urine then flows into the **urethras** (tubes that extend from the kidneys to the urinary bladder). **The urinary bladder** stores urine. When it becomes **full, nerve impulses** stimulate both voluntary and involuntary muscles to **release urine from the urethra**. The urethra is a narrow tube leading from the bladder through which urine passes out of the body.

Urinary System and the Health

Urinary System and Health

- To **maintain healthy kidney**, it is important to have the equivalent of at least six glasses of water in your diet daily.
- Many foods you eat contain water.
- Sometimes a kidney must be removed because of a disease.

In such cases, one healthy kidney can perform the task of two. If both kidneys are removed or fail to work properly, a person may be placed on a dialysis machine.

Dialysis

Dialysis is a process in which **a person's blood is filtered by a special machine** which takes the place of kidneys. The person's blood is circulated through tubes into a filtering machine. The blood is cleaned and then returned through a tube to the person's body. An alternative to dialysis is a kidney transplant. It is the exchange of unhealthy failed kidney for a healthy kidney. The healthy kidney often comes from a blood relative of the person who receives the transplant. This reduces the chance of rejection.

Urinalysis

Urinalysis is the **chemical examination of a person's urine**. It is a routine part of most physical examinations to **detect substances that normally are not in urine**, or substances that are in **larger than normal quantities**. Some people develop **kidney stones**. These stones can become lodged within the kidney itself or pass into the ureter. The danger of the stones is that they can obstruct the flow of urine into the bladder. If the urine backs up into the kidneys it can cause infection and destroy kidney tissue. The stones must be removed. **New advances in medicine now make it possible to remove stones more efficiently and safely than ever before**. The **lithripter** is a machine that uses a **focused wave to crumble kidney stones**. No **incision** is needed because the shock wave passes through body tissues without harming them. **The waves hit the stones**

causing them to crumble. The pieces can be passed out of the person's body through the urine. The use of the **lithripter** is **less expensive, less painful, and requires less recovery time** than kidney stone surgery.

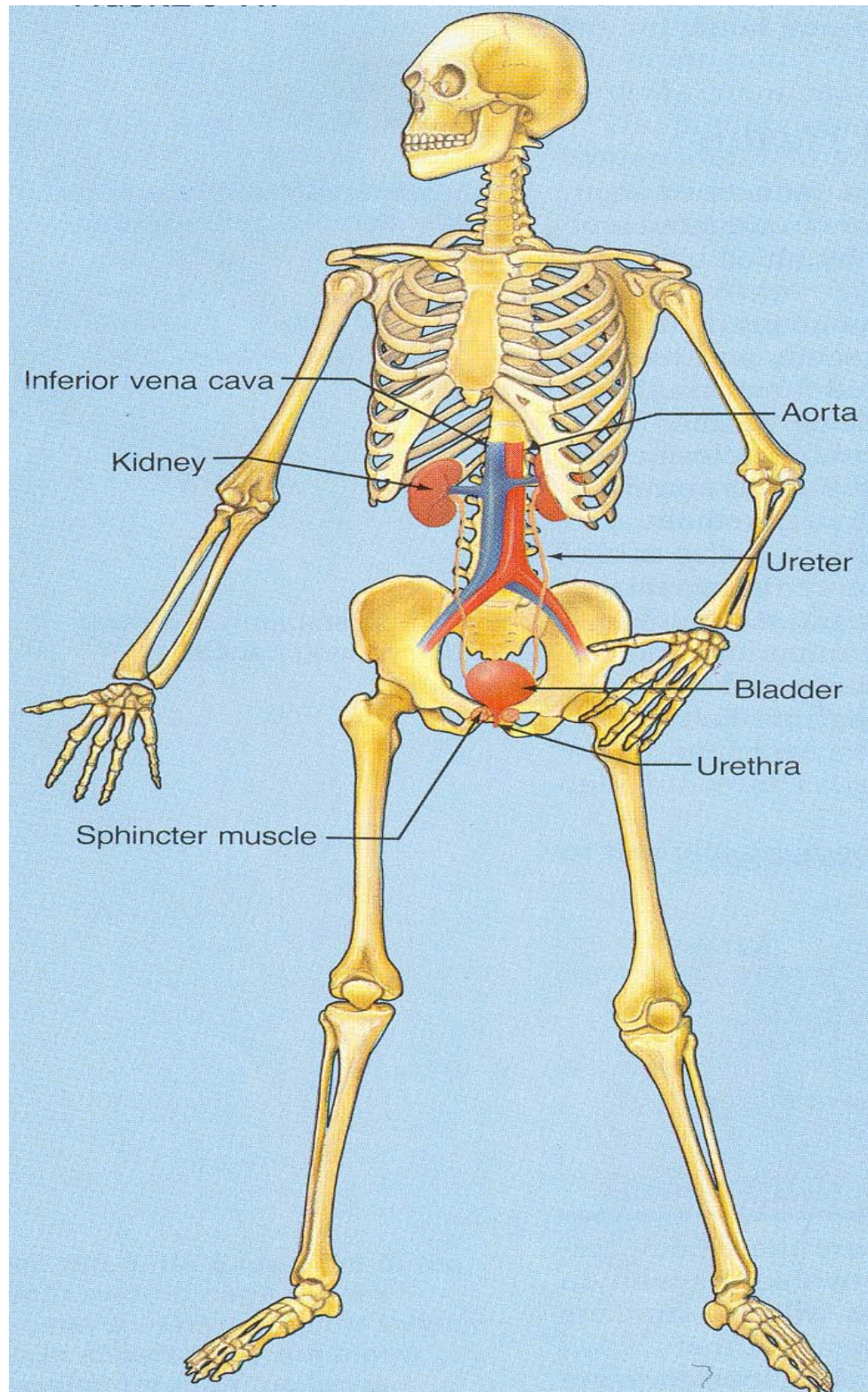


Figure 2.9: Urinary system

Endocrine
and
Reproductive
Systems

2.4 Endocrine System and Reproductive Systems

Endocrine
System

2.4.1 Endocrine System

Endocrine system works closely with the **nervous system**. It **controls functions** such as **growth, sexual development and the use of food**. The endocrine system consists of **glands that secrete hormones**. Hormones are chemicals that **act as messengers and regulate body activities**. Hormones are specific. The endocrine glands are: **pituitary, thyroid, parathyroid, adrenal medulla, thymus, pancreas, testes and ovaries**.

Reproductive
System

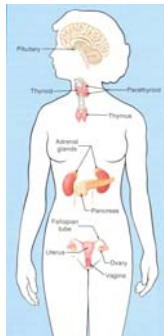
2.4.2 Reproductive System

Reproduction is the process of **producing offspring**. Unlike other body systems, the reproductive system **is not vital to an individual's survival**. However, this system is **vital to the continuation of the human race**.

Female
Reproductive
Organs

a- Female Reproductive Organs

The internal reproductive organs of the female include **two ovaries, fallopian tubes, uterus and vagina**, see Figure 2.10.



Associated reproductive structures, the **external parts of the female reproductive system** are known as **genitalia or genitals**.

The **genitals** include the **mons veneris, labia, and clitoris**. These parts together are known as the **vulva**. The **mammary glands** of the breasts **secrete milk** that can be used to **nourish a baby after birth**. Milk drains through **ducts to the openings in the nipples**.

During puberty, the menstrual cycle begins. The **menstrual cycle** is a **monthly series of changes that occur in a woman's body**. During the menstrual cycle, the **ovaries produce a mature egg cell**, the **lining of the uterus is prepared for a fertilized egg**, and the lining **breaks if an egg is not fertilized**.

Female
Reproductive
Health

Female Reproductive Health

- **Women are encouraged to perform breast self examination** once a month after each menstrual period.
- **Any breast lump should be checked as soon as possible** by physician.
- **Early detection and treatment of cancer** improve the chances of cure.

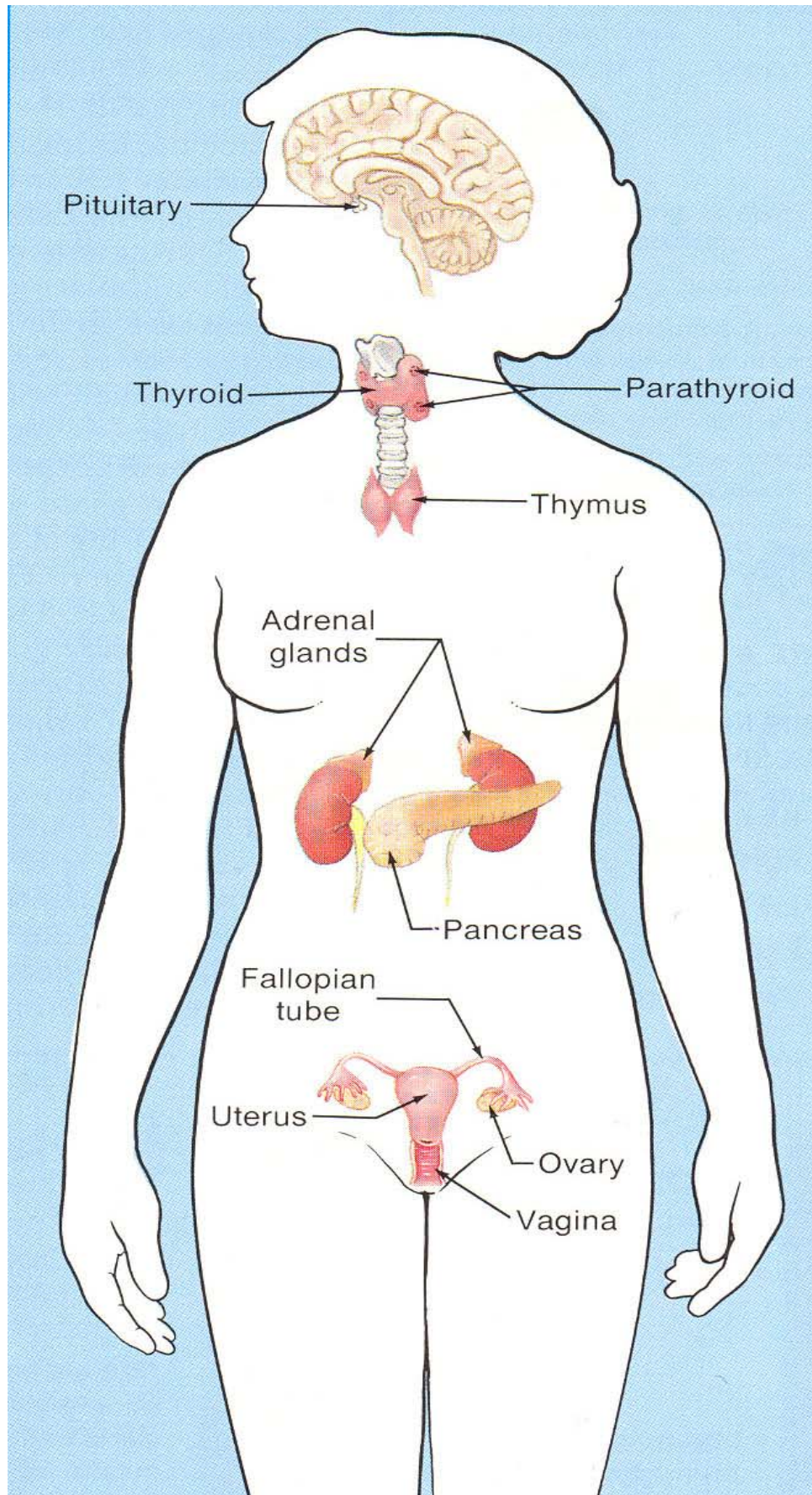
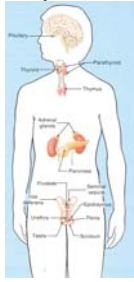


Figure 2.10: Female reproductive organs

Male
Reproductive
System



b- Male Reproductive System

The **main organs** of the male reproductive system are the **testes**. **Testes** are sometimes called **testicles**, see Figure 2.11. The other organs of the system can be grouped as internal and external reproductive organs.

Testes are **two glands** that are **contained in a sac** called the **scrotum**. **Sex hormones and reproductive cells called sperm** are produced in **seminiferous tubules** and stored in the **epididymus**. Before leaving the body, sperm move through a series of small tubes. From the epididymus, **sperm** move through the **vas deferens** to the **prostate gland**. The **prostate secretes a fluid to nourish the sperm**. Behind the prostate lies the **seminal vesicles**; sac-like structures that **secrete fluids to help sperm motility**. Sperm also receive secretions from the **Cowper's glands** on either side of the urethra. From the prostate sperm enter the **ejaculatory duct** (tube that leads from the **prostate** to the **urethra**). The urethra in the male serves as a way through **the penis for both urine and sperm**. However, urine and sperm do not pass through the urethra at the same time. The urethra extends through the penis to the outside of the body.

Circumcision is the removal of the foreskin of the penis. It is a minor surgical procedure, done a few days after birth.

The penis is composed of three layers of spongy tissue. Many blood vessels and nerves are supplied to this tissue. When these tissues become filled with blood, they cause **erection**. Erection usually occurs when a male is **sexually stimulated**. A male can have **erection without sexual stimulation**. For example, awaking up in the morning and the cause could be a **full bladder or sleeping on the stomach**. Also wearing tight clothes is a cause.

Ejaculation is the release of semen from the urethra. About **teaspoon containing about 600 million sperm** is released.

Male
Reproductive
Health

Male Reproductive Health

Cancer testes have increased in recent years. Early signs of this kind of cancer may be an **enlarged scrotum or a hard, painless lump** in one of the testes. A change in the testes may be found by doing a self examination each month. Any change should be checked immediately by a physician.

There are many other diseases that can affect the male reproductive organs. These diseases may be transmitted through sexual contact and are **called sexually transmitted diseases (STDs)**.

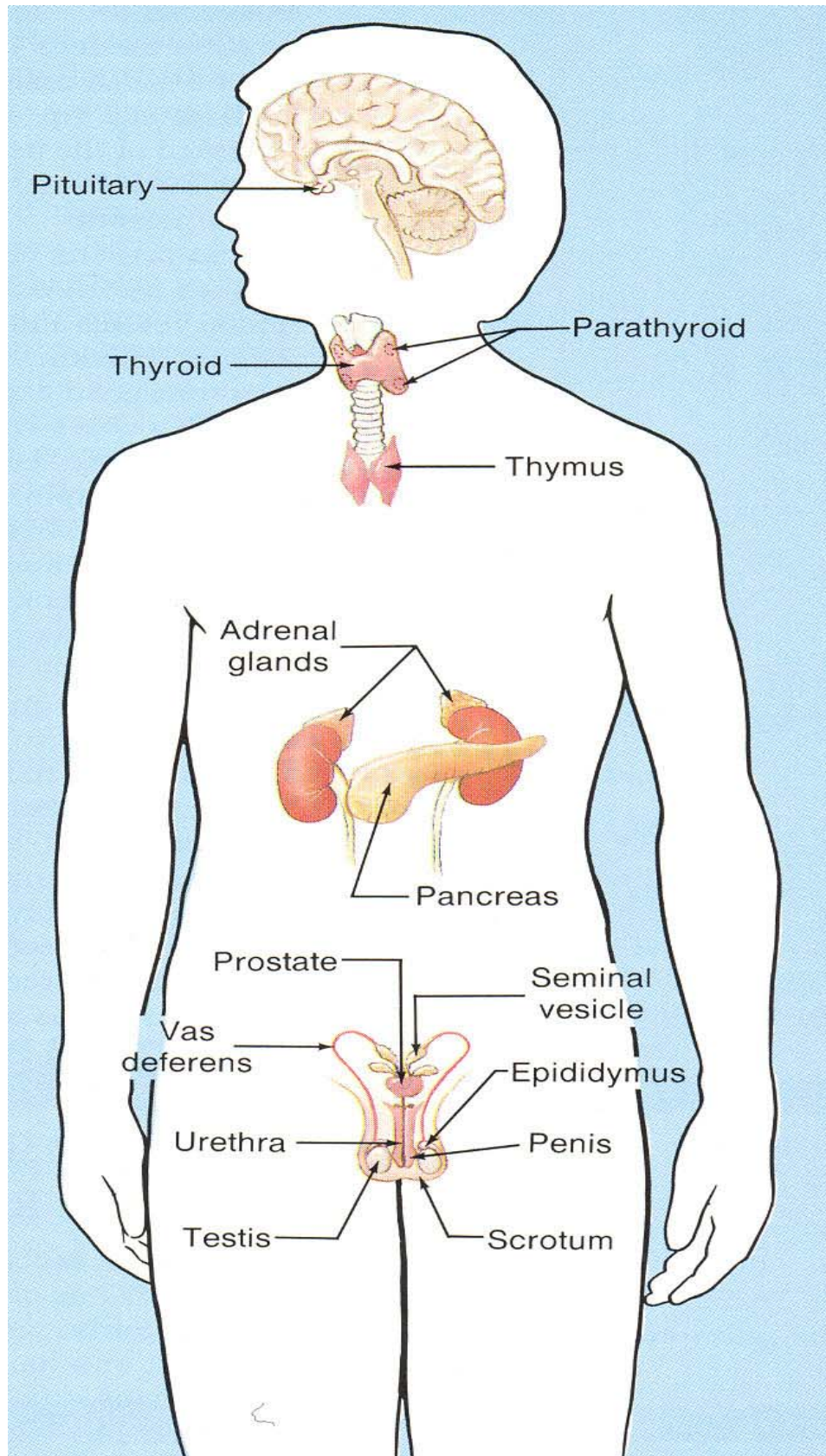


Figure 2.11: Male reproductive organs