محاضرات تشريح الحيوان
معهد الشطرة التقني/ الجامعة التقنية الجنوبية
فرع الصحة الحيوانية / قسم الإنتاج الحيواني/ المرحلة الأولى
Prepared by Dr. Salam Al-Helali
2018-2019

Anatomy is the study of form and structure.

• **Gross anatomy** is the study of structures that can be seen with the naked eye.

• **Microscopic anatomy** is the study of structures that require a microscope.

Organ systems.

1. Integumentary system (skin)
2. Skeletal system (bones)
3. Muscular system (muscles)
4. Circulatory system (heart & blood vessels)
5. Endocrine system (glands & hormones)

The integumentary system

The integumentary system is covering the body and is essential for:

- Regulating body temperature • Balancing water • Protecting internal organs

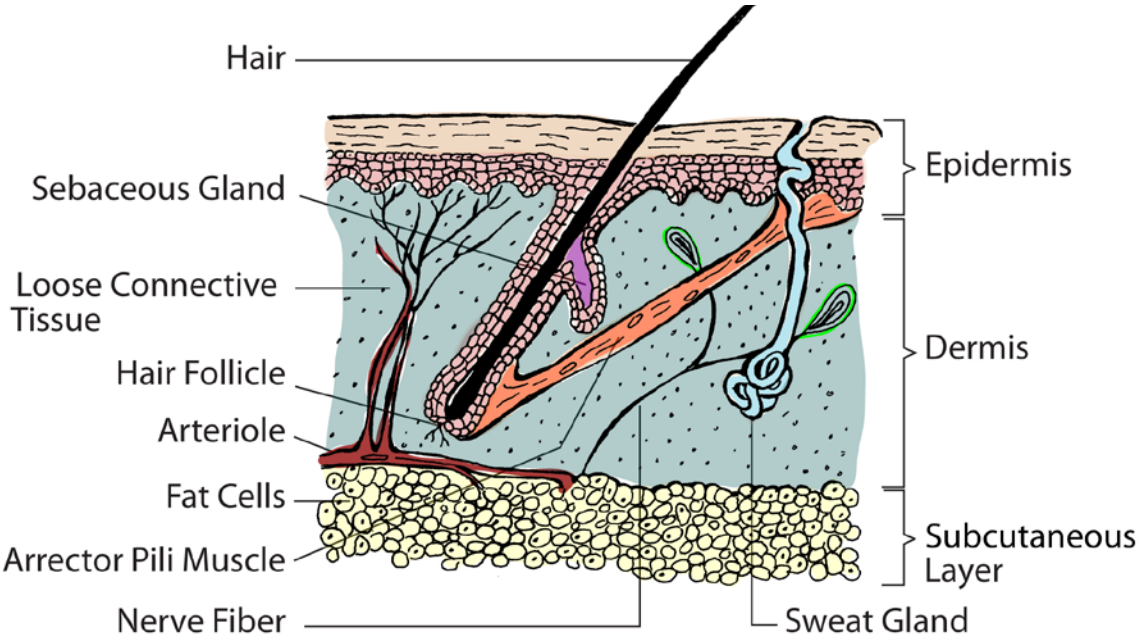
The integumentary system consists of skin and skin appendages, including:

- Hair • Nails • Horns • Sebaceous glands •Sweat glands
- The primary function of the skin is to act as a protective layer against disease, infection, the sun, and other potentially harmful elements.
- The skin consists of two layers, the epidermis, and the dermis.
- The epidermis is the outer layer and contains no blood cells.

- The epidermis is of stratified epithelial tissue comprised of an external layer of dead cells sitting on a lower layer of living cells.
- The dermis is the inner layer of the skin and contains blood vessels, lymph vessels, nerves, glands, hair follicles, and muscle fibers.
- The dermis is a deeper layer of dense, irregular connective tissue.

Skin Appendages (modified extensions) derived from the skin include:

- Hair • Scales • Hoofs • Feathers • Claws • Horns • Nails
- Coat coverings differ between animals species.
- Goats, horses, cattle, have hair; sheep have wool, and poultry has feathers.
- Hair, wool, and feather are comprised of protein and regulating body temperature.



- Each hair follicle has a small bundle of smooth muscle fibers that can contract to pull the hair perpendicular to the skin surface.
- The arrector pili muscles are stimulated to contract involuntarily by the nervous system in times of stress or cold.

- When all hairs are standing perpendicular, they trap more air and keep the animal's body warmer.
- The glands of the skin are sweat glands and sebaceous glands.
- Sweat glands release water to cool the body.
- Sebaceous glands secrete oil to lubricate the skin and hair.

The skeletal system

- The skeletal system is the framework of the body.
- The skeletal system is made up of bones and connective tissue and provides the support for all of the other organ systems.
- The skeletal system protects the organs of the body.
- The skull protects the brain, ribs protect the lungs, and vertebrae protect the spinal cord.
- The skeleton also works in conjunction with the muscles to allow movement of the different body parts.

The skeleton isof the axial skeleton and the appendicular skeleton

The axial skeleton os the bones on the midline of the body including:

- Skull • Vertebrae • Ribs • Sternum

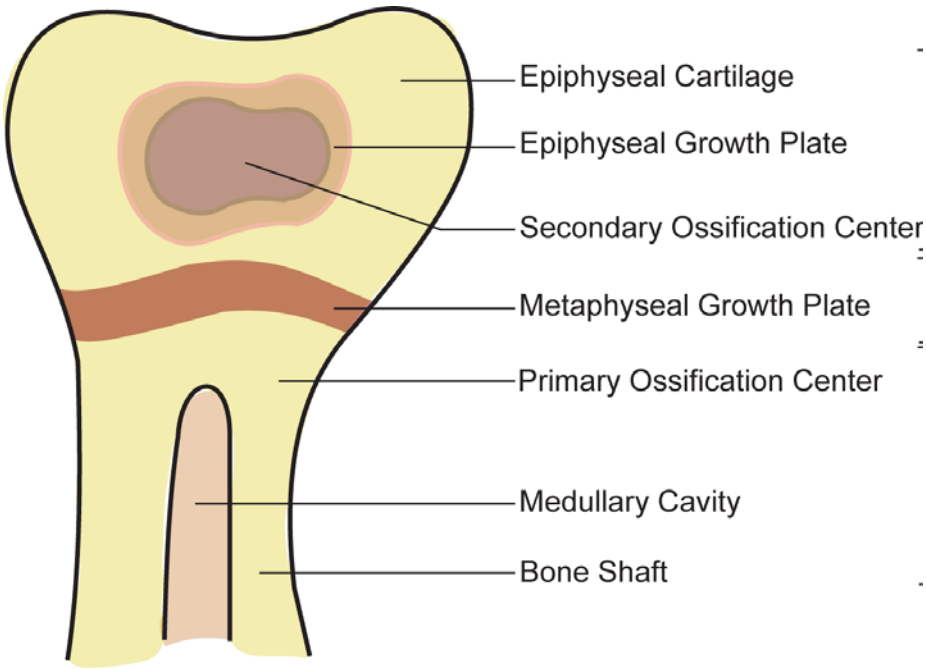
The appendicular skeleton is comprised of those bones coming off the midline of the body including:

- Forelegs (arms)
- Hindlegs (legs)

- Bones in the pelvic region

Bones are divided into four classes.

- Long bones
- Flat bones
- Short bones
- Irregular bones
- Long bones, found in the limbs, are the supporting columns and levers for the skeletal system and the body.
- Flat bones protect the body's organs and serve as an area of muscle attachment.
- Short bones, such as the bones in the knee hock joint, diffuse concussion, diminish friction and change the direction of tendons.
- Irregular bones are those found in the vertebral column.



- Bone is made up of organic and inorganic matter.
- The organic matter is mostly collagen and gives bone flexibility and resilience.
- The inorganic matter is mostly Ca_3PO_4 and gives bone rigidity and hardness.
- The inner core of the bone is soft tissue called bone marrow.
- The outer portion of bone marrow is comprised of red tissue, called red marrow.
- The red marrow is responsible for blood cell and platelet formation.
- Bone is a living tissue that changes constantly.
- Bone is formed from cartilage when the animal is an embryo.
- The bone forming cells are known as osteoblasts.
- Osteoblasts develop into osteocytes or mature bone cells.

Connective tissue binds tissues together to give form and strength to organs and provide protection and leverage.

Four types of connective tissues exist within the skeletal system:

- Ligaments • Tendons • Cartilage • Fascia
- Ligaments connect bone to bone
- Tendons attach muscle to bone

Three types of cartilage found in the body:

- Hyaline cartilage is found on the ends of bones and acts as cushioning in joints.
- Elastic cartilage makes up body parts such as the ears.
- Fibrocartilage provides cushioning between the vertebral discs.

• Fascia is located between the skin and the underlying muscle or bone. It is of 2 layers. The top layer, superficial fascia, is attached to the skin, the bottom layer, deep fascia, covers the muscle or bone.

Joints are articulations between bones. Three types of joints are found in the body:

• Freely movable

• Partially/Slightly movable

• Immovable

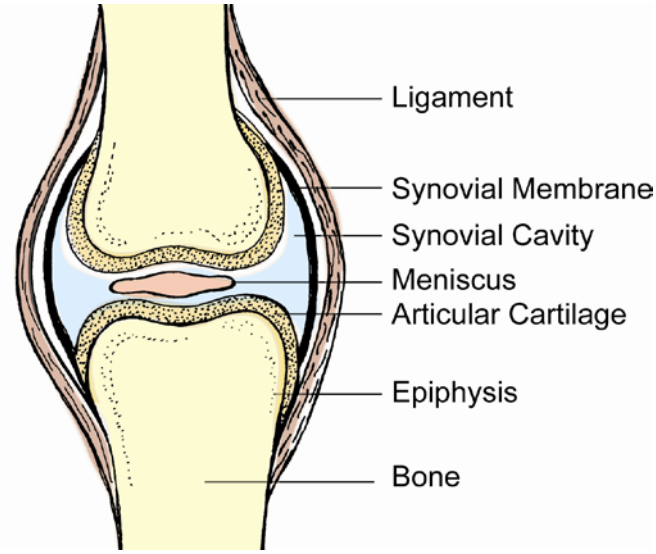
• Joints can be highly movable – for example, the shoulder

• Partially movable – for example, the ribs

• Immovable – Like suture joints between the plates of the skull.

Allow the greatest range of movement such as:

• Gliding • Flexion • Extension • Hyperextension • Rotation • Adduction • Abduction • Circumduction



The muscular system

- It is in conjunction with the skeletal system, allows the movement of internal structures, limbs, and the body as a whole.

Muscles can be categorized by their:

- Function (skeletal, visceral, or cardiac)
- Activation method (voluntary or involuntary)
- Physiology (smooth, striated or unstrained)
- Skeletal muscles are striated, voluntary muscles that are involved in the movement of the skeleton.
- Skeletal muscles can be intentionally controlled by the animal.
- Smooth or visceral muscles are involuntary, unstraited muscles found in the digestive organs and blood vessels of the body.
- Visceral muscles function automatically or controlled by the animal.
- Cardiac muscle is involuntary, striated found only in the heart.
- No conscious control of cardiac muscle occurs in the animal, but it can be regulated by the autonomic nervous system.

Skeletal muscles can be divided into four functional groups:

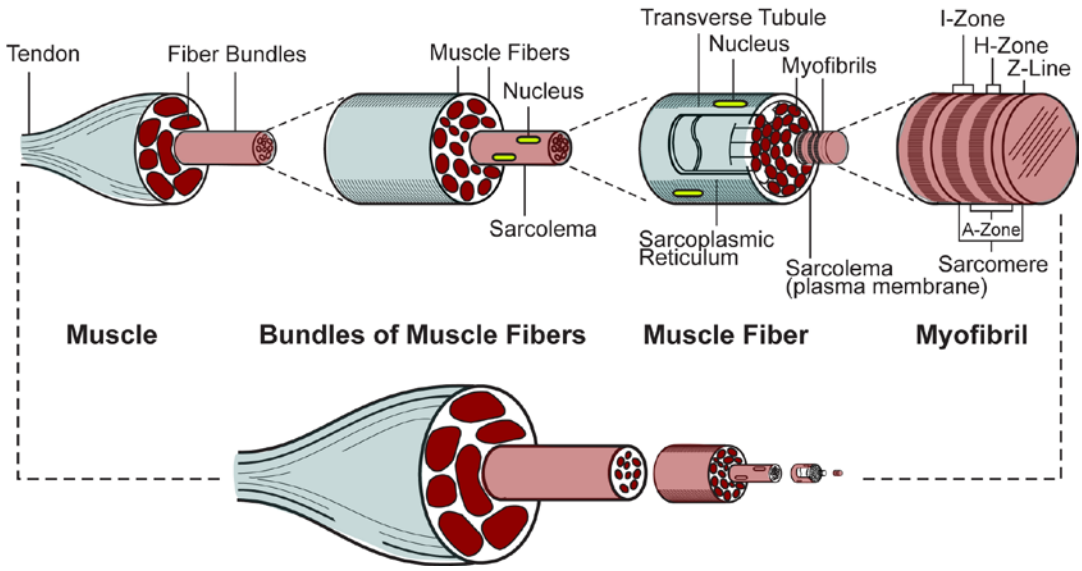
- Flexors • Extensors • Abductors • Adductors
- Skeletal muscle is made up of bundles of fibers or cells that stretch from one tendon, or connective tissue, to the other tendon.
- These bundles of fibers lie parallel to each other within the muscle sheath making the muscle appear striped, or striated.
- Each bundle consists of fibers, which are individual cells with multiple nuclei.

• Individual muscle fibers are made up of bundles of myofibrils enclosed in a series of sarcomeres. They are made up of thick filaments of myosin and thin filaments of actin.

• Muscle contraction occurs as a result of a process known as sliding-filament action.

• Each individual sarcomere contracts as a result of the actin and myosin filaments sliding over each other.

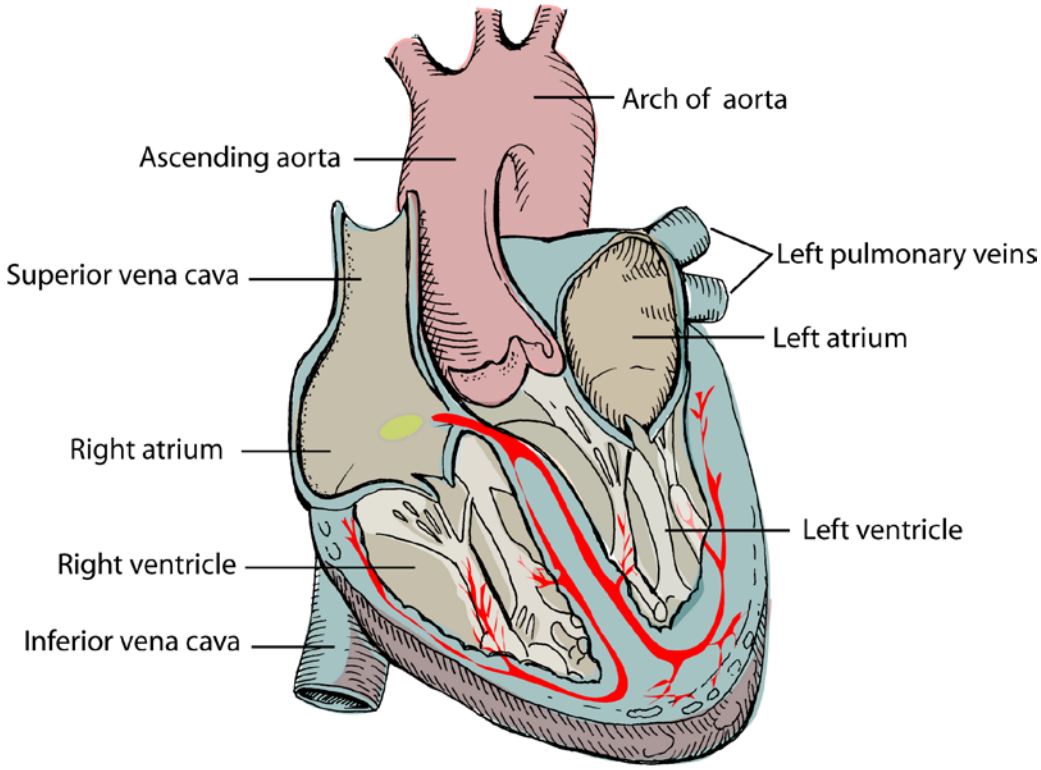
• Energy utilized for muscle contraction comes primarily from non-protein sources such as adenosine triphosphate (ATP), glycogen and fats.



The circulatory system

The circulatory system includes the heart, veins, capillaries, arteries, lymph vessels, and lymph glands. The circulatory system is responsible for:

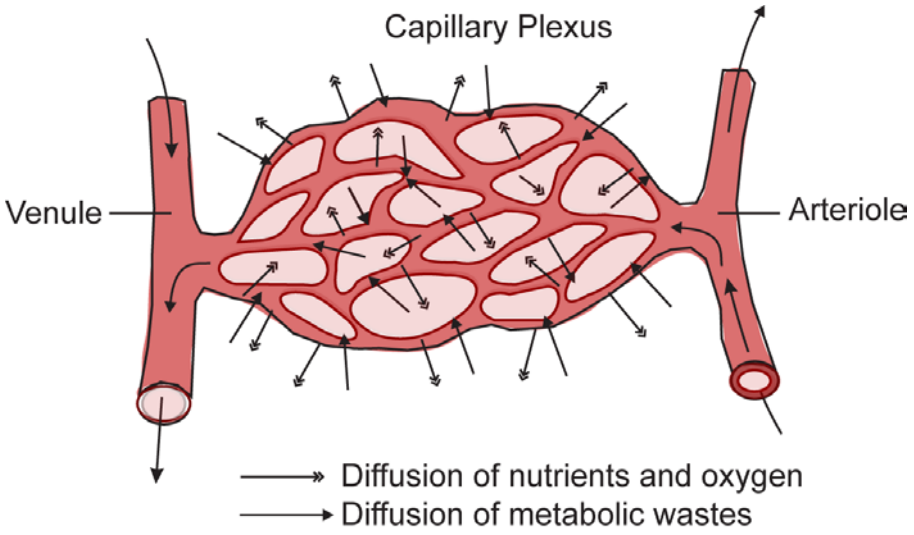
- Distributing blood throughout the body • Removing wastes •Mounting immune responses to infection • Aiding in regulating body temperature
- Blood provides organs, tissues, and cells with oxygen, nutrients, gasses, hormones, and antibodies, and removes carbon dioxide and metabolic wastes.
- The lymphatic system is responsible for draining fluid from the body and is an important defense mechanism against infection.
- The heart is a muscle and is divided into the left and right side. Each side is made up of an atrium and a ventricle.
- The atria receive blood, either from the lungs or the rest of the body.
- Blood then passes into the ventricle before being pumped out of the heart again.
- Deoxygenated or venous blood coming from the body enters the right atrium, passes through the right V.A. (atrioventricular) valve and into the right ventricle.
- It is then pumped through the pulmonary artery to the lungs.
- Oxygenated or arterial blood returns from the lungs via the pulmonary vein and enters the left atrium; it then passes through the left A.V. valve and into the left ventricle before being pumped out of the heart to the rest of the body via the aorta.



Five types of blood vessels exist within the body:

- Arteries • Arterioles • Veins • Venules • Capillaries
- Arteries are blood vessels that carry blood away from the heart.
- Arterioles are small arterial branches that deliver blood to capillaries.
- Veins are blood vessels that convey blood from tissues back to the heart.
- Venules are small veins that collect blood from capillaries and to a vein.
- Blood vessels gradually become smaller as they migrate away from the heart.
- Arteries divide into arterioles and veins divide into venules.
- Capillaries are the smallest blood vessels. Capillaries are involved in the transfer of oxygen, nutrients, and gases to the cells of the body and the removal of carbon dioxide and metabolic waste.

- Capillaries have very thin membranes, so the components of blood can diffuse across the membrane and enter cells.
- Interaction of molecules flowing in and out of blood at the capillary bed.



The two main circulation systems within the body are the:

- Pulmonary System
- Systemic System
- The pulmonary system delivers blood to and from the lungs.
- The systemic system circulates blood throughout the rest of the body.

Blood is composed of:

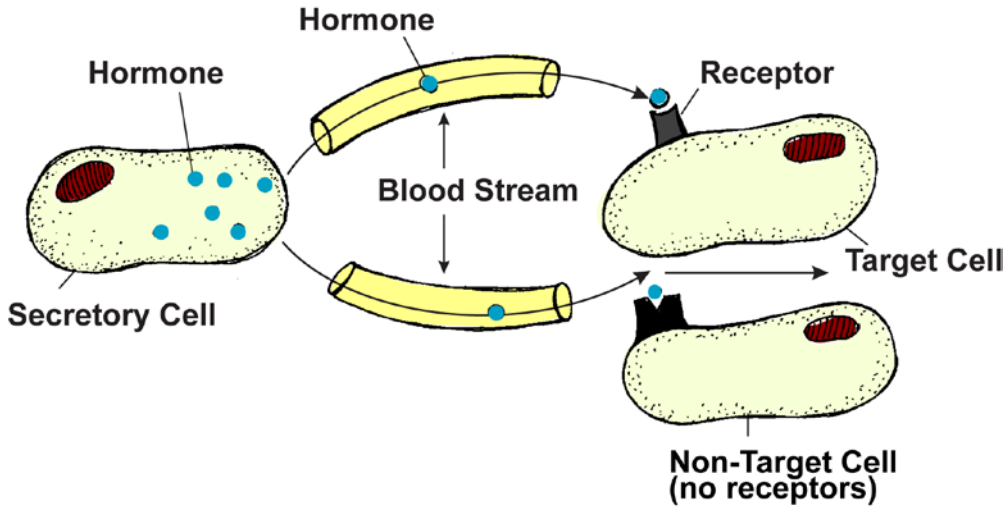
- Red cells (erythrocytes),
- White blood cells (leukocytes)
- Platelets (thrombocytes)

- Plasma
- Red blood cells are the most numerous and contain a protein called hemoglobin.
- Hemoglobin contains the mineral iron and is responsible for carrying oxygen in the blood.
- Red blood cells deliver oxygen to cells and aid in the removal of carbon dioxide.
- White blood cells are responsible for the body's immune response, or defense against infection.
- There are two types of white blood cells, granulocytes and agranulocytes (lymphoid cells) which aid in combating foreign bodies, bacteria, viruses, and other infective agents.
- Platelet (thrombocyte) is a fragment of cytoplasm enclosed in a cell membrane and lacking a nucleus; found in circulating blood, platelets play a role in clotting.
- Plasma is the yellowish extracellular fluid found in blood vessels. Plasma is 90% water.
- They lymphatic system is comprised of lymph vessels, lymph nodes, lymph organs and areas of lymph tissue within the intestinal wall.
- Lymphatic organs include bone, marrow, tonsils, thymus, and the spleen.
- The lymphatic system maintains internal fluid balance and is an important component of the body's immune system.
- Lymph vessels are thin-walled and blind-ended. They originate in the body tissue and take lymph towards the heart.
- Lymph nodes are located throughout the body along the lymph vessels.

- Lymph nodes filter lymph and act as a barrier against infection by harboring lymphocytes, monocytes and plasma cells.

Endocrine System

- A network of glands that secrete hormones, which provide chemical control of various functions of the body.
- Endocrine glands secrete chemical compounds called hormones into the blood.
- Hormones are secreted from a secretory cell in a gland and act on a target cell at another part of the body.
- Target cells must have receptors for the specific hormone.



Hormones play an important role in body functions including:

- Growth • Fattening • Reproduction • Lactation • Egg Laying

There are three types of hormones that can be grouped by their chemical structure:

- Steroids • Peptides • Amines
- Lipids that are secreted by the gonads, adrenal cortex, and placenta.

- Two common steroid hormones are progesterone and testosterone.
- Short chains of amino acids secreted by the pituitary gland, parathyroid gland, heart, stomach, kidneys, and liver.
- Peptide hormones include oxytocin, luteinizing hormone, a thyrotropin releasing hormone.
- Secreted from the adrenal medulla and the thyroid.
- Amine hormones include epinephrine, norepinephrine, T3 (triiodothyroxin), and T4 (tetraiodothyroxin).
- The hypothalamus is located above the pituitary gland near the base of the brain.
- The hypothalamus gland coordinates hormonal activity in the pituitary gland.
- Stimulatory and inhibitory hormones are produced by the hypothalamus and transported to the anterior pituitary.
- Hormones are transported to the anterior pituitary through the blood.
- The hormones oxytocin and vasopressin, travel to the pituitary by nerve cells.
- The pituitary gland is located at the base of the brain.
- It is composed of two parts, the anterior and posterior pituitary glands.
- The pituitary controls the hormonal secretions of numerous endocrine glands.

Thyroid Gland consists of **2** lobes located on either side of the trachea or windpipe.

- Thyroxine, produced by the thyroid gland controls body metabolism and growth.
- Calcitonin, also produced by the thyroid controls the calcium level in the blood and promotes the incorporation of calcium into the bone.
- The parathyroid glands include four small glands embedded in the thyroid.

- The parathyroid glands produce parathyroid hormone, which maintains the level of calcium and phosphorus in the blood.
- The adrenal glands, consisting of the medulla and a cortex, are located in front of the center of the kidneys.
- The medulla produces norephinephrine, which helps maintain blood pressure and stimulates smooth muscles.
- The cortex produces steroids, which are involved in carbohydrate and fat metabolism.
- The production of hormones by endocrine glands is carefully balanced, and an imbalance can result in illness or improper development of the animal.