Veterinary Science
Preparatory Training for the Veterinary Assistant
Floron C. Faries, Jr., DVM, MS
Anatomy & Physiology of Animals

Floron C. Faries, Jr., DVM, MS
Objectives

- Define anatomy
- Discuss the different fields of anatomy
- Identify and describe the integumentary system
- Identify and describe the musculoskeletal system
- Identify and describe the cardiovascular system
- Identify and describe the lymphatic system
- Identify and describe the digestive system
- Identify and describe the respiratory system
- Identify and describe the endocrine system
- Identify and describe the urinary system
- Identify and describe the reproductive system
- Identify and describe the nervous system and special senses
Definitions

- **Anatomy**
  - The study of the **structures** of living things

- **Physiology**
  - The study of the **functions** of living things
    - Mechanical, physical, or biochemical
Latin – Anatomy

- “ana” “tome”
  - “ana” – again or go back
  - “tome” – to cut

- “cut again” or “go back and cut”

- The study of the structure of the animal body and the relationships of its many parts
Fields of Anatomy

- Gross anatomy
- Microscopic anatomy
- Developmental anatomy
- Applied anatomy
Study of gross anatomy

- Systemically
- Regionally
Macroscopic Anatomy (gross anatomy)
Seen with the naked eye by dissection.
Organs and organ systems

Microscopic Anatomy
Viewed with a microscope.

Cytology: the study of cells

Histology: the study of the four basic types of tissues
CELL – Smallest unit of protoplasm

TISSUE – Groups of cells with same general function
  e.g., muscle, nerve

ORGAN – Two or more types of tissues
  e.g., skin, kidney, intestine, blood vessels

ORGAN SYSTEM – Several organs
  e.g., respiratory, digestive, reproductive systems
Four Basic Types of Tissue

EPITHELIUM TISSUE

CONNECTIVE TISSUE

MUSCULAR TISSUE

NERVOUS TISSUE
Functions of Epithelium

- Covers organs
- Lines viscera and blood vessels
- Secretory cells of glands
Functions of Connective Tissue

- Provides mechanical support.
- Provides place for metabolite exchange.
- Provides place for energy storage.
- Provides place for inflammation.
- Provides place for fibrosis – healing.
Connective Tissue and Blood Cells

**Red Cells**
- Carry oxygen to and carbon dioxide from the body’s tissues.

**White Cells**
- Manufactured in bone marrow.
- Pass through the blood to connective tissue for defense.

**Platelets**
- Act in blood clotting.
Muscular Tissue

Function
Generates contractile force.

Nervous Tissue

Function
Provides transmission, reception, and integration of electrical impulses.
Organs

Definition: a distinct collection of two or more tissues that performs a specific function or functions

Examples:
- bones
- brain
- liver
- kidney
- heart
Organ Systems

Definition: a group of interconnected organs that work together with a common purpose or purposes
Organ Systems

- Digestive
- Respiratory
- Urinary
- Reproductive
- Musculoskeletal
- Endocrine
- Nervous
- Integumentary
- Cardiovascular (circulatory)
- Lymphatic (immune)
Integumentary System

- **Epidermis**
  Outermost layer of skin

- **Dermis**
  Beneath the epidermis
  Consists of connective tissue

- **Hypodermis**
  Subcutis
  Lowest layer of skin
  Mainly houses fat
Functions of Skin

- Protects against injury and desiccation.
- Maintains water balance.
- Excretes various substances.
- Provides thermoregulation.
- Receives stimuli.
  - Temperature
  - Pain
  - Pressure
- Provides basis of recognition of well-being.
- Provides place for fat metabolism in the hypodermis.
Parts and Functions of the Musculoskeletal System

**Muscles**: system of levers that aid muscle action
- Smooth Muscle
- Skeletal Muscle
- Cardiac Muscle

**Bones**: provide support and protection
- Long bones
- Short bones
- Flat bones
- Irregular bones
Parts and Functions of the Musculoskeletal System

- **Joints**
  Form the junction between two or more bones.

- **Cartilage**
  Forms cushion.

- **Ligaments**
  Connect bone to bone.

- **Tendons**
  Attach muscles to bone.
Functions of Muscle

- Produces contractibility (movement).
  - Running, walking, jumping
- Produces posture.
- Stabilizes joints.
- Produces heat.
Functions of Cartilage

- Provides flexible support. (ears, nose, and respiratory)
- Slides across each other. (joints)
- Provides a cushion. (joints)

No nerves, so no pain during compression of cartilage.
Functions of Bone

- Provides skeletal support.

- Provides protective enclosure.
  - Skull to protect brain.
  - Long bone to protect blood producing cells.

- Regulates calcium.

- Provides place for hemopoiesis.
  - Blood cell formation in the body
Skeleton of the “hand”
Carpal bones

Metacarpal bones

Phalanges (Digits)
Carpal bones

Metacarpal bones

Phalanges
Carpal bones
Metacarpal bones
Phalanges
Carpal bones

Metacarpal bones

Phalanges
Carpal bones

Metacarpal bones

Phalange
Cardiovascular System

- Heart
- Arteries
- Veins
- Capillaries
Parts and Functions of the Cardiovascular System

**Heart**
Produces blood pressure during systole.

**Elastic arteries**
Conduct blood and maintain pressure during diastole.

**Muscular arteries**
Distribute blood and maintain pressure.

**Arterioles**
Provide peripheral resistance. Distribute blood.

**Capillaries**
Exchange nutrients and waste.

**Venules**
Collect blood and edema from capillaries.

**Veins**
Transmit blood to large veins. (reservoir)

**Large veins**
Receive lymph and return blood to heart. (reservoir)
arteries

arterioles

capillaries

water (ISF); O2/CO2, nutrients, cells, proteins, hormones
The circulatory system forms a cycle:

- Arteries carry oxygen-rich blood to the body's tissues.
- Venules transport oxygen-poor blood back to the heart.
- Veins carry oxygen-poor blood from the tissues back to the heart.
- Capillaries exchange nutrients, oxygen, carbon dioxide, and waste products between the blood and the tissues.

Water (interstitial fluid), oxygen (O2), carbon dioxide (CO2), nutrients, cells, proteins, and hormones are exchanged in the capillaries.
Closed Loop with Pressure Drop
The diagram illustrates the blood circulation system. It starts in the heart, marked with '2', and flows through veins, venules, capillaries, and arterioles, ending back in the heart, marked with '125'.

- Veins: transport blood away from the heart.
- Venules: smaller veins that carry blood to venules.
- Capillaries: the site of exchange, where water (ISF), O2/CO2, nutrients, cells, proteins, and hormones are exchanged.
- Arterioles: smaller arteries that regulate blood flow.

The numbers '15' and '30' likely indicate the oxygen saturation or pressure levels at these points in the circulation.
Major Branches of the Aorta
interatrial septum

interventricular septum
R. AV valve (tricuspid valve)

L. AV valve (mitral valve)
aorta
pulmonary trunk
pulmonary valve
aortic valve
Systole
Diastole
Systole
Lymphatic System

- Returns fluid from the tissues to the circulatory system.

- Consists of:
  - Lymph
  - Lymphatic vessels
  - Lymphatic structures
Parts and Functions of the Lymphatic System

- **Lymph nodes**
  - Filters and traps foreign particles.
  - Contain white blood cells.

- **Tonsils**
  - Protects against bacteria.

- **Thymus**
  - Helps with immunologic cells.

- **Spleen**
  - Clears out old red blood cells.
Functions of the Lymphatic System

- Removes excess fluids from body tissues.
- Absorbs fatty acids.
- Transports fat.
- Produces immune cells (lymphocytes).
- Helps combat infections.
Digestive System

- Involves
  - Prehension
  - Digestion
  - Absorption of food
  - Elimination of solid waste material

- Parts
  - Oral cavity
  - Esophagus
  - Stomach (gastro)
  - Small intestines
  - Large intestines
Functions of the Gastro-Intestinal Tract (G-I Tract)

- Moves food.
- Secretes of digestive juices.
- Absorbs digested foods, water, and electrolytes.
Stomach of Ruminants

- Four chambers
  - Rumen
  - Reticulum
  - Omasum
  - Abomasum

Stomach of Monogastrics

- Single stomach
Ruminant Digestive System

1. Ingestion
2. & 3. Rumen and reticulum work together with symbiotic bacteria to help break down feed. The reticulum sorts the feed and sends it back to be chewed further.
4. The cow regurgitates and rechews the cud to break down the fibers further.
5. The omasum removes water from the feed.
6. Abomasum, where digestion continues.

Note: Many of the nutrients a cow receives comes from the by-products of the bacteria that help the cow digest the hay and grass it eats.
Digestive System of the Horse
Intestinal Tract of the Horse
Parts of the Respiratory System

- For conducting air:
  - Nasal cavity
  - Nasopharynx
  - Larynx
  - Trachea
  - Bronchi
  - Bronchioles

- For exchanging gas:
  - Alveoli
Functions of the Respiratory System

- Includes inspiration and expiration.
- Provides an exchange of respiratory gases. (oxygen and carbon dioxide)
- Warms, cleans, and humidifies air.
- Aids olfaction and phonation.
TRACHEA

CRANIAL LOBE OF LEFT LUNG

CRANIAL LOBE OF THE RIGHT LUNG

MIDDLE LOBE OF RIGHT LUNG (NOT PRESENT IN HORSE)

CAUDAL LOBE OF LEFT LUNG

ACCESSORY LOBE OF RIGHT LUNG

CAUDAL LOBE OF RIGHT LUNG

DOG
Internal Anatomy of the Lungs
Reproductive System

Functions of the reproductive system
- Provides process for reproduction.
  - Production of offspring

Parts of the reproductive system
- Female animals
- Male animals
Female Reproductive System of the Horse
PIG

- Accessory Glands
- Ureter
- Bladder
- Ductus Deferens
- Penis and Spongy Urethra
- Testis and Epididymis
Parts of the Urinary System

- Kidneys
- Urinary bladder
- Ureters
- Urethra
Functions of the Urinary System

- Absorbs metabolites.
- Storages urine temporarily.
-Eliminates urine.
  - Excretes waste products.
Parts of the Endocrine System

- Pituitary gland
- Thyroid gland
- Parathyroid glands
- Adrenal glands
- Related parts:
  - Pancreas
  - Gonads
  - Placenta
  - G-I tract
Functions of the Endocrine System

- Releases hormones.
- Regulates metabolism.
- Regulates growth/development.
- Regulates tissue function.
- Regulates mood.
Parts of the Nervous System

- Central nervous system
  - Brain
  - Spinal cord

- Peripheral nervous system
  - Somatic nerves
  - Automatic nerves
Functions of the Nervous System

- Controls functions and movement of:
  - Organs
  - Muscles
  - Sensory organs

- Neurons relay and receive information.

- Neurons conduct electrochemical signals.
The Central Nervous System (CNS)

The Brain
The central information processing organ of the body

The Spinal Cord
Long, thin tubular bundle of nerves
Connected to the brain
The Peripheral Nervous System

Somatic Nerves
Control voluntary muscles that provide movement.

Autonomic Nerves
Control involuntary responses.
(smooth muscle, cardiac muscle, glands, and organs)
Special Systems

The Eye (sight)

The Ear (hearing and balance)

The Tongue (taste)

The Nasal Cavity (smell)