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Practical Manual Of Histology

Basic and Systemic tissues

Workbook for Veterinary Undergraduates

Name of Student _____

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PRACTICAL MANUAL OF HISTOLOGY

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INTRODUCTION

The study of Histology over the years has given rise to many brilliant discoveries especially with the use of electron microscope to further probe into the world of tissues. For a student of histology to completely grasp the uniqueness and dynamism of the animal body, knowledge of these tissues are paramount and can only be achieved through quality time spent on practicals in the laboratory.

It is with this challenge in mind that this practical workbook has been produced to aid and direct the student of histology during the practical laboratory sessions; at the same time encouraging self-further study during leisure times. This manual emphasizes the features of the four fundamental tissues; that is epithelial, connective, muscular and nervous tissues from which all the body structures and organs are derived, the features of specific organs that make up various systems of the body such as the nervous, cardiovascular, lymphatic respiratory, digestive, urinary, reproductive, special senses and endocrine systems.

It is sincere hope that this workbook will enable an undergraduate student of histology achieve the objectives outlined in each chapter of this manual.

CHAPTER I

EPITHELIAL TISSUES (LINING/COVERING EPITHELIUM)

OBJECTIVES:

- Classify lining epithelium based on
 - Shape of cells
 - Squamous
 - Cuboidal
 - Columnar
 - Number of layers
 - Simple
 - Stratified
 - Pseudostratified
 - Surface characteristics
 - Ciliated
 - Keratinized
 - Stereociliated

- Identify the types of epithelial cells and relate them to where they are found in the body and their function.
 - Simple squamous epithelium
 - Simple cuboidal epithelium
 - Simple columnar epithelium
 - Simple columnar ciliated epithelium
 - Stratified squamous epithelium
 - Stratified squamous keratinized epithelium
 - Stratified cuboidal epithelium
 - Stratified columnar epithelium
 - Pseudo-stratified columnar ciliated or stereo-ciliated epithelium
 - Transitional epithelium

SIMPLE SQUAMOUS EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Thin, plate-like one layered cells.
- ❖ Edges joined like mosaic tile covering a floor.
- ❖ Flattened or ovoid, i.e. egg-shaped nuclei.
- ❖ Nuclei are located centrally.

<i>Name:</i> Simple squamous epithelium
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Simple cuboidal epithelium
<i>Magnification:</i>
<i>Organ located:</i>

SIMPLE CUBOIDAL EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Cubic-shaped cells.
- ❖ Single layered cells.
- ❖ Approximate equality in all dimensions.

SIMPLE COLUMNAR EPITHELIUM

(With or without microvilli or brush border)

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Cylindrical shaped cells.
- ❖ One layered cells arranged like cells in a honeycomb.
- ❖ Their nuclei are usually located at the same height within the cells - often close to the base of the cells
- ❖ Goblet cells may be seen.

<i>Name:</i> Simple columnar epithelium
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Simple columnar ciliated epithelium
<i>Magnification:</i>
<i>Organ located:</i>

SIMPLE COLUMNAR CILIATED EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Cylindrical-shaped cells with cilia at the surface.
- ❖ Goblet cells may be seen

STRATIFIED SQUAMOUS EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Many layered cells.
- ❖ Thin eye shaped cells at the top layers.
- ❖ Centrally located round shaped nuclei.

<i>Name:</i> Stratified squamous epithelium
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Stratified squamous keratinized epithelium
<i>Magnification:</i>
<i>Organ located:</i>

STRATIFIED SQUAMOUS KERATINIZED EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Many layered cells.
- ❖ Dead or cornified or keratinized cells at the topmost layer
- ❖ Centrally located round shaped nuclei.

STRATIFIED CUBOIDAL EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Usually double layered.
- ❖ Not very conspicuous cubic like cells
- ❖ Centrally located round shaped nuclei.

<i>Name:</i> Stratified cuboidal epithelium
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Stratified columnar epithelium
<i>Magnification:</i>
<i>Organ located:</i>

STRATIFIED COLUMNAR EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Usually double layered.
- ❖ Cylindrical-like cells at the top with spherical nuclei and basal cells at the bottom with round nuclei
- ❖ Goblet cells may be seen between cells

PSEUDOSTRATIFIED COLUMNAR CILIATED AND STEREOCILIATED EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Nuclei of cells are at different levels.
- ❖ Spherical nuclei located at the upper most
- ❖ Round nuclei at different levels or heights of cells
- ❖ All cells are in contact with basement membrane
- ❖ Made up of long and short cells
- ❖ May see goblet cells

<i>Name:</i> Pseudo-stratified columnar ciliated and stereo-ciliated epithelium
<i>Magnifications:</i>
<i>Organs located:</i>

<i>Name:</i> Transitional epithelium
<i>Magnification:</i>
<i>Organ located:</i>

TRANSITIONAL EPITHELIUM

Instruction: View this epithelium under the microscope and sketch what you have seen stating its magnification and location in the space provided.

Features to note and study include:

- ❖ Many layered
- ❖ Size of cells decreasing downwards (i.e cells are neither squamous nor columnar)
- ❖ Round nuclei
- ❖ Surface cells may be dome shaped

CHAPTER II

EPITHELIAL TISSUES (GLANDULAR EPITHELIUM)

OBJECTIVES:

- Classify glands based on
 - Functions
 - Exocrine
 - Endocrine
- Classify and identify Exocrine glands based on
 - Duct structure
 - Simple glands
 - Compound glands
 - Location
 - Intra-epithelial
 - Extra-epithelial
 - Structure of secretory portion
 - Tubular
 - Acinar/Alveolar
 - Content of secreta
 - Serous
 - Mucous
 - Seromucous (Serous demilune or mixed)
- Identify the types of Exocrine glands and where they are located in the body
 - Simple tubular
 - Simpl alveolar/acinar
 - Simple coiled tubular
 - Simple branched tubular
 - Simple branched alveolar
 - Compound tubular
 - Compound alveolar/acinar
 - Compound tubuloalveolar

INTRAEPITHELIAL GLAND (GOBLET CELL)

Instruction: View the simple columnar or stratified columnar epithelium under the microscope at 100x and 400x magnification to identify this gland. Sketch the gland with part of the epithelium at both magnifications

Features to note and study include:

- ❖ Onion or bulblike shape
- ❖ Mucin presence in gland

<i>Name:</i> Goblet cell
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Goblet cell
<i>Magnification:</i>
<i>Organ located:</i>

SIMPLE TUBULAR

Instruction: View a slide of the Colon or small intestine and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

SIMPLE BRANCHED TUBULAR

Instruction: View a slide of the Oesophagus and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

SIMPLE COILED TUBULAR

Instruction: View a slide of the Sweat gland and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

SIMPLE ALVEOLAR

Instruction: View a slide of any gland forming organ of a young species and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

SIMPLE BRANCHED ALVEOLAR

Instruction: View a slide of the Skin (Sebaceous gland) and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

COMPOUND ALVEOLAR

Instruction: View a slide of the Mammary gland and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

COMPOUND TUBULAR

Instruction: View a slide of the testis (Seminiferous tubules) and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

COMPOUND TUBULO ALVEOLAR

Instruction: View a slide of the Pancreas and sketch what you have seen, identify and study its features.

<i>Magnification:</i>

SEROUS, MUCOUS AND SERO-MUCOUS GLANDS

Instruction: View slides containing this gland and sketch what you have seen, identify and study their following features.

Serous gland

- ❖ Basophilic basal cytoplasm
- ❖ Centrally-located nucleus
- ❖ Secretory vesicles (zymogen granules) in apical cytoplasm

Mucous gland

- ❖ "Empty"-appearing apical cytoplasm
- ❖ Densely-stained, basal nuclei

Sero-mucous gland

- ❖ Mixture of serous and mucous glands
- ❖ Serous gland capping of mucous glands (Serous demilune)

<i>Name:</i> Serous gland	<i>Name:</i> Mucous gland	<i>Name:</i> Sero-mucous gland
<i>Magnification:</i>	<i>Magnification:</i>	<i>Magnification:</i>
<i>Organ located:</i>	<i>Organ located:</i>	<i>Organ located:</i>

CHAPTER III

CONNECTIVE TISSUES (CONNECTIVE TISSUE PROPER)

OBJECTIVES:

- Identify the types of connective tissue proper
 - Loose connective tissue
 - Dense connective tissue
 - Dense regular
 - Dense irregular
- Relate these tissues to their locations
- Identify the components of connective tissues
 - Cells
 - Fibres
 - Ground substance

LOOSE CONNECTIVE TISSUE

Instruction: View three (3) different slides of this type of connective tissue under a microscope, sketch what you have seen. Identify and label the cells and fibres and give examples of where this tissue can be located.

Features to note include:

- ❖ Randomly oriented and interlacing
- ❖ Apparent delicate collagen, reticular and elastic fibres
- ❖ Blood vessels and Scattered fat cells

<i>Name:</i> Loose connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Loose connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Loose connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

DENSE REGULAR CONNECTIVE TISSUE

Instruction: View three (3) different slides of this type of connective tissue under a microscope, sketch what you have seen. Identify and label the cells and fibres and give examples of where this tissue can be located.

Features to note include:

- ❖ Wavy orderly parallel orientation of collagen fibres
- ❖ Homogenous pink staining background with H and E
- ❖ Wavy and longitudinally oriented fibrocytes
- ❖ Nuclei of fibrocytes appear dark and vary from oval to elongated

<i>Name:</i> Dense regular connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Dense regular connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Dense regular connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

DENSE IRREGULAR CONNECTIVE TISSUE

Instruction: View three (3) different slides of this type of connective tissue under a microscope, sketch what you have seen. Identify and label the cells and fibres and give examples of where this tissue can be located.

Features to note include:

- ❖ Increased coarse network of thick collagen fibres with some reticular and elastic fibres
- ❖ Reduced fibroblasts

<i>Name:</i> Dense irregular connective tissue <i>Magnification:</i> <i>Organ located:</i>

<i>Name:</i> Dense irregular connective tissue <i>Magnification:</i> <i>Organ located:</i>

<i>Name:</i> Dense irregular connective tissue <i>Magnification:</i> <i>Organ located:</i>

CHAPTER IV

CONNECTIVE TISSUES (SPECIAL CONNECTIVE TISSUE)

OBJECTIVES:

- Identify the types of Special connective tissue
 - Embryonal connective tissue - Elastic connective tissue
 - Reticular connective tissue
 - Adipose tissue
 - White adipose tissue
 - Brown adipose tissue
 - Cartilage
 - Elastic cartilage
 - Hyaline cartilage
 - Fibro cartilage
 - Bone
 - Classification
 - Fibrous (woven or immature)
 - Lamellar (mature)
 - Configuration or arrangement
 - Cancellous (spongy or trabeculae)
 - Compact (lamellae or osteons)
 - Covering
 - Periosteum
 - Endosteum
 - Blood
 - Erythrocytes
 - Leucocytes
 - Thrombocytes
- Identify the components of these tissues and relate them to their location
 - Cells
 - Fibres
 - Ground substance

EMBRYONAL CONNECTIVE TISSUE

Instruction: View a high magnification of a slide of the Umbilical cord under a microscope. Identify, sketch and label the cells and fibres.

Features to note include:

- ❖ Triangular shaped mesenchymal cells forming cellular contacts via collagen fibres giving an appearance of a cellular reticulum.

<i>Name:</i> Embryonal connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

ELASTIC CONNECTIVE TISSUE

Instruction: View a high magnification of a slide of the Aorta under a microscope. Identify, sketch and label the connective tissue noting the predominant elastic fibres.

<i>Name:</i> Elastic connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

RETICULAR CONNECTIVE TISSUE

Instruction: View three (3) different slides of this type of connective tissue under a microscope, sketch what you have seen. Identify and label the cells and reticular fibres and give examples of where this tissue can be located.

Features to note include:

- ❖ Fibrous network of fine reticular fibres
- ❖ Many free cells may be present

<i>Name:</i> Reticular connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Reticular connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

<i>Name:</i> Reticular connective tissue
<i>Magnification:</i>
<i>Organ located:</i>

ADIPOSE TISSUE

Instruction: View a slide of white or unilocular adipose tissue and that of brown or multilocular adipose tissue. Sketch and label what you have seen and identify their features.

Features to note and study in white adipose tissue include:

- ❖ Single large adipocytes
- ❖ Spherical or polyhedral
- ❖ Surrounded by thin cytoplasm
- ❖ Eccentric and flat nucleus (displaced)
- ❖ Signet ring appearance
- ❖ Reticular fibres may surround adipocytes



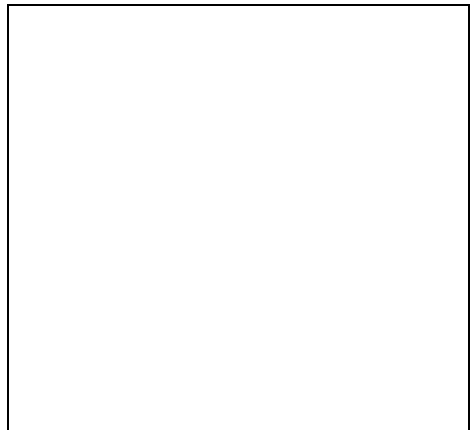
Name: White adipose tissue

Magnification:

Organ located:

Features to note and study in brown adipose tissue include:

- ❖ Smaller adipocytes of varying sizes within cytoplasm
- ❖ Eccentric round nucleus (not displaced)



Name: Brown adipose tissue

Magnification:

Organ located:

CARTILAGE

Instruction: View the three (3) types of cartilage under a microscope, sketch what you have seen. Identify and label the cells and reticular fibres and give examples of where this tissue can be located.

Hyaline cartilage:

- ❖ Perichondrium surrounding cartilage
- ❖ Flat shaped chondroblasts in small lacuna seen near perichondrium
- ❖ Large and ovoid shaped lacuna with chondrocytes within matrix
- ❖ Isogenous cluster of chondrocytes

Elastic cartilage:

- ❖ Abundant elastic fibres (pink staining) within matrix
- ❖ Perichondrium surrounding cartilage
- ❖ Flat shaped chondroblasts in small lacuna seen near perichondrium
- ❖ Large and ovoid shaped lacuna with chondrocytes within matrix
- ❖ More isogenous cluster of chondrocytes

Fibro cartilage:

- ❖ Abundant coarse collagen fibres in parallel orientation
- ❖ Large and ovoid shaped lacuna with chondrocytes within matrix are spaced in orderly manner between fibres

<i>Name:</i> Hyaline cartilage
<i>Organ located:</i>
<i>Name:</i> Elastic cartilage
<i>Organ located:</i>
<i>Name:</i> Fibro cartilage
<i>Organ located:</i>
<i>Magnification:</i>

BONE

Compact bone

Instruction: View two (2) different magnifications of the compact bone tissue under a microscope, sketch what you have seen. Identify and label the components.

Features to note include:

- ❖ Osteons (Concentric lamellae)
- ❖ Cement line (surrounding each osteon)
- ❖ Osteocytes in lacunae (Osteocytic lacunae)
- ❖ Canaliculi continuous with osteocytic lacunae
- ❖ Osteonal or haversian canal
- ❖ Osteonal endosteum (surrounding the osteonal canal)
- ❖ Interstitial bone (in between osteons)
- ❖ Communicating or Volkmann's canal (linking to haversian canal)

<i>Magnification:</i>
<i>Magnification:</i>

<i>Name: Developing bone</i>
<i>Magnification:</i>

Developing bone

Instruction: View a slide of the developing bone tissue under a microscope, sketch what you have seen. Identify and label the components.

BONE

Cancellous bone

Instruction: View two (2) different magnifications of the cancellous bone tissue under a microscope, sketch what you have seen. Identify and label the components.

Features to note include:

- ❖ Spicule shaped bone
- ❖ Abundant interosseous space

<i>Magnification:</i>
<i>Magnification</i>
<i>Location on the bone:</i>

BLOOD

Red blood cell (mammal, aves, pisces and amphibians)

Instruction: View a slide of the blood of the mammalian and avian species. Sketch what you have seen, identify and study its features.

Mammals

- ❖ Biconcave or round disc cells
- ❖ Non nucleated cells
- ❖ Rouleau formation

Aves, Pisces, Amphibians

- ❖ Oval shaped cells
- ❖ Oval nuclei
- ❖ Orange pink to red cytoplasm

<i>Mammals</i>
<i>Aves, Pisces, Amphibians</i>

White blood cell (neutrophil)

Instruction: View a slide of the blood containing neutrophil and sketch what you have seen, identify and study its features.

- ❖ Larger size than red blood cells
- ❖ Segmented nucleus with 3-5 lobes
- ❖ Nucleoplasmic strand connects nucleus
- ❖ Light pink to purple

Magnification:

White blood cell (eosinophil)

Instruction: View a slide of the blood containing eosinophil and sketch what you have seen, identify and study its features.

- ❖ Bilobed nucleus
- ❖ May be pleomorphic
- ❖ Acidophilic granules (lysosomes) in cytoplasm

Magnification:

White blood cell (basophil)

Instruction: View a slide of the blood containing basophil and sketch what you have seen, identify and study its features.

- ❖ Bilobed or more lobed nucleus
- ❖ Round, coarse, variable sized basophilic granules
- ❖ Darker stained granules than nucleus
- ❖ Granules obscuring nucleus

Magnification:

White blood cell (lymphocyte)

Instruction: View a slide of the blood containing lymphocyte and sketch what you have seen, identify and study its features.

- ❖ Round or indented nucleus
- ❖ Condensed heterochromatin nucleus
- ❖ Basophilic cytoplasm



Magnification:

White blood cell (monocyte)

Instruction: View a slide of the blood containing monocyte and sketch what you have seen, identify and study its features.

- ❖ Large sized
- ❖ Kidney shaped or round or trilobed nucleus
- ❖ Lighter nuclear chromatin
- ❖ Gray or ground glass appearance of cytoplasm



Magnification:

White blood cell (thrombocyte)

Instruction: View a slide of the blood containing monocyte and sketch what you have seen, identify and study its features.

- ❖ Small tiny discs clustering
- ❖ Membrane bound
- ❖ Round to oval in shape



Magnification:

BONE MARROW

Instruction: View a slide of the red and white bone marrow under a microscope, sketch what you have seen. Identify and label the following components;

- ❖ Blood cells in various stages of formation – erythroid (red blood cell) series and myeloid (white blood cell) series
- ❖ Vascular sinusoids
- ❖ Connective tissue cells – Megakaryocytes, plasma cells, adipocytes, osteoblasts and osteoclasts
- ❖ Reticular mesh work

<i>Name:</i> Red bone marrow	<i>Name:</i> White bone marrow
<i>Magnification:</i>	<i>Magnification:</i>

CHAPTER V

MUSCULAR TISSUES

OBJECTIVES:

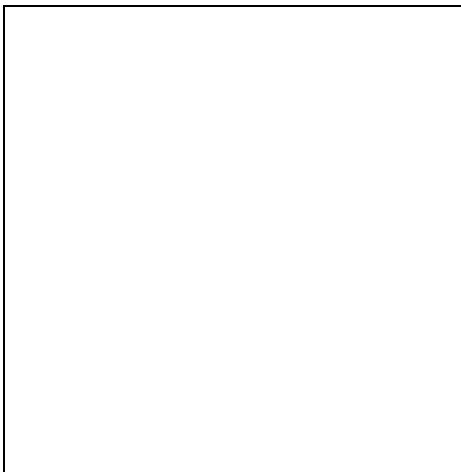
- Identify the types muscular tissue
 - Striated muscle
 - Skeletal muscle
 - Cardiac muscle
 - Non striated muscle
 - Smooth muscle
- Identify the characteristics of these tissues
- State the location of these muscles in the body

SKELETAL MUSCLE

Instruction: View a slide of the longitudinal and transverse section of the skeletal muscle. Sketch and label what you have seen and identify their features.

Features to note and study in the longitudinal section include:

- ❖ Long parallel muscular fibres
- ❖ Perpendicularly oriented cross striations
- ❖ Peripherally located multi nuclei
- ❖ Oval nuclei



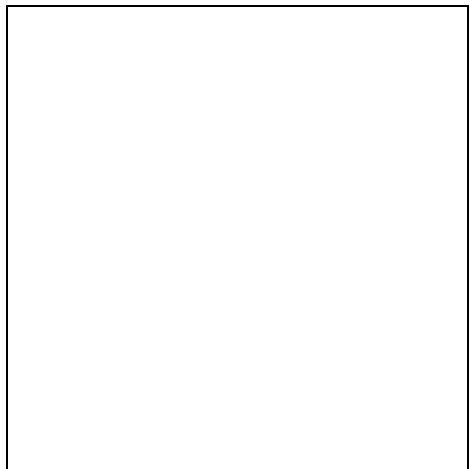
Name: Skeletal muscle (longitudinal section)

Magnification:

Organ located:

Features to note and study in the transverse section include:

- ❖ Fibres appear as rounded polygons separated by endomysium (grouped in bundles or fascicles)
- ❖ Eccentric or peripheral nucleus
- ❖ Perimysium surrounding fascicles
- ❖ Blood capillaries



Name: Skeletal muscle (Transverse section)

Magnification:

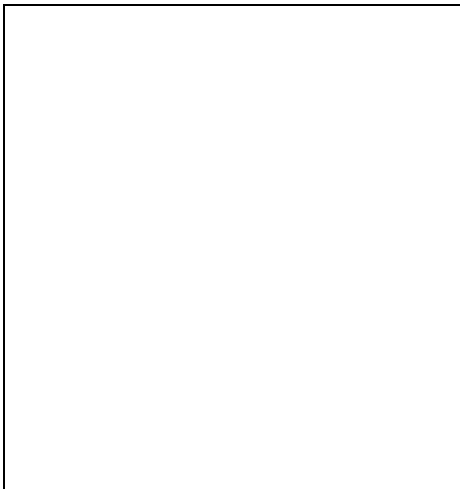
Organ located:

CARDIAC MUSCLE

Instruction: View a slide of the longitudinal and transverse section of the cardiac muscle. Sketch and label what you have seen and identify their features.

Features to note and study in the longitudinal section include:

- ❖ Branched fibres
- ❖ Centralized nucleus
- ❖ Cross striations
- ❖ Intercalated disc



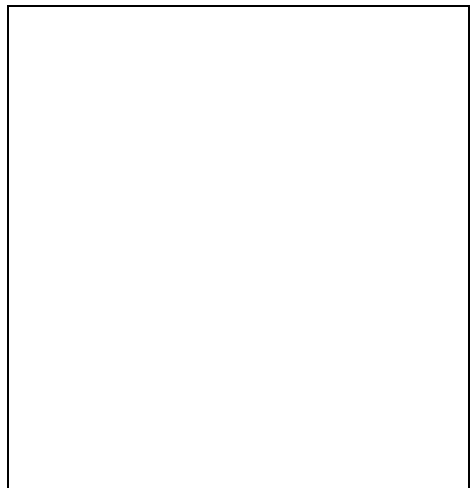
Name: Cardiac muscle (longitudinal section)

Magnification:

Organ located:

Features to note and study in the transverse section include:

- ❖ Branched fibres
- ❖ centralized nucleus
- ❖ Perinuclear halos
- ❖ Prominent connective tissue around fibre



Name: Cardiac muscle (Transverse section)

Magnification:

Organ located:

SMOOTH MUSCLE

Instruction: View a slide of the longitudinal and transverse section of the smooth muscle. Sketch and label what you have seen and identify their features

Features to note and study in the longitudinal section include:

- ❖ Indistinct boundaries of individual fibers
- ❖ Adjacent fibers are grouped into sheets (or bundles) and within each sheet tend to overlap in a staggered fashion.
- ❖ Elongated (ovoid to cigar-shape) nuclei and lies midway of the fiber length
- ❖ Cytoplasm is homogeneous and strongly acidophilic.

<i>Name:</i> Smooth muscle (longitudinal section)
<i>Magnification:</i>
<i>Organ located:</i>

Features to note and study in the transverse section include:

- ❖ Fibres appear as circular discs (oval or round)
- ❖ Round and centrally located nucleus which may not be seen in all cell sections.

<i>Name:</i> Smooth muscle (Transverse section)
<i>Magnification:</i>
<i>Organ located:</i>

CHAPTER VI

NERVOUS TISSUES

OBJECTIVES:

- Identify the neuron and its primary components
 - Cell body
 - Axon
 - Dendrites
 - Telodendron
- Identify the types of neuron based on structure
 - Unipolar neuron
 - Bipolar neuron
 - Multipolar neuron
- Identify some neuroglia cells
 - Astrocytes
 - Microglia
 - Oligodendrocytes
 - Ependymal
 - Neurolemocytes
 - Capsule cells

NEURON

Instruction: View a slide of the grey matter of the spinal cord and sketch what you have seen, identifying and labeling the following components.

- ❖ Cell body
- ❖ Nucleus
- ❖ Axon
- ❖ Axon hillock
- ❖ Dendrites

<i>Name:</i> Neuron
<i>Type of neuron:</i>
<i>Magnification:</i>
<i>Organs located:</i>

ASTROCYTES

Instruction: View a slide of the astrocytes and sketch what you have seen, identifying and labeling its parts.

Name: Astrocytes
Magnification:
Organ located:

EPENDYMAL CELLS

Instruction: View a slide of the Spinal cord's central canal or brain ventricle to identify, sketch and label the ependymal cells.

Name: Ependymal cells
Magnification:
Organ located:

DATE _____ WEEK 12

AMPHICYTES OR SATELLITE CELLS

Instruction: View a slide of the dorsal root or autonomic ganglion and sketch what you have seen, identifying and labeling the amphicytes surrounding the globular ganglionic cells.

Name: Amphicytes or Satellite cells surrounding ganglionic cell
Magnification:
Organ located:

CHAPTER VII

NERVOUS SYSTEM

OBJECTIVES:

- Classify the nervous system into:
 - Central nervous system
 - Brain
 - Spinal cord
 - Peripheral nervous system
 - Somatic nervous system
 - Autonomic nervous system
- Identify the coverings of the CNS
 - Dura mater
 - Arachnoid
 - Pia mater
- Identify the white and gray matter of the CNS
- Identify the components or features of the CNS
- Identify the layers of the cerebellum and cerebrum
- Identify the features of ganglia
- Identify the features of the peripheral nerve

CENTRAL NERVOUS SYSTEM

Instruction: View a low magnification of the cross sectional slide of the spinal cord, brain and brain stem. Sketch what you have seen. Identify the structure and position of the following features:

- ❖ Dura mater, pia mater and arachnoid
- ❖ Arachnoid trabeculations
- ❖ Subarachnoid space
- ❖ Dorsal and ventral horn
- ❖ Dorsal and ventral funiculus
- ❖ Lateral funiculus
- ❖ Central canal with ependymal cells
- ❖ Grey matter and White matter

Spinal cord
Brain stem
Magnification:

Brain (Cerebrum)
Brain (cerebellum)
Magnification:

DATE _____ WEEK 1

CENTRAL NERVOUS SYSTEM

Instruction: View a high magnification of the grey and white matter of the spinal cord. Sketch what you have seen. Identify the following features:

- ❖ Perikaryon
- ❖ Nissl bodies
- ❖ Nucleus and nucleolus
- ❖ Glia cells
- ❖ Axons and dendrites
- ❖ Myelinated and unmyelinated fibres

Gray matter of the Spinal cord	White matter of the Spinal cord
Magnification:	Magnification:

CENTRAL NERVOUS SYSTEM

Instruction: View a high magnification of the gray matter of cerebellum and cerebrum. Sketch what you have seen. Identify the following layers:

Cerebellum

- ❖ Outer molecular layer
- ❖ Central piriform layer
- ❖ Inner granular layer
- ❖ White matter

Cerebellum
Magnification:

Cerebrum

- ❖ Molecular layer
- ❖ Outer granular layer
- ❖ Pyramidal cell layer
- ❖ Inner granular layer
- ❖ Ganglionic cell layer
- ❖ Polymorphic cell layer

Cerebrum
Magnification:

DATE _____ WEEK 1

PERIPHERAL NERVOUS SYSTEM

Instruction: View a high magnification of the cross and longitudinal section of the peripheral nerve and sketch what you have seen, identifying and labeling the following components.

- ❖ Nerve cell
- ❖ Epineurium
- ❖ Fascicles
- ❖ Perineurium
- ❖ Endoneurium
- ❖ Myelin sheath

Peripheral nerve (L.S)	Peripheral nerve (X.S)
Magnification:	Magnification:

DATE _____ WEEK 1

PERIPHERAL NERVOUS SYSTEM

Instruction: View a slide of the dorsal root and autonomic ganglion (Cross section) and sketch what you have seen, identifying and labeling the following components.

- ❖ Ganglion cell
- ❖ Nucleus and nucleolus
- ❖ Satellite cell (Amphicytes)
- ❖ Capillaries

Dorsal root ganglion	Autonomic ganglion
Magnification:	Magnification:

NEURONAL TERMINALS

Instruction: View slides containing Meissner's and Pacinian corpuscles. Sketch what you have seen, identify and study their following features.

Meissner's corpuscles

- ❖ Encapsulated
- ❖ One or more nerve terminals arranged in a helix around a helical cell mass.
- ❖ Look like fir cones

Pacinian corpuscles

- ❖ Large encapsulated nerve endings
- ❖ Have an onion like appearance

Meissner's corpuscle	Pacinian corpuscle
<i>Magnification:</i>	<i>Magnification:</i>
<i>Organ located:</i>	<i>Organ located:</i>

CHAPTER VIII

CARDIOVASCULAR SYSTEM

OBJECTIVES:

- Identify the histological components of the
 - Blood vascular system
 - Heart
 - Atrial and Ventricular wall
 - Valves
 - Arteries
 - Elastic
 - Muscular
 - Arteriole
 - Capillaries
 - Veins
 - Large
 - Medium
 - Venules

THE HEART

Instruction: View a low and high magnification of the cross sectional slide of the heart wall. Sketch what you have seen. Identify the structure and position of the following features:

- ❖ Endocardium
- ❖ Myocardium
- ❖ Epicardium

- ❖ Endothelium
- ❖ Sub-endothelial layer
- ❖ Sub-endocardial layer
- ❖ Cardiac muscle
- ❖ Loose connective tissues
- ❖ Mesothelium

Heart wall
Low magnification:

Heart wall
High magnification:

THE HEART

Instruction: View two magnifications of a section of the heart showing either the tricuspid or bicuspid valve. Sketch what you have seen. Identify its structure and the following components.

- ❖ Endothelium that covers the valve
- ❖ Loose fibrous connective tissue under the epithelium
- ❖ Inner core of dense fibrous connective tissue

Heart valve	Heart valve
Magnification:	Magnification:

BLOOD VESSELS

Instruction: View x400 magnification of three slides of Aorta, common carotid artery and kidney showing Elastic, muscular and small (arteriole) arteries respectively. Sketch what you have seen. Identify its structure and the following components of each slide.

Elastic artery

- Thin tunica intima
- Thick and distinct tunica media
- Thin tunica adventitia

Muscular artery

- Thin tunica intima, distinct and folded internal elastic lamina.
- Thick tunica media with 5 - 40 layers of circular smooth muscle.
- Thick tunica adventitia but thinner than tunica media.

Arteriole

- Very thin tunica intima
- 1-5 layers of smooth muscle and elastic fibres in tunica media
- Thin tunica adventitia

Elastic artery	Muscular artery	Arteriole
Magnification:	Magnification:	Magnification:

Capillaries

Instruction: View a slide of any of the following organs; Kidney, spleen or bone marrow. Identify the capillaries. Sketch what you have seen noting the following features:

- ❖ Endothelium
- ❖ Pericytes

Capillaries
Magnification:

Sinusoids

Instruction: View a slide of the liver; identify the sinusoids. Sketch what you have seen noting the following features:

- ❖ Incomplete endothelium
- ❖ Large uneven channels across

Sinusoids
Magnification:

Large vein

Instruction: View x400 magnification of slide showing large veins. Sketch what you have seen. Identify its structure and the following components of each slide.

- ❖ Thin but well developed tunica intima
- ❖ Tunica media is muscular
- ❖ Thick and best developed tunica adventitia

Large vein
<i>Magnification:</i>

Artery, Vein and Nerve

Instruction: View a high magnification of the slide showing an artery, vein and nerve together. Sketch what you have seen. Study and identify their major differences.

Artery, Vein and Nerve
<i>Magnification:</i>

CHAPTER IX

LYMPHATIC SYSTEM

OBJECTIVES:

- Identify the histological components of the
 - Lymph vascular system
 - Lymph capillaries
 - Lymph vessels
 - Lymph collecting duct
 - Lymph nodes
 - Tonsils
 - Thymus
 - Spleen
 - Bursa of fabricius
 - Mucosa associated lymphatic tissue
 - Payer's patches

DATE _____ WEEK 3

LYMPH VESSEL AND COLLECTING DUCT

Instruction: View a low and high magnification of a slide of the lymph vessel and thoracic duct. Sketch and identify its following features.

<i>Magnification:</i>	<i>Magnification:</i>
<i>Magnification:</i>	<i>Magnification:</i>
Lymph vessel	Thoracic duct

LYMPH NODE

Instruction: View a low and high magnification of a slide of the lymph node. Sketch what you have seen. Identify the structure and position of the following features:

- ❖ Dense connective tissue capsule
- ❖ Trabeculae
- ❖ Subcapsular sinus
- ❖ Cortex and medulla
- ❖ Medullary sinus
- ❖ Germinal centres

Lymph node
Low magnification:

- ❖ Central germinal centre
- ❖ Outer corona
- ❖ Reticular and collagen fibres of trabeculae
- ❖ Medullary cords
- ❖ Medullary sinuses

Lymph node (Cortex)
Lymph node (medulla)
High magnification

TONSILS

Instruction: View the three (3) different types of tonsils under a microscope, sketch what you have seen. Identify and label the following features:

- ❖ Nodular and loose lymphatic tissues with germinal centres
- ❖ Invaginations or crypts
- ❖ Stratified squamous epithelium on luminal surface

Lingual tonsil
<i>Magnification:</i>

Palatine tonsil
<i>Magnification:</i>

Pharyngeal tonsil
<i>Magnification:</i>

THYMUS

Instruction: View a low and high magnification of a slide of the Thymus. Sketch what you have seen. Identify the following features:

- ❖ Loose collagenous tissue capsule
- ❖ Cortex
- ❖ Medulla
- ❖ Hassal's corpuscles

Thymus – magnification:
Thymus - magnification:

SPLEEN

Instruction: View a low and high magnification of a slide of the Spleen. Sketch what you have seen. Identify the structure and position of the following features:

- ❖ Dense connective tissue capsule
- ❖ Trabeculae
- ❖ Arteries, veins
- ❖ Splenic corpuscles
- ❖ Red pulp
- ❖ White pulp

Spleen – magnification:
Spleen - magnification:

DATE _____ WEEK 3

BURSA OF FABRICIUS

Instruction: View a low and high magnification of a slide of the Bursa of fabricius. Sketch what you have seen. Identify the structure and position of the following features:

- ❖ Thick mucosa folds (Plicae) surrounded by pseudostratified columnar epithelium
- ❖ Polyhedral follicles divided by septae
- ❖ Germinal centres

Bursa of fabricius	Bursa of fabricius
Magnification:	Magnification:

DATE _____ WEEK 3

MUCOSA ASSOCIATED LYMPHATIC TISSUE

Instruction: View a low and high magnification of a slide of the Oesophagus and intestine. Focus on the mucosa, locate and identify the lymphatic tissue in oesophagus (M.A.L.T) and intestine (Payer's patches). Sketch what you have seen.

M.A.L.T in Oesophagus	Payer's patches
<i>Magnification:</i>	<i>Magnification:</i>

CHAPTER X

RESPIRATORY SYSTEM

OBJECTIVES:

- Identify the histological components of the portions of the respiratory system
 - Conducting portion
 - ✓ External nares
 - ✓ Nasal cavity
 - ✓ Nasopharynx
 - ✓ Larynx
 - ✓ Trachea
 - ✓ Bronchi
 - ✓ Bronchioles
 - Exchange portion
 - ✓ Alveolar ducts
 - ✓ Alveolar sacs
 - ✓ Alveoli

NASAL CAVITY

Instruction: View a slide of the nasal cavity. Focus on the three regions (vestibule, respiratory, olfactory). Identify the structure and components of the mucosa (epithelium and lamina propria). Sketch and label what you have seen.

Nasal cavity - vestibule
<i>Magnification:</i>

Nasal cavity – respiratory region
<i>Magnification:</i>
Nasal cavity – Olfactory region
<i>Magnification:</i>

LARYNX

Instruction: View a slide of the larynx (frontal section). Identify structure and components of the mucosa (epithelium and lamina propria). Sketch and label what you have seen.

Larynx
Magnification:

EPIGLOTTIS

Instruction: View a slide of the Epiglottis. Identify structure and components of the mucosa and submucosa. Sketch and label what you have seen.

Epiglottis
Magnification:

DATE _____ WEEK 4

TRACHEA

Instruction: View a low and high magnification of the Trachea. Identify the respiratory epithelium, basement membrane, submucosal glands (both serous and mucous parts), perichondrium, tracheal cartilage and trachealis muscle (smooth muscle). Sketch what you have seen and label its main features.

Trachea	Trachea
<i>Magnification:</i>	<i>Magnification:</i>

LUNG

Instruction: View a low magnification of the entire lung tissue. Sketch and label what you have seen, identifying the following features and components.

- ❖ Basket – like appearance
- ❖ Bronchi
- ❖ Larger bronchiole
- ❖ Terminal bronchiole
- ❖ Alveolar duct
- ❖ Alveolar sac
- ❖ Alveoli
- ❖ Blood vessels

Lung tissue
<i>Magnification:</i>

BRONCHI

Instruction: View a slide of the lung, focus on the bronchi and identify the structure and components of the mucosa (epithelium and lamina propria), submucosa, muscularis externa and tunica adventitia. Sketch and label what you have seen.

Bronchi
Magnification:

LARGE BRONCHIOLE

Instruction: View a slide of the lung, focus on the bronchiole and identify the structure and components of the mucosa (epithelium and lamina propria), submucosa, muscularis externa and tunica adventitia. Sketch and label what you have seen.

Large Bronchiole
Magnification:

TERMINAL BRONCHIOLE

Instruction: View a slide of the lung, focus on the terminal bronchiole and identify the structure and components of the mucosa (epithelium and lamina propria), submucosa, muscularis externa and tunica adventitia. Sketch and label what you have seen.

Bronchi
Magnification:

ALVEOLAR DUCT, SAC AND ALVEOLI

Instruction: View a high magnification of a lung section; identify the alveolar duct, alveolar sac and alveoli. Sketch and label these components. Also magnify the alveoli to identify the alveolar cells (Pneumocyte type 1 and 2, macrophages)

Alveolar duct, sac and alveoli
Magnification:
Alveoli cells
Magnification:

CHAPTER XI

DIGESTIVE SYSTEM

OBJECTIVES:

- Identify the histological components of the organs of the Digestive system
 - Main organs
 - ✓ Lip
 - ✓ Oral mucosa
 - ✓ Dental pad
 - ✓ Hard palate
 - ✓ Teeth
 - ✓ Tongue
 - ✓ Oesophagus
 - ✓ Simple Stomach
 - ✓ Rumen
 - ✓ Reticulum
 - ✓ Omasum
 - ✓ Abomasum
 - ✓ Duodenum
 - ✓ Jejunum
 - ✓ Ileum
 - ✓ Caecum
 - ✓ Colon
 - ✓ Rectum
 - ✓ Anal canal
 - Accessory organs
 - ✓ Salivary glands
 - ✓ Liver
 - ✓ Gall bladder
 - ✓ Pancreas

LIP

Instruction: View a slide of the upper lip; identify, sketch and label the components of the mucosa, submucosa and muscularis externa

Lip
Magnification:

ORAL MUCOSA

Instruction: View a slide of the oral mucosa; identify, sketch and label the components of the mucosa, submucosa and muscularis externa

Oral mucosa
Magnification:

DENTAL PAD

Instruction: View a slide of the dental pad; identify, sketch and label the components of the mucosa, submucosa and muscularis externa

Dental pad
Magnification:

HARD PALATE

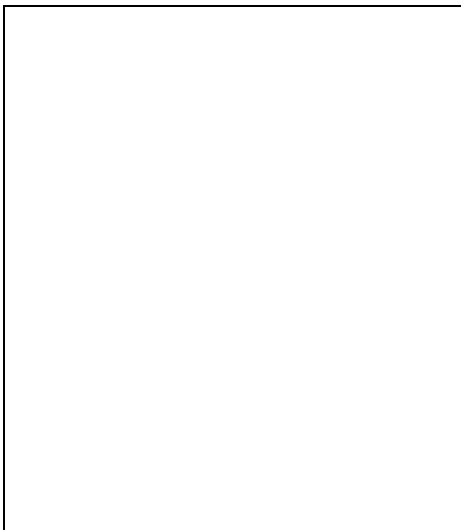
Instruction: View a slide of the hard palate; identify, sketch and label the components of the mucosa, submucosa and muscularis externa

Hard palate
Magnification:

DEVELOPING TOOTH (Longitudinal section)

Instruction: View a low magnification of this slide. Sketch what you have seen. Identify its structure and the following components.

- ❖ Oral epithelium
- ❖ Dental sac
- ❖ External enamel epithelium
- ❖ Stellate reticulum
- ❖ Ameloblasts
- ❖ Enamel
- ❖ Dentine
- ❖ Predentine
- ❖ Odontoblast
- ❖ Dental papilla
- ❖ Dental alveolus



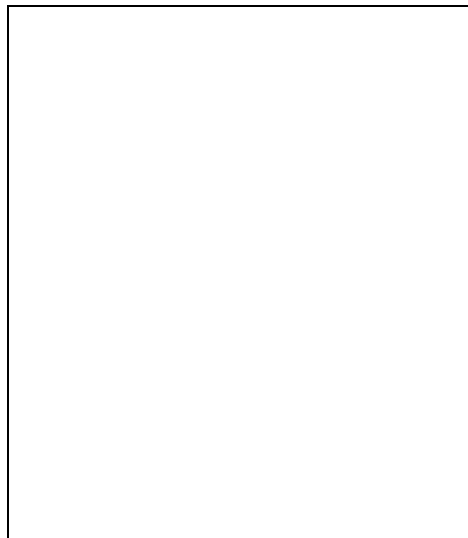
Developing tooth (L.S)

Magnification:

DEVELOPING TOOTH (Dentino-enamel junction)

Instruction: View a high magnification of the developing tooth (Longitudinal section). Focus on the Dentino-enamel junction, sketch what you have seen. Identify its structure and the following components.

- ❖ Stellate reticulum
- ❖ Stratum intermedium
- ❖ Ameloblasts
- ❖ Enamel
- ❖ Dentine
- ❖ Predentine
- ❖ Odontoblast
- ❖ Dental papilla



Dentino-enamel junction

Magnification:

DECALCIFIED TOOTH (Longitudinal section)

Instruction: View a low magnification of this slide. Sketch what you have seen. Identify its structure and the following components.

- ❖ Enamel
- ❖ Dentine
- ❖ Pulp
- ❖ Cementum
- ❖ Root canal

Decalcified tooth (L.S)
Magnification:

TOOTH – Root (Cross section)

Instruction: View a high magnification of this slide. Sketch what you have seen. Identify its structure and the following components.

- ❖ Dental cement
- ❖ Periodontium
- ❖ Bone of the alveolar wall
- ❖ Dense connective tissue of the gums
- ❖ Multilayered squamous epithelium of the gums
- ❖ Dentine
- ❖ Dental pulp

Root of Tooth (X.S)
Magnification:

TONGUE – Longitudinal section

Instruction: View a low magnification slide of the tongue; identify, sketch and label the components of the mucosa, submucosa and muscularis externa.

Note the following features:

- ❖ Epithelium
- ❖ Papillae of different types
- ❖ Connective tissue with interlacing bundle of skeletal muscle fibres
- ❖ Lingual glands
- ❖ Blood vessels
- ❖ Nerve fibres

Tongue (Longitudinal section)
<i>Magnification:</i>

FILIFORM PAPILLAE

Instruction: View a slide of the filiform papillae; sketch what you have seen noting its narrow conified thorn-shape that bends backwards.

Filiform Papillae
Magnification:

FUNGIFORM PAPILLAE

Instruction: View a slide of the fungiform papillae; sketch what you have seen noting its conified mushroom shape.

Fungiform papillae
Magnification:

FOLIATE PAPILLAE

Instruction: View a slide of the foliate papillae; sketch what you have seen and identify the following:

- ❖ Leaf shaped separated by invagination of mucous membrane
- ❖ Taste buds
- ❖ Non keratinized epithelium
- ❖ Gustatory glands

Foliate papillae
Magnification:

VALLATE (CIRCUMVALLATE) PAPILLAE

Instruction: View a slide of the vallate papillae; sketch what you have seen and identify the following:

- ❖ Large mushroom shape
- ❖ Are not elevated above the lamina epithelialis mucosae
- ❖ Surrounded by a deep furrow
- ❖ Taste buds in lateral walls

Foliate papillae
Magnification:

TASTE BUD

Instruction: View a high magnification of a slide of the taste buds; sketch what you have seen and identify the following:

- ❖ Ovoid or barrel shape
- ❖ Basal cells at base of bud
- ❖ Dark pink elongated sustentacular and light pink elongated gustatory cells within its confines
- ❖ Taste pores opening at the surface epithelium
- ❖ Taste hairs extending through taste pore

Taste bud
Magnification:

OESOPHAGUS

Instruction: View a low and high magnification of a section of the oesophagus; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

<i>Magnification:</i>
<i>Magnification:</i>
Oesophagus

OESOPHAGO-CARDIAC JUNCTION

Instruction: View a slide of the oesophago-cardiac junction; identify, sketch and label what you have seen noting the change in components of the mucosa and submucosa.

Oesophago-cardiac junction
<i>Magnification:</i>

STOMACH (Simple)

Instruction: View a low magnification of slides of the cardiac, fundic and pyloric regions of the glandular stomach; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Cardiac region
Magnification:

Fundic region
Magnification:

Pyloric region
Magnification:

FUNDIC-PYLORIC JUNCTION

Instruction: View a slide of the fundic pyloric junction; identify, sketch and label what you have seen noting the change in components of the mucosa and submucosa.

Fundic-pyloric junction
Magnification:

PYLORIC-DUODENAL JUNCTION

Instruction: View a slide of the pyloric-duodenal junction; identify, sketch and label what you have seen noting the change in components of the mucosa and submucosa.

Pyloric duodenal junction
Magnification:

PROVENTRICULUS

Instruction: View a slide of the proventriculus; identify, sketch and label the components of the mucosa, submucosa and muscularis externa

Proventriculus
Magnification:

VENTRICULUS

Instruction: View a slide of the ventriculus; identify, sketch and label the components of the mucosa, submucosa and muscularis externa

Ventriculus
Magnification:

STOMACH (Complex)

Instruction: View a low magnification of slides of the rumen, reticulum and omasum; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa. The following features should be noted:

Rumen:

- ❖ Conical papillae projecting into the lumen from the cutaneous mucous membrane.
- ❖ Lamina epithelialis mucosa – stratified squamous keratinized with variable thickness.

Reticulum:

- ❖ Tall permanent folds (primary reticular crests) partitioning mucosa into compartments
- ❖ Shorter secondary reticular papillae on the floor of the compartments

Omasum:

- ❖ Cornified cutaneous mucous membrane with many laminae.
- ❖ Laminae are lined with stratified squamous epithelium.

Rumen	Reticulum	Omasum
<i>Magnification:</i>	<i>Magnification:</i>	<i>Magnification:</i>

SMALL INTESTINE

Instruction: View a low magnification slide of the small intestine; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Small intestine
Magnification:

LARGE INTESTINE

Instruction: View a low magnification slide of the large intestine; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Large intestine
Magnification:

ANAL CANAL/SAC

Instruction: View a low and high magnification slide of the anal canal/sac; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Magnification:
Magnification:
Anal canal/sac

SMALL INTESTINE

Instruction: View a high magnification of a section of the small intestine; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa of the duodenum, jejunum and ileum.

Duodenum
Magnification:

Jejunum
Magnification:
Ileum
Magnification:

LARGE INTESTINE

Instruction: View a high magnification of a section of the large intestine; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa of the colon, caecum and recto-anal junction.

Colon
Magnification:

Caecum
Magnification:
Recto-anal junction
Magnification:

MAJOR SALIVARY GLANDS

Instruction: View a low magnification of a section of the Parotid, mandibular and sublingual salivary glands. Identify, sketch and label the components of each gland noting the following:

- ❖ Serous adenomere
- ❖ Mucous adenomere
- ❖ Serous Demilune
- ❖ Myoepithelial cells
- ❖ Striated duct
- ❖ Intercalated duct

Parotid gland
Magnification:

Mandibular gland
Magnification:
Sublingual gland
Magnification:

LIVER

Instruction: View x40, x100 and x400 magnification of a section of the liver. Identify, sketch and label the following features in each magnification.

X40 – Lobules, central vein, interlobular connective tissue

X100 – Sinusoids, Hepatocytes

X400 – Sinusoids, Hepatocytes, Portal triad, bile capillaries

Liver	Liver
<i>X40 magnification</i>	<i>X100 magnification</i>
Liver	Bile capillaries
<i>X400 magnification</i>	<i>Magnification:</i>

GALL BLADDER

Instruction: View two magnifications of a section of the gall bladder; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Gall bladder	Gall bladder
<i>Magnification:</i>	<i>Magnification:</i>

PANCREAS

Instruction: View two magnifications of a section of the Pancreas; identify, sketch and label the exocrine portions.

Pancreas	Pancreas
<i>Magnification:</i>	<i>Magnification:</i>

CHAPTER XII

URINARY SYSTEM

OBJECTIVES:

- Identify the histological components of the organs of the Urinary system
 - Urine production organ
 - ✓ Kidney
 - Urine conduction organs
 - ✓ Renal pelvis
 - ✓ Ureter
 - ✓ Urinary bladder
 - ✓ Urethra

KIDNEY – Cortex and Medulla

Instruction: View a low magnification of a section of the kidney cortex and medulla; identify, sketch and label what you have seen. Note the following features:

Cortex – Renal corpuscles, proximal and distal convoluted tubules, medullary ray, arcuate artery and vein.

- Medulla – collecting ducts, loop of henle, papillary ducts

Kidney cortex
Kidney medulla
<i>Magnification:</i>

KIDNEY - Cortex - Juxtaglomerular apparatus

Instruction: View a high magnification of the cortex; focus on the juxtaglomerular apparatus; identify, sketch and label the following features:

- ❖ Bowman's capsule
- ❖ Glomerular capillaries
- ❖ Podocytes
- ❖ Mesangial cells
- ❖ Afferent arteriole
- ❖ Efferent arteriole
- ❖ Juxtaglomerular cells
- ❖ Macula densa
- ❖ Urinary pole
- ❖ Vascular pole
- ❖ Proximal convoluted tubule
- ❖ Distal convoluted tubule

Juxtaglomerular apparatus
<i>Magnification:</i>

KIDNEY - Medulla

Instruction: View a high magnification of the Medulla; identify, sketch and label the following features:

- ❖ Loop of henle (Thick segments)
- ❖ Loop of henle (Thin segments)
- ❖ Collecting ducts

Medulla of kidney
<i>Magnification:</i>

KIDNEY – Renal pelvis

Instruction: View a high magnification of the renal pelvis; identify, sketch and label the following features:

- ❖ Papillary ducts
- ❖ Renal pelvis
- ❖ Covering transitional epithelium
- ❖ Adipose tissue

Renal pelvis
<i>Magnification:</i>

URETER

Instruction: View a low and magnification magnification of section of the Ureter; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

<i>Magnification:</i>
<i>Magnification:</i>
Ureter

URINARY BLADDER

Instruction: View a low and magnification magnification of section of the Urinary bladder; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

<i>Magnification:</i>
<i>Magnification:</i>
Urinary bladder

CHAPTER XIII

REPRODUCTIVE SYSTEM

OBJECTIVES:

- Identify the histological components of the organs of the Genital/Reproductive system.
 - Male reproductive system
 - ✓ Testis
 - ✓ Genital ducts
 - ❖ Ductus efferens
 - ❖ Ductus epididymis
 - ❖ Ductus deferens
 - ❖ Urethra
 - ✓ Accessory genital glands
 - ❖ Ampullary
 - ❖ Vesicular
 - ❖ Prostate
 - ❖ Bulbourethral
 - ✓ Penis
 - ✓ Glans penis
 - Female reproductive system
 - ✓ Ovary
 - ✓ Oviduct
 - ✓ Uterus
 - ✓ Vagina
 - ✓ Vulva
 - ✓ Mammary gland

TESTIS

Instruction: View a low magnification of slide of the testis, sketch and label what you have seen identifying its components (Seminiferous tubules and interstitial cells)

Testis
Magnification:

TESTIS – Seminiferous tubules

Instruction: View a high magnification of slide of the testis, sketch and label what you have seen identifying the spermatogenic cells of the seminiferous tubules

Seminiferous tubules
Magnification:

RETE TESTIS

Instruction: View a high magnification of the Rete testis from the slide of the testis; identify, sketch and label its features.

Rete testis
Magnification:

SPERMATOOZOA

Instruction: View a slide of the sperm smear identify, sketch and label the components of spermatozoa.

Spermatozoa
Magnification:

EPIDIDYMIS

Instruction: View a low and high magnification of the Epididymis; identify, sketch and label its features.

Epididymis	Epididymis
<i>Magnification:</i>	<i>Magnification:</i>

DUCTUS DEFERENS

Instruction: View a low and high magnification of a section of the ductus deferens; identify, sketch and label its features. Note the extensive amount of smooth muscle peripheral to the lumen of the organ in the low magnification.

Ductus deferens	Ductus deferens
<i>Magnification:</i>	<i>Magnification:</i>

URETHRA

Instruction: View a low and high magnification of section of the Urethra; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Urethra	Urethra
<i>Magnification:</i>	<i>Magnification:</i>

PENIS AND GLANS PENIS

Instruction: View a low magnification of a section of the Penis and glans penis; identify, sketch and label their features.

Penis	Glans penis
<i>Magnification:</i>	<i>Magnification:</i>

DATE _____ WEEK 9

ACCESSORY GENITAL GLANDS

Instruction: View the same magnification of the ampullary, seminal vesicle, prostate and Bulbourethral gland; identify, sketch and label their features.

Ampulla	Seminal vesicle
Prostate	Bulbourethral
Magnification:	Magnification:

DATE _____ WEEK 10

OVARY

Instruction: View a low magnification of the ovary; identify, sketch and label the following features:

- ❖ Cortex
- ❖ Medulla
- ❖ Primordial follicles
- ❖ Primary follicles
- ❖ Secondary follicles
- ❖ Mature or Graafian follicle
- ❖ Corpus luteum
- ❖ Corpus albicans

Ovary
Magnification:

OVARY

Instruction: View the same magnification of the primordial, primary, Secondary and Graafian follicle; identify, sketch and label their features.

Primordial follicle	Primary follicle
Secondary follicle	Mature follicle
Magnification:	Magnification:

OVARY – Corpus luteum and albicans

Instruction: View a slide of the ovary showing the corpus luteum and corpus albicans; identify, sketch and label their features.

Corpus luteum	Corpus albicans
<i>Magnification:</i>	<i>Magnification:</i>

OVIDUCT – Oestrus and Anoestrus

Instruction: View a low magnification of a slide of the oestrus and anoestrus stages of the oviduct; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Oviduct - Oestrus	Oviduct - anoestrus
<i>Magnification:</i>	<i>Magnification:</i>

UTERUS

Instruction: View a low magnification of a slide of the oestrus and anoestrus stages of the uterus and its high magnification; identify, sketch and label the following:

- ❖ Endometrium
- ❖ Myometrium
- ❖ Stratum vasculare
- ❖ Perimetrium

Uterus
Magnification:

Uterus - oestrus
Magnification:
Uterus - anoestrus
Magnification:

UTERUS – Secretory phase and cervix

Instruction: View slides of the Uterus (secretory phase) and Uterus (cervix); identify, sketch and label their features.

Uterus – secretory phase	Uterus - cervix
<i>Magnification:</i>	<i>Magnification:</i>

VAGINA – Oestrus and Anoestrus

Instruction: View a low magnification of a slide of the oestrus and anoestrus stages of the vagina; identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Vagina - Oestrus	Vagina - anoestrus
<i>Magnification:</i>	<i>Magnification:</i>

MAMMARY GLAND

Instruction: View slides of the non-lactating and lactating stages of the mammary gland; identify, sketch and label their features.

Mammary gland – Non lactating	Mammary gland - lactating
<i>Magnification:</i>	<i>Magnification:</i>

TEAT

Instruction: View a low magnification of the teat (cistern) and teat (papillary duct); identify, sketch and label the components of the mucosa, submucosa, muscularis externa, tunica adventitia and serosa.

Teat - cistern	Teat – papillary duct
<i>Magnification:</i>	<i>Magnification:</i>

CHAPTER XIV

ENDOCRINE SYSTEM

OBJECTIVES:

- Identify the histological components of the organs of the Endocrine system.
 - Primary endocrine organs
 - ✓ Pituitary gland
 - ✓ Pineal gland
 - ✓ Thyroid gland
 - ✓ Parathyroid gland
 - ✓ Adrenal gland
 - Secondary endocrine organs
 - ✓ Pancreas
 - ✓ Testes
 - ✓ Ovaries
 - ✓ Placenta

PITUITARY GLAND

Instruction: View a low magnification of a section of the pituitary gland. Identify, sketch and label the following features:

- ❖ Pars distalis
- ❖ Pars nervosa
- ❖ Pars intermedia
- ❖ Pars tuberalis
- ❖ Rathke's pouch

Pituitary gland
<i>Magnification:</i>

PITUITARY GLAND

Instruction: View a high magnification of a section of the pars distalis, pars nervosa and pars intermedia. Identify, sketch and label the following features:

- ❖ Pars distalis
 - ✓ Basophils
 - ✓ Acidophils
 - ✓ Chromophobes
- ❖ Pars nervosa
 - ✓ Pituicytes
 - ✓ Herring bodies
- ❖ Pars intermedia
 - ✓ Vessicles

Pars distalis
Magnification:

Pars nervosa
Magnification:
Pars intermedia
Magnification:

PINEAL GLAND

Instruction: View a low and high magnification of a section of the Pineal gland; identify, sketch and label the pineolocytes and astrocytes in the high magnification.

Pineal gland	Pineal gland
<i>Magnification:</i>	<i>Magnification:</i>

THYROID GLAND

Instruction: View a low and high magnification of a cross section of the Thyroid gland; identify, sketch and label the follicular cells, parafollicular cells and colloid.

Thyroid gland	Thyroid gland
<i>Magnification:</i>	<i>Magnification:</i>

PARATHYROID GLAND

Instruction: View a low and high magnification of a section of the parathyroid gland; identify, sketch and label the chief cells and oxyphil cells.

Parathyroid gland	Parathyroid gland
<i>Magnification:</i>	<i>Magnification:</i>

ADRENAL GLAND

Instruction: View a low magnification of a section of the Adrenal gland; identify, sketch and label what you have seen distinguishing clearly the cortex and medulla.

Adrenal gland
<i>Magnification:</i>

PANCREAS

ADRENAL GLAND

Instruction: View a high magnification of a section of the adrenal gland focus on the entire cortex and part of the medulla; identify, sketch and label the following:

- ❖ Adrenal capsule
- ❖ Zona glomerulosa
- ❖ Zona fasciculata
- ❖ Zona reticularis
- ❖ Chromaffin cells (Medulla)

Adrenal gland
<i>Magnification:</i>

Instruction: View a low and high magnification of a slide of the Pancreas. Identify, sketch and label the islets of Langerhans and its cellular components if visible.

<i>Magnification:</i>
<i>Magnification:</i>
Islets of Langerhans

CHAPTER XV

SPECIAL SENSES

OBJECTIVES:

- Identify the histological components of the Special senses
 - Eye
 - ✓ Eye lid
 - ✓ Cornea
 - ✓ Sclera
 - ✓ Choroid
 - ✓ Lens
 - ✓ Retina
 - Ear
 - ✓ Pinna
 - ✓ Ear canal
 - ✓ Semicircular canal
 - ✓ Cochlea
 - Skin and its appendages

EYE

Instruction: View a low magnification of the eye section; identify, sketch and label the following features:

- ❖ Eyelid
- ❖ Fibrous tunic (Cornea and Sclera)
- ❖ Vascular tunic (retina)
- ❖ Iris
- ❖ Lens
- ❖ Aqueous humor
- ❖ Vitreous humor
- ❖ Choroid
- ❖ Optic nerve

Eye _____
<i>Magnification:</i> _____

EYELID

Instruction: View a slide of the eyelid (vertical section), identify, sketch and label what you have seen.

Features to identify include:

- ❖ Palpebra conjunctive
- ❖ Tarsus
- ❖ Tarsal duct
- ❖ Tarsal gland
- ❖ Orbicularis oculi
- ❖ Eyelashes
- ❖ Hair follicle and sebaceous gland
- ❖ Sweat gland
- ❖ Connective and adipose tissue

Eye lid
Magnification:

LACRIMAL GLAND

Instruction: View a slide of the lacrimal gland; identify, sketch and label what you have seen.

Features to identify include:

- ❖ Tubuloalveolar acini
- ❖ Interlobular excretory duct
- ❖ Myoepithelial cells
- ❖ Connective tissue septa
- ❖ Blood vessels
- ❖ Nerve
- ❖ Adipose tissue

Lacrimal gland
Magnification:

CORNEA

Instruction: Focus on the cornea of the eye section, identify, sketch and label what you have seen.

Layers to identify include:

- ❖ Anterior surface (stratified squamous epithelium)
- ❖ Anterior limiting lamina
- ❖ Corneal stroma (Collagen fibres and fibroblasts)
- ❖ Posterior limiting lamina
- ❖ Posterior epithelium

Cornea
<i>Magnification:</i>

Lens
<i>Magnification:</i>

LENS

Instruction: Focus on the lens of the eye section, identify, sketch and label what you have seen.

Layers to identify include:

- ❖ Lens capsule
- ❖ Subcapsular epithelium
- ❖ Lens fibres

CHOROID

Instruction: Focus on the choroid of the eye section, identify, sketch and label what you have seen.

Features to identify include:

- ❖ Loose connective tissue
- ❖ Dense network of blood vessels
- ❖ Melanocytes
- ❖ Bruch's membrane

Choroid
Magnification:

Retina
Magnification:

RETINA

Instruction: Focus on the retina of the eye section, identify, sketch and label what you have seen.

Layers to identify include:

- ❖ Pigment epithelium
- ❖ Receptor layer
- ❖ External limiting membrane
- ❖ Outer nuclear layer
- ❖ Outer plexiform layer
- ❖ Inner nuclear layer
- ❖ Inner plexiform layer
- ❖ Ganglion cell layer
- ❖ Optic fibre layer
- ❖ Inner limiting layer

EXTERNAL EAR (Pinna and Ear canal)

Instruction: View a section of the Pinna and external ear canal; identify, sketch and label the following features:

Pinna

- ❖ Mucosa - Epithelium
- ❖ Dense connective tissue
- ❖ Elastic cartilage
- ❖ Loose c. tissue in t. adventitia

Ear canal

- ❖ Mucosa - Epithelium
- ❖ Hair follicle and Ceruminous glands
- ❖ Elastic cartilage
- ❖ Loose c. tissue in t. adventitia

Pinna
External ear canal
Magnification:

INNER EAR (Semicircular canal)

Instruction: View a section of the inner ear (semicircular canal); identify, sketch and label the following features:

- ❖ Ampulla
- ❖ Crista
- ❖ Macula
- ❖ Perilymph space

Semicircular canal
Magnification:

COCHLEA

Instruction: View a low magnification of a section of the cochlea (vertical section); identify, sketch and label the following features:

- ❖ Scala media, vestibule and tympani
- ❖ Vestibular, tectorial and basilar membrane
- ❖ Organ of corti
- ❖ Cochlea nerve
- ❖ Spiral ligament
- ❖ Helicotrema
- ❖ Osseous labyrinth
- ❖ Modiolus

Cochlea
Magnification:

COCHLEA

Instruction: View a high magnification of a section of the cochlea (vertical section); focus on the cochlea duct; identify, sketch and label the following features:

- ❖ Scala media (Cochlea duct)
- ❖ Vestibular, tectorial and basilar membrane
- ❖ Organ of corti
- ❖ Hair cells
- ❖ Stria vascularis
- ❖ Spiral limbus
- ❖ Cochlea nerve
- ❖ Spiral ligament

Cochlea duct
<i>Magnification:</i>

SKIN

Instruction: View a low magnification of the Skin section; identify, sketch and label the following features:

- ❖ Epidermis
- ❖ Epithelium (Stratified squamous keratinized)
- ❖ Dermis
- ❖ Dermal papillae
- ❖ Arrector pilli
- ❖ Sebaceous gland
- ❖ Hair follicle
- ❖ Pacinian corpuscles
- ❖ Adipose tissue
- ❖ Blood vessels

Skin <i>Magnification:</i>	
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SKIN - Epidermis

Instruction: View a high magnification of thick skin epidermis; identify, sketch and label the following layers:

- ❖ Basement membrane
- ❖ Stratum basale
- ❖ Stratum spinosum
- ❖ Stratum granulosum
- ❖ Stratum lucidum
- ❖ Stratum corneum

Thick skin epidermis <i>Magnification:</i>	
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HAIR FOLLICLE

Instruction: View a high magnification of the hair follicle (longitudinal and transverse sections); identify, sketch and label the following features:

- ❖ Dermal papilla
- ❖ Medulla
- ❖ Cortex
- ❖ Cuticle
- ❖ Inner root sheath
- ❖ Outer root sheath
- ❖ Dermal sheath or connective tissue

Hair follicle (L.S)	Hair follicle (X.S)
<i>Magnification:</i>	<i>Magnification:</i>

NOTE: This Practical Manual must be submitted for grading at the end of each practical session to the practical coordinator.

Practical Coordinator's signature