HISTOLOGY
THE COURSE BOOKLET
FOR STUDENT & STAFF

THE ACADEMIC YEAR 2004-2005
PRE-CLINICAL STAGE

BY
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Histology Course

Aim of the course:

In the process of completing this course, students acquire the following competencies:
* recognize and memorize the structural components of the cells.
* define the different organelles of the cell in relation to chemical and physiological processes.
* categorize the basic tissues which make up the human organs and systems.
* classify the different types of each kind of tissues.
* know the criteria of each cell and tissue.
* organize the structure of the organs & systems and relate that to the specific function(s).
* identify the clinical correlations between the cell, tissue organs and systems.

Intended learning outcome of the course:
At the end of histology course students will be able to:
* identify the normal karyotyping of both normal male and female.
* explain any chromosomal aberrations in the any chromosomal map.
* discuss the possible causes of any chromosomal aberrations.
* discuss the probability of occurrence of similar cases in the family.
* apply and practice how to solve a medical problem in a comprehensive exam.
* the students, after being familiar with the normal structure of the different tissues and organs, will be able to identify and describe any pathological changes on studying pathology later on.
* The students will be acquainted with good and up-to-date knowledge about. different types of Microscopes, Microtechniques, tissue culture and karyotyping.
* The students will acquire the skills required for staining and examining different tissues under the light microscope.
* students will acquire general skills in the assessment of visual data.
* they will acquire specific skills in interpretation of images of cells and tissues.
* they will learn the practical use of the light microscope.
* students will be able to classify, locate and describe the different tissues of the body.

Objectives are connected with various parts of the subject:
These are divided into:
1. **Introduction**  
   It includes:- Microscopy, Microtechniques and Types of stain.
2. Medical biology includes:- Cytology and cytogenetics.
3. General Histology including:
   - Epithelial tissue.
   - Connective tissue.
   - Muscular tissue.
   - Nervous tissue.
4. Systematic Histology includes; studying the structure of organs of different systems in the body.

**FIRST YEAR**

1. **Introduction** includes:-

1.1 **Microscopy:**
   - The students will be able to use the light microscope to examine the different tissues and organs using different magnifying powers.
   - The students will be aware of the other types of microscopes such as Electron microscope, Fluorescent microscope, Phase contrast microscope and the uses of each type.

1.2 **Microtechniques:-**
   - The student will have a fair idea on the various methods for preparing histological sections, as parafin technique, cellodin and freezing techniques.

1.3 **Types of stains including:**
   - Ordinary stain e.g. H & E.
   - Specific stain for demonstration of lipids and carbohydrates.
   - Supravital staining for demonstration of living cells in vitro.
   - Vital staining for demonstration of living cells in vivo.
   - Histochemistry to demonstrate enzymes, minerals, DNA, RNA, etc. inside the cells.
   - Immunocytochemistry to demonstrate antigens and antibodies.

2. **Medical biology includes:**

2.1 **Cytology**

   **Objectives**
   1- To describe the structure of the different organelles.
   2- To differentiate between the different organelles in electron microscopic pictures.
   3- To correlate between the structure of each organelle with its specific function.
   4- To identify the different parts of the nucleus.
   5- To know the cell inclusions.
The students will be familiar with the light microscopic picture, E/M structure of the nucleus and various organoids such as the cell membrane, Golgi apparatus, Mitochondria, Lysosomes, Endoplasmic reticulum, Ribosomes, Centrioles, Microtubules, Microfilaments, and Cilia. The adaptation of each structure to functions is discussed in these classes.

2.2 **Cytogenics:**

**Objectives**
1- to identify the structure of human chromosomes.
2- to classify the chromosomes in the chromosomal map.
3- Students will have a fair idea about karyotyping (definition, method & importance).
4- To identify the inactive x- chromosome and its importance.
5- Students will be aware of Rhuses factor.
6- The students will be aware of some of the hereditary factors at the cellular level such as:
   - Cell cycle, cell division, significance of tissue culture, karyotyping, chromosomal abnormalities.
   - Studying some of the congenital diseases.

3. **General Histology Includes:**

3.1 **Epithelial tissue:**

**Objectives**
1- To identify different types of tissues of the body.
2- To classify epithelium into simple & stratified.
3- To describe the different types of simple epithelium.
4- To correlate between their sites and function.
5- To classify the different types of stratified epithelium.
6- To correlate between their sites and function.
7- To know the classification & sites of glandular epithelium.
8- To describe the structure and site of myoepithelium & neuroepithelium.
9- To know well the different features of epithelium.
   - Students will study and examine under the light microscope various types of Epithelial tissue:
     - Simple epithelium.
     - Stratified epithelium.
     - Glandular epithelium.
     - Neuro epithelium.
     - Myoepithelium.

3.2 **Connective tissue**

**Objectives**
1- To describe the structure of C.T.
2- To classify C.T. according to the nature of the matrix.
3- To know the different types of C.T. cells, fibers and matrix.
4- To correlate between the structure and sites of different types of cartilage.
5- To differentiate between the different types of cartilage cells.
6- To identify the different types of bone.
7- To differentiate between the different types of cartilage under the microscope.
8- To identify the different types of bone under the microscope.
9- To have a fair idea about different types of ossification.

**Connective tissue includes:**
- C.T. proper.
- Various types of cartilages.
- Bone and stages of ossification.
- Blood: together with haemopoiesis.

**Objectives of blood**
1- To classify the different types of blood cells.
2- To know the normal percentage of each, the abnormalities of the count & the causes of these abnormalities.
3- To learn how the RBCs adapt their function.
4- To describe the morphology of different WBCs.
5- To correlate this morphology with the functions.
6- To learn the differences between RBCs & WBCs.
7- To identify the structure of blood platelets by using the light & electron microscopic.
8- To correlate between the structure & function.

the student will do:
- Blood film, stained with Leishman stain.
- Differential leucocytic count.
- Total count of red blood corpuscles.
- Total leucocytic count.
- Platelet count

**3.3 Muscular tissue:**

**Objectives**
1- To identify the different types of muscles.
2- To know the light and electron microscopic structure of skeletal & smooth muscles.
3- To describe the triad tubular system.
4- To identify the molecular structure of thin & thick filaments.
5- To describe the mechanism of contraction in both skeletal & smooth muscles.
6- To demonstrate the structure of skeletal muscle and smooth muscle under the light microscope.
7- To know myoneural junction Myathenia Gravis as a clinical application for a defect at the motor end plate.
The student will be aware of L/M picture, E/M structure of:

- Skeletal muscle.
- Smooth muscle.

3.4 **Nervous tissue:**

**Objectives**

1. Classify the nervous system.
2. Identify the different parts of the peripheral nervous system.
3. Describe the structure of the neuron.
5. Know the structure, types of the ganglion.
6. Know the synapse & its classification.
7. Learn the structure of the different types of receptors.

**Peripheral Nervous system includes**

Include studying of the L/M picture and E/M structure of:

a. Neurons, synapse, ganglia.
b. Neuroglial cells.
c. Nerve endings (receptors and effectors).
d. Degeneration and regeneration of neurons.

4. **Systematic Histology:**

4.1 The students will study and be familiar with the histological sections of different organs in different systems including:

1. **Lymphatic system:**

**Objectives**

1. Describe the primary & secondary lymphoid organs.
2. Know the histological structure of the spleen.
3. Identify the circulation and functions of the spleen.
4. Learn the morphology of the lymph node.
5. Describe the circulation of the lymphocytes.
6. Know the normal structure of the thymus.
7. Describe the functions of the thymic gland.
8. Identify thymus, spleen & lymph node under the light microscope.

Studying of the histological structure of spleen, Lymph nodes, tonsils and thymus and their immunological role.

1. **The Macrophage System (MNPS)**

   Studying of the cells which are concerned with the defensive mechanism in the different organs of the body.
LIST OF PRACTICAL HISTOLOGICAL SLIDES

1st YEAR

LOW POWER SLIDES

1- Umbilical cord (mucoid C.T.)
2- Ligamentum nuchae (elastic connective tissue)
3- Costal Cartilage (hyaline cartilage).
4- Ear Pinna (elastic fibro-cartilage).
5- Compact Ground Bone.
6- Comapct Decalcified Bone.
7- Spongy Bone (rib).
8- Growing Bone (cartilagenous ossification).
9- Skeletal Muscle (T.S.).
10- Skeletal Muscle (L.S.).
11- Nerve Trunk (Hx and E.).
12- Nerve Trunk (Osmic acid).
13- Spinal Ganglion (H & E)
14- Spinal Ganglion (silver).
15- Sympathetic Ganglion (H & E).
16- Bone Marrow.
17- Lymph Node.
18- Spleen.
19- Tonsil.
20- Thymus.
**HIGH POWR SLIDES**

1- Muscle spindle ( T.S.).
2- Pacinian corpuscle.
3- Hassall's corpuscle.
4- Megakaryocyte.
5- Blood leucocytes.

**ELECTRO-MICROGRAPHS**

1- Cell Membrane.
2- Mitochondria.
3- Golgi Apparatus.
4- Rough Endoplasmic Reticulum.
5- Smooth Endoplasmic Reticulum.
6- Lysosomes.
7- Ribosomes.
8- Centriole.
9- Microtubules
10- Cilia.
11- Microvilli.
12- Nucleus (nuclear envelop, nucleolus, chromatin & nuclear sap).
13- Cell inclusions (glycogen granules)
SECOND YEAR

1. The Cardiovascular System:
   Objectives:
   1- Differentiate between the different types of muscles (cardiac, skeletal & smooth).
   2- Describe the histology of the cardiac wall (epicardium, myocardium & endocardium).
   3- Identify the histological appearance of: large elastic arteries as aorta, muscular arteries as coronary, cerebral arteries as basilar, and also the morphology of umbilical artery.
   4- Learn the structure of the large veins as inferior vena cava, medium sized vein & small veins.
   5- Know the morphology of Purkinje fibers & how they adapt their physiological function.
   6- Classify the different types of blood capillaries & correlate between the structure, site & function of each type.
   7- Identify the histological slides of the cardiac muscle, different arteries & veins, & moderator band.

The students will be aware of the structure of cardiac muscles & valve, the conducting system of the heart, different arteries, veins, capillaries, venules, blood sinusoids and arterio-venous shunt.

2. Skin and its appendages:
The students will acquaint fairly good knowledge on studying of the skin, sweat glands, sebaceous glands hairs and hair follicles.

3. Respiratory System:
   Objectives:
   1- Identify the different parts of the respiratory system.
   2- Classify it into proximal & distal.
   3- Know the histology of the nasal cavity, para nasal air sinuses.
   4- Correlate between the morphology of each with the corresponding functions.
   5- Learn the structure of the pharynx & larynx.
   6- Identify the layers of the trachea.
   7- Know the histological appearance of extra pulmonary, intrapulmonary bronchi, & the different types of bronchioles.
   8- Describe the fetal lung.
   9- Know the medico legal importance of its examination.
   10- Differentiate between fetal & adult lung.
   11- Identify different parts of the pleura.
   12- Learn well the lung macrophages.
13- Know the defense mechanism of the respiratory system & correlate this to the structure of the different parts.
14- Identify the slides of trachea, lung (adult & fetal).
15- Learn the vasculature of the lung & identify a lung section injected with gelatin carmine.
Studying of the histological structure of nose, nasopharynx, trachea, bronchial tree and lung.

4. The Urinary system:
Objectives:
1- Know the parts of the urinary system.
2- Identify the functions of the urinary system.
3- Describe parts of the uriniferous tubule and the nephron.
4- Know well the histological structure of Malpighian renal corpuscle, proximal & distal convoluted tubule.
5- Differentiate between the histological sections of both PCT & DCT.
6- Know the morphological parts of Henle's loop & correlate between its histological structure & function.
7- Describe the juxta glomerular apparatus & its function.
8- Identify transitional epithelium & how it adapts to its function.
9- Describe the wall of the ureter, urinary bladder & the urethra in both male & female.
10- Learn the microcirculation of the kidney.
11- Identify the slides of the kidney, Malpighian renal corpuscle, ureter & urinary bladder & a slide of kidney injected with gelatin carmine.
Studying of kidney, ureter, urinary bladder and urethra.

5. Digestive system:
Objectives:
1- Describe structure of the organs present in the oral cavity (lip, tongue, & salivary glands).
2- Identify the morphology of the esophagus.
3- Know the anatomical & histological parts of the stomach.
4- Differentiate between duodenum, jejunum, & ileum.
5- Correlate between the structure & the function of the different parts of the small intestine.
6- Describe the histological changes at: gastro-oesophageal junction, & the pyloro-duodenal junction.
7- Learn the morphological appearance of the colon & how it can adapt to its function. The histological changes at recto anal junction.
8- Classify the interior of the liver into (hepatic lobule, hepatic acinus, portal lobule, & portal tract).
9- Describe the pancreas as a mixed gland: structure of the pancreatic acini, structure of islets of Langerhans. regulation of pancreatic secretion.
10- Identify the slides of:
esophagus, fundus & pylorus of stomach, duodenum, ileum, large intestine, gastro- esophageal junction, pyloro- duodenal junction, liver & gall bladder, liver pig (to see the classic hepatic lobule), liver injected gelatin carmine
11- Identify structure of the appendix & its relation to occurrence of appendicitis.

Studying of the structures of various organs of the digestive system (oral cavity, pharynx, esophagus, stomach, small & large intestines) and associated glands (salivary glands, liver & pancreas).

6. Endocrine glands:

Objectives:
1- Know the general structure of any endocrine glands.
2- Describe the structure of the different parts of the pituitary gland & its correlation to embryological origin.
3- Learn the hypothalamo- hypophyseal portal circulation & its importance.
4- Identify the structure of the thyroid gland. The adaptation of the thyroid follicles to their function.
5- Describe the morphology of parathyroid glands.
6- Identify the histological structure of the supra renal gland.
7- Know about pineal body.
8- Know about the regulatory control of the pituitary gland on other endocrine glands.

Endocrine glands include pituitary gland, suprarenal, thyroid, parathyroid, and pineal body.

7. The male genital system:

Objectives:
1- Classify the parts of the male genital system.
2- Describe the structure of the testis as a mixed gland (structure of the seminiferous tubule, Leydig cells, sertoli cells).
3- Identify the structure of intra testicular tubules.
4- Know the structure of extra testicular tubes (epididymis, vas, spermatic cord, & urethra).
5- Classify the male accessory organs (prostate, seminal vesicles, bulbo-urethral glands & Coper's glands).
6- Identify the morphology of the penis.
7- Describe the different parts of male urethra.
8- Identify histological slides of: testis & epididymis, vas, spermatic cord, prostate, penis.
9- Know the stages of male gamete formation, capacitation of sperm.
The histological structure of testes (and intra testicular genital ducts), epididymis, Vas deferens, prostate seminal vesicles, penis and spermatic cord.

8. **The female genital system:**
   **Objectives:**
   1. Identify the different parts of the female genital system.
   2. Describe the ovary & different types of ovarian follicles (primordial, growing, mature, & atritic). The maturation of these follicles (mechanism & factors affecting growth).
   3. Know the parts & structure of Fallopian tube & how is it a suitable environment for fertilization?
   4. Describe the wall of the different parts of the uterus.
   5. Learn the structure of vagina, resting & lactating mammary gland, the external genitalia.
   6. Describe the placenta & placental barrier.
   Identify slides of: ovary, oviduct, uterus vagina, resting & lactating mammary gland.
   Includes the ovary, fallopian tubes, uterus, placenta, cervix of the uterus, vagina external genitalia and mammary glands.

9. **special sense includes:**
   1. **The Eye:**
      Studying of the histological structure of Cornea, Sclera, Iris, Ciliary body, Lens, Choroid, Retina, Coreneo-scleral junction, Eyelid and Lacrimal glands.
   2. **The Ear:**
      Studying of external, middle and inner ear including receptors of hearing and equilibrium.

10. **The C.N.S.**
   **Objectives**
   1. Classify the central nervous system.
   2. Describe the internal structure of the spinal cord (tracts, nuclei & laminae).
   3. Know the different levels of the spinal cord (cervical, upper thoracic, lower thoracic & lumbar).
   4. Describe sections of the medulla oblongata (closed motor, closed sensory & open medulla), pons (upper, middle & lower), midbrain (superior level & inferior level), cerebral cortex layers, cerebellar cortex layers.
   5. Know a fair idea about ascending & descending tracts.
   6. Identify sections of: spinal cord (cervical, thoracic & lumber levels), medulla oblongata (closed sensory, closed motor & open levels), pons, midbrain (superior & inferior levels), cerebrum & cerebellum.
   • It includes the menings and brain barriers.
• The spinal cord in different levels.
• The brain stem: Medulla, Pons and mid brain together with cranial nerves.
• The cerebellum and cerebellar connections
• The cerebral cortex.
LIST OF PRACTICAL HISTOLOGICAL SLIDES

1st Semester

Low Power Slides
1- Cardiac Muscles and Valve.
2- Moderator Band.
3- Medium-sized Artery and Vein.
4- Aorta.
5- Basilar Artery.
6- Thick Skin (tip of finger).
7- Thin Skin (Scalp).
8- Trachea.
9- Adult Lung.
10- Foetal Lung.
11- Lung injected with gelatine carmine.
12- Kidney
13- Ureter
14- Urinary bladder

High Power Slides
Malpighian Renal Corpuscle
Organs Injected With Gelatin Carmine
Kidney.

2nd Semester

A) Digestive System
1- Lip.
2- Tongue.
3- Tongue rabbit (papilla foliata)
4- Oesophagus dog (oesophageal glands).
5- Oesophagus cat (muscularis mucosa).
6- Gastro-oesophageal Junction (L.S.).
7- Stomach (fundus).
8- Stomach (pylorus).
9- Pyloro-duodenal junction (L.S.).
10- Small Intestine (duodenum).
11- Small Intestine (jejenum)
12- Small Intestine (ileum).
13- Pyloro-duodenal Junction
14- Large Intestine.
15- Appendix (Rabbit).
16- Liver pig
17- Liver & Gall Bladder.
18- Liver injected with gelatin carmine.
19- Parotid Gland.
20- Submaxillary gland.
21- Pancreas.

**B) Endocrine System**
22- Suprarenal Gland.
23- Pituitary Gland.
24- Thyroid and Parathyroid.

**C) Reproductive System**
25- Testis.
26- Epididymis.
27- Vas Deferens.
28- Spermatic Cord.
29- Prostate.
30- Penis.
31- Ovary.
32- Fallopian Tube.
33- Uterus.
34- Placenta.
35- Vagina.
36- Resting Mammary Gland.
37- Lactating Mammary Gland.

**D) Special Sense**
38- Eye Lid.
39- Cornea.
40- Retina.
41- Cochlea.

**E) Central Nervous System**
**C.N.S. Slides Stained (H&E or silver).**
42- Spinal Cord Cervical.
43- Spinal Cord Thoracic.
44- Spinal Cord Lumbar.
45- Closed Medulla At Motor Decussation.
46- Closed Medulla At Sensory Decussation.
47- Open Medulla.
48- Pons At Its Middle level.
49- Midbrain At Superior Colliculus.
50- Midbrain At Inferior Colliculus.
51- Cerebrum.
52- Cerebellum.

**High Power Slides**
53- Taste buds.
54- Liver lobule.
55- Islet's of Langerhans.
56- Thyroid Follicles.
57- Seminiferous tubule.
58- Mature Graafian Follicle.
59- Cornea.
60- Retina.
61- Organ of Corti.

**Organs Injected With Gelatin Carmine**

Liver

**Teaching Hours:**

**FIRST YEAR**

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**SECOND YEAR**

**First Semester**

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**Second Semester**

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- Year Assessment Represents 30% of the total marks.
- This 30% is divided as:
  1. mid semester (&/or mid year) 15%
  2. Active participation (class sharing) 5%
  3. Attendance 5%
  4. Seminar presentation 5%
- 70% for final exams.
- The 35% of the written exam is divided as:
  - 50% or more for account
  - 50% or less for MCQs and others

**Text Books of Histology:**
CONTENTS AND METHODS OF TEACHING
OF THE COURSE
The course of histology consists of the following:

First Year
1. Lecturing programme of 74 lectures of 60 minutes each distributed all over the year.
2. Practical sessions: 52 sessions of 120 minutes all over the terms.
3. Elective Seminars: integrated with other subjects of basic sciences.

Second Year
First semester:
1- Lecturing programme of 36 lectures of 60 minutes each distributed all over the whole semester.
2- Practical sessions: 12 sessions of 120 minutes all over the semester.

Second semester:
1- Lecturing program of 50 lectures of 60 minutes each distributed all over the whole semester.
2- Practical sessions: 30 sessions of 120 minutes all over the semester.
3- Active participation: students do presentations of certain points within 10 min.along the semester. They use power point presentation.
4- Electromicrographs.
5- Slides.
6- Audiovisual unit.
7- Elective Seminars: integrated with other subjects of basic sciences.