



Benha University
Faculty of Veterinary Medicine
Histology and Cytology Department



HISTOLOGY Exam for 1st year 1st semester

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برنامج جودة و مراقبة الأغذية

Time:- 3 hours

(I) What do you know about:

1. Nucleus.

- The nucleus is the "Control Center" of each cell, which contains DNA (deoxyribonucleic acid, which is genetic information) in the form of genes, and also information for the formation of proteins. DNA, which is combined with protein, is normally dispersed throughout the nucleus as chromatin. During cell division the chromatin becomes visible as chromosomes.

The nucleus also contains ribonucleic acid (RNA), most of which is located in the nucleolus it present in all cell except thrombocyte, lens cell of eye and R.B.Cs of mammals

Vary in shape & size from cell to another.

Most of cells have one nucleus but in Liver cell → 2 nucleuses.

While Osteoclast cell → multinucleated

It consists of

Nuclear envelope.

Nucleolus

Nuclear sap or “ Karyolymph

Chromatin

(1) Nuclear envelope:-

It appears as membrane boundary separated the nucleus from the cytoplasm.

EM

2 concentric unit membrane

“ inner and outer “ Trilaminar .

- Outer studded with ribosome & continue with ER.

- Inner attached to small particles of chromatin heterochromatin.

- Nuclear pore present with septum for exchange of RNA between interior and exterior. Nuclear pores permit substances (such as nutrients, waste, and cellular information) to pass both into, and out of, the nucleus

- Both membranes enclose perinuclear cisternae.

(2) Karyolymph:-

It's also known as nucleoplasm, nuclear sap

It is fluid fill the space of the nucleus & contains several nucleoprotein, lipid, mineral and enzyme (polymerase)

(3) Chromatin:-

Highly coiled long strand of DNA with histone & other structure protein. Two types of chromatin

	Heterochromatin	Euchromatin
Known As	Condensed	extended or diffuse
Location	cells with low activity	cells with high activity
Shape	dark clumps inside the envelope	light stain strands of DNA and mRNA

Action	Inert in protein synthesis	active in protein synthesis
Position	Peripheral chromatin Nucleolus associated chromatin Chromatin island	Diffuse in the karyolymph

(4) Nucleolus:-

* The **nucleolus** is a dense spherical structure within the nucleus of a cell. It contains ribonucleic acid (RNA) for the synthesis of ribosomes and also has an important role in the production of proteins and RNA. The nucleolus is a part of the nucleus of the cell that disappears during cell division. Basophilic mass eccentrically present in the nucleus.

L.M → Basophilic mass more shiny than other structure.

E.M → consists of 2 parts

(1) Nucleolenema:- Anastomosing threads of compact RNA filaments associated with RAN granules.

(2) *Pars amorpha*

Centrally located and densely packed filament forming round mass.

Or it may be known as

Pars granulosa → granular RNA

Pars fibrosa → filament RAN

Function → synthesis & assembly of rRNA.

2. Stratified epithelium.

(1) Stratified squamous epithelium:-

(A) Mucous type “none keratinized:-

The epithelium consists of many layer of epithelial cells, the innermost is tall columnar rest on the basement membrane while the middle layer consists of polyhedral cells and the outermost consists of squamous cells Location: On the most orifice of the body as mouth, vagina, pharynx, esophagus and urethra

(B) Cutaneous type “keratinized:-

This type is similar to the non-keratinized type except presence of keratin on the outermost squamous cells

Location:- In all body surface except cornea of eye

(2) Stratified cuboidal epithelium:-

This type consists of only two layer of cuboidal cells rest on the basement membrane

Location:-Large ducts of some gland in the body (sweat gland).

(3) Stratified columnar epithelium:- It consists of many layers as that of the stratified squamous epithelium and the most outer layer is columnar in shape

Location: - Small portion of pharynx, larynx. Glandular duct of the mammary gland and salivary gland portion of urethra

(4) Transitional epithelium:-

Special type of the stratified epithelium, the innermost layer is high cuboidal rest on interrupted basement membrane, the middle layer is polygonal and polyhedral and the outermost layer characterized by dome shape cells with one or two nuclei The number of the epithelial layer is changeable according to the physiological state of the urinary bladder (if empty the number is 6-15 layer and if full the number is 3-4 layer) Location:- Renal pelvis, ureter, urethra and urinary bladder

3. Loose C.T.

Areolar tissue (loose connective tissue proper) forms the stroma or framework of many organs and surrounds blood vessels and nerves. Compare the morphology of the thick collagen fibers with the thin branched elastic fibers. Identify the spindle- shaped fibroblasts with their pale, oval euchromatic nuclei. Numerous cytoplasmic granules and pale-staining spherical nuclei of mast cells. Ground substance has been lost during

fixation leaving open spaces throughout this tissue.

* Fill the space between fibers, Muscle sheath, and support epithelium from layer of endothelial sheath of blood vessels.

It also found in the papillary layer of dermis, hypodermis, serosal lining of peritoneum, pleural cavity, and glands.

II- What are the histological structure of:

1. Mitochondria.

Mitochondria" is a plural term; which is appropriate because it is not usual to find a single "mitochondrion" (which may also be referred to as a "chondriosome"). Mitochondria provide the energy a cell needs to move, divide, produce secretory products, contract - in short; they are the power centers of the cell. They are about the size of bacteria but may have different shapes depending on the cell type.

One of the cytoplasmic organelles, membranous can seen with light microscope using" supra vital dye of Janus "green color"

It bounded by 2 membrane separated with inter membranous space.

It may be short rods, threads or granules.

About 2500- 3000 in each cell & increase in cell with high metabolic action.

E.M.

Bounded with 2 membranes. "Outer is smooth, inner extended in ward forming crista or internal ridge which divided mitochondria into incomplete compartments.

The inner membrane has mitochondrial granules or elementary particles which consist of head, neck and base.

It also contains matrix granules which have binding site (diformazan granules).

It also contains ribosome like particles.

It also contains enzymatic granules.

It also contains DNA in close ring (maternal DNA).

Function:-

Power house of the body.

Contain many biochemical reactions.

Contain enzyme of crib's cycle.

2. Large vein.

T. intima:-

Endothelium layer.

Subendothelial CT: - loose connective tissue.

T .media:-

Few layers of smooth muscle fibers with collagen and elastic fiber.

T .adventitia:-

It is the most prominent layer. Contain longitudinal or spiral arranged bundles of smooth muscle fibers that challenge the pressure over the vein especially in abdomen & extremities. It also contain collagen and elastic fibers

3. Blood.

It is consists cells and plasma.

Plasma:-

It is the liquid intercellular material which gives the blood its fluid properties.

Chemically plasma consists of:- Water 91 – 92 % ; Protein 7.8 % protein globulin, albumen, fibrinogen ; other salts 1-2 % . Electrolytes, non protein nitrogenous sub. Regulatory substance, blood gases.

BLOOD CELLS

1- R.B.Cs 2- blood platelets 3- W.B.Cs

* R.B.Cs (Red Blood Corpuscles):-

Biconcave disk like, non nucleated.

Have phenomena of Rulax formation.

Its size and number goat 1 – 4 um 7 million.
 Dogs 7 um 14 million.

Life span about 120 day.

Old cells removed by the reticuloendothelial cells.

New R.B.Cs generated in the myeloid tissue.

E.M.

Mature R.B.Cs have no organelles.

No nuclei, Golgi, Mitochondria, centriole.

Interior of the cell consists of fine granular material.

Plasma membrane surrounds the cell.

Specific component are hemoglobin.

Species Difference in R.B.Cs

* Camel & lama (Tylopoda)

Biconcave, small elliptical, no nucleus.

* Birds, reptiles and fish

Biconvex, medium size, oval and nucleated

* Amphibian (frog)

Biconvex, large, ovoid and nucleated.

Blood Platelets

Small cytoplasmic fragments.

350000 – 500000 in mammals and 2 – 14u in size.

100,000 in Bird (nucleated).

Life span 5 – 9 days.

It originate from the megakaryocyte of the bone marrow

E.M.

Cells have well developed cell coat & surrounded by plasma membrane.

It contains 2 types of granules.

Alpha lysosomal granules.

Very dense granules.

Two system of tubules

(1) One connected to the surface.

(2) One contain electron dense material, it also contain microtubules & filament.

Two definite areas are seen:-

(1) The chromomere “granulomere → intensely stained area. (It contain the microtubules and the filaments)

(2) hyalomere→ lightly stained area .(it contain the tubules , dense granular material and other components).

Number of W.B.Cs are few up to 10000 cells

Life span are few days

Neutrophils:-

- Their size 10- 12 um and represent 60 – 70 of total W.B.Cs.

- Nucleus is lobulated 2 – 5 lobules which are connected by fine chromatin strand.

- The female Neutrophils characterized by small oval nuclear body bar body are seen attached to the main lobe.

- Cytoplasm is pale grayish contain fine dust like granule.

- Immature neutrophils called “Band or juvenile neutrophils which has horse shoe shape nucleus.

Has neutrophilic granules → 80%. (Small, contain bactericidal substance & phosphate).

Has azurophilic granules → 20%. (Oval dense like & contain hydrolytic & peroxidase enzyme

Function

1-Highly phagocytic “microphage”

- 2- They share in the pus formation “died neutrophil plus infected tissue
- 3- They attract the monocyte to the site of infection
- 4- They stimulate the bone marrow → give neutrophils

Eosinophil:-

Its size 12- 15 um and represent 1-5% of the total W.B.Cs

Nucleus is typically bilobed.

The compact hetero chromatin is chiefly adjacent to the nuclear envelope, where euchromatin chiefly present in the center.

Cytoplasm is loaded with large refractile granules which stain with eosin.

It only contain space which represent the membranous organelles expect numerous large elongated granules

Function:-

Contain Histaminase enzyme destroy histamine sulphatase destroy SRS-A as in mast cells.

Accumulate in the site of allergy.

It attracted to the site of allergy by eosinophil chemotactic factor) released by mast cells.

They have very low powerful phagocytic function “it destroy phagocytose Antigen – Antibody Complex.

Basophil:-

Its size 8- 10um and represent 1/2 – 1% Total W.B.Cs.

Nucleus obscured by large granules.

E.M.

Large lobulated nucleus.

Heterochromatin chiefly in peripheral location.

Euchromatin centrally located.

Cytoplasm is coarse basophilic metachromatic granules which stain darker than the nucleus.

Function

Cell secretes heparin, serotonin and histamine.

Basophile related but not identical to mast cell of C.T

GRANULOCYTE

Small Lymphocyte:-

- Mature 6-9um. , represent 20-30% of total W.B.Cs.

- The nucleus is large, spherical, dense, No organelles except Ribsomes.

Non granular cytoplasm with thin pale blue.

They are antibody producing cell, they are covered by microvilli.

LARGE LYMPHOCYTE

- Less mature cell 12-15 um.

- They divided to give medium, small lymphocyte.

- The nucleus → smaller, less dense and indented.

- Cytoplasm → more abundant, pale blue, non granular

- Azurophilic granules may be seen at nuclear indentation.

* Antibody producer.

Lymphocytes are highly motile → head contain nucleus.

While → tail contain rest of cytoplasm “look like Tennis racquet “

- Two types of lymphocytes are known B & T

Monocyte

They are mature cell 15-20um in size and represent 5% of total W.B.Cs.

Nucleus → oval or horse shoe or kidney shape, eccentric position.

Cytoplasm → more abundant, pale grayish blue.

Fine dust like azurophilic granules usually present.

- The cell membrane show pseudopodia

Function →

- Phagocytic cells capable of migrating by amoeboid movement into the surrounding CT change to macrophage and stay for 3 day in the blood.

III- Discuss the function structure relationship of the following:

1. Esophagus.

Epithelium → st. sq. epith. it may be ciliated columnar or cuboidal in some spp.

L. Propria → loose CT

T. Submucosa → fibroelastic CT

T. Muscularis → *outer circular and inner longitudinal and oblique skeletal muscles* then this muscle orientation change caudally and become *smooth muscles*

T. Serosa → loose CT lined by mesothelial cells.

2. Skin.

The epidermis consists of 5 layers. Only in (sole & palm) have 5 layer but in case of thinner epidermis not have 5 layer. It consists of st. sq. epith.

Stratum basale “germinativum”

Stratum granulosum.

Stratum spinosum “prickle layer”

Stratum corneum

Stratum lucidum “clear layer”.

Stratum basale” stratum germinativum.

Basophilic columnar or cuboidal cells rest on basement membrane.

Desmosomes bind it laterally & upper surface.

Hemidesmosome bind it to the basement membrane.

It shows intense mitotic division.

It responsible for the constant renewal of the epidermal cells with the initial portion of the next layer.

E.M → tonofilaments, melanosome, secretory granules. RER, Mitochondria, GA

* Stratum spinosum “prickle layer”

- Polygonal cells with central nucleus.

- It have cytoplasmic process “spine”.

- This layer is firmly bounded together with desmosomes & tonofibrils.

- When it subjected to continuous friction that leads to thickness of tonofibrils

* Both stratum basalis & stratum spinosum called malpighan layer:

* Stratum granulosum:-

Flatten polygonal cells with central nuclei.

Cytoplasm filled granules called keratohyalin granules.

They are non-membrane bounded granules it contain Histidine rich protein granules.

These cells also contain membrane coating granules called “Lamellar granules” = odland bodies. It produced by Golgi complex.

These granules also present in stratum spinosum.

These granules are ovoid or rods like.

It released into the inter cellular space.

It contains mucopolysaccharides & phospholipids.

It act as cement material “act as barrier against foreign bodies”

* Stratum lucidum “clear layer”

It’s translucent layer, homogenous.

Flatten cell & eosinophilic cytoplasm. Both of the nucleolus & cytoplasmic organelles not evident.

Several layer of fully keratinized, closely compacted and dead cells.

Cytoplasm contains dense cytokeratin embedded in amorphous dense matrix derived from keratohyalin granules.

The intermediate filaments & the matrix constitute the immature keratin which sometimes called eleidin.

Stratum corneum:-

These are flattened non nucleated cells

It contains numerous keratin granules.

Several layers of completely keratinized, dead scale like keratinocyte with thickened plasma membrane.

These cells represent final stage of keratin & are filled with mature keratin

Intercellular lipid substance derived from the lamellar granules is present between stratum corneum cells → it forms a complex barrier.

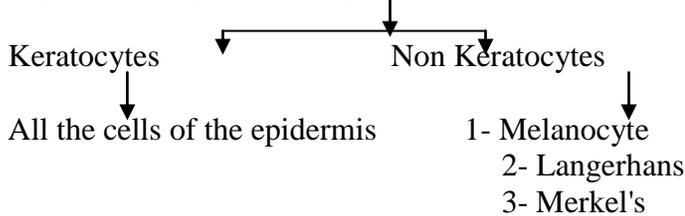
Dead cells are continuously sloughed from the surface.

Soft keratin → must pass through tonofilaments → keratohyalin,

Eleidine → Keratin.

Hard keratin → tonofilaments → keratin

Types of cells present in epidermis.



Keratocytes →

It includes all cells of the epidermis that give keratin of low molecular weight than it increases upward.

Keratin is one component of the cell cytoskeleton & consists of polypeptides.

Melanocyte →

1) It originates from neural crest of the embryo.

It protects against radiation.

There are fixed numbers of melanocytes in all races but the amount of melanin differs in secretion.

It is stellate in shape

Round cell body & irregular extension process.

This extension carries melanin to other cells.

Present between stratum spinosum, basale.

Present in hair follicle.

Melanophore does not synthesize melanin because it has no tyrosinase enzyme. But it phagocytizes melanin “carrier for melanin.”

mesodermal in origin

Melanocyte → forms tyrosinase enzyme by aid of R.E.R and Golgi apparatus.

Langerhans cell

Represent 2- 8% of epidermal cell.

Bone marrow derived macrophage.

Similar to melanocyte.

Related to monocyte-macrophage series.

Star shape “intended” irregular nucleus”

Contain small vesicles & multivesicular bodies.

Contain numerous numbers of lysosomes.

No tonofilaments & contain granules called “Birbeck granules”

Present at top of stratum spinosum.

Act as “immune cell or macrophage”

The lymphocytes accumulate around it in allergy & it migrates from skin to regional lymph node.

Its surface contains Fc, F3, Ia receptors

It may be old melanocyte.

Merkel's cell →

It consider as para neuron involved in sensory reception.

Present in thick skin in palm and sole.

Free nerve ending end in an expanded terminal disc (are present in the base of Merkel cell “no synapses”

It has APUD like activity, sensory cell.

With Best Wishes

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