



## Histology Exam

### (Food quality & control Program)

15 June 2015

Complementary Exam (امتحان تكميلي)

Time allowed: - 3 hours

Please answer the following questions and illustrate your answers with diagrams.

من فضلك دعم جميع الإجابات بالرسوم التوضيحية و لن يلتفت إلى الإجابات الزائدة

#### **A- Describe the functional structural relationship between the following:-**

1. Skin of fish.
2. Synapse.
3. Lymph node.

#### **B- what do you know about:**

1. Spleen.
2. Swim bladder.

#### **C- Write** short notes on your internet research (Classification of nerve cells).

#### **D- Explain the functional structural relationship :-**

1. Gills.
2. Testis of catfish.

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*With Best Wishes*  
*Prof. Dr. Ehab M. EL-Zoghby*  
*Head of the Dept.*



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### A- Describe the functional structural relationship between the following:-

#### 4. Skin of fish.

The popular conception of a fish as a slippery, streamlined aquatic animal that possesses fins and breathes by gills applies to many fishes, but far more fishes deviate from that conception than conform to it. For example, the body is elongate in many forms and greatly shortened in others; the body is flattened in some (principally in bottom-dwelling fishes) and laterally compressed in many others; the fins may be elaborately extended, forming intricate shapes, or they may be reduced or even lost; and the positions of the mouth, eyes, nostrils, and gill openings vary widely. Air breathers have appeared in several evolutionary lines.

Many fishes are cryptically coloured and shaped, closely matching their respective environments; others are among the most brilliantly coloured of all organisms, with a wide range of hues, often of striking intensity, on a single individual. The brilliance of pigments may be enhanced by the surface structure of the fish, so that it almost seems to glow. A number of unrelated fishes have actual light-producing organs. Many fishes are able to alter their coloration—some for the purpose of camouflage, others for the enhancement of behavioral signals.

#### 5. Synapse.

is the site of contact between an axon and another neuron that transmit neuronal information from neuron to other neuron

#### Consists of :-

1- *Pre synaptic element.*

2- *Synaptic cleft.*

3- *Post synaptic membrane.*

#### 1- Pre synaptic element:-

a- Terminal bulb are telodendritic terminal expansion of variable shape (club, bulb and basket)

b- Preterminal bulbs are preterminal axon expansion. The inner leaflet of the terminal and preterminal bulb cell membrane is characterized by increased thickness and cone shaped electron dense protrusions.

c- Synaptic vesicle of varying shapes and size:-

1- **Spherical electron lucent vesicles** (40-50nm) are most common. They are characteristic of terminals that contain the neurotransmitters acetylcholine.

2- **Spherical electron dense vesicles** (40-60nm) are characteristic for monoamine neurotransmitters as norepinephrine, dopamine and serotonin.

d- Other presynaptic organelles as mitochondria, tubular smooth axoplasmic reticulum, neurofilaments.

#### 2- Synaptic cleft:-

It is narrow (15-20nm) cleft present under terminal button, which contain gel like extra cellular fluid. The membrane under the cleft is structureless.

#### 3- Post synaptic membrane:-

Is membranous structure with cytoplasm underneath the terminal enlargement & has parrelled cisternae that constitute the spine apparatus. It contains receptors to which neurotransmitters bind to trigger an excitatory or inhibitory response.

## 6. Lymph node.

Lymph nodes are round or kidney-shaped lymphoid organs which are distributed throughout the body along lymphatic vessel system. All lymph passes through at least one node before it enters the circulatory system. Afferent lymphatic vessels enter a lymph node along the convex surface of the capsule. Efferent lymphatic vessels leave lymph node at a concave depression called the hilum (or hilus). Arteries enter and veins leave the node via the hilum as well. Each node has a dense connective tissue capsule which (like the thymus) sends connective tissue septa or trabeculae into the organ. Reticular cells and reticular fibers form a supporting meshwork which extends throughout the lymph node. In addition, a lymph node contains an inner and outer cortex and a medulla.

### **Cortex**

Afferent lymphatics empty into the subcapsular (or cortical) sinus located immediately beneath the capsule. This sinus connects to the medullary sinuses via intermediate or paratrabecular sinuses which run alongside the trabeculae.

The outer cortex is populated primarily by B-lymphocytes along with macrophages, plasma cells, and reticular cells. Lymphoid follicles are found here.

The inner (or deep) cortex contains mostly T-lymphocytes. This area also called paracortex or paracortical zone. Few lymphoid nodules will be found in this area. Contains specialized vessels called high endothelial venules (HEVs). They are lined with plump, cuboidal endothelial cells with large nuclei. These vessels serve as the point of entry for lymphocytes from the peripheral blood into the lymph node parenchyma.

### **Medulla**

The medulla is composed of medullary cords of lymphatic tissue separated by medullary sinuses which contain lymph.

Medullary cords contain lymphocytes (both T and B), macrophages, and plasma cells. This is the area where plasma cells are formed, and, therefore, where antibody production takes place.

### **Follicles**

Primary follicles are nodules or aggregates of small B-lymphocytes.

When a germinal center develops in a primary follicle, it becomes a secondary follicle. The presence of germinal centers indicates the lymph node is being antigenically-stimulated. The lighter-staining germinal center contains activated B-cells which eventually give rise to antibody-forming plasma cells. The germinal center is surrounded by a cuff of small, dark B-lymphocytes called the mantle zone.

Dendritic Reticulum Cells (DRCs) are found in the germinal center. They trap antigens on their surface and present them to B-lymphocytes. They are long-lived and difficult to see by light microscopy.

The B-cells found in the germinal center are large and have vesicular nuclei. These are proliferating cells, so mitotic figures are not uncommon in this area.

Tingible body macrophages can also be found in the germinal center. These are large cells whose cytoplasm contains phagocytized debris. Because their cytoplasm is not conspicuous (unless it's filled with something), they appear as "clear areas" in the tissue.

### **Circulation of lymph**

Afferent lymphatic vessels → subcapsular sinus → intermediate sinuses → medullary sinuses → efferent lymphatic vessels.

Lymphatic vessels contain one-way valves to assure flow of lymph in proper direction.

## **B- what do you know about:**

### 3. Spleen.

Capsule →

Spleen is surrounded by thick C.T capsule divided into two ill distinct layers ; C.T layer and muscular layer

The thickness of the capsule varies according to the animal species, in which it thicker in horse than ruminant than pig than dog and cat

Trabecula →

Irregular CT trabecula contains collagen; elastic fibers and muscle contain nerve blood vessels and lymph vessels.

Both of the trabecula and the reticular fiber support the parenchyma of the spleen.

CT capsule and trabecula contain myofibroblast which not only contractile but also give extracellular CT fiber.

Hilus → on medial aspect hold passage for splenic artery, nerve lymph vessels & vein.

Spleen hold large volume of RBCs in reverse storage

Parenchyma of the spleen:-

1-White pulp→

It is the lymphatic tissue distributed randomly through out the spleen lymph nodule and as PALS (periarterial lymphatic sheath)

The lymph nodule may or may not contain germinal center according to the functional state.

Principle cells of germinal center are lymphocyte.

T lymphocyte occupy periphery of the nodule & PALS.

The reticular cells & fibers form 3 dimension stroma contain sequestered lymphocyte & plasma cell.

Marginal Zone → at periphery of the white pulp the reticulum form concentric layers, immediately adjacent to the last layer is the marginal Zone.

- Marginal zone is the location through which most blood filter before entering red pulp.
- Also with this area T lymphocyte has initial opportunity to interact with B lymphocyte.
- It's efficient filtering station "functionally significant part of the spleen

NB

- appear basophilic area due to staining of numerous nuclei of lymphocyte 'heterochromatin.

Branch of the splenic artery enter white pulp through capsule & trabecula so called central artery 'the lymphocyte PALS occupies it & replace it so appear eccentric position

Human → germinal center seen by naked eye.

Lymph nodule = splenic nodule = Malpighian corpuscle.

Red pulp

Most of the splenic pulp is red owing to high amount blood held with in reticulum.

- It consists of → splenic sinus (venous sinus).

Splenic cords between sinuses

Splenic Sinuses

Are wide vascular channel lined with elongated longitudinal arranged endothelial cells contain contractile microfilament arranged parallel to lateral cell margin which make stabilization of the endothelial cells.

Gap or slit opening done when contraction that enables Rbcs to pass from cords sinus and pass bet cells.

The cells rest on fenestrated basement membrane and supported by reticular fiber. Some of which encircling the sinus form hoop like structure.

Splenic cord:-

It located between sinuses forming a vast 3 dimension net work composed of

- \* Reticular fiber with enmeshed reticular cells + Rbcs macrophage, plasma cells & leukocyte, lymphocyte.
- \* It's difficult to see all structure red pulp because spleen collapse by death & some structures are obliterated by compression.

#### 4. Swim bladder.

The swim bladder is classified as digestive organ in some species, where it classified as respiratory organ in other species.

The histology of the swim bladder is extremely variable between species but, nevertheless, very important clinically. In some fishes, the swim bladder has essentially the same histology as its origin, the digestive tract. In other fishes, the anatomy of the swim bladder is greatly reduced. There may be no more than an inner mucous membrane layer with a thin outer connective tissue covering.

In sturgeon, pepsin-secreting and mucus-secreting glands are still found in the swim bladder, which has all of the components of a digestive viscus. Most species have swim bladders covered with a simple squamous epithelium over a layer of dense fibrous connective tissue with longitudinal, circular, and oblique fibers arranged in layers.

Guanine crystals, shaped like thin platelets embedded in this connective tissue, give the swim bladder of some species a distinctive silver color. The outer layers of connective tissue are joined to the inner layers of the structure by a loose, elastic, connective tissue layer. The inner epithelium of the swim bladder is commonly cuboidal and may be ciliated, partially ciliated, or completely devoid of cilia. The epithelial layer can include pigment cells. It is supported by a muscularis of smooth muscle in most fishes.

Rainbow trout have a thin muscularis of smooth muscle with many elastic fibers arranged with the outer layer of fibers running longitudinally and inner fibers circumferentially. Perch have a thin-walled swim bladder covered with a peritoneum containing numerous melanocytes. Underneath is a fibrous tunic that covers an inner layer of circular connective tissue fibers. The only evidence of a muscularis is in the region of the oval or gas gland. Some groups of the catfish and loach families have their swim bladder protected within a bony capsule derived from the vertebrae.

The gas gland (oval, red gland, red body) varies widely in shape and form. It is often oval or round but can be a torus or stellate or dendriform. It can occupy a small or large percentage of the swim bladder wall. The gas gland is a highly vascular organ that usually consists of parallel venous and arterial rete mirabile arranged in a counter-current fashion. There are many versions of these glands in different species. In the codfish and the stickleback, only a single pair of retia is formed between the venules and arterioles of the gland. As many as three sets of retia can occur in other species, with retia forming at the capillary, venule/arteriole, and vein/artery levels.

It consists of:-

Simple sq. epith (s.cuboidal or columnar and pigmented)

Dense fibrous CT

Three directions of smooth muscles

Guanine crystals (thin elements present in the CT giving the fish its silver appearance).

**C- Write short notes on your internet research (Classification of nerve cells).**

**D- Explain the functional structural relationship :-**

3. Gills.

4. Testis of catfish.

Sertoli cells are elongated cells that extend from the basal lamina of seminiferous tubules to the lumen. Adjacent, Sertoli cells are joined by tight junctions, thereby dividing the seminiferous epithelium into basal and distal (adluminal) regions, which form an effective blood testis barrier. Sertoli cells play an essential role in the development and maturation of gametes and also serve an endocrine function, as they produce inhibin. Some studies indicate that Sertoli cells multiply during a limited posthatching period and therefore do not proliferate in adulthood. Other studies, however, describe extensive apoptosis of Sertoli cells at the end of the reproductive period in seasonally breeding birds, suggesting the potential for these cells to regenerate in adulthood in preparation for the following breeding season. Sertoli cells express androgen receptors and their adult size and function are hormonally regulated

the egg remains in this region for about 20 hours, during which calcification of the shell and formation of the cuticle take place. water fluid is also added to the albumen. the uterine mucosa forms flat, leaf-shaped, longitudinal folds, the epithelium is a continuous layer of columnar cells with alternating basal and apical nuclei, and these have been named and apical cells.

the basal cells have a restricted apical surface; the apical cell are ciliated.

the tubular glands of the uterus are lined with cells that contain plae sinning granules both before and during the phase of she formation, but which are subsequently depleted.

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*With Best Wishes*

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