

## **LABORATORY 25- LIVER, GALLBLADDER AND PANCREAS**

### **OBJECTIVES:**

#### **LIGHT MICROSCOPY:**

Liver: Recognize each component of liver lobules including hepatocytes, portal canals (tract) and the structures it contains (portal vein, hepatic artery, bile duct, lymphatics and nerve). Understand the structure of the plates of hepatocytes, and observe and distinguish sinusoids, endothelial cells, Kupffer cells and the space of Disse. Also, central veins and other components of blood return (sublobular and hepatic veins). Understand function of each component related to its structure and the flow of materials into and out of the liver. Also, recognize glycogen, Kupffer cells and in the fetal liver observe the distribution of sites of hemopoiesis within the liver before birth. Understand role of liver in bile formation.

Gallbladder: Analyze gall bladder according to its three-layered structure. Note distinctive features.

Pancreas: Recognize exocrine and endocrine regions. Distinguish acini and ducts from those of salivary glands.

#### **ELECTRON MICROSCOPY:**

Liver: Recognize hepatocytes, endothelium, Kupffer cells and fat storing cells of Ito. Observe the distribution of the different cell types within the sinusoids, space of Disse and bile canaliculi.

Pancreas: Observe characteristics of exocrine pancreas.

### **ASSIGNMENT FOR TODAY'S LABORATORY**

#### **GLASS SLIDES**

<a href="#">SL 102</a>	Liver
<a href="#">SL 103</a>	Liver, porta hepatis
<a href="#">SL 7A</a>	Glycogen in liver (normal and fasted)
<a href="#">SL 7B</a>	Glycogen in liver (normal, predigested with amylase)
<a href="#">SL 67</a>	Liver of rat injected with trypan blue
<a href="#">SL 69</a>	Liver, premature baby, also gall bladder, premature baby
<a href="#">SL 104</a>	Bile in liver
<a href="#">SL 105</a>	Gallbladder, dog
<a href="#">SL 106</a>	Gallbladder, human
<a href="#">SL 107</a>	Common bile duct
<a href="#">SL 54</a>	Hepatopancreatic ampulla, also Pancreas, child
<a href="#">SL 108</a>	Pancreas
<a href="#">SL 2A</a>	Pancreas, distribution of RNA and DNA
<a href="#">SL 2B</a>	Pancreas, distribution of RNA and DNA, RNase treated
<a href="#">SL 109</a>	Pancreas, alpha and beta cells

#### **ELECTRON MICROGRAPHS**

Liver: EMs 1, 5, 13, 14, 17 Liver  
Texts: J. 16-13, 16-16, to 16-21; W. 15.12

Gallbladder: J. 16-27

Pancreas: J. 16-8, 16-9; W. 15.15c

#### **POSTED ELECTRON MICROGRAPHS**

# 25 Liver  
# 76 Pancreas

[Lab 25 Posted EMs](#); [Lab 25 Posted EMs with some yellow labels](#)

(Continued on the next page)

**HISTOLOGY IMAGE REVIEW** - available on computers in HSL  
Chapter 15, Liver, Pancreas and Gallbladder  
Frames: 1014-1053

**SUPPLEMENTARY ELECTRON MICROGRAPHS**

Rhodin, J. A.G., An Atlas of Histology  
Copies of this text are on reserve in the HSL.  
Liver, gallbladder and pancreas pp. 332 - 343

## I. LIVER

The histological organization of the liver is complex. As an aid to understanding the structural-functional relationships of this organ, review diagrams in text. (J. 16-10, 16-11, 16-14, 16-15, 16-17, 16-19, 16-22 to 16-24; W. 15.7 and 15.5)

A. NORMAL LIVER SL 102. This slide illustrates the main histological characteristics of human liver.

1. Observe the lobules of the liver. Portal canals indicate the periphery of each lobule (blue line) and a central vein (green arrow) is located in the center.
2. Examine several portal canals (1, 2, 3) and try to find the five structures that they contain: 1) branch of portal vein, 2) hepatic artery, 3) bile duct, 4) nerve (nerve, blue circle) and 5) lymphatic vessels. Often there are duplicates of these structures (portal vein, green circle; bile duct, blue circle; hepatic artery yellow, circle). The smallest portal canals are the ones that feed the lobules. Which structures contain material leaving the liver? Where are the products that are found within each of these vessels formed?
3. Using this section locate veins of different sizes: central veins, sublobular veins and hepatic vein (note that Wheater's uses the terms *terminal hepatic venule* and *intercalated vein* for central vein and sublobular vein, respectively). These veins are not associated with the portal canals. Connective tissue is evident surrounding sublobular and hepatic veins (central vein, blue arrow; sublobular vein, green arrow; hepatic vein, black arrow). How do the veins relate to each other? How can they be distinguished from each other?
4. Examine hepatocytes, sinusoids and the endothelial cells that line the liver sinusoids. Is the space of Disse evident? (endothelial cells yellow arrows; space of Disse, blue arrows)
5. Observe the thick capsule of connective tissue that surrounds the liver (Glisson's capsule).
6. Electron microscope (J. 16-16 to 16-21; W. 15.12)
  - a. In EM 17 observe the following structures:
    - Sinusoid 17-1
    - Endothelium 17-2
    - Space of Disse (numerous microvilli from hepatocytes are evident) 17-3
    - Bile canaliculus 17-4
  - b. In addition, observe EM 1, 5, 13, and 14. Review cellular organelles and inclusions as related to function.

B. LIVER (section through porta hepatis) SL 103 This slide shows all of the structures demonstrated in SL 102. In addition, observe: Portal vein, hepatic artery, hepatic duct, nerves and lymphatics. **NOTE:** Many slides do not show all the structures.

The next four slides demonstrate several functions of the liver.

C. GLYCOGEN WITHIN LIVER SL 7A and SL 7B (W. 15.2b) This slide is stained to show the distribution of glycogen within rat liver. Sections are derived from: a normal rat and a fasted rat (SL 7A), and a normal rat with glycogen removed from the tissue by the enzyme, amylase (SL 7B).

- D. LIVER - LOCALIZATION OF TRYPAN BLUE [SL 67 \(high\)](#). (W. 15.9) This section of liver from a rat injected with trypan blue shows that dye has been accumulated by certain cells of the liver ([red arrows](#)).
1. The dye is localized in macrophages. What are the macrophages of the liver called? Where in the liver lobules are these cells located?
  2. What is the origin of the macrophages?
- E. LIVER, PREMATURE BABY [SL 69](#). This section shows hemopoiesis occurring in the liver lobules. The abundance of [pyknotic nuclei](#) suggest that more white or red blood cells are being formed?
- F. LOCALIZATION OF BILE [SL 104 \(med\)](#). A major function of the liver is secretion of bile. Due to a pathological condition this liver was prevented from secreting bile and the bile has accumulated in hepatocytes ([blue arrows](#)). Bile was precipitated in the liver cells by fixing tissue with barium chloride. The bile appears as a brownish precipitate that may be difficult to see in some slides.

## II. GALLBLADDER AND BILE DUCTS

- A. GALLBLADDER (DOG) [SL 105 \(low, med\)](#). (J. 16-26; W. 15.13, Note: disregard reference to submucosa). Slide shows lower portion approaching neck with partial attachment to liver.
1. Mucosa - Usually has characteristic folds.
    - a. Epithelium - tall columnar cells - single cell type. For what function is epithelium adapted?
    - b. Lamina propria - diffuse lymphoid tissue. Mucous glands limited to neck region.
  2. Muscularis - Smooth muscle lacks organization of intestine ([between blue arrows](#)) .
  3. Adventitia or Serosa depending on region of gall bladder. Which is present in your slide?
  4. Electron microscope - Note features (J. 16-27).
- B. GALLBLADDER (HUMAN) [SL 106 \(scan, med\)](#) Although typically the mucosa is folded as in this slide, these folds disappear when the organ is distended.
- C. GALLBLADDER (PREMATURE BABY) [SL 69](#). Note structures not as well developed, especially the muscularis. You will not need to make the distinction between adult and fetal gall bladders.
- D. COMMON BILE DUCT [SL 107 \(scan\)](#). If your slide shows only one lumen, it is the common bile duct of a dog. If it shows 2 lumina it is the hepatic and/or cystic duct from a monkey. You won't have to distinguish between species, or whether or not a bile duct is common hepatic, common bile, etc. Just recognize a bile duct when you see it
- E. HEPATOPANCREATIC AMPULLA (AMPULLA OF VATER). [SL 54 \(scan\)](#). This slide shows the ampulla close to or piercing the duodenal wall.

*Pancreas on next page*

### III. PANCREAS

The four regions (head, neck, body and tail) of the pancreas are indistinguishable in histological structure except that the endocrine portions of the gland, the islets of Langerhans are more numerous in the tail.

- A. [SL 108](#) ([low](#)). (J. 20-18, 16-6, 16-7; W. 15.14, 15.15)
1. Observe the serous acini. In the cells of the serous acini there are apical secretory granules that vary in number in different acini throughout the gland, indicating various stages of secretion ([med](#), [oil](#)).
  2. Study lobules and the duct system ([long](#), [cross 1](#), [cross 2](#)). Compare the pancreas to the parotid gland. What type of duct is absent from the pancreas?
  3. Observe the [islets](#) of Langerhans ([within red circles](#)) (J. 20-18, to 20-23). What are the products of the islet cells?
  4. What are the functions of the serous acinar cells and the cells of the ducts?
  5. Electron microscope - Review (exocrine pancreas: J. 16-8, 16-9; W. 15.15c; islets: J. 21-12).
- B. [SL 2A](#). and [SL 2B](#). Stained for RNA and DNA ([low](#), [med](#)) - In section that is deep blue ([SL 2A](#)) note the exocrine (acini) and endocrine portion (islets) of the gland ([endocrine portion within red circles](#)). Section [SL 2B](#) is the same tissue predigested with RNAse before staining.
1. Note [centroacinar](#) cells and intercalated ducts can be seen more easily on this slide.
  2. Is there any staining of the cytoplasm in the cells of the islets ([red circles](#))?
  3. Review the ultrastructural characteristics of protein secreting cells and relate them to the staining feature of the serous acinar cells on this slide.
- C. PANCREAS (MONKEY) – [SL 109](#) ([med](#)). (J. 21-19 to 21-21; W. 17.21 to 17.23) - Tissue fixed in Zenker's fixative and stained with Gomori's chrom-alum-hematoxylin and phloxine to demonstrate Alpha (red) and Beta (blue) cells. What other cell types occur in the islets of Langerhans? What are the hormones secreted by each cell type?
- D. [SL 54](#) ([scan](#), [low](#), [med](#)). Pancreas, mesenteric lymph nodes, upper duodenum and hepatopancreatic ampulla ([enclosed within green line](#)) (child). This slide is useful as a review of these organs.

## **OBJECTIVES FOR LABORATORY 25: LIVER, GALL BLADDER, PANCREAS**

1. Using the light microscope or digital slides, identify:

Liver

Capsule (of Glisson)

Lobule

Central vein

Portal triad (also observe at porta hepatis SL103)

Hepatic artery

Hepatic portal vein

Bile duct

(nerves and lymphatic vessels – seen at porta hepatis SL103)

Hepatocytes

Glycogen

Bile (with special staining)

Kupffer cells

Sinusoids

Endothelial cells

Veins

Central vein (same as above)

Sublobular vein

Hepatic vein

Gall bladder

Mucosa

Muscularis

Adventitia / serosa

Bile duct

Hepatopancreatic ampulla (of Vater)

Pancreas

Serous acini

Ducts

Intercalated ducts

Centroacinar cells

Pancreatic islets (of Langerhans)

2. On electron micrographs, identify:

Liver

Hepatocyte

Sinusoid

Endothelial cells

Space of Disse

Bile canaliculus

Pancreas

Exocrine cells

Endocrine cells

## **REVIEW**

1. What cells form bile? How does it leave the liver?
2. What cells form trypsinogen? Where does it become activated?
3. What cells form insulin? In general, what is its function? How does it reach its destination?
4. Compare the histology of the pancreas and the parotid gland. What type of alveoli found in the submandibular and sublingual glands differentiate them from the pancreas and parotid gland?