



(REVIEW ARTICLE)



## Histological study of liver for squirrel (*Sciurus anomalus*) (Güldenstädt, 1785) in Iraq

Noor Hussein Yousif\*

*Iraq Natural History Research Center & Museum, University Of Baghdad, Iraq.*

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### Abstract

The liver (hepatic) is one of the largest glands or organs of the digestive system in the body of living organisms, including rodents, take the squirrel in this study for example. The study and the collection of sources emerged to be put into the hands of those, especially those interested in histological studies, including junior or professionals and veterinarians, knowledge of the stains used in the research and their final results.

**Keyword:** Hepatic; Hepatocyte; Histology; Liver; Squirrel

### 1. Introduction

Rodents are among the most important mammals that are used in laboratories for scientific research (1). The Caucasian squirrel is one of the rodents scattered in the forests of the Middle East, defining (East and Southwest Asia are 1 of 28 species in the genus *Sciurus*). Its external appearance is medium size, it is grayish-brown in color, and there is a yellowish-orange color shown on the back area (2,3). It is known that histology is one of the essential sciences through which it is possible to differentiate various between the normal and pathological structure of cells (4,5) The sources are concurrent the liver is the largest organ of mammals. It contains several lobes of 4-5 surrounded by connective tissue and vascular forming the fibrous capsule (6). The liver has one of the largest endocrine glands in the body belonging to the digestive system. It contains two types of exocrine secretion, which are bile production and endocrine secretion, which is the production or secretion of the protein, in addition to several functions of the liver, storage, and synthesis lipid portion of lipoprotein; metabolic activities, and amino activities. It is considered one of the important organs in the embryonic formation and detoxification of harmful organ substances (7,8) . The parenchyma of the liver is surrounded by a group of lobules supported by a fine network fiber. The blood, nervous and lymphatic nutrition enters the liver from the concavity area of the hilus, The parenchyma is the sinus of connective tissue of cells macrophages or Kupffer cells (9,10).

### 2. Technique Stain & examination

The histological techniques used in the fixation the sample by formale aldehyde, it is washed and dried, it is passed under a series of ascending alcohols (ethyl alcohol) then a sample is embedded in xylol to clear it, and the last is placed in paraffin wax this block cut to a thickness of 4-6 micrometers and then dyed with the following stains :

- Hematoxylin, Harris and Eosin .
- Mason dye is rich in collagen for collagen fibres.
- General Chephus Acid Cycle (PAS) Technique
- Carbohydrates, McManus (11,12).

\* Corresponding author: Noor Hussein Yousif  
Iraq Natural History Research Center & Museum, University Of Baghdad, Iraq.

### 3. Methodology of research

#### 3.1. Scientific classification

Kingdom: Animalia  
 Phylum: Chordata  
 Class: Mammalia  
 Order: Rodentia  
 Family: Sciuridae  
 Genus: *Sciurus*  
 Species: *S. anomalus* (13)

#### 3.2. Liver histology

Scientists have unanimously of one accord that the liver has a complex gland covered by a thin peritoneal epithelium of flattened cells resting on the basement membrane of fibrous connective tissue composed of collagenous fibers With a number of fibroblasts, each lobe is subdivided into numerous lobules. The interlobular connective tissue is limited to the portal duct at the angle of the lobules (14,15).

Mentioned (16,17) In Marwari goat and in black. The livers of two species of *H. javanicus* and *S. carolinensis* It was covered with a layer of flattened epithelial cells The cells are scattered with the can be seen muscle fibers deep liver portion of *S. carolinensis* .European bison (18) and African palm squirrel (19). these research results of camels and pigs are not consistent with the results, where the hepatic lobules were found to be hexagonal in shape, with thick, defined and clear borders interlobular septa. The parenchyma of the liver is formed from hepatic cells arranged in thick cords called hepatic cords with central veins (20,21) . The hepatic chords are arranged in a radially arranged manner around the central vein, which is the heart of the lobes, extending parallel to the capsule and just below it. enclose the hepatic sinusoids, which have large lumens. In both animals, the hepatocytes were polyhedral shaped with a centrally located, large, spherical nucleus in which more than one distinct dark nucleoli were present (22) . research Studies have observed that hepatocytes are binuclear few in number in the liver tissue. Hepatocytes are responsible for the physiological functions of the liver (20). Through comparative research, it was found that the human liver has a thicker capsule than some rodents and Hepatocytes the lobular, interlobular, biliary systems, differ from those of rodent (23) (Fig:1)

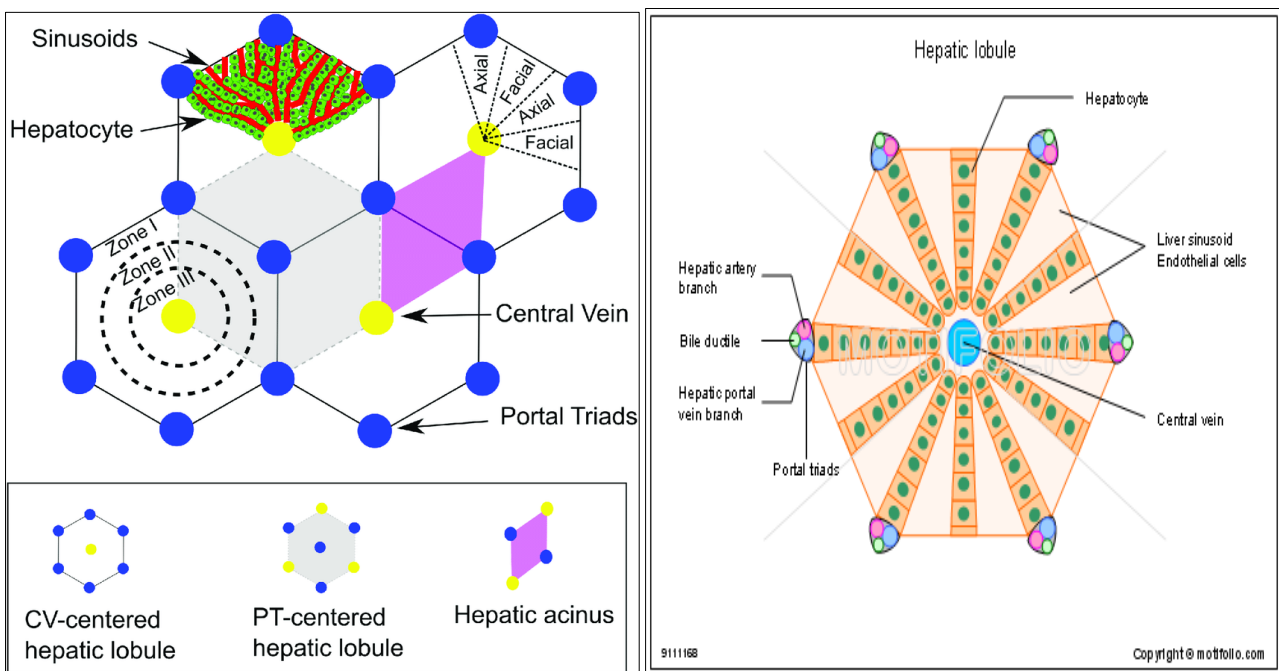


Figure 1 projects show the hepatic lobule histological and portal area with sinusoids

### 3.3. Liver of squirrel

Embryonal, the liver of squirrels develops from the primitive gut. The hepatocytes result in glandular liver cells separated by wide vascular ducts, Food after being absorbed by the stomach passes into the liver via the hepatic portal vein directly (24,25). Studies of squirrel livers indicated that several external factors may affect the shape of the hepatocytes, including mechanical stress, surface tension, environment, and genotype, based on which the animals adapt to the live environment. in squirrels cytoplasm eosinophilic hepatocytes containing fewer vacuoles and more fine granules. The hepatic sinusoidal spaces are regular in shape, filled with several erythrocytes, lined with endothelial cells, and phagocytic Kupffer cells lined up in the sinusoid (26).

The former cells from the main type in the liver sinusoidal lining with a dark elongated nucleus, while Kupffer's cells have fewer numbers that are easily recognized for their being oval in shape with their pale stained. Kupffer cells have a role in removing foreign bodies Toxic substances from portal blood. The branches of the bile duct are surrounded by thick connective tissue covered with muscle fibers, The solitary bile duct in the liver was lined by typical cuboidal biliary cells and was covered by a thick layer of collagen fibers (26) .

In (19) also has proved the capsule surrounds the dense irregular connective tissue of the liver, The liver parenchyma contained hepatocytes and it was the radial arrangement, The liver is lobed and the hepatocytes are polygonal in shape, bordering the central vein, Both the hepatic artery and vein are lined with simple squamous epithelium. The tunica media contains smooth muscle, tunica intema separated from it by the internal elastic laminar.

The bile duct is lined with a simple cuboidal epithelium with nerve fibers. The hepatic sinus is Lined with intermittent lining and was connective. Seen in the space under the sinuses.

Researchers have not proven differences in the tissue architecture of all types of squirrels. On this fundamental, this brings study.

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## 4. Conclusion

There are no extensive studies on this search, information was collected from research in general for all types species of squirrels studied, and it is recommended to conduct research especializing in squirrel liver histologically because it is rare in Iraq.

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## References

- [1] Nzalak J. O, Onyeanusi B.I, Salami and S.O. Macrometric study of the digestive system of the African giant rat (*Cricetomys gambianus*, Waterhouse 1840). *Eur. J. Anat.*, 2012, 16 (2):113-8.
- [2] Koprowski, J. L, Gavish, L, & Doumas, S. L. *Sciurus anomalus* (Rodentia: Sciuridae). *Mammalian Species*, 2016, 48 (934), 48-58.
- [3] Boukhdoud, Liliane, et al. First mitochondrial genome of the Caucasian squirrel *Sciurus anomalus* (Rodentia, Sciuridae). *Mitochondrial DNA Part B Resou*, 2021, 6.3: 883-885.
- [4] Copenhaver, W. M. (1964). *Bailey's Textbook of Histology*. The Williams and Wilkins Company, Baltimore.
- [5] Banks, W. J. (1993). *Applied Veterinary Histology*. Third Edition, Mosby Books, USA.
- [6] Petcoff G M, Díaz A O, Escalante A H and Goldemberg A L, *Histology of the liver of Oligosarcus jenynsii* (Ostariophysi, Characidae) from Los Padres Lake, Argentina. *Iheringia, Sér.Zool.* 2006, 96 (2), 205-208.
- [7] Akiyoshi, H. & Inoue, A. Comparative Histological Study of Teleost Livers in Relation to Phylogeny. *Zoolog. Sci.*, 21 (8):841-50, 2004.
- [8] KADHIM, Khalid H.; KARIM, Abdulkarim J.; KADHIM, Khalid K. Histological and histochemical study of the liver and gall bladder of adult male common carp *Cyprinus carpio*. *Plant Arch*, 2020, 20.1: 438-442.
- [9] Tacke, Frank. Targeting hepatic macrophages to treat liver diseases. *J.Hepatol.Suppl.*, 2017, 66.6: 1300-1312.
- [10] Carollo, V.; Giancamillo, D. A.; Vitari, F.; Schneider, R. & Domeneghini, C. Immunohistochemical Aspects of Ito and Kupffer Cells in the Liver of Domesticated and Wild Ruminants. *Open J. Vet. Sci.*, 2 (3):129-36, 2012.
- [11] NAFADY, Allam AM, AWADALLA, Eatemad A. *Journal of Advanced Trends in Basic and Applied Science* Vol. 1, No. 2: 148-158, 2017.

- [12] Singh, Himanshu, et al. Fixation and fixatives: roles and functions—a short review. *DJAS*.2019, 7.02: 051-055.
- [13] Khalili, Farzaneh; Malekian, Mansoureh; Sadeghi, Maedeh. Habitat suitability modelling of Persian squirrel (*Sciurus anomalus*) in Zagros forests, western Iran. *J Wildl Biodivers*, 2018, 2.2: 56-64.
- [14] EL-SALKH, Boshra A., et al. Anatomical, Histological and histochemical studies on some organs of true desert rodents in the Egyptian habitats. *Egypt J Hosp Med*, 2008, 33.1: 578-306.
- [15] Rajathi, S., Et Al. Morphology of the Gall Bladder and Extrahepatic Ducts in the Postnatal Ages of Guinea Pig. *Int. J. Curr. Microbiol. App. Sci*, 2020, 9.6: 1110-1116.
- [16] Madhan K E and Raju S Comparative Histology of human and Cow, Goat and Sheep liver. *Journal of Surgical Academia* 2014, 4 (1), 10-13.
- [17] Madhu D (2013) Morphological studies on the visceral organs of wild ruminants. M.V.Sc. Thesis. Department of Veterinary Anatomy and Histology, Veterinary College, Sciences University, BIDAR: 129.
- [18] Prunescu P P, Prunescu P, Krasinska M and Krasinsk Z, A Liver histological structure in adult European Bison. *Bison bonasus* (Linnaeus, 1758). *Folia Morphol*. 2002, 61 (3), 137–142.
- [19] Ikpegbu E, Nlebedum U C, Nnadozie O and Agbakwuru I O) The Liver Micromorphology of the African Palm Squirrel *Epix erusebii*. *Int. J. Morphol*. 2014, 32 (1), 241-244.
- [20] Frappier B L (2006) Digestive system in Dellmanns text book of veterinary histology (eds. Eurell J A and Frappier B L). 6th edn., Black well publishing. pp: 201-206.
- [21] Mathur R (2012) Gross and histological studies on the liver of Marwari goat (*Capra hircus*). M.V.Sc. Thesis. Department of Veterinary Anatomy.College of Veterinary and Animal Science:100pp.
- [22] Alshamarry H A, Sucar D K and Taha T J Comparative Histological study for The Iraqi. Camels (*Camelus dromedarius*) liver & Cows (*Bos indicus*). *Journal of Thi-Qar Science* 2010, 2 (3), 39-48
- [23] Al-Samawy, E. R., Waad, S. K., Hashim, W. S., & Alabbas, G. (2019). Comparative Histology of Human, Rats and Rabbits Liver. *Indian J Public Health Res Dev*, 10 (5).
- [24] Ezenwaji, N. E., Obiekwe, E. C., & Nwaigwe, C. O.). Histological Studies of Some Organs of Squirrels (*Xerus erythropus*) in Tropical Ecological Zone. *Animal Research International*, 2013, 10 (1), 1689-1698.
- [25] Adamu, K. M, et al. *Direct Research Journal of Biology and Biotechnology*. 2021.
- [26] AL-Aamery, Rana Alaa, et al. morphological description and comparative histological study of the liver in two iraqi mammals: weasel (*herpestes javanicus*) and eastern gray squirrel (*sciurus carolinensis*). *Biochem. Cell. Arch*. 2020 Vol. 20, No. 1, pp. 167-170.