

The Study of Retinal Structure in Frugivorous Bat (*Rousettus Aegyptiacus*) By Light And Electron Microscope

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Abstract

Vision is fundamentally important sense in animals for perceiving their environment, but in bat less well known. In present study, the retinal tissue of the frugivore bat (*Rousettus aegyptiacus*) was examined by light and electron microscope. So 5 male bats weighing of 123 ± 0.8 g were anesthetized, dissected, and their retina was removed. The sections (1×1 mm) were isolated, fixed in 4% glutaraldehyde and 2% paraformaldehyde (1hour) and rinsed with sodium cacodylate buffer (0.1). They were post fixed in osmium tetroxide 1%. The semithin sections ($0.5 \mu\text{m}$) were stained with Toluidine blue, and the ultrathin sections (70 nm) were prepared. The retinal cells and layer thickness were measurements by Grids-sterolite software. Obtained data were analyzed by ANOVA and t test ($p < 0.05$). Findings showed that the ratio of the eye's diameter to the body length was 1:18.83. Retina layers conform to the general mammalian blueprint, but in wavy pattern with $106.61 \pm 16.19 \mu\text{m}$ thickness. Inner nuclear layer was the thickest layer (18.52 ± 1.55). Retina is duplex with dominant rod cells especially in centralis [$\approx 25 \text{ cell}/(100 \mu\text{m})^2$], Cone/ Rod ratios: 1/ 7.95, and four other cell types with different density and distribution were seen. According to obtained results, this species of bat can be active in both dim light and daylight.

Keywords: Dim light, Duplex retinal, Megabat, Photoreceptor, Stereological study

Introduction

Eye is the most important sensory receptor in animals, and this organ is different in diurnal and nocturnal animals. The retina as a major area of image formation and object recognition is a neural layer with variety of cells include photoreceptor cells and associated neurons (Masland 2012). There is a significant difference in photoreceptor population and their distribution in diurnal animals compared to nocturnal one (Agbaga et al. 2018).

Bats with almost 1400 known species comprise about a quarter of mammals and widespread throughout world (Burgin et al. 2018). They are benefit animals in ecosystem and divided to subspecies of Megachiroptera with large eye (Boonman et al. 2013) and Microchiroptera with small eyes and poor eyesight (Greiter, and Firzlaflaff 2017). They have diurnal and nocturnal species and respond to moonlight intensity (Appel et al. 2017).

Although the anatomy and histology of bat's eye is similar to that of other mammals, but due to their adaptation to different habitats and habits, proportional differences in thickness of layer, density and distribution of retinal cells, is seen (Muller et al. 2007, 2013). The documented research showed that bat's vision is dichromatic color and UV-sensitive cones that aid them in orientation, foraging and prey detection in night (Muller et al. 2009; Gorresn et al. 2015).

Rousettus aegyptiacus (Geoffroy 1810) is frugivorous bat that unlike the other megabat use echolocation for orientation. They produce ultrasounds by the tongue banging on the mouth wall (Lee et al. 2017) or with their wing (Boonman et al. 2014). They live in dark roosts, but able to detect small differences in brightness and hunt during the day in sunlight. The histological study of their eye showed that their retina with undulating pattern is a unique feature among mammals (Bojarski and Bernard 1988). Although some research about structure of eye in the domestic animal have been done in Iran (Esfandiari et al. 2008; Saberi and Golami 2013; Rezaii and Mohamadpour 2015), but present study about the retinal histology of *R. aegyptiacus* including layers thickness, cells morphology, cell density and distribution was performed for

the first time in Iran.

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