Short Communication

An Unusual Organelle in the Pineal Gland of the Rat

M. Evelyn McNeill*
Department of Anatomy, School of Medicine, East Carolina University, Greenville, North Carolina, U.S.A.

Summary. An electron microscopic survey of pinealocytes from normal rats revealed a highly organized arrangement of cytoplasmic tubules. Such tubules had been previously observed in normal rats (Lin, 1967) and in rats after melatonin administration or two weeks exposure to darkness (Freire and Cardinali, 1975). In a later publication the presence of the tubules was attributed to experimental manipulation resulting in infertility (Gusek, 1976). The present study resolves the discrepancy in the literature by establishing that the tubular organelle does indeed occur in untreated male rats, but rather rarely.

Key words: Pineal – Rat – Unusual organelle – Ultrastructure.

Introduction

In an electron microscopic study, Lin (1967) observed for the first time a peculiar and highly structured configuration of tubules in the cytoplasm of rat pinealocytes. He referred to the structure as a "canaliculate lamellar body" and found it in pineals of both male and female rats between two months and two years of age including rats in late pregnancy, animals maintained either in continuous light or in constant darkness for one week, and in untreated normal rats. Similar structures ("annulate lamellae") were observed by Freire and Cardinali (1975, see Fig. 13) after melatonin administration or exposure to darkness for two weeks. The same configuration ("Mikrotubuli") was recently reported by Gusek (1976, see p. 144) in sexually mature male rats after hormonal castration by cyproterone acetate. He found them only in animals treated with cyproterone acetate. The
The purpose of the present study was to investigate the pineal's ultrastructure in untreated male rats with special emphasis on the search for the canaliculate lamellar body described by Lin (1967).

**Materials and Methods**

Twenty two normal adult male Holtzman rats, housed in individual cages under diurnal artificial lighting (lights on from 7:00 A.M.-7:00 P.M.) and provided water and commercial lab chow ad libitum, were decapitated between 10:00 A.M. and noon during May, June and July. The pineals were fixed in 2.5% cacodylate-buffered glutaraldehyde for two hours, and postfixed for one hour in 2% phosphate buffered osmium tetroxide, stained en bloc with uranyl acetate-maleic acid, dehydrated, and oriented in Epon to be sectioned horizontally, frontally or sagittally. Thin sections were stained with lead citrate and examined with a Philips 201 electron microscope.

**Results and Discussion**

The canaliculate lamellar body was observed in four of the 22 glands surveyed. When present it lies consistently in close proximity to lipid droplets (Fig. 1) and to rough endoplasmic reticulum (Fig. 2). Cytoplasmic aggregates of ribosomes accompany the structure (Fig. 2). The characteristic and uniform appearance of the organelle is that of closely packed lamellae stacked at right angles to a membrane containing periodically spaced annular pores. The average diameter of the pores is 550 Å, the distance between being about half the diameter of the pores. Intercellular spaces, canaliculi, and the canaliculate lamellar body are shown in relation to the perivascular space (Fig. 1). Canaliculi can be distinguished from perivascular spaces as they appear empty in electron micrographs (Fig. 1).

The configuration of this organelle with precisely arranged tubules running in a plane perpendicular to the lamellae is so characteristic that it is unmistakably the organelle described by Lin (1967), by Freire and Cardinali (1975), and by Gusek (1976). The occurrence of these tubules and a possible functional role are considerations which appear worthy of attention.

While the organelle is seen in pinealocytes of untreated rats, it does not occur as consistently as other organelles. Neither Ariëns Kappers' (1969) nor Wolfe’s (1965) extensive studies of the rat pineal depict the exact structure in question though the “cisternal grille” in Figure 20 of Wolfe’s article is somewhat comparable as pointed out by Lin (1967). Lin (1967) stated that many cells were surveyed before the canaliculate lamellar body was noticed. He observed the structure in both normal and experimental rats but did not comment on its incidence. A plethora of references in the literature fails to describe the organelle in other animals.

The pineals in Lin’s study were obtained from male and female Long-Evans rats; those in Gusek’s and in Freire and Cardinali’s studies from Wistar males, and those in the present study from Holtzman males. The paucity of its reported incidence therefore is not due to strain or sex specificity.

The functional state of the animal may also determine the incidence of the structure. It is conceivable that the season of the year, hour of sacrifice, and stage of sexual maturity might influence the occurrence of the organelle. Gusek (1976)