Ultrastructural observations on the pineal gland of the Chinese hamster, *Cricetulus griseus*

I. The superficial pineal

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Summary. The ultrastructure of the pineal parenchymal cells, pinealocytes and glia-like cells, of the Chinese hamster (*Cricetulus griseus*) is described. Pinealocyte nuclei contain spindle-shaped inclusions consisting of bundles of closely packed parallel filaments of about 8 nm in thickness. Mitochondria contain lamellar and tubular cristae. Smaller and larger mitochondria are usually localized separately in individual pinealocytes. Flattened mitochondria contain two to four closely arranged, unusual lamellar cristae, which lie parallel to the surface of the mitochondria. These cristae exhibit particular structures. Rough endoplasmic reticulum is frequently found in close association with such flattened mitochondria. Tubular expansions of the outer membrane of mitochondria occur frequently. The pinealocyte cytoplasm contains stacks of flattened cisternae, which are continuous with both smooth and rough endoplasmic reticulum. Pinealocyte cell bodies and processes contain granulated vesicles. Although larger granulated vesicles measuring up to 300 nm in diameter occasionally occur, smaller granulated vesicles (about 100 nm in diameter) and larger ones are usually localized separately in individual cells. Vacuoles containing flocculent material are found in groups in close association with rough endoplasmic reticulum. Glia-like cells with darker cytoplasm and nuclei lie surrounding pericapillary or intercellular spaces. The glia-like cells are characterized by the presence of abundant lipid droplets and occasional pigment granules. Bundles of filaments run parallel to the long axis of the processes of the glia-like cells.

Key words: Pineal gland – Ultrastructure – Chinese hamster (*Cricetulus griseus*)
The pineal gland of the Syrian hamster has been examined electron microscopically by many investigators (Sheridan and Reiter 1968, 1970; Bucana et al. 1971, 1973, 1974; Clabough 1971; Lin et al. 1975; Sheridan 1975; Sheridan and Sladek 1975; Sheridan and Walker 1975; Barratt et al. 1977; Hewing 1978, 1980). The ultrastructure of the pineal gland of the Chinese hamster (Cricetulus griseus), however, has not previously been described. Our recent preliminary observations revealed that morphological features of the pinealocytes of the Chinese hamster exhibited remarkable diurnal rhythms (Matsushima and Morisawa 1981). The purpose of this study is to describe the ultrastructure of the pineal parenchymal cells of the Chinese hamster. On the basis of these observations, subsequent quantitative morphological studies on the pineal gland of this species will be undertaken.

Materials and methods

Male Chinese hamsters (Cricetulus griseus) used in this study were originally raised at the Department of Biological Sciences, Asahikawa Medical College, under diurnal lighting conditions with lights on from 5 a.m. to 7 p.m. At the weaning period (20–30 days of age) the animals were transferred to our laboratory with lights on from 7 a.m. to 7 p.m. The temperature was maintained at 23 ± 2 °C throughout the experiments. Seven hamsters aged 60–70 days were killed at 1 p.m. by decapitation. The pineal glands were immersed in a mixture of 4 % paraformaldehyde and 1% glutaraldehyde in 0.1 M cacodylate buffer (pH 7.4) for 30 min at room temperature. The glands were then postfixed in 1.33 % osmium tetroxide in 0.067 M s-collidine buffer (pH 7.4) for 1 h at 4 °C. Following postfixation, the tissues were block-stained with 0.5 % uranyl acetate in water at 4 °C for 15 h, dehydrated and embedded in Spurr’s plastic (Spurr 1969). Thin sections were cut on a Sorvall MT2 microtome, stained with lead citrate for 5 min and examined with a Hitachi HS-8 or a Hitachi HU-12A electron microscope.

Results

The pineal gland of Chinese hamsters is primarily divided into the distal and proximal portions, i.e., the superficial and deep pineal, which lie directly under the confluence of sinuses or between the habenular and posterior commissures, respectively (Gregorek et al. 1977). These two main parts are connected by a narrow strand of pineal parenchymal tissue, the pineal stalk. This study is concerned with the ultrastructure of the superficial part of the pineal gland. Pineal parenchymal cells of the Chinese hamster are, based on their ultrastructural features, classified as pinealocytes and glia-like cells, which represent the major and minor cell types, respectively. In this study, a small number of so-called dark pinealocytes with dark cytoplasm and nuclei were identified. Since light and dark pinealocytes exhibited similar ultrastructural features except for the difference in their electron opacity, these may belong to the same cell type.

Fig. 1. Pinealocyte (PN pinealocyte nucleus) and glia-like cell (GN glia-like cell nucleus). Smooth endoplasmic reticulum and microfilaments are accumulated in the perikaryonal cytoplasm of the pinealocyte. Cell body and processes of the glia-like cell surround a pericapillary space. ×8,200

Fig. 2. Pinealocyte nucleus containing a spindle-shaped filamentous inclusion, an end of which lies in close proximity to a nucleolus. ×18,800

Fig. 3. Perikaryonal cytoplasm of a pinealocyte exhibiting many larger mitochondria packed with tubular and lamellar cristae. ×8,200