Further observations on the ultrastructure of the flank gland of the musk shrew, *Suncus murinus viridescens* (Blyth)

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Abstract. The ultrastructure of the flank gland tissue of both sexes of the Indian musk shrew, *Suncus murinus viridescens* was investigated. The undifferentiated and differentiated sebaceous secretory cells in the glands of both sexes possess 1–8 mitochondrial dense osmophilic inclusions. A few inclusions of medium electron density, and clear vacuoles were also seen in the mitochondria. The muscle fibres in the glandular complex were devoid of these characteristic mitochondrial inclusions. Secretory activity of the well differentiated sebaceous cells was characterised by the presence of a number of large secretory granules. Mitochondria and polyribosemes were found in close association with the secretory granules. The flank gland tubules of the shrew were highly vascularised.

Keywords. Indian musk shrew; *Suncus murinus viridescens*; flank gland; sebaceous tubules; ultrastructure; mitochondrial inclusions.

1. Introduction

Specialized integumentary glands play an important role in the mammalian social behaviour. Ethological and histological parameters concerned with mammalian olfaction have been the focus of attention of most of the investigations on mammalian chemoreception during the past few years (Müller-Schwarze 1983; Balakrishnan and Alexander 1985). Information on the fine structure of mammalian sebaceous glands has also accumulated in the past few years (Kurosumi 1961; Ellis and Henrikson 1963; Sansone *et al* 1970; Bell 1974; Gorgas and Völk 1984; Jenkinson *et al* 1985; Sokolov *et al* 1986).

Although both sebaceous and sudoriferous glands of mammals have odour producing properties, these glands are widely different in their structural organisation, chemical composition and in the functional process of secretory activities (Mykytowycz 1970; Quay 1972; Strauss *et al* 1976). The specialized integumentary glands in the Indian musk shrew, *Suncus murinus viridescens* have been the subject of detailed investigation in recent years (Balakrishnan 1975; Balakrishnan and Alexander 1985). An investigation on the fine structure of the sebaceous cells of the flank gland of the male shrew was also made (Balakrishnan *et al* 1984). The present report represents the results of further detailed investigations on the ultrastructure of the flank gland of *S. m. viridescens*.

2. Materials and methods

Adult shrews of both sexes were trapped live on the University Campus, Kariavattom, and were kept in individual wire-mesh cages for 2–3 days on a regular supply of
minced beef sprinkled with shark liver oil and tap water *ad libitum*. The fur of the flank gland area was shaved off using a fine blade and the glandular skin from both sides was dissected out from 4 males and 3 females under ether anaesthesia. Thin slices of the glandular tissue were fixed in 2.5% glutaraldehyde in 0.1 M phosphate buffer (pH 7.2-7.3). The fixed tissues were washed in the buffer for 2 h and post fixed in 1% osmium tetroxide in 0.1 M phosphate buffer. The samples were then carried to the USSR in the same buffer and dehydrated using alcohol and acetone in the ascending grades and embedded in Epon 812. Ultra-thin and 1 μm sections were cut using glass knives in LKB Ultrotomes III and IV. The ultra-thin sections were mounted on formvar-coated grids. These sections were stained with uranyl acetate and lead citrate as detailed by Reynolds (1963) and examined under a JOEL JEM 100 C Electron Microscope at an accelerating voltage of 80 kV. 1 μm sections were stained with toluidine blue and observed under a light microscope for cellular localisation of the secretory tubules and their pattern of arrangement.

3. Results

The flank gland tissue of *S. m. viridescens* is comprised of sebaceous and sudoriferous gland tubules. The latter are few in number and situated mainly on the glandular periphery. The undifferentiated sebaceous secretory cells were distinguished from the mature differentiated and differentiating cells by the absence of lipid secretory droplets in the former. The undifferentiated cells formed the basal layer of the secretory tubules whereas the inner lining of the tubular lumen was with well differentiated and disintegrating holocrine secretory cells. Disintegrating cellular structures were also seen in the sebaceous tubular lumen (figures 1 and 2). The differentiating and the differentiated sebaceous cells contained a few to several lipid droplets. Further, the differentiated cells were having comparatively larger granules.

One to eight electron dense osmophilic inclusions were observed in the mitochondria of the secretory cells. Mitochondria also contained a few inclusions of medium electron density. Some of the mitochondria had 2-4 clear vacuoles (figure 3). Detailed observations have revealed that these were not artefacts. The mitochondrial inclusions were seen both in the undifferentiated and differentiated sebaceous secretory cells of the flank gland of both sexes of the shrew. These characteristic mitochondrial inclusions were absent in the adjacent muscle fibres. The mitochondria were in close association with the lipid droplets (figure 4). Many free ribosomes were seen throughout the cytoplasm of the secretory cells, and polyribosomes were situated around the periphery of the lipid droplets (figure 5). A large number of capillaries were found around the secretory tubules of the flank gland showing the high vascularisation of the gland (figure 3). Further, the invagination of capillaries into the sebaceous secretory tubules was evident even in light microscopic observations (figures 1 and 2). Some of the sebaceous cells were having a number of finger-like peripheral protrusions at the level of capillaries (figure 6).

4. Discussion

The flank gland of the Indian musk shrew consists of well developed sebaceous and a few sudoriferous secretory tubules (Balakrishnan and Alexander 1977a). No significant