FINE STRUCTURE OF THE SWEAT GLANDS OF THE
ANTEBRACHIAL ORGAN OF *LEMUR CATTA*

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Summary. The sweat glands of the antebrachial organ of the ring-tailed lemur are atypical apocrine glands which have some characteristics of eccrine sweat glands. The myoepithelial cells are large and consist of well-differentiated basal and apical regions. The secretory cells form a monolayer of tall, columnar cells filled with numerous secretory vacuoles and capped with differentiated apical blebs. The vacuoles are formed in the Golgi region and their contents are discharged into the lumen and into intercellular canaliculi. The blebs are pinched off at the luminal surface by a true apocrine mechanism. In addition to the usual organelles (abundant rough endoplasmic reticulum, prominent Golgi region, large mitochondria, pigment, secretory vacuoles), the secretory cells contain bundles of microtubules. Each microtubule is about 325–350 Å in diameter. The glands are larger and more active in the male. These sweat glands are distinctly different from the apocrine glands of the general body surface of *L. catta.*

Introduction

The antebrachial organ, a conspicuous cutaneous gland of the forearm of *Lemur catta,* consists of a compact mass of sweat glands and well-developed interstitial tissue, covered by a glabrous extension of the palmar skin and accompanied, in the male, by a horny spur. At first thought to be an organ of touch or an aid in gripping trees (AFFOLTER, 1938), it recently has been considered to be a scent-marking gland associated, at least in part, with seasonal reproductive behavior (EVANS and Goy, 1966; JOLLY, 1966). Although described by several authors (SUTTON, 1887; POCOCK, 1918; AFFOLTER, 1938), the organ has been characterized histochemically only recently by MONTAGNA and YUN (1962). These authors reported that the sweat glands have features both of eccrine and of apocrine sweat glands, in part resembling apocrine glands over the general body surface of this prosimian primate and in part resembling eccrine glands of higher primates. This study elucidates the fine structure of these sweat glands and compares them with other sweat glands of *Lemur catta.*

Material and Methods

Tissue obtained by punch or knife biopsy from the antebrachial organ and scalp of male and female *Lemur catta* was fixed for 3–6 hours at 4°C in one of the following fixatives: 1% OsO₄-collidine (BENNETT and LUFT, 1959); 1% OsO₄ buffered with 1% eacodylate with 4.5% sucrose added; or 3% glutaraldehyde-collidine followed by 1% OsO₄-collidine. After fixation the tissue was dehydrated rapidly in cold ethanol and embedded in Araldite (LUFT, 1961). Thin sections, cut with a diamond knife on an LKB Uitrotome, were stained with potassium permanganate or with aqueous uranyl acetate and with lead citrate (REYNOLDS, 1963) and were examined in a Philips 200 electron microscope.

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Observations

The antebrachial organ is situated in the dermis on the flexor surface of the forearm (see Montagna, 1962b, for a detailed anatomical description). The organ is composed of masses of coiled sweat glands, between which are clusters of large, polyhedral cells; connective tissue trabeculae carry blood vessels and non-myelinated nerve fibers between groups. Pacinian corpuscles are found deep within the organ. Grossly, the antebrachial organ is about three times larger in the male, the bulk consisting of more numerous sweat glands. During arousal or when squeezed, the organ of the male exudes a clear secretion, which is deposited on various objects, including his tail; the organ is dry in the female, who does not seem to make any use of it.

The coiled, tubular sweat glands are composed of a monolayer of columnar epithelial cells resting on a well-developed myoepithelium, the whole enveloped by a thick basement membrane of connective tissue (Fig. 1). The myoepithelium is not a continuous sheet but has many gaps in which small portions of the secretory cells extend to the basement membrane (Fig. 2). Although nonmyelinated nerve fibers course along the basement membrane parallel to the myoepithelium, no connection between them has been seen.

The myoepithelial cell consists of a basal region in which are masses of fibrils approximately 50—60 Å in diameter and of an apical region in which the cytoplasm is filled with variable amounts of glycogen, small elements of rough-surfaced endoplasmic reticulum, a few lipid droplets, and ovoid mitochondria with sparse cristae (Figs. 2, 3, 7). Similar mitochondria, 0.4—1.0 μ in diameter, are interposed between fibrils in the basal region. The fibrils are anchored to the basal cell membrane by attachment plaques consisting of approximately 280 mÅ diameter patches of very dense fibrillar material, resembling half desmosomes (Fig. 3). The nucleus, located in the basal region, is dense, homogeneous, 3—4 μ in diameter, and usually of irregular outline. No intermediate or “clear” cells (Tandler, 1965) have been seen, although isolated portions of apical cytoplasm of the myoepithelium may give the appearance of an “intergrade” (as discussed by Ellis, 1962). The surface of the myoepithelial cell in contact with the basement membrane is relatively smooth, containing along its length numerous attachment plaques; but, at its junction with the secretory cells, the cell border is interdigitated with the secretory-cell border in irregular flat folds, with a few desmosomes between cells (Figs. 2, 3, 7).

The secretory cell, along its full 25—35 μ extent from its interface with the myoepithelium to the protrusion of its microvilli-fringed apical border into the lumen of the gland, is filled with numerous organelles (Figs. 4—8). The nucleus, located usually in the basal third of the cell, is 3—6 μ in diameter, varies in shape from ovoid to quite irregular, and often contains a prominent nucleolus. Centrioles are conspicuous. Ovoid mitochondria found throughout the cytoplasm are 0.5—2.0μ in diameter and have well-formed cristae. Occasional giant mitochondria with few cristae are seen which are similar to those described by Munger (1965b). Ribonucleoprotein particles lie free in the cytoplasm and stud the extensive cisternae and vesicles of endoplasmic reticulum. A Golgi complex, composed of flattened saccules and small vesicles, is usually a prominent feature of the cell, at times occupying a very large part of the cytoplasm. Lipo-pigment complexes, consisting of extremely electron-opaque granules surrounding vacuoles of medium opacity,