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Title Fine Structure of the Interstitial Cells of the Antebrachial Organ of Lemur catta

Abstract approved

Tissue obtained by punch biopsy from the antebrachial organ of *Lemur catta* has been studied with the electron microscope. This study describes the fine structure of the interstitial cells found between apocrine sweat glands in the antebrachial organ. These large polygonal cells are of three types: light cells, dark cells, and cells intermediate between these two types. The light cell contains a large vesicular nucleus, small tubular and vesicular elements of an agranular reticulum, numerous mitochondria with lamelliform or villiform cristae, microfilaments, and large aggregates of membrane-bounded particles. The dark cell has a dense, irregular nucleus, expanded vesicles of agranular reticulum, mitochondria with few cristae, microfilaments, and a large, hexagonal crystalloid of tubular structure. The intermediate cell is widely variable in appearance,
containing usually expanded elements of agranular reticulum, mitochondria with both types of cristae, very dense aggregates of membrane-bounded particles, and occasionally a more or less developed crystalloid. Discussion is presented comparing the interstitial cell of the antebanchial organ with steroid hormone secreting cells, particularly the Leydig cell of the testis.
FINE STRUCTURE OF THE INTERSTITIAL CELLS
OF THE ANTEBRACHIAL ORGAN OF LEMUR CATTA

by

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Introduction.

The Ring-tailed Lemur, *Lemur catta* (Linnaeus, 1758), is a prosimian primate whose habitat, like that of all true lemurs, is confined to the island of Madagascar. It is the most terrestrial of lemurs, living partly in the trees and partly in dry, rocky terrain. It is herbivorous, eating leaves, flowers, and fruits, mainly prickly-pear. Breeding is seasonal; according to one report (18, p. 386), copulation occurs in November-December, and parturition occurs in August. In appearance, the Ring-tailed Lemur is raccoon-like, with a long muzzle and foxy face, a grey and white pelage, and a long, bushy tail ringed in black and white (see Fig. 1). It has two pairs of prominent cutaneous glands: the brachial gland on the shoulder, and the antebrachial organ on the forearm. The antebrachial organ is found uniquely in *L. catta* and in *Hapalemur griseus* (18, p. 352).

Because of its prominence, attention was drawn to this organ as early as 1887 by Sutton (50, p. 369-372), who described "a collection of glands resembling sweat glands" but did not mention the interstitial tissue. Pocock, in 1918 (35, p. 25-27), noted the presence of the gland in *L. catta* and in *H. griseus* but added little to Sutton's description. The interstitial tissue was first named by Affolter (1, p. 90) in 1938 in *H. griseus*. Affolter did not ascribe any function to this tissue. Montagna (27, 28), in characterizing the antebrachial organ of *L. catta* histochemically, described clusters of large interstitial cells lying between the sweat glands which he compared with testicular Leydig cells. He found in these cells many
inclusions and vacuoles and a hexagonal crystalloid. He stated that these cells "have the histochemical properties of active cells" and concluded that they comprise an unknown endocrine organ (28, p. 102). This study is an effort to describe the morphology of these interstitial cells at the electron microscope level in order to elucidate their fine structure and, possibly, their function.
Methods and Materials.

Young adult male and female Ring-tailed Lemurs (Lemur catta) were used in this study, through the courtesy of the Oregon Regional Primate Research Center, Beaverton, Oregon.

Tissue from the antebraichial organ was obtained by punch biopsy or by knife biopsy while the animal was under Sernylan general anesthesia, transferred within a few seconds to vials of cold fixative, and subsequently minced into fine pieces. Fixation was continued for 2-3 hours at 4°C. The fixative, buffered in all cases to pH 7.4, was either 1.33% OsO₄ buffered with 0.067 M s-collidine (5, p. 113-114) or 2% glutaraldehyde buffered with 0.05 M cacodylate and followed by 1% OsO₄-cacodylate (modified from 44, p. 19-58). After fixation the tissue was rapidly dehydrated in several changes of cold ethanol of increasing concentration and brought to room temperature in absolute ethanol. After overnight dehydration in absolute ethanol, sometimes with 1% phosphotungstic acid added as a bulk stain, the tissue was passed through two changes of propylene oxide and embedded in Araldite (26, p. 409-414).

Thin sections were cut with glass knives on an LKB Ultrotome, stained with aqueous uranyl acetate (53, p. 475-478) and lead citrate (40, p. 208-212), and examined in an RCA EMU-3F electron microscope. Photographs were taken on Kodak Medium Contrast Lantern Slide Plates. Thick sections (½-1 µ) were stained with 1% toluidine blue (51, p. 343-348) or 1% methylene blue-azure A (41, p. 313-323) for examination with the light microscope.
Observations.

The antebrachial organ is a cutaneous gland situated in the dermis on the flexor surface of the forearm in both male and female Ring-tailed Lemurs [see Montagna (27, p. 192-194) for a detailed anatomical description].

In this organ, the interstitial cells are arranged in groups of 5 to 20 cells in the spaces between the apocrine sweat glands. They are large, polyhedral cells measuring 10-25 μ. Each cell is surrounded by a basement lamina and by collagen fibrils (Figs. 4, 10, 11). Connective tissue trabeculae run between clusters carrying blood vessels and myelinated nerve fibers (Fig. 2). There is no intimate association of the interstitial cells with blood capillaries, nor is there any evident relationship between the interstitial tissue and the sweat glands, the glands being isolated by basement laminae and several layers of connective tissue. Three types of interstitial cells are encountered: a light cell, an intermediate cell, and a dark cell. Either light or dark cell type may predominate in a nest, or all three may be found together (Figs. 3, 4, 10). In some glands one type may be much more frequent. Intermediate cells are seen infrequently, interspersed apparently randomly in the clusters. In addition, some undifferentiated mesenchymal-type cells are seen in the interstitium.

LIGHT CELL. The light cell has a large vesicular nucleus of 5-10 μ diameter with diffuse chromatin and a tight perinuclear cisterna; the cell is occasionally binucleate (Figs. 2, 3). The cytoplasmic matrix is fairly homogeneous and of moderate electron density. An agranular reticulum is dispersed throughout the cytoplasm.
in numerous tubular or vesicular elements of 100-300 μm diameter. In some places the agranular reticulum may be tightly compacted in a tubular arrangement (Fig. 6). Elements of the Golgi apparatus are difficult to distinguish from the many tubular and vesicular elements of the reticulum. There is a paucity of distinct Golgi material. A prominent feature of this cell are the mitochondria, of which there are two populations. In the majority of mitochondria, the internal membranes are arranged in the usual fashion as parallel lamelliform cristae. There are round or ovoid or occasionally rod-like mitochondria 0.5-1 μm in diameter. In the second population, the cristae have a peculiar, tortuous tubular shape. They are nearly always round or ovoid and 0.5-1 μm in diameter. In both populations, the mitochondrial matrix is much denser than that of the surrounding cytoplasm (Figs. 5, 7, 8). Another prominent feature of the light cell is the presence of membrane-bound particles of varying diameter from 90 μm to 0.5 μm. These particles are found in large numbers in masses that may reach 5-7 μm in extent. Aggregates of agranular reticulum and mitochondria of both types often are associated with these particles (Fig. 5). Mitochondria at times may be seen surrounded by particles. Sometimes these particles become so dense that their membranes are difficult to distinguish. Two other particulate bodies also occupy the cytoplasm of the light cell. Dense bodies 0.5-1 μm diameter are found. These are quite osmiophilic and may contain numerous small vesicles; they have a granular appearance. These bodies are limited by a membrane, but it is usually very difficult to distinguish (Fig. 7). Small bodies resembling cytolyosomes are seen, usually enclosing various membranes,
vesicles, and granules. They are 500-800 μ in diameter and vary widely in appearance (Fig. 7). Microfilaments of 50-70 Å diameter are found in the cytoplasm, apparently without any special orientation (Fig. 8). Granules of glycogen are seen often in the cytoplasmic matrix.

**DARK CELL.** In the dark cell, in direct contrast to the light cell, the nucleus is dense and irregular in outline with clumped chromatin and a dilated perinuclear cisterna. The diameter of the nucleus is 6-8 μ. The mitochondria have few cristae, which are lamelliform; the mitochondrial matrix is usually less dense than that of mitochondria found in the light cell (Fig. 10). They are round or ovoid and 0.5-1 μ in diameter. The agranular reticulum is expanded into vesicles of 0.2-1 μ diameter, reducing the cytoplasmic matrix into thin, dense strands between vesicles, and giving the cell its characteristic "foamy" appearance (Figs. 10, 11). Other components of the cytoplasm are microfilaments, which are seen frequently (Figs. 11, 12), and dense bodies, seen rarely. Glycogen and large aggregates of membrane-bounded particles have not been seen. The most prominent feature of the dark cell is a more or less developed crystalloid, whose profile, often hexagonal, may be 7-10 μ in diameter (Fig. 10). The crystalloid is composed of tubules which are continuous with the membranes of the agranular reticulum (Figs. 11, 13). The diameter of the tubules is approximately 200-250 Å. The arrangement of the tubules is such that in cross section they appear to be composed of a meshwork, almost as if knitted. Infrequently the crystalloid displays a moiré pattern. Mitochondria are frequently associated with the
crystallloid, and occasionally mitochondria or membrane-bounded particles appear to be "trapped" in the meshwork (Figs. 9, 11). Microfilaments are seen often either intimately associated with the crystallloid or in the adjacent cytoplasm (Figs. 11, 12). Rarely, myeloid figures are seen in the center of the crystallloid. Crystalloids appear to be more common in the female. In thick sections (1 μ) of biopsy material from each animal examined in the light microscope, 25-50% of cells in the female have crystalloids, compared to 7-10% in the male.

INTERMEDIATE CELL. Cells intermediate in type between dark and light cells are seen. These vary widely in appearance. Usually, the intermediate cell has the appearance of a light cell, containing many organelles as described for that cell, but with expanded vesicles of agranular reticulum of varying diameter and often with very dense aggregates of membrane-bounded particles; occasionally such a cell may contain a more or less developed crystallloid (Fig. 12). Rarely a cell is seen which has both dense aggregates of membrane-bounded particles and a crystallloid; mitochondria in these cells vary from those with numerous villiform and lamelliform cristae to those with few cristae, and the agranular reticulum is usually somewhat expanded.
Discussion.

The presence of light and dark cells in the interstitial tissue of the antebrachial organ of *Lemur catta* leads to speculation as to the relationships between the morphology of these cell types and their possible physiological variability. If it may be assumed that one cell type is converted into the other, as is suggested by the presence of intermediate cell types, the physiological stimulus which determines this change and the direction of the conversion pose challenging problems. In his characterization of the antebrachial organ of *L. catta*, Montagna (27, 28) does not distinguish light and dark cells in the interstitial tissue, perhaps due to the histochemical techniques employed. He speaks, however, of cells with cytoplasmic vacuoles and cells without such inclusions (28, p. 101); these may correspond to dark cells (with vacuoles) and light cells (no vacuoles) of this study. Since Montagna compares the interstitial tissue to the Leydig cells of the testis (27, 28), it is of note that light and dark cells are found in testicular interstitial tissue (7, 8), the differing cell types being merely manifestations of variation in physiological activity. Such physiological diversity is proposed for the interstitial cell of the antebrachial organ.

The physiological activity of the interstitial cell is complicated by the presence of many different organelles, most of which may undergo variation. The membrane-bounded particles are one such organelle, the nature of whose role in cellular activities is unknown. At times they approach the size of mitochondria (0.5 μ) and are similar to them in the density of their matrix. Indeed, mitochondria with few or no
cristae are very similar to these particles except that they have two membranes rather than one. This may lead one to postulate a relationship between these two organelles; for example, mitochondria with many cristae may transform into mitochondria with few and then no cristae, and these in turn may lose their internal membranes altogether and appear as membrane-bounded particles. (The opposite sequence of events might also be postulated; however, in studies of mitochondria—see Elliott and Bak (11) for review—no such origin has been encountered.) Mitochondria associated with fatty yolk production have been seen (52, p. 324) to lose their internal membranes as lipid accumulates, suggesting that the lipid of the membranes contributes to yolk formation; dense, granular bodies are seen in conjunction with this process. Other authors (8, 11) also relate formation of dense lipid bodies to the degeneration of mitochondria. However, in antebrachial organ interstitial cells, so-called dense bodies are encountered but not often enough to relate them to mitochondria nor are obviously degenerating mitochondria encountered. The membrane-bounded particles may represent mitochondria which have become transformed, rather than degenerate ones.

The crystalloid is another constituent of the interstitial cell the formation of which is problematical. It is seen to be continuous with the agranular reticulum (Figs. 11, 13) and is interpreted as being formed by a differentiation of the reticulum. The mechanism of this transformation is unknown. Mitochondria are frequently associated with the crystalloid, presumably functioning as an energy source.
Microfilaments very often are found near the crystalloid (Figs. 11, 12), but their role, if any, has not been determined. One problem is whether additional membranes are formed in organizing the crystalloid or whether the already-existing reticulum is utilized, thus reducing the amount of reticulum left free in the cytoplasm. If the membranes of the reticulum are derived from the nuclear envelope, as is sometimes assumed (36, 13), no evidence has been found in the interstitial cell of the formation of additional membranes which might function in crystalloid formation. If the already-formed membranes are used, this might explain the dilated appearance of the vesicles of agranular reticulum in the dark cell; as more of the 300 μm diameter reticulum is removed from the cytoplasmic matrix and compacted into 30 μm diameter tubules in the crystalloid structure, the remaining vesicles become expanded. This process presumably could be reversible, so that the crystalloid might "unravel" to disperse the membranes into a vesicular reticulum such as is found in the light cell. Many examples of strands of loosened membranes are seen (Figs. 9, 13), usually at the edges of the crystalloid, but whether the alteration in progress is one of formation or dispersion is impossible to tell from the static picture.

Concerning the physiological variability of the cell as a whole, the picture is somewhat more clear. One possible interpretation of the conversion of cell types is the interconvertibility of light cell and dark cell. The sequence may be light cell to intermediate cell to dark cell; under the proper, but unknown, stimulus, the dark cell may
reconvert into the light cell with the disappearance of the crystalloid and dispersal of the vesicular elements of the agranular reticulum in the cytoplasmic matrix, concomitant with the reappearance of many cristae in the mitochondria. This interpretation is predicated on the assumption that the light cell is in a stage of active synthesis and the dark cell a storage phase, perhaps in the crystalloid. Morphologically, there is some evidence to support this assumption. There is, for example, the vesicular nucleus of the light cell, which is regarded as being active in nucleic acid synthesis (17, p. 29-51), as opposed to the dense nucleus with clumped chromatin of the dark cell. The large number of mitochondria, especially those with villiform cristae, which are found in cells known to be secretory (3, 4, 8, 10, 16, 22, 30, 45), bespeaks activity in the light cell; the mitochondria of the dark cell, on the other hand, have few cristae and so are less active. In the light cell, the vast array of vesicles and tubules of agranular reticulum, found in metabolically active cells (7-9, 12, 15, 19-23, 33, 34, 36, 37, 45, 57, 59, 60), contrast with the larger, empty vesicles of the dark cell, the majority of the reticulum presumably being bound up in the crystalloid; if activity of the reticulum is based on available surface area, the dark cell is relatively inert.

Even if this interpretation of the conversion is correct, the physiological stimulus which triggers the change is unknown. Although the turnover might be a constant one, this seems unlikely, as intermediate types are relatively infrequent, and one cell type usually predominates in a particular gland (Fig. 3). One may look, then, to
the physiological constitution of the animal as a whole for a clue to
the stimulus. It is tempting to speculate that variability of the
antebrachial organ interstitial tissue is related to seasonal repro-
ductive activity, since, as Montagna has stated (27, p. 206), the
cells "have a curious similarity to the interstitial cells of the
testis" and possibly comprise an unknown endocrine organ. The most
obvious similarity is the abundance of agranular reticulum, which has
been found in Leydig cells of the testis of man (14, 57), mouse (6),
ophossom (7), rabbit (8), and the fish Lebistes (15). It has been
found also in other steroid hormone producing cells, such as adrenal
cortex (21, 23, 43, 45, 60), corpus luteum (12, 23, 59), ovarian
interstitial cells (9, 16, 30) and theca interna cells (3), and in
such lipid-metabolizing cells as meibomian gland (33) and adipose
cells (31, 32, 54). The tightly compacted arrangement of tubules of
agranular reticulum seen occasionally in antebrachial organ inter-
stitial cells (Fig. 6) is a characteristic feature of opossum testis
(7, p. 653-670). Human testicular interstitial cells contain a cry-
stallloid of fine tubular structure very much like that described here.
This crystalloid displays in cross section a regular hexagonal pattern
"like a knitwork" (57, p. LL-1) with a tubular diameter of about 250 Å,
as does the crystalloid of the dark cells (Fig. 13). In addition to
agranular reticulum, all of the steroid-secreting cells named above
contain mitochondria with tubular cristae (4, p. 369-372), which are
found in moderate numbers in antebrachial organ interstitial cells
(Figs. 5, 8). In marked contrast to their semblance to steroid-
producing cells, the interstitial cells have little in common with such endocrine tissues as anterior pituitary (42, 49) islets of Langerhans (55), thyroid (56), and parathyroid (29), of which tissue none contains agranular reticulum or mitochondria with villiform cristae, nor produces steroid hormones.

However, despite the enticing likeness to steroid-secreting cells, it would be a mistake to conclude hastily that these cells are indeed such on the basis of these similarities; the endocrine nature originally postulated for this cell is still unproved. Agranular reticulum, for one thing, is not limited to steroid-producing cells. It is found also in chloride ion secreting cells of gastric mucosa (19, 20, 47) and in fish gill chloride cells (34), in crayfish oocytes (2), and in several cell types in association with glycogen metabolism: liver (36), sarcoplasmic reticulum of muscle (37), paraboloid of turtle retina (58), and pigmented epithelium of frog retina (38). In all these cells, the function of the reticulum is thought to be that of sequestering and transporting the cell product (2, p. 634-636; 36, p. 142). In steroid secreting cells, the reticulum has been implicated directly in the synthetic process (7, p. 660-669; 43, p. 659-662). Fawcett (13, p. 80A) recently questioned the advisability of regarding "all the membrane-bounded canalicular elements of the cell as part of a single organelle" and has called for a more rigorous definition of the reticulum in light of the wide diversity of dimension, stability, and biochemical function which has been found. Therefore, no conclusive statement about the function of the agranular reticulum can be
made. Another factor in the controversy under discussion is the fact that mitochondria with tubular cristae are not limited to steroid-secreting cells. Configurations of the mitochondrial cristae described as "angular," "zigzag," or "honeycomb," as well as tubular, have been found in several other cell types, including cardiac myofibers (48), a Protozoan (11), chloride cell of fish gill (34), crayfish oocytes (2), and cells of the central nervous system (39). All of these are metabolically active cells, and several authors (2, 4, 10, 39) regard the pleomorphism of mitochondrial cristae as a structural adaptation related to high energy requirements or correlated with specialized enzymatic activity. Thus, while mitochondrial specialization is not unique to steroid-producing cells, it certainly indicates that the cell is active metabolically. A third possible objection to postulated secretory activity in the interstitial cell is the presence of a basement lamina and collagen fibrils completely surrounding each cell, since endocrine tissue has classically been regarded as being in intimate contact with adjacent blood vessels. That this is not always the case is amply demonstrated by rabbit testicular Leydig cells, in which capillaries are described as being surrounded by a multilayered basement membrane and by several layers of connective tissue (8, p. 587-604). A subendothelial space, usually with some collagen fibers in it, has been seen separating secretory cells from capillaries in other endocrine tissues (24, p. 293-296). In adipose tissue (31, 54), each cell is surrounded by a basement lamina and by several layers of connective tissue, but lipid transport
is effected. In the corpus cardiacum of insects, which is regarded as having endocrine functions (46, p. 761-796), a basement lamina approximately 2 µ wide is found, and yet secretory products are able to traverse the distance to the surrounding hemocoele. For all the objections to postulated endocrine activity in antebrachial organ interstitial cells, exceptions and explanations can be found. So little is known of the physiology of the Ring-tailed Lemur, however, that no final conclusions can be made on the basis of this study.

Additional work is indicated in order to elucidate further the role of the interstitial cells of the antebrachial organ in the lemur's physiology. A first project could be the histochemical analysis of cholesterol and steroid-related substances in the antebrachial organ. This might implicate one or more cell organelles in the secretory process. Another related project indicating the role of this tissue would be the microchemical analysis of the products of the gland. Furthermore, a study is needed on normal reproductive cyclicity in male and female lemurs, correlated with concomitant changes, if any, in the composition of the interstitial tissue of the antebrachial organ. Monthly biopsies, if feasible, would be very helpful in demonstrating the changes taking place over a year's time. Tissue from immature lemurs, when such material becomes available, would be useful in studying the developmental aspects of the gland. In order to demonstrate the effects of the sex hormones on the interstitial tissue, if there is such an effect, one might alter the hormonal balance of the lemur by suitable hormone injections and study the
resultant change in the interstitial tissue. Another approach to this problem would be to biopsy the antebrachial organ, then castrate the lemur, and observe the effect on the interstitial tissue; hormonal replacement therapy might also be tried. A second advantage of this method would be the opportunity to compare testicular interstitial tissue to antebrachial organ interstitial tissue in the same animal. These are not all the possible studies that might be undertaken, but they are ones which might be completed within the limits of the number of animals available.
**Summary.**

A study of the fine structure of the interstitial cells of the antebrachial organ of *Lemur catta* has been presented. This tissue is seen to be composed of light cells, dark cells, and cells intermediate between these two types.

The light cell contains a large, vesicular nucleus, a homogeneous cytoplasmic matrix in which are dispersed small tubular and vesicular elements of an agranular reticulum, numerous mitochondria with lamelliform or villiform cristae, microfilaments, and large aggregates of membrane-bounded particles.

The dark cell contains a dense, irregular nucleus, a dense cytoplasmic matrix seen as strands between expanded vesicles of agranular reticulum, mitochondria with few cristae, numerous microfilaments, and a large, hexagonal crystalloid of tubular structure.

Intermediate cells vary widely in appearance, usually containing mitochondria with both types of cristae, expanded vesicles of agranular reticulum of varying diameter, often very dense aggregates of membrane-bounded particles, and occasionally a more or less developed crystalloid.

The interstitial tissue has many characteristics in common with steroid hormone secreting cells, and a secretory function has been postulated for this tissue.
Bibliography.


APPENDIX
Figure Abbreviations.

AR - Agranular reticulum
BV - Blood vessel
C - Crystalloid
CL - Cytolysome
DB - Dense body
DC - Dark cell
LC - Light cell
Mf - Microfilament
M₁ - Mitochondrion with lamelliform cristae
M₂ - Mitochondrion with villiform cristae
MN - Myelinated nerve
N - Nucleus
P - Membrane-bounded particles
SG - Sweat gland
V - Vesicle
Fig. 1. Adult male lemur used in this study. Position of antebrachial organ is indicated by arrow.
(Portrait courtesy of Miss Lois L. Wright of the Oregon Regional Primate Research Center.)
Fig. 2. Light micrograph of antebrachial organ, showing arrangement of sweat glands (SG), interstitial cells, mostly light cells (LC), blood vessels (BV), and myelinated nerve fibers (MN). Male; OsO₄; methylene blue-azure A. 500x.
Fig. 3. Nest of interstitial cells containing many crystalloids. Dark cells (DC), light cells (LC), and a light cell with a crystalloid (C) are apparent. Two sweat glands (SG) have been cut obliquely. Female; glutaraldehyde; methylene blue-azure A. 2000x.
Fig. 4. Low power electron micrograph of an apocrine sweat gland (SG) and nest of light interstitial cells (LC). Masses of membrane-bounded particles (P) are seen in several of the cells. Note that each interstitial cell is surrounded by connective tissue (arrows). The space between the sweat gland and the nest of cells is an artifact. Male; glutaraldehyde. 3000x.
Fig. 5. Light cell, showing nucleus (N), two types of mitochondria (M₁, M₂), tubules and vesicles of the extensive agranular reticulum (AR), and a mass of membrane-bounded particles (P). Male: OsO₄. 32,000x.
Fig. 6. Portion of a light cell with a meshwork of tubules and vesicles of the compacted agranular reticulum (AR). Numerous mitochondria with parallel cristae (M) are associated with the reticulum. Male; OsO₄. 22,000x.

Fig. 7. Cytoplasm of light cell containing several cytolyosome-like bodies (CL), two dense bodies (DB), abundant vesicles of the agranular reticulum (AR), and numerous mitochondria (M). Male; OsO₄. 22,000x.
Fig. 8. Light cell cytoplasm, showing microfilaments (arrow). Mitochondria of both types may be seen. Male; OsO$_4$. 21,000x.

Fig. 9. Intermediate cell with partly formed crystalloid, enclosing a membrane-bounded particle (arrow). Dense, irregular body in crystalloid is an artifact. Male; OsO$_4$. 20,000x.
Fig. 10. Comparison of light cell with vesicular nucleus and "foamy" appearing dark cell with lobed nucleus and well-developed crystalloid. Note basement lamina around each cell and collagen fibrils between. Part of a fibroblast extends between cells (arrow). Female; glutaraldehyde. 11,000×.
Fig. 11. Typical dark cell with lobed nucleus and well-developed crystalloid. Note association of membranes of agranular reticulum with crystalloid (arrow). Microfilaments (Mf) may be seen in cross section. Dense body (DB), dilated vesicles (V), and mitochondria (M) are shown. Female; glutaraldehyde. 14,000x.
Fig. 12. Section of crystalloid showing longitudinal aspect of tubules. Note intimate association of microfilaments (Mf) with the periphery of the crystalloid. Female; glutaraldehyde. 45,000x.
Fig. 13. Part of crystalloid, showing continuity of agranular reticulum with tubules of crystalloid (arrows). Crystalloid may be in process of formation. Diameter of tubules is about 200-250 Å. Female; glutaraldehyde. 52,000x.