# PRISMATIC CRISTAE AND MATRIX GRANULES IN MITOCHONDRIA OF THE KIDNEYS OF AMMOCOETES

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The kidneys of ammocoetes of *Petromyzon marinus* L. degenerate anteriorly and grow by the proliferation of the posterior nephrogenic tissue (1), which consists of small groups of cells surrounding narrow lumina. The cytoplasm of these cells contains large amounts of glycogen, smooth endoplasmic reticulum, lipid droplets, and mitochondria. This note describes prismatic cristae and granules within these mitochondria.

Kidneys from ammocoetes of various ages were fixed for study with the electron microscope (2). The proliferating tubules of the posterior tip were composed of differentiating cells undergoing mitosis which were unlike those found more anteriorly (3).[1] Their mitochondria were of many shapes and sizes, but all contained angular cristae which appeared in transverse section as triangular prisms with sides measuring 400–450 A (Fig. 1 *a*). Unlike the prismatic cristae of the anterior tubules,[1] these were arranged to form six-pointed "stars of David" (4), with their bases forming a hexagonal tube and their apices the points of the star (Fig. 1 *a* and *b*). The tube had an inside diameter of 900 A and contained a single row of ovoid granules, each 300–350 A in diameter and as much as 1000 A long (Fig. 1, *a–d*). The granules were connected by thin, electron-opaque strands (Fig. 1 *c*). More thae six parallel prismatic cristae were often oriented so that the sides of a prism of one tube contributed to the formation of other hexagons, each surrounding its own row of granules (Figs. 1 *c*, 2).

Not all cristae within a mitochondrion were arranged hexagonally, nor did they run in the same plane, so that associations were often seen of angular cristae with no special configuration (Fig. 1 *c* and *d*).

The structure of the cristae appears to be related to the activity of the cell (5), and different configurations of the cristal membranes have been induced by altering the energy states of mitochondria (4). In active tissues the cristae are usually angular and packed together (4), and may often assume a hexagonal form (6).

There have been no descriptions of a close association between granules and these "star of David" configurations. Granules of similar dimensions and structure, but not linearly arranged or associated with prismatic cristae, have been reported as being typical mitochondrial inclusions of differentiating adipocytes (7). Intramitochondrial granules have been shown to be the site for the binding of ions (8), but there is reason to suggest that granules within mitochondria of differentiating cells are of different chemical composition and function (7). Their linear arrangement and unusual association with the cristae in mitochondria of differentiating cells of the ammocoete kidney are perhaps further evidence for this hypothesis.

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[1] Youson, J. H., and D. B. McMillan, manuscript in preparation.

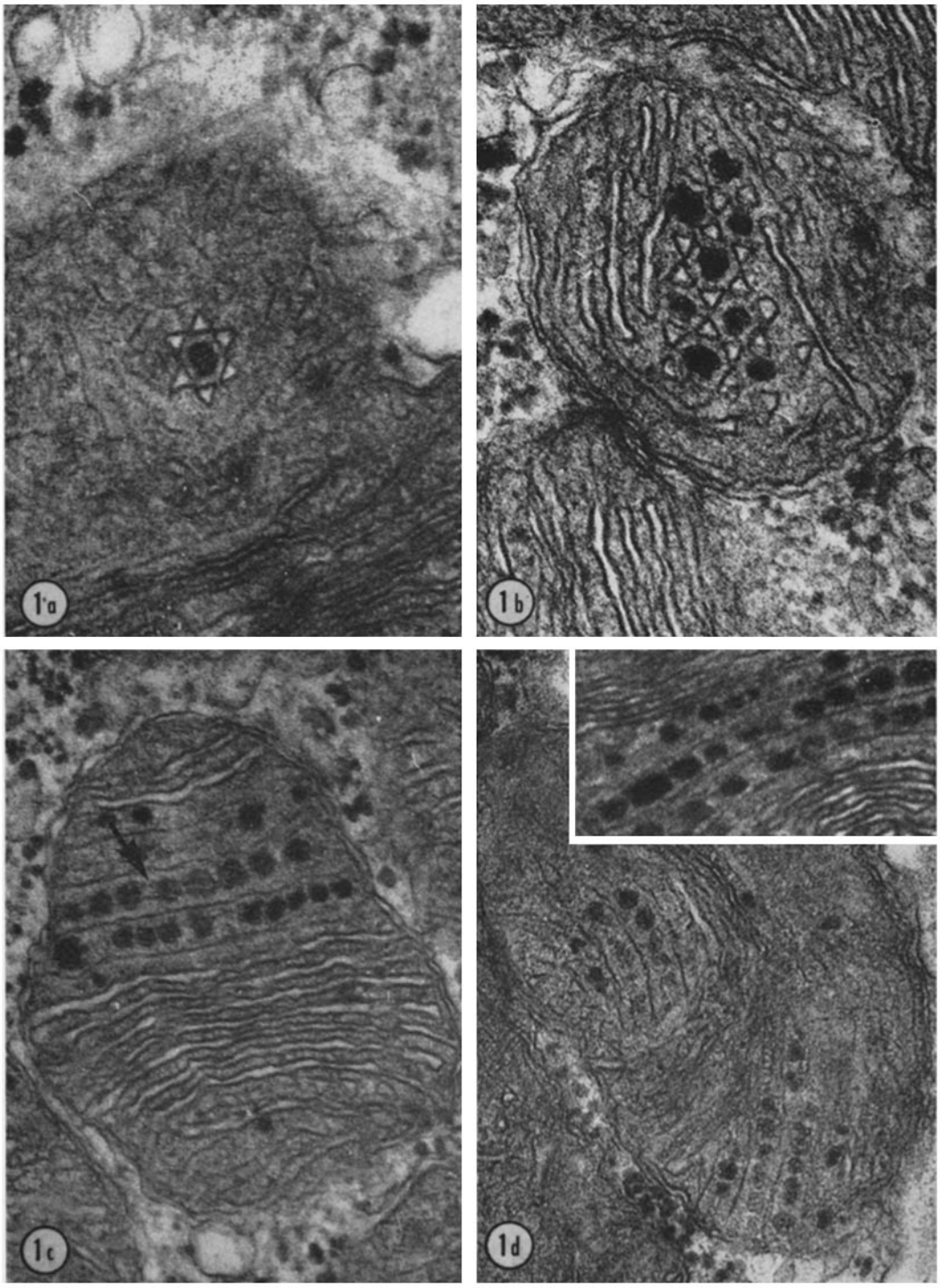


FIGURE 1 Mitochondria from cells of the posterior tip of the kidney. (*a*) Transverse section of six prismatic cristae showing their star-shaped arrangement forming a hexagonal tube surrounding a granule. × 80,000. (*b*) Transverse section through several cristae showing the formation of several hexagonal tubes, each containing a granule. The prisms of one star contribute to the formation of a second star. × 80,000. (*c*) Longitudinal section through several tubes showing the linear arrangement of their confined granules. The granules appear to be attached to thin strands (arrow). The membranes separating each row are the cristal membranes. × 57,000. (*d*) Longitudinal sections through several tubes, showing that they are oriented in several planes within a mitochondrion. × 54,000.
*Inset:* Rows of granules, some of which are as long as 1000 A. × 54,000.

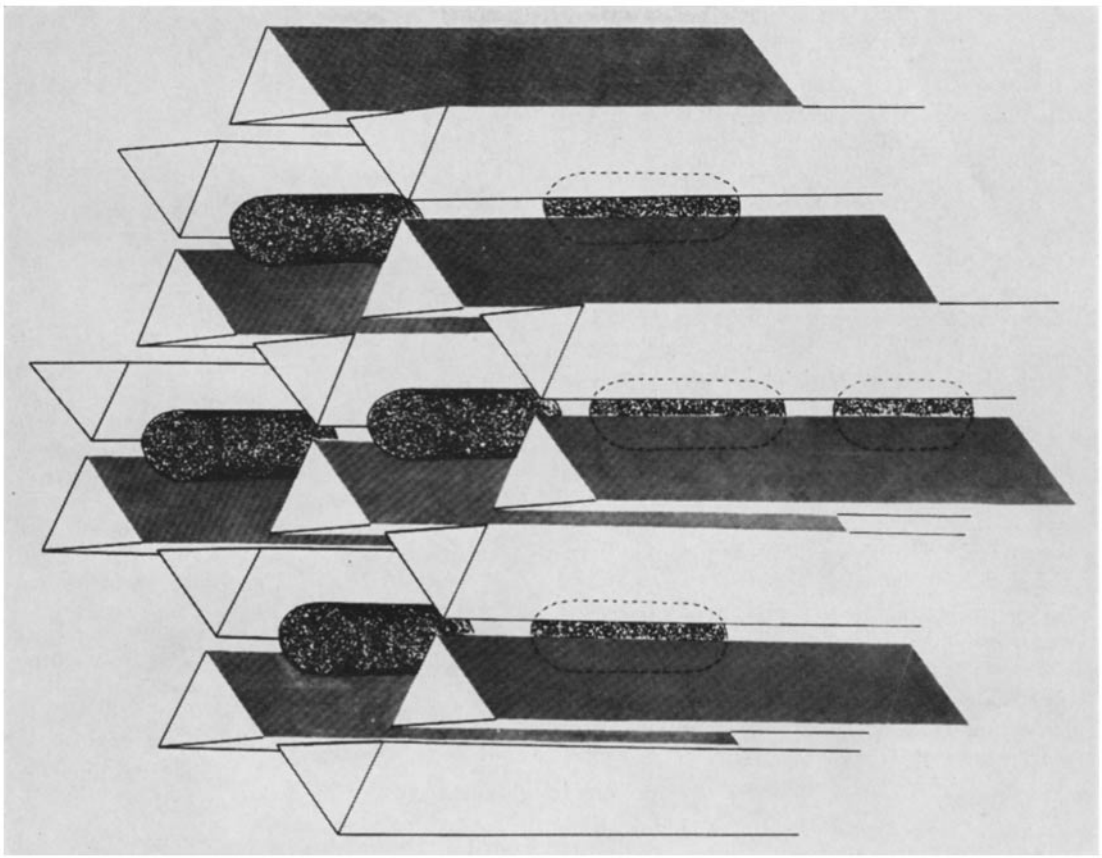

FIGURE 2 Schematic interpretation of the arrangement of prismatic cristae and granules in mitochondria from the cells of the posterior part of the kidney. Granules occur in rows within a hexagonal tube formed by six parallel prismatic cristae. Cristae of one tube contribute to the formation of adjacent tubes, which also enclose granules.

## REFERENCES


1. WHEELER, M. W. 1899. *Zool. Jahrb. Abt. Anat. Ontog. Tiere.*. **13**:1.
2. YOUSON, J. H., and D. B. MCMILLAN. 1970. *Amer. J. Anat.* **127**:207.
3. YOUSON, J. H., and D. B. MCMILLAN. 1970. *Amer. J. Anat.* **127**:233.
4. HARRIS, R. A., C. H. WILLIAMS, M. CALDWELL, D. E. GREEN, E. VALDIVIA. 1969. *Science (Washington).* **165**:700.
5. REVEL, J. D., D. FAWCETT, C. W. PHILPOTT. 1963. *J. Cell Biol.* **16**:187.
6. BLINZINGER, K., N. B. REWCASTLE, H. HAGER. 1965. *J. Cell Biol.* **25**:293.
7. SUTER, E. R. 1969. *Lab. Invest.* **21**:246.
8. PEACHEY, L. D. 1964. *J. Cell Biol.* **20**:95.