OCCURRENCE OF MELANOSOMES AND OF CRYSTAL SACS WITHIN THE SAME CELL IN THE TAPETUM LUCIDUM OF THE STINGAREE

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The chorioid of the stingaree *Dasyatis sabina* contains large numbers of melanocytes and guanophores, the latter forming an oriented reflecting layer on the inner surface. The crystals contained in these cells have been chemically analyzed and consist of guanine (Nicol and Van Baalen, 1969). At deeper levels both kinds of cells are commingled, generally preserving their separate identities. Examining electron micrographs of these cells, however, we found several instances in which guanine crystals and melanocytes are present in the same cell (Figs. 1 and 2); such cells occur well within the oriented reflecting layer.

Guanophores contain stacks of superposed crystal sacs, each enclosing a crystal chamber possessing a crystalline inclusion (Fig. 1). It is common experience that crystals such as these drop out when thin sections are being made for electron microscopy, leaving characteristic clefts (Arnott, 1966; Bevelander and Nakahara, 1969 *a*, *b;* Arnott and Nicol, 1970). Crystal sacs are bounded by a membrane, as are melanosomes. In cells containing both kinds of inclusions, the crystal sac may be independent of the melanosome (Fig. 1), or the melanin granule and the crystals may occur within the same membrane (Fig. 2). A "melanosome" in Fig. 2 contains one pigment granule and two crystalline inclusions.

It seems as if occasional pigment cells of the chorioid are indeterminate and have the ability to form both crystal sacs and melanosomes. Perhaps, this indicates a common type of stem cell for both melanocyte and guanophore. A mixed cell containing both dark pigment granules and reflecting particles is not unknown elsewhere, e.g. in the retinal pigment epithelium of some bony fishes (Moore, 1944). It is perhaps more interesting to find both crystal chambers and a pigment granule within the same organelle, a "crystal melanosome." Maul (1969) has recently shown convincingly that melanosomes are developed from tubular membrane extensions connected to the Golgi apparatus. We have been seeking, for some time, to trace the origin of the crystal sac during cytogenesis, knowing it to be developed from smooth membrane systems. The present observations, coupled to the findings of Maul, strongly point to the possible participation of the Golgi apparatus in the formation of the crystal sacs.

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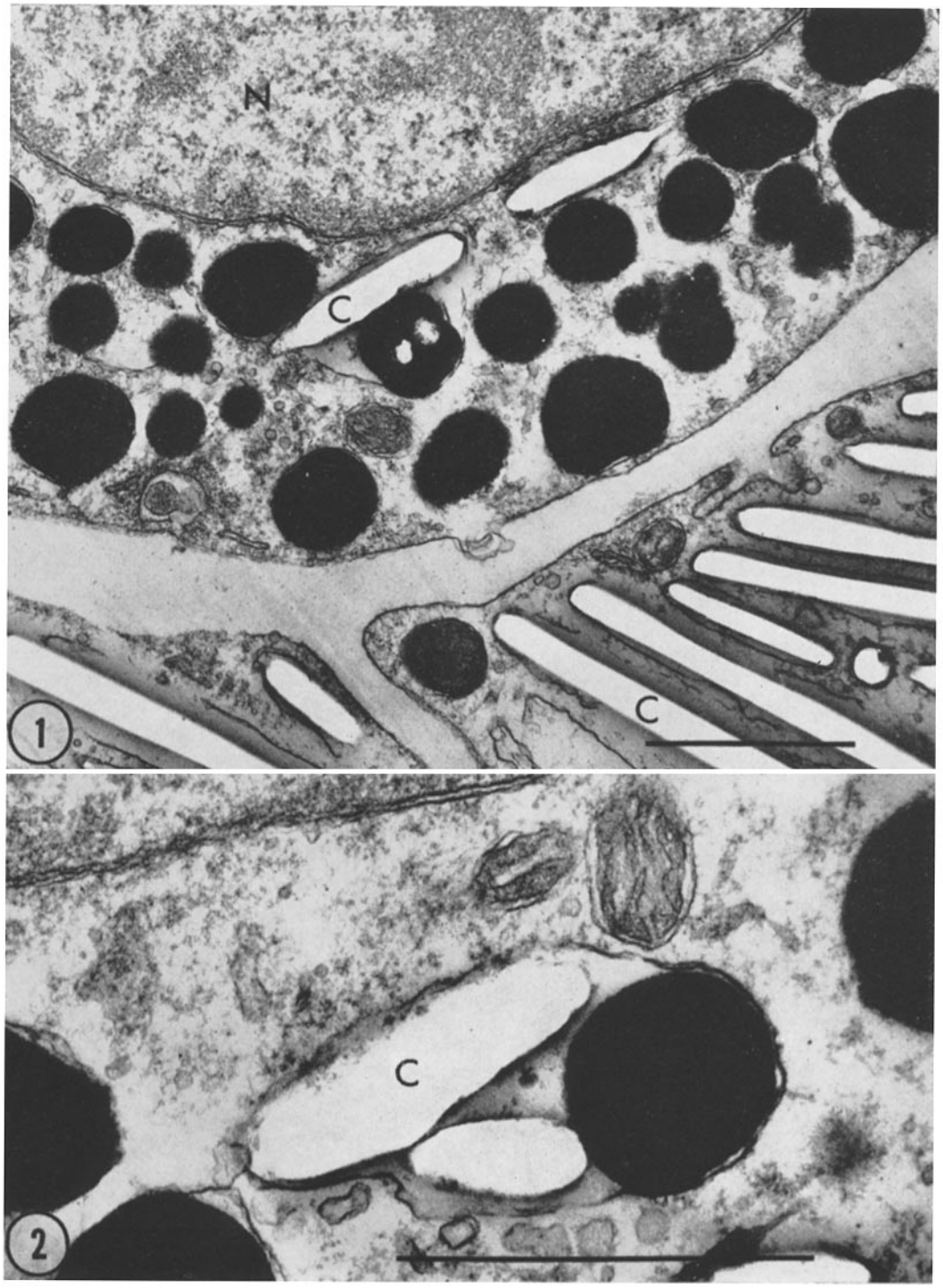

FIGURE 1 Juxtaposition of three cells in the middle chorioid of the stinagree. Two guanophores at bottom of figure, containing stacks of crystal sacs bounded by unit membranes. At top of figure, a melanocyte containing melanosomes, an independent crystal sac, and a crystal chamber (*c*) enclosed within the bounding membrane of a melanosome. *N*, nucleus. × 31,000.

FIGURE 2 A melanocyte containing a melanosome in which there are a pigment granule and two crystal chambers (*c*). × 62,000.