Cytochemical Studies of Normal and Tumor Mast Cells in Tissue and in Vitro*

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Since the first description of spontaneous mast cell tumors (mastocytomas) of dogs (2), subsequent studies have been concerned with the morphology and behavior of the neoplastic mast cells in tissue culture (11). Chemical preparations of these tumors have demonstrated considerable quantities of an anti-coagulating substance that is presumably heparin (10). The present study demonstrates the presence of lipids, cytochrome oxidase, and acid and alkaline phosphatases in normal and tumor mast cells and of tumor mast cells grown in tissue culture for several weeks.

RESULTS

Table I summarizes the enzyme and lipid content found in uncultured normal and tumor mast cells, and in tumor mast cells cultivated in vitro. The phosphatases were present in the form of cytoplasmic granules; however, it was difficult to ascertain whether or not these corresponded to the mast granules. Some cultured cells contained a paranuclear granule-free area (11). When stained for acid phosphatase this region revealed a delicate black reticulum (Fig. 4) which is suggestive of the Golgi apparatus revealed in other tissue cells (3, 4) when they are stained for phosphatases.

DISCUSSION

The observations in Table I reveal that both normal and tumor mast cells contain acid and alkaline phosphatases in their cytoplasm (Figs. 1-4). In tumor mast cells, however, both enzymes were found in the nucleus as well (Figs. 2, 4). In normal mast cells of the rat, Noback and Montagna (9) demonstrated alkaline phosphatase only in the cytoplasm. The cultured tumor cells evidenced phosphatase content identical with the original tumor cells, indicating that the former maintain their phosphatase constituents despite the changes in cell morphology which occur in tissue culture.

Controversy exists concerning the lipid character...
of the mast granules of normal mast cells (8). In our material, Sudan black B revealed lipid granules in all categories of mast cells examined (Fig. 5). Sudan IV, however, gave negative results. The distribution of the lipid droplets appeared to coincide both qualitatively and quantitatively with the distribution of the mast granules. Excellent staining of the lipid granules were obtained despite previous immersion of the tissues in alcohol, acetone, chloroform, and other lipid solvents at 60° C. for 48 hours. When mast cells fixed in Baker's formol-calcium-cadmium are stained by the Smith-Dietrich method, vaguely distinguishable black granules can be seen in the cytoplasm. These facts give pre-
sumptive evidence that the lipid substances in the mast cells of the dog consist of lipins.

Opinions differ concerning the presence or absence of oxidase in the mast cell granules (8). In our material, "stabile" cytochrome oxidase was demonstrated in the mast granules of uncultured normal and tumor cells, and of cultivated cells in vitro.

**SUMMARY**

Histochemical studies of normal and tumor mast cells, and of tumor mast cells cultivated in vitro
reveal that the mast cells in all these categories contain lipids, cytochrome oxidase, and acid and alkaline phosphatases in their cytoplasm. The tumor cells, in addition, contain alkaline and acid phosphatases in their nuclei.

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