Summary. After direct injection of Mercox into the thyroid parenchyma we obtained the corrosion casts of lymphatics to be observed by scanning electron microscopy. It seems reasonable to deduce from the following points that these corrosion casts were of the lymphatic system: 1) variable size of columnar vessels, 2) their three-dimensional anastomoses, 3) occurrence of blind endings, 4) V-shaped reliefs on parts of the columns, certainly indicative of valves, 5) bead-like structures formed by closure of valves, 6) depressions and surrounding saw-toothed figures on the surfaces of the casts, probably corresponding to the nuclei and boundaries of endothelial cells.

The method described in this study seems useful in the study of the structures and changes of lymphatics in various organs.

Along with the development of the corrosion casting technique (Murakami, 1971), it has been possible to make studies of three-dimensional structures of the blood vascular bed in its finest network (Murakami, 1971, 1972; Kondoh, 1973; T. Fujita and Murakami, 1973; H. Fujita and Murakami, 1974). About corrosion casts of lymphatics, however, no report has been published until now. On the other hand, Matoba and Kikuchi (1969) reported for the first time that lymph capillary nets were visualized by injecting oil-contrast medium into the thyroid gland. Thyroid lymphography thereafter has become popular (Kuwabara et al., 1975).

From the above-mentioned references we supposed that it might be possible to make the corrosion casts of thyroid lymphatics by application of the corrosion casting technique by injecting Mercox (Viline Co. Ltd.) into the thyroid lobes. The result revealed that the attempt was worthwhile and we could observe the detailed distribution and structure of lymph vessels by scanning electron microscopy.

Materials and Methods

Six mongrel dogs weighing 6 to 8 kg were used. The thyroid lobes were exposed by anterior median incision under thiopental anesthesia. Then an injection mixture of 1.0 to 1.5 ml was directly injected into the thyroid lobes during about a 1 min period. The lobes were removed 5 to 10 min after, kept at room temperature for about 30 min and immersed in hot water of about 50°C for about 15 min for the purpose of aging. After cooling down to room temperature, the specimens were completely macerated in a bath of 20% NaOH and the macerated tissues were gently washed out in running water. The specimens were then immersed in hot water (ca. 50°C) for a few min to take off adherent fat. They were frozen in water using a Cryostat and the frozen corrosion casts were cut into about 3 mm cubes by a razor. After drying, sputter-coating with gold was carried out, and the specimens were subjected to observation by Hitachi scanning electron microscope HSM-2.
Fig. 1. Corrosion casts of subcapsular vessels of dog thyroid gland. Columns of variable size are three-dimensionally anastomosed, partly showing blind ends (B) and beaded swellings (S). ×200

Fig. 2. The left upper part of Figure 1. V V-shaped picture, R bead-like swellings. ×585
Results and Discussion

The corrosion casts revealed column-shaped vessels of variable caliber sizes, part of which showed a smooth blind end. They were connected with each other three-dimensionally, and every anastomosis was more or less conspicuously swollen (Fig. 1). The known facts are that the contrast medium injected into the thyroid mostly move into lymphatics (Kuwabara et al., 1975), and that lymph vessels begin at blind ends, repeatedly anastomose with one another and are of conspicuously variable shapes and calibers and, still more, that they form sinuses in some sites (Block et al., 1967; Bloom and Fawcett, 1975). The corrosion casts made by us apparently showed these features regarded as characteristic of lymphatics. But as thyroid veins also may form sinuses under the same experimental conditions (Bargmann, 1939), a question is raised whether the swollen figures on corrosion casts were of lymphatics or of veins. Comparing our corrosion casts with those of thyroid blood vessels (H. Fujita and Murakami, 1974), both figures were found clearly different from each other. We determined that these swellings on corrosion casts were not of veins but of lymphatics.

More detailed observation revealed a V-shaped relief here and there on the parts of columnar anastomoses, while bead-like structures with periodical incisions were seen in many places (Fig. 2). Usually in lymph vessels there are more valves than in veins, which are formed by a pair of opposed leaves (Bloom and Fawcett, 1975). When the lymph vessels are filled with lymph, they are swollen into a bead-like shape because of the periodically located valves (Kaneko, 1965). The above finding thus apparently indicates that the casts reproduce lymphatic valves.

In magnified surfaces of corrosion casts, we could see depressions of ca. 9.0 to

![Fig. 3. Magnified surface of corrosion cast. N depressions, T saw-toothed reliefs. ×2,800](image-url)
11.5 μ in long diameter and ca. 4.6 to 5.0 μ in short one and saw-toothed figures around them (Fig. 3). The nuclei of endothelial cells in lymphatics strongly bulge into the lumen (Bloom and Fawcett, 1975) with lower ratio of long to short diameter than in the nuclei of blood vessel endothelium, and the endothelial intercellular lines are more strongly undulated than blood vessels (Ito et al., 1958). This knowledge led us to the assumption that the magnified structures in question belonged to lymphatics.

References


