FUNCTIONS OF CONNECTIVE TISSUE CELLS

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I. Fibrocytes and Histiocytes

There are a lot of references regarding the phagocytotic activities of histiocytes. In their recent studies on the functions of histocytes by means of electron microscope, *Yamane* and *Nishioka* (1958) of our department have demonstrated that the histiocytes of healthy mice phagocytose sepia melanin in the form of granules which are clearly seen within the enlarged vacuoles. It also has been shown that when the liver or pancreas of mice have been severely damaged experimentally, the vacuoles of histiocytes are filled with a homogeneous mass which seems to have been produced by destruction of sepia granules. In such instances, the vacuoles are relatively small and take the form of maple leaves. (Fig.1)

In view of the fact that the sepia granules are chemically stable and hardly affeccted by the digestive function of the histiocyte, the observed phenomenon is difficult to explain. It is very improbable that destruction of sepia granules did occur in the cells. The most likely explanation is that the sepia granules were taken into the cells, after they had already been destroyed and transformed into a homogeneous mass. This is further supported by the fact that the destructive process took place within a very short time after injection.

In short, it can be stated that the sepia granules have much difficulty in passing through the endoplasmic reticulum, and that only the healthy histiocytes are capable of engulfing such granules through endoplasmic reticulum. The relationship between the phagocytotic and excretory processes in the histiocyte has also been studied by means of electron microscope. It was observed that the vacuoles, which were at first small and filled with sepia melanin, gradually became enlarged with the lapse of time, and that the sepia granules moved outward and attached to the inner walls, through which the granules were finally pushed out of the vacuoles. (Fig. 2)

The sepia that had been taken into the protoplasm was excreated outside of the cells through the endoplasmic reticulum, the site through which the granules had previously entered into the cells.

In the course of the experiment the sepia injection was tried many times, but similar processes of phagocytosis and excretion were repeatedly observed every time.

In the abnormal histiocyte, the above-mentioned processes were not so prominent

as in the normal one.

Seki and his coworker (1956) have studied another aspect of the histiocyte functions and claim that the histiocyte produces immune bodies.

II. Mast Cells

Jorpes, *Holmgren* and *Wilander* (1937) found that it was heparin present in tissue mast cell granules that control blood coagulation. Subsequently, it was proved by *Riley* and *West* (1953) that the mast cell granules contain not only heparin but also histamin in a relatively high concentration. Since these granules are more readily soluble in water than those of the other cells, it is necessary to scrutinize the fixative solutions to be used for detection of the granules. *Takeda* (1958) of our department made it clear that israbin and acrinol solution are chemically well combined with tissue mast cell granules and the sediments become insoluble in water and alcohol. When these dyestuffs are used, the staining and fixing are to be done at the same time and thus satisfactory results can be obtained.

It has been ascertained also by *Takeda* (1958) that as far as the tissue mast cells in the subcutaneous connective tissue of the back of mice are concerned, they may be classified into two types, the'immature type' and the 'mature type'. The former contains mono-sulphatic heparin acid, may be stained positive to the periodic acid Schiff's reaction (PAS reaction), takes orthochromatic colour in toluidin blue, thionin staining, and are chiefly located around the blood vessels with circular muscle coating. The latter contains polysulphatic ester, i.e. di-sulphatic heparin, tri-sulphatic heparin or their mixture, show negative reaction to the periodic acid Schiff's test, takes metachromatic colour in toluidin blue, thionin staining, and are chiefly located on the walls of capillaries and in the loose connective tissues.

Furthermore, the stainability of these cells differs according to different stages of esterifing in the process of synthesis of heparin.

It was proved that these two different types of tissue mast cells not only differ morphologically according to the sites where they are located, but also this difference means that the process of growth of the tissue mast cells, and also the chief origin of the cells may be the adventitial coat of the small blood vessels or the undifferentiated mesenchymal cells.

The tissue mast cells germinated out of the adventitial coat cells of the blood vessels or the undifferentiated mesenchymal cells are chiefly of mono-sulphatic heparin-type. After passing through the definite circumferential tissues, they are transformed into the trisulphatic heparin-type through the di-sulphatic-type as they grow up to maturity. Thereafter, they gradually undergo degeneration. It seems likely that heparin is set free in the circumferential tissues, and is activated therein to act as a strong anti-coagulant.

III. Eosinophil Cell

The functions of eosinophil cell are as yet unknown, but *Kovacs* (1956), *Vercauteren* (1952) and *Indal* (1954) reported that eosinophil cells contain antihistamin substances.

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Explanation of Plate-figures

Fig. 1. Vacuoles of histiocyte assuming the form of maple leaves. ×20,000

Fig. 2. Sepia granules attached to the inner walls. Some of the granules have been pushed out of the vacuole through its wall. ×30,000

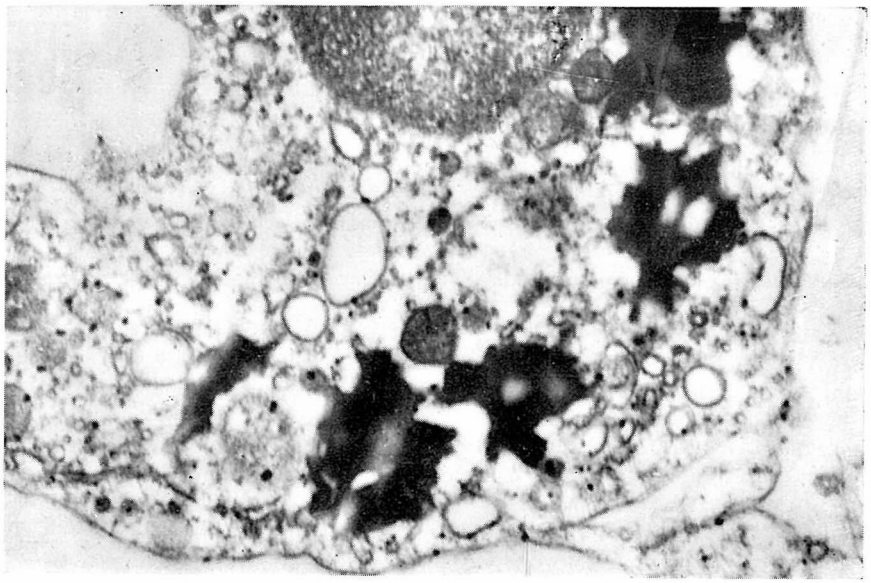

Fig. 1

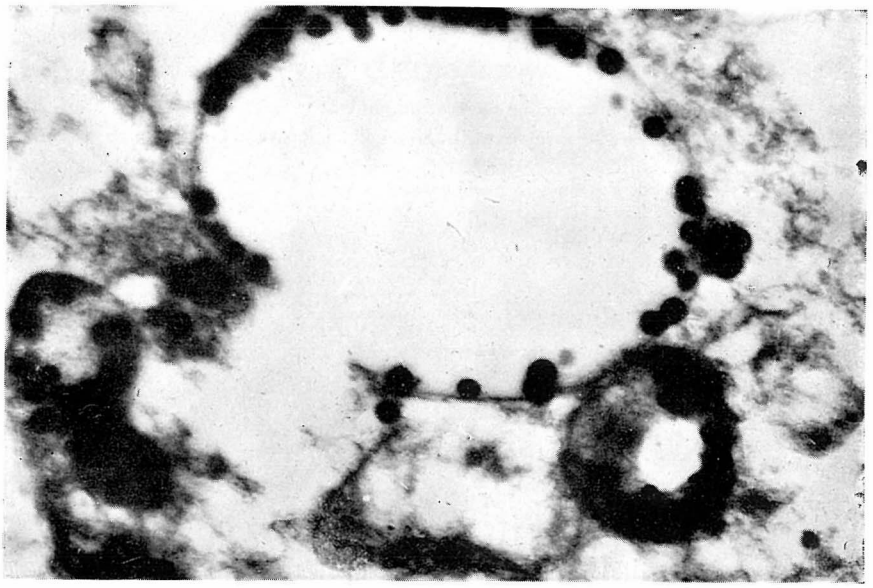

Fig. 2