COMMUNICATIONS

A Combined Electron-Microscope and Cytochemical Study of Acid Phosphatase Activity in Human Cervical Squamous Carcinoma

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The arrangement of the membranous structures comprising the Golgi complex is sufficiently distinctive and consistent from one cell type to another to permit easy identification. Its structure has been adequately reviewed by Beams & Kessel (1968), but its functions are still subject to much discussion. Though it appears to be directly involved with the secretory process, its existence in cells not known to be involved with secretion indicates still other functions essential to the internal economy of the cell.

With the development of the 'lysosome concept' by de Duve (1963) and Novikoff (1963) the Golgi complex took on a new importance. Early cytochemical evidence pointing to the Golgi complex as a site of high acid phosphatase activity was reviewed by Novikoff (1961). Numerous other observations supported the proposal that Golgi vesicles transfer acid hydrolases from their sites of formation to endocytic vacuoles.

These views concerning primary lysosomes have been subject to much discussion and modification. Novikoff and co-workers, though maintaining that endocytic vacuoles may be supplied with hydrolases from Golgi vesicles, drew attention to the possibility that the areas of the endoplasmic reticulum closely associated with the Golgi complex may also give rise to lysosomes. They symbolized this complex system by the initials GERL (Golgi: endoplasmic reticulum: lysosomes) (Novikoff, Essner & Quintana, 1964).

It has been observed in previous morphological studies that the Golgi complex is very prolific in cells obtained from invasive squamous-cell carcinoma of the human uterine cervix. We decided to determine if this proliferation was in any way associated with the production of primary lysosomes.

The sites of localization of acid phosphatase were investigated by using Gomori's technique modified for electron microscopy as reported by Rowden (1967). Reaction product was frequently found to overlie areas that had the configurations of the Golgi complex. Other observations of acid hydrolase activity in primary lysosomes will be presented.

Autophagy is frequently observed in carcinoma cells and could arise as part of a cellular response to

anoxia and lack of adequate nutrient supply caused by disproportionate growth of the epithelial cells in relation to their blood supply. The possible involvement of lysosomal enzymes with the observed autophagy will be discussed.

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Evidence for Proteolytic Activity in Liver Mitochondria

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It is known that protein breakdown occurs when preparations of liver mitochondria are incubated. The process is most rapid at acid pH, presumably on account of the acid cathepsin present in the accompanying lysosomes. However, appreciable breakdown occurs also at pH 7 and above (studied in detail by Alberti & Bartley, 1965) and the questions have arisen whether this is due to a separate enzyme and, if so, in which type of particle this occurs. Baird (1964) found that the distribution of amino acid-releasing activity between 'light' and 'heavy' mitochondrial fractions did not correspond exactly to that of either succinate dehydrogenase or acid phosphatase, but bore more relation to that of the lysosomal enzyme than to that of the mitochondrial enzyme.

Myoglobin is readily attacked by liver-mitochondrial preparations over a wide pH range and was used as substrate for particle proteinases. The proteolytic activity of 'heavy' mitochondrial fractions, measured from pH 4-8, fell sharply with no indication of a peak.

The proteolytic activity, measured at pH 7.0, of 'heavy' and 'light' mitochondrial fractions, obtained by differential centrifuging, was approximately the same, whereas proteolytic activity at pH 3.6 was always higher in the 'light' mitochondria. Mitochondria were further separated