The Fine Structure of Human Gastric Parietal Cells

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Although it is generally accepted that gastric mucosal parietal cells are responsible for the acid content of gastric juice, light-microscopic studies of these cells have shown little detectable change during the various secretory phases. Early workers felt that the intracellular canal system became more prominent during secretion,\(^1\)\(^-\)\(^5\) and more recent histochemical studies have demonstrated an increase in the succinic dehydrogenase activity of parietal cells after histamine stimulation.\(^4\) Electron-microscopic studies of animal and human parietal cells have shown changes to occur within the cytoplasm of these cells with acid secretion.\(^4\)\(^-\)\(^13\)

The present report concerns electron-microscopic observations of human parietal cells obtained during the nonsecretory and secretory phases of gastric function. Some of the initial data contained in this paper have been previously reported.\(^13\)

**MATERIAL AND METHODS**

Twenty-two gastric mucosal specimens from 18 human subjects were studied. All subjects were shown to be capable of secreting normal amounts of hydrochloric acid in response to maximal histamine stimulation (0.04 mg./kg. body weight).

All observations were made after a 12-hr. fast. Mucosal tissue was obtained with Wood's peroral biopsy tube.\(^14\) Eleven specimens were taken 45 min. after histamine stimulation at a time when the stomach was actively secreting, as determined by the hydrochloric acid concentration of the gastric juice (90 mEq./L. or more, titrated against 0.1N NaOH, with the use of Töpfer's reagent and phenolphthalein as indicators). The histamine acid phosphate was injected subcutaneously in a dosage of

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0.04 mg./kg. body weight. Neo-Antergan,* 50 mg. subcutaneously, was administered 30 min. prior to the histamine to allay the systemic side effects of the latter. Nine mucosal specimens were obtained 45–60 min. after the subcutaneous injection of 0.5 mg. atropine sulfate, at which time the gastric contents had a pH of 6.6–7.2 and contained no free acid. Two other specimens were taken when subjects were found to be basally achlorhydric for a period of 30 min. without atropine suppression. Biopsies were obtained from 4 subjects after both stimulation (maximal histamine) and inhibition (atropine) of secretion.

Within 60 sec. after excision, the biopsy specimens were minced in cold (0–4 °C.) 1% osmium tetroxide buffered to pH 7.6 with a veronal acetate buffer. After fixation for 1 hr. (0–4 °C.), the tissue was dehydrated in ethanol and embedded in Epon 812.† Thin sections were cut on a Porter-Blum microtome, placed on 100–200 mesh carbon-coated copper grids and studied with an RCA EMU-3E electron microscope.‡ Half of each specimen was fixed in 10% buffered formalin and prepared for light microscopy.

**OBSERVATIONS**

In all instances, the histologic characteristics observed by light microscopy appeared normal.

Human parietal cells, as observed by electron microscopy, are large cells averaging 16–22 μ in greatest diameter. They are distributed radially about the glandular lumen and in the lower one-third of the gastric gland are interspersed with the smaller chief cells which contain large zymogenic granules and an abundant, rough-surfaced endoplasmic reticulum. The parietal cells contain many mitochondria composed of a dense matrix and closely approximated cristae mitochondrialia. Within the cytoplasm are prominent intracellular canals bounded by a membrane which is continuous with the plasma membrane of the cell. The canalicular membrane is formed into finger-like projections, or microvilli, which project into the canalicular lumen (Fig. 1). These microvilli may assume various configurations, appearing at times elongate and thin and on other occasions, short and blunt. The lumen of the canalculus appears patent or filled with closely approximated microvilli, depending upon the secretory state of the cell at the time of fixation (Figs. 2 and 3). The intracellular canalicular system may communicate directly with the glandular lumen or empty into an intercellular canalculus and thence into the glandular

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