FINE-STRUCTURAL CHANGES OF THE SECRETORY APPRATUS IN PANCREATIC EXOCRINE CELLS

Y. WATANABE

Department of Pathology, School of Medicine, Keio University, Tokyo

Pancreatic exocrine cells of the rat were examined by electron microscopy after the *in vivo* treatment of pilocarpine, cycloheximide and actinomycin D. Experiments were divided into following three groups.

1. Animals were injected with pilocarpine (6 mg/100 g) and sacrificed 2, 4, 6 and 8 hr after the injection.

2. Animals were injected with pilocarpine as in Group 1 and then received cycloheximide (0.2 mg/100 g) 3 and 5 hr after the pilocarpine injection. Animals were sacrificed 1, 3 and 5 hr after the first cycloheximide injection.

3. Animals were injected with actinomycin D every 6 hr (0.8 mg/kg in total) and sacrificed 24 hr after the first injection. Pilocarpine was injected 6 hr before the sacrifice.

In all experimental groups, ^3H -leucine was injected 30 min before the sacrifice. In Group 3, some animals were injected with ^3H -uridine instead of leucine. Incorporation of ^3H -leucine, into the pancreatic protein, incorporation of ^3H -uridine into pancreatic RNA and the amylase activity of pancreatic tissue were measured. These biochemical studies indicated that the pilocarpine stimulated, at first, the excretion of the secretory substance which secondarily stimulated the protein synthesis, and that the cycloheximide almost completely inhibited the protein synthesis. In Group 3, no significant inhibition of the protein synthesis occurred, though the RNA synthesis was suppressed.

Fine-structural changes of pancreatic exocrine cells are summarized as follows: In Group 1, 1) decrease in the number of secretion granules, 2) increase in the number of vacuolar Golgi sacs, 3) decrease in the number of attached ribosomes of rER. In Group 2, 1) marked decrease in the number of secretion granules, 2) decrease in the number of vacuolar Golgi sacs, 3) appearance of large numbers of small vesicles in the apical portion of cells (apical vesicles), 4) marked decrease in the number of attached ribosomes of rER, and 5) increase in the number of attached polysomes of rER. In Group 3, no significant change was observed in the cytoplasm. Segregation of granular components was seen in nucleoli.

On the basis of these findings described above, we consider that:

1) The increase in the number of vacuolar Golgi sacs would represent the accelerated production of secretory granules.

2) The apical vesicles seen in the cycloheximide-treated animals may well be abortive secretory granules which are deficient of secretory materials, because there are gradual transitions between apical vesicles and Golgi vesicles. The budding of vesicles from rER in the vicinity of the Golgi apparatus was seen in the cycloheximide-treated animals as frequently as in the pilocarpine-treated ones.

3) Increase in the number of attached polysomes of rER in the pilocarpine-treated animals may indicate the increased rate of the protein synthesis.

4) Although increase in the number of attached polysomes of rER in the cycloheximide-treated animals is contradictory, this may be explained by the "freezing action" of the cycloheximide to the steady state of polysomes.

5) The experiment with actinomycin D would indicate that the secretory apparatus in pancreatic exocrine cells continues to work normally, though the synthesis of RNA has been inhibited, in a limited time course.

FIG. 1. A Golgi apparatus from a pilocarpine treated animal (6 hr after the injection).

FIG. 2. A Golgi apparatus from a cycloheximide-treated animal.

FIG. 3. Apical vesicles in the vicinity of the duct lumen from a cycloheximide-treated animal.

FIG. 4-6. Oblique sections of membranes of rER from an untreated (Fig. 4), a pilocarpine-treated (Fig. 5), and a cycloheximide-treated animal (Fig. 6). No polysomes are observed on the membranes of rER in the untreated animal, whereas a number of polysomes are present in the pilocarpine- and cycloheximide-treated one.