PROTEIN SYNTHESIS IN CELLS OF VARIOUS PARTS OF THE EXOCRINE EPITHELIUM OF THE RAT PANCREAS

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Histoautoradiographic study of cells of the exocrine epithelium of the rat pancreas using methionine-S^{35} showed that synthesis of sulfur-containing proteins took place more intensively in the cells of the acini surrounding the islets of Langerhans.

The study of the intensity of protein metabolism in the epithelial structures of the pancreas in normal animals is helpful to the understanding of changes arising in these structures under experimental conditions.

Using methionine-S^{35} as an indicator of protein metabolism, it was shown [1] that the intensity of incorporation of the isotope into the exocrine parenchyma of the pancreas is directly dependent on the content of zymogen in the pancreas. Hansson [9] observed a zonal distribution of the isotope in the acinar parenchyma of the rat pancreas during the first 6 h after injection of methionine-S^{35}. The highest concentration of the isotope was observed in the cells of the exocrine epithelium around the islets of Langerhans.

However, this zonal distribution of the isotope in the exocrine epithelium of the pancreas has not hitherto been determined quantitatively. The present investigation was carried out for this purpose.

EXPERIMENTAL METHOD

The test material consisted of pieces of the splenic portion of the pancreas from four male Wistar rats weighing 140 g. The animals were kept on an ordinary diet but were starved for 17-20 h before sacrifice and received only water. The rats were decapitated at 11 a.m., 2 h after receiving an intraperitoneal injection of methionine-S^{35} in a dose of 0.5 μCi/g body weight. The material was fixed in Carony's mixture and FMA (formalin, mercuric chloride, acetic acid) [3]. Autoradiography was carried out by Zhinkin's method [2]. Tracks were counted by means of an ocular grid with the following magnification: immersion objective 90×, binocular attachment 2.5×, ocular 10×. The intensity of incorporation of the isotope was expressed as the number of grains of silver to one square of the grid. The error of the method was calculated from duplicate determinations according to the formula:

$$S^{\text{det}} = \pm\sqrt{\sum d^2/2n},$$

where d is the difference between the duplicates and n the number of duplicates [6]. Not less than 10 acini adjacent to

TABLE 1. Incorporation of Methionine-S^{35} into Exocrine Parenchyma of the Pancreas of Intact Rats (M ± σ)

Rat no.	Around islets		Away from islets	
	value	error of method (in %)	value	error of method (in %)
301	8,2±1,7	2,3	7,0±1,9	3,3
310	8,8±1,7	8,7	6,6±1,7	7,5
311	7,9±2,3	5,1	5,0±1,4	3,4
319	6,1±1,2	3,1	5,4±0,9	2,2
Mean	7,8	4,8	6.0 $P<0,005$	4,1

Note. Absolute values obtained for each animal and their standard errors are given in the column "value".

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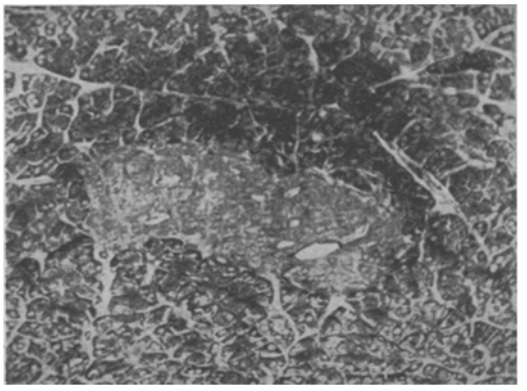

Fig. 1

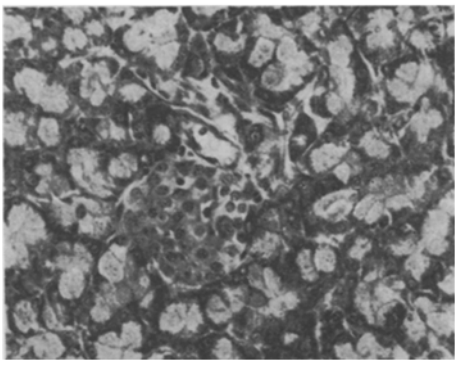

Fig. 2

Fig. 1. Total proteins in exocrine epithelium of the rat pancreas. Mercuric chloride and bromphenol blue, objective 20×, Homal 3×.

Fig. 2. Absence of "zymogen zone" around islet of Langerhans. Stained with chrome-hematoxylin and Gomori's trichrome mixture, objective 20×, Homal 5×.

the islets and not less than 10 acini some distance from them were studied in each animal. In all the counts, to reduce the systematic error and to keep it as constant as possible, Hellman's propositions [10] were observed. The sampling coefficient of correlation was calculated by Snedocor's method [12]. The significance of the differences was verified by the t-criterion. In addition, "total proteins" were demonstrated histochemically by staining with mercuric chloride and bromphenol blue and also by Danielli's method [4].

EXPERIMENTAL RESULTS

"Total proteins" in the acinar epithelium of the pancreas gave a similar picture when stained histochemically with mercuric chloride and bromphenol blue, and by Danielli's method: in the basal portions of the acinar cells the reaction for protein was stronger than in the apical portions. A particularly marked reaction for protein was given by the acinar cells surrounding the islets of Langerhans (Fig. 1).

The values obtained for the intensity of incorporation of methionine-S^{35} into the acinar parenchyma of the pancreas are shown in Table 1. The cells of the acini surrounding the islets incorporated the isotope significantly more strongly than cells of the acini away from the islets of Langerhans ($P < 0.005$). Positive correlation was found between the incorporation of methionine-S^{35} into cells of the acini near the islets and into cells of the acini away from the islets, i.e., the more active incorporation of the isotope into the peri-insular zone correlated with more active incorporation of the isotope also into the zone distant from the islets ($r = 0.992$, $P < 0.01$).

The results indicate that the intensity of synthesis of sulfur-containing proteins in the cells of the acini surrounding the islets of Langerhans is significantly higher than in the cells of acini at a distance from the islets.

These features of the peri-insular zones of the exocrine pancreas in rats accord with the observed heterogeneity of the acinar parenchyma of the pancreas in intact animals [7, 9, 11] and in animals subjected to various experimental procedures [5, 7, 8].

The peri-insular regions of the exocrine part of the pancreas cannot be dismissed simply as "zymogen zones" [7] and the intensity of incorporation of methionine-S^{35} is unambiguously determined by the zymogen content in the cells of the acini [1, 9], for concentrations of zymogen may be absent around the islets of Langerhans (Fig. 2). Meanwhile, histochemically detectable differences in the reaction of the exocrine part of the pancreas for total proteins were constant.

This variation in the pattern of synthesis of sulfur-containing proteins in the cells of the exocrine epithelium of the pancreas surrounding the islets can be explained, in the writer's opinion, by the effect of hormones liberated by the islets of Langerhans, but not by insulin exclusively [7].

This pattern of protein synthesis in the exocrine parenchyma of the pancreas of intact animals must be allowed for during the analysis of processes taking place in the pancreas under experimental conditions.

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