CELL MEMBRANE POTENTIALS IN THE HEAD OF THE GUINEA PIG PANCREAS IN SITU

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Various types of cells can be differentiated in glandular organs (salivary and lacrimal glands) in vivo on the basis of their membrane potential (MP) level. The acinar cells of the salivary glands have MP of the order of 30 mV, the duct cells up to 80 mV [5]. In the pancreas, however, and in particular in vitro, only cells with the following values of MP are found: in mice, of the order of 32 ± 0.5 mV [6]; in rats, 36.2 ± 1.7 mV; in cats 33.8 ± 1.0 mV [4], and in guinea pigs, 44.8 ± 0.5 mV [2]. The experimental conditions evidently could not reveal the highly polarized duct cells of the pancreas, because of their low resistance to hypoxia, following disturbance of the circulation.

In the investigation described below, MP levels of different types of cells located in the pancreas in vivo were investigated.

EXPERIMENTAL METHOD

Experiments were carried out on 30 guinea pigs weighing 250-300 g. The animals were anesthetized with pentobarbital (40 mg/kg, intramuscularly), laparotomy performed without injuring the vessels, the pancreas was isolated, and a glass plate introduced under it to immobilize the organ, so that the head of the pancreas lay on the plate and did not move when the microelectrode (Me) was inserted. An area of capsule of the pancreas was carefully removed at the site of insertion of Me (in a region where no islets of Langerhans were present on the surface). The temperature of the pancreatic tissue was maintained at 37-38°C by irrigation with warm physiological saline. MP were investigated by a standard microelectrode technique, using glass (Pyrex) Me (resistance 15-20 MΩ), filled with 3M potassium chloride solution. The depth of insertion of Me into the pancreatic tissue was determined by means of an electronic stepgauge. The numerical results were subjected to statistical analysis by Student's test.

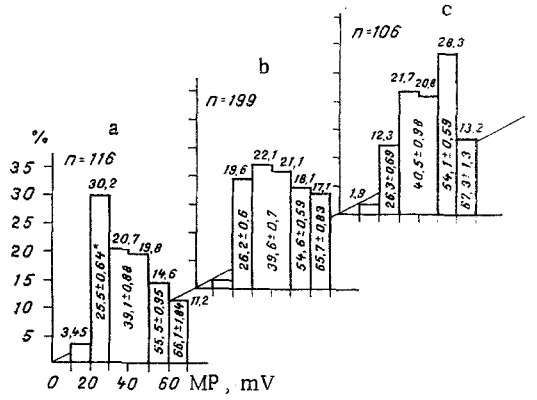

Fig. 1. Histograms of laminar distribution of cell MP in the pancreas. Depth of insertion of Me: a) from 0 to 150 μ, b) 150-500 μ, c) 500-900 μ. Average membrane potential of the given cell clone indicated by asterisk (M ± m); n) number of cells recorded. Abscissa, membrane potential (in mV); ordinate, number of cells (in %).

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EXPERIMENTAL RESULTS

On the basis of data showing that the large ducts are located mainly in the center of the pancreas and the small ducts closer to its surface [1], values of MP of the cells were studied at various depths: 0-150 μ, 150-500 μ, and 500-900 μ (the total thickness of the guinea pig pancreas is 1-1.2 mm). It will be clear from Fig. 1 that the largest number of cells with a polarization level not exceeding 30 mV was recorded in the surface layers of the dorsal regions of the pancreas. Cells with MP of up to 50 mV constituted a smaller group, and cells with MP up to 70 mV formed the smallest group. The character of the histogram changed at mid-depth. There, the number of cells with MP up to 30 mV decreased appreciably, the number of cells with MP up to 50 mV was virtually unchanged, but the number of cells with MP of over 50 mV increased. In the deep layers of the pancreas, lying next to the serous membrane, the number of cells differed appreciably from that in the middle and dorsal regions. In the deep layers the smallest number of cells with MP of up to 30 mV was recorded, and the number of cells with MP of up to 50 mV was virtually the same as in the other layers. Meanwhile, in the deep layers, the number of cells with high MP was increased. As regards cells of the islets of Langerhans, they have a low MP [3], and when the track of Me passed outside the zone of these islets on the surface of the pancreas, only a few of them were recorded in the deeper zones.

Thus MP of different types of cells can easily be recorded in the pancreas in vivo and a laminar analysis of their number undertaken. In this respect the pancreas resembles the salivary glands. On the other hand, the distribution of cells with a high MP level predominantly on the ventral surface shows that ducts are evidently most numerous in this region.

LITERATURE CITED

1. D. E. Brockman, Cell. Tissue Res., 205, 445 (1980).
2. J. S. Davison and G. T. Petersen, J. Physiol. (London), 310, 44 (1981).
3. P. M. Dean and E. K. Matthews, J. Physiol. (London), 210, 255 (1970).
4. A. Nishiyama and O. H. Petersen, J. Physiol. (London), 238, 145 (1974).
5. L. H. Scheyer and C. A. Scheyer, Am. J. Physiol., 209, 1304 (1965)
6. J. Singh, J. Physiol. (London), 358, 469 (1985).

CHANGES IN WATER-SOLUBLE ANTIGEN LEVELS IN THE RAT BRAIN DURING BILATERAL AVOIDANCE TRAINING

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Despite many publications on the role of protein metabolism in learning and memory processes [1] the role of individual proteins in the mechanisms of conditioned reflex formation and consolidation still remains a comparatively unresearched problem.

The aim of this investigation was to study metabolism of individual water-soluble antigen proteins using methods of rocket and crossed immunoelectrophoresis during active avoidance training in animals. Attention was concentrated on analysis of the content of a water-soluble brain antigen which we designated antigen 2, which has the electrophoretic mobility of albumins and is not found in the liver and in various other organs [2]. The content of this antigen is several times higher in the hypothalamus, mesencephalon, and medulla (i.e., in re-

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