nuclei and lysosomes remained at the same level, whereas the density of the surface of ER and the mitochondria showed a tendency to decline. The surface density of the vacuoles increased.

It can thus be concluded from vital fixation of liver tissue and ultrastructural stereometry that local cooling, under the experimental conditions used, is accompanied by destructive changes in the hepatocytes, expressed as translucency of part of the hyaloplasm, the formation of empty spaces and cavities in the cytoplasm, disturbance of the integrity of mitochondrial membranes, and changes in ER. These qualitative data are supplemented and confirmed by values for the volume and surface density of these structures. Meanwhile the character of changes in the nuclear apparatus of the hepatocytes and Kupffer cells (widening of the nuclear pores and of canals in the condensed chromatin, a peripheral location of the nucleolus, the presence of ribosomal complexes in the nucleus, concentration of mitochondria near the nucleus) suggests strengthening of the regulatory influence of the nucleus on cytoplasmic structures, associated, evidently, with the commencement of repair processes.

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QUANTITATIVE ANALYSIS OF DENDRITIC BRANCHING PATTERNS IN STRIATAL NEURONS BY THE LEITZ ASM SYSTEM

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KEY WORDS: quantitative analysis; dendritic system; long-axon neurons; striatum.

The neuronal organization of the mammalian striatum has been the subject of much research [10-12, 14]. However, the facts so far obtained are very contradictory. According to our own data [4, 5] the striatum contains two classes of long-axon cells: densely branched arborescent spinous neurons (small and medium-sized cells, accounting for about 96% of the total number of cells) and sparsely branched reticular neurons (large cells, accounting for about 1% of all neurons). Until now spinous cells in many publications have been regarded as short-axon neurons, even though investigations by the horseradish perioxidase method have demonstrated their long-axon nature [7, 9, 13].

The dendritic system of long-axon striatal neurons was studied in the investigation described below in a comparative series of mammals, using quantitative methods of analysis.

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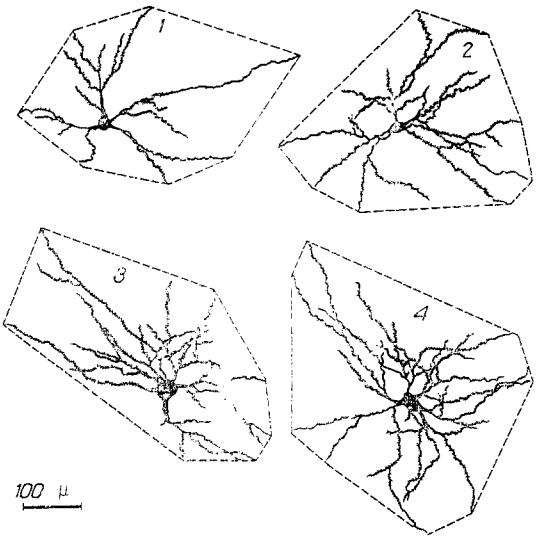

Fig. 1

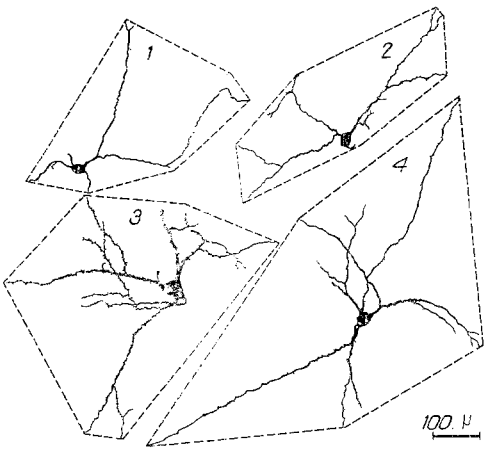

Fig. 2

Fig. 1. Accurate drawing of densely branched arborescent striatal neurons in a comparative series of mammals (Golgi method). 1) Hedgehog, 2) rabbit, 3) dog, 4) monkey. Broken line marks boundaries of area of dendritic field.

Fig. 2. Accurate drawing of sparsely branched reticular striatal neurons in a comparative series of mammals (Golgi method). Legend as to Fig. 1.

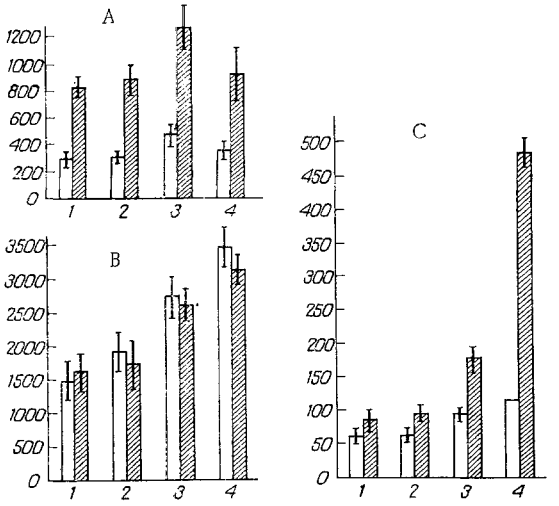

Fig. 3. Quantitative characteristics of long-axon striatal neurons in a comparative series of mammals. Ordinate: A) area of cross-section of neuron bodies (in μ^2), B) total length of dendrites (in μ), C) area of dendritic field (in $\mu^2 \cdot 10^3$). Shaded columns represent mean value of parameters for reticular neurons, unshaded column — the same for aborescent neurons. Confidence interval for $P < 0.05$ shown above each column. Remainder of legend as to Fig. 1.

EXPERIMENTAL METHOD

Two classes of long-axon striatal neurons — densely branched aborescent and sparsely branched reticular — were analyzed in adult animals (hedgehog, rabbit, dog, and monkey). Measurements were made on accurate drawings from preparations stained by Golgi's method, by means of the semiautomatic Leitz-ASM system (West Germany), by tracing the outlines of the details of the neuron chosen for study with a light pen. The area of cross-section of neuron bodies, the area of the dendritic field, and the total length of the dendrites were measured previously [2, 6]. By area of the dendritic field is meant the area of the convex

polygon obtained by joining the ends of the dendrites by straight lines. Altogher 140 neurons were analyzed. The results were subjected to statistical analysis by Student's t test. Differences between the means were considered significant at the $P < 0.05$ level.

EXPERIMENTAL RESULTS

Analysis of the arborescent and reticular neurons showed that in the Mammalia class these two types of long-axon striatal neurons have their own characteristic structural features, whereby they can be easily distinguished in each of the abovementioned animals. Densely branched arborescent neurons had small round, triangular, or polygonal cell bodies. Their dendrites were numerous, and mainly given off radially from the cell body. They were relatively short, thin, highly branched, and densely studied with short spines (Fig. 1). Sparsely branched reticular neurons were large cells of many different forms. The dendrites spread out from the cell body in several trunks for considerable distances; they were thick, comparatively straight, and gave off few branches. On these dendrites there were far fewer spines (Fig. 2). The greatest similarity between these two types of neurons occured in the hedgehog in which, according to the quantitative data, significant differences were discovered only for one of the parameters measured, namely the area of cross section of the neuron bodies (Fig. 3A). Differences between arobrescent and reticular neurons increased from the lower to the higher mammals, to reach a maximum in primates. This could easily be seen by comparing measurements of the area of the dendritic fields (Fig. 3C). In monkeys the area of the dendritic field of reticular neurons was more than four times greater than that of the arborescent neurons. As regards the total length of the dendrites, no difference could be found between these two types of neurons in any of the animals studied. This fact may be explained by the considerable increase in ramification of the dendrites of the densely branched aborescent neurons compared with the sparsely branched, reticular neurons, which had long dendrites, but with few branches (Fig. 3B). The most informative parameters of those which were measured, for detecting differences between aborescent and reticular neurons, were thus the area of cross-section of the neuron bodies and the area of the dendritic field.

The quantiative approach enabled the specific structure of the dendritic system of each of the two types of striatal neurons analyzed to be revealed and characterized in a more concrete manner. Arborescent neurons in the hedgehog and rabbit were found to have a significantly smaller total length of their dendrites and area of their dendritic field than in the dog and monkey (Fig. 3B, C); the total length of the dendrites was greatest in the monkey. The largest arborescent neurons were shown to be characteristic of the dog; the mean area of cross-section of the neurons was greatest in the dog (Fig. 3A). The absence of any significant differences with respect to this parameter for arborescent neurons between the monkey and the lower mammals can be explained by the wider scatter of the size of bodies of these neurons in the monkey. For the sparsely branched reticular neurons differences in the comparative series of mammals were more marked than in arborescent cells. For instance, there was an almost twofold increase in area of the dendritic field from rabbit to dog, and a fourfold increase from dog to monkey (Fig. 3C). The increase in the total length of the dendrites of the reticular striatal neurons in the dog showed a steep increase compared with the rabbit, and a further increase in the length of the dendrites of these neurons was observed in the monkey (Fig. 3B). The change in area of cross section of the bodies of the reticular striatal neurons from hedgehog to monkey was similar to that for the densely branched aborescent neurons, i.e., this parameter reached a maximum in dogs (Fig. 3A). Incidentally, the dendritic system of the striatal neurons, like that of the cortical neurons, in monkeys is more finely differentiated [8], i.e., it has a fine dendritic structural pattern by contrast with the dog, in which the dendritic system is constructed on a massive, coarse principle [1].

On the whole insectivores and rodents exhibit similarity in the structure both of their reticular and of their arborescent striatal neurons, whereas from rodents to carnivores, and from them to primates, these types of neurons undergo considerable changes. It can be concluded from the results that structural differentiation of the dendritic system in these two types of striatal neurons in a comparative series of mammals is progressive in character, as is shown not only by the quantitative characteristics studied, but also by the increase in the degree of ramification of the neurons and the greater diversity of shape of their neuron bodies, as the writers showed previously by qualitative analysis [5]. The results of the present investigation into the neuronal structure of the striatum agree fully with data on progressive differentiation of the striatum in the evolution of mammals, obtained by the study of its cytoarchitectonics [3].

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MORPHOLOGICAL AND FUNCTIONAL CRITERIA FOR CHOICE OF DIETARY MIXTURES FOR ENTERAL FEEDING

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KEY WORDS: electron microscopy; dietary mixtures; tube feeding.

Clinicians and theoretical medical scientists are currently displaying increased interest in the question of enteral tube feeding. According to current views, enteral administration of the necessary quantity of nutrients must be the method of choice in cases when, in surgical patients or victims of trauma, no disturbances of function of the gastrointestinal tract are present [3, 5]. Meanwhile, reliance on total enteral feeding for patients undergoing abdominal operations, by the use of transintestinal injection of essential nutrients in the composition of high-calorie elementary mixtures or mixtures of natural food products is often accompanied by dyspeptic disorders [4, 6, 7].

The aim of this investigation was to determine the absorptive activity of the intestine in relation to ingredients of nutrient mixtures and to study the state of the morphological structures of the mucosa of the intestinal wall after enteral administration of high-calorie nutrient mixtures of varied composition, as a criterion with which to assess the suitability of their use.

EXPERIMENTAL METHOD

The preparatory operations used were those developed previously for the formation of multiple fistulas in dogs and for determination of the digestive and absorptive functions of the small intestine [2]. The rate of passage of the nutrients from the intestine to the internal medium of the body, and also the effect of the composition of the test nutrient mixture on evacuatory activity of the small intestine were studied by autoperfusion of the small intestine while temporarily isolated from the digestive tract [1].

The content of sodium, potassium, calcium, proteins, fats, and carbohydrates was determined in samples of the nutrient mixtures administered and in the perfusion fluid by the

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