

STATE OF THE PINEAL GLAND DURING HIBERNATION

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The pineal gland in active, waking red-cheeked sousliks differs from that of rats by its clear delineation into cortical and medullary zones, its larger pineocytes, and the well-marked polymorphism of their nuclei with numerous pseudokaryosomes. The onset of hibernation is accompanied by a decrease in the serotonin content of the pineal gland, disappearance of the division into medullary and cortical layers, and morphological features of reduced function. The changes thus developing are similar to those arising in the pineal gland after denervation.

KEY WORDS: pineal gland; hibernation; serotonin.

There is information in the literature on the possible role of the pineal gland as a synchronizer of diurnal endogenous rhythmic processes [7]. Meanwhile, the state of the pineal gland during the natural rhythmic process of hibernation has not hitherto been studied.

The object of this investigation was to study the special features of the pineal gland in the hibernating souslik and changes taking place in the gland during hibernation.

EXPERIMENTAL METHOD

Red-cheeked sousliks (*Citellus erythrogenys major* Brandt) and Wistar rats were used. The serotonin concentration in the pineal glands was determined fluorimetrically [1]. For morphological investigation the pineal glands were fixed in Lillie's fluid, taken through alcohol-chloroform, and embedded in paraffin wax. Sections 3-5 μ in thickness were stained with hematoxylin-eosin, Sudan Black B, and bromphenol blue [4].

EXPERIMENTAL RESULTS

The serotonin content in the pineal glands of active, waking sousliks (17.6 ± 1.0 ng) was about the same as in the guinea pig, sheep, and man [7], but much less than in the pineal glands of rats (76.0 ± 6.0 ng). In these sousliks the cortical and medullary layers of the pineal gland were clearly distinguished. The pineocytes were much larger but fewer in number than in rats. The nuclei were polymorphic, translucent, and swollen with granules of chromatin and many pseudokaryosomes. The cell cytoplasm stained deeply with bromphenol blue and Sudan, pointing to a high level of protein and lipids in the cell. Large capillaries, filled with red blood cells, were more conspicuous at the periphery of the gland.

During hibernation the boundary between the peripheral and central parts of the pineal gland disappeared. The nuclei of the pineocytes were pycnotic, homogeneously stained, and condensed and degenerative forms were often seen. No pseudokaryosomes were visible. The cytoplasm stained weakly with bromphenol blue and Sudan. The capillaries were empty. The serotonin level was halved (6.7 ± 0.6 ng). The serotonin content was independent of whether the sousliks were kept in permanent darkness or with periodic illumination.

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The results point to marked morphological and functional changes in the pineal glands of sousliks during hibernation. These changes were largely similar to those taking place after denervation of the pineal gland. In that state the serotonin level was lowered by 2.5-3 times [2], the characteristic rapid changes in its content with the change to light and darkness [3, 5], and disappearance of the morphological division of the pineal glands into peripheral and central parts [6] were found. This suggests that during hibernation the pineal gland is in a state of "functional denervation."

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