DIURNAL RHYTHM OF MITOTIC ACTIVITY IN THE ADRENAL CORTEX AND CORNEAL EPITHELIUM OF 16-DAY RAT FETUSES

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During the study of mitotic activity in 16-day rat fetuses no diurnal rhythm of mitosis was found either in the adrenal cortex or in the corneal epithelium.

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The diurnal rhythm of mitosis in the adrenal cortex and corneal epithelium of adult animals has been studied comparatively well [1, 4, 5, 7-10]. Differences have been found between the diurnal rhythms in the zona glomerulosa of the adrenals and in the zona fasciculata and zona reticularis [4, 7, 8].

It has also been shown recently that the characteristic mitotic rhythm of adult animals appears in both zones of the adrenal after sexual maturity, while in the corneal epithelium the appearance of a definitive diurnal mitotic rhythm is associated with opening of the eyes [2, 3, 6].

No attempt has been made to study whether a diurnal rhythm of mitosis is present in the early stages of embryonic development. There is no information on this problem in the literature, and accordingly it was decided to investigate the rhythm of mitosis in the adrenal and corneal epithelium of 16-day rat fetuses. In fetuses of this age the palpebral fissure is still open, closure taking place before birth (18th day of prenatal development), and the eyes of young rats finally become open 15 days after birth; the adrenal cortex is not yet subidivided into zones.

EXPERIMENTAL METHOD

Experiments were carried out on noninbred female albino rats kept in natural illumination and with free access to food. The rats were killed by decapitation on the 16th day of pregnancy every 3 h during the 24 h period, and fetuses were taken from the uterus, 5-7 fetuses being examined at each time. The mean length of the fetuses was 15 mm and their mean weight 316 mg.

The material was fixed in Carnoy's mixture, the kidney together with the adrenal embedded in paraffin wax, and sections 7 μ in thickness were stained with Carazzi's hematoxylin.

Mitotic activity was determined in the adrenal cortex in 6000-8000 cells (both adrenals were counted), and in the corneal epithelium in 2000 cells (both corneas were counted).

EXPERIMENTAL RESULTS

Results of the counts showed that during the 24 h period changes are observed in the number of mitoses in the adrenal (Fig. 1A): the number of mitoses reached a maximum at 7 p.m. (MI = 14.2%), and a minimum at 4 p.m. (MI = 12.5%). None of the variations found in the mitotic index (MI) was statistically significant (P = 0.3-0.4). The mean level of mitotic activity during the 24-h period was 14%, in agreement with the results of earlier experiments on rat fetuses aged 21-22 days (13.3%) [6].

None of the changes in MI in the corneal epithelium (Fig. 1B) during the 24-h period likewise were significant and the character of the curve showing changes in MI during the 24-h period resembled that obtained for the adrenal: the number of mitoses reached a maximum at 7 p.m. (MI = 8.3%) and a minimum at 4 p.m. (MI = 5.3%). The mean value of MI during the 24-h period in the corneal epithelium of the 16-day fetuses was 6.8%, the same as that found in 21- and 22-day fetuses (6.6%).

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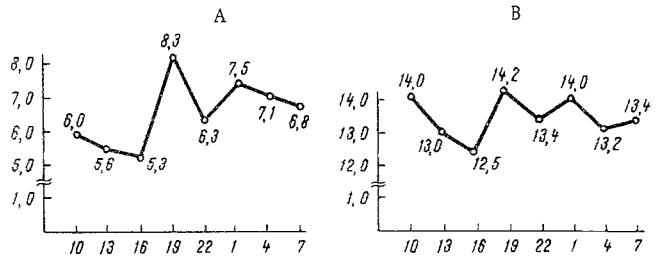

Fig. 1. Changes in mitotic activity in cells of adrenal cortex (A) and corneal epithelium (B) during 24-h period. Abscissa, time of day; ordinate, mitotic index (in %).

The changes in the number of mitoses found in the adrenal and corneal epithelium of 16-day fetuses during the 24-h period were thus small and were not statistically significant. The results of this experiment clearly showed that the characteristic diurnal rhythm of mitosis observed in most tissues of adult animals appears at a particular stage of ontogenetic development, and is not inborn.

Most probably before a certain stage of fetal development there is no common system of regulation of cell division for most organs. During growth and maturation of the organs and with the onset of their function, common mechanisms of regulation of cell division begin to predominate.

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