

# CIRCADIAN RHYTHM OF MITOSIS AND MITOTIC ACTIVITY OF EPITHELIUM OF THE CONVOLUTED TUBULES OF THE KIDNEY AT HIGH ALTITUDES

F. Kh. Sharipov

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After rats have been taken up from the valley (800 m above sea level) into the mountains (3379 m above sea level), the mitotic activity of the epithelium of the renal convoluted tubules is sharply inhibited for the first few days. This activity increases slightly toward the 5th day and returns almost to normal after the animals have remained for 30 days at a high altitude. When the rats are taken back from the mountains into the valley, their normal mitotic activity is restored within five days. The circadian rhythm of mitosis was undisturbed at high altitudes.

After infliction of skin or muscle wounds and also of fractures on animals during the first few days after being taken up to a high altitude, the processes of posttraumatic regeneration are retarded. Conversely, recent work has shown that the relative adaptation of albino rats and mice developing after the animals have been kept for 1 month at a high altitude restores the rate of their regenerative processes close to that observed in the valley.

In the present investigation, the mitotic activity and its circadian rhythm were studied in the renal epithelium of rats under the influence of transportation to a high altitude, local adaptation to mountain conditions, and descent to the plains after adaptation for one month.

## EXPERIMENTAL METHOD

Experiments were carried out in the mountains at an altitude of 3379 m above sea level (Anzobskii Pass) on 200 male albino rats weighing 100-200 g. The animals were divided into five groups with 40 rats in each group, and batches of five animals from each group were kept in separate cages. They were fed once a day (at 9 a.m.) ad lib. The rats received no food on the day of sacrifice. The animals were killed by decapitation every 3 h, from 6 a.m. to 3 a.m., five at each time, on the 2nd, 5th, and 30th days after arriving in the mountains from the plains (altitude of Dushanbe 800 m above sea level). The remaining 80 rats, after remaining for 1 month in the mountains, were taken down to the plains and sacrificed there at the same time as in the mountains, on the 2nd and 5th days. A further 40 rats, which were not taken into the mountains, were sacrificed in the plains as a control.

## EXPERIMENTAL RESULTS

The experimental results showed that the ascent from the plains into the mountains caused sharp inhibition of mitotic activity in the renal tubules. The mean mitotic coefficient (MC) for the 24-hour period fell from 0.69 to 0.20 ‰. This decrease was statistically significant at all times (transgression absent).

The number of mitoses reached a maximum at 12 noon, just as in the plains, and a minimum at 9 p.m. and midnight in the mountains and in the plains, while in the rats adapted to high altitude conditions for 4-5 days a further minimum was found at 6 p.m.

The experiment showed that during adaptation of the animals to high altitude conditions, the MC increased, so that in rats staying in the mountains for 4-5 days it was 0.45 ‰, and in rats staying one month it was 0.57 ‰.

The mean value of MC for the 24-hour period in the experimental series (0.45 ‰) was rather nearer to the control value (0.69 ‰) on the 5th day, and the differences which were present were close to statisti-

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cally significant ( $P < 0.05$ ). On the 30th day, the value of MC was still closer to the control figure: the difference between them was not statistically significant ( $P < 0.05$ ). The results of the final series of experiments showed that the normal MC was restored on the 5th day after the rats had come down from the mountains where they had stayed for 30 days. The difference from the control was not statistically significant ( $P < 0.05$ ).

It thus follows from these experiments that the complex of factors operating at high altitudes (low concentration of oxygen and low atmospheric pressure, high ultraviolet radiation and ionization of the atmosphere, etc.) has an inhibitory action on mitotic activity of the epithelium of the renal convoluted tubules of animals during the first days after their transfer from the plains to the mountains. Gradual adaptation of the animals to high altitude conditions has a favorable effect on mitotic activity, so that after the animals have been taken down to the plains, the mitotic activity of the epithelium of their renal convoluted tubules is rapidly restored to normal.