

# Effect of Destruction of the Subthalamic Area on Grooming Rhythms in Rat Ontogeny

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Experiments on rats under conditions of free behavior showed that the subthalamic nucleus through the corticospinal tract stimulates the development of a spinal generator of scratching movements in rat ontogeny.

**Key Words:** *subthalamus; biorhythms; grooming; ontogeny; graphic recording*

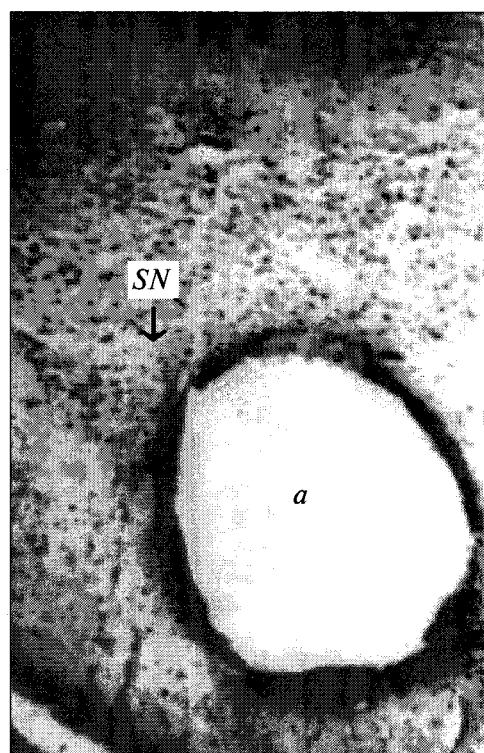
Axons of the subthalamic nucleus (SN) form a descending pathway and this nucleus is responsible for motor function. The subthalamic region belongs to the adaptive system facilitating reflectory activity [9]. The subthalamic region is a part of the hypothalamic locomotor area [2], and its stimulation induces locomotion or modulates its rhythm [8,14].

In sympathectomized animals, morphological and functional changes in SN correlate with changes in the rhythm of scratching movements (RSM) [5]. We suggested that SN regulates rhythms of not only locomotion, but also other automatic movements including grooming. The most typical feature of grooming is its rhythm. There is ample of evidence that suprasegmental structures participate in the regulation of grooming movements [3,4,7,12]. However, there are no data on suprasegmental control over RSM. The aim of this study was to elucidate whether the subthalamic region regulates RSM, i. e. interacts with spinal generators of grooming rhythms, and their development during ontogeny.

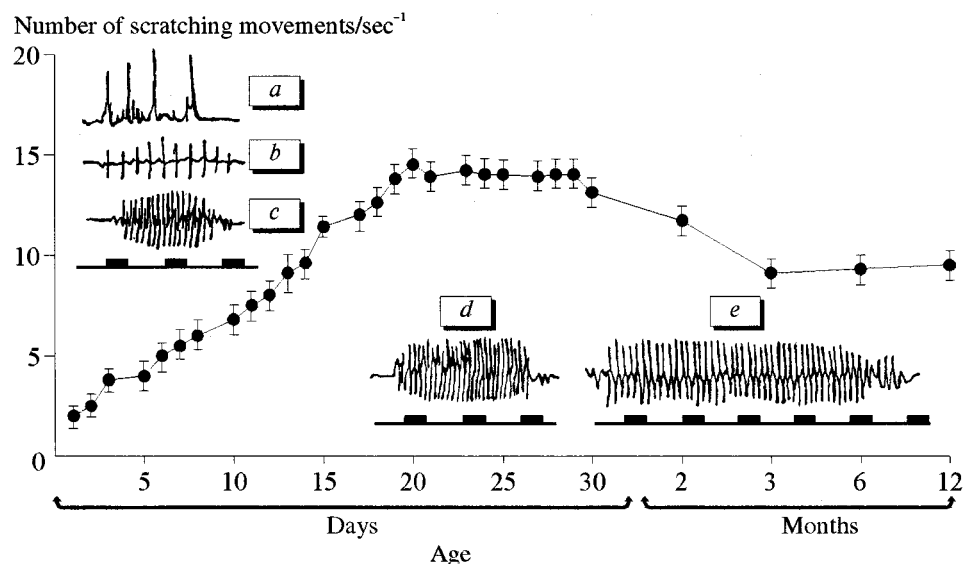
## MATERIALS AND METHODS

Experiments were carried out on male albino rats aged from several days to 6 months under conditions of free behavior. Motor activity of control ( $n=7$ ) and operated rats ( $n=8$ ) was recorded on an encephalograph coupled

to an actograph with a piezoelectric transducer [6]. The control and operated animals were placed in different actographs simultaneously to compare their locomotor activity. This approach allows us to analyze



**Fig. 1.** Histological verification of electrode localization during stereotaxic operation. *a*: destroyed area; SN: intact part of the subthalamic nucleus.



**Fig. 2.** Developmental changes in the rhythm of scratching movements in rats. *a-d*) 3, 7, 10, and 22 days; *e*) 3 months.

the rhythms of grooming (washing, scratching, licking, biting, and shaking) before and after destruction of SN.

The right SN was destroyed stereotactically at the age of 4-5 days by passing anodal 3A current for 2 sec. Localization of the electrode was verified histologically (Fig. 1). The data were analyzed statistically.

## RESULTS

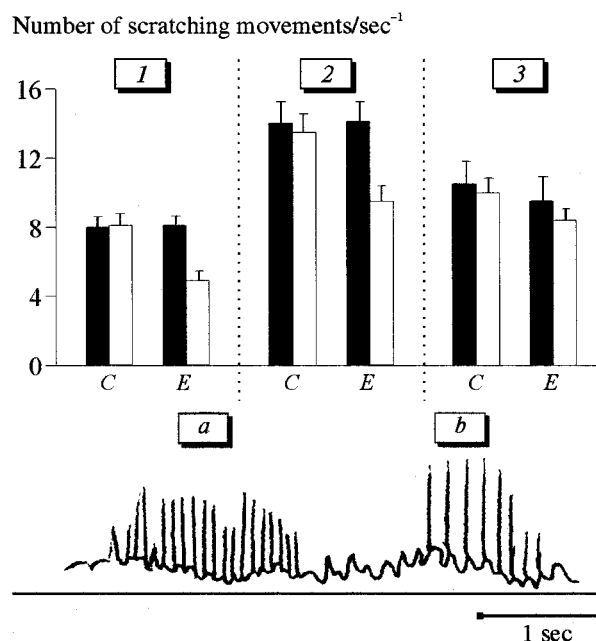
Unilateral destruction of SN had no effect on the dynamics of ontogenetic changes in the rate of such grooming movements as washing, licking, and shaking. In operated rats at the age 20-60 days the frequency of furbiting tended to decrease but significant changes were observed only in the rhythm of scratching.

The dynamics of RSM during ontogeny can be divided into three periods. The first period (before eye opening, 16 days) was characterized by a rapid increase in the frequency of scratching movements from  $2.6 \pm 0.3 \text{ sec}^{-1}$  in 1-day-old pups to  $10.0 \pm 0.5 \text{ sec}^{-1}$  in 14-day-old rats, which corresponded to the adult rate (Fig. 2, *a-c*). This period was described previously [1]. During the second period (after eye opening), the rate of scratching movements gradually increased and at the age of 2 months became higher than in adult animals (Fig. 2, *d*). In the third period RSM returned to the adult value and remained stable for a long time (Fig. 2, *e*).

Destruction of the right SN affected only RSM of the contralateral (left) paw (Fig. 3, *b*). In the control group, the rate of scratchings by the right and left paws was the same in all developmental periods.

In the operated group, a decrease in the left-paw RSM was significant before eye opening (40%) and in 2-month-old rats (30%), while in 3-month-old rats with destroyed SN, the rate of scratching was only 10% below the control (Fig. 3).

Frequency of RSM reflects the maturity and functional state of spinal RSM generator located in lumbar segments C1-C3 [13]. It can be suggested that this generator receives suprasegmental activating influences through the corticospinal tract, which is known to establish contralateral connections with SN [10]. The fibers of the corticospinal tract reach the lumbosacral segments of the spinal cord on day 2 after birth [11]. Our findings suggest that SN stimulates the development and activation of a spinal generator of RSM in



**Fig. 3.** Effect of destruction of subthalamic area on scratching rate in different ontogenetic periods. 1) before eye opening; 2) after eye opening until 2 months; 3) adult, 3 months; C: control rats; E: destruction of the right SN; filled bars: right-paw scratchings; open bars: left-paw scratchings. Actograms below correspond to scratchings by the right (*a*) and left (*b*) paws in a 21-day-old rat after destruction of the right subthalamic nucleus.

rats and its tonic effect is most pronounced at the early stages of postnatal ontogeny.

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