EP.1814

Startle reflex and aggressiveness in adult male Norway rats selected for behavior after intranasal oxytocin administration in adolescence

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Introduction:

Oxytocin is known to play an important role in social interaction functions such as maternal behavior, sexual behavior, and aggression, as well as in nonsocial functions, such as anxiety, learning, and startle reflex. There is evidence that oxytocin administration in early postnatal development affects adult social behavior by altering neural structure and function. However, the action of oxytocin on behavior is not always uniform. It may depend on individual features, situation, way of administration, and the activity of the endogenous oxytocinergic system.

Since 1972, Institute of Cytology and Genetics SB RAS (Novosibirsk, Russia) carries out selection of wild Norway gray rats (Rattus norvegicus) for elimination of defensive reactions to humans (tame rats) and for enhancement of aggressive behavior toward humans (aggressive rats). Reaction of rats to humans was assessed in the glove test (see video). Tame rats are not afraid of humans and are more accustomed to human hands than laboratory rats. Tame rats have decreased intermale aggression as compared to rats of aggressive strain, having same behavioral patterns of agonistic interactions. Aggressive rats have an increased aggressiveness towards humans, as well as towards conspecific animals.

Aggressive rats

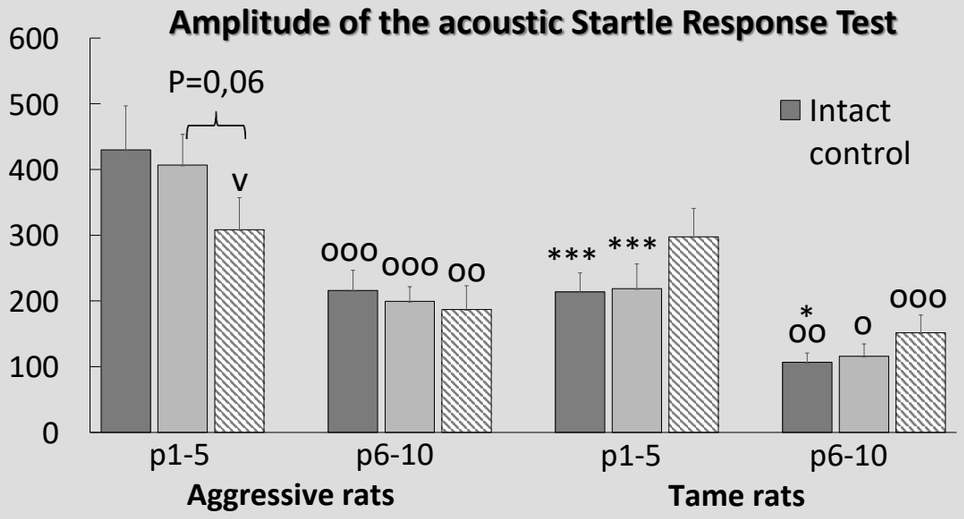
Wild rat

Tame rat

Materials and methods, results:

After weaning on day 23, males of the same behavior group belonging to different litters were placed in fives into cages. Within the next four days, the animals were exposed to handling for 2 min once a day to accustom them to this procedure. Starting on day 28, the animals received nasal applications of 5 µL of oxytocin solution (1 µg/µL) or saline for 5 days.

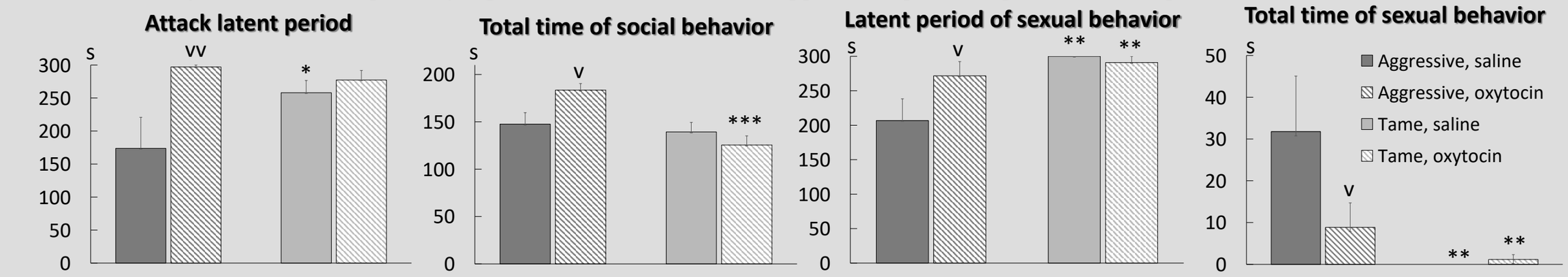
At the age of two months, the amplitude of the acoustic startle reflex was assessed in two series of 5 acoustic stimuli.



*** p<0.001, * p<0.05 in comparison to corresponding aggressive rats;
v p<0.05 in comparison to control group;
ooo p<0.001, oo p<0.01, o p<0.05 in comparison to 1-5 stimuli of corresponding group.

The results indicate that the startle amplitude in aggressive rats of the intact group (in either series) and those having received saline (in the first series (p1-5)) was larger than in the corresponding tame groups. Oxytocin applications to aggressive rats reduced the startle amplitude in the first series in comparison to intact animals (P<0.05) and to animals having received saline (P=0.06), thereby leveling the difference between tame and aggressive animals. In tame animals, oxytocin administration did not affect the startle reflex amplitude in either series.

The resident–intruder test was performed one week later. The intruders were Wistar males with weights close to those of residents. The following events were registered: first attack latency, the overall time of aggressive behavior, and the numbers and times of its components: rearings, keepings down, lateral threats, aggressive groomings, and chasings.



*** p<0.001, ** p<0.01, * p<0.05 in comparison to corresponding aggressive rats (Fisher LSD); ^{vv} p<0.01, ^{v} p<0.05 in comparison to saline group (Fisher LSD).

The latency of attacks and sexual behavior in aggressive males having received oxytocin were longer than in control males receiving saline. Oxytocin applications to aggressive males prolonged the time of social behavior, excluding aggressive or sexual, and shortened the time of sexual behavior in comparison to control.

Conclusion:

Thus, oxytocin applications in adolescence reduces the acoustic fear reaction and aggressiveness in aggressive but not tame males. This phenomenon may be related to features of the endogenous oxytocinergic system or the rate of its development in tame males.

Supported by the Russian Foundation for Basic Research no. 16-04-00637-a.