



Absence of the tail in female rats disrupts the copulatory pattern of experienced male partners

ESTELA CUEVAS*, MAYVI ALVARADO† & PABLO PACHECO‡

*Centro Tlaxcala de Biología de la Conducta, Universidad Autónoma de Tlaxcala, México

†Instituto de Neuroetología, Universidad Veracruzana, México

‡Instituto de Investigaciones Biomédicas, Universidad Nacional Autónoma de México

(Received 26 October 2006; initial acceptance 31 January 2007;

final acceptance 8 August 2007; published online 20 February 2008; MS. number: A10603R)

Diverse factors such as sex hormones and sensory stimulation, mainly of the perigenital region, influence sexual behaviour of both Wistar male and female rats, *Rattus norvegicus*. The tail in rats provides important sensory and proprioceptive information, which suggests that this part of the body could be relevant during sexual performance. We analysed the repercussion of the absence of the tail on male and female sexual behaviour. In experiment 1, the lack of the tail in males (caudotomized group) did not affect their copulatory parameters. In comparison with sham and intact groups, they correctly executed the copulatory pattern and deposited the seminal plug into the vagina. Thus, the sensory information given by the tail in males was not relevant for their sexual performance. In experiment 2, the lack of the tail in females did not affect the lordosis quotient in comparison with control females, but it did alter copulatory parameters of male partners with tails. Although caudotomized females were as attractive as control females, males that mated with caudotomized females performed more mounts, and fewer intromissions, and they had lower intromission rates, longer latencies to ejaculation, longer interintromission intervals and longer postejaculatory intervals than males that mated with control females. These results suggest that the female tail stimulates the perineal area of males, facilitating male copulatory performance, because males that mated with caudotomized females had reduced sexual performance.

© 2008 The Association for the Study of Animal Behaviour. Published by Elsevier Ltd. All rights reserved.

Keywords: copulatory behaviour; ejaculation; intromission; lordosis; mating; mount; *Rattus norvegicus*; sexual motivation; tail; Wistar rat

Sexual behaviour in both male and female rodents involves execution of stereotyped behavioural responses using diverse muscles (Hart & Melese-D'Hospital 1983) and specific brain regions (van Furth et al. 1995; Kondo et al. 1997; Agmo 1999; Liu & Sachs 1999). The sexual display behaviour of male rats is characterized by an arousal phase and a performance phase, although sexual

arousal occurs during the performance phase. The first, or 'precopulatory', phase includes male recognition of females by olfaction, production of ultrasonic vocalizations and urine marking. The second phase involves rhythmic pelvic movements that may result in insertion of the penis into the vagina. Temporal and spatial patterns of both phases can be modulated by sex hormones (Clancy et al. 2000; Huddleston et al. 2003; Bakker et al. 2004) and sensory stimuli (e.g. presence of a receptive female: Hetta & Meyerson 1978; López et al. 1999; Agmo 2003; female odour: Carr et al. 1965). The mating pattern of the female rat includes attractive, proceptive and receptive (lordosis) behaviours (Komisaruk 1974; Beach 1976; Erskine 1989). Similar to males, female mating behaviour can be regulated by gonadal hormones

Correspondence: P. Pacheco, Instituto de Neuroetología, Universidad Veracruzana, Xalapa, Ver., México (email: ppacheco@uv.mx). E. Cuevas is at the Centro Tlaxcala de Biología de la Conducta, Universidad Autónoma de Tlaxcala, Tlaxcala, México, Carretera Tlaxcala/Puebla Km 1.5, C.P. 90110. M. Alvarado is at the Instituto de Neuroetología, Universidad Veracruzana, Xalapa, Ver., México, Carretera Xalapa-Veracruz Km 3.5.

(Brandling-Bennett et al. 1999; White & Uphouse 2004) and sensory stimuli. Thus, vaginocervical stimulation in rats during copulation influences both the intensity of lordosis and the length of the female postcopulatory refractory period (Yang & Clemens 1998; Lehmann & Erskine 2004).

Sensory systems in male and female rats are strongly activated during sexual behaviour, so any interruption of these systems disrupts sexual performance. For example, in males, the deafferentation of the olfactory bulb increases their latency to ejaculate (Edwards et al. 1996), and stimulation of the genital area induces erection and flips of the penis (Hart 1968). Moreover, sensory pudendal nerve transection reduces the number of intromissions and ejaculations (Sachs & Liu 1992). In females, stimulation of the flank, rump and perigenital regions promote female lordosis (Komisaruk 1978; Brandling-Bennett et al. 1999; Bennett et al. 2002). Likewise, the sensory field of the perineal regions changes under the influence of gonadal hormones, being greatest during receptivity (Komisaruk et al. 1972). Thus, sensory systems are extremely important to sexual performance both in males and in females. In particular, we are interested in the sensory and proprioceptive information given by the tail during copula in rats, taking into account that this portion of the body in rats has a long field of skin, which has been little explored.

The tail in rats has been proposed as the major organ for heat loss, because of its great vascular irrigation (Little & Stoner 1968; Stricker & Hainsworth 1971; Prímola-Gomes et al. 2007). Likewise, the tail has been considered as an excellent sensor of temperature in rats: when an individual is exposed to heat, it shows a tail flick reflex that involves dorsiflexion and movement of the tail to one preferred horizontal direction (Cruz et al. 1996). However, nothing is known about the sensory information provided by the skin of the tail in males or females during copulation. The tail in rats has numerous scales, with three richly innervated hairs on each scale, which could provide important sensory information (Thompson 1970), so it is relevant to ask whether the tail in rats also participates in copulatory behaviour.

Furthermore, the rat's tail acts as an equipoise, allowing the animal to maintain its balance. Small adjustments in the position of the tail during an unbalanced situation require proprioceptive information, which is provided by numerous spindles in the small muscles of the tail (Thompson 1970; Andrew et al. 1973) and which can be regulated by visual, auditory, tactile or rotatory stimuli (Steg 1964). However, it is not known whether the proprioceptive information given by the tail is also relevant during copulation, such that the tail could operate as a motor tool during copulation.

Although the tail in rats is an important sensory organ and has a clear motor function, its participation during mating is poorly described. Thus, the specific aim of the present study was to investigate the effect of tail removal (caudotomy) on the copulatory parameters of male and female rats, hoping to demonstrate a modulatory action of the tail on the performance of rat sexual behaviour.

METHODS

Throughout the study, animals were treated and maintained according to the Policy on the Use of Animals in Neuroscience Research (The Society for Neuroscience), the Policy on Humane Care and Use of Laboratory Animals (National Institutes of Health), and the guidelines of the Instituto de Investigaciones Biomédicas, Universidad Nacional Autónoma de México, for the treatment of animals in research. Male and female adult Wistar rats were maintained on a reversed 12:12 h light:dark cycle (lights off at 0800 hours), with food (Harlan, México, D.F.) and water freely available.

Subjects were experienced male rats (obtained by screening tests) and ovariectomized female rats that were treated with sex hormones. Bilateral ovariectomy was performed under intraperitoneal injection of sodium pentobarbital anaesthesia (30 mg/kg of body weight; Anestosal, Smith Kline, México City, México). One week later, females were subcutaneously injected with 10 µg of estradiol benzoate and 2 mg of progesterone, 52 and 4 h before testing, respectively (Lucio et al. 1994; Brandling-Bennett et al. 1999; Manzo et al. 2000). Both hormones (Sigma Chemical, St Louis, MO, U.S.A.) were dissolved in 0.1 ml of sesame oil. Female sexual behaviour was evaluated by lordosis quotients (number of lordosis responses divided by the number of mounts by the male, multiplied by 100) (Uphouse 2000). Females displaying low levels of sexual receptivity (lordosis quotient <70) at the time of the screening tests were eliminated from the study.

Caudotomy

Caudotomy and sham lesions were performed under intraperitoneal injection of sodium pentobarbital anaesthesia (30 mg/kg of body weight; Anestosal, Smith Kline). Caudotomy consisted of making a longitudinal incision in the dorsal tail skin to expose the fascia and tail muscles associated with the sacral 4 (S4) and coccyges 1 (Ca1) vertebrae. After cauterization of the lateral veins and arteries, the tail was removed after severing the vertebral column at the S4–Ca1 articulation. Muscles and skin were carefully sutured to minimize the formation of scar tissue. During sham surgery, an incision was made in the tail skin and the fascia, and the muscles were exposed at the Ca1 spinal vertebra level. Immediately after surgery, the animals were injected intramuscularly with benzilpenicillin (50 000 units/animal) to prevent infection and with sodium metazolone (28 mg/kg) to counteract possible hyperalgesia. Animals were placed in an incubator for 6 h, then housed individually in acrylic cages (37 × 34 × 20 cm).

Mating Tests

Mating tests were carried out every other day during the final third of the dark phase and under dim red light (Mercier et al. 1987). Tests involved two consecutive copulatory series. During the first test, each male was placed alone in a cylindrical arena of transparent acrylic

Download English Version:

<https://daneshyari.com/en/article/2417739>

Download Persian Version:

<https://daneshyari.com/article/2417739>

[Daneshyari.com](https://daneshyari.com)