



MINI-REVIEW

Pheromone and Animal Reproduction: Speciation in Response to the Chemical Signal.

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SUMMARY

The first pheromone ever identified in (1956) was a powerful sex attractant for silkworm moths. A team of German researchers worked 20 years to isolate it. After removing certain glands at the tip of the abdomen of 500,000 female moths, they extracted a curious compound. The minutest quantity of it made male moths beat their wings in a 'flutter dance'. This clear sign that males had sensed the attractant enabled scientists to purify the pheromone. Step by step, they removed extraneous matter and sharply reduced the quantity of attractant needed to provoke the flutter dance. Pheromones are substances produced by animals that specifically serve as stimulus to other animals of the same species for one or more behavioural response. While humans are highly dependent upon visual cues when in close proximity, smell also play a big role in sociosexual behaviours. There is an inherent difficulty in studying human pheromones because of the need for cleanliness and odourlessness in human participants. Pheromones are often divided by function into two: Sex pheromones or reproductive pheromones and aggregation or convergent pheromones. For the purpose of this work, sex pheromones are the focus.

INTRODUCTION

Pheromones are important smell signal to find a sexual partner during the oestrous cycle (Hugo, 2004). Pheromones are air borne compounds and combination of compounds which strongly relate to the sense of smell that cause physiological and or behavioural changes within a species (Lawrence et al; 2004). Pheromones are chemicals that pass through the environment of an organism and cause either a change in the physiological state or a change in the immediate behaviour of an organism. The former is called a signalling pheromone while the latter is a releasing pheromone (Breer et al; 1998).

The vomeronasal organ is a major receptor site for pheromones, although it is possible that the olfactory system is also involved (Buck, 1991). Classically, pheromones have been thought of as a single chemical compound, but work with insect pheromones as well as with some mammalian pheromones strongly suggest that fully effective pheromones are actually combinations of chemicals in certain ratios (Rolls et al; 1998).

PEROMONES IN ANIMAL REPRODUCTION

Pheromones are chemicals usually with some degree of volatility that are produced by males and females and that stimulate

sexual interest through the olfactory system of animals within the same species (Benjamin, 2004).

Boars produce sexual attractants in the preputial pouch and in submaxillary salivary glands (Knobil, *et al*; 1998). The salivary pheromones are androgen metabolites 3 α -androstenol and 5 α -androstenone (Younquist, 1997). These influence females in estrus to facilitate their expression of a rigidity reflex, the copulatory or saw-horse stance signifying their sexual receptivity and readiness for coitus (Noakes *et al*; 2001).

Goats secrete capric or caproic acid; a pheromone secreted by the sebaceous glands located around the caudomedial aspect of the base of the horn. They are found in both sexes but smaller in castrate males and pregnant females. During breeding season, the sebaceous glands in goats hypertrophy and is very odourous. The odour is attributed to the secretion of capric or caproic acid by the gland.

Introduction of a ram into a flock of ewes just before the breeding season hastens its onset. The smell of the ram causes an increased frequency of pulsatile discharge of Luteinizing Hormone (LH) in ewes. This in turn causes follicular development and ovulation (Bracken, 2001).

Exposure of heifers to the bull urine causes them to reach puberty earlier (Garner *et al*; 2000). Similarly presence of the male accelerates pubertal onset in rodents, pigs and sheep.

The male dog attractant methyl-p-hydroxybenzoate from vaginal secretions of the bitch primes the male dog to reproductive activity (Feldman *et al*; 1996).

Human pheromones are based on three

classes of putative pheromones namely: axillary steroids, vaginal aliphatic acids and stimulators of the vomeronasal organ (Karl, 2005). There are three axillary steroids that have been described as human pheromones. They are: androstenone, androstenol and androstandienone. The axillary steroids are produced by the testes, ovaries apocrine glands and adrenal glands (Warren, 2003). These androstenone, androstenol and androstandienone as biological chemicals are not active until puberty when the sex steroids influence their activity (Taymour, 2012).

ANIMAL RESPONSE TO PHEROMONE

Normally, the female mammals release the highest quantity of pheromones during the estrus. Estrus is a period of sexual receptivity. The pheromones released at this time is normally both primer, priming the males to reproductive activity as well as a releaser, causing a change of behaviour in the females which lead to acceptability of the males for coitus. Also, the female receive a primer olfaction secreted by the male of the same species. Thus, the reproductive behaviour of the female animal is a complex combination of pheromones available in the environment from both the male and the female secretory organs.

Increased female activity includes seeking out the male by the ewes, mounting other herd mates and standing to be mounted by the cows, Lordosis by the horse, rigidity reflex by the sow and vocalization by the queen (Mckinnon *et al*; 1993; Cupps, 1991).

Penile erection occurs spontaneously or in response to complex female cues mediated through the male's sense of sight, hearing and olfaction (Senger, 1997). Female pheromones associated with vaginal secretions and urine during estrus evoke a flehmen response. Flehmen refers to the

head elevation and curling of the upper lip that is best exemplified in the stallion, behavioural repertoire. This response is thought to assist the male, example; bulls, rams and stallion in identifying mating opportunities through their vomeronasal organ (Breer *et al*; 1998).

multigene family may encode Odorant Receptors: A Molecular

The vomeronasal organ is an accessory olfactory gland that enables detection of less volatile pheromone from female fluids that can reach it from the oral cavity by way of the nasopalatine (incisive) ducts (Miller, 1995).

Female pheromones frequently trigger the male's sexual response mediated by both the central and the autonomic nervous system. Episodically produced testosterone is aromatised to estradiol in the brain, thereby serving to prepare the hypothalamus to initiate the male sexual response (as well as the female) to sensory input to the appropriate stimuli (Rolls *et al*; 1998; Reece, 1997). This can involve neurons of virtually every level of the central nervous system and results in an expression of various male reproductive behaviours characteristic of individual spe

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