

Feline Behavior

Benjamin L. Hart, D.V.M., Ph.D.

Olfaction and Feline Behavior

□ In one sense cats and most other mammals live in a world completely different than ours. Think of what it would be like if every time you wondered who had been at your back door, or had last driven your car, you could simply smell the area and identify the individual. Think of what it would be like if you could tell the reproductive state of every woman you met by her smell as she was approached. Also think of what it would be like to identify your children simply by briefly smelling them. These are a few examples of how the animal's world of olfaction differs greatly from ours. This difference in olfactory capacity is related to some rather major differences in size of the olfactory systems between cats (and most other mammals) and man. The olfactory bulbs, which are the first neuronal relay station for the transfer of olfactory information from the nose to the brain, and the associated olfactory tracts, are much larger in cats (Fig. 1).

Two Olfactory Systems

In addition to having a larger olfactory system, cats and other mammals (except new world monkeys) have an accessory olfactory system that is not present in man. The peripheral olfactory organ is sometimes referred to as Jacobson's organ but more frequently it is called the vomeronasal organ. The accessory olfactory system is receiving more attention from research investigators, especially those interested in the role that this olfactory system plays in reproductive behavior.

The vomeronasal organ is a blind pouch situated just dorsal to the hard palate. The organ may never have been mentioned in veterinary anatomy classes since it is small and it is only very recently that there has been interest in the organ. This organ communicates with the nasal and oral cavities by means of the nasopalatine duct which opens just behind the incisor teeth.

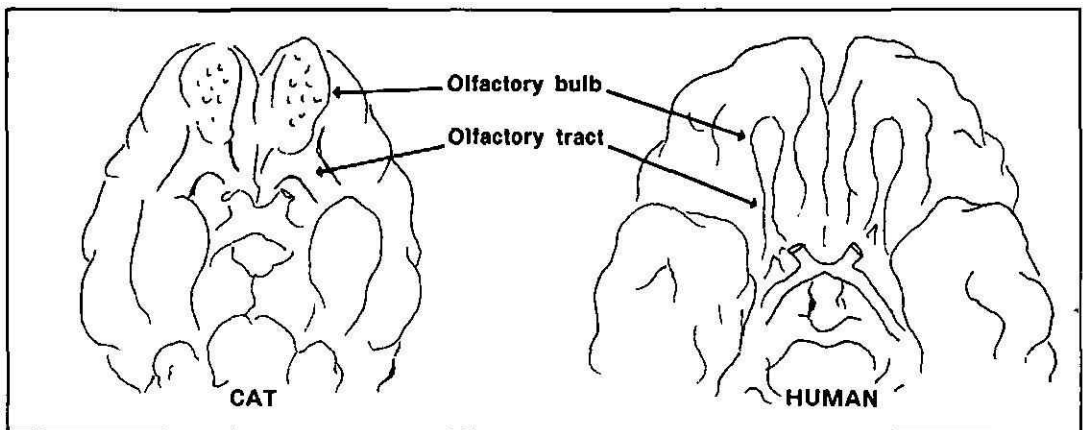
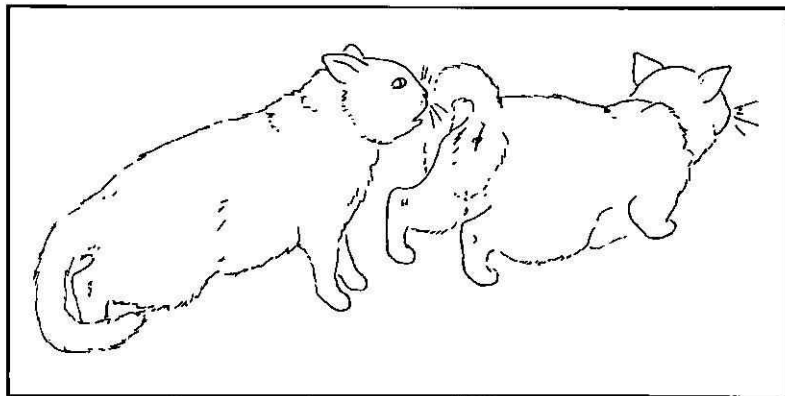


Fig. 1 — Olfactory bulbs and tracts are relatively larger in the cat than in the human brain.

Fig. 2 — Male cats sometimes flehmen as they investigate the genital area or voided urine of female cats.



The organ is lined by olfactory epithelium with olfactory cells very similar to those found in the main olfactory epithelium of the nasal cavity. The organ is filled with a mucous fluid.

The nerves that innervate the vomeronasal organ run to an accessory olfactory bulb and from there connections in the brain involve an entirely different set of nuclei and pathways than those coming from the main olfactory system. How and when the accessory olfactory system is used in addition to or instead of the main olfactory organ is unknown. It is generally believed that the vomeronasal organ is involved in reproductive activities and possibly in social interactions. One theory holds that this organ is particularly useful in the perception of sexual attractants or sexual pheromones put out by females when they come into estrus.

THE FLEHMEN REACTION

It has been proposed that the flehmen reaction displayed by tomcats and occasionally by neutered males and females, is a behavior that facilitates the exposure of the vomeronasal organ to the chemical sex pheromones. The flehmen reaction involves extension of the neck and lifting of the upper lip which seems to constrict the nasal passages (Fig. 2). The animal presumably then inspires and substances are drawn from the mouth into the nasopalatine duct for exposure to the vomeronasal organ. In ruminants and horses the flehmen response is more readily identified since the curling of the upper lip is quite prominent.

According to the sex pheromone detection theory when a male cat investigates the urine or vaginal area of a female cat and makes a flehmen response he is better able to determine if she is in estrus or not. The vomeronasal organ and the flehmen re-

sponse are involved in examination of urine and other scent marks in a cat's environment that are not related to reproduction.

Sex Pheromones

It is fairly well documented that female cats and females of other mammalian species (except possibly the human) produce substances in the urine and vaginal secretions during the time of estrus which communicate to males of the same species that the female is sexually receptive. No one has identified these particular pheromones for the cat or any mammal for that matter. But tests with urine and vaginal secretions from estrous and anestrus females have indicated that the males are capable of discriminating between samples from estrous and anestrus females and that they prefer the samples from females in estrus. The substances in the urine or secretions may be metabolites of estrogen or they may be secretory products induced by the secretion of estrogen. It is interesting that there appears to be a great deal of species specificity in the reaction of males to such sex pheromones. For example, tomcats do not seem to get particularly excited by urine from a female dog or cow in estrus but may react to the urine from a female cat in estrus.

As important as the sense of smell is in the sexual interaction of cats, normal sexual behavior will continue even when male cats are incapable of smelling. In one experiment it was found that removal of the olfactory bulbs and the accessory olfactory bulbs did not eliminate copulatory activity (Aronson LR, Cooper ML, Behav Biol 4:459-480, 1974).

The catnip reaction shown by some 50-70% of the domestic cats is evidently

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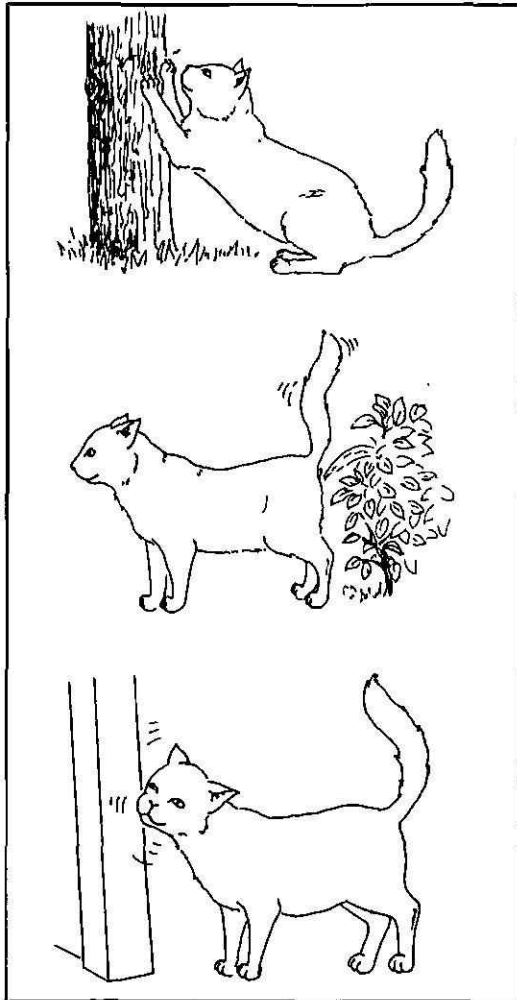


Fig. 3 — Three types of scent marking in cats: marking with foot glands while leaving visual (claw) marks; urine spraying; rubbing cheek glands.

evoked by olfactory stimulation. Some cats are obviously attracted to the smell of catnip, and when they have smelled enough of it engage in rolling and rubbing similar to that performed by a female cat in estrus when she contacts the urine of a male cat. Whether the catnip reaction is a function of stimulation of the main olfactory organ or of the vomeronasal organ is a question which could be investigated but is presently unknown.

Scent Marking in Cats

As I mentioned, cats live in an olfactory world much different than ours. Not only are they capable of smelling things that we

cannot perceive, but they engage in a good deal of scent marking which either communicates their presence to other cats or familiarizes them with their territory. Cats appear to engage in three types of scent marking (Fig. 3).

TREE SCRATCHING

Tree scratching, of course, leaves a visual mark when the same tree is repeatedly scuffed up. At the same time it is probably true that the cat is applying secretory material from foot glands onto the tree to give it a particular scent. This odor can then be detected by the resident as well as intruders who would recognize this tree as some sort of territorial mark. Perhaps the sight of a scuffed-up tree attracts other cats to the visual mark to investigate it more fully.

URINE SPRAYING

Urine spraying is a type of scent marking resorted to most frequently by tomcats. We must assume that urine of different male cats carries individual odors and that objects such as trees, bushes, sides of a house or car tires, when marked with urine, have a particular odor that indicates which individual cat is responsible for the spraying. Spraying tends to be done during certain times of the day and often when the cat is excited or emotionally upset. Since emotional disturbances most frequently occur in territorial boundaries, objects that are sprayed tend to be often located along territorial boundaries.

CHEEK RUBBING

A third type of scent marking is cheek rubbing or head rubbing. In these instances cats presumably rub glands, located at the corners of the cheek or in the supraorbital region between the eye and the ear, on objects in the territory. Table legs, chairs, and doorway thresholds are common objects marked in this manner as are the legs of the people in the cat's immediate family. This type of scent marking probably helps the cat feel adapted and more familiar with its surroundings.

When we realize that there are several diverse ways that cats produce olfactory marks, and that they are capable of utilizing the chemical signals not only to recognize the sex and reproductive status of other cats, but individuals as well, it is possible to imagine how the olfactory world of cats must differ markedly from our own more visually oriented world. □