

DEER 'TALK' WITH THEIR NOSES

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There's little doubt that the most important sense to white-tailed deer is the sense of smell. Deer rely on their noses to warn them of the presence of predators and to help them find food. However, the most important function of scents is their role in communication with other deer. Simply through the sense of smell, deer can recognize other deer, learn about the other deer's sex, dominance status, reproductive state, and so on. Because we perceive our world primarily through visual means, it is hard for us to fathom the importance of odors in the world of other animals, such as whitetails. To just get a clue about what types of information deer get out of each whiff of air, we have to spend months, or years, in the laboratory working with highly sophisticated analytical equipment. Even after we identify a number of suspected compounds, we still only have a guess as to what these compounds tell the deer, if anything. We can test these compounds, and see how deer react to them. However, in many cases deer don't react to them at all. Does this mean that the deer didn't receive any information from them? Hardly! Just because the deer didn't give a behavioral response doesn't mean that it didn't learn something. On top of that, the context in which the scents are presented certainly influences how a deer may respond. What all this means is that until someone figures out how to wire up a deer's nose to a human, or to put a human's mind into a deer's brain, we will never be certain what a deer smells when it smells something.

One of the best ways for us to get an idea of how deer communicate with scents is to look at the different glandular areas on the deer. We can watch the behavior of the animals and try to determine when and how these glands are used. We can look at the structure of these glands microscopically to determine how they differ between sexes, age classes and times of the year. We can even hook up electronic monitoring equipment to the glands to determine if they are active or not. However, the first step is to just identify the different glands. It seems like a new gland is found every couple of years. So far we know of 7 different glands or glandular areas on deer, but as we continue our research, we may discover even more.

So what are the glands on white-tailed deer and what do we know, or think we know, about them?

Interdigital Gland - The interdigital glands are located on all four feet. Each gland is a small sparsely-haired sac that opens between the toes. In this sac you can generally find a yellowish, cheesy material. This accumulation is the result of sloughed cells and glandular secretions. The material often has a foul, rancid odor. Some of this scent is undoubtedly left in a deer's track every time it takes a step. Several years ago at The University of Georgia we identified several compounds associated with this gland. They were all small molecules called volatile fatty acids. Interestingly, these molecules have different volatilities. In other words, the molecules evaporate off at different rates. This would cause the odor of the track to change over time which may be how a deer (or a predator) can tell how old the track is and which way the track is headed. More recently, Dr. Jon Gassett, a

former graduate student at the University conducted a more sophisticated analysis of the compounds associated with this gland. He identified 46 volatile compounds from the interdigital scent. Interestingly, 5 of these compounds occurred in much greater concentrations in dominant than in subordinate bucks. What this may mean to deer is not known, but it is interesting to speculate that pawing at scrape sites may leave a scent specific to dominant bucks.

Metatarsal Gland - The metatarsal glands are located on the outside of the deer's hind legs. Each gland consists of an oval ring of whitish hairs that surrounds a black callous area. The area under the hairs has large numbers of enlarged sebaceous glands. We have been unable so far to determine what function this gland plays in deer communication, if any. In mule and black-tailed deer, this gland is much larger than in whitetails and has been shown to be the source of an alarm pheromone (scent) that can alert other deer in the area to the presence of danger. Although it is possible that this gland serves the same purpose in whitetails, it may be just vestigial. This means that eons ago it may have had a purpose, but now it is slowly fading away. This has already occurred in some races of whitetails such as those in South America and Central America that completely lack this gland.

Tarsal Gland - Without a doubt the most important glands to whitetails, the tarsal glands are located on the inside of the deer's hind legs. These glands consist of a tuft of elongated hairs that is underlain by an area of enlarged sebaceous glands. They glands secrete a fatty substance, called a lipid, which adheres to the long hairs.

All hunters who have harvested a buck know about the strong smell that is often associated with this gland. However, not many know that this smell does not come from the gland itself but rather comes from urine deposited on the gland. All deer, bucks and does, adults and fawns, urinate onto the tarsal gland in a behavior called rub-urination. As the urine runs over the tarsal gland, the fatty material secreted from the glands onto the hairs selects out some molecules and holds them on the gland. The urine that is deposited on the gland, however, does not smell at all like the odor of the tarsal gland. This urine that remains on the gland undergoes some reactions with the air and with bacteria to produce the gland's characteristic smell.

Many hunters don't realize that all deer urinate on these glands at all times of the year. Even fawns less than a month of age will urinate onto the gland at least once a day. Most of the time the excess urine is licked off of the gland. However, during the breeding season the males, and primarily the dominant or mature males, urinate onto the tarsal much more frequently. They also no longer lick off the excess urine from the gland. This frequent rub-urination, along with chemical changes, is what stains the gland dark and gives the buck its rutting odor.

At the University, we have just completed a study of the secretory glands that underlay the tarsal tuft. We were surprised to learn that the activity of these glands did not change during the year and that there was no difference in activity between males and females. These findings verify that it is not a change in the activity of the gland that causes a change in the smell of the tarsal organ, but rather only a change in the frequency of rub-urination. In addition, our investigations have shown that the tarsal tuft is an excellent environment for bacterial growth. We have identified a number of species of bacteria on the tarsal gland. Apparently, the production of the tarsal odor results from a very complex interaction between products secreted by the gland itself, urinary deposition of additional compounds, and bacterial alteration of these compounds. It appears likely that the tarsal gland is somewhat analogous with the human underarm where bacterial alteration of body secretions produces each person's individual scent.

Clearly the tarsal gland is used by deer to recognize other deer. Deer often sniff the glands of other deer. By doing so they cannot only tell whom the other deer is, but also learn about the other's sex, dominance status, and condition. Does likely identify their fawns through the odors given off by the fawn's tarsal gland. Rutting bucks use this gland to advertise their dominance status and breeding condition both to other bucks and to does.

Because the tarsal is so important in deer communication, it would make sense that this gland could be used to the hunter's advantage. By placing a tarsal from a mature buck into the scrape of another buck you may signal a challenge to the buck. If he thinks someone is trying to invade his 'turf', he may return to the scrape more often. Using a tarsal while rattling also has its obvious advantages, as does making a drag from a tarsal gland.

Before using a tarsal, however, you need to remember that this gland is a signal of dominance among bucks. If a younger, subordinate deer gets a whiff of the scent of a mature buck, he may choose to go the other way instead. So if you're out after a 'good' buck only, the tarsal may help increase your odds. However, if you aren't particular and any buck will do, you might want to forget the tarsal.

Preorbital Gland - The preorbital, or lacrymal gland, is a small pocket located in front of the deer's eyes. At most times the pocket is closed. However it is under muscular control, and I have seen deer flare this gland open in several situations. Rutting bucks may open this gland when signaling their aggressive intents to other bucks (or deer researchers!). In addition, does often open this gland when they are tending their fawns.

We are not sure whether or not this gland actually produces a scent or not. The opening of the gland may just be a visual display and not an olfactory display. Some researchers, and hunters, suggest that the preorbital is used to mark the overhanging branch at a scrape site. Although this may be true, if you watch a buck marking an overhanging branch, you'll notice that he appear to be marking it with his whole head - forehead, antlers, nose, mouth, and preorbital area. It seems more likely that he is leaving scent on the branch from several areas which may include the preorbital gland.

Forehead Gland - The entire area between the antlers and the eyes is another very important gland to whitetails. The skin in this forehead area contains large numbers of secretory glands called apocrine sweat glands. These glands become more active during the rutting season in all deer, but the greatest amount of activity occurs in dominant, mature bucks. It seems certain that this gland is the source of scent left on antler rubs, and possibly on overhanging branches, during the breeding season. If you watch a deer making a rub, you'll notice that the buck uses the bases of his antlers and his forehead region. He will often pause and sniff or lick the rub as he makes it, apparently checking the scent he is leaving on the tree. Interestingly, we have observed does rubbing their foreheads on antler rubs made by bucks. The importance of this behavior in deer communication is not known.

Nasal Gland - Inside the nostrils of deer are two almond shaped glands that empty to the nostril by a short duct. We don't know if this gland produces a scent or if it just serves to lubricate the nose. However, it is possible that it may be used to mark overhanging branches in addition to other glandular regions of the head.

Preputial Gland - At the University we recently discovered another previously unknown gland on whitetails. The preputial glands, as we call them, are located on the inside of the buck's penal sheath. These glands are actually clusters of very enlarged sebaceous glands associated with very long hairs that extrude from the penal sheath. Since this gland was discovered so recently, we have not had time to determine what purpose it serves in

communication among deer. However, we guess that it could be important in helping bucks obtain their characteristic rutting odor.

Two Noses? Few hunters realize that a deer actually has two 'noses'. The second nose is technically not a nose, but it serves some of the same purpose. If you look on the roof of the deer's mouth you will see a diamond shaped structure with a small passage leading into the palate. This additional nose, called the vomeronasal organ (VNO), is similar to the Jacobson's organ that snakes use to 'taste' the air. Deer use the VNO exclusively to analyze urine. When a buck sees a doe urinate, he will often take some of this urine into his mouth and perform a behavior called flehmen, or lip-curl. This flehmen helps to introduce urine into the VNO. It is interesting that this organ is not connected to the same part of the brain that the nose is connected to. Instead it is connected to the part of the brain that controls the reproductive condition of the deer. What type of information the deer is getting is unknown, but it is likely that odors analyzed in the VNO help get the hormones pumping in the buck and bring him into rutting condition.

So far we know that deer have seven different glandular areas. How many more will we find? Who knows, but I think its a safe bet that we will find more. What are the purposes of these glands? In most cases we don't know, but we're going to keep chipping away at what we don't know.

Will we ever know everything about deer scent communication? I hope not

