Deer Scent Communication:  
What Do We Really Know?

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There is no question that the sense of smell is the most important sense to white-tailed deer. Deer rely on odors to warn them about the presence of predators and to help locate 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. Since we humans live in a vision-oriented world, it is difficult, if not impossible, to comprehend how important the sense of smell is to other animals like whitetails. For us just to 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, but 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 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 also 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 on deer. It seems like a new gland is found on deer every couple of years. So far we know of 7 different glands or glandular areas on deer, but as we continue our research, we will likely discover 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 gland is located on all four feet. It is a small sparsely-haired sac that opens between the toes by a short wide duct. In this sac you can generally find a yellowish, cheesy material that is the accumulation of sloughed cells and glandular secretions. The material often has a foul, rancid odor. Some of this scent undoubtedly left in a deer's track every time it takes a step. At The University of Georgia we have identified several compounds associated with this gland. These are all small molecules called volatile fatty acids. Interestingly, these molecules have different volatilities. In other words, the molecules evaporate 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 direction the animal is headed.

Metatarsal Gland

The metatarsal gland is located on the outside of the deer's hind legs. It is 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, we think that it is 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 which completely lack this gland.

Tarsal Gland

Without a doubt the most important gland to whitetails, the tarsal gland is located on the inside of the deer's hind legs. This gland consists of a tuft of elongated hairs that is underlaid by an area of enlarged sebaceous glands. These glands secrete a fatty substance, called a lipid, that adheres to the long hairs.

All hunters who have harvested a buck know about the strong smell often associated with this gland. However, not many know that this smell does not originate 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. This urine that remains on the gland undergoes some reactions with the air and with bacteria to produce the gland's characteristic smell.
Although all deer urinate on these glands at all times of the year, during the rut males, and primarily dominant or mature males, urinate on them much more often. This frequent rub-urination, along with chemical changes, is what stains the gland dark and gives the buck its rutting odor.

Clearly the tarsal gland is used by deer to recognize individual deer. Deer often sniff the glands of other deer. By doing so they not only tell who the other deer is, but also learn about the other’s sex, dominance status and condition. Rutting bucks use this gland to advertise their dominance status and breeding condition both to other bucks and to does.

Preorbital Gland

The preorbital, or lacrimal, gland, is a small pocket located in front of the deer’s eyes. At most times the pocket is closed. However, it has muscular control and I have observed deer flare this gland open in several situations. Rutting bucks may open this gland when signalling 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. 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 appears 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

Research conducted by Dr. Tom Atkeson while he was at the University of Georgia demonstrates that 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 sweat glands that become active during the rutting season. 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. All deer, bucks and does, have this glandular region, but the most active glands are found on dominant, mature bucks during the rut. 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 into 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 have very recently discovered another gland on whitetails. The preputial glands, as we call them, are located on the inside of the buck’s penile sheath. These glands are actually clusters of very enlarged sebaceous glands associated with very long hairs that extrude from the penile 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 purposes. 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 flehmen into the VNO. It is interesting that this organ is not connected to the same part of the brain to which the nose is connected. 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 it’s 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 chirping away at what we don’t know. Will we ever know everything about deer scent communication? I hope not!

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