

A Year in the Life of the White-tailed Deer The Magic of Deer Antlers

Karl V. Miller
School of Forest Resources
University of Georgia

Throughout the summer, while the does are busy raising fawns, bucks are enjoying a life of leisure. Since the end of the rut last winter, bucks have regrouped into bachelor groups and have been rebuilding body condition in anticipation of this fall's breeding season. At the same time, they're also growing a new set of antlers – a phenomenon unique among all other mammals. It's also a phenomenon that has made deer antlers prized as trophies for primitive and modern hunters alike.

The antlers that are grown by male members of the deer family (and female caribou) are true bones. This is different from the unbranched horns of cows, goats and sheep that are composed of keratin, a protein similar to the hooves. While growing, antlers also have a blood and nerve supply. However, the most amazing thing about antlers is that they are grown anew each year, making them the only mammalian appendage capable of being replaced annually.

Biologists have long debated how and why deer developed these appendages. In fact, antlers seem so improbable, that the thought of an animal that grows sharpened bone daggers from its head each year would seem beyond the imagination of even science fiction writers. But here they are, and clearly they are used in competition among males for mates. Antlers are used in scent marking, dominance displays, and in particular for sparring and fighting.

The seasonal cycle of antler growth and shedding is under the influence of testosterone, but myriad other hormones have been implicated in regulating antler growth. Growth of antlers coincides with long daylengths when testosterone levels are at their yearly minimum. At this time of year, bucks are quite docile and very tolerant of one another. Shortening days (actually longer nights) toward the end of summer result in a stimulation of the testes. The resultant rise in testosterone causes the final mineralization and maturation of the antler, and finally the death and shedding of the antler velvet. Interestingly it is this same rise in testosterone that stimulates muscle growth in the buck, and ultimately transforms him into what researcher John Ozoga calls “a hormone-charged weapon, wielding an awesome mass of muscle – a totally unpredictable beast of amazing strength, stamina, and determination”.

In white-tailed deer, antler growth begins sometime during April or May. Unlike horns which grow from the base, antlers grow from the antler tip. Early growth is slow, but accelerates toward early summer when the antler may grow up to a quarter of an inch in length per day. The growing antlers are highly vascularized, and are quite warm to the touch. Because they are rather fragile, bucks are very careful with their growing antlers. Abundant nerves in the antler velvet allow the buck to know the size and shape of the

antler. Rarely does a buck bump his antlers into trees or other objects. They seem to have an uncanny ability to weave their way through brush, fences, and other objects without damaging the tender antlers. The nerves in the antler velvet must be quite sensitive to touch, as even tame deer will rarely allow someone to touch his antlers for very long.

The nerves are also very important in determining the shape of the growing antler, and it appears that there is a 'trophic memory center' in the brain that will cause a deer to maintain the same general antler confirmation from year to year. If an antler is injured during the growth stage, the antler may heal but be abnormally shaped. Interestingly, in subsequent years, that injury may be 'remembered' and the next year's antler may show some degree of abnormality. However, if the antler is broken after antler growth is completed, subsequent antlers will very likely be normal.

By the end of July or perhaps early August, antler growth is essentially complete. Amazingly, whether it's a short spike antler or a Boone and Crockett, all antler growth is essentially completed in about 100 days. This rapid growth places a physiological drain on the buck. Antler bone is composed primarily of calcium and phosphorus, and these minerals either must be supplied in the diet or mobilized from the deer's skeleton. Throughout August until the velvet is shed, all that remains is the final mineralization of the completed antler.

In most parts of Georgia, velvet is shed sometime toward the last week of August through mid-September. Typically younger deer shed velvet later. Similarly, unhealthy or poorly-nourished deer will also shed velvet later.

Velvet shedding occurs quickly in most deer. Mature bucks may completely shed their velvet in 24 hours, and some may complete the process in an hour or two. Often younger bucks take a little longer to completely remove the velvet. Again, unhealthy deer may take longer to shed velvet, and some may retain shreds of velvet on the antler for some period of time. Often deer will eat the velvet as it is shredded off the antler.

Following shedding of the velvet, the mature antler is essentially dead bone, although there remains some living connection to the deer's skull which allows for a very limited amount of fluid movement. This helps to maintain a high resistance to impact and prevents the antler from drying out and becoming brittle. In addition, the antler is not composed of solid bone. Except for the antler tips, the antler has a central core of *substantia spongiosa* (spongy core) surrounded by the *substantia compacta* (compact sheath). This sheath of compact bone surrounding a spongy core acts to increase the moment of inertia of these antlers compared to antlers of the same weight but composed entirely of compact bone. In other words, ounce for ounce, antlers with a spongy core will have greater strength than solid antlers.

Following the rut, antlers are cast in response to diminishing testosterone levels. Most antler casting occurs in January and February, but well nourished animals may keep their antlers longer. In addition, a prolonged rut may keep bucks in rutting condition longer

thereby maintaining elevated testosterone levels, and causing delay in antler casting. In some of our studies of captive deer, we've noticed that the larger, dominant deer tend to be the first to cast antlers. Whether this is the case in the wild is unknown, but certainly the health and condition of the buck will be an important factor. A 'rutted-out' buck who has spent the last couple of months fighting and chasing does would seem a good candidate to cast antlers early.