Handout 1-A
Antlers and Horns: Student Lab Investigation

Name _____ Date _____

- CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS -

Your Job

In groups, examine antlers and horns at lab stations set up by your teacher. Show how each horn or antler at the station is unique through your descriptions, measurements, and drawings. Exchange your written analysis with another group's and check the accuracy of their analysis by comparing it with the antler or horn they observed. Finally, determine the species of the headgear using the Animal Headgear Information Cards that your teacher will give you after you have analyzed the antlers/horns at at least three stations.

Your Steps

1. Go to your assigned lab station. Choose a member of the group to be a recorder. The recorder, with the group's help, writes down the following on a half-sheet of paper—your "observation sheet." *Note:* Do not record the antler or horn number that your teacher has assigned to the lab station on your observation sheet. Make a key with this information on a separate piece of paper.
   - Names of people in the group.
   - Qualitative data (You want other students to be able to read your observations and identify which specimen you are describing.)
     - Write a description of the antler/horn.
     - Draw the design and shape of the antler/horn.
   - Quantitative data
     - Make a measurement of the antler/horn.
     - Count something on the antler/ horn (be sure to write down what it is that you have counted).
     - Give size comparisons or ratios between parts on the antler/horn (example: _____ is two times as long as _____).
2. Visit at least three lab stations. Use a new sheet of paper at each new station. When finished, give your written observations to the teacher.

Handout 1-A
Antlers and Horns: Student Lab Investigation

3. Your teacher will pass out the observations, making sure that groups do not get their own. Read the written observations of another group and find the specimen described. Check for accuracy of all parts of the observations. Write the specimen number on the top of the matching observations.

4. Return the papers to the group recorders for them to check.

5. Get a set of "Animal Headgear" information cards. Working in your groups, determine the species for each antler and horn. Record your decisions in a two-column table (column one: lab station number; column two: species).

6. Discuss or write answers to the following questions:

What Did You Discover About Antlers and Horns?

1. Which was easier—writing a descriptive observation of the specimens or checking the accuracy of another group's observations? Why?

2. When you wrote your descriptions, which antler/horn was the easiest to describe? Why? Which was the hardest? Why?

3. When you checked the accuracy of other observations, which description was easiest to match with the specimen? Why? Which was hardest to match? Why?

4. Which type of information was most helpful in matching the description to the correct antler or horn: written word description, drawing, measurement, or counts? Why?

5. How would these observation skills be important for solving a wildlife crime?

6. Read your comments on antlers and horns in your Investigator Notebook *(What do I know…, What do I want to know…).* Now answer this question: *What have I learned about antlers and horns?*

Handout 1-A

Antlers and Horns: Student Lab Investigation

STUDENTS: TAKE A CLOSER LOOK

- One person claims a new species has horns and someone else says it has antlers. How could they find the correct answer by observing the animal for a year?
- When would a female deer choose to mate with a male who is not the strongest and does not have the largest antlers or horns? Defend your answer.
- How does testosterone affect changes in both antler growth and male behavior?

Handout 1-B

Specialized Headgear: Antlers and Horns

Name _____ Date _____

- CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS - CRIME SCENE - DO NOT CROSS -

Public Demand For Antlers and Horns

The antlers and horns of many different animals across the globe are popular both for their ornamental beauty and their perceived medicinal value. The demand for these antlers and horns has fueled illegal hunting and the trafficking (buying and selling) of these items. In some countries in the Middle East, rhinoceros horns are still used to make dagger handles. Ground into a powder, rhino horn is prescribed to treat fevers in traditional Chinese medicine in parts of the world today (LWC 2006). Pieces of elk antler are sold illegally as an aphrodisiac (a food or drug that people believe arouses sexual desire), priced as high as several hundred dollars an ounce. The market for this item has become a problem in America's national parks, where rangers have reported finding dead (obviously killed) elk with sawed-off antlers (Harrell 2006).

What Does the Forensic Scientist Need To Know?

Forensic scientists are often sent items made from animal parts that were collected in police seizures. In order to determine if a crime has been committed, scientists must first identify from which animal the antler or horn came. Even a small portion of this material can be enough to determine the species of origin. Thus, such material is valuable evidence in wildlife crime investigation.

Deer and elk can only be killed during certain seasons. Therefore, scientists must be able to tell the season the antler was taken. Federal law states that antlers in velvet (skin that allows the antler to grow) must be treated with formaldehyde to make the velvet useless for traditional Asian medicines. Since it is illegal to have untreated velvet antlers, scientists must run chemical tests to determine if formaldehyde treatment has been done.

Anatomy of Antlers And Horns

What animals have horns?

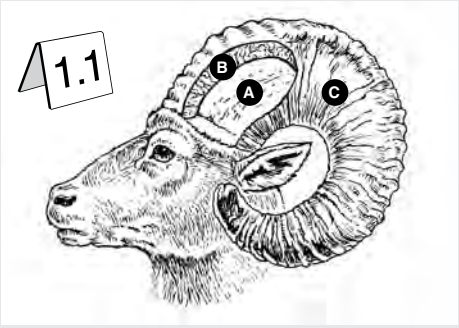
Bighorn sheep, white sheep, mountain goats, bison, musk ox, American pronghorn.

What are horns?

Horns are a permanent part of the animal's skull and have three layers (Figure 1.1). The inner layer extends up from the skull as a bony core (Figure 1.2). It is covered by a thin layer of blood-vessel-rich tissue that supplies blood to the outer layer of the horn, called the sheath. This

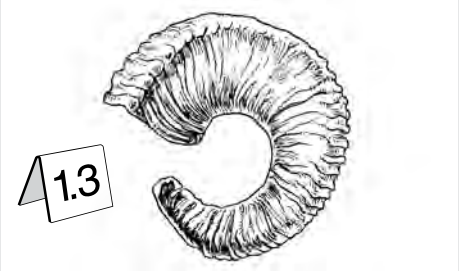
Handout 1-B
Specialized Headgear: Antlers and Horns

third layer is made of keratin, a protein that is also in fingernails and hair. The sheath continues to grow throughout the animal's life and is what people are referring to when they use the term *horn* (Figure 1.3).



A: Core
B: Sheath
C: Keratin

Skull showing the bony core.



Outer keratin layer—the "horn" as we know it.

Both males and females have horns, though the females' are usually smaller. Horns are not shed except in American pronghorns, who shed the keratin sheath once each year.

What animals have antlers?

White-tail deer, mule deer, elk, caribou, moose

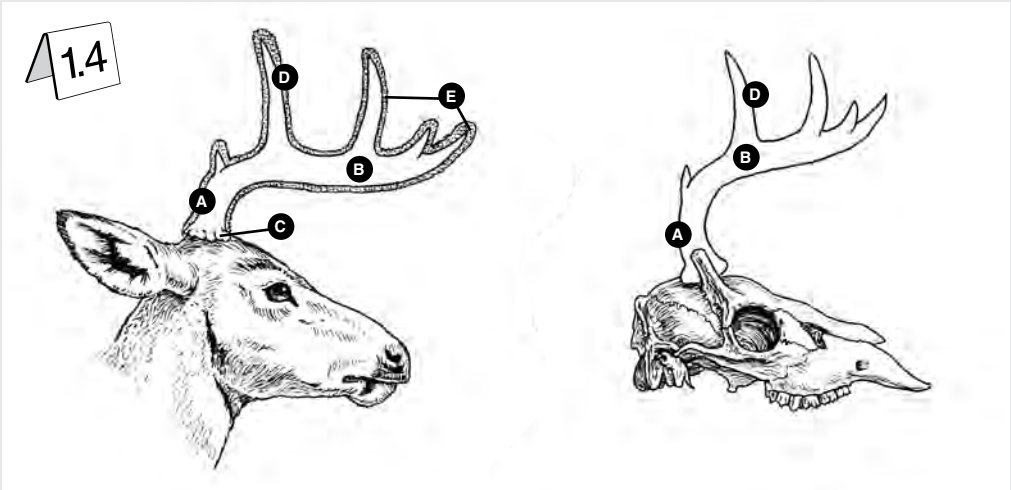
What are antlers?

Antlers grow from the skull (Figure 1.4), and are shed once each year. They are made of bone that grows from two disc-shaped bumps on the skull, called pedicles. During the months when the antler is growing, the soft cartilage is covered by blood-vessel-rich skin called velvet. When the antler is finished growing, this tissue dies, the cartilage hardens to bone and the velvet falls off. In all but one species, the caribou, only males grow antlers. Both sexes of caribou have antlers, though the females' are smaller.

How big do antlers and horns grow?

The size of a male's antlers or horns tells a story. To grow large antlers or horns, a male must be healthy and well fed—and strong enough to carry the weight of this specialized headgear. Elk antlers can weigh up to 25–40 pounds (11–18 kg). Male bighorn sheep horns can weigh as much as 30 pounds (14 kg). That is

Handout 1-B
Specialized Headgear: Antlers and Horns



Antler
A: Base—the raised rounded end of the main beam that is attached to the skull.
B: Main beam—the part of the antler that grows from the base and supports the branching tines (points).
C: Pedicle—disc-shaped bumps of bone on the skull from which antlers grow.
D: Prong or Tine—a point on an antler that is at least 1 inch long and longer than it is wide.
E: Velvet—layer of blood-vessel-rich skin that covers the outside of a growing antler and supplies it with blood.

more that the weight of all other bones in his body!

What's the Purpose of Antlers and Horns?

Rutting (mating) season is the one time during the year that males gather with the female herds. Drama unfolds as the males battle each other with their horns and antlers for territory closest to the females. Holding onto this choice spot means a male has more chances of mating with a female when she is ready. Even though the stronger, larger males

STUDENTS: TAKE A CLOSER LOOK

- What are anatomical differences between antlers and horns?
- If an animal has antlers or horns, it must be a male. Agree or disagree. Defend your answer.
- An animal has to be killed to get its antlers or horns. Agree or disagree. Defend your answer.

Handout 1-B

Specialized Headgear: Antlers and Horns

stay busy chasing the other males away from the females, they do not have exclusive access. Females will mate with other males if the larger male's attention is distracted or if a less dominant male is closer and more convenient to the female.

REFERENCES

Harrell, A. 2006. *Point Reyes (California) Light.* Park rangers are after elk antler poachers who sell the aphrodisiac to black-market shops in Chinatown. March 2.

Lewa Widlife Conservancy (LWC). 2006. Uses of rhino horn. *www.lewa.org/rhino-horn-uses.php*

Handout 1-C
Antlers Through the Seasons

Name _____ Date _____

How can males grow huge antlers in just a few months? Why do antlers always begin growing in the spring, lose their velvet in the fall, and fall off the male's head in the winter? Why do new antlers begin growing as soon as the full-grown antlers fall off? The answer to all these questions is … hormones, hormones, and more hormones!

Antlers in the Spring to Mid-Summer

Spring signals the start of new antlers. Soft layers of cartilage, growing from the pedicle on the head, are covered by velvet (Figure 1.5). This thin layer of living tissue is filled with blood vessels. Antlers grow rapidly—moose antlers, for example can grow up to one inch a day. Although antlers can be damaged during this growing stage, the velvet provides some protection while supplying blood to the growing tissue.

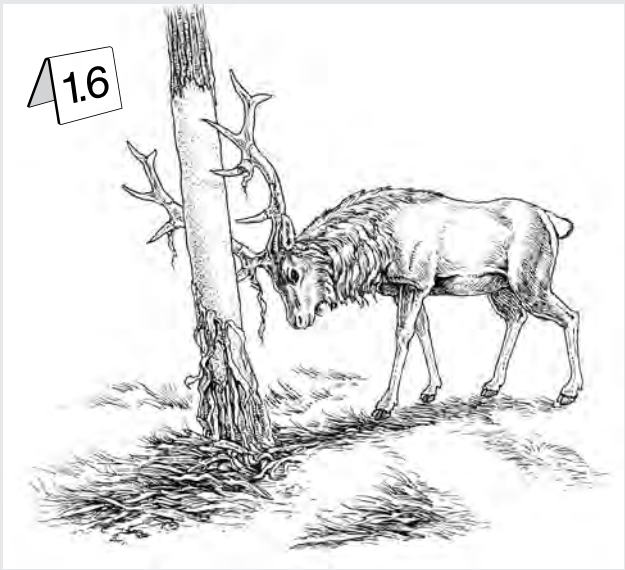
Why do the antlers grow?

An increase in daylight triggers the body to make high levels of the male hormone testosterone. This hormone stimulates the growth of antlers.

Antlers in Late Summer

Antlers begin to harden into bone and the velvet begins to fall off. This is when males can be seen rubbing their antlers against trees to shed their velvet (Figure 1.6).

Deer with velvet antlers.



Elk rubbing velvet strips on tree.

Handout 1-C
Antlers Through the Seasons

Why do the antlers stop growing?

Blood stops flowing through the velvet to the antlers, causing the living tissue to die. The antlers stop growing, and change from soft cartilage to hard bone.

Antlers in Early Fall

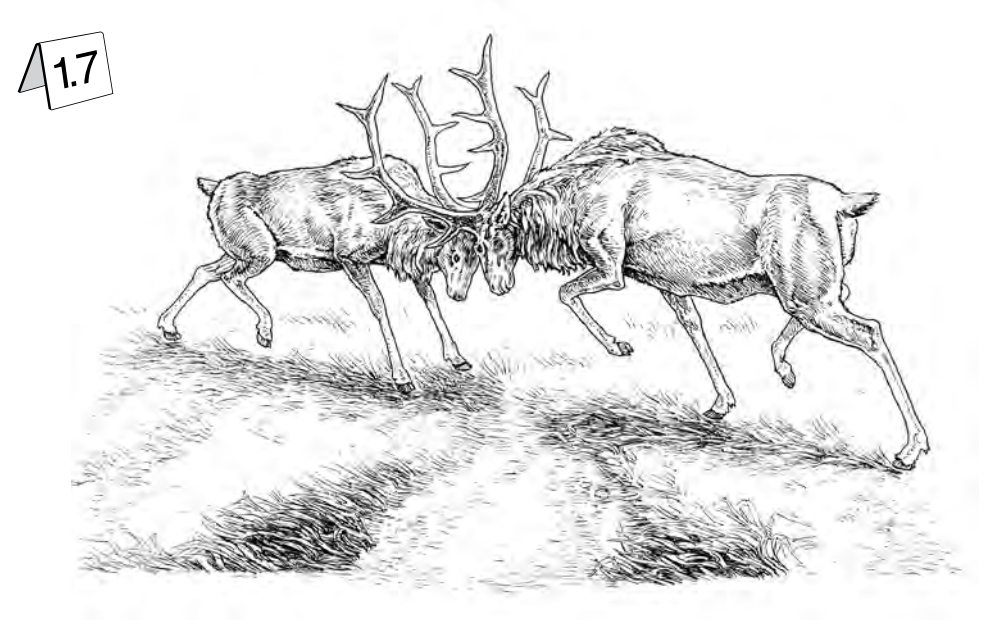
The antlers, cleaned of all velvet, are marked with grooves and ridges where blood vessels once lay. The antlers are firmly attached to the pedicle on the animal's skull. This is the season of rut, when males use their antlers to battle for the territory closest to the females. Claiming and defending this prime location gives them more chances to mate.

Why do the antlers remain in place?

Testosterone remains high in early fall. This keeps the antlers firmly attached to the skull. It also affects the male's behavior during the rutting season. Males become more aggressive and willing to fight for territory next to the females (Figure 1.7).

Antlers in Late Fall Through Early Winter

Rut and mating season ends. The males stop battling for territory, leave the females, and go off on their own.



Two male elk fighting.

Handout 1-C
Antlers Through the Seasons

Why do males stop battling?

Testosterone levels begin to drop, and so does the male's aggressive mating behavior.

Antlers in Late Winter

Antlers fall off (are shed). Like kids wiggling loose teeth, males can be seen rubbing partially attached antlers on trees. It is not unusual to see a male with one antler hanging or missing (Figure 1.8). In a few months the cycle will begin again as a new set of antlers begins to grow.

Why do antlers fall off?

Testosterone levels drop to their lowest points, causing the antler to detach from the pedicle.

Deer with one antler.