GOAL STATEMENT:
Students will learn about sheep and goats and the various products we get from them.

OBJECTIVES:
• Students will learn the terminology used to describe sheep and goats.
• Students will be able to compare and contrast sheep and goats.
• Students will carry out a simple investigation and reinforce how to use a microscope.

REQUIRED MATERIAls:
• Images of sheep and goats (printed or projected in PowerPoint)
• "Wild and Wooly: Everything About Sheep and Goats" PowerPoint presentation
• Copies of "Sheep and Goat Terminology" worksheet (1 per student)
• Samples of sheep wool and goat hair (optional)
• Copies of "CSI: Maryland" worksheet (1 per student)
• Copies of images of different types of fibers under a microscope (1 per group)
• Fiber samples of silk, cotton, polyester, and wool
• Microscopes, slides, and cover slips

AMOUNT OF TIME TO ALLOW:
75 minutes. Extension activities will take additional time.
Goats and sheep share many similarities, but they also have many differences. After dogs, sheep and goats were the earliest animals to be domesticated or tamed. A male goat is called a buck, a female goat is a doe, and baby goats are called kids. A male sheep is called a ram, a female sheep is a ewe, and baby sheep are called lambs.

What do they look like?
Structurally, sheep are bigger, fatter, and more muscular than goats; goats tend to be leaner and more angular or boney. Goats and sheep also have different personalities. Sheep are shy, timid, easily spooked, and flock together. Goats are curious, independent, and adventurous and tend to escape from their designated areas. Goats come in a variety of hair color patterns whereas most sheep are white. Some sheep are naturally colored and can come in variety of color variations from off-white to black. (White is preferred for wool sheep because white wool can be dyed any color.)

Most goats have horns, but many times they are removed for safety reasons. Most sheep don’t have horns. (Animals born without horns are called polled.) Usually only rams (male sheep) have horns. Goat horns grow upright and spread out, whereas sheep horns curl along the head. Surprisingly, many goats – both male and female – have beards while some sheep have manes.

What do they eat?
Sheep and goats are ruminants (cud-chewing animals). Their stomach is divided into four sections: the rumen, reticulum, omasum, and abomasum. Ruminants chew a cud (mass of regurgitated food). They have 32 teeth; however, they don’t have teeth on their upper front. Instead they have a dental pad which helps with grazing and browsing. Sheep like to eat grass close to the ground and are known as grazers, whereas goats are browsers and nibble on vegetation higher off the ground. Goats are often used to control unwanted plants.

How do they reproduce?
Sheep and goats are mammals because they secrete milk. Sheep and goats carry their young and are pregnant for 5 months or 150 days. Sheep and goats normally give birth to multiples. They typically have 1, 2, or 3 babies at a time. During mating season, bucks have a distinct odor because they urinate all over themselves. Rams do not, but they can become aggressive.

What are they used for?
Sheep and goats have many uses. Both are used mainly for meat. Goat meat is called chevon, the meat from a young lamb under a year old is called lamb, and mutton is meat from a sheep over 1 year old.

Since sheep and goats are mammals, they are used to produce milk. Did you know that more people worldwide drink milk from goats on a worldwide basis than from cows? Most sheep and goat milk is used to make a variety of cheeses. Many people who are lactose intolerant are able to drink sheep or goat milk. Sheep and goats are also used to produce fiber.

Most sheep grow wool and need to be sheared annually, but some sheep produce hair. Hair sheep are slick, and they shed their coats naturally. Most goats are covered with hair. However, some goats grow fibers similar to wool which is called mohair or cashmere and which must be sheared or combed out.
Sheep and goats are often used as research models and to produce medical products. In addition, they make great pets.

**Engagement**

20 minutes

Show pictures of different kinds of sheep and goats to see if students can tell the species apart. In the first pictures, it will be easy for the students to differentiate between the two species. In later pictures, it will become more difficult and students may not be able to tell the difference. Use this “difficulty” and additional pictures to generate a discussion of the similarities and differences between sheep and goats.

Divide students into small groups, and provide each group with several sticky notes that you have prepared with a characteristic of either a sheep, a goat or both. Write "sheep," "goats," and "both" on three different sections of the board or create a Venn diagram. Have students discuss and then place their sticky notes within the proper sections of the Venn diagram. For example, “prey” would be characteristic of both species, whereas “browser” would be characteristic of goats only.

Teachers can refer to the "Sheep and Goats: Compare and Contrast" worksheet to assist with this activity.

**Exploration**

45 minutes

**Activity 1: Everything About Sheep and Goats**

Show the "Wild and Wooly: Everything About Sheep and Goats" PowerPoint presentation. Have students complete the Sheep and Goat Terminology worksheet.

**Activity 2: CSI Maryland**

Most students should be familiar with CSI-type TV shows and forensic science. Explain that a robbery has been committed and the suspect left behind fiber(s) at the crime scene. By examining the fiber(s) under a microscope, it may be possible to determine what type of clothes the suspect was wearing.

The teacher may want to prepare the slides ahead of time. Students should only see fiber strands under a microscope and not a full fabric sample. Seeing the entire fabric sample makes identification of the suspects too easy. To prepare a slide place strand of fiber on the slide, put a drop of water over it, and place a cover slip on top.

Divide students into groups and distribute the "CSI: Maryland" worksheet. Instruct students to observe each fiber under the microscope and draw what they see. Students should then compare their observations with a microscopic image of the fiber left behind at the crime scene. Have students share their observations with rest of the class.
Discuss with the students what they saw and the conclusions determined from the Exploration activity.

Ask the students the following questions while facilitating a group discussion:
- What sheep and goat products have you used and/or purchased?
- What is a new fact you learned about sheep and goats?

Complete the attached word search puzzle (products we get from sheep and goats).

Take students on a field trip to the University of Maryland Eastern Shore sheep and goat farm.

Conduct experiments with wool that demonstrate its natural properties.
- Felt wool. (Felting is the process of creating a textile by matting, condensing, and pressing fibers together.)
- Make soap from goat’s milk.
- Write a report on a breed of sheep or goat.
- Make a poster showing different kinds of wool and/or sheep and goat fiber.

Student understanding can be evaluated through class discussion or assessment of completed activity data sheets. The following questions may also be used to evaluate student learning.

1. Identify two similarities and two differences between sheep and goats.
2. List three products we get from sheep and goats.
3. What characteristics did you use to differentiate between plant, animal, and synthetic fibers when viewed under the microscope?
Career Connections

- **Farmer/rancher** – This is a person who raises sheep and/or goats.
- **Scientist** – This person may study sheep and goats. Very often, sheep and goats are used as “models” to study human health problems or make products that be used to treat diseases. The first artificial lung was transplanted in a sheep. Rattle snake anti-venom is made in sheep. Bacteria is cultured in sheep blood.
- **Veterinarian or veterinary technician** – This person may be responsible for health care of sheep and/or goats.
- **Teacher** – This is a person at any level of the educational system who teaches students about animals and agriculture.
- **Meat processing plant worker** – This is a person who works in a processing plant and prepares packaged meats for sales in retail and other facilities.
- **Textile mill worker** – This person uses fiber from sheep and goats to make thread, yarn, and fabrics.

References

Sheep 101, <www.sheep101.info>
Sheep and Goats: Compare and Contrast

After dogs, sheep and goats were the earliest animals to be domesticated (tamed) by man. They were the first animals to be milked. Sheep were totally domesticated and became very dependent upon man for their care and survival. In contrast, goats could probably easily revert back to a wild state.

Sheep and goats are among society’s most useful animals. They are multi-purpose, raised for their meat, milk, fiber, skins, pelts, and as pets. Due to their selective grazing habits, sheep and goats are being used increasingly to control (eat) invasive weeds and other unwanted vegetation. Sheep and goat grazing is an environmentally friendly alternative to manage landscapes.

While sheep and goats are very similar animals, they are two distinct species that have different numbers of chromosomes. Sheep (Ovis aries) have 54 chromosomes whereas goats (Capra hircus) have 60 chromosomes. If a sheep and goat mate, the pregnancy will not maintain itself. Sheep x goat hybrids can be made in a laboratory by fusing embryos from both species. A sheep x goat hybrid is called a chimera.

What are the similarities between sheep and goats?

- Early domestication by man.
- Multi-purpose, raised for meat, milk, dairy, skins (leather), and pelts.
- Bodies may be covered by hair and/or wool.
- May have horns.
- Have cloven (split) hooves.
- Have ruminant digestive systems (4-compartment stomach; chew cud.)
- Upland grazers (prefer higher elevations → avoid low-lying wet areas.)
- Don’t have any upper incisor teeth.
- Seasonal in their breeding habits (mate in fall → give birth in spring.)
- Pregnancy lasts for five months.
- Usually give birth to singles, twins, or triplets (sometimes more.)
- Share almost all the same diseases.
- Have similar nutritional requirements.
- Selective grazers: eat a more varied diet than other grazing livestock.
- Prey animals: vulnerable to attack by dogs, wild canines, and other predators.
**Sheep and Goats: Compare and Contrast**

**How do sheep and goats differ?**

<table>
<thead>
<tr>
<th>Foraging behavior</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHEEP</strong></td>
<td><strong>GOATS</strong></td>
</tr>
<tr>
<td>Grazers</td>
<td>Graze plants from the top-down</td>
</tr>
<tr>
<td>Prefer to graze close to the ground</td>
<td>Prefer taller growing plants: shrubs, vines, twigs, leaves, brush, and briars</td>
</tr>
<tr>
<td>Prefer weeds</td>
<td></td>
</tr>
<tr>
<td>Like grass and clover</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical traits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHEEP</strong></td>
<td><strong>GOATS</strong></td>
</tr>
<tr>
<td>Tails hang down</td>
<td>Upright tails</td>
</tr>
<tr>
<td>Tend to be bigger, fatter, and heavier</td>
<td>Tend to be leaner and more angular</td>
</tr>
<tr>
<td>More heavily muscled</td>
<td>Lighter muscled</td>
</tr>
<tr>
<td>Grow faster</td>
<td>Slower growing</td>
</tr>
<tr>
<td>Deposit fat externally (over bones)</td>
<td>Deposit fat internally (around organs)</td>
</tr>
<tr>
<td>Most are polled (naturally hornless)</td>
<td>More agile</td>
</tr>
<tr>
<td>Horns are more circular</td>
<td>Most have horns</td>
</tr>
<tr>
<td>Some rams have throat manes</td>
<td>Horns are more upright</td>
</tr>
<tr>
<td>Wool has lanolin (grease) in it</td>
<td>Both sexes can have beards</td>
</tr>
<tr>
<td>More genetic diversity (more breeds)</td>
<td>Mohair and cashmere do not have grease</td>
</tr>
<tr>
<td>Male has strong odor, especially during rut (mating season)</td>
<td>Less genetic diversity (fewer breeds)</td>
</tr>
<tr>
<td>Often have wattles (hair-covered appendages)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavior</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong flocking instinct</td>
<td>Weaker flocking instinct</td>
</tr>
<tr>
<td>More easily frightened</td>
<td>Curious and independent</td>
</tr>
<tr>
<td>Aloof and wary</td>
<td>Fight by rearing up, then charging</td>
</tr>
<tr>
<td>Fight by charging</td>
<td>Do not like to get wet</td>
</tr>
<tr>
<td>Avoid wet areas</td>
<td>Seek shelter more readily</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Easier to keep in fences</td>
<td>Harder to keep in fences</td>
</tr>
<tr>
<td>Easier to handle</td>
<td>Harder to handle</td>
</tr>
<tr>
<td>Tails are usually shortened (docked) to prevent accumulation of fecal matter on hindquarters</td>
<td></td>
</tr>
</tbody>
</table>
You are the chief scientific investigator for the police department and just heard that a theft occurred in broad daylight at the local jewelry store. Detectives and officers are on the scene now collecting evidence for you to process back at the lab. There was $100,000 worth of diamond rings stolen from the display case while everyone was on their lunch break. The store had 4 employees working at the time and the police have collected samples of their clothing to view as they have also found some fibers around the area where the rings were taken from. This is believed to be an inside job that was perpetrated by one of the 4 suspects. Begin by analyzing each of the fibers from the 4 suspects and the samples from the case will be delivered to your lab soon to compare.

Mrs. Coral  
(silk shirt)  
Ms. Amarillo  
(cotton shirt)  
Mr. Lavender  
(polyester shirt)  
Mr. Black  
(wool coat)

**Instructions**

1. Take the suspect’s sample provided and place it on a slide. Place a drop of water over the sample and cover it with the cover slip.
2. Look at the sample under the microscope.
3. Draw a picture of what the fiber looks like and compare it to the pictures of fibers provided.
4. Repeat this process for all of the samples you are provided for the suspects.
5. When the sample from the diamond case arrives, follow the same procedure.
6. Compare your pictures and create a hypothesis of who the thief is.
Evidence Sheet

Draw what each suspect’s sample looks like under the microscope.

Mrs. Coral (silk)  Ms. Amarillo (cotton)

Mr. Lavender (polyester)  Mr. Black (wool)

*Compare your drawings to the fiber types handout

Sketch the sample from the fibers that were found in the case and compare it to the suspects.

Fibers in the Diamond Case

Who do you suspect is the thief?
Images of Different Types of Fibers Under a Microscope

1. Wool
2. Cotton
3. Polyester
4. Silk

1.”Electron micrograph of a clean merino wool fiber” by CSIRO is licensed under the Creative Commons Attribution 3.0 Unported license.
2.”Cotton fibers under a Scanning Electron Microscope” by Featheredtar is licensed under the Creative Commons Attribution 3.0 Unported License.
3.”Scanning electron microscope image of a polyester fibre” by CSIRO is licensed under the Creative Commons Attribution 3.0 Unported license.
4.”Carbon fibres generated from propylis of a silk cocoon” by DTU Mohanty is licensed under the Creative Commons Attribution-Share Alike 4.0 International license.
Sheep and Goat Terminology

Fill in the blanks or circle the correct answer.

A female sheep is called a [ewe] [doe].

A castrated (neuter ed) male sheep or goat is called a ____________________.

Mohair is produced by [sheep] [Angora goats] [Cashmere goats].

All the fiber sheared from one sheep or goat is called a ____________________.

The meat from goats is called ________________.

Lamb is the meat from a [old, over 1 year old] [young, less than 1 year old] sheep.

A ____________________ is an animal that lives by preying on (eating) other animals.

When a goat delivers her babies, it is called ____________________.

When a sheep delivers her babies, it is called ____________________.

______________________ is the technical term for giving birth.

A [browser] [grazer] eats leaves, twigs, and other vegetation that is up off the ground.

A [browser] [grazer] eats grass and other plants that are growing near the ground.

A baby goat is called a ____________________.

A sheep that is less than one year old is called a ____________________.

A polled sheep has no [wool] [horns] [wattles].