



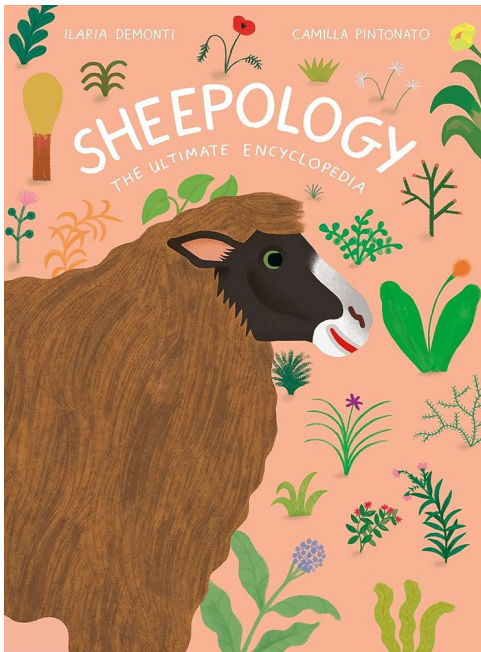
The Book Planter



Ag in the Classroom

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Note for educators: This book discusses reproduction and uses terms and images that may not be appropriate for young readers, specifically on pages 18-19.



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Sheepology: The Ultimate Encyclopedia

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Illustrated by: Camilla Pintonato

Welcome to the wonderful world of sheep! Discover all there is to know about sheep in all their woolly glory in *Sheepology*, a delightfully illustrated guide you will flock to again and again! For instance, did you know that sheep do not like to be alone and get along well with other animals? Or that a sheep was the first mammal to be cloned by humans? Have you ever wondered how sheep's milk turns into cheese? Or how sheep are shorn and wool is made into cloth? These and other intriguing and engaging facts about this lovable animal can be found in *Sheepology*, a visual encyclopedia and follow-up to *Pigology* and *Chickenology*.

Vocabulary

Ewe: A female sheep

Herbivore: Only eats plant material

Lamb: A young sheep

Lanolin: The Greasy wax that coats a sheep's fleece to protect it from weather elements

Mammal: a warm-blooded animal

Ram: A male sheep

Transhumance: The seasonal migration between grazing areas

Wool: The fiber we get from a sheep

Engage

1. Brainstorm physical features, such as eye color and hair, which make students look different from each other.
2. Explain that these characteristics are called *traits*. A trait is a physical characteristic or feature, obvious and observable, which is inherited from one or more parent.

3. Ask the students if animals also possess traits. Brainstorm physical characteristics found in animals. Examples could include coat color or pattern, size of the animal, the presence or absence of horns, etc.
4. Explain that like people, animals also have specific traits that distinguish them. These traits are a result of their genetic makeup. At the completion of this lesson, students will:
 - consider how genes affect traits; and
 - discover the role of an animal geneticist.

Activity 1: Roll of the Genes¹

1. Review the concept of probability and related terms such as chance, likely, unlikely, possible, and impossible with the students.
2. Instruct the students to raise their hand if they've ever been told they look like a family member. Allow a few students to share about their personal experience. Explain that traits are passed from parents to their children through DNA. The piece of DNA that carries the trait is called a gene. Clarify that traits may be dominant or recessive. A dominant trait is displayed if one or both parents carry the trait. A recessive trait is displayed only when both parents carry the trait.
3. Tell students that traits are also passed on in the animal world. For example, livestock geneticists have been able to improve a breed's traits through selective breeding programs.
4. Distribute the [Have You Any Wool?](#) handout to students and project a copy onto a large screen. Read the sheep's genetic background aloud and define any unknown scientific terms. Explain that the Punnett square is a diagram that helps geneticists predict the outcome of breeding two animals.
5. Explain that the class is going to use the Punnett square to determine what color wool the sheep's offspring will have. Dominant traits are expressed with a capital letter and recessive traits are expressed with a lowercase letter. If dominant and recessive traits are combined, the dominant trait will always overpower the recessive trait. Complete the Punnett square in front of the class while explaining the process.
6. Remind the students that probability is the likelihood that a particular event, or outcome, will occur. It is expressed as a fraction with the numerator being the total number of favorable outcomes and the denominator being the total number of possible outcomes. In this scenario, two quadrants have dominant genes for white wool and two quadrants have recessive genes for black wool; thus the lamb has a 2 out of 4 chance of inheriting white wool and a 2 out of 4 chance of inheriting black wool. Have every student roll a die to determine the breeding outcome. Instruct students to sketch a portrait of the lamb in the box provided at the bottom of the handout.

Variations

- Introduce genetics through an educational video on heredity. Check out the video "Heredity" on [BrainPOP](#) or search YouTube using the term "Punnett Square."

- Students work on the project individually, with a partner, in small groups, or as a class.
- Students research actual phenotypes expressed in breeds of cattle. They create new variations of cattle by crossing actual breeds with the imaginary cattle featured in the *Cattle Call* handout.

ELL Adaptations

- While leading students through the *Have You Any Wool?* handout, allow students time to think and respond to questions.
- Throughout the lesson ELL students can be partnered with students that are proficient or advanced English speakers.
- Students can define new terms like genes and alleles in their science journal or on a classroom word wall for future reference.

Activity 2: Hands-On With Wool²

Materials

1: Spinning the Wool

- Carded wool 1/4" x 14" (6.35 mm x 35.56 cm), 1 per student
- Spinning hooks, 1 per student
 - Carded wool and spinning hooks are available for purchase in a [Wool Spinning Kit](#)

2: Kool-Aid Dye Method

- Wool; cut to one arm's length
- 1 Tbsp vinegar (15 mL)
- 1 cup water (240 mL)
- Glass bowl
- Microwave
- Kool-Aid

3: Natural Dye Method

- Wool; cut to one arm's length
- Natural plants for dyeing

4: Weaving the Wool

- Cardboard
- String
- Spun and plied wool
- Spinning hook from the Wool Spinning kit (see activity 1 materials)

5: Felted Wool Marbles

- 2" x 2" (5.08 cm x 5.08 cm) pieces of dyed wool, 1 per student
- Bowl of warm, soapy water

6: Ziploc Felting

- Natural and dyed wool
- Tulle fabric
- Sandwich-size resealable bags, 1 per student



- Soapy water

Procedures

1: Spinning the Wool

1. Give each student a piece of carded wool approximately $\frac{1}{4}$ " (6.35 mm) wide and 14" (35.56 cm) long. Fold about $\frac{1}{2}$ " (1.27 cm) of wool over the end of the spinning hook and begin spinning.
2. Back your non-spinning hand out as the wool is spun; this is called drafting.
3. Draft out the wool so that the spun wool is taut but not bumpy. If you get twisted bumps in your spun yarn, let out more unspun wool. When you have twisted the entire length of the wool, don't let go—it will unspin. You are now ready to ply your yarn.
4. Plying the yarn will keep it from unspinning and make it stronger. Plying is the twisting together of two single strands of spun wool. Have someone hold the center of the twisted wool while you hold the ends.
5. Bring the ends of the wool together in one hand so that there are two strands side-by-side. Have your helper let go, and let the wool twist together. It should spring into a twisted strand. The double strand is now called plied yarn.
6. Tie the plied yarn around your wrist to form a friendship bracelet.

Note: You can view a demonstration of the [wool spinning process](#).

2: Kool-Aid Dye Method

1. In a glass bowl, combine 1 package of Kool-Aid, 1 cup (240 mL) of water, and 1 tablespoon (15 mL) of vinegar. Stir until the Kool-Aid completely dissolves.
2. Completely immerse an arm's length of wool into the Kool-Aid mixture.
3. Place the bowl of wool and Kool-Aid mixture into a microwave. Heat on high for two minutes.
4. Remove the bowl from the microwave and allow to cool. BE CAREFUL, IT'S HOT!
5. After the mixture has cooled, squeeze the liquid out of the wool and into the bowl. If the liquid is fairly clear, rinse the wool in cold water. If the liquid is not clear, heat the bowl of wool and Kool-Aid mixture for one additional minute before cooling and rinsing. This process will result in dyed wool that you can allow to dry and use in other projects.

3: Natural Dye Method

1. Select and chop the plant material. For a list of plants and their resulting colors, see the table below. About one pound (480 g) of plant material will produce satisfying color on about a half pound (240 g) of wool.
2. Cover the chopped plant material with water. Simmer for about an hour to allow the natural pigments to color the water.
3. Strain and discard the plant material (cheesecloth works well), and add pre-dampened wool to the liquid. You may have to add more water at this stage so that the wool is completely immersed.
4. Simmer for another hour or until the wool is the desired color.
5. Rinse in cold water.

Note: A mordant is a chemical that opens up the fiber so it bonds more easily with the dye, and produces a more vivid color. You may choose to add a mordant to the dye bath or use it on the wool before dyeing. However, most mordants (copper, tin, chrome, iron) are quite toxic. Alum or vinegar, both available at most grocery stores, can be used safely. Mordant is derived from the Italian word "mordere," which means "to bite." The colors will bite and be more intense if a mordant is used. In

order to experiment with plants and color, give your students a piece of white poster board and instruct them to scrape a leaf or flower across the card. The resulting stain is a good indication of the color the plant will produce when used as a dye.

<i>Plant and/or Plant Part</i>	<i>Color</i>
Coreopsis bloom (fresh or dried)	Bright golden yellow
Onion skins	Rich reddish brown
Alfalfa leaves and stems	Soft baby yellow
Poplar leaves	Tan
Teasel	Khaki
Canada thistle leaves, stems, flowers	Grey
Sunflowers	Greenish gold
Cattail	Beige
Sagebrush	Golden tan
Red cabbage	Blue

4: Weaving the Wool

1. Cut a rectangular piece of cardboard to your desired size. We used a 5" x 5" (12.7 cm x 12.7 cm) piece. This will become your loom.
2. Use scissors to cut 1/4" (.635 cm) slits 1/2" (1.27 cm) apart along two opposite ends of the cardboard (see Figure 1).

- To create the warp on the loom, tape one end of the string to the back of the cardboard. Then string it through the first notch, around the front of the cardboard piece from top to bottom and into the opposite notch. Continue until all of the notches have been filled. Tape the second end of the string to the back of the cardboard (see Figures 2 and 3).
- Tie several strands of the spun and plied wool from activity one together to make one long piece.
- Use the spinning hook from the wool spinning kit as your shed stick. A shed stick is a tool used to create a temporary separation between the warp yarns. Feed the shed stick over and under the warp with every second string being raised (see Figure 4).
- Weave the yarn across the loom following the pattern of the shed stick. This yarn is known as the weft. To weave the second row, feed the shed stick in the opposite over under pattern from the previous row and follow the pattern with the yarn. Use the shed stick to gently push each row together. Repeat this process until the weaving is finished (see Figures 5 and 6).
- When the weaving is finished, insert a twig or dowel above and below the woven piece. Detach the strings from the cardboard notches and tie the loose ends to the twigs. An extra piece of yarn can be tied to the top twig for hanging (see Figures 7 and 8).



Figure 1

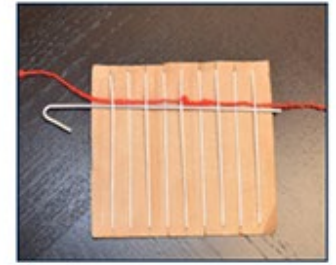


Figure 5

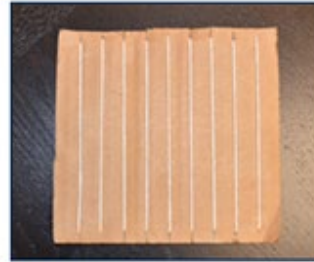


Figure 2

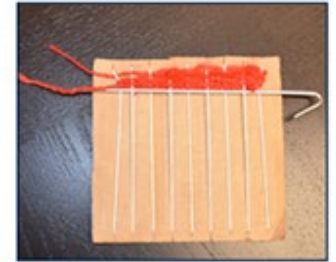


Figure 6



Figure 3



Figure 7

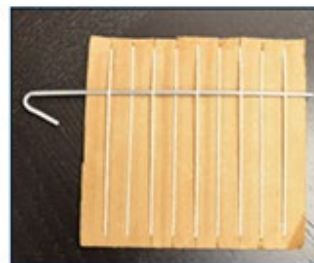


Figure 4



Figure 8

5: Felted Wool Marbles

- Separate the fibers from a 2" x 2" (5.08 cm x 5.08 cm) piece of dyed wool until you have a puff of wool.
- Lightly and gently roll the wool in your hands to create a loose ball.
- Dip the wool into warm, soapy water.
- Roll the wool between your palms in a gentle but quick circular motion. Do not press or squeeze the wool.
- Continue rolling until the wool starts to stick together and looks like felt. This should take about five minutes.
- Allow the marble to dry.

6: Ziploc Felting

- Cut a rectangular, flat piece of wool small enough to fit inside the resealable bag.

2. Create a design by layering dyed wool on top of the rectangular piece.
3. Place rectangular pieces of tulle on the top and bottom of the wool. This will help speed up the felting process.
4. Place the wool and tulle inside the bag.
5. Pour enough soapy water into the bag to completely saturate the wool.
6. Place the bag flat onto a towel.
7. Squeeze the excess water out of the bag by pressing with your hand from the bottom of the bag to the top.
8. Seal the bag and work the wool by poking and pounding with your hands from the outside of the bag until the wool becomes firm and felt-like.
9. After the wool has felted, remove it from the bag, discard the tulle, and gently rinse in water, alternating hot and cold.
10. Roll the felt in a towel to squeeze out any excess water. Lay flat to dry.

Sheepology Scavenger Hunt/Breakout EDU Game (attached at the end of this activity sheet)

Note for teachers: [Breakout EDU](#) games are educational experiences for students using lock boxes with various combinations. You can order your own [Breakout EDU kit](#), or you can create using your own purchased locks and boxes. Students will use the Scavenger Hunt to answer questions from the book *Sheepology*. Some of the answers will correspond to lock combinations. For example, if one of the answers is “lamb” that could correspond to an alpha lock, or if an answer is “red” that could correspond to a color lock. Of course there are number locks, and shape locks too.

If you do not have access to this resource, you can still use the Scavenger Hunt worksheet in your classroom for other purposes.

Other Lessons:

- From Wool to Wheel <https://agclassroom.org/matrix/lesson/412/>

Sources

1. <https://agclassroom.org/matrix/lesson/119/>
2. <https://agclassroom.org/matrix/resource/402/>

K-5 Subject Areas: English Language Arts, Social Studies and Science

English Language Arts (Reading and Writing)

- RI.K.1 With prompting and support, ask and answer questions about key details in a text.
- RI.K.2 With prompting and support, identify the main topic and retell key details of a text.
- RI.K.3 With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.
- RI.1.1 Ask and answer questions about key details in a text.
- RI.1.2 Identify the main topic and retell key details of a text.
- RI.1.3 Describe the connection between two individuals, events, ideas, or pieces of information in a text.
- RI.1.4 Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
- RI.1.5 Know and use various text features to locate key facts or information in a text.
- RI.1.6 Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.
- RI.1.7 Use the illustrations and details in a text to describe its key ideas.
- RI.2.4 Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.
- RI.2.5 Know and use various text features to locate key facts or information in a text efficiently.
- RL.2.7 Explain how specific images contribute to and clarify a text.

- RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.
- RI.3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.
- RI.3.5 Use text features and search tools to locate information relevant to a given topic efficiently.
- RI.3.7 Use information gained from illustrations and the words in a text to demonstrate understanding of the text.
- RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
- RI.4.5 Describe the overall structure of events, ideas, concepts, or information in a text or part of a text.
- RI.4.7 Interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the text in which it appears.
- W.4.5 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.

Social Studies

- K.G.2 Understand the interaction between humans and the environment.
- K.B.1.1 Identify cultural practices in local communities and around the world.
- K.B.1.2 Compare cultural practices of people in local communities and around the world.
- 1 B.1.1 Identify cultural practices and traditions in local communities and places around the world.
- 1.C&G.1.1 Exemplify ways individuals and groups play a role in shaping communities.
- 1.H.1 Understand that history tells a story of how people and events changed society over time.
- 2.C.1 Understand how various cultures influence communities.
- 3.H.2 Use historical thinking skills to understand the context of events, people, and places.

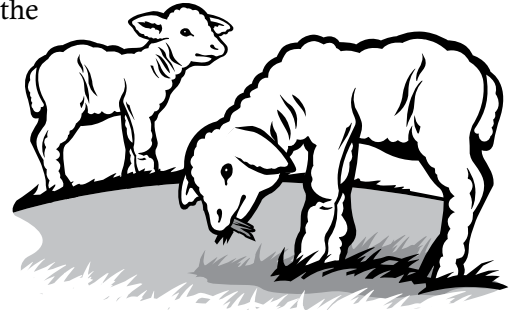
Science

- PS.K.1 Understand how objects are described based on their physical properties and how they are used.
- LS.K.1 Understand the characteristics of living organisms and nonliving things.
- LS.K.2 Understand characteristics of organisms that make them alike and different.
- LS.1.1 Understand characteristics of various environments and behaviors of humans that enable plants and animals to survive.
- ESS.1.3 Understand that natural resources are important to humans.
- LS.2.1 Understand animal life cycles.
- LS.2.2 Understand that organisms differ from or are similar to their parents and other offspring based on the characteristics of the organism.
- LS.4.1 Understand the effects of environmental changes, adaptations and behaviors that enable animals (including humans) to survive in changing habitats.
- LS.5.3 Understand some characteristics of an organism are inherited and other characteristics are acquired.

Have You Any Wool?

Name: _____

As an animal geneticist, you help ranchers determine the probable outcome of sheep breeding programs. A sheep rancher has two sheep he would like to breed. The male is called a ram, the female, a ewe. You decide to use a Punnett square to determine the probability of their lamb's wool color based on the genes passed on by the parents. An allele is a gene containing inherited traits from parents. The ram has white wool. An upper case W is used to represent his *dominant* white wool allele and a lower case b to represent his *recessive* black wool allele. The ewe has black wool. Two lowercase b's are used to represent her *recessive* black wool alleles. What is the probability their offspring, a lamb, will have white wool? What is the probability for black wool?



		RAM	
EWE		Roll 1	Roll 2
		Roll 4	Roll 3

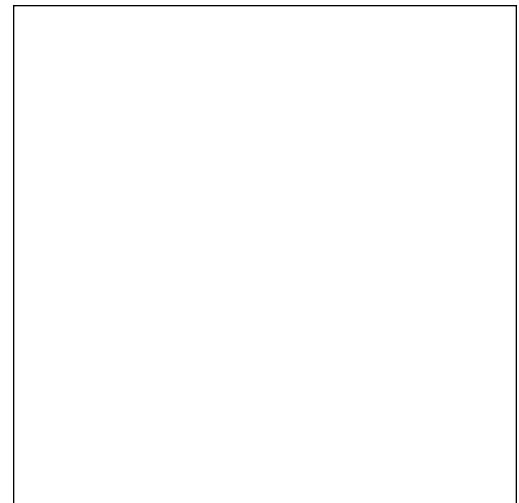
Probability of white wool:

_____ out of _____

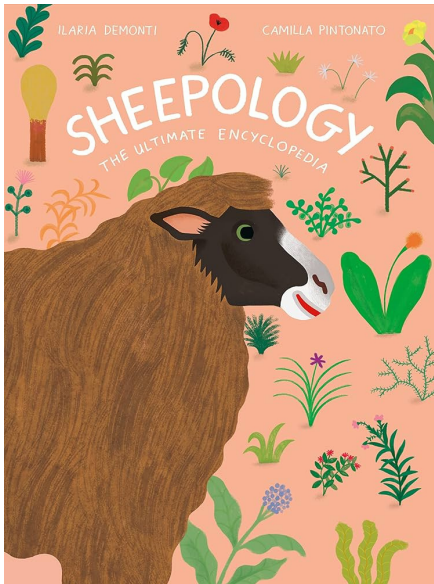
Probability of black wool:

_____ out of _____

Directions: After reading the paragraph above, complete the Punnett square to determine the probability of the lamb having black or white wool. Once you know the probability of black or white wool, roll a die to represent chance. If you roll a one, select the top left hand square. If you roll a two, select the top right hand square. If you roll a three, select the bottom right hand square. If you roll a four, select the bottom left hand square. In the space provided, sketch a portrait of the newborn lamb.



Name: _____



Sheepology by Ilaria Demonti

SCAVENGER HUNT

Answer Key

1. How many sheep are in the world? (1.2 billion)
2. What are the three parts of a sheep's day? (grazing, ruminating, and sleeping)
3. What are baby sheep called? (lambs)
4. How many compartments does a sheep's stomach have? (4)
5. What do sheep have an excellent memory for? (faces)
6. How many failed attempts did it take to show that Dolly could be cloned? (276)
7. What are the three ingredients to make cheese? (milk, rennet, and salt)
8. What are wool fibers made of? (keratin)
9. What color is the Shropshire breed's fleece? (white)
10. Where does a sheep's food end up? (in the rumen)

If using with Breakout EDU boxes, here are some possible lock combinations:

Word lock: LAMB (#3)

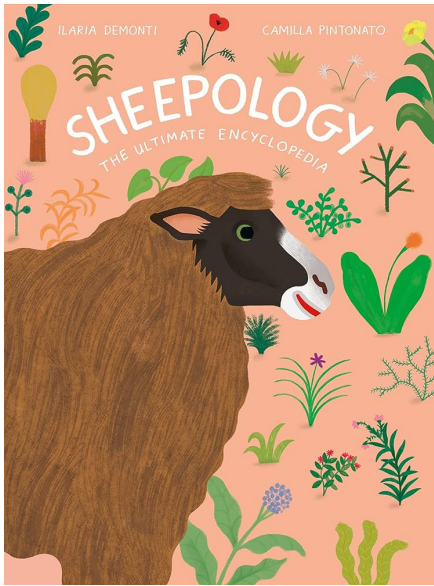
3-digit lock: 276 (#6)

Color lock: white dots (#9)



Ag in the Classroom

Name: _____



Sheepology by Ilaria Demonti

SCAVENGER HUNT

Questions

1. How many sheep are in the world?
2. What are the three parts of a sheep's day?
3. What are baby sheep called?
4. How many compartments does a sheep's stomach have?
5. What do sheep have an excellent memory for?
6. How many failed attempts did it take to show that Dolly could be cloned?
7. What are the three ingredients to make cheese?
8. What are wool fibers made of?
9. What color is the Shropshire breed's fleece?
10. Where does a sheep's food end up?



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