

Lesson 10

Mimicry

Prepare

In Lesson 10, students learn about two engineers whose designs mimic the ways plants and animals use their body parts. Students analyze the structure of a burdock burr and record their observations about three different human-made fasteners to consider how the properties of plant and animal body parts can inform engineered solutions. This lesson prepares students to solve a problem in an upcoming Engineering Challenge.

Student Learning

Knowledge Statement

Humans can solve some problems by mimicking how plants and animals use their body parts.

Objective

- Lesson 10: Examine two human-made products that mimic how plants and animals use their body parts.

Application of Concepts

Task

Preparation for Engineering Challenge

Phenomenon Question

How can observing body parts help people solve problems?

Texas Essential Knowledge and Skills Addressed

- 2.2D **Record and organize data using pictures, numbers, and words.** (Introduced)
- 2.4A **Collect, record, and compare information using tools, including** computers, hand lenses, rulers, plastic beakers, magnets, collecting nets, **notebooks**, and safety goggles or chemical splash goggles, as appropriate; timing devices; weather instruments such as thermometers, wind vanes, and rain gauges; and materials to support observation of habitats of organisms such as terrariums and aquariums. (Addressed)
- 2.10A **Observe, record, and compare how the physical characteristics and behaviors of animals help them meet their basic needs.** (Mastered)
- 2.10B **Observe, record, and compare how the physical characteristics of plants help them meet their basic needs** such as stems carry water throughout the plant. (Addressed)

English Language Proficiency Standards Addressed

- 1C Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary.



Materials

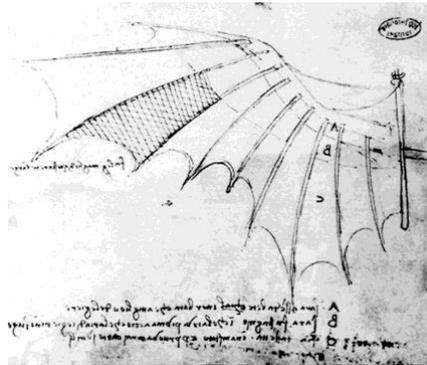
		Lesson 10
Student	Science Logbook (Lesson 10 Activity Guide)	•
	Plastic handheld magnifier (1 per student pair)	•
	Dog with Burr Photograph (Lesson 10 Resource C) (1 per group)	•
	Burr Photograph (Lesson 10 Resource D) (1 per group)	•
	Fastener activity: brad (1 per group), hook and loop fastener (1 per group), safety goggles (1), screw (1 per group)	•
Teacher	Da Vinci Drawing (Lesson 10 Resource A)	•
	Red Kite Photograph (Lesson 10 Resource B)	•
	Dog with Burr Photograph (Lesson 10 Resource C)	•
	Burr Photograph (Lesson 10 Resource D)	•
Preparation	Prepare to distribute a color copy of Lesson 10 Resource C to each group.	•
	Prepare to distribute a color copy of Lesson 10 Resource D to each group.	•
	Prepare a piece of hook and loop fastener for each group. Press both sides of the fastener together and then pull them apart. Repeat this several times so the hooks become more visible. Then cut the hook and loop fastener into 3 cm pieces.	•

Lesson 10

Objective: Examine two human-made products that mimic how plants and animals use their body parts.

Launch 7 minutes

Display the da Vinci drawing (Lesson 10 Resource A). 



- What do you notice about this picture?
 - *It looks like a drawing of a wing.*
 - *It looks old, and it has writing on it.*
- What do you wonder about this picture?
 - *Is it supposed to be a real wing?*

Agenda

Launch (7 minutes)

Learn (23 minutes)

- Observe a Plant Body Part (7 minutes)
- Describe Different Fasteners (16 minutes)

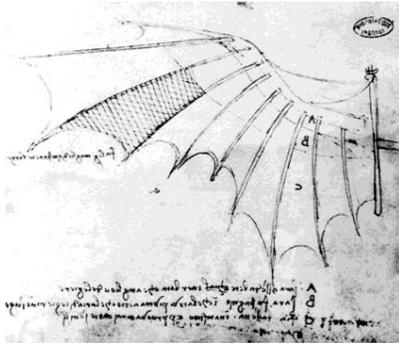
Land (5 minutes)



Teacher Note

The image of da Vinci's flying machine represents only part of his original sketch.

Display the photograph of the red kite (Lesson 10 Resource B) next to da Vinci's drawing. Tell students that the bird in the photograph is called a red kite.



- How is the drawing like the photograph of the red kite? How is it different?
- *I think the drawing looks like it has one of the red kite's wings.*
 - *They are different because one picture is a drawing and the other picture is a photograph of a real bird.*

Reveal to students that the drawing is by a famous artist and engineer named Leonardo da Vinci, who lived more than 500 years ago. Ask students to share what they know about engineers. 📄

Sample student responses:

- *Engineers help solve problems.*
- *Engineers make inventions that help people.*

Build on student responses to confirm that engineers are people who use their science knowledge and creativity to solve problems and help people. Then explain that the word *inspire* means to give an idea, and tell students that engineers are often inspired by the world around them. ✨

Bring students' attention back to da Vinci's drawing. Explain that da Vinci wanted to create a machine that humans could use to fly and that this drawing shows one part of da Vinci's flying machine. Tell students that a red kite inspired da Vinci's drawing.

- Which body part of a red kite do you think inspired da Vinci?
- *I think the bird's wings inspired him.*



Teacher Note

Students may be familiar with engineers and engineering problems. However, even without prior experience, students can still be successful in this lesson and in the Engineering Challenge.



Spotlight on Knowledge and Skills

Help students reflect on the relationship between human-made products and the natural world by listing examples of human-made objects, such as desks, pencils, and paper, and natural objects, such as trees.

Although the two categories are distinct, every human-made product is designed by applying some knowledge of the natural world.

Confirm that a red kite's wings inspired da Vinci.

► Why do you think a red kite's wings inspired da Vinci to draw his flying machine? 

- *A red kite uses its wings to fly, and he wanted to make a machine that could fly.*

Explain to students that da Vinci closely studied a red kite's wings. He observed what they looked like and what they felt like to understand how to copy their function for his flying machine. Then tell students that da Vinci's machine never worked, but his drawings and research may have been used many years later to help other engineers create machines that could fly.

Tell students that in this lesson they will learn about another engineer who was inspired by body parts as they explore the Phenomenon Question **How can observing body parts help people solve problems?**

Learn 23 minutes

Observe a Plant Body Part (7 minutes)

Divide the class into groups. Distribute a copy of the dog with burr photograph (Lesson 10 Resource C) to each group, and distribute a handheld magnifier to each student pair.



Ask students to use their handheld magnifiers to observe the photograph closely. After a few minutes, have students share what they observe.



Teacher Note

If students struggle to make the connection between a red kite's wing function and the flying machine, remind students of the heron video they viewed in the Lesson 4 Launch. Ask them about the function of a heron's wings, and point out that a red kite uses its wings to fly too.

Sample student responses:

- *There is a dog and a person's hand in the picture.*
- *The person is picking something out of the dog's fur.*
- *Something is stuck to the dog.*

Display the burr photograph (Lesson 10 Resource D). Explain that a burr contains the seed of a burdock plant, so it is similar to an acorn shell that surrounds the seed of an oak tree.



Have students return to the photograph of the dog with the burr, and confirm that the person in the photograph is removing a burr from the dog's fur. Then tell students the following information about an engineer named George de Mestral.

- About 80 years ago, a man named George de Mestral was hiking with his dog. He noticed that when his dog passed some plants, burrs stuck to the dog's fur. De Mestral looked closely at the burrs to find out why they stuck to the dog's fur. Let's take a closer look and see what he may have observed.

Distribute a copy of the burr photograph (Lesson 10 Resource D) to each group. Allow students in each group to use their handheld magnifiers to observe the photograph closely and describe to each other what the burrs look like and what they think the burrs feel like. 🧐 Invite students from a few groups to share their descriptions with the class.

- How did you describe the burrs?
 - *I notice the ends have little hooks on them.*
 - *Some of the ends are straight, but others are kind of bent.*

**Content Area Connection: English**

Guide students to distinguish shades of meaning among similar verbs by asking them to think about what it means to observe and what it means to look. Explain that when students observe something during these lessons, they take time to examine the object carefully and notice the details.



Highlight student responses that focus on the curved or hook shapes on the burrs. Reveal that these hooks help a burr hold onto the fur of an animal. Remind students that a burr contains the seed of a burdock plant. Further explain that when an animal moves around, a burr can stay attached to the animal's fur, and the burr may eventually fall to the ground and grow into a new burdock plant. Explain that the properties of a burr help it perform the function of holding onto materials such as fur. 

Tell students that de Mestral wondered if he could copy the properties and function of a burr to help humans hold objects together.

Describe Different Fasteners (16 minutes)

Display a brad, a hook and loop fastener, and a screw. Explain that each object is a fastener, or something that can hold other objects together.

Explain that only one of these fasteners was created by de Mestral and was inspired by a burr's hooks. Then distribute a brad, the hooked side of a hook and loop fastener, and a screw to each group.



Safety Note

This activity poses potential hazards. To minimize the risk, review these safety measures and look for evidence that students are following them (2.1A):

- Wear safety goggles during the activity.
- Do not remove the fasteners from the table or desk.
- Do not touch the tips of the brad or screw.

Ask students to use their handheld magnifiers to look closely at each fastener. Then instruct students to draw each fastener in their Science Logbooks (Lesson 10 Activity Guide) and label some of the properties of each fastener.  



Teacher Note

In this lesson, students receive a brief explanation of how the properties of a burr relate to its function.



Teacher Note

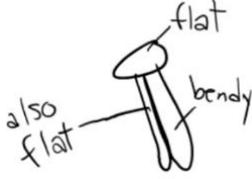
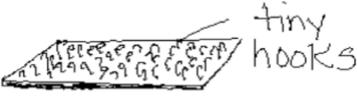
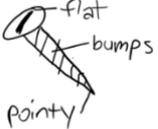
To ensure that students fill out the chart correctly, read each row aloud while holding up the corresponding fastener. Circulate to provide support as students work with their groups.



Teacher Note

To help students manage their time while they draw, remind them that scientists create drawings to record close observations and that artistic skill does not matter. Encourage students to recall the way they drew their models in Lesson 3 (1C).

Sample student response:

Fastener	Looks Like and Feels Like
Brad	
Hook fastener	
Screw	

After students complete their drawing, instruct them to circle the fastener they think de Mestral created. Then lead the class in a Vote–Discuss–Revote routine. After students discuss their vote with a partner and they revote, have students revisit their drawings and make changes or additions if needed. Confirm that de Mestral created the hook and loop fastener.



Teacher Note

In the Vote–Discuss–Revote instructional routine, students receive a question and three to six possible answers. Students first vote individually and anonymously on a sticky note. Votes are collected and recorded publicly. Students then discuss their answer with a partner before voting again. The process can be repeated after students investigate concepts further. This formative assessment tool can also track students’ thinking across lessons.



Check for Understanding

Students record information about three different fasteners and decide which one was inspired by a burr to identify that the structure and function of a burr are most closely related to the structure and function of the hook and loop fastener.

Evidence	Next Steps
<p>Students write and draw relevant structural properties of each fastener that could relate to its function.</p>	<p>If students struggle to identify properties of each fastener, prompt them to observe closely with their handheld magnifiers, and ask questions such as these: What does the fastener look like? What does it feel like? Highlight properties they mention that relate to the fastener’s function.</p>
<p>Students identify that the shape of the hooks on the burr is related to the shape of the hooks on the hook and loop fastener.</p>	<p>If students struggle to compare the fasteners’ structures with the structure of a burr, remind students of the burr properties they described earlier in the lesson. Prompt student thinking with questions such as these: What made the burr stick to the dog? Which of the fasteners has parts that look like the burr? Which of the fasteners might feel most like a burr? Were any properties the same for a burr and one of the fasteners?</p>

Allow students to figure out how a hook and loop fastener works by distributing the looped side of a hook and loop fastener to each group. Have them look closely at how the hooked side and looped side work together. Then ask students the following questions.

► Why did burrs inspire George de Mestral to create his hook and loop fastener?

- *He was inspired by the little hooks*
- *He observed that burrs stuck to his dog's fur*

► What is the function of a burr's hooks?

- *They stick to animals so burdock plants can grow in new places.*
- *They stick to something.*

Confirm that de Mestral was inspired by a burr's ability to stick or hook onto something. Explain that de Mestral's hook and loop fastener became a product that many people use today.

► In what ways have you seen a hook and loop fastener used? Has it helped you?

- *It's on my shoes, and it helps me keep my shoes on. I don't have to tie them.*
- *I have it on my mittens. It helps me keep my mittens on.*

Summarize the different ways a hook and loop fastener can help solve problems. Tell students that engineers can **mimic**, or copy, the properties and functions of plant and animal body parts to solve problems.



English Language Development

Students will encounter the term *mimic* throughout the Engineering Challenge. English learners may benefit from an opportunity to act out this term. Invite students to use their bodies and voices to mimic several animals.

Land 5 minutes

Ask students to Think–Pair–Share in response to the Phenomenon Question **How can observing body parts help people solve problems?**

Sample student responses:

- *People can get ideas from the properties of plant body parts to solve problems.*
- *I think people can observe the body part and what it does. Then they can mimic the function of the body part.*
- *We can make something that looks and feels like a plant or animal body part to help people.*

Tell students that in the next lessons, they will use what they know about the properties and functions of body parts to solve a problem in an Engineering Challenge.

Optional Homework

Students look for other examples of human-made objects that seem to mimic the functions of plant and animal body parts. Students list or draw these objects and the body parts engineers may have mimicked.