Investigate a Nature-Inspired Invention
Hook-and-Loop Tape

Facilitator-Led Tabletop Activity

The seedpods of the burdock plant have tiny hooks so that they get caught on the fur and feathers of animals that get close. This seed spreading adaptation inspired the invention of Velcro. Participants, examine a photo of a burdock seed pod, then look at a piece of double-sided Velcro with a hand-held microscope to compare the two. Then they try rubbing the hook side of their Velcro to different fabric surfaces to compare the sound and feel of each.

Question to investigate

Which fabric does hook-and-loop tape stick to the best?

Chemistry concepts

- Inventions are often inspired by nature. The invention of Velcro and various synthetic fibers were designed to mimic natural fibers and fabrics.
- There are many tiny hooks and many tiny loops made of nylon on tape made of polyester. These materials were chosen because they are strong, flexible, and lightweight.
- The structure of Velcro makes it function well in many different applications.

Activity logistics

- **Ages**: As written, this activity is best suited for elementary and middle school students.
- **Group Size**: This activity serves up to 60 children or teens over a period of 2 hours, with each iteration of the activity lasting approximately 8 minutes.
- **Set-up**: Arrange the materials along one side of an 8-foot table into four stations to reach up to four children at once.
- **Facilitators**: One facilitator can comfortably manage two stations at the same time.

Prepare in advance

What you'll need

- Images
  - Seed pod from either a wild or cultivated burdock plant
  - Illustration of woven, nonwoven, and knitted fabrics
- 1 roll of Velcro for cable ties, 75 feet per roll
- Scissors
- Variety of different fabrics with different weaves and different fiber-types.
  - Examples include tights, tube socks, towels, and T-shirts
  - Keep in mind that sample fabrics will likely become damaged in this activity
- 4 trays
- 4 Hand-held microscopes

Procedure

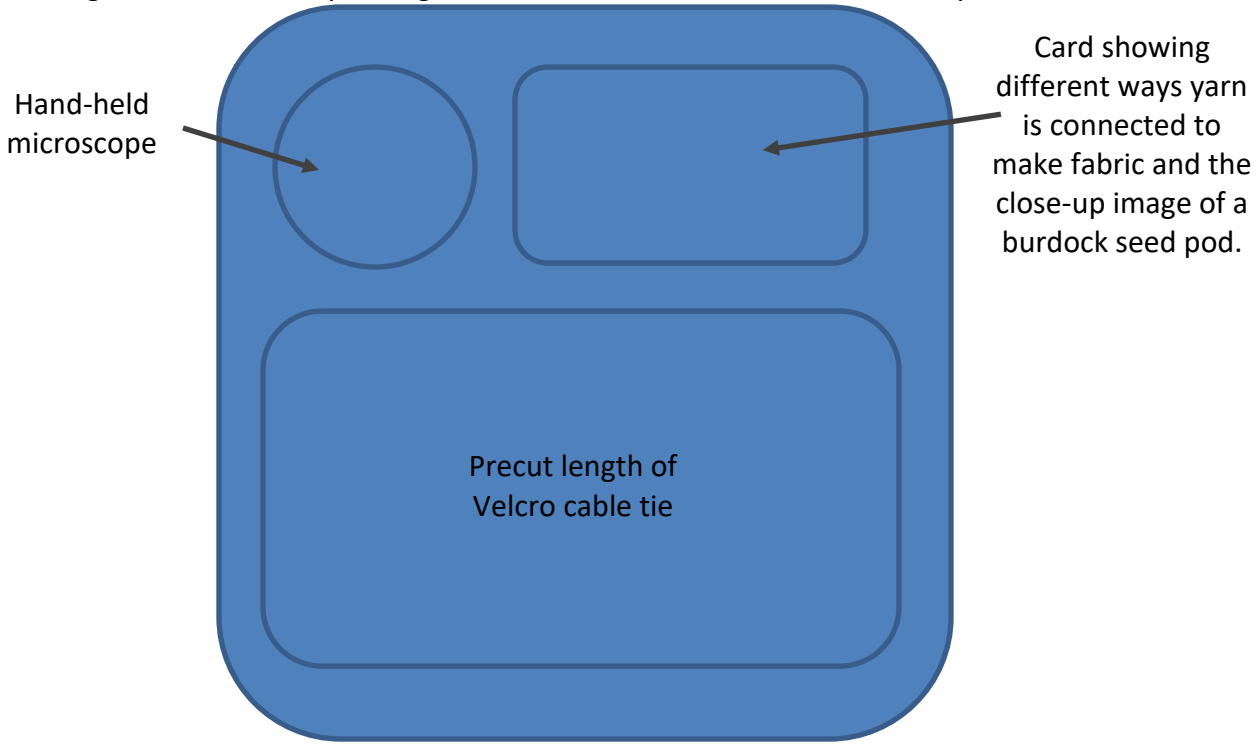
1. Cut cable ties into 8-inch pieces.

2. Print and cut images to make 4 double-sided cards for each station.

Prepare on-site

Prepare four stations to accommodate up to four participant groups at one time

1. Arrange four divided trays along the front of the table. Items on each tray as shown.



2. Place assorted textile samples near the facilitator.

Facilitate the activity

Invite participation

1. **Introduce the activity by telling the story that led to the invention of velcro.**

   Ask students:
   What is the name of the product that shoes on feet, bibs on babies, and rocks in pockets?
   Velcro

   This is how it all began: Engineer George de Mestral was walking his dogs in the meadows of the Swiss Alps. When they returned home, he noticed that burr seed pods were stuck on his dogs' fur! He even found some stuck to his own clothes. De Mestral was curious: Why did the burr seed pods stick to fur and fabric? The answer he found inspired him to invent a special new material … one that you may use every day! Let's take a look!

Support Exploration

2. **Invite students to examine the Velcro "wristband" and compare it to the photo of a burdock seed pod.**

Procedure

1. Look closely at the photo of the seed pod.
2. Stick the Velcro piece on your tray together hook-side out to make a circle.
3. Turn on the hand-held microscope and place it on the edge of the cable tie. Raise and lower the microscope slightly until it comes in focus.
4. Pull the ends of the Velcro apart slightly and use a magnifier to look at the place where the two are being pulled apart.
5. Next, listen to the sound as you pull the hook and loop sides apart.

Deepen Understanding

Ask students:

- Are both sides of Velcro the same or different?
- Which side is more similar to the seed pod.
- What you notice about Velcro and how it works?
- How do you think the seed pods got stuck to the dog's fur?

When de Mestral looked at the burrs under a magnifying glass, he saw that they had tiny hooks that got caught on the yarns of his clothes and on the dogs' fur. He used nylon to make the hooks. There was a problem, though, the nylon hooks would tear fabric!

Support Exploration

3. **Listen to the sound the hook side of Velcro as it is removed from different fabrics.**

Procedure

1. Press the hook side against one of the sample fabrics here and listen as you pull it off.
2. Compare this sound to the hooks coming off the loop side of Velcro.
   Which makes the loudest sound?
3. Examine the different fabrics with the hand-held microscope.
4. Turn the card over and determine whether each fabric is woven, nonwoven, or knitted.

Deepen Understanding

Ask students:

- What does Velcro stick to the best?
- How do you know?
- Why does the hook side stick to the loop side so well?

Velcro works so well because the hooks on one side of the tape grab onto some of the many loops on the other side. The loops are made of nylon, too because nylon is really strong. The hooks are designed to be tougher and thicker than the loops. When pulled, the flexible loops can detach from the hooks. Some loops are torn in the process, but there are many loops, so this fabric fastener is reusable many times!

Fun facts about Velcro

- George de Mestral patented his nature-inspired fabric in 1955, calling it Velcro.
- Velcro is a combination of the French words "velours" and "crochet," which translates to "velvet hook."
- Astronauts use hook-and-loop tape to secure important scientific equipment (and their dishes) in zero-gravity space.
- Hook-and-loop tape is made with nylon and polyester. The hooks and loops are nylon and the tape that they are attached to is polyester.

Clean-up

Reset for the next group

1. Make sure that microscopes are turned off.
2. Reset the trays.

At the end of the event

- Make sure that microscopes are turned off.
- Place them back in their boxes for safe traveling.
- Pack everything back in the large bin.