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Soft Robots

Science Film Festival Knowledge Through Entertainment

KEY OBJECTIVES

Create simple machines that move in response to the presence of water

INTRODUCTION

When you think of robots you will probably think of hard metallic machines, with motors and gears and pistons and advanced electronics. Engineers use these elements to make the robot move and interact with its environment. When the robot is working in a factory, being made of hard stiff components is not a problem, in fact it might be necessary.

However, if the task was to make a small robot to work within the body of a human, a hard stiff robot might be disastrous. It might not be able to move around the tight curving spaces within blood vessels, or between the soft delicate tissues of the body. For these tasks soft, flexible robotic systems are necessary.

In many living systems (plants, animals and even fungi) simple movements are often achieved through the movement of water into or out of parts of their bodies. This can cause tissues to swell - like a blowing up of a balloon - which can lead to movement of all or part of the organism. We will use some simple materials to create simple machines that move in response to the presence of water.

KEYWORDS

Soft robots

LEVEL

Primary & Secondary School

TIME FOR ACTIVITY

20 min

GUIDING QUESTIONS

How to create simple machines that move in response to the presence of water?

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MATERIALS & PREPARATION

- **Shallow saucer**
- **Water**
- **Small pieces (10 cm x 10 cm) of a range of paper types (newsprint, printer paper, blotting paper, glossy magazine papers etc.)**
- **Pen/pencil**
- **Scissors**
- **Use the template on the second page to cut out a number of star shapes from a few different types of paper**

TASKS & PROCEDURE

1. Use the template below to cut out a number of star shaped from a few different types of paper.
2. Fold each of the points over to create a small 5 sided form.
3. Fill a small saucer or tray with water to a depth of 1 to 3 cm.
4. Hold the folded paper shape on the palm of your hand, and observe it for a moment.
5. Then carefully drop one of the folded shapes onto the top of the water, with the points on the top.
6. Observe what happens.
7. After a while take the paper out of the water and try another star made from different paper.
8. What do you notice?

The first thing you and the students will see is that the stars open once they are placed on the surface of the water. They will also probably see that different papers open at different speeds.

It is worth asking the students to consider how the stars open, what drives the movement, why do different papers open at different speeds. How could you test these ideas?

POSSIBLE EXTENSIONS

As an extension you might prompt the students to see if they can design and make a device from paper to do something more complex, using this phenomena.

For example: Can you take a strip of paper and fold it into a spring? Can you find a way to cut out the initials of your name and have them unfold?

Soft robots are finding applications in many areas of medicine, being able to make more natural prosthetics, implants that can remain in the body for many years without causing tissue damage.

SOURCES

Presented by **Dr. Stuart Kohlhagen/The Science Nomad**

Template

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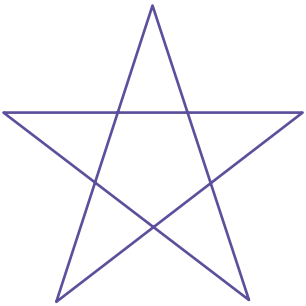

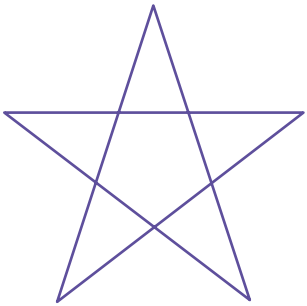

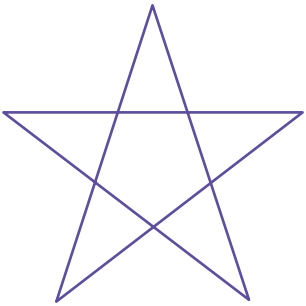

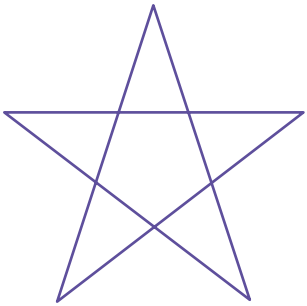

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