How Does Soap Remove Viruses?	Grades 4 to 6

Lesson Plan

Description

Soap is a great molecule with two important parts. It has a hydrophilic end. This is the water-loving end. It has a hydrophobic end. This is the water-fearing end. The hydrophobic end will stick to things like fats. Soap can effectively remove germs from surfaces, especially our hands.

Learning Outcomes

Students will learn about different virus structures

Student will learn that the first level of defense against germs is our skin.

Students will learn the special properties of soap make it ideal for removing germs, including viruses, from our skin.

Materials

- Aluminum foil
- Double sided tape
- Butter
- Sprinkles or cracked pepper (should not dissolve in warm water)
- Water
- Soap
- Spoon

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Action

1. Make two different virus models. Base – make small balls of aluminum foil and wrap with double-sided tape.

2. For the non-enveloped virus, roll in sprinkles. For the enveloped virus, coat in butter and then roll in sprinkles.

3. Two types of virus structures:

Non-enveloped virus	**Enveloped virus**
Protein shell Genetic material Attachment proteins	Protein shell Genetic material Attachment proteins Lipid membrane envelope (like our cell membrane)
Poliovirus, rotavirus, hepatitis A virus	Influenza virus, measles virus, coronavirus

4. Fill a bowl with warm water and add 2 tsps. of soap. Use the spoon to dissolve the soap in the water.

5. Carefully drop the virus models in the bowl of soapy water and swirl the water with the spoon. Observe the virus models for 2 minutes.

6. Remove the virus models from the water and describe them.

7. Write a description of what you think happened?

Explanation:

Dropping the virus models into soapy water mimics washing your hands with warm water and soap. Swirling the viruses around in the water is like scrubbing your hands with soap. The butter, which represents the lipid (fat) membrane envelope, slowly dissolves in the warm soapy water. This is because the soap molecules interact with the butter molecules, which leads to the butter layer being destroyed.

The enveloped virus model should lose all its sprinkles over time. The non-enveloped virus model should keep its sprinkles much longer. Soap can remove viruses from our hands, but soap can also make some viruses non-infectious or less infectious by removing the proteins from their surfaces.

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Soap molecules have a hydrophobic head and a hydrophilic tail. Hydrophobic means water-fearing, but more importantly it will mix with fats and lipid (like the coating of viruses). Soap can break apart and dissolve the lipid membrane. Since the envelope holds the proteins (represented by the sprinkles) that hook onto host cells, these proteins are removed with the envelope. This means the virus cannot invade our cells.

The hydrophilic head (water-loving) will be attracted to the water and will pull away the viruses and other things attached to the hydrophobic tail when you rinse your hands. All of this goes down the drain.

Consolidation/Extension

Use a timer to measure how long it takes for all the sprinkles to disappear from each type of virus model. Use this information to explain effective hand-washing techniques.
Try the experiment using cold water and soap, and just using water. Measure how long it takes to remove the sprinkles.

Accommodations/Modifications

Students could wear gloves when handling the butter and the virus models.

Duct tape might work better as a base than a ball of aluminum foil and double-sided tape. Test it out.

Note: this activity is a good demonstration of how soap works, but it is not a well-controlled experiment.

Assessment

Use the report and the answers to the questions above to assess the students' understanding of how soap removes germs from our hands.

Additional Resources

It's Catching: The Infectious World of Germs and Microbes by Jennifer Gardy, 2014
How Does Soap Clean Your Hands? The Science Behind Healthy Habits by Madeline J. Hayes, 2020

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