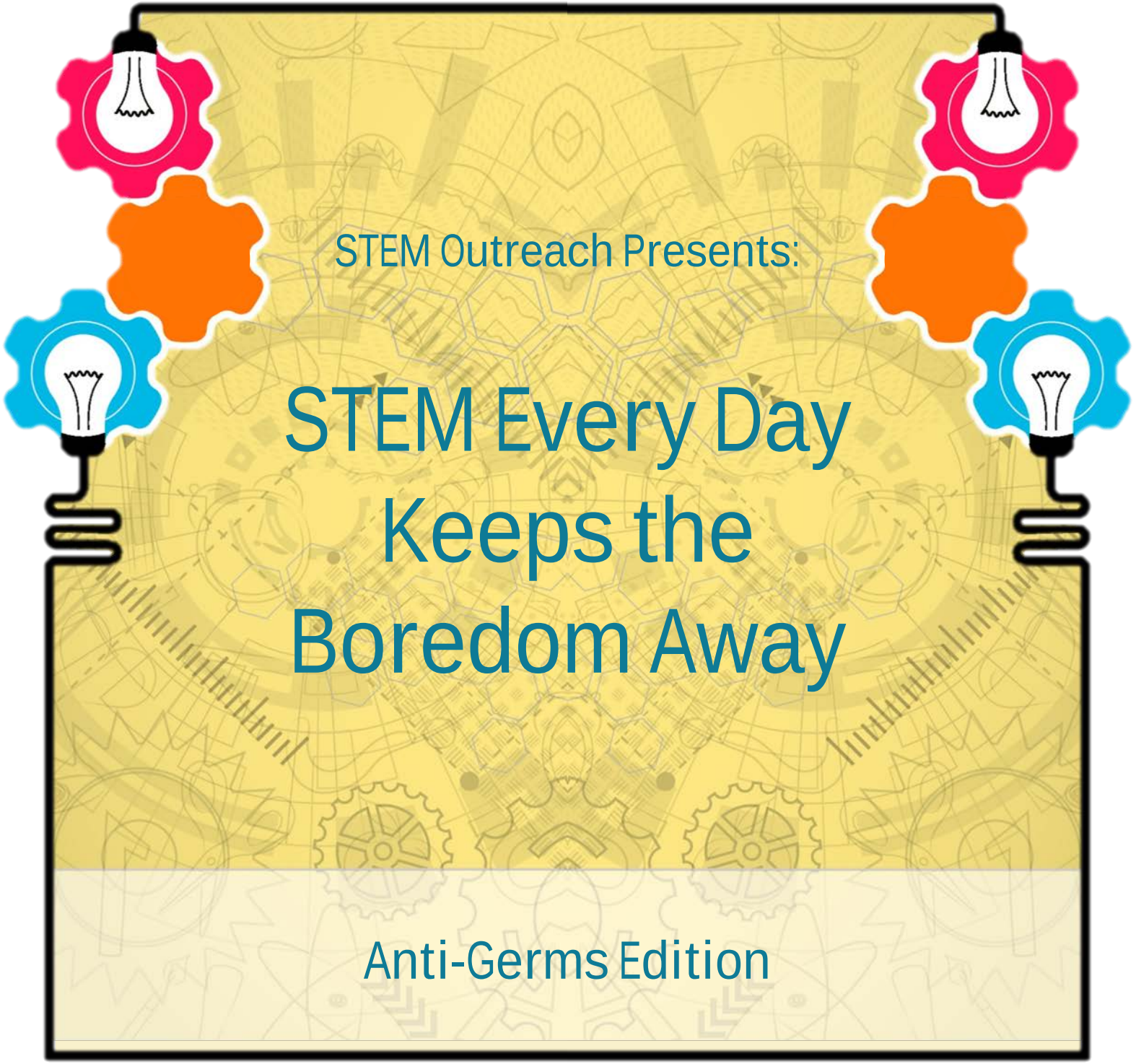


Always ask a trusted adult before starting a Science or Engineering project.

Snot Slime

DIFFICULTY LEVEL: NOVICE

PURPOSE

Explore how mucus, such as snot, protects the body from foreign particles.

MATERIALS

Measuring cups/spoons
1 Zip-closing bag (snack size)
2 tsp Water
1 tsp Clear gel glue
Food coloring
1 Disposable plastic cup (3 oz.)
1 Disposable plastic spoon
½ tsp Borax Detergent Booster
¼ tsp Glitter (spices can be used, if preferred)
1 Cookie sheet
Wax paper

INSTRUCTIONS

Creating the "mucus"

1. **Pour** 2 teaspoons of water and 1 teaspoon of clear gel glue into a zip-closing bag.
2. **Seal** the bag completely. Squeeze the bag between your fingers until the contents are thoroughly mixed.
3. **Open** the bag and add two drops of food coloring.
4. **Repeat** step 2.
5. **Pour** 1/4 cup of water into the plastic cup.
6. **Make** a borax solution by adding 1/2 teaspoon of borax to the water in the cup and stirring with the plastic spoon until most of the borax dissolves.
7. **Open** the zip-closing bag and add 1 teaspoon of the borax solution to the glue mixture.
8. **Repeat** step 2.

CONCEPT #1

Immune System

The Immune system protects your body from pathogens that cause illnesses like viruses, parasites, and bacteria. The immune system is made up of cells, organs, and tissues that team up to fight against these invaders.

The immune system keeps people from getting sick from the millions of germs most people encounter everyday and fights the pathogens that do make us sick.

Snot Slime (cont.)

INSTRUCTIONS

Trapping the "foreign bodies"

1. Place a sheet of wax paper on the cookie sheet.
2. Remove the slime from the bag place on the wax paper and make observations about its properties.
3. Put all of the slime back in the zip-closing bag.
4. Place ¼ teaspoon of glitter on the wax paper. The glitter represents foreign bodies (pollen, allergens, bacteria, viruses, etc.).
5. Place the slime on the wax paper and roll it over the glitter. What do you observe? Does the glitter stick to the slime?
6. Pour any extra borax solution down the drain, and throw away the rest of the materials. Do not try to pour the slime down the drain. Throw it in the trash instead. Thoroughly clean the work area and wash your hands.

CONCEPT #2

Magnificent Mucus

Mucus is a slimy substance made by animals. Mucus can have many different purposes. Snot is the mucus produced in the nose to keep the lungs clean. The slime in this activity models how snot works. You may have noticed that the sticky slime was able to collect the glitter it rolled over.

Similarly, snot traps particles in the air such as germs and allergens (dust, pollen, etc.) when you inhale through your nose. If these particles got into the lungs, they could get irritated or even infected, which would make it difficult to breathe. When these particles are trapped by the snot, they stay in the nose and cannot go into the lungs.

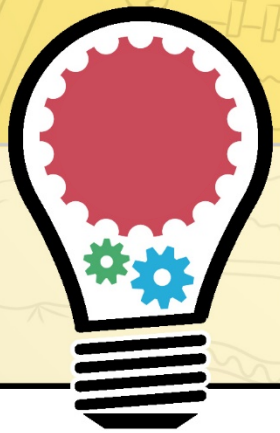
Snot is just one way the immune system protects the body from pathogens.

CONCEPT #3

Chemistry of Snot Slime

The glue and water mixture contains long chains of repeating molecules, known as polymers. Adding the borax solution makes the liquid turn into a ball of slime by linking the long polymer chains together. The new structure of the material, makes it difficult for the trapped glitter to come out, much like how pathogens get trapped in mucus (snot). Natural mucus contains sugars and proteins, which are also polymers.

Mucus protects many other parts of the body. The inside of a stomach is completely coated with it. If there were no mucus to protect the stomach, the powerful acids used to digest food would digest the stomach too.



REFERENCES

Adapted from:

https://californiasciencecenter.org/file/sticky-snotpdf

https://www.acs.org/content/dam/acsorg/education/resources/k-8/science-activities/characteristicsofmaterials/polymers/glitter-slime.pdf

ADULT ASSISTANCE REQUIRED

Gel Sanitizer

DIFFICULTY LEVEL: INTERMEDIATE

PURPOSE

Explore the creation of gel sanitizer

MATERIALS

PREP

Dishwashing soap
Water

INGREDIENTS

Isopropyl alcohol, 90% or higher concentration
Aloe Vera gel
Optional: essential oil with a pleasant scent

TOOLS

1 Clean bottle or tube, preferably with flip top
Measuring cups/spoons
1Tbs Bleach (unscented)
1 Bowl
1 Spoon
1 Funnel

GEL SANITIZER INSTRUCTIONS

Before you start, have a trusted adult:

1. **Wash** the tools in warm soapy water and rinse them with clean water.
2. **Make** a disinfecting solution by mixing one tablespoon of bleach in one gallon of room temperature (not hot!) water. Bleach is a good disinfectant; it kills most germs.
3. **Dunk** the tools in your sanitizing solution.
4. **Let** the tools air-dry on a clean and disinfected drying rack.
5. **Disinfect** the workspace.

CONCEPT #1

Sanitizer

Disease causing bacteria, viruses, fungi are all germs, and alcohol-based hand sanitizer (with at least 60% alcohol) kills many of these.

https://www.livinglocurto.com/hand-sanitizer/

Gel Sanitizer (cont.)

GEL DISINFECTANT INSTRUCTIONS

1. **Wash** your hands well.
2. **Mix** one part aloe gel with three parts isopropyl alcohol in a clean bowl with a clean measuring spoon.

Choose your amounts based on the size of your container (bottle): one "part" should be no bigger than ¼ the volume of the container.

For example, if your bottle holds 4 cups, you can mix 1 cup of aloe gel with 3 cups of isopropyl alcohol.

Optional: To give your sanitizer a more pleasing scent, you can add a few drops of essential oil.

3. **Pour** the mixture into a clean bottle, using a funnel. Close the bottle well.
4. **Let** your hand sanitizer sit for at least 3 days before using it.
5. **When** you start using the sanitizer, make sure to close the bottle after each use and avoid touching the mouth of the bottle when applying the sanitizer.

CONCEPT #2

Keeping Sanitizer Effective

It is advised to let homemade sanitizer sit for three days before starting to use it so any harmful germs that accidentally made it into the hand sanitizer will be dead by the time you use the sanitizer. You need to close the bottle after each use for two reasons:

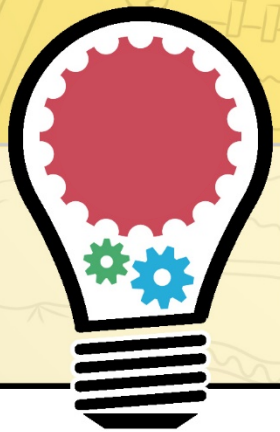
1. **it prevents the alcohol in the sanitizer from evaporating so the spray's potency will last longer, and**
2. **it prevents airborne pathogens from entering the bottle.**

To keep the bottle clean and free of germs, you should not touch the mouth of the bottle or nozzle with unclean hands.

CONCEPT #3

Sanitizer vs. Soap

To kill germs such as viruses, the hand sanitizer has to have a minimum of around 60% alcohol in it (after adding all the ingredients). The alcohol can kill virus particles much like soap does, but you have to soak every part of your hands thoroughly with the sanitizer. For this reason, a squirt of sanitizer gel or a wipe may not be thorough enough to kill the germs on your hands. But, if it isn't possible to wash your hands with soap and water, hand sanitizer is useful.



REFERENCES

Adapted from:
https://www.sciencebuddies.org/stem-activities/sanitizer#instructions

ADULT ASSISTANCE REQUIRED

Spray Sanitizer

DIFFICULTY LEVEL: INTERMEDIATE

PURPOSE

Explore the creation of spray sanitizer.

MATERIALS

PREP

Dishwashing soap

Water

INGREDIENTS

1 2/3 cups – 2 cups Isopropyl alcohol, mixture of 70% or higher concentration

2tsp Glycerol or glycerin

1Tbs Bleach (unscented)

1 Tbs Hydrogen peroxide, 3% solution

0-1/4 cup Distilled water

Optional: essential oil with a pleasant scent

TOOLS

1 Clean spray bottle, holds at least 2 cups

Measuring cups/spoons

1 Bowl

1 Spoon

1 Funnel

SPRAY SANITIZER INSTRUCTIONS

Before you start, have a trusted adult:

1. **Wash** the tools in warm soapy water and rinse them with clean water.
2. **Make** a disinfecting solution by mixing one tablespoon of bleach in one gallon of room temperature (not hot!) water. Bleach is a good disinfectant; it kills most germs.
3. **Dunk** the tools in your sanitizing solution.
4. **Let** the tools air-dry on a clean and disinfected drying rack.
5. **Disinfect** the workspace.

CONCEPT #1

Glycerol

The alcohol solution dries out the skin as it evaporates. Glycerol (also called glycerin) is mainly added to keep your hands from drying out too quickly. If glycerol or glycerin is not available, moisturize your hands after every use of the sanitizer.

Spray Sanitizer (cont.)

SPRAY DISINFECTANT INSTRUCTIONS

1. **Wash** your hands well.
2. **Pour** 1 and 2/3 cups of isopropyl alcohol in a large clean bowl.
3. **Find** the alcohol concentration on the bottle of isopropyl alcohol's label and use the table below to determine next ingredient

Isopropyl Alcohol Mixture	Add
At least 90%	¼ cup distilled water
Less than 90%	¼ cup alcohol mixture

4. **Mix** in 1 tablespoon of hydrogen peroxide. This ingredient will inactivate bacterial spores.
5. **Use** a clean teaspoon to add 2 teaspoons of glycerol to the mixture. If glycerol or glycerin is not available, moisturize your hands after every use of the sanitizer.
6. **Optional**: To give your sanitizer a more pleasing scent, you can add a few drops of essential oil.
7. **Use** a funnel to pour the mixture into a clean spray bottle. Close the bottle well.
8. **Let** your hand sanitizer sit for at least 3 days before using it.

CONCEPT #4

Using Spray Sanitizer

When you start using the sanitizer, avoid touching the nozzle when applying the sanitizer. If you need to touch it, wash your hands first.

To effectively sanitize your hands, spray it on, rub it around so every part of your hand gets disinfected, and let your hands air dry.

To sanitize a surface with this spray: spray it on, let it sit a little and if needed, dry off. You can also use it to create disinfecting wipes.

https://www.sciencebuddies.org/stem-activities/sanitizer#instructions

CONCEPT #2

Water in Sanitizer

Water is essential in alcohol-based sanitizing as it slows down the evaporation rate to increase the contact time of the solution with the germs, and thus makes it more likely to kill the germs.

For bacteria and fungi, water also helps the alcohol to enter the germ cells. The recipes in this activity all make sure the sanitizer has a water concentration within the recommended 10% to 40%.

abc

https://www.sciencebuddies.org/stem-activities/sanitizer#instructions

REFERENCES

Adapted from:
https://www.sciencebuddies.org/stem-activities/sanitizer#instructions

Soap vs. Virus

DIFFICULTY LEVEL: ADVANCED

PURPOSE

Abc

MATERIALS

Aluminum foil
Double-sided tape that stays sticky when wet
Butter
Butter knife
Small plate
Sprinkles (the waxy elongated kind) or cracked pepper
Bowl
Warm water
Paper towel
Soap
Spoon

INSTRUCTIONS

1. **Check** to make sure the type of sprinkles you are using do not dissolve in warm water. Pour a few in a small bowl of warm water and wait two or three minutes. If they do dissolve, use cracked pepper instead of the sprinkles.
2. **Refill** the bowl with warm water and add two squirts of hand soap.
3. **Mix** the soapy water with a spoon until all the soap has dissolved.
4. **Pour** a heap of sprinkles onto a small plate.

CONCEPT #1

Viruses

A virus is a type of germ that can cause diseases in people such as the cold, the flu (influenza), chicken pox, or COVID-19. Viruses come in many different shapes and sizes. All viruses consist of a nucleic acid core which includes their RNA or DNA, and an outer protein shell which is called the "capsid".

In addition to this basic structure, some viruses such as SARS-COV-2, the coronavirus that causes COVID-19, have an additional outer lipid membrane envelope that surrounds its capsid. This type of virus is called an "enveloped virus".

So how can you protect yourself from being infected by a virus? Your first line of defense is not allowing a virus to enter your body. This means staying away from people who are or could be sick, avoiding touching your nose, mouth or face, and practicing good hand hygiene.

Why is hand washing so important and how does it affect the virus? The simple answer is that the mechanical action of hand washing dislodges and carries away most of the virus. But soap also plays an important part in killing some viruses.

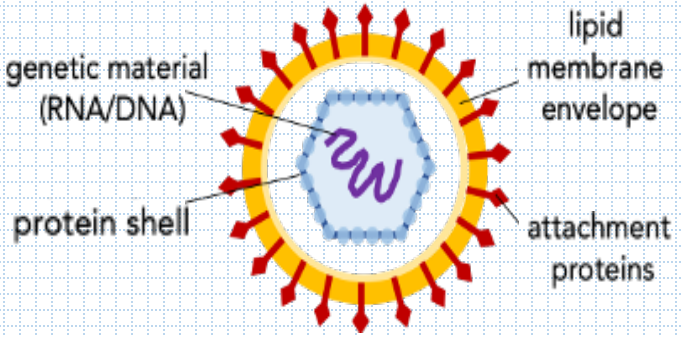
Soap vs. Virus

INSTRUCTIONS

With the help of a trusted adult:

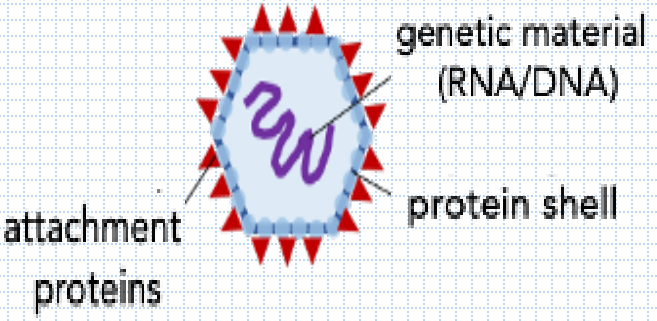
1. **Keep** these diagrams (right) of the two types of viruses handy to look at as you build your virus models. If you prefer, download and print a PDF of the virus diagram.
2. **Roll** two balls out of the aluminum foil that have a ½-inch diameter each. These will be your virus models.
3. **Cover** each of the aluminum balls with double-sided tape.
4. **Roll** one aluminum ball around in the sprinkles. These represent the attachment proteins.
5. **Cover** the second aluminum ball in butter from all sides. It should have an even layer of butter around it. This represents the lipid membrane envelope of an enveloped virus.
6. **Roll** the aluminum ball with the butter around in the sprinkles (attachment proteins).
7. **Carefully** drop both virus models into the bowl with the soapy water. Swirl the water with a spoon to make sure both virus models get splashed with water from all sides. Observe the virus models for at least 2 minutes.
8. **After** 2 minutes, take both aluminum balls out of the soapy water and place them next to each other on a paper towel.
9. **Observe** the results. What do your results tell you about how real viruses are affected by washing your hands with soap and water?

Enveloped virus



Virus Diagram
https://www.sciencebuddies.org/stem-activities/show-soap-kills-virus#instructions

Non-enveloped virus

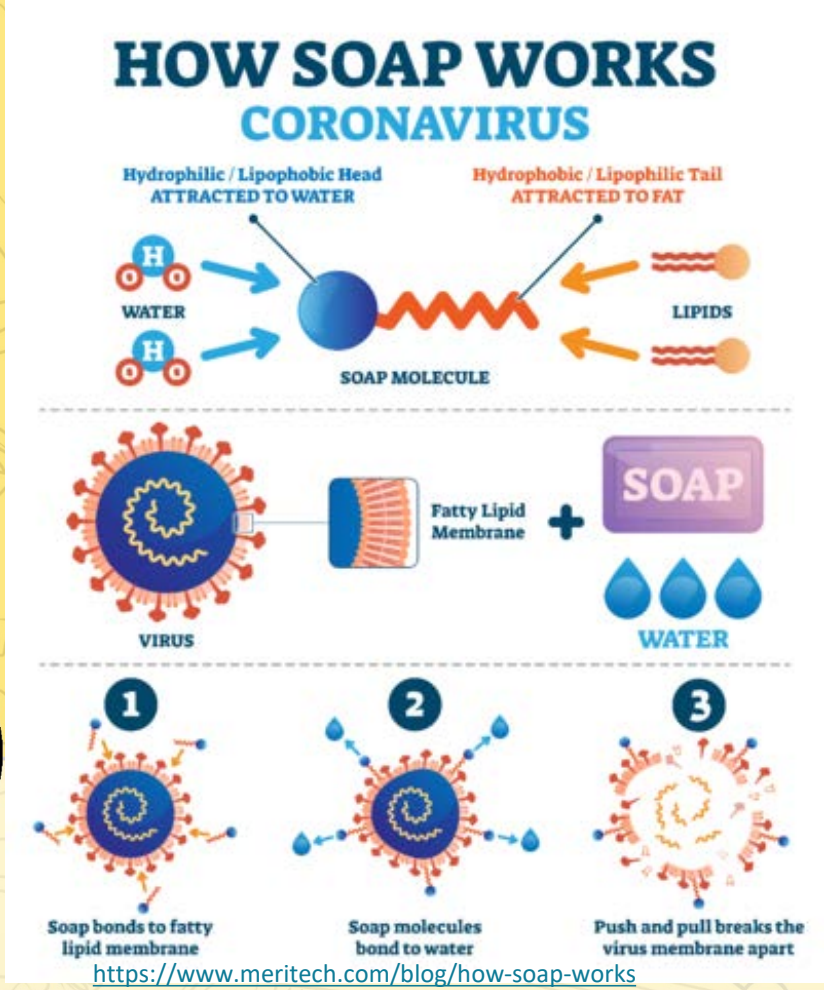


Virus Diagram
https://www.sciencebuddies.org/stem-activities/show-soap-kills-virus#instructions

CONCEPT #3

How Soap Works

The molecules of soap have one end that loves water (hydrophilic) and one end that loves oil (hydrophobic). When washing with soap, the soap molecules act as a link between the water and the oil on the skin. A molecule of water joins to one end of the soap molecule and a molecule of oil joins to the other end. When you rinse your hands, the water runs off with the soap, lifting the oil off your skin and taking the germs with it.



https://www.meritech.com/blog/how-soap-works

Because SARS-COV-2, the coronavirus that causes COVID-19, is an "enveloped virus" it has additional outer lipid (oily) membrane. When you wash your hands with soap, the lipid coating falls apart, destroying the virus particle. The Center for Disease Control recommends scrubbing your hands for at least 20 seconds with water and soap to get rid of viruses such as SARS-COV-2.

Some soaps are labeled "antibacterial". You might wonder if these are better in fighting off diseases. While they kill some bacteria, they are not better than any other soap for fighting off viruses.

REFERENCES

Adapted from:

https://www.sciencebuddies.org/stem-activities/show-soap-kills-virus#instructions

https://www.kidsnews.com.au/explainers/hand-washing-how-does-soap-work-and-is-hand-sanitiser-better/news-story/ed0b18c7ac76ee49bdcd797abe28e0bb

More Germ-Related STEM Activities

Printable Antibody Model
https://www.exploratorium.edu/snacks/antibody-attack

Making Soap (the Easy Way)
https://www.pbs.org/parents/crafts-and-experiments/how-to-make-soap

Making Soap from Scratch
https://thezooicallhome.com/easing-into-chemistry-with-soapmaking/

Making Petri Dishes to Explore Germs
https://kitchenpantryscientist.com/microbial-zoos-homemade-petri-plates/

How Well Do You Wash Your Hands?
https://www.playdoughtoplato.com/kids-science-growing-germs/

Anti-Germs Edition