

# SOAP meets COVID-19: The Amphiphile Phenomenon

Exploration/Interactive Slideshow Presentation

Images: Vox article and video: [How Soap Absolutely Annihilates the Coronavirus](#)

Access at: [https://www.vox.com/science-and-health/2020/3/11/21173187/coronavirus-covid-19-hand-washing-sanitizer-compared-soap-is-dope?utm\\_campaign=vox.social&utm\\_content=voxdotcom&utm\\_medium=social&utm\\_source=youtube](https://www.vox.com/science-and-health/2020/3/11/21173187/coronavirus-covid-19-hand-washing-sanitizer-compared-soap-is-dope?utm_campaign=vox.social&utm_content=voxdotcom&utm_medium=social&utm_source=youtube)

And From The Quint video: How Soap Destroys Coronavirus <https://youtu.be/37mxPDM1F5Q>

**\*\*Perform the Phenomena Discovery task first **before** showing the video and reading the article.**

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# A note to educators:

This lesson has been broken down with differentiation in mind. As we all know not necessarily all students learn in the same ways. Concerning the responses that I ask of my students, I do not limit them to one style of note-taking. Some students might like to add little “models” or pictures to support their learning. Some might like to web out their brainstorm, and others like to create lists. My personal philosophy is that I provide different styles to address the diversity of student needs. Then students are the ones who have agency to choose what style works best for them. I believe that the more we can put agency into our student’s hands so that they are driving their learning experiences, the better!

As for the length. Please pick and choose what you want to do. Depending on the age of the students, and time constraints, I might split the lesson into parts or add and remove to it as necessary. This is the creative aspect of educators as curriculum developers. We can critically curate lessons, then iterate on them as suits our needs.

From the start of the school year, I build in a we must record our thoughts culture. This naturally brings in purposeful writing into the curriculum, and is one of the ways that writing is integrated into my curriculum.

Mahalo nui loa,

Alison Ka`ōlinokaimana Yasuoka

# Educator/Parent Prep

Prep these supplies *before* starting the activity

## LET'S EXPLORE PREP

\*\*Keep all supplies close together. Best to work in an area where if some oil spills it can be easily wiped.

### **Phenomena Prep Part 1**

(Small groups, family project)

Prepare all of your materials before the online/remote meeting or class meeting

- One large see through container-- (For elementary students a see through clear plastic bottle would be great! )
- Water about half full.
- $\frac{1}{3}$  cup of oil
- One soap dispenser, to squirt later into the bottle of water.
- Paper towels

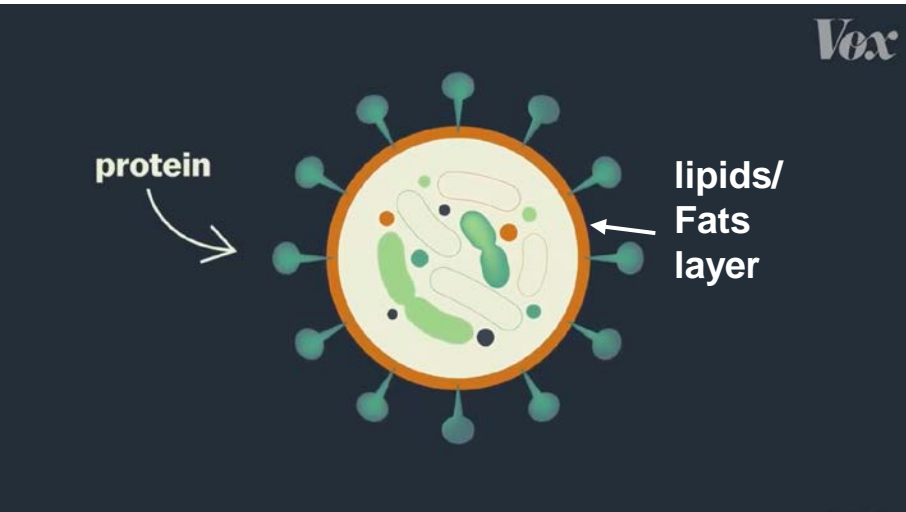
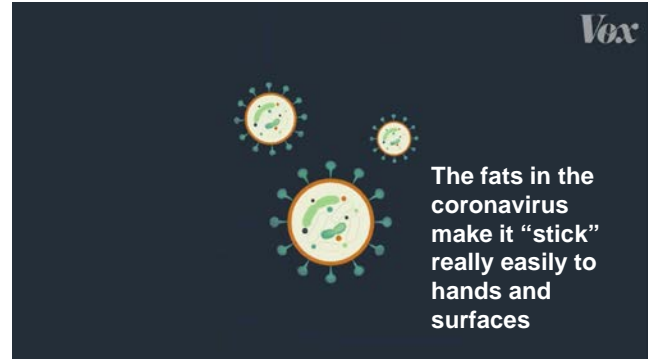
### **Phenomena Prep Part 2 (Extend Activity)**

Simple, individual, interactive activity  
Each student will get to experience

- Have all your materials prepped.
- Will be engaging with this activity when this “step” is introduced.
- A spoonful of oil in a bowl.
- Plastic dishwashing “tub”/container or easily accessible sink to run water over
- Water that can be poured
- Soap dispenser (to pump soap onto hands during the lesson)
- Paper towels

# Amphiphile Phenomenon Exploration

# What is the COVID-19 coronavirus?



“Under the microscope, coronaviruses appear to be covered with pointy spires, giving them the appearance of a crown, or “corona”--hence the name. Beneath the crown is the outer layer of the virus, which is made up of lipids, or what you and I would call fat.”

<https://www.cnn.com/2020/03/24/health/soap-warm-water-hand-sanitizer-coronavirus-wellness-scn/index.html>

# PART 1 Amphiphiles Phenomena:

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A Hydrophylic  
& Hydrophobic Exploration

**Engage:** The oil in this measuring cup represents the virus. Is there anything that will “defeat” this invisible virus? If you have a prediction please share why you are making that claim.

Make a claim. Share why you think this will work to defeat the invisible COVID 19 virus.

**\*\*Do not go onto the next slide until students record their responses.**



## Advanced Prep:

Make sure to have the following items prepared in advance in a space where it's okay if a little oil spills.

- One large see-through container--for elementary students a clear plastic bottle is best
- Fill about half full with water
- $\frac{1}{3}$  cup of oil
- One soap dispenser to squirt into the bottle of water
- Paper towels

First, describe and record what you notice about the water in the bottle.

## Adding the Oil

Next, carefully pour the oil into the half-filled bottle of water. Record what you notice happening. Why do you think this is happening. Supply reasons, explanations.

# Making Predictions (Part 1):

What do you think will happen when we pour the oil into the water?

Record student predictions here.

Let's explore. Pour the oil into the bottle of water. Record what's happening until what you see stops changing.

# If you are doing this as a virtual class, record student noticings and findings.

(If this is being conducted as a group, record student responses during this discussion. Note who provided the response. If you are all on a shared document students may add in their responses and record their own names.)



Create a shared document in which students can input their noticings on what happened when the oil was poured into the water.

Allow different voices to share.

If students share about what they think is happening, they need to link it to a reason.

When there are no further changes,

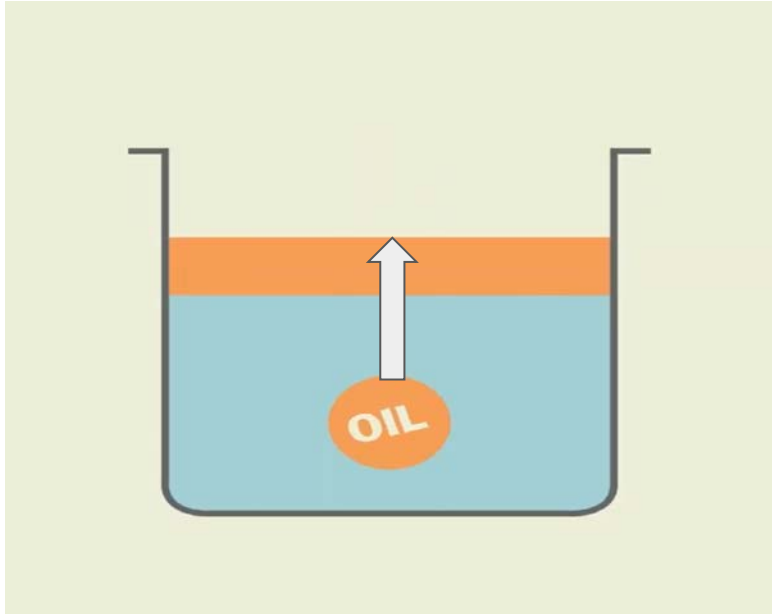
- How many layers do you see?
- What's on top?
- What's on the bottom?
- What do you notice?

Why do you think this happened? Explain your thinking.



# Explain

The oil that was added did not mix with water. The mixture separated and less dense oil rose to the top.



Water and oil, like oil and vinegar dressing, don't mix. The oil droplets (nonpolar hydrocarbons) float to the top and join up. The coronavirus has a fatty layer around it. It acts like a tiny oil droplet so the virus doesn't break down or dissolve like salt or sugar in water.

Is washing our hands important during this pandemic?  
Why or why not? Make a claim and support it with  
evidence and reasons.

# Making Predictions: Let's add soap (Part 1)

## What will happen when we add soap to the water and oil mix? Why?

Record student responses here. Explain why.

Let's explore. Now add a few squirts of soap into the oil and water. Place the cover securely onto the bottle, and shake it up. Record what happened here.

When you first add soap to the oil and water in the bottle/see through container, what did you notice?

After adding the soap (do not shake) record student noticings, student wonders, student possible explanations.





## NOW SHAKE IT UP!!!

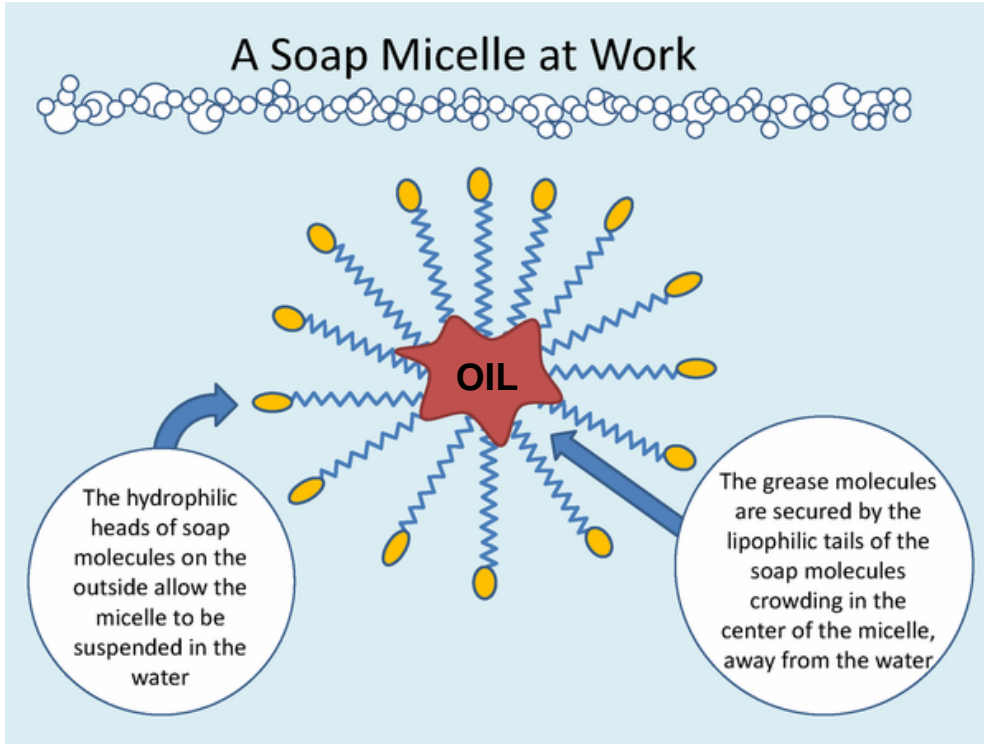
1. Place the water bottle cover back on tightly.
2. Give the bottle a good shake.
3. Record what you see until changes stop.
4. Compare what you see to what you saw with just oil and water.



EXPLORE: Record student noticings, students wonders, students possible explanations of what happened, of what they observed.

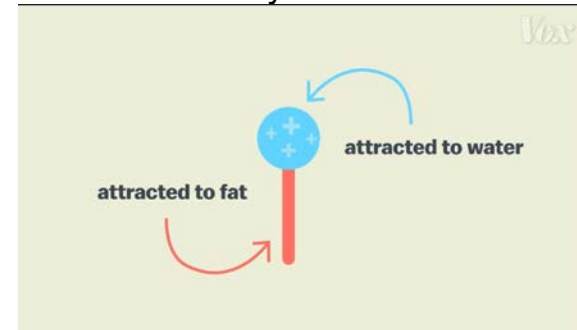
# Explore: MICELLES

After the class shares their noticings introduce the concept of **micelles**. These are the small particles that clouded up the soap+water+oil mixture after you shook it.



A soap molecule has a **lipophilic/hydrophobic** end that loves **fats and oils** and a **hydrophilic** end that loves **water**. See "A Soap Micelle at Work."

When you shook the mixture, soap molecules surrounded the tiny droplets of oil. **Lipophilic** ends are in the **oil** and **hydrophilic** ends in the **water**. Coronavirus that cause COVID-19 act like the oil droplets. They are in the center of micelles, ready to be rinsed away.



Think about it:



Consider what just happened with the water, oil, and soap.

Why do you think it would be important to wash your hands for 20 seconds?

Brainstorm and record your ideas here.

# To Examine the 20 Second Rule of Thumb

Let's try it out on your hands. Imagine the oil is the COVID-19 virus.

**\*\*Before the thorough explanation of amphiphile phenomena, go to the Part 2, the connected project, to further explore this phenomena**

# PART 2

**Extend**

# Let's Explore Further Part 2 Lesson Extension:

Before starting make sure you completed the previous 2 slides--Making Predictions:

\*\*Do this activity over a large plastic container or over the sink. If you are doing this at home, ask a parent first for permission and to assist you :)

## PART 2

1. Over the plastic container, pour half a teaspoon of oil into a spoon. \*\*Keep the hand you write with oil free)
2. Over the plastic container, pour the oil into the palm of the hand *you do not write with* then rub it around with the back of the spoon including the back of your hands.
3. Record what happened, what it feels like, what you notice in your learning journal.
4. While your oily hand is above the plastic tub or the basin, gently pour some water over your hand.
5. What happens? What does it feel like? Look like? Record your description of what happened and how it feels and looks in your learning journal. Compare your experience to the prediction you made in your journal.
6. Did the oil come off with water? Why or why not? Record your thoughts and explanations in your journal.
7. Imagine that the oil is the coronavirus. Would you have removed the "virus" from your hands? Explain why or why not in your journal.

# Let's Explore:

## (Continued PART 2)

1. Recall the prediction that you made about the oil, water, and soap. Explore this prediction now.
2. \*\*For this part of the exploration you will need to keep a vivid mental recording of what is happening so that you can record after it's done. (If you are doing this at home, a parent or family member could help you to record your thoughts.)
3. Keep your oil and water hands above the plastic tub or basin. Using the hand you write with, pump a couple of squirts of soap onto your hand.
4. Next, wet the unoiled hand in the bowl of water.
5. Rub your hands together including back of your hands and thumb for at least 20 seconds :)
6. Remember or record in detail what you are noticing, what is happening, what it feels like. Be as descriptive as you can. (It is important to take lots of mental notes as this will improve your recall. If you need to pause to visualize, and bookmark in your mind, please do so. Leave a visual "impression", recording in your mind.)
7. At the sink run more water over your hands. Keep recording the experience in your mind.
8. When you are done rinsing your hands dry them off. How does the oily hand look and feel now?
9. Record the oil+water+soap experience in your journal.





# The Amphiphile Soap Story

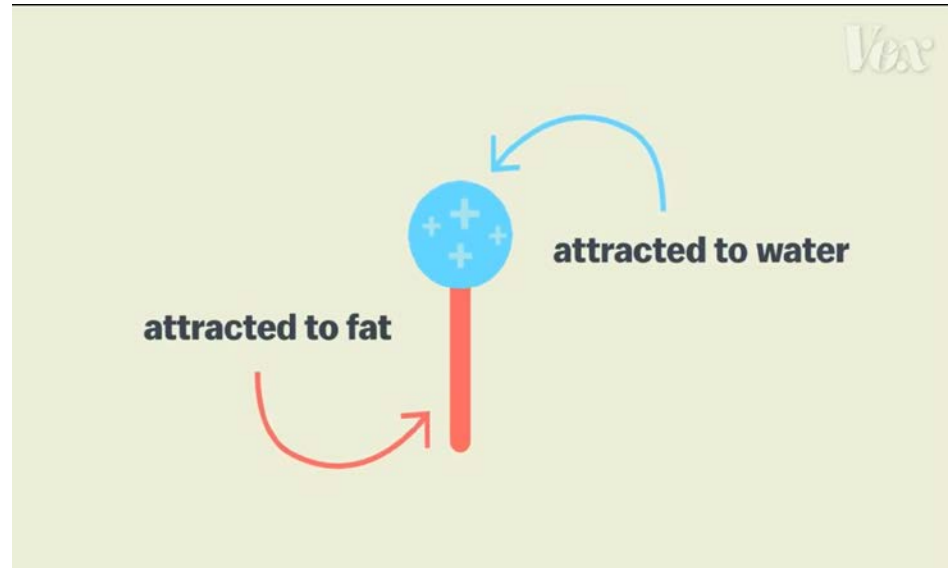
Explore the Concept

# Meet an amphiphilic (or amphipathic) molecule

“Soap is a common phrase for what chemists call ‘amphiphiles.’ These are molecules that have a dual nature. One end of the molecule is attracted to water and repelled by fats and proteins. The other side of the molecule is attracted to fats and is repelled by water.”

“It’s this dual-nature chemical construction that makes soap so effective. ‘When you buy a conventional soap, it consists of a mixture of these amphiphiles. And they all do the same thing.’”

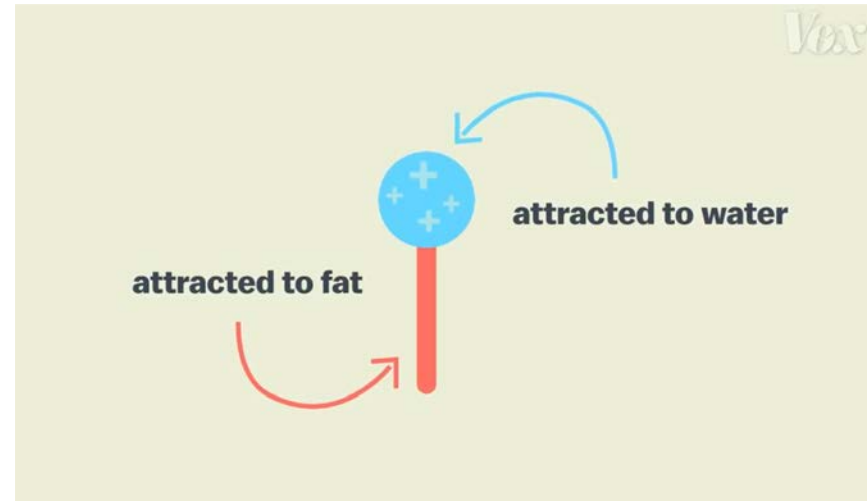
Pall Thordarson, March 8, 2020.



Soap (from Latin *sapon*) and detergents are molecules that link up with both oil and water.



**Phobic** from Greek fear or aversion.  
**Philic** from Greek love or attraction.  
**Amphi** from Greek both, think about amphibians.



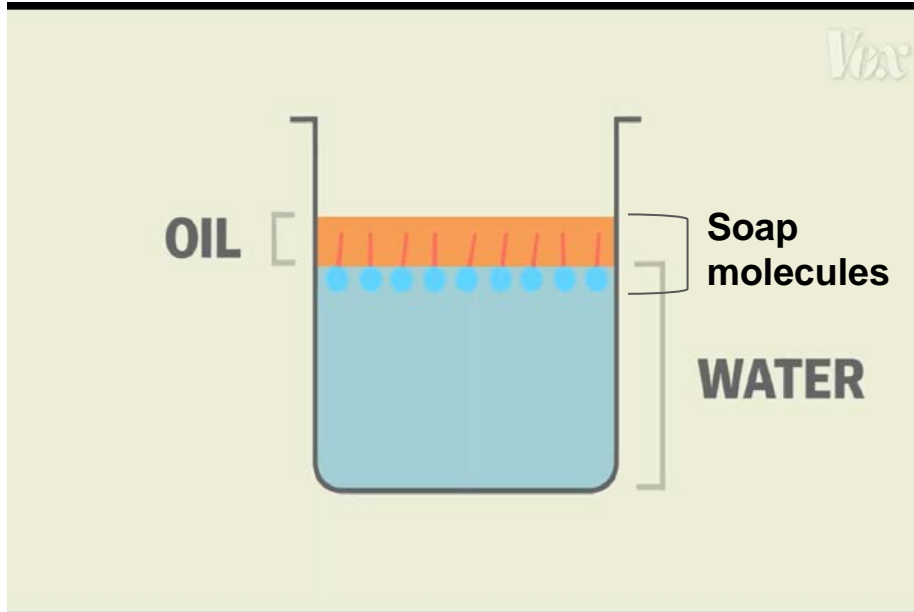
Soap and detergents are made up of **amphiphilic** molecules. These long molecules have one end attracted to fats and oils. The other end is attracted to water.  
**Lipophilic** or **Hydrophobic** end--"fears" water, likes oil  
**Hydrophilic** end--"likes" water

# What are the soap molecules doing in this image?



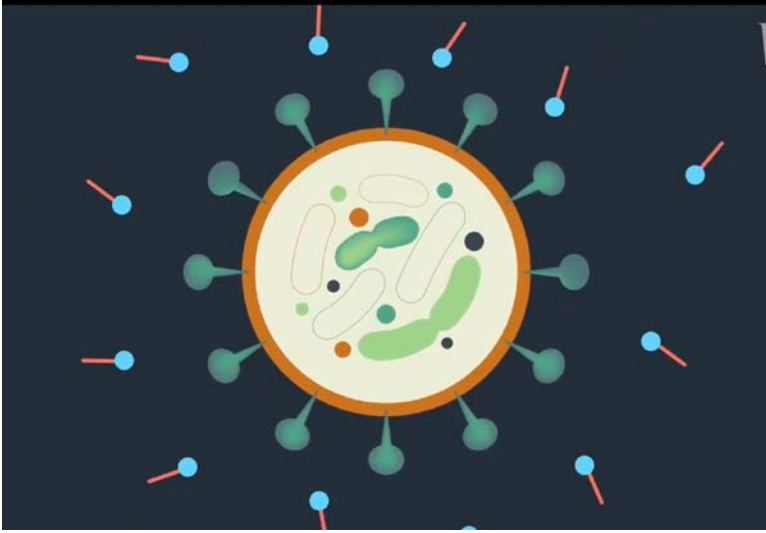
Look carefully.  
Can you see the **amphiphilic soap molecules**?

Explain why the soap molecules are drawn like this.  
Look at the previous diagram to explain and/or draw and label what is happening.



Predict what you think will happen next if the soap+water+oil mixture is shaken.

# A fatty layer around the virus cannot defend it from soap



The coronavirus acts like an oil droplet. The orange coat of the virus is a fatty layer.

Imagine you're using a soap solution to clean a surface a COVID-19 patient coughed on.

When **amphiphilic** soap molecules get close to the virus they attach to it.



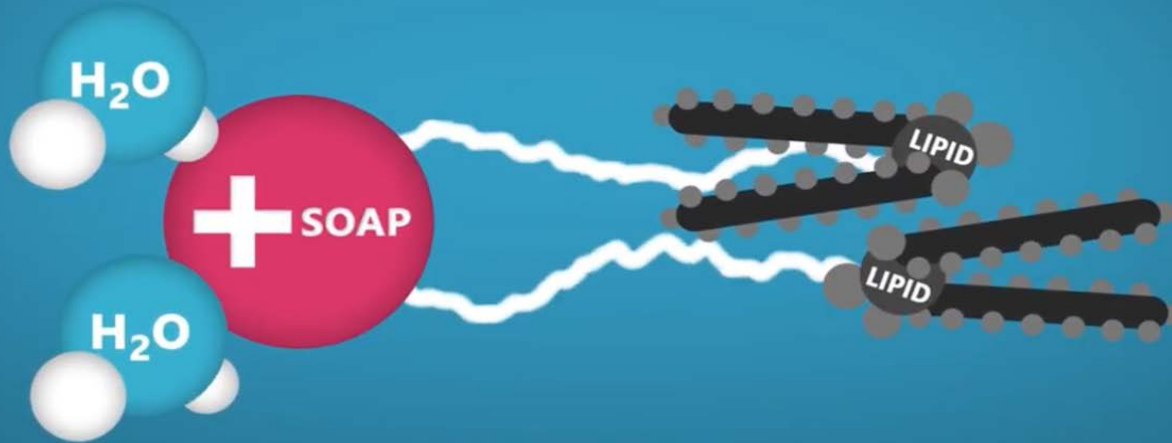
The soap molecules' **hydrophobic/lipophilic** side attach to the fatty coating of the coronavirus.

The **hydrophilic, water-loving** side of the soap molecules attach to water molecules. A **micelle** forms.

The **micelle, soap molecules with a virus center**, is suspended in the water and ready to rinse away.

**FIT**

## SOAP MOLECULES AT WORK



**and the other half loves fatty acids or lipid.**

Animation: How Soap Destroys Coronavirus | The Quint  
<https://youtu.be/37mxPDM1F5Q>

# Why 20 seconds?

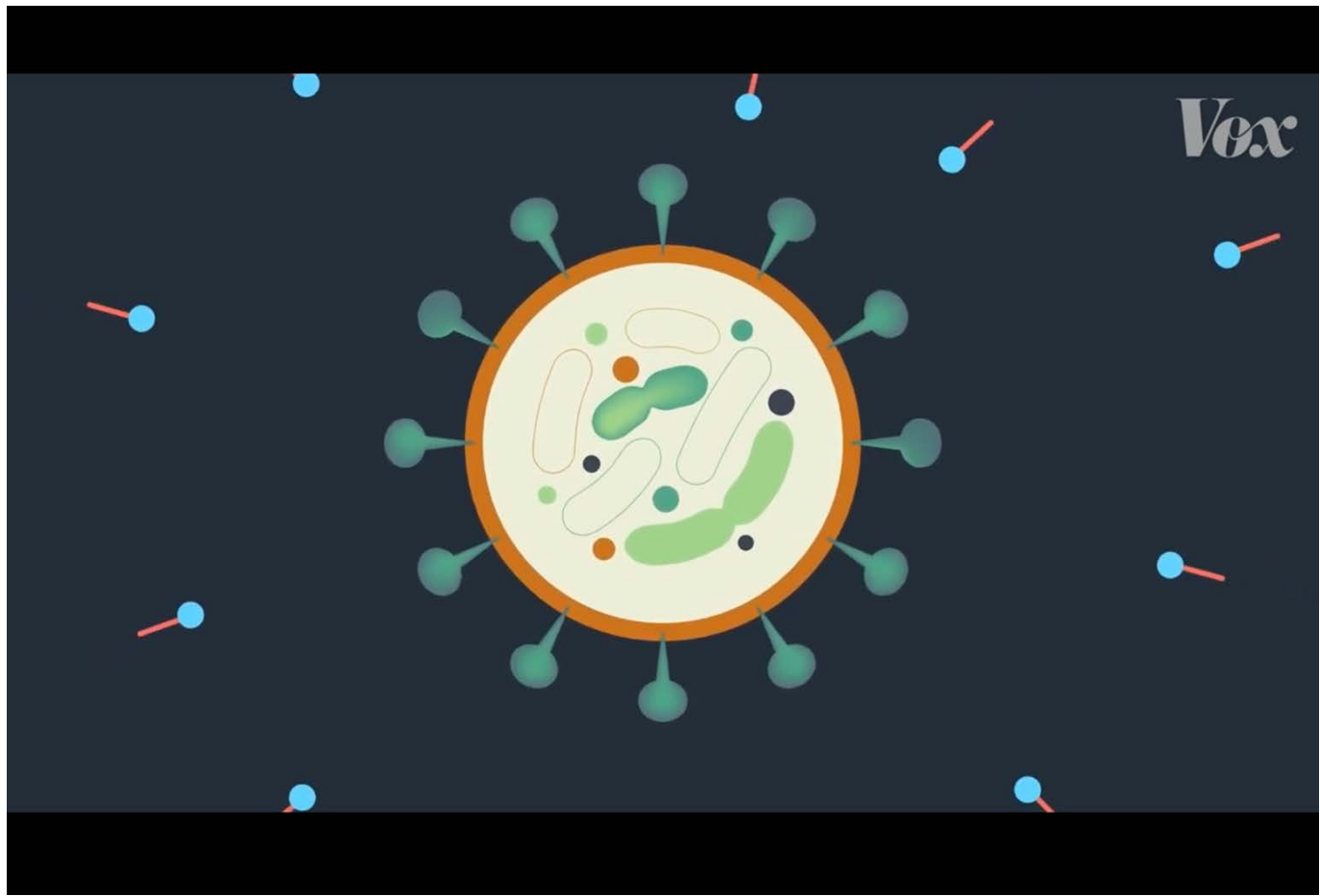
Why is that the hand washing “magic” number?



Think About It: Why do we need to wash for 20 seconds?

Hint: Look at your skin with a magnifying glass or a Zoomy. Is it perfectly smooth or wrinkled and furrowed? What about under your fingernails? Look at your mom and dad's or a grandparent's hand. Compare it to yours.





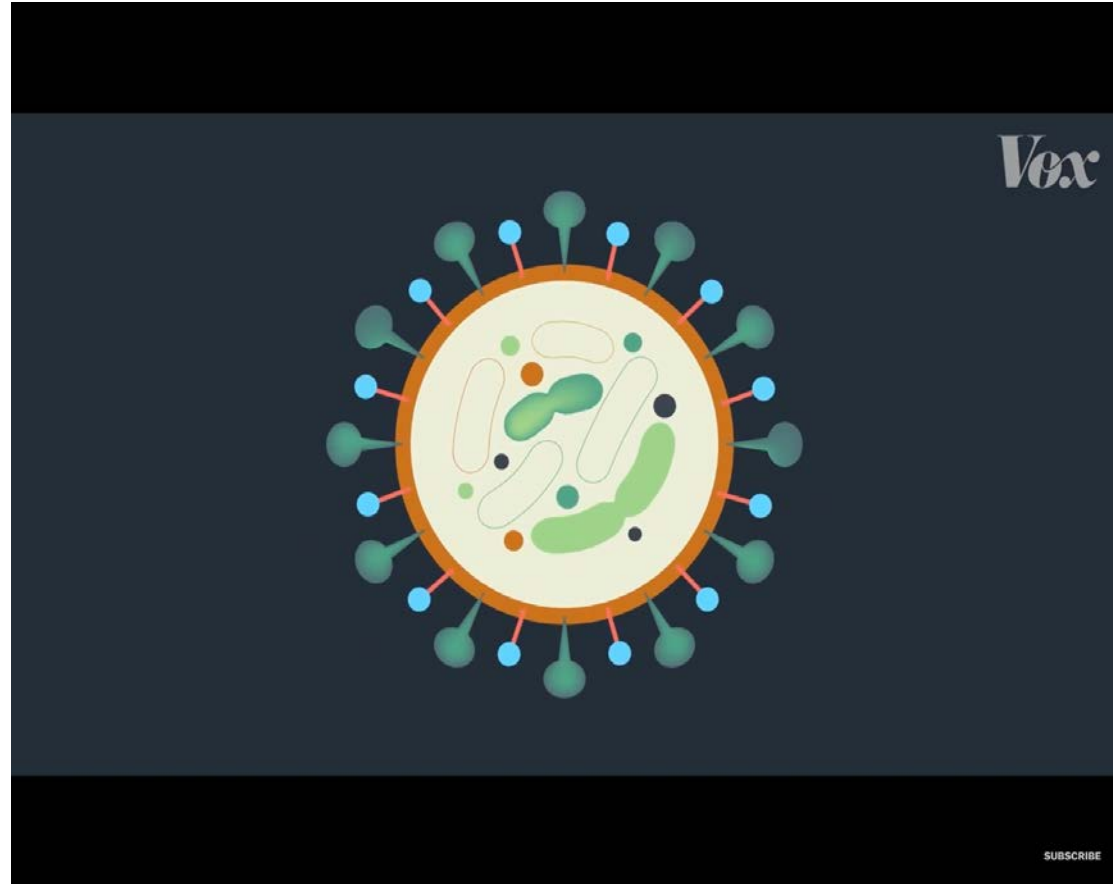
Amphiphilic molecules surround the coronavirus.

The head side of the amphiphile bonds with the water. The tail is attracted to the lipids (fats) and attaches itself to the coronavirus' outer layer--the fatty layer that is the virus outer coat.

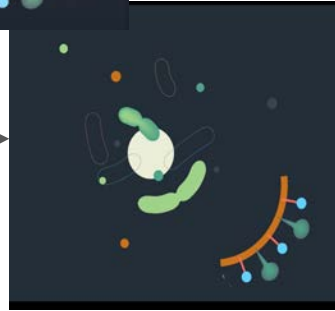
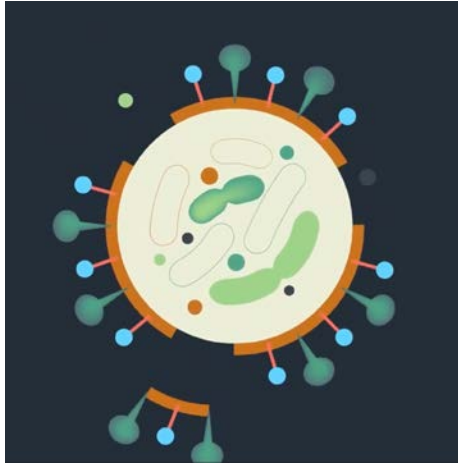
The amphiphiles attached to the coronavirus and water form a micelle. As the outer coat of the coronavirus is penetrated the lipid/fat layer begin to break apart and the virus is destroyed.

**But it takes time** to completely break apart the virus and get into the folds of your skin and under your nails.

**How long? 20 seconds**



# What happens to the virus over 20 seconds?



If you wash your hands for too short a time, you miss some places. Some of the virus will still be there with the capacity to cause harm.

It takes time for amphiphiles to get into all the wrinkles in your skin, under your nails, and the back of your hands and to tear apart the virus.

After 20 seconds of very thorough washing you will succeed in “annihilating” the COVID-19 coronavirus.

## After 20 seconds...



“Once the virus or bacteria splits open, it spills its guts into the soapy water, and dies.”

[“Why soap, sanitizer and warm water work against COVID 19 and other viruses” CNN](#)

The soap has rendered the coronavirus, null and void!

Soap is the hero in this particular story.

So do, do, do make use of it!

And don't stop, don't give up because your hands are drying out...

This is a must needed defense!

# View Video: How soap kills the coronavirus

[https://www.vox.com/science-and-health/2020/3/11/21173187/coronavirus-covid-19-hand-washing-sanitizer-compared-soap-is-dope?utm\\_campaign=vox.social&utm\\_content=voxdotcom&utm\\_medium=social&utm\\_source=youtube](https://www.vox.com/science-and-health/2020/3/11/21173187/coronavirus-covid-19-hand-washing-sanitizer-compared-soap-is-dope?utm_campaign=vox.social&utm_content=voxdotcom&utm_medium=social&utm_source=youtube)



\*\*Either watch in entirety, or cue to the part where they explain how the amphiphiles work.

Explain & Extend &  
Elaborate

## EXTEND: Be creative. Teach what you learned. Amphi...what?

Share what you learned about the molecules that can defeat the COVID-19 virus on your hands or surfaces.

Your choice: Write a story, poem or song, make a drawing, or create a dance about using soap or 60% alcohol hand sanitizer to destroy and remove viruses. Show the whole process of how it works, all the way to helping tear apart the virus.

# Explain & Extend: Art-Science-Writing Integration

Create a PSA poster or video that promotes hand washing.

## Considerations:

- What would your audience need to know?
- What information should be included to build awareness?
- What message would need to be shared to convince your audience that washing hands with soap is important in the fight against COVID-19?

\*\*You may do additional research. Please record where you get additional information from in your reference section.

Please put the information you share in your own words.



## Extend/Elaborate: How the Pros Do it “Does *how* we wash our hands matter?”

Water and scrubbing with your hands are important to this process because the combination creates more soap bubbles, which disrupt the chemical bonds that allow bacteria, viruses and other germs to stick to surfaces. You want to scrub, build up bubbles and scrub some more, getting into every crack and crevice of your hands and fingers, including your fingernails, for 20 seconds, which is about as long as it takes to sing Happy Birthday twice. (But if you're tired of that ditty, there are [songs from every decade](#) you can sing instead.)

Now, when you rinse your hands, all the germs that have been hurt, trapped or killed by soap molecules are washed away. "All those bubbles and foam ... literally pick germs up and wash them down the drain," said Dr. William Schaffner, a professor of preventative medicine and infectious disease at Vanderbilt University School of Medicine in Nashville.



From the CNN article:

[Why soap and sanitizer and warm water work against the Covid-19 and other viruses?](#) By Sandee LaMotte, CNN

<https://www.cnn.com/2020/03/24/health/soap-warm-water-hand-sanitizer-coronavirus-wellness-scn/index.html>

# Elaborate/Evaluate

Put everything you know about COVID-19 together

Think about this 'ōlelo no`eau:

*E lauhōāi nava`ai ke kākāhoe; kākāhoe, ke  
kā pae akā`āina.*

Translation: Paddle together, bail, paddle; paddle, bail; paddle towards the land.

Explanation: If everybody works together the work will be done quickly.

When confronted by an epidemic or pandemic, do you think that everyone has kuleana, responsibility to make pono choices?

Think about what pono choices would be if we were considering, the health and well being of everyone--especially the most vulnerable and the health care professionals who are caring for those that fall seriously ill from COVID-19.

Pono Choices	Self Interest/ Poor Choices

# References

1. [How soap absolutely annihilates the coronavirus](https://www.vox.com/science-and-health/2020/3/11/21173187/coronavirus-covid-19-hand-washing-sanitizer-compared-soap-is-dope) Retrieved from:  
<https://www.vox.com/science-and-health/2020/3/11/21173187/coronavirus-covid-19-hand-washing-sanitizer-compared-soap-is-dope>
  - a. Related video embedded in the article--visuals/animation by Madeline Marshall/Nicole Finater (Vox)
  - b. Article by Brian Resnick (Vox) Updated March 27, 2020
1. [Why soap, sanitizer, and warm water work against COVID-19 and other viruses](https://www.cnn.com/2020/03/24/health/soap-warm-water-hand-sanitizer-coronavirus-wellness-scn/index.html)  
<https://www.cnn.com/2020/03/24/health/soap-warm-water-hand-sanitizer-coronavirus-wellness-scn/index.html>
  - a. Article by Sandee LaMotte, CNN Updated March 24, 2020
1. Deadly viruses are no match for plain, old soap — here's the science behind it, Pall Thordarson <https://www.marketwatch.com/story/deadly-viruses-are-no-match-for-plain-old-soap-heres-the-science-behind-it-2020-03-08>
2. How Soap Destroys Coronavirus/The Quint <https://youtu.be/37mxPDM1F5Q>

## Additional Resource

1. From Davidson Institute of Science Education: [Why Does Soap Easily Remove Fats from Metalware and Glassware, But Not Plastic?](https://davidson.weizmann.ac.il/en/online/askexpert/chemistry/why-does-soap-easily-remove-fats-metalware-and-glassware-not-plastic-tom)  
<https://davidson.weizmann.ac.il/en/online/askexpert/chemistry/why-does-soap-easily-remove-fats-metalware-and-glassware-not-plastic-tom>