FOSS COVID-19 Lesson 2, 5-day lesson plan (Grades 5-8)
May 8, 2020

NOTE: *FOSS (Full Option Science System) is a K-8 science curriculum designed at the Lawrence Hall of Science at the University of California, Berkeley, and used in classrooms all around the US and abroad. Visit www.FOSSweb.com or our publisher's website to learn more about the FOSS curriculum.*

Teacher Instructions

This is Lesson 2 in the FOSS COVID-19 lesson plan series. This is a 5-day lesson plan about the novel virus SARS-CoV-2 for you to use with science students in grades 5-8. This lesson is designed for use if:

1) you have already taught FOSS COVID-19 Lesson 1, and
2) students have reliable Internet access at home.

The lesson is divided into 5 different topics. Each day, you can provide students with the corresponding lesson description below.

NOTE: Determine how you will collect student responses, because this will vary depending on your school's distance learning protocols.

1 - Research updates from April 2020
2 - Treating the disease: COVID-19 antiviral treatments
3 - Preventing the disease: SARS-CoV-2 vaccine
4 - Profile of Dr. Corbett
5 - Using models to think about what's next

Low-Tech Options

If students do not have home access to technology, you can modify Days 1, 2, 4, and 5. See instructions below.

Day 1 alternate assignments for students with no access to technology at home - Teacher instructions: Print out the information in Tasks 1 and 2, and the questions in Task 3. Students can respond to the questions in Task 3.

Day 2 alternate assignments for students with no access to technology at home - Teacher instructions: Print out the information in Tasks 1 and 2.

Day 4 alternate assignments for students with no access to technology at home - Teacher instructions: Print out the article in Task 2. Students can read the article and write a reaction to or summary of the article.

Day 5 alternate assignments for students with no access to technology at home - Teacher instructions: Print out the information in Task 1 and the assignment in Task 3. Students can respond to the questions in Task 3.

FOSS COVID-19 PART 2, 5-day lesson plan (Grades 5-8)
Student Instructions

Day 1 - Research Updates from April 2020

- Task 1: Read the information in the two paragraphs below to get ready for questions in Task 3.

  One of the challenges of stopping the spread of the virus SARS-CoV-2 is that it is a novel (new) virus. We still don't know that much about it. We know it causes the disease COVID-19. However, we can't yet predict which patients might develop severe side effects, or which treatments will work best. The good news is that scientists, doctors, and researchers all over the world are sharing information and working as fast as they can to learn more.

  Doctors have been using tests to tell if someone is sick with COVID-19, but the big news in April 2020 is that there are now **antibody** tests. Antibody tests can show if someone was exposed to the virus in the past, not if they are sick now. Researchers collected blood from thousands of people and tested for SARS-CoV-2 antibodies. These studies revealed that many people had the virus in the past and never knew they were sick! But the tests are currently not very reliable, and they only tested a very small number of people. And, we still don't know if a person with antibodies is **immune** to COVID-19 or if they could be **infected** again.
- Task 2: Doctors have studied so many coronavirus cases that they now have a better idea of the symptoms. Doctors and researchers realized that SARS-CoV-2 affects more than just the lungs. It can also affect other body organs and systems, especially the heart, blood, and kidneys. The Centers for Disease Control (CDC) adds new symptoms as researchers find new information. They recently added six new symptoms to their list.
  - Visit the updated symptom list to learn more about the symptoms and what to do if someone gets sick.
- Task 3: Respond to these questions.
  - What are some new things scientists and doctors have learned about COVID-19 in April 2020?
  - How can these new findings help us fight the disease?
  - What are some questions you still have about the virus SARS-CoV-2 or the disease COVID-19?
  - What do you think scientists, doctors, and researchers should study about SARS-CoV-2 next?

Day 1 Optional/Extension resources:

1. This video provides a good overview of the challenges of tracking and studying COVID-19.
    - Why is COVID-19 So Hard to Track?
2. A very small number of dogs and cats (including a tiger in a New York zoo!) have tested positive for SARS-CoV-2, but so far there is no evidence that pets can make people sick. It is a good idea to socially distance yourself from other people's pets when you are out for a walk.
    - Read more about the advice for pets from the Centers for Disease Control and Prevention (CDC).

Day 2 - Treating the disease: COVID-19 antiviral treatments

- Task 1: We are going to learn about the difference between vaccines and antiviral treatments. A **vaccine** is used *before* a person gets sick, to stop a virus (like the SARS-CoV-2 virus) from infecting a person. An **antiviral treatment** is used to help a person *after* they were infected by the virus and now are sick with a disease, like COVID-19. Today, we will focus on antivirals, and tomorrow we will learn about vaccines.
- Task 2: Watch the video about antiviral treatments, read the important note, then answer the questions below.
    - Here's the Latest on Hydroxychloroquine and Coronavirus Antivirals
    - IMPORTANT NOTE: Here are updates on two antiviral treatments, as of May 8, 2020.
        - Hydroxychloroquine - This antiviral is still undergoing some trials, but early trials indicated an increased risk of death or cardiac (heart) side effects. Many hospitals have stopped using it due to concerns about these side effects.
        - Remdesivir - This antiviral is just finishing phase 3 clinical trials, and appears to help people recover from COVID-19 more quickly. Results are so promising that on May 4, 2020, the Food and Drug Administration (FDA) approved an Emergency Use Authorization so that Remdesivir may be used to treat hospitalized COVID-19 patients immediately.
    - Respond to these questions.
        - Why are scientists running **trials** on antivirals before giving them to all COVID-19 patients? What information do they need to know before giving them to all COVID-19 patients?

        - What are some reasons to wait for scientists to do clinical trials before taking new medicines?
- Task 3: Watch this short video about clinical trials, then answer the questions below. Note the video mentions “cancer treatments” but it applies to all medical treatments, including COVID-19 antiviral and SARS-CoV-2 vaccine development.
    - What Are Clinical Trial Phases?
    - Respond to these questions.
        - What requirement does a treatment need to move to phase 2?
        - What requirement does a treatment need to move to phase 3?
        - How does having three phases of trials help protect the most people?

Day 3 - Preventing the disease: SARS-CoV-2 vaccine

- Task 1: A **vaccine** is used *before* a person gets sick, to stop a virus (like the SARS-CoV-2 virus) from infecting a person. Developing a SARS-CoV-2 vaccine is the goal of the entire world right now! Watch the video to learn more about what a vaccine is, then answer the questions below.
    - Coronavirus: What is a vaccine and how is one made?
    - Respond to these questions.
        - How does a vaccine prepare your body to fight off a virus?
        - How long do most people think it will take to successfully create a vaccine for the SARS-CoV-2 virus?
        - Why does it take so long to create a new vaccine?
- Task 2: Watch the next video to learn more about SARS-CoV-2 vaccine development.
    - How Fast Can We Make a Coronavirus Vaccine?
    - Respond to these questions.
        - How do the body’s antibodies block the SARS-CoV-2 virus from infecting cells?
        - DNA and RNA vaccines are brand new kinds of vaccines. What is the biggest advantage of these new kinds of vaccines?

Day 3 Optional/Extension resource:

- Some scientists are working hard to quickly create a "temporary vaccine" to prevent infection if individuals are exposed to SARS-CoV-2. Unlike a regular vaccine, which creates permanent immunity, this therapy would create immunity

for only several months, giving medical workers and vulnerable populations some protection until a full vaccine is available.

- Watch video The Race to Develop a Coronavirus Treatment in 60 Days

Day 4 - Profile of Dr. Corbett

- Task 1: An mRNA vaccine is one of the most promising vaccines being developed and tested to prevent SARS-CoV-2 from infecting people. Dr. Kizzmekia Corbett is leading the National Institutes of Health (NIH) team working with a company called Moderna on the mRNA-1273 vaccine. Watch the video below to hear Dr. Corbett explain the vaccine development.
  - NIAID Soundbites: Novel Coronavirus Vaccine Research
  - Respond to these questions.
    - What questions do you have about vaccine development?
    - Why are clinical trials of new vaccines important?
  - NOTE: This video is from January 31, 2020. Updates since then:
    - Feb 7, 2020 - Moderna developed the first clinical batch of vaccines,
    - March 16, 2020 - Moderna completed Phase 1 trials, and
    - April 27, 2020 - Moderna and the NIH requested FDA approval to begin Phase 2 trials.
- Task 2: Learn more about Dr. Corbett and the work her team is doing to lead the charge in SARS-CoV-2 vaccine development.
  - Read "Dr. Corbett's Path to a SARS-CoV-2 Vaccine"

Day 4 Optional/Extension resources:

1. Watch a CNN interview with Dr. Corbett describing how her team's research is working at record speeds for a vaccine
   Lead coronavirus vaccine scientist: When can we expect a vaccine
2. Watch the following video The Vaccine to End the Pandemic? RNA Vaccines and COVID-19

Day 5 - Using models to think about what's next

- Task 1: Read the information in the two paragraphs below to get ready for questions in Task 2.

  Most people in the US have been asked to stay home to reduce coronavirus infection rates. Many families have lost jobs and many businesses have lost income. How can science help our leaders figure out how to get us back to school and work (and visiting friends) safely, while we wait for a vaccine? One tool that most scientists are using are **models.**

  Models help us predict the spread of coronavirus. A successful model uses data about how many COVID-19 tests, cases, and deaths are in an area. COVID-19 models also use information about how infectious the disease is and how many hospital beds and other resources are available. All of this information helps researchers and policy makers decide when it is safe to reopen and let people go back to normal activities.

  Any model has **limitations**, which are ways in which a model is not exactly like reality. Because we are still learning about COVID-19, all of these models have limitations and cannot predict exact risks or outcomes.
- Task 2: All countries and states are using strategies to try to keep the number of COVID-19 cases low. Watch the video to learn more about the strategies of **testing**, **contact tracing**, **isolation**, and **limiting gathering size**. These strategies could help the US be successful in getting out of our houses again.
  - The big lesson from South Korea's coronavirus response
  - Respond to these questions.
    - What is contact tracing?
    - A phone app that can track your movement makes contact tracing much more successful, but it means you have less privacy, which is a concern for many people. Would you want the US government to use phones for contact tracing?
    - Would you use a phone tracking app like this if you had the option?
- Task 3: Writing in a journal can be a helpful way to process feelings, organize thoughts, and release stress. In addition, you may someday want to look back and see what you were thinking during this historic time. Using a notebook or Google Doc, record responses to some or all of the questions below.
  - How has the virus disrupted your daily life?
  - What changes, big or small, are you noticing in the world around you?
  - What do you miss most about your life before the pandemic?
  - What do you hope will remain changed after the pandemic is over?
  - How do your feelings change throughout the day?

- What acts of kindness have you seen, heard about, or participated in since the novel coronavirus outbreak began?

Day 5 Optional/Extension resources:

1. Video about contact tracing
   What Exactly is Contact Tracing?
2. Video about Coronavirus testing
   The Two Coronavirus Tests The World Needs Immediately
3. Nature journaling, "Sit Spot"
   - Find a spot—by a window, on your front steps, or in your backyard—and return to that same spot as often as you can. It doesn't have to be every day, but try to return more than once a week. Be sure to date each entry.
   - Consider the following suggestions of what to do in your spot.
     - Describe in detail, what do you see, hear, smell, and feel?
     - What changes between your visits? What stays the same?
     - Draw pictures and maps of what you can see from your spot.
     - While you sit still and take in the world around you, breathe deeply.
     - You may be inspired to free write or draw. Go for it! There are really no "rules" except to return to the same spot and journal.

FOSS COVID-19 Lesson 2
Student Reading

Dr. Corbett's Path to a SARS-CoV-2 Vaccine

Photo credit: Dr. Kizzmekia Corbett

Dr. Kizzmekia Corbett is a senior researcher at the National Institutes of Health (NIH) Vaccine Research Center. She also leads the team that is developing one of the most promising vaccines for SARS-CoV-2.

A Path of Ambition and Determination

Dr. Corbett grew up in North Carolina and started focusing on science in high school. She spent time in summer research internships before attending University of Maryland, Baltimore County (UMBC). She majored both in biology and sociology.

After graduating from college, Dr. Corbett spent one year working at NIH before starting graduate school. During that time, she made quite an impression on Dr. Barney Graham, the deputy director of the NIH Vaccine Research Center. Dr. Graham recalled what Dr. Corbett said when he asked what her goals were—she told him she wanted his job!

Dr. Corbett did return to work with Dr. Graham as an NIH research fellow, after receiving her PhD in Microbiology and Immunology from University of North Carolina at Chapel Hill. She became the leader of her team studying vaccines for coronaviruses and influenza. She was only 29 years old!

Developing the mRNA-1273 Vaccine at Record Speeds

Now, Dr. Corbett has been leading her team for five years. The team studies the spike proteins on coronaviruses. These coronaviruses include SARS-CoV (commonly known as SARS) and MERS-CoV (commonly known as MERS). SARS and MERS viruses both attack human cells in the same way as SARS-CoV-2. They use the spike protein to break into the host cell (the spike protein is shown in the photo).

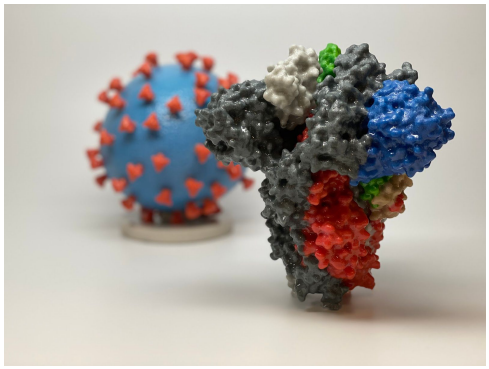

Photo credit: National Institutes of Health

Dr. Corbett's team was already researching SARS and MERS, including developing vaccines for these viruses. This allowed the team to adapt quickly when SARS-CoV-2 started to infect people. Based on what they knew about the genetic sequences of SARS and MERS, it took the team just two days to identify the SARS-CoV-2 RNA for the spike protein. They were able to start working on a SARS-CoV-2 vaccine quickly. Researchers modified the SARS vaccine to get started making a vaccine for SARS-CoV-2.

A Phase 1 clinical trial is the first step in testing an experimental drug or treatment in humans. In 2003, it took the NIH team *20 months* to get to a Phase 1 clinical trial for a SARS vaccine. In early 2020, Dr. Corbett's team began Phase 1 trials just *2 months* (63 days) after identifying the genetic sequence for the SARS-CoV-2 vaccine.

Developing a vaccine that can prevent COVID-19 is a worldwide goal. Scientists and researchers are working at record speeds to test and approve new treatments. Just 6 weeks after the NIH began the Phase 1 clinical trials, Dr. Corbett's team submitted a request for FDA approval to begin a Phase 2 trial. Phase 2 will involve 600 participants. If the Phase 1 trial continues to go well, Phase 2 should be approved in the next few months. If Phase 2 is successful, Phase 3 could begin in the Fall of 2020. This is a process that usually takes many years!

Dr. Corbett and her team work seven days a week, getting only 3-4 hours sleep a night. But in several recent interviews, Dr. Corbett has described how amazing this is. She can see how all the work her team has done for the past five years has set them up to move so quickly. They built a foundation to be part of the solution *right now*.