An Integrated Curriculum For The Washington Post Newspaper In Education Program

Novel Coronavirus

- KidsPost Reprint: “Kids’ coronavirus questions”
- KidsPost Reprint: “We often call a virus a bug. Does that mean it’s alive?”
- Post Reprint: “The Coronavirus isn’t alive. That’s why it’s so hard to kill”
- Discussion Questions: The Virus Uses Humans to Survive, Replicate and Spread
- Student Activity: Not Our First Encounter With a Zoonotic Virus
So Much That’s New to Us

Novel. New. The novel coronavirus first appeared in late November 2019 in Wuhan, China. And began its spread across the globe. As reported in The Post and by medical professionals, viruses “much like this one have been responsible for many of the most destructive outbreaks of the past 100 years.”

Viruses are not new. They have survived for millions and millions of years — “perfecting the art of surviving without living.” Students will learn about viruses and impact on people by reading KidsPost’s “Kids’ coronavirus questions” and “We often call a virus a bug. Does that mean it’s alive?” For a more in-depth understanding of viruses and the current outbreak, give students “This pathogen isn’t alive. That’s why it’s so hard to kill.” Activities are also provided.

Students may have heard news reports and talked about why people were becoming ill. They may not have been aware that Covid-19 was real until their school closed indefinitely, new words like “social distancing,” “quarantine” and “medical surveillance” entered vocabularies and their experience, and appeals for masks and PPE were broadcast. Now you are a community of distance learners. We hope the resources and suggestions in this guide will assist you in instructing your students, working to make lessons interactive and lasting, while miles away.

Although viruses are not new this one presents so much that’s new to us.

On the cover: NATIONAL INSTITUTES OF HEALTH/EP A-EFE/SHUTTERSTOCK
Kids’ coronavirus questions

Why are schools closing, what is “social distancing” and why all the hand-washing?

With schools closing across the nation in response to coronavirus concerns, many students may be jumping for joy. Others are worried, scared or confused. But as the American essayist Ralph Waldo Emerson wrote, “Knowledge is the antidote to fear.”

With that in mind, let’s answer a few common questions about coronavirus — starting with its name.

Everybody keeps talking about “coronavirus” and “covid-19.”

Which is it?

Technically, either of these terms could be correct, depending on how they are used. The actual virus that appeared in China at the end of 2019 and has since hopped across the world is called “SARS-CoV-2,” which is short for “Severe Acute Respiratory Syndrome” and “coronavirus.” Once the virus gets into a person — often through their mouth or nose — it can cause an illness known as “Coronavirus Disease 2019,” or covid-19. Also, you might hear it referred to as a “novel coronavirus,” which means that scientists already knew about other coronaviruses, such as...
the one that caused an outbreak of SARS in Asia in 2003, but that this one is new.

**How does covid-19 affect people?**

The most common symptoms of covid-19 include fever, cough and/or shortness of breath. A person might develop one or more of these symptoms in as few as two days after being exposed to the virus, but they may also not feel sick for up to two weeks after contact.

Scientists say most people who get the virus will be able to fight it as they might a bad case of the flu, however some people will have a harder time than others. Elderly people seem to be especially vulnerable, as are those with other conditions such as heart disease, lung disease or diabetes. Some people who have the virus won’t even realize it, but in the worst cases, covid-19 can result in death. Fortunately, death is extremely unlikely to happen in infected children and teenagers.

**Can pets get covid-19?**

So far, one dog in Hong Kong has tested positive for the coronavirus. However, it isn’t showing any symptoms, so it’s unclear whether the virus can have a negative effect on pets. According to the World Health Organization, there is no evidence yet that dog owners can catch the virus from their pets. Of course, if you keep your animals inside and avoid walking them in public places, they will be even more unlikely to come into contact with the virus.

**Why are schools, stores and restaurants closing?**

Because SARS-CoV-2 is new, our immune systems haven’t had a chance to learn how to fight it off. This allows the virus to move around quickly, infecting many new people for each group it comes into contact with. This makes schools, stores, restaurants and other public gatherings the perfect places for the virus to spread.

The biggest concern now, based on what’s happened in countries such as Italy, is that if enough people get sick at the same time, hospitals might not be able to keep up with the demand for treatment. This is a problem for those who need treatment because of covid-19, but also for anyone else who might need medical services for everything from a twisted ankle or a cut requiring stitches to more serious conditions.

**Can this coronavirus be stopped?**

There are many scientists around the world working to develop a vaccine that could be used to halt the spread of this coronavirus for good. However, it will take time to develop that vaccine, and there are measures communities and families can adopt in the meantime to help slow the virus’s spread.

**Why do we have to wash our hands so often?**

First, washing your hands after going to the restroom or before handling food is a great practice in general and can help you avoid catching nasty illnesses from germs others leave on surfaces you touch. (Eating food with unwashed hands can give viruses a ride into your body.) But hand-washing has become even more important as this coronavirus spreads. The easiest way to ensure you’re washing your hands well enough is to use warm or cold water and soap and to keep scrubbing every inch of your fingers, thumbs, palms and wrists for the time it takes to sing “Happy Birthday to You” twice. The Centers for Disease Control and Prevention (CDC) has more tips at cdc.gov/handwashing. (Also, remember to cover your cough with a tissue or at least your inner elbow.)

**What is “social distancing?”**

If your parents no longer want you to play basketball with your neighbors or go to a party that was set for next weekend, it’s probably on account of something called “social distancing.” And while it seems like a bummer, experts say it’s another way everyone can work together to limit the impact of this coronavirus.

The idea behind social distancing is simple. The fewer people we have close contact with each day, the fewer opportunities the virus has to spread. (The CDC says “close” is six feet or less.) And that means not only will you and your family have better chances of avoiding covid-19, but so will your grandparents, your Scout group and the person you sit next to in a bus — any of whom might be at a higher risk to have a more serious reaction from the virus.

**How long will this last?**

Unfortunately, no one can answer that question yet. The CDC recommends that large events be canceled or postponed for at least the next eight weeks. Your parents, teachers and KidsPost will be coming up with creative ways to pass the time. But you can, too. If you have a suggestion on how to have
fun and stay safe, send your ideas to kidspost@washpost.com

And another question from a student
Can children become very sick from the coronavirus even if they don’t have breathing problems, such as asthma?
— Isaiah L., 9, Mount Vernon, Iowa

Unfortunately the short answer is, yes, people of all ages and medical backgrounds can become seriously ill from covid-19. But the good news is the odds for kids developing serious infections are really low.

How low? Of the 55,924 people who tested positive for covid-19 in China as of February 20, only 2.4 percent were 18 years old or younger.

So imagine a packed major league baseball stadium. (We’ll pick Dodger Stadium because it holds the most people.) If a person infected with covid-19 were sitting in each of the 56,000 seats, 1,344 visitors would be kids infected with the virus.

And because most people who become infected don’t develop serious illness, the numbers look better. Of those 1,344 sick children, only 34 kids would develop a severe case. And only three* kids would have what the World Health Organization calls “critical disease.”

Scientists, though, still don’t know why kids are less affected by covid-19 or how big of a role they play in spreading the disease, so for now, keep washing your hands and practicing social distancing!

*Several numbers in the answer have been rounded to the nearest whole. In this case, the more precise number is 2.7.

Write a question you have about covid-19.

Find a reliable source to answer your question.

Give the name of your source (include URL if your source is online).

Answer your question.

Give an example of how you are practicing social distancing.
We often call a virus a bug. Does that mean it’s alive?

*It shows signs of life, but scientists don’t agree on whether it’s alive.*

KidsPost

Rachel Feltman

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Some illnesses are caused by bacteria. Bacteria are alive: They’re very small — you can’t see them without a microscope — but they take in nutrients, reproduce and die. Viruses can make copies of themselves only by hijacking the cells of the creatures they infect. When the flu virus is outside of your body — lurking on a doorknob, for instance — it’s dead by any definition. But once inside your body, it shows many of the characteristics of life. Viruses might even be the descendants of living organisms that shed seemingly necessary traits to live more efficiently (with a little help from our cells).

“Most viruses have molecules — genes and proteins — like us and other live beings. However, they need another living being to make these proteins,” says Jordi Paps, an evolutionary biologist at the University of Essex in England. Some researchers point out that many organisms — including such parasites as tapeworms that can live in your gut — need hosts to feed them and help them reproduce. Viruses aren’t so different. “However, others say that all organisms, parasites or not, can make proteins by themselves, but viruses can’t, so this is why they do not consider them alive,” Paps says. Other scientists see it differently. “Viruses can be regarded similar to ‘seeds’ of plants,” says Gustavo Caetano-
Anollés of the University of Illinois.

“Some seeds appear dead, and you can keep them for years without anything happening to them until [the plant starts growing].”

Scientists debate this mostly because it’s interesting, not because they’re desperate for an answer. But there are very good reasons to try to understand how viruses work and how they fit into the ecosystem.

David Bhella, a researcher at the University of Glasgow in Scotland, explains that some researchers worry that eliminating a virus will leave another one in its place. We see this with animals; our mammalian ancestors got the chance to evolve only because big dinosaur predators died in a mass extinction event.

Bhella says we see this happening constantly with the flu.

“Each year a handful of strains circulate, and in the face of increasing immunity in the population they are eventually replaced with different strains that occupy the same niche,” he says.

We know how this works with animals: If humans killed off all the lions in the world, for example, there would suddenly be a lot more hyenas, because both predators eat the same sorts of animals. Fewer lions mean more food for hungry hyenas. But since we know less about how viruses fit into the world around them, it’s hard to know what would happen if the flu disappeared, Bhella says. “What defines an evolutionary opportunity for a virus? If we eradicate a virus, will something else take its place?”

We don’t need to decide whether viruses are alive to answer that question, but we do need to study them a lot more. And in coming to understand them, we might realize we don’t want to get rid of most of them. Scientists have recently come to understand that viruses exist pretty much everywhere — including inside our guts — and mostly don’t cause trouble. Some may even help us out.

“Viruses are cool, and may accidentally move genes from one group of organisms to another,” Paps says.

One example is a protein in the placenta, the organ that transfers nutrients from a mother to her unborn baby, Paps says. “This protein comes from a virus. Maybe without viruses there wouldn’t be mammals or they would look very different!”

After reading the article, select the best response to complete the statements.

1. A virus
   a. Requires a microscope to see it
   b. Makes copies of itself by living on others
   c. Is dead until it enters a host
   d. All of the above

2. Which of the following statements is false?
   a. Viruses need hosts to feed them.
   b. Viruses are as alive as bacteria.
   c. Viruses exist almost everywhere, including the human body.
   d. Viruses cannot make proteins by themselves.

3. What is meant by the term “evolutionary opportunity”? Include an example in your response.

4. What point is Feltman making by concluding with an example of a benefit or positive action of viruses?

5. What would be helpful for scientists to know about covid-19?
The Coronavirus isn’t alive.
That’s why it’s so hard to kill

The science behind what makes this coronavirus so sneaky, deadly and difficult to defeat

BY SARAH KAPLAN, WILLIAM WAN AND JOEL ACHENBACH

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Viruses have spent billions of years perfecting the art of surviving without living — a frighteningly effective strategy that makes them a potent threat in today’s world.

That’s especially true of the deadly new coronavirus that has brought global society to a screeching halt. It’s little more than a packet of genetic material surrounded by a spiky protein shell one-thousandth the width of an eyelash, and it leads such a zombielike existence that it’s barely considered a living organism.

But as soon as it gets into a human airway, the virus hijacks our cells to create millions more versions of itself.

There is a certain evil genius to how this coronavirus pathogen works: It finds easy purchase in humans without them knowing. Before its first host even develops symptoms, it is already spreading its replicas everywhere, moving onto its next victim. It is powerfully deadly in some but mild enough in others to escape containment. And for now, we have no way of stopping it.

As researchers race to develop drugs and vaccines for the disease that has already sickened 350,000 and killed more than 15,000 people, and counting, this is a scientific portrait of what they are up against.

‘Between chemistry and biology’

Respiratory viruses tend to infect and replicate in two places: In the nose and throat, where they are highly contagious, or lower in the lungs, where they spread less easily but are much more deadly.

This new coronavirus, SARS-CoV-2, adeptly cuts the difference. It dwells in the upper respiratory tract, where it is easily sneezed or coughed onto its next victim. But in some patients, it can lodge itself deep within the lungs, where the disease can kill. That combination gives it the contagiousness of some colds, along with some of the lethality of its close molecular cousin SARS, which caused a 2002-2003 outbreak in Asia.

Another insidious characteristic of this virus: By giving up that bit of...
lethality, its symptoms emerge less readily than those of SARS, which means people often pass it to others before they even know they have it.

It is, in other words, just sneaky enough to wreak worldwide havoc.

Viruses much like this one have been responsible for many of the most destructive outbreaks of the past 100 years: the flus of 1918, 1957 and 1968; and SARS, MERS and Ebola. Like the coronavirus, all these diseases are zoonotic — they jumped from an animal population into humans. And all are caused by viruses that encode their genetic material in RNA.

That’s no coincidence, scientists say. The zombie-like existence of RNA viruses makes them easy to catch and hard to kill.

Outside a host, viruses are dormant. They have none of the traditional trappings of life: metabolism, motion, the ability to reproduce.

And they can last this way for quite a long time. Recent laboratory research showed that, although SARS-CoV-2 typically degrades in minutes or a few hours outside a host, some particles can remain viable — potentially infectious — on cardboard for up to 24 hours and on plastic and stainless steel for up to three days. In 2014, a virus frozen in permafrost for 30,000 years that scientists retrieved was able to infect an amoeba after being revived in the lab.

When viruses encounter a host, they use proteins on their surfaces to unlock and invade its unsuspecting cells. Then they take control of those cells’ molecular machinery to produce and assemble the materials needed for more viruses.

“It’s switching between alive and not alive,” said Gary Whittaker, a Cornell University professor of virology. He described a virus as being somewhere “between chemistry and biology.”

Among RNA viruses, coronaviruses — named for the protein spikes that adorn them like points of a crown — are unique for their size and relative sophistication. They are three times bigger than the pathogens that cause dengue, West Nile and Zika, and are capable of producing extra proteins that bolster their success.

“Let’s say dengue has a tool belt with only one hammer,” said Vineet Menachery, a virologist at the University of Texas Medical Branch. This coronavirus has three different hammers, each for a different situation.

Among those tools is a proofreading protein, which allows coronaviruses to fix some errors that happen during the replication process. They can still mutate faster than bacteria but are less likely to produce offspring so riddled with detrimental mutations that they can’t survive.

Meanwhile, the ability to change helps the germ adapt to new environments, whether it’s a camel’s gut or the airway of a human unknowingly granting it entry with an inadvertent scratch of her nose.

Scientists believe that the SARS virus originated as a bat virus that reached humans via civet cats sold in animal markets. This current virus, which can also be traced to bats, is thought to have had an intermediate host, possibly an endangered scaly anteater called a pangolin.

“I think nature has been telling us for a long time that, ‘Hey, coronaviruses that start out in bats can cause pandemics in humans, and we have to think of them as being like influenza, as long-term threats,’” said Jeffery Taubenberger, virologist with the National Institute of Allergy and Infectious Diseases.

Funding for research on coronaviruses increased after the SARS outbreak, but in recent years that funding has dried up, Taubenberger said. Such viruses usually simply cause colds and were not considered as important as other viral pathogens, he said.

The search for weapons

Once inside a cell, a virus can make 10,000 copies of itself in a matter of hours. Within a few days, the infected person will carry hundreds of millions of viral particles in every teaspoon of his blood.

The onslaught triggers an intense response from the host’s immune system: Defensive chemicals are released. The body’s temperature rises, causing fever. Armies of germ-eating white blood cells swarm the infected region. Often, this response is what makes a person feel sick.

Andrew Pekosz, a virologist at Johns Hopkins University, compared viruses to particularly destructive burglars: They break into your home, eat your food, use your furniture and have 10,000 babies. “And then they leave the place trashed,” he said.

Unfortunately, humans have few defenses against these burglars.

Most antimicrobials work by interfering with the functions of the germs they target. For example, penicillin blocks a molecule used by bacteria to build their cell walls. The drug works against thousands of kinds of bacteria, but because human cells don’t use that protein, we can ingest it without being harmed.

But viruses function through us. With no cellular machinery of their own, they become intertwined with ours. Their proteins are our proteins.
Their weaknesses are our weaknesses. Most drugs that might hurt them would hurt us, too.

For this reason, antiviral drugs must be extremely targeted and specific, said Stanford virologist Karla Kirkegaard. They tend to target proteins produced by the virus (using our cellular machinery) as part of its replication process. These proteins are unique to their viruses. This means the drugs that fight one disease generally don’t work across multiple ones.

And because viruses evolve so quickly, the few treatments scientists do manage to develop don’t always work for long. This is why scientists must constantly develop new drugs to treat HIV, and why patients take a “cocktail” of antivirals that viruses must mutate multiple times to resist.

“Modern medicine is constantly needing to catch up to new emerging viruses,” Kirkegaard said.

SARS-CoV-2 is particularly enigmatic. Though its behavior is different from that of its cousin SARS, there are no obvious differences in the viruses’ spiky protein “keys” that allow them to invade host cells.

Understanding these proteins could be critical to developing a vaccine, said Alessandro Sette, head of the center for infectious disease at the La Jolla Institute for Immunology. Previous research has shown that the spike proteins on SARS are what trigger the immune system’s protective response. In a paper published this month, Sette found the same is true of SARS-CoV-2.

This gives scientists reason for optimism, according to Sette. It affirms researchers’ hunch that the spike protein is a good target for vaccines. If people are inoculated with a version of that protein, it could teach their immune system to recognize the virus and allow them to respond to the invader more quickly.

“It also says the novel coronavirus is not that novel,” Sette said.

And if SARS-CoV-2 is not so different from its older cousin SARS, then the virus is probably not evolving very fast, giving scientists developing vaccines time to catch up.

In the meantime, Kirkegaard said, the best weapons we have against the coronavirus are public health measures, such as testing and social distancing, and our own immune systems.

Some virologists believe we have one other thing working in our favor: the virus itself.

For all its evil genius and efficient, lethal design, Kirkegaard said, “the virus doesn’t really want to kill us. It’s good for them, good for their population, if you’re walking around being perfectly healthy.”

Evolutionarily speaking, experts believe, the ultimate goal of viruses is to be contagious while also gentle on their hosts — less a destructive burglar and more a considerate house guest.

That’s because highly lethal viruses like SARS and Ebola tend to burn themselves out, leaving no one alive to spread them.

But a germ that’s merely annoying can perpetuate itself indefinitely. One 2014 study found that the virus causing oral herpes has been with the human lineage for 6 million years. “That’s a very successful virus,” Kirkegaard said.

Seen through this lens, the novel coronavirus that is killing thousands across the world is still early in its life. It replicates destructively, unaware that there’s a better way to survive.

But bit by bit, over time, its RNA will change. Until one day, not so far in the future, it will be just another one of the handful of common cold coronaviruses that circulate every year, giving us a cough or sniffle and nothing more. ■
The Virus Uses Humans to Survive, Replicate and Spread

1. When you discuss or read about a new topic, knowing the vocabulary related to the subject is very helpful. Define the following terms.
   a. Antiviral
   b. Dormant
   c. Infectious
   d. Lethal
   e. Molecular
   f. RNA
   g. Viral
   h. Virologist
   i. Virus
   j. Zoonotic

Read “The Coronavirus isn’t alive. That’s why it’s so hard to kill” before responding to the following questions.

2. What features gave “coronavirus” its name?

3. The second paragraph of the article is descriptive.
   Select details that are helpful in understanding the pathogen.

4. Give the three steps of how the coronavirus pathogen works.
   a.
   b.
   c.

5. The fifth paragraph is what journalists call the “nut graph.” After giving an introductory or anecdotal lede, the reporter makes a direct statement of the article’s theme or main idea. What do readers expect to follow in this article?

6. Reporters indicate that SARS-CoV-2 is both contagious and lethal. In what ways does the place it sets up “home” influence its impact?
   a. Contagious
   b. Lethal
7. Reporters use the terms “dormant” and “zombielike” as well as having protein spikes and invasion and control of cells. Explain this seeming contradiction.

8. The reporters interviewed five virologists.
   a. Why are they reliable sources?
   b. Select a quotation. State the source (virologist) and explain why you find this information interesting.

9. What’s a body do to fight SARS-CoV-2?

10. Take a look at fighting a virus
    a. What is a vaccine?
    b. How does vaccine work to stop a virus?
    c. Do you agree with virologist Kirkegaard who said “the best weapons we have against the coronavirus are public health measures, such as testing and social distancing, and our own immune system.” Explain why or why not.
Not Our First Encounter With a Zoonotic Virus

Zoonotic diseases jump from an animal population into humans. And all are caused by viruses that encode their genetic material in RNA.

TO GAIN PERSPECTIVE on novel coronavirus become familiar with other destructive outbreaks of the past 100 years.

Read through the articles, graphics and photographs in Cute, Dangerous or Both? https://nie.washingtonpost.com/sites/default/files/EndemicEpidemicorPandemic.pdf OR https://tinyurl.com/qonldd6. Its current event tag is the H5N1 or bird virus and an outbreak of mumps in 2006. It provides the following articles to read for background: “Resurrecting 1918 Flu Virus Took Many Turns,” “Pandemic of Fear,” “When Animals Suffer, So Do We,” “1 Billion Awarded For Flu Vaccine” and “Can We Stop the Next Killer Flu?”

Select one of the seven outbreaks. Read additional reliable information about that zoonotic disease. If someone in your family or community has had experience with your selected outbreak, interview him or her (maintain a safe distance). Include as an anecdote or quotation in your essay.

1. Influenza of 1918 (Spanish Flu)
2. Flu of 1957 (Asian Flu)
3. Flu of 1968 (Hong Kong Flu)
4. Flu of 2006 (Bird Flu, H5N1 strain)
5. SARS
6. MERS
7. Ebola

Write a 200- to 500-word essay about your selected outbreak to inform your family and classmates. Include what it means to be “caused by viruses that encode in RNA” and to be zoonotic.