Pathfinder Name: _____

Viruses – Pathfinder Honor

1. **A virus is _____ _____ parasite that _____ and then _____ inside a living cell. The word virus is from Latin for poison. The study of viruses is known as virology, a subspecialty of microbiology.**

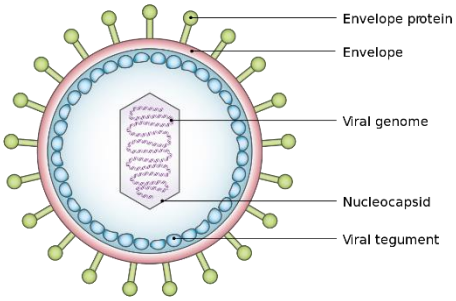
2. **There is some controversy regarding whether viruses are alive or not. Viruses can infect all types of life forms, from animals and plants to microorganisms, including bacteria. Viruses are the most abundant type of biological entity. The debate on viruses is because they share traits with both living and non-living things:**

Living Things	Viruses	Non-Living Things
Complicated Structure		Simple Structure
Adapt to their environment		Does not adapt
Has DNA & RNA		Does not have DNA & RNA
Reproduces		Does not reproduce
Uses energy, breathes		Does not use energy, breathe
Made up of cells		Does not have cells
Grows		Does not Grow
Respond to Stimuli		Does not respond to Stimuli

3. **Viruses are _____ classified into any of the five life kingdoms, since they missing key features of livings things and do not have cells. While not inside an infected cell or in the process of infecting a cell, viruses exist in the form of independent particles known as virions that are inert and lifeless as a rock.**

4. **Dmitri Ivanovsky, a Russian botanist, discovered viruses in 1892 when he identified a non-bacterial pathogen infecting tobacco plants, later named the tobacco mosaic virus. About 5,000 virus species have been described in detail, although there are millions of different types.**

5. **ALL viruses have three things in common:**



   a. **A _____ coat that protects the virus.**

   b. **An inner core that contains _____ material (direction for making new viruses).**

   c. **Surface proteins that allow it to _____ to certain cells in the host.**

6. **Viruses are very _____. Much smaller than bacteria, being submicroscopic – most range in size from 5-300 nanometers (nm). A human hair is around 60,000 nm in diameter.**

7. **_____ are similar to viruses as they are infectious protein particles. Prions are smaller than viruses and they do not have any DNA or RNA. They are rare but they cause Mad cow disease, a fatal disease that slowly destroys the brain and spinal cord in cattle. A human version of mad cow disease called variant Creutzfeldt-Jakob disease (vCJD) is believed to be caused by eating beef products.**

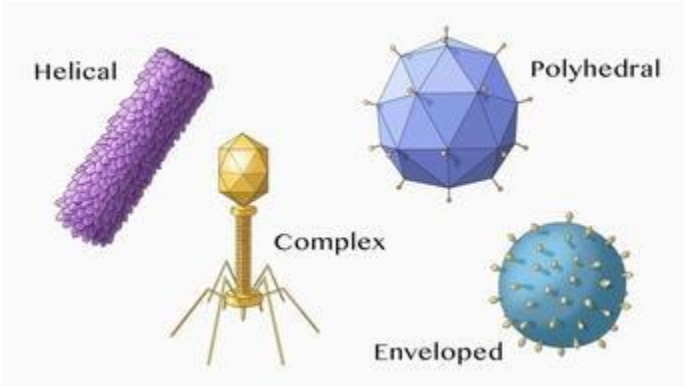
8. **Name some morphological shapes of viruses and give an example of each:**

   a. **_____ viruses are long and cylindrical, including the TMV (_____ mosaic virus) which was the first virus identified. Many plant viruses are helical.**

   b. **_____ (many-sided) capsids (protein shell) form the shape of _____, the most common viral infectious agent in humans and the predominant cause of the common cold. Often the capsid takes the form of an icosahedron, a three-dimensional, 20-sided structure with 12 vertices, similar to a soccer ball and it is roughly spherical. Other examples include poliovirus, and herpesviruses.**

   c. **_____ virus structures, such as variola virus which causes _____, have a combination of icosahedral and helical shape and may have a complex outer wall or head-tail morphology. The head-tail morphology structure is unique to viruses that only infect bacteria and are known as bacteriophages.**

   d. **Some viruses have an _____ (outer layer) surrounding them such as the _____ virus which causes the flu. The lipid bilayer envelope of these viruses is relatively sensitive to heat, and detergents, therefore these viruses are easier to sterilize than non-enveloped viruses, have limited survival outside host environments, and typically must transfer directly from host to host. These viruses still have a conventional icosahedral or helical structure on the inside.**



9. **The genetic material _____ _____ many of the cells functions once the virus gets it inside a cell. It then instructs the cell to produce more of the virus which go on to infect more cells. Most viral infections eventually result in the death of the host cell.**

10. **When infected with a virus, _____ are produced which can neutralize the virus. Some antibodies work by interfering with virion binding to receptors or block uptake into cells.**

11. **_____ help develop immunity by imitating an infection through a weakened or inactive form of the virus that is injected into the body. The body creates antibodies to match the virus. If an active virus shows up later the body already has the antibodies to fight.**

12. **_____ _____ _____ work on viruses, which leaves vaccines (and certain antiviral drugs) as the main defense against harmful virus caused diseases.**

13. **Some parents refuse, delay, or are hesitant to vaccinate their children because of religious reasons, personal beliefs, philosophical reasons, or safety concerns. The Seventh-day Adventist Church encourages responsible**

immunization/vaccination but leaves the decision up to each individual.

14. **Viruses are continuously _____ and changing as a result of genetic selection. They undergo subtle genetic changes and major genetic changes through recombination. Mutation occurs when an error is incorporated in the viral genome. Recombination also occurs when coinfecting viruses exchange genetic information, creating novel (new) viruses.**

15. **A _____ mutation in a virus gene allows the virus to become resistant to treatment with a particular antiviral drug is will work less well or not work at all.**

16. **The _____ virus was _____ solely through vaccination after 200 years. The World Health Organization (WHO) declared smallpox eradicated in 1980. The first smallpox immunization was created in 1796. It took a worldwide vaccination program to fully eradicate the disease. The last known naturally occurring case of smallpox was diagnosed on Oct. 26, 1977, in Somalia, according to the CDC.**

17. **Viruses are _____ to treat because:**
    a. **They are about a hundred times tinier than human cells.**
    b. **The virus often has an outer membrane similar to a host cell making hard to identify.**
    c. **Antibiotics do not work on viral infections.**
    d. **A person can be infected and contagious before they even know they have the virus.**
    e. **Vaccine programs are the most effective prevention system so far and they depend on everyone working together to get a vaccine which doesn't always happen especially in developing countries.**

18. **Explain the difference between a cold and the flu:**

Illness		
Type of Illness	Respiratory	Respiratory
Contagious Time	2-3 Weeks	2-3 Weeks
Caused by	Rhinovirus	Influenzavirus
Cough	Usually Mild	Common
Sneezing, Stuffy Nose, Sore Throat	Common	Sometimes
Fever, Headache, Chills	Rare	Common
Fatigue, Weakness	Sometimes	Common
Symptom onset	Gradual	Abrupt

19. **In the _____ time respiratory infections increase. They are transferred more readily because people spend more time inside close to others. Winter's chilly, dry air also affects your respiratory system, making it more susceptible to germs.**

20. **Every year flu has a _____ _____ that attacks many people at about the same time and may spread through one or several countries. It occurs due to re-emergence of the previous year's virus strain with a slight change in its surface binding proteins that may not be recognizable by the body's immune system.**

21. **The Flu can be _____. For most people, the flu is an inconvenience that subsides in a few days. For others, influenza can lead to health complications, visits to the hospital and even death. Globally, about 10% of adults and 30% of children get the flu each year. Some cases are severe leading to over 250,000 deaths on average each year, according to the World Health Organization (WHO). The 1918 flu, "The Great Pandemic," infected 20-40% of the worldwide population and an estimated 50 million people died.**

22. **Details on some rash diseases (exanthematous):**

Disease			
Basic Reproduction Num.	**5-7**	**12-18**	**9-10**
Case fatality ratio	**Near 0%**	**1-3%**	**.02% in Adults 30% in infants**
Symptoms	**fever, sore throat, rash, headache, and red, itchy eyes**	**fever, rash, cough, runny nose, and red, watery eyes**	**blister-like rash, itching, fever, and tiredness**
Possible Complications	**Pregnant women could miscarriage or her baby could be born with serious birth defects**	**ear infection, diarrhea, pneumonia, brain damage, and death**	**severe skin infection, scars, pneumonia, brain damage, or death**

23. **Choose three of the following viral diseases and describe their form of infection, symptoms and prevention Demonstrate your learning creatively through a display, presentation, or prepared speech.**
    a. **Herpes, AIDS, Mumps, Poliomyelitis, Meningitis, Hepatitis, Dengue.**
    b. **Some alternatives could be: Coronavirus, Ebola Virus, Varicella Zoster Virus (causes chicken pox and shingles), West Nile Virus, Zika Virus, Hand-Foot-and-Mouth Virus.**

24. **Do one of the following:**
    a. **Give a brief report about a viral pandemic and the impact it had/is having on the world.**
    b. **Create a skit, multimedia presentation, or other interactive display that informs audiences from developing countries to the danger of one or more of these viruses and gives them training in how to combat or control the virus.**
    c. **Have an Aid/relief worker give a talk or presentation about epidemics and virus control in third-world countries. Raise money as a group to support aid relief in the country(ies) the worker tells you about.**

Answers: 1. Tiny, non-living, invades, multiples. 2. Complicated, They Adapt, Has DNA or RNA, Reproduces??, Uses energy??, No cells, Does not grow, No response to Stimuli. 3. Not. 5. Protein, Genetic, Attach. 6. Small. 7. Prions. 8a. Helical, tobacco. 8b. Polyhedral, Rhinovirus. 8c. Complex, Smallpox. 8d. Envelope, Influenza. 9. Takes over. 10. Antibodies. 11. Vaccines. 12. Antibiotics do not. 14. Mutating. 15. Resistance. 16 Smallpox, Eradicated. 17. Difficult. 18. Cold, Flu. 19. Winter. 20. Seasonal Outbreak. 21. Deadly. 22. Rubella, Measles, Chickenpox. 23.

Herpes

Herpes is caused by a virus: Herpes simplex virus (HSV). This virus has two types, HSV 1 and HSV 2. HSV 1 (oral herpes) usually causes infections on the lips or mouth (cold sores or fever blisters). HSV 2 (genital herpes) usually causes sores and blisters in the genital area.

However, virus from the mouth can infect the genitals and virus from the genitals can infect the mouth. Herpes virus can also infect other parts of the body. Both viruses can live inside nerve cells and cause symptoms that occur again and again.

Almost everyone has had HSV 1

Fifty to 90% of adults have had HSV 1 infection. Infections in children are often mild or cause no symptoms at all. Even if you have had HSV 1, you can still catch HSV 2.

Herpes infection is spread from person-to-person. You can get infected:

- By direct contact (touching, kissing, rubbing) with the sores or blisters
- By having sex with someone with herpes already.
- From mother to baby during childbirth

Signs and symptoms of herpes to look for:

- Painful small bumps on the lips or mouth that turn into blisters or open sores
- Painful blisters or sores on or around the penis, vagina, labia, or rectum

Symptoms start about 2 to 12 days after contact with the virus. The first time a person has these symptoms is usually the worst. Herpes skin lesions may come back, usually occurring at the same place as before. Herpes can come back when a person is stressed, has a fever, gets too much sun, or at other times when the body is weakened. Herpes is also more common near the time when a woman has her period. The sores caused by HSV last for about a week or two.

Treatment with antiviral medications may help genital herpes

Several medications may reduce shedding of the virus, diminish pain, speed up healing time, and decrease the number of times that the lesions come back. A doctor must prescribe these medications.

Prevent herpes infections by avoiding contact with sores and by good hygiene

- If you have herpes blisters or sores on your lips, do not get your mouth close to babies. Wash your hands very well before touching babies.
- If you have herpes blisters or sores on your lips, do not kiss anyone on the mouth or genitals.
- Keep toys clean and limit saliva contact among children.
- Wear gloves if touching open herpes lesions.
- Cover herpes lesions and wash hands often.
- Excluding students or employees with herpes from schools or child care centers is not usually necessary.
- If you are pregnant and have herpes, it is very important to tell your doctor

Herpes infection in babies can be very serious. Newborns can get severe infections that lead to mental retardation or death. A doctor may recommend a cesarean section to avoid exposing the baby to the virus during birth.

Mumps

What is mumps? Mumps is a disease caused by a virus. You can catch mumps through the air from an infected person's cough or sneeze. You can also get it by direct contact with an infected surface. The virus usually makes you feel sick and causes a salivary gland between your jaw and ear to swell. Other body tissues can become infected too.

What are the symptoms? After a person is exposed to mumps, symptoms usually appear in 16 to18 days. But, it can take 12 to 25 days after exposure. The symptoms are usually: Low-grade fever, Headache, Muscle aches, Stiff neck, Fatigue, Loss of appetite, Swelling and tenderness of one or more of the salivary glands, Some people have just mild symptoms, or no symptoms.

What are the complications of mumps? Severe complications are rare. A small number of people may have inflammation of the brain and tissues that cover the brain and spinal cord (encephalitis/meningitis). Or, they may have inflammation of the testicles, ovaries or breasts. Deafness or spontaneous abortion may also occur.

How long is a person with mumps contagious? A person with mumps can pass it to others from 2 to 3 days before the swelling starts until five days after the swelling begins.

Is there a treatment for mumps? There is no treatment. Acetaminophen or ibuprofen can ease fever and pain.

If my child or another family member has been exposed to mumps, what should I do? Immediately call your local health department, doctor or clinic for advice. If you never had mumps or were never vaccinated against it, you may need to stay home from work or school for a while.

What is the best way to prevent mumps? We recommend that all children get the Measles, Mumps and Rubella (MMR) vaccine. Children should get their first MMR shot at 12 through 15 months old (as soon as possible within this time period). The second dose may be given as soon as one month after the first dose. But, it is usually given between 4 and 6 years of age. These people are at high risk for getting mumps: students at college, health care workers, international travelers or people living in a community with a mumps outbreak. If you are in this group, you are considered immune to mumps if you have written proof of two valid doses of a mumps-containing vaccine. Children of preschool age, or adults not at high risk, are considered immune to mumps if they have proof of one valid dose of a mumps-containing vaccine. You are also considered immune to mumps if you have a written lab report of immunity, or you were born before 1957. Anyone who lacks proof of mumps immunity, as defined above, should receive at least one dose of MMR vaccine. Two doses of MMR vaccine are recommended for some groups of adults. This includes health care personnel, college students, and international travelers. The doses should be given at least 28 days apart.

What are the MMR vaccine requirements for school attendance? For pre-kindergarten, including day care, Head Start or nursery school: one dose of MMR vaccine. Kindergarten to 12th grade: 2 doses of MMR vaccine. College: 2 doses of MMR vaccine.

What should I do if I'm not sure I was vaccinated against mumps? Check with your doctor. If you were born before 1957 it's likely that you have been exposed to the virus and are immune. If you were born between 1957 and 1971 when vaccines weren't as reliable, ask your doctor if you've been properly vaccinated.

What should I or my family members do to prevent mumps if we are traveling out of the country? Mumps is still common in many other countries. Make sure you and your children are fully vaccinated before traveling out of the U.S. Children, adults and adolescents should have two doses of MMR vaccine, at least 28 days apart. An early dose of MMR vaccine is recommended for children 6-11 months of age who will be traveling internationally. These children will still need the 2 routine doses given at 12-15 months and 4-6 years of age to ensure protection. They will receive a total of 3 MMR vaccines.

Viral Meningitis

Viral meningitis is the most common type of meningitis, an inflammation of the lining of the brain and spinal cord. It is often less severe than bacterial meningitis, and most people get better on their own (without treatment). However, anyone with symptoms of meningitis should see a doctor right away because some types of meningitis can be very serious. Only a doctor can determine if someone has meningitis, what is causing it, and the best treatment. Babies younger than 1 month old and people with weakened immune systems are more likely to have severe illness from viral meningitis.

Causes: Non-polio enteroviruses are the most common cause of viral meningitis in the United States, especially from late spring to fall. That is when these viruses spread most often. However, only a small number of people infected with enteroviruses will actually develop meningitis. Other viruses that can cause meningitis are: Mumps virus, Herpesviruses, including Epstein-Barr virus, herpes simplex viruses, and varicella-zoster virus (which causes chickenpox and shingles), Measles virus, Influenza virus, Arboviruses, such as West Nile virus, Lymphocytic choriomeningitis virus.

People at Risk: People of any age can get viral meningitis. However, some people have a higher risk of getting the disease, including: Children younger than 5 years old, People with weakened immune systems caused by diseases, medications (such as chemotherapy), and recent organ or bone marrow transplantations, Babies younger than 1 month old and people with weakened immune systems are also more likely to have severe illness.

How it Spreads: Close contacts of someone with viral meningitis can become infected with the virus that made that person sick. However, these close contacts are not likely to develop meningitis. Only a small number of people who get infected with the viruses that cause meningitis will actually develop viral meningitis. Viruses that can cause meningitis spread in different ways. Learn more about how the following viruses spread by visiting CDC's websites: Non-polio enteroviruses, Mumps virus, Herpesviruses, including Epstein-Barr virus, herpes simplex viruses, and varicella-zoster virus, Measles virus, Influenza virus, Arboviruses, like West Nile virus, Lymphocytic choriomeningitis virus.

Common symptoms in children and adults: Fever, Headache, Stiff neck, Eyes being more sensitive to light, Sleepiness or trouble waking up from sleep, Nausea, Irritability, Vomiting, Lack of appetite, Lethargy (a lack of energy)

Most people with mild viral meningitis usually get better on their own within 7 to 10 days. Initial symptoms of viral meningitis are similar to those for bacterial meningitis. However, bacterial meningitis is usually severe and can cause serious complications, such as brain damage, hearing loss, or learning disabilities.

See a doctor right away if you think you or your child might have meningitis. A doctor can determine if you have the disease, what is causing it, and the best treatment.

Treatment: In most cases, there is no specific treatment for viral meningitis. Most people who get mild viral meningitis usually recover completely in 7 to 10 days without treatment. Antiviral medicine may help people with meningitis caused by viruses such as herpesvirus and influenza. Antibiotics do not help viral infections, so they are not useful in the treatment of viral meningitis. However, antibiotics do fight bacteria, so they are very important when treating bacterial meningitis. People who develop severe illness, or are at risk for developing severe illness may need care in a hospital.

Prevention: There are no vaccines to protect against non-polio enteroviruses, which are the most common cause of viral meningitis. The best way to help protect yourself and others from non-polio enterovirus infections is to: 1. Wash your hands often with soap and water for at least 20 seconds, especially after changing diapers or using the toilet. 2. Avoid close contact, such as touching and shaking hands, with people who are sick. 3. Clean and disinfect frequently touched surfaces. 4. Stay home when you are sick and keep sick children out of school.

Vaccines can protect against some diseases, such as measles, mumps, chickenpox, and influenza, which can lead to viral meningitis. Make sure you and your child are vaccinated on schedule. Avoid bites from mosquitoes and other insects that carry diseases that can infect humans. Control mice and rats. If you have a rodent in or around your home, follow appropriate cleaning and control precautions

Hepatitis

Hepatitis is inflammation of the liver tissue. Some people with hepatitis have no symptoms, whereas others develop yellow discoloration of the skin and whites of the eyes (jaundice), poor appetite, vomiting, tiredness, abdominal pain, and diarrhea.

Hepatitis is acute if it resolves within six months, and chronic if it lasts longer than six months. Acute hepatitis can resolve on its own, progress to chronic hepatitis, or (rarely) result in acute liver failure. Chronic hepatitis may progress to scarring of the liver (cirrhosis), liver failure, and liver cancer.

Hepatitis is most commonly caused by the viruses hepatitis A, B, C, D, and E. Other causes include heavy alcohol use, certain medications, toxins, other infections, autoimmune diseases, and non-alcoholic steatohepatitis (NASH).

Hepatitis A and E are mainly spread by contaminated food and water. Hepatitis B is mainly sexually transmitted, but may also be passed from mother to baby during pregnancy or childbirth and spread through infected blood. Hepatitis C is commonly spread through infected blood such as may occur during needle sharing by intravenous drug users. Hepatitis D can only infect people already infected with hepatitis B.

Hepatitis A, B, and D are preventable with immunization. Medications may be used to treat chronic viral hepatitis. Antiviral medications are recommended in all with chronic hepatitis C, except those with conditions that limit their life expectancy.

Worldwide in 2015, hepatitis A occurred in about 114 million people, chronic hepatitis B affected about 343 million people and chronic hepatitis C about 142 million people. Hepatitis results in more than a million deaths a year, most of which occur indirectly from liver scarring or liver cancer. In the United States, hepatitis A is estimated to occur in about 2,500 people a year and results in about 75 deaths.

Viral hepatitis is the most common type of hepatitis worldwide. Viral hepatitis is caused by five different viruses (hepatitis A, B, C, D, and E). Hepatitis A and hepatitis E behave similarly: they are both transmitted by the fecal–oral route, are more common in developing countries, and are self-limiting illnesses that do not lead to chronic hepatitis.

Hepatitis B, hepatitis C, and hepatitis D are transmitted when blood or mucous membranes are exposed to infected blood and body fluids. However, kissing, sharing utensils, and breastfeeding do not lead to transmission unless these fluids are introduced into open sores or cuts.

Hepatitis B and C can present either acutely or chronically. Hepatitis D is a defective virus that requires hepatitis B to replicate and is only found with hepatitis B co-infection. In adults, hepatitis B infection is most commonly self-limiting, with less than 5% progressing to chronic state, and 20 to 30% of those chronically infected developing cirrhosis or liver cancer. However, infection in infants and children frequently leads to chronic infection.

Unlike hepatitis B, most cases of hepatitis C lead to chronic infection. Hepatitis C is the second most common cause of cirrhosis in the US (second to alcoholic hepatitis). In the 1970s and 1980s, blood transfusions were a major factor in spreading hepatitis C virus. Since widespread screening of blood products for hepatitis C began in 1992, the risk of acquiring hepatitis C from a blood transfusion has decreased from approximately 10% in the 1970s to 1 in 2 million currently.

Coronavirus 2019 (COVID-19)

- What is coronavirus disease 2019 (COVID-19)?
  - Coronavirus disease 2019 (COVID-19) is a respiratory illness that can spread from person to person. The virus that causes COVID-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China.
- Can people in the U.S. get COVID-19?
  - Yes. COVID-19 is spreading from person to person in parts of the United States. Risk of infection with COVID-19 is higher for people who are close contacts of someone known to have COVID-19, for example healthcare workers, or household members. Other people at higher risk for infection are those who live in or have recently been in an area with ongoing spread of COVID-19. Learn more about places with ongoing spread at https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html#geographic.
- Have there been cases of COVID-19 in the U.S.?
  - Yes. The first case of COVID-19 in the United States was reported on January 21, 2020. The current count of cases of COVID-19 in the United States is available on CDC's webpage at https://www.cdc.gov/coronavirus/2019-ncov/cases-in-us.html.
- How does COVID-19 spread?
  - The virus that causes COVID-19 probably emerged from an animal source, but is now spreading from person to person. The virus is thought to spread mainly between people who are in close contact with one another (within about 6 feet) through respiratory droplets produced when an infected person coughs or sneezes. It also may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads. Learn what is known about the spread of newly emerged coronaviruses at https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html.
- What are the symptoms of COVID-19?
  - Patients have had mild to severe respiratory illness with symptoms of fever, cough, shortness of breath
- What are severe complications from this virus?
  - Some patients have pneumonia in both lungs, multi-organ failure and in some cases death.
- How can I help protect myself?
  - People can help protect themselves from respiratory illness with everyday preventive actions. Avoid close contact with people who are sick. Avoid touching your eyes, nose, and mouth with unwashed hands. Wash your hands often with soap and water for at least 20 seconds. Use an alcohol-based hand sanitizer that contains at least 60% alcohol if soap and water are not available.
- If you are sick, to keep from spreading respiratory illness to others, you should:
  - Stay home when you are sick.
  - Cover your cough or sneeze with a tissue, then throw the tissue in the trash.
  - Clean and disinfect frequently touched objects and surfaces.
- What should I do if I recently traveled from an area with ongoing spread of COVID-19?
  - If you have traveled from an affected area, there may be restrictions on your movements for up to 2 weeks. If you develop symptoms during that period (fever, cough, trouble breathing), seek medical advice. Call the office of your health care provider before you go, and tell them about your travel and your symptoms. They will give you instructions on how to get care without exposing other people to your illness. While sick, avoid contact with people, don't go out and delay any travel to reduce the possibility of spreading illness to others.
- Is there a vaccine?
  - There is currently no vaccine to protect against COVID-19. The best way to prevent infection is to take everyday preventive actions, like avoiding close contact with people who are sick and washing your hands often.
- Is there a treatment?
  - There is no specific antiviral treatment for COVID-19. People with COVID-19 can seek medical care to help relieve symptoms.