Northeastern University
College of Engineering

Weekly STEM Newsletter - Week 33 (MARCH 29 - APRIL 05, 2021)

COVID Vaccines

Introduction

The World Health Organization (WHO) defined Coronavirus (COVID-19) as an infectious disease caused by a newly discovered coronavirus. The majority of people who test positive for the COVID-19 virus will experience mild to moderate respiratory illness and recover with minimal special treatment. The elderly and those with underlying medical problems such as diabetes, cancer, cardiovascular disease, etc are more likely to develop serious illnesses if they contract COVID-19. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. The best way to prevent and slow down the transmission of the virus is to wash your hands or use alcohol-based rubs, like hand sanitizer, frequently, wear a mask, refrain from touching your face, avoid large crowds, and social distance 6 feet. As a result of COVID-19 and the pandemic, life as we knew it has changed. At the beginning of last year, schools at all levels closed from in-person learning and opted in for virtual learning through Zoom. Restaurants and public venues have decreased their capacity along with businesses and companies sanitizing everything more often. A year later, masks are still required but places are allowing outdoor dining with indoor options if they have ample spacing, schools are beginning to implement a combination of virtual and in-person class options, and vaccination is readily available.

Currently, there are three vaccines that are authorized and recommended to prevent COVID-19 available in the United States. The vaccines available are being manufactured by Pfizer/ BioNTech, Moderna, and Janssen Pharmaceuticals Companies of Johnson & Johnson. The vaccine manufactured by Pfizer/ BioNTech is an mRNA-based vaccine given to the patient by 1 shot in the muscle of the upper arm followed by another after 21 days. Additionally, the Moderna vaccine is an mRNA-based vaccine also given to patients with 1 shot in the muscle of

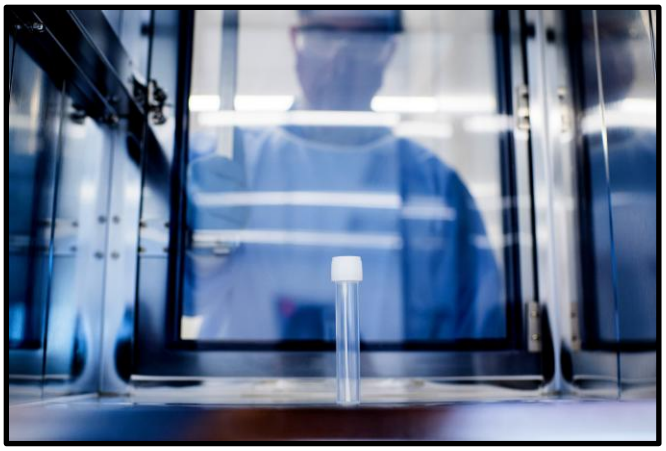
the upper arm and an additional shot 28 days later. mRNA COVID-19 vaccines teach our cells how to make a protein that triggers an immune response inside our bodies. This immune response produces antibodies that protect us from infection if the actual virus enters our body. The last vaccine option accessible is the Janssen Pharmaceuticals Companies of Johnson & Johnson, a viral vector vaccine administered by 1 shot in the muscle of the upper arm. Viral vector vaccines use genetic material to help train your immune system to recognize the spike protein found on the surface of the coronavirus and respond accordingly. The difference between the mRNA-based and viral vector vaccine is that the genetic material in the viral vector vaccine is DNA rather than mRNA. The modified piece of DNA is harmless and degraded once its task is complete. The side effects of the 3 vaccines have similar common side effects such as pain, redness, and swelling in the arm where the shot was received, tiredness, headache, muscle pain, fever, chills, and nausea. Side effects typically start within a day or two of getting the vaccine but should go away in a few days. The vaccines are presently recommended for people ages 18 and older.

Currently, there has been a grand total of almost 4 million doses shipped to Massachusetts, with 1.3 million people being fully vaccinated (received two doses from Pfizer/Moderna or one dose from Johnson & Johnson). Currently, there are 2.1 million people with at least one dose of the vaccine. Massachusetts has been rolling out the vaccine in phases. Phase 1 was between December and February, prioritizing health care workers that work with COVID patients, first responders, and other health-related workers. The next phase, Phase 2 (this is the current phase we are in) prioritizes people that are at the highest risk of becoming critically ill if contracted with COVID-19 such as people older than 75, then those older than 60, people with 2 or more chronic illnesses, as well as school staff, and other workers. The next part of Phase 2 will start in early April, allowing people that are 55 or older as well as people with 1 certain medical condition. Phase 3 is scheduled to start April 19th, where anyone over the age of 16 will be eligible to register and receive the vaccine. This is exciting news, as it brings us closer to the end of the pandemic. However, we must remember to still wear masks, social distance, and stay safe.

Northeastern Connections

Faculty Connection

Set up by the Director of Executive Training and Biotechnology Programs, Jared Auclair, the Northeastern Life Sciences Testing Center was created to handle all of the university's testing protocols. They receive thousands of coronavirus swabs a day, analyze the molecular makeup for a diagnosis, and return results all in about 24 hours. According to Auclair, one of the facility's main focuses is to further sophisticate these tests' analysis. They're hoping to gear up sequencing to detect other coronavirus variants as currently only 1% of swabs get tested for various strains.



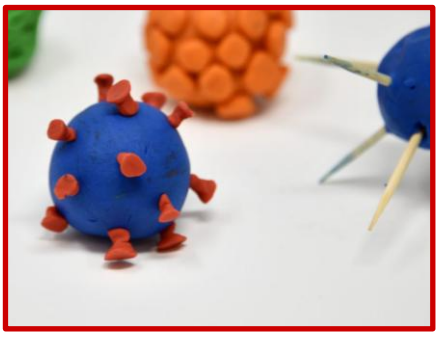
Student Connection

Northeastern University has a student-led chapter of Global Public Health Brigades, an organization that works to improve health conditions in the developing world. Students in Global Health Brigades work alongside local community members to build projects that improve lives in Honduras, Nicaragua, and Ghana. The organization teaches and empowers the local communities in order to help ensure long-term sustainability and maintenance. Last year, Northeastern's chapter of Global Medical Brigades, a branch of Global Public Health Brigades, took part in a brigade to Honduras and Greece. The brigade to Honduras ran a medical clinic for the region and set up a water irrigation system. The brigade to Greece visited various refugee camps and ran medical clinics within the camps.

This is an image of the students who traveled on the Global Medical Brigade to Honduras last year. Due to covid-19, GMB accommodated by hosting TeleBrigades, but they plan on going to Ghana next.

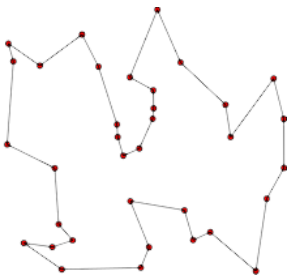
Do Now

I'm sure you've heard different numbers associated with the different types of vaccines for COVID-19 (known as efficacy rates), such as 95% being associated with the Pfizer vaccine. But what do these numbers actually mean? Does it mean that 95% of the people that take the vaccine are fully immune and 5% are not immune at all? Or does it mean that you are 95% immune once you receive it? To find out more about what these numbers mean, watch this video for today's "Do Now": Why you can't compare Covid-19 vaccines. Learn more about how the vaccine trials worked for each type and under what conditions. Now, remember, no matter the efficacy rate, some protection against the coronavirus is better than no protection at all.



Activity

This activity is going to help you understand and visualize the actual structure of the coronavirus, to help understand how the vaccine was made and how it makes you immune. Understand the different

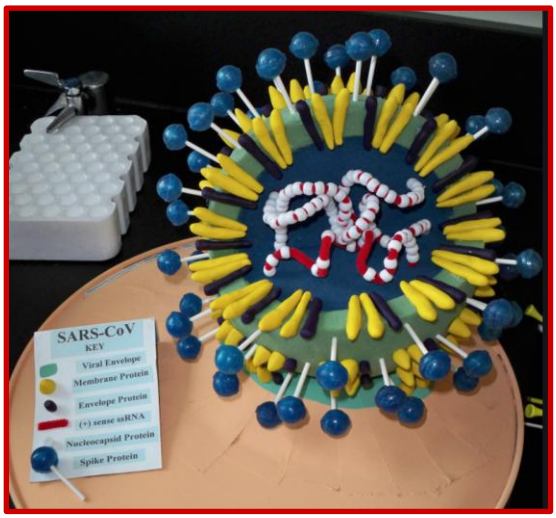


components of the virus and what they are used for.

Materials Needed:

You can use any materials you want but here are some suggestions:

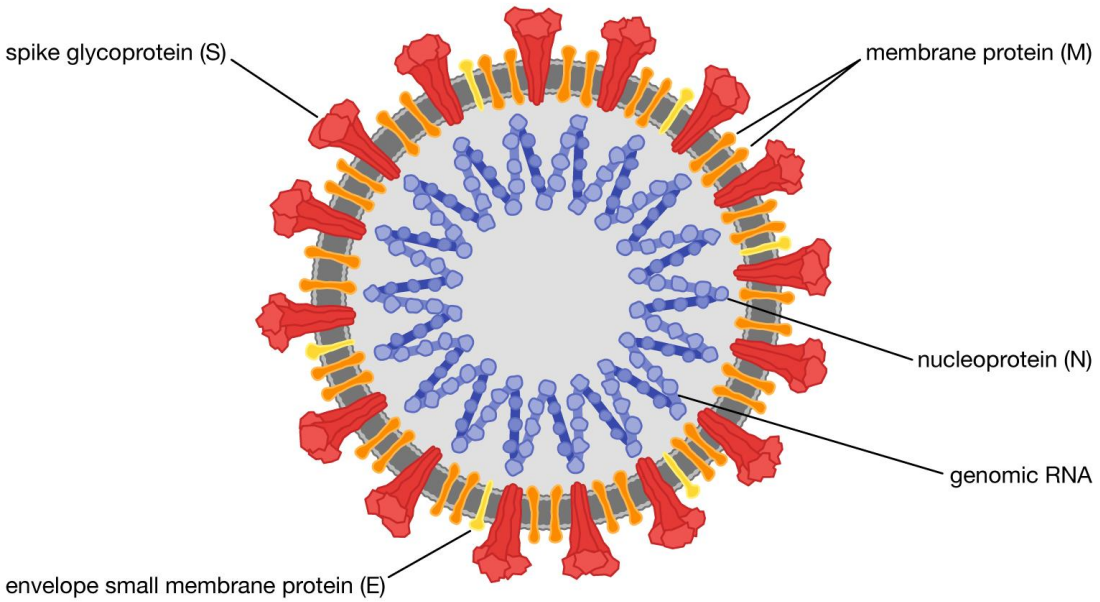
- Clay
- String
- Colored paper/card
- Pipe cleaners
- Glitter
- Cotton buds
- Pom poms
- Paint
- Toothpicks



Steps:

- The goal is to make a model of the coronavirus!
- You can use any of the materials suggested (or other ones not mentioned) to make a model
- Use the diagram below as a reference to the structure of this virus.
- One idea is to make paper mache and mold it into shape. You can also use play-dough or different colored clay on paper, or a mixture of different materials! Be creative! You can also look at the images above for some inspiration.
- Make sure you include a key or label your model.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)



Discussion Questions:

- What do the different parts of the virus do and what they are responsible for?
- How does the body fight the coronavirus if that person is vaccinated (assume they are immune)?
- What are the similarities and differences between the coronavirus and other common viruses when it comes to their structures?

Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share with us something you learned and/or send us pictures! Email us at stem@northeastern.edu.

Related links/Extensions

- Center for Disease Control and Prevention - COVID-19
- World Health Organization - Coronavirus
- Worldometer - COVID-19 Coronavirus Pandemic
- Details on Massachusetts' COVID-19 vaccination phases