

Ys and Antibodies



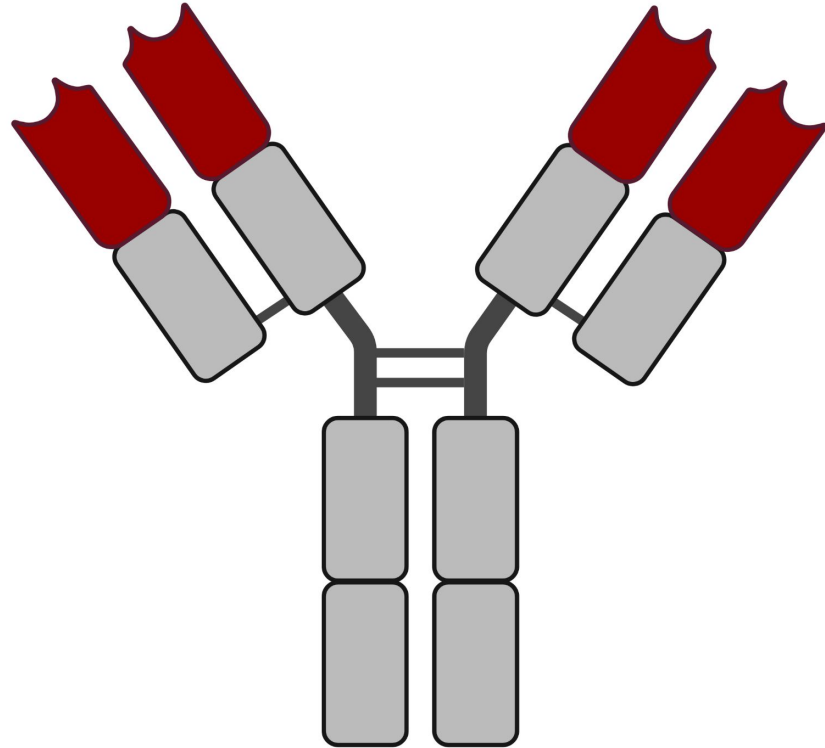
How antibodies help us stay healthy.



**Let's get to know each other:
Introductions**

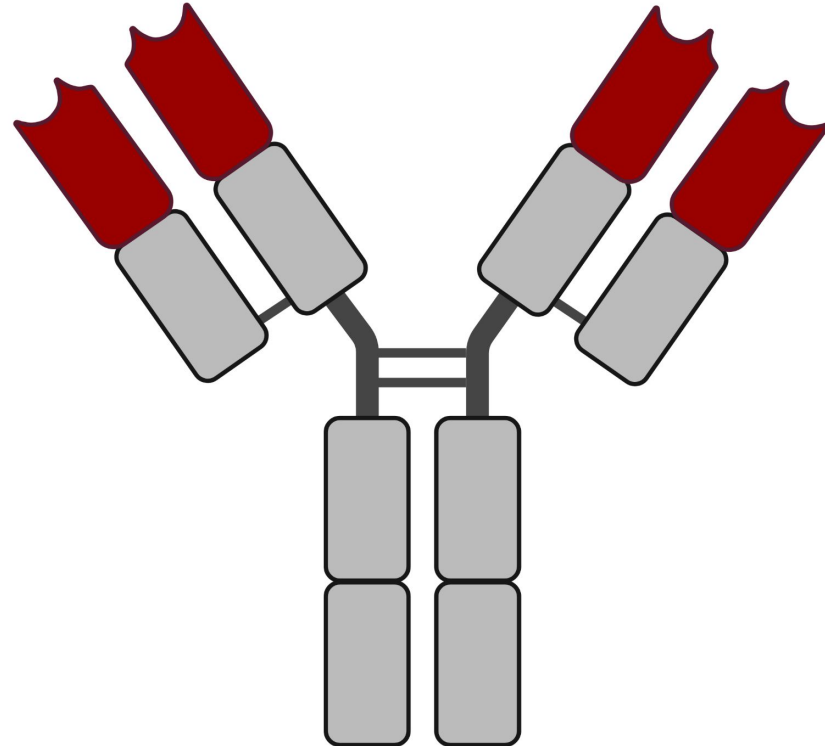
What is an Antibody?

- Antibodies are a part of the immune system that bind to foreign material like viruses and bacteria.
- When an antibody binds to a material, it signals white blood cells to attack and breakdown the material
- When you are sick, your body is creating lots of different antibodies to try and find one that recognizes the bacteria or virus making you sick
- After you have fought off an infection, memory B cells “remember” the invader and quickly produce the right antibodies if it comes across the invader again



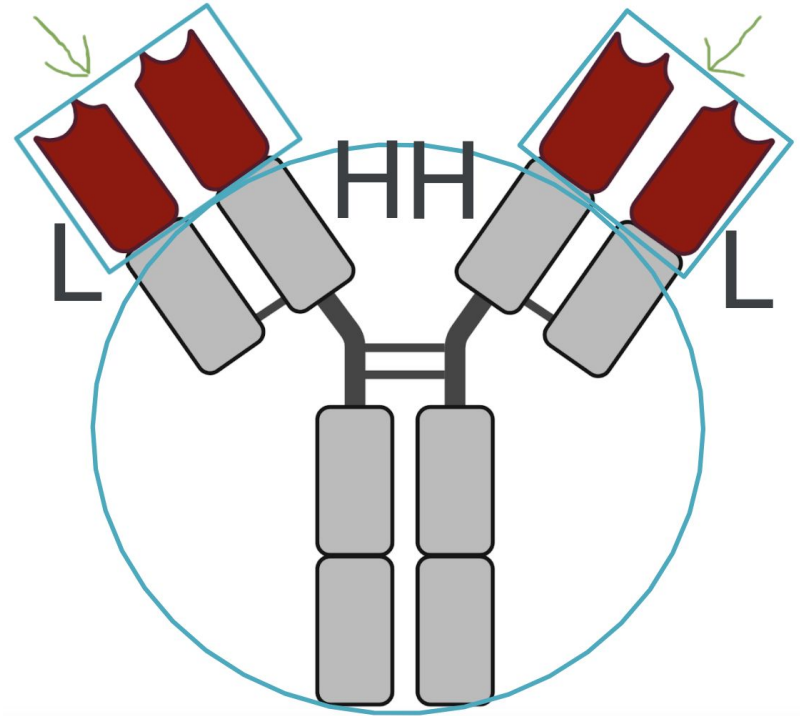
Label the “Ys”: Parts of an antibody

1. Label the light chain of the antibody with the letter “L”
2. Label the heavy chain of the antibody with the letter “H”
3. Draw rectangles around the variable regions on this antibody.
4. Circle the constant region(s) on this antibody.
5. Draw an arrow to the region that may bind to a specific epitope.



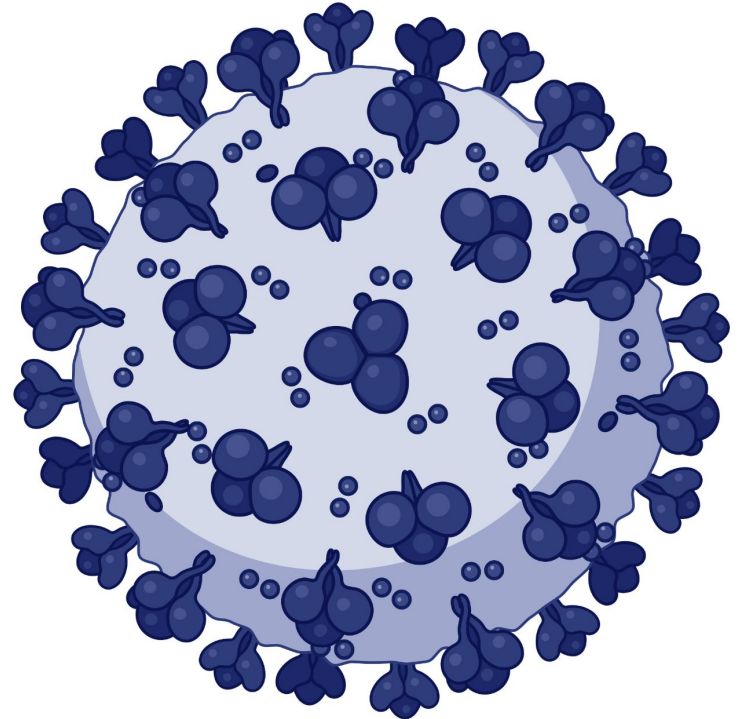
KEY: Parts of an antibody

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The Virus and its Antigens: Recognizing potential invaders.

1. Where are the potential epitopes in the diagram above?
2. How many different types of epitopes do you see?
3. What is the relationship between epitopes, antigens, and antibodies?



Hands-on Activity!

1. Does **antibody 1** recognize the **influenza virus**? If so, which epitope does it recognize?
 - a. Find out by pushing the antibody's binding site on different virus epitopes and seeing if they stick together. Be sure to repeat this for every epitope on the virus!
2. Does **antibody 2** recognize the **influenza virus**. If so, which epitope does it recognize?
3. Now check if **antibody 1** can recognize the **coronavirus**. If it does, which epitope does it recognize?
4. Finally, does **antibody 2** recognize the **coronavirus**? If so, which epitope does it recognize?

The background features a repeating pattern of light gray Y-shaped antibodies and small, spherical virus particles. The text is centered in a bold, black font.

Hands on Activity

How many different viral spike types (epitopes) can you identify?

- A. 1
- B. 2
- C. 3
- D. 4

Influenza virus



The 3D antibodies in the image are composed of...

- A. Blue heavy chains and white light chains
- B. Blue light chains and white heavy chains



influenza virus

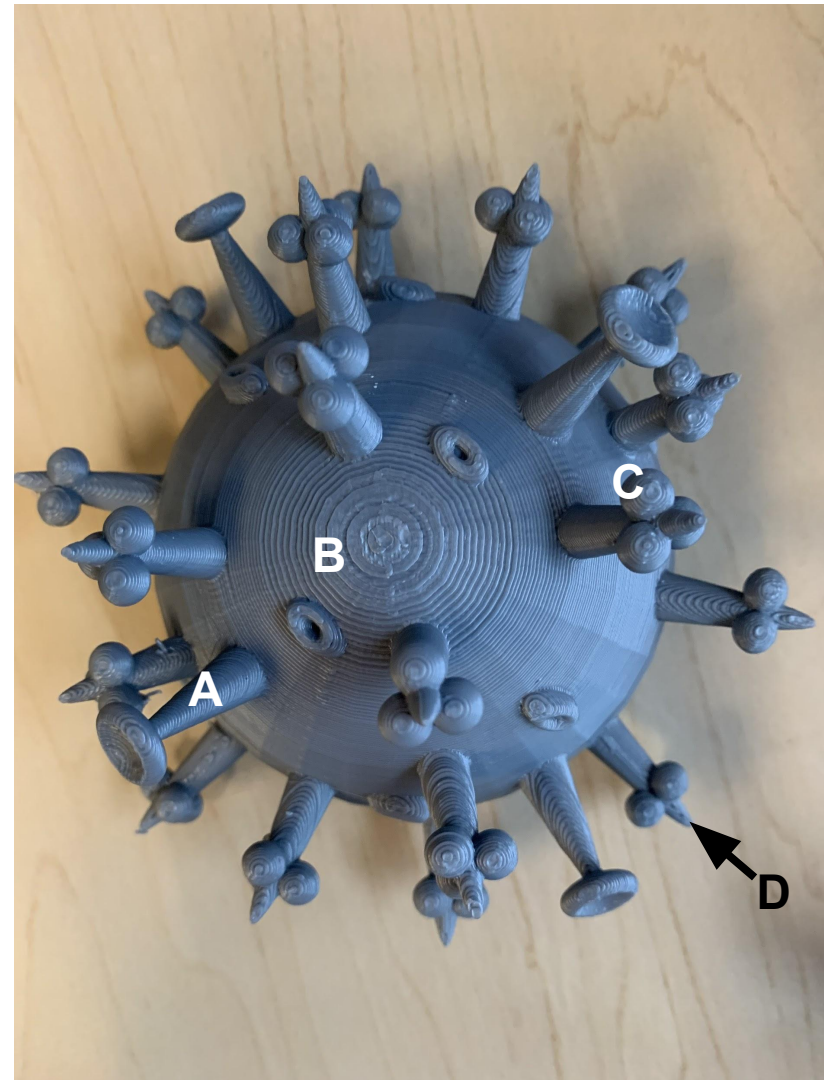
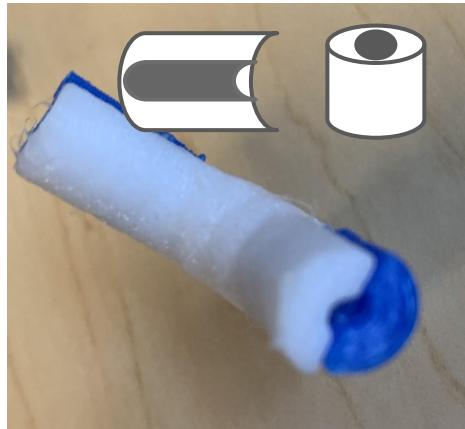


antibodies

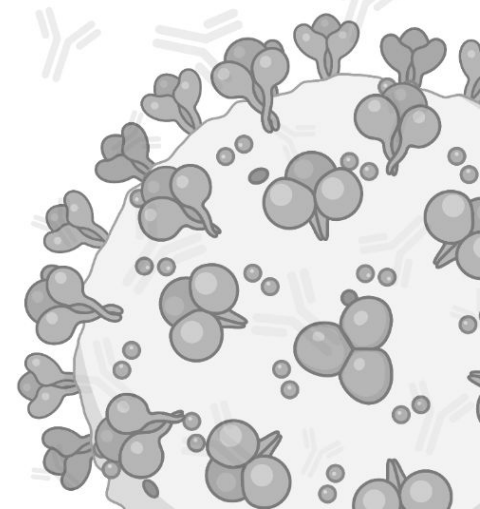
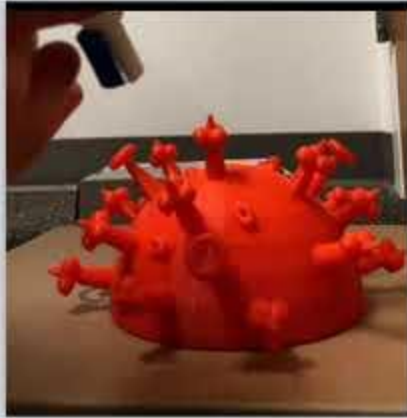


Which epitope does this combination of heavy chain 1 and light chain 1 bind?

- A. A
- B. B
- C. C
- D. D

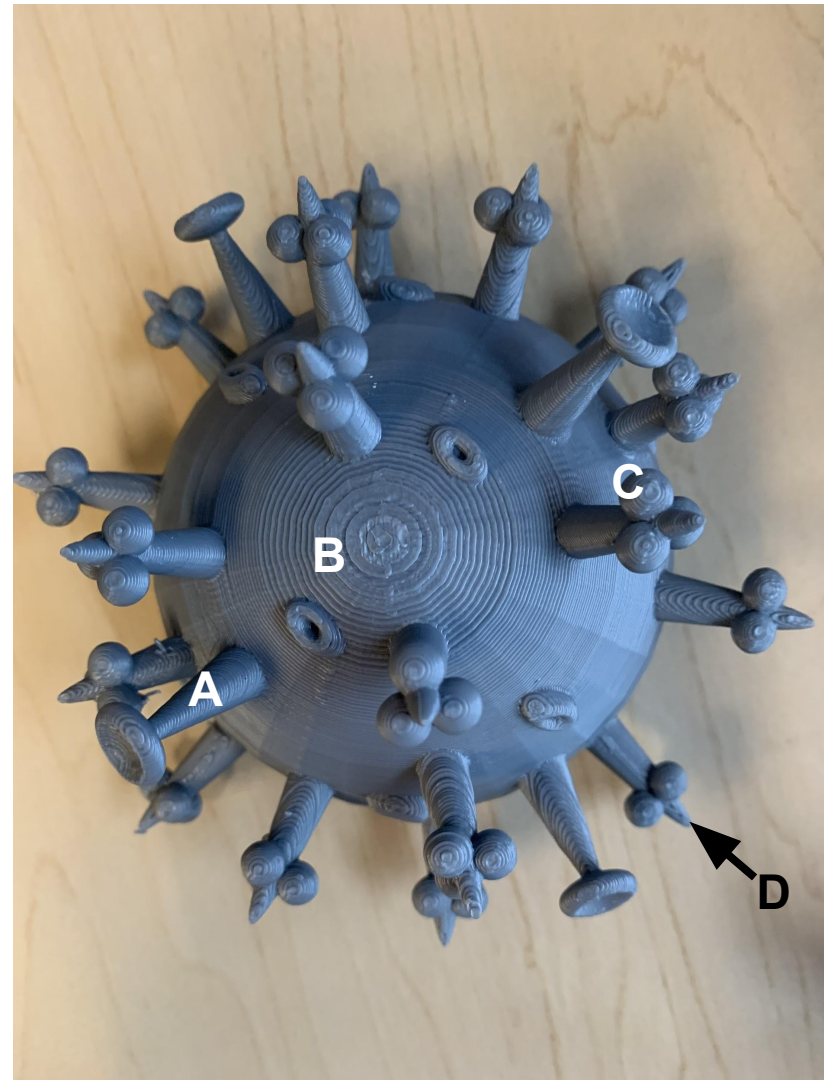
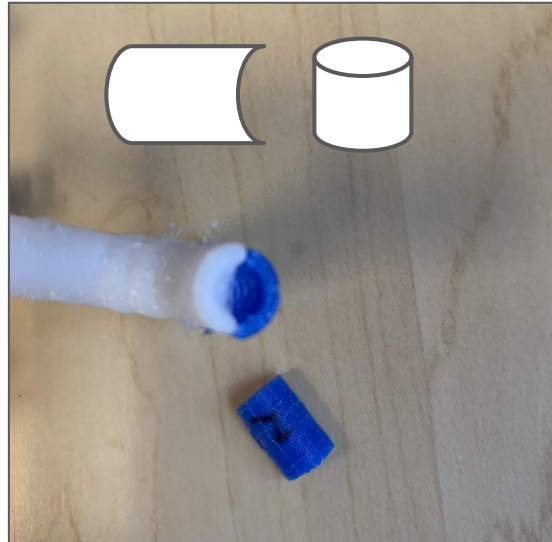


Antibody 1

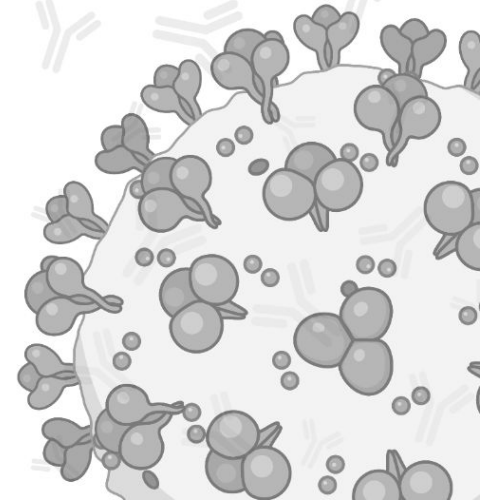
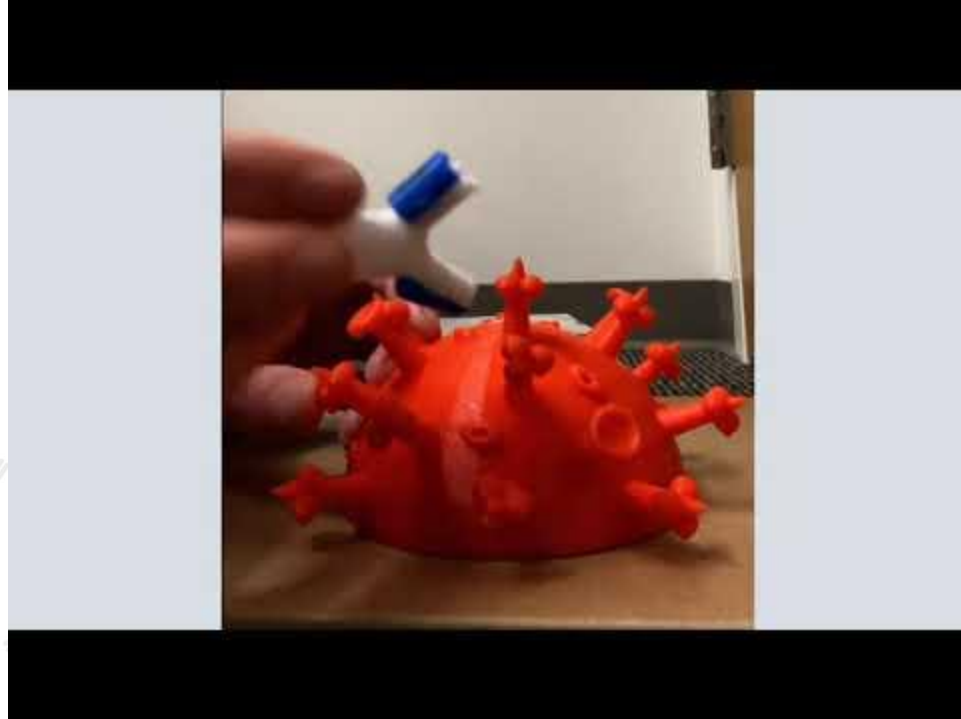
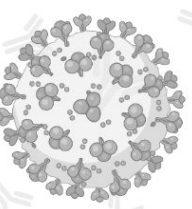


What epitope does this combination of heavy chain 2 and light chain 2 bind?

- A. A
- B. B
- C. C
- D. D
- E. None of these

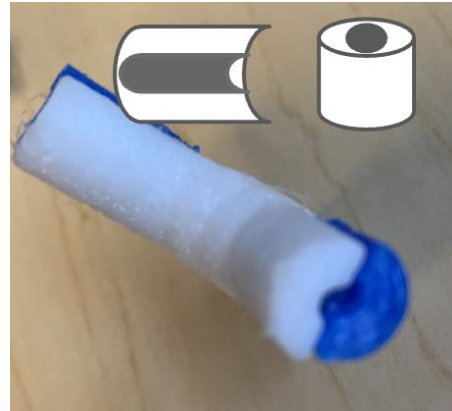


Antibody 2



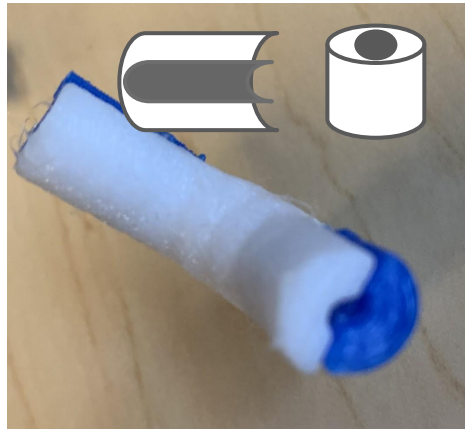
Now create new antibodies by combining heavy chain 1 with light chain 2, and heavy chain 2 with light chain 1. Do the new antibodies bind to the epitopes?

- A. They bind better
- B. They bind more weakly
- C. There is no difference

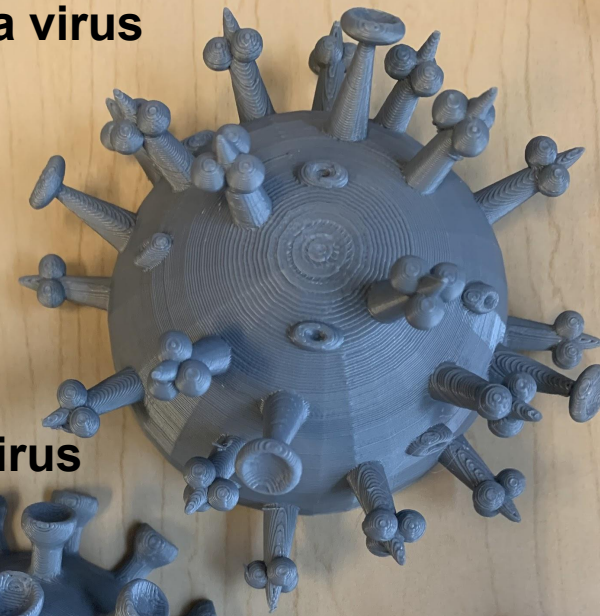


Do either of the original
light/heavy chain combinations
bind antigens on the
coronavirus?

- A. Yes, one binds
- B. Yes, both bind
- C. No, neither bind



influenza virus



coronavirus



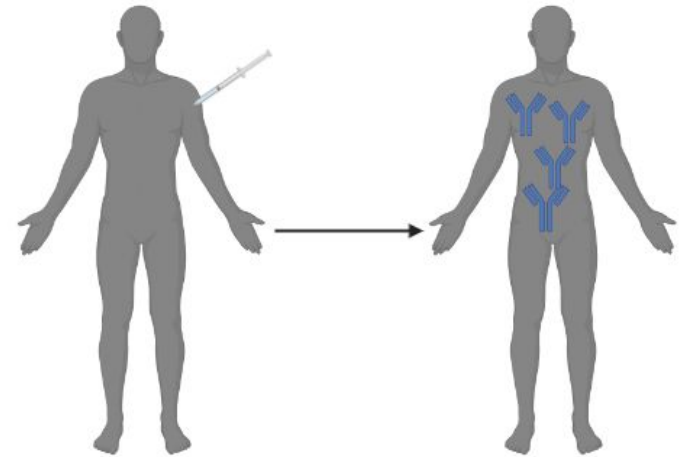
antibodies

Discussion Questions

1. Do all antibodies share the same binding region?
2. When an antibody binds to a virus, is it able to recognize every epitope presented by the virus?
3. Why is binding of an antibody to an epitope important in the immune response?
4. What do vaccines have to do with the production of antibodies?

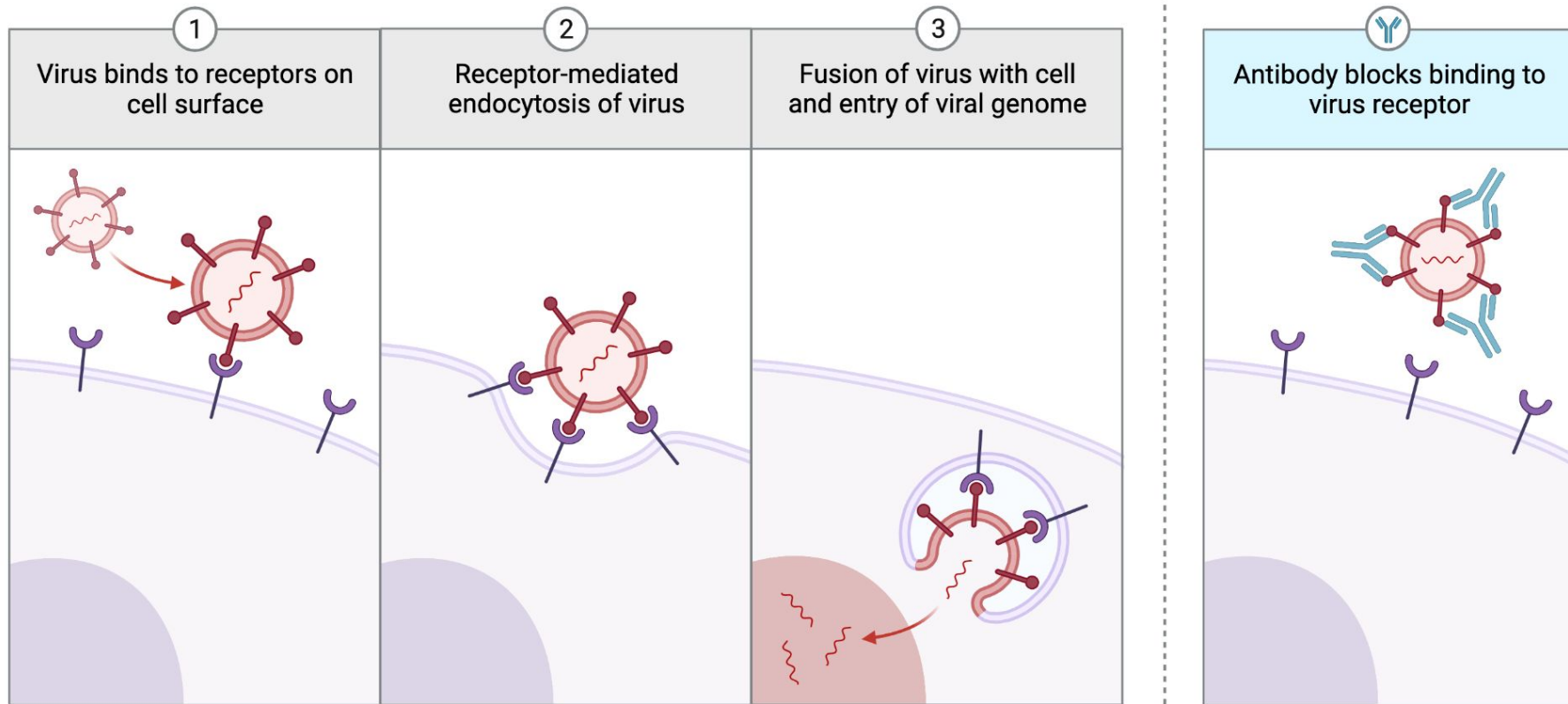
Vaccines and Antibodies

- Your body is unable to recognize pathogens it has not encountered before
- A vaccine exposes your body to a harmless version of the pathogen so your body is able to produce antibodies that recognize it
- If you ever come across the actual pathogen, you now already have antibodies to fight it off



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How do antibodies protect us?

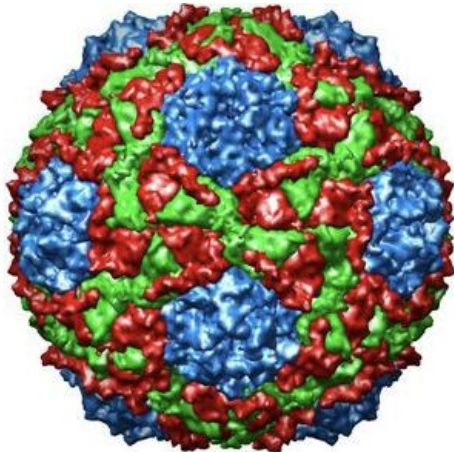


An Actual Virus and Antibody

These are the actual structures of a plant virus and a human antibody.

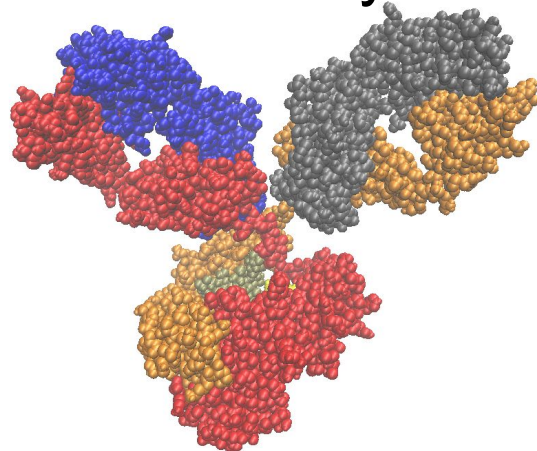
It is not easy to identify the epitopes or determine if an antibody will bind to them!

Plant Virus



Johnson Lab, Scripps University

Antibody



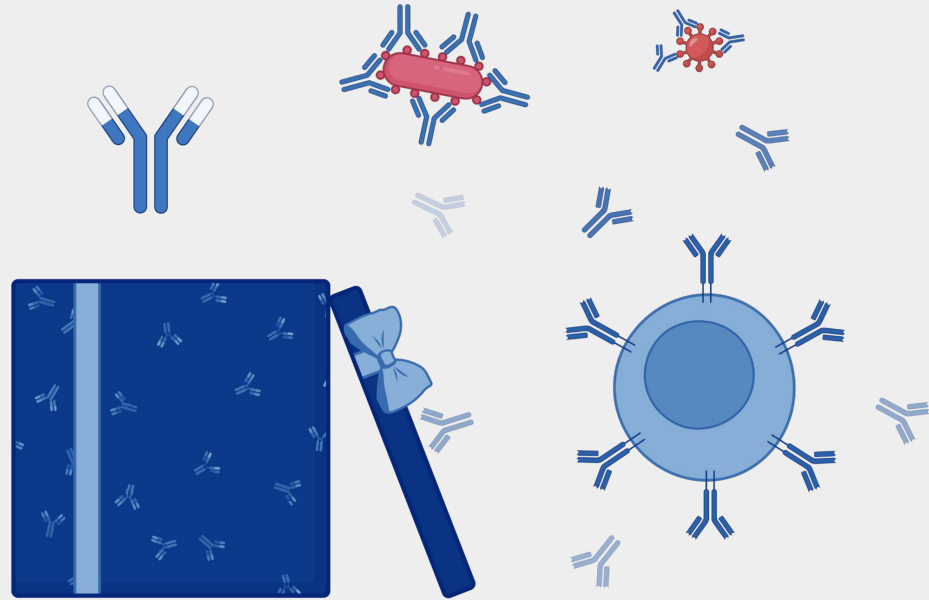
PDB Databank



**What else do you
think antibodies can do?**

Thank you for your time and questions!

Don't hesitate to contact us with
questions!



Credits & Acknowledgements

We would like to give attribution and appreciation to Dr. Claire Gordy, Dr. Melissa Ramirez, Vianey Ramirez and the authors of Suchman et al who helped provide materials and guidance to deliver this lesson on antibodies!

We are also supported by the wonderful educational team in the Biotechnology Program who helped plan and support this work so we can share it with the wonderfully curious students at NCSD.

Lesson was adapted from [Suchman E.L. et.al. \(2018\)](#):

Suchman E.L. et.al. (2018). Modeling Antibody-Epitope Interactions with 3D Printed Kits in Large or Small Lecture Courses. *HAPS Educator* 22 (1): 73-78. doi: 10.21692/haps.2018.009.

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