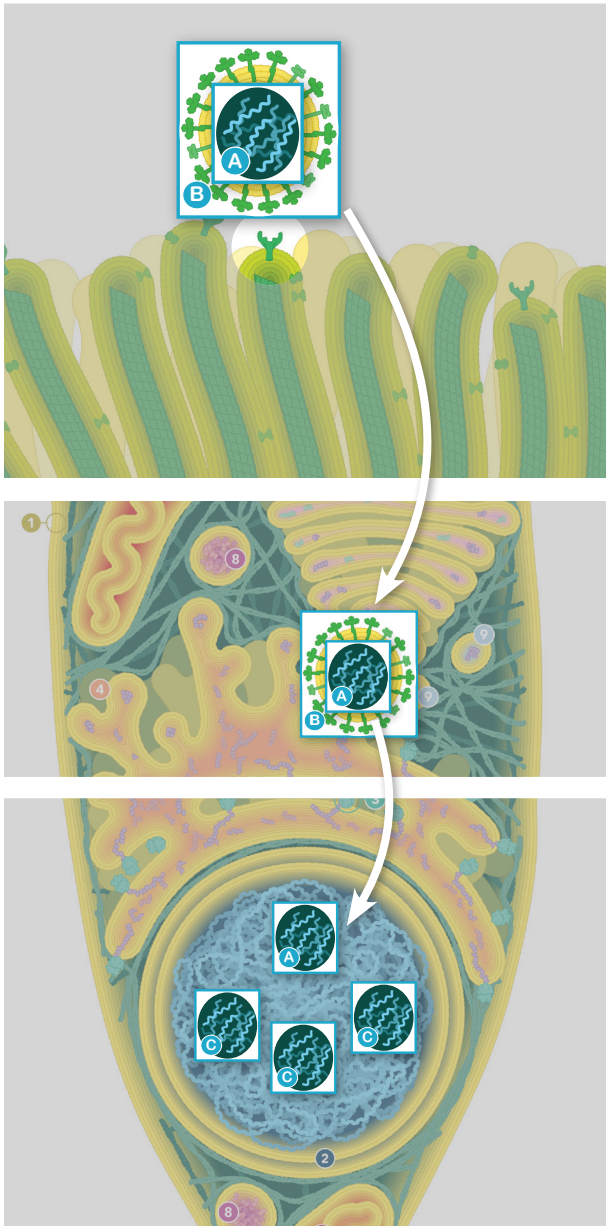
Hijacked Cells! Influenza virus

Modeling Instructions

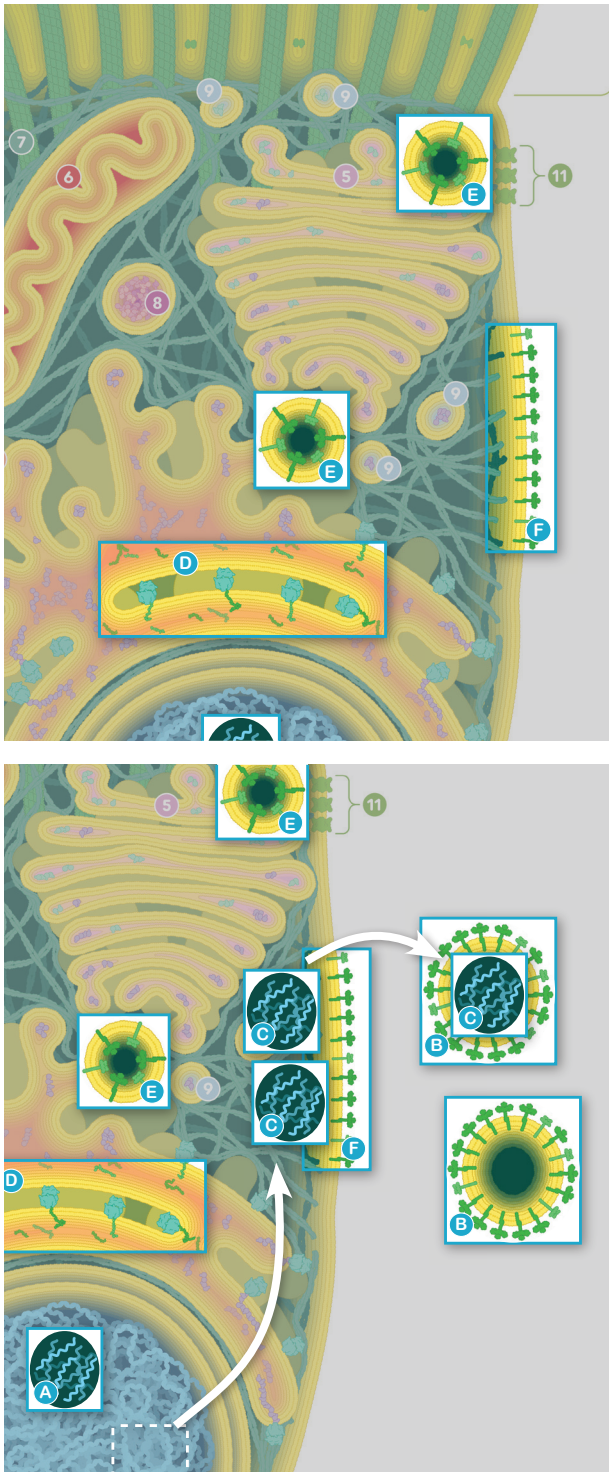
When you have the flu, it means the influenza virus is infecting cells in your respiratory tract. It makes you feel sick because it turns each cell it infects into a virus factory. Then, the copies of virus are shipped off to infect more cells. In this activity, you'll use your Mystery Cell Model and some cut-outs to model what happens when the flu virus infects an airway epithelial cell.

Use Influenza virus cut-outs and Mystery Cell Model A.

The virus & host cell do this:	Do this with your model:
A mature virus is made up of a protein-covered membrane wrapped around a package of the viral genetic information.	**Set-up:** Place a copy of genetic information (A) inside a virus (B).
1. A protein on the surface of the virus attaches to a protein on the host cell membrane. It's like a key in a lock.	Find a protein in the cell membrane that fits with a protein on the virus. Attach the virus to your cell by overlapping the two proteins.
2. The virus enters the cell.	Move the virus (A+B) into your host cell.
3. The virus sheds its protective coat. Its genetic information goes to the cell's nucleus.	Remove (B) from the model. Move the virus' genetic information (A) into the nucleus of your cell. Tape it into place.
4. The host cell makes many copies of the virus' genetic information.	Place the remaining copies of the virus' genetic information (C) in the nucleus of your cell.



5. The host cell reads the viral genes to make messenger molecules. The ribosomes read the messages to build viral proteins.	Add the ribosomes building proteins (D) to your cell's ER. Tape it into place.
6. Packages of new viral proteins go to the Golgi. Here they're tagged and moved in vesicles that go to the cell membrane.	Place vesicles filled with viral proteins (E) between the ER and Golgi, and between the Golgi and cell membrane. Tape them into place.
7. Vesicles, with embedded proteins, fuse with the cell membrane.	Place the membrane with embedded viral proteins (F) on top of the cell membrane. Tape it into place.
8. Viral genetic information joins with viral proteins at the cell membrane.	Move the copies of genetic information (C) to the cell membrane, just beneath the embedded viral proteins (F). Leave (A) in the nucleus.
9. Mature viral particles bud off from the cell membrane.	Put an empty virus (B) outside the cell membrane, near the pieces from step 8. Move the genetic information (C) into the virus.
10. The cell makes many copies of virus, which go on to infect more cells.	Place more viruses with genetic information (B+C) outside the cell.



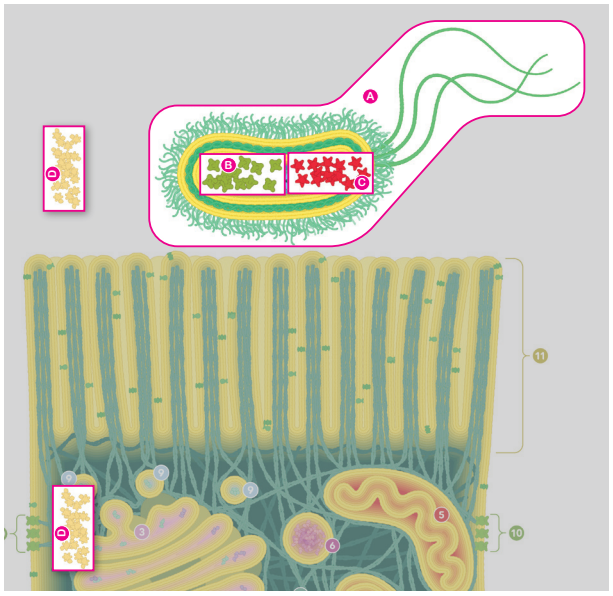
Hijacked Cells! *E. coli* bacteria

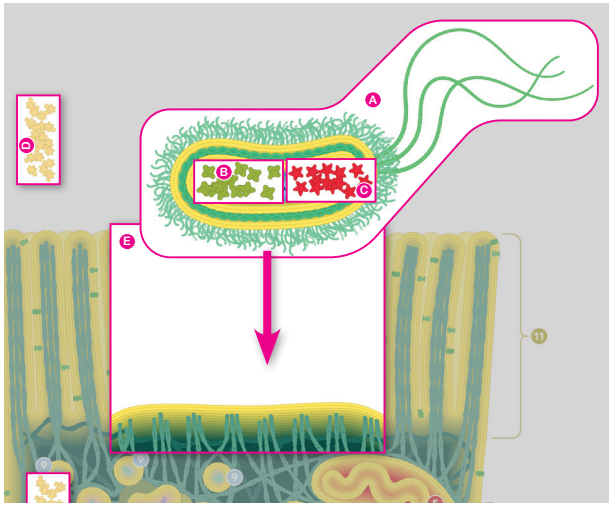
Modeling Instructions

E. coli are bacteria, a type of single-celled organism. Like other living things, *E. coli* need a place where they can obtain nutrients and reproduce. To meet these needs, many *E. coli* live in host organisms. Most *E. coli* are harmless to their hosts. In fact, there are many types living peacefully in your gut right now. But some *E. coli* make you sick. You may have heard about these types in the news. They're a common cause of food poisoning. People get infected from contaminated food or water. In this activity, you'll model what happens when an *E. coli* cell infects an epithelial cell in your small intestine.

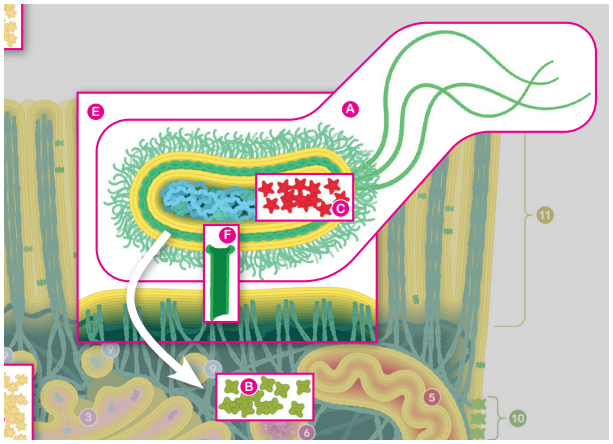
Use *E. coli* bacteria cut-outs and Mystery Cell Model B.

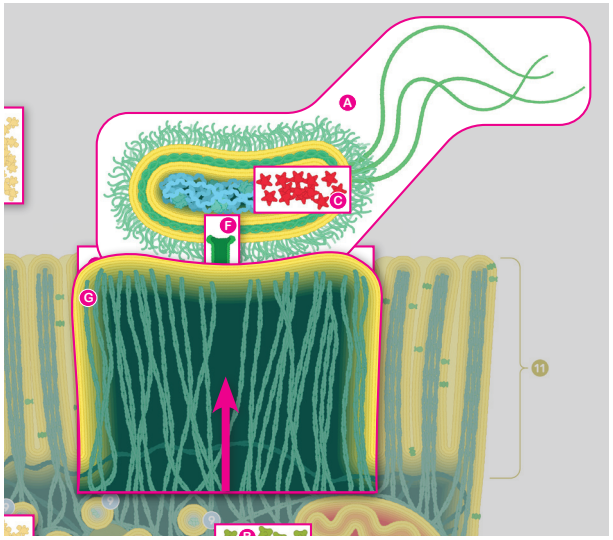
The virus & host cell do this:	Do this with your model:
The bacterium swims through a host's small intestine with a long tail-like structure called a flagellum.	**Set-up:** Place proteins (B) and toxin molecules (C) inside the *E. coli* bacteria (A). Place food molecules (D) inside your cell, and on the outside above the microvilli.
1. The bacterium uses short, bristle-like structures (called pili) to attach to the host cell's membrane.	Park the *E. coli* on top of your epithelial cell's microvilli.
2. The bacterium re-shapes the host cell. Below the bacterium, the microvilli turn into a smooth patch of membrane.	Place the piece of smooth membrane (E) over the microvilli. Tape it in place. Place the *E. coli* against the smooth surface where the microvilli used to be.

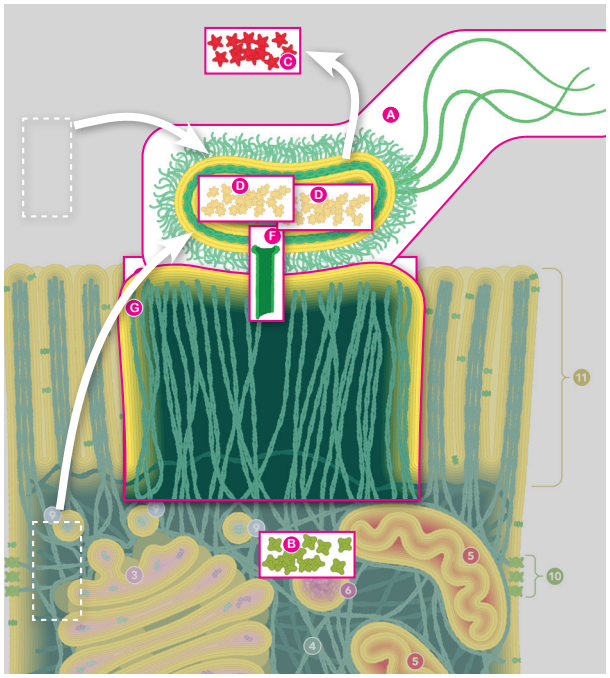




3. The bacterium uses a needle-like structure to poke through the cell membrane.	Place the cut-out that looks like a needle and syringe (F) onto your model with the needle poking into your cell. Tape it to the *E. coli* cell.
4. The bacterium injects some of its proteins into the host cell.	Move the proteins (B) out of the *E. coli* and into the host cell.
5. The bacterial proteins re-shape the host cell's cytoskeleton. The cytoskeleton pushes the bacteria upward, until it's sitting on a structure that looks like a pedestal.	Lay the pedestal (G) on your host cell, just beneath the *E. coli*. Use the pedestal to push the *E. coli* upward. Tape the pedestal (G) in place.
6. *E. coli* steal nutrients from the host. They take partially digested food from the small intestine. They also suck nutrients out of the host cells. This gives the *E. coli* resources to grow and reproduce. The new *E. coli* infect nearby cells.	Move food particles (D) into the *E. coli*.
7. *E. coli* makes a toxin that it releases into the intestine. The toxin reaches other cells in the host. It stops these cells from making their own proteins, eventually killing them.	Move the toxins (C) out of the *E. coli* cell and into the space above.







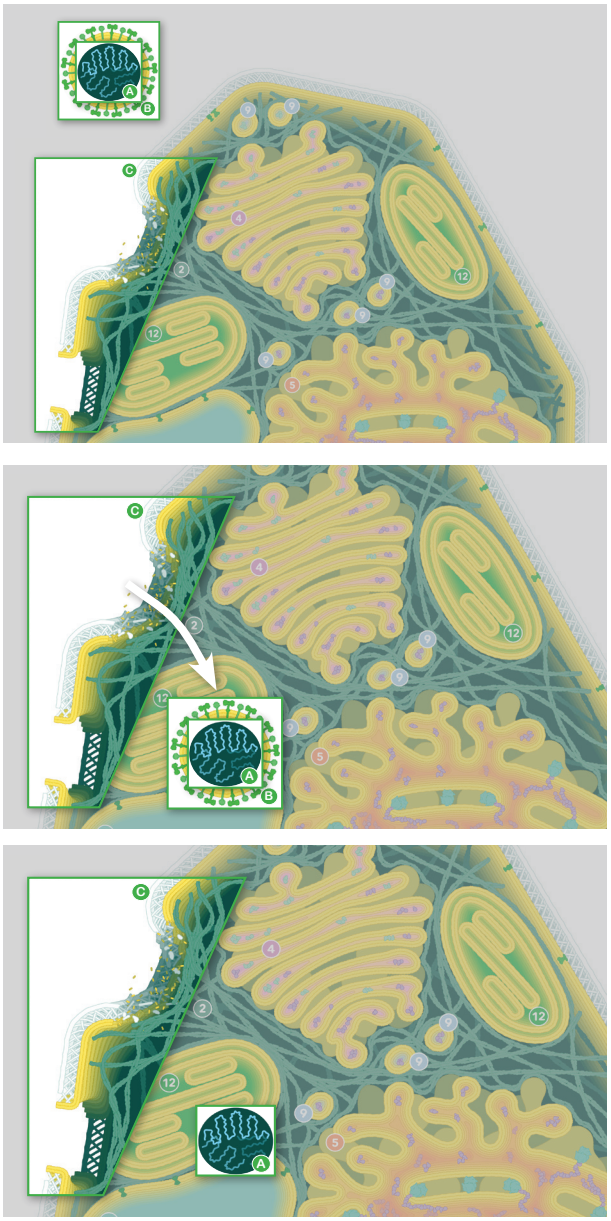
Hijacked Cells! Tomato Spotted Wilt Virus

Modeling Instructions

When tomato spotted wilt virus (TSWV) infects a plant, it causes dark spots, wilt, or even kills the plant. Despite its name, the virus can infect over 1000 different plants—including tomatoes, peppers, watermelon, lettuce, potatoes, papayas, and peanuts. In this activity, you'll model what happens when TSWV attacks a spongy parenchyma cell.

Use Tomato Spotted Wilt Virus cut-outs and Mystery Cell Model C.

The virus & host cell do this:	Do this with your model:
A mature virus is made up of a protein-covered membrane wrapped around a package of the viral genetic information.	**Set-up:** Place a copy of genetic information (A) inside a virus (B).
1. Insects called thrips carry the virus between plants. When they feed, they puncture cell walls.	Lay the piece of damaged cell wall (C) over the healthy cell wall on your host cell. Tape it into place.
2. Virus particles move from the mouth of an infected thrip into the plant cell. *Note: the lower opening is a channel that neighboring cells use to communicate. It's not open to the outside.*	Move the virus cut-out (A+B) into your host cell. It goes in where the cell wall is damaged (upper opening).
3. The virus sheds its protective coat, releasing its genetic information inside the cell.	Remove the virus' coat (B), leaving the exposed genetic information (A) in the cell. Tape (A) into place.



4. The virus reads its own genetic material to make messenger molecules. The messenger molecules attach to the cell's ribosomes, which read them to build viral proteins.	Add the ribosomes building proteins (D) to your cell's ER. Tape it into place.
5. Some of the viral proteins go to the Golgi.	Place vesicles carrying viral proteins (E) between the ER and Golgi. Tape them into place.
6. The cell makes many more copes of the virus' genetic information.	Add the remaining cut-outs of the viral genetic material (F) to your model.
7. Copies of viral genetic information build up between pieces of the Golgi.	Layer the misshapen Golgi (I) over the cell's healthy Golgi. Tape it into place.
8. Golgi membrane with viral proteins in it wraps around viral genetic information. The packets separate from the Golgi.	Place the virus wrapped in stolen Golgi membrane (H) next to your cell's Golgi.
9. Membrane- wrapped viruses merge with the ER. Mature viruses build up in the ER. Thrips that come to feed pick up these viruses.	Layer the virus-filled ER (G) over your model's healthy ER. Tape it into place.
10. Neighboring plant cells are connected with channels that they use to communicate. Unwrapped packages of virus genetic information move through these channels, spreading to neighboring cells.	Move the copies of the virus' genetic information (F) out of the cell through the lower opening in the cell wall.