Hijacked Teams!

Copy Instructions

Make Single-sided Copies

- Cut each page in half to make two cards.
- This document includes 3 sets of cards, marked A, B & C.
- The cards are companions for the infections introduced in Hijacked Cells!

Tips

- Print in color and laminate for re-use.
- Print each set of cards on a different color of paper, to make it easier to keep track of which cards belong together.
**Infleunza vs. Ciliated Epithelial Cell**

**The flu can infect any cell in the airway epithelium.** But it usually can’t infect other types of cells. They lack the molecule the virus uses to get in. A few very nasty strains, like H1N1 “swine” flu, don’t need the molecule to get in, so they can infect more cell types.

Each infected cell can make up to a million copies of flu virus! The copies go into the airway, where they can infect new cells or travel out into the world.

The virus cuts through the mucus lining to get to cells.

**Ciliated epithelial cells**
- Sick or dying cells lose some of their cilia and don’t work well.

**Goblet cells**
- Make extra mucus for more protection.

The immune system kills some infected cells to stop the virus from spreading.

**Airway epithelium**
- Many cells in this tissue die. Dead cells & mucus end up the airway.

**Immune cells** move through, causing swelling and pain in these tissues:

- **Blood vessels** carry immune cells around the body. They crawl through blood vessel walls.

- **Gland tissue** (sometimes it’s infected directly too)

- **Irritated smooth muscle tissue** has a hard time expanding and contracting.

**Affected tissues**

Some effects of the flu come directly from the virus. Others come from the immune system. You need the immune system to fight the flu, but the cells and molecules it releases have other effects.

The bronchus is shown here, but all the organs that form the airway of the respiratory system have these tissue types.
Infleunza vs. Ciliated Epithelial Cell

**Affected respiratory organs**

Many of the effects you feel from the flu—mostly in **respiratory organs**—are a direct result of the infection.

- The **nose, trachea & bronchi** are all infected directly. Usually, the infection starts in your nose and spreads downward.
- They all:
  - Make & expel lots of mucus
  - Are sore and irritated
  - Are swollen, with a narrower path for air

**Brain**

The immune system tells your brain there’s an infection. The brain responds:

- You feel tired so you’ll rest.
- Your body temperature increases, so it’s harder for the virus to replicate.

**Muscles**

Immune molecules cause swelling & pain.

Infleunza vs. Ciliated Epithelial Cell

**Other affected organs**

The flu makes you feel bad all over. Much of what you feel is from your immune system. Parts of your immune system move through the bloodstream around your whole body as they work to kill the virus.
E. coli vs. Intestinal Absorptive Cell

Affected cell types

**Absorptive cells**
When bacteria attach, they destroy microvillii. The cells lose lots of their surface area so they absorb much less liquid and nutrients.

E. coli vs. Intestinal Absorptive Cell

Affected tissues

Some effects of food poisoning come directly from the E. coli. Others come from the immune system. You need the immune system to fight the bacteria, but the cells and molecules it releases have other effects.

**Intestinal epithelium**
Can’t do its job as well, so nutrients & liquid stay inside the intestine.

**Immune cells** move through as they fight the infection and the toxin. They cause swelling and pain in these tissues:

- **Irritated smooth muscle tissue** has a hard time expanding and contracting.
- **Gland tissue**
- **Blood vessels** carry immune cells around the body. They crawl through blood vessel walls.

With a severe infection, toxin goes into **blood vessels** here and travel around the body. The toxin kills cells that line blood vessels.
E. coli vs. Intestinal Absorptive Cell

Affected digestive organs

- Small intestine
  - The contents are very watery, and the small intestine becomes irritated & painful.

- Brain
  - The brain has lots of blood vessels that deliver oxygen and nutrients. It's rare, but if blood vessels here are damaged, parts of the brain are cut off from the supplies they need. In the worst cases, dead cells form a clot that completely stops blood flow.

- Kidneys
  - Clean waste and extra water from the blood. They have tiny blood vessels that work like filters. Blood vessel cells killed by the toxin can cause clogs. In severe cases, the kidneys can no longer clean the blood.

Other affected organs

E. Coli stay in the digestive system. But in severe cases, the toxin it makes enters the blood stream and travel to organs throughout the body.
Tomato spotted wilt virus also infects tiny flying insects called thrips. They carry the virus from plant to plant. They puncture leaves with their needle-like mouth parts and deliver the virus as they feed.

Tomato spotted wilt virus can infect any cell type in the plant shoot system.

A spongy parenchyma cell is shown here, but they’re all affected the same way.

The cell wall protects against infection. But it’s broken when an infected insect takes a bite of leaf. The virus enters the cell with the insect’s saliva.

The virus damages chloroplasts. Damaged cells make less sugar. Their green color fades.

Having many copies of the virus leaves less room for water in the vacuole. Without pressure from the vacuole, the cells’ shape can collapse.

Once a cell in the plant is infected, virus can move between neighboring cells. It goes through tiny tunnels in the cell wall that cells use to communicate.
**Affected tissues**

Infected cells get soft and they can't do their jobs as well. They eventually die, leaving spots of dead tissue. Some cells are killed by the virus. Others are killed by the plant's immune system to stop the virus from spreading.

- **Epidermal tissue**
  This protective plant “skin” no longer forms a solid barrier. Damage lets water escape the waxy barrier. Leaves dry out.

- **Mesophyll tissue**
  This tissue gets too soft to hold its shape. It also makes less glucose.

- **Vascular tissue**
  As the virus spreads, it makes its way into the vascular tissue. The virus damages the tissue, and tubes no longer carry water and nutrients throughout the leaf. Once in the network of tubes, the virus can travel to other parts of the plant.

- **Leaves**
  Leaves dry out. Misshapen leaves aren't well positioned to collect sunlight. When there's too much damage, entire leaves die.

- **Stems**
  Damaged stems can't support leaves. Tubes in the stems carry virus throughout the plant.

- **Buds**
  The plant’s growth slows as it uses more resources to fight the virus.

**TSWV vs. Spongy Parenchyma Cell**

All organs of the plant shoot system can be infected. Spots of dead spread around the plant. If the virus spreads too far, the plant dies. Young plants are most likely to die, since they're small and the virus can take over quickly.