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# What the flu does to your body, and why it makes you feel so awful

By Laura Haynes  
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*Common symptoms of the flu are congestion, headaches, muscle aches, and other unpleasant sensations. But what exactly does the flu do to your body? And why do you feel so bad? As you read, take notes on how the flu can cause other complications in the body.*

[1] Every year, from 5 to 20 percent of the people in the United States will become infected with influenza virus. An average of 200,000 of these people will require hospitalization and up to 50,000 will die. Older folks over the age of 65 are especially susceptible<sup>1</sup> to influenza infection, since the immune system becomes weaker with age. In addition, older folks are also more susceptible to long-term disability following influenza infection, especially if they are hospitalized.



*"influenza - flu" by Matteo Bagnoli is licensed under CC BY 2.0*

We all know the symptoms of influenza infection include fever, cough, sore throat, muscle aches, headaches and fatigue. But just what causes all the havoc? What is going on in your body as you fight the flu?

I am a researcher who specializes in immunology<sup>2</sup> at the University of Connecticut School of Medicine, and my laboratory focuses on how influenza infection affects the body and how our bodies combat the virus. It's interesting to note that many of the body's defenses that attack the virus also cause many of the symptoms associated with the flu.

## How the flu works its way into your body

Influenza virus causes an infection in the respiratory tract, or nose, throat and lungs. The virus is inhaled or transmitted, usually via your fingers, to the mucous membranes of the mouth, nose or eyes. It then travels down the respiratory tract and binds to epithelial cells<sup>3</sup> lining the lung airways via specific molecules on the cell surface. Once inside the cells, the virus hijacks the protein manufacturing machinery of the cell to generate its own viral proteins and create more viral particles. Once mature viral particles are produced, they are released from the cell and can then go on to invade adjacent cells.

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1. **Susceptible (adjective):** likely to be influenced or harmed by something  
 2. a branch of medicine and biology that deals with the immune system  
 3. cells on the surfaces of your body, serving as a barrier between the inside and outside of your body

- [5] While this process causes some lung injury, most of the symptoms of the flu are actually caused by the immune response to the virus. The initial immune response involves cells of the body's innate immune system, such as macrophages and neutrophils. These cells express receptors that are able to sense the presence of the virus. They then sound the alarm by producing small hormone-like molecules called cytokines and chemokines. These alert the body that an infection has been established.

Cytokines orchestrate other components of the immune system to appropriately fight the invading virus, while chemokines direct these components to the location of infection. One of the types of cells called into action are T lymphocytes, a type of white blood cell that fights infection. Sometimes, they are even called “soldier” cells. When T cells specifically recognize influenza virus proteins, they then begin to proliferate<sup>4</sup> in the lymph nodes around the lungs and throat. This causes swelling and pain in these lymph nodes.

After a few days, these T cells move to the lungs and begin to kill the virus-infected cells. This process creates a great deal of lung damage similar to bronchitis, which can worsen existing lung disease and make breathing difficult. In addition, the buildup of mucous in the lungs, as a result of this immune response to infection, induces coughing as a reflex to try to clear the airways. Normally, this damage triggered by arrival of T cells in the lungs is reversible in a healthy person, but when it advances, it is bad news and can lead to death.

The proper functioning of influenza-specific T cells is critical for efficient clearance of the virus from the lungs. When T cell function declines, such as with increasing age or during use of immunosuppressive drugs,<sup>5</sup> viral clearance is delayed. This results in a prolonged infection and greater lung damage. This can also set the stage for complications including secondary bacterial pneumonia, which can often be deadly.

## Why your head hurts so much

While the influenza virus is wholly contained in the lungs under normal circumstances, several symptoms of influenza are systemic,<sup>6</sup> including fever, headache, fatigue and muscle aches. In order to properly combat influenza infection, the cytokines and chemokines produced by the innate immune cells in the lungs become systemic — that is, they enter the bloodstream, and contribute to these systemic symptoms. When this happens, a cascade of complicating biological events occur.

- [10] One of the things that happens is that Interleukin-1, an inflammatory type of cytokine, is activated. Interleukin-1 is important for developing the killer T cell response against the virus, but it also affects the part of the brain in the hypothalamus that regulates body temperature, resulting in fever and headaches.

Another important cytokine that fights influenza infection is something called “tumor necrosis factor alpha.” This cytokine can have direct antiviral effects in the lungs, and that’s good. But it can also cause fever and appetite loss, fatigue and weakness during influenza and other types of infection.

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4. to increase rapidly in numbers

5. drugs that suppress an individual's immune response

6. **Systemic (adjective):** relating to a system, especially as opposed to a particular part of that system

## Why your muscles ache

Our research has also uncovered another aspect of how influenza infection affects our bodies.

It is well-known that muscle aches and weakness are prominent symptoms of influenza infection. Our study in an animal model found that influenza infection leads to an increase in the expression of muscle-degrading genes and a decrease in expression of muscle-building genes in skeletal muscles in the legs.

Functionally, influenza infection also hinders walking and leg strength. Importantly, in young individuals, these effects are transient<sup>7</sup> and return to normal once the infection has cleared.

- [15] In contrast, these effects can linger significantly longer in older individuals. This is important, since a decrease in leg stability and strength could result in older folks being more prone to falls during recovery from influenza infection. It could also result in long-term disability and lead to the need for a cane or walker, limiting mobility and independence.

Researchers in my lab think that this impact of influenza infection on muscles is another unintended consequence of the immune response to the virus. We are currently working to determine what specific factors produced during the immune response are responsible for this and if we can find a way to prevent it.

Thus, while you feel miserable when you have an influenza infection, you can rest assured that it is because your body is fighting hard. It's combating the spread of the virus in your lungs and killing infected cells.

*[What the flu does to your body, and why it makes you feel so awful](#) by Laura Haynes, University of Connecticut, February 12, 2018. Copyright (c) The Conversation 2018, CC-BY-ND.*

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7. lasting for only a short time

## Text-Dependent Questions

**Directions:** For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which statement best expresses the central idea of the text?
  - A. The immune system does more harm than good when it's fighting the flu because of the life-threatening symptoms it can cause.
  - B. The influenza virus brings about many uncomfortable sensations in the body as it slowly spreads to more cells.
  - C. Much of the discomfort that people feel when they're infected with influenza virus is from their immune system's attack on the infection.
  - D. While the influenza virus causes painful symptoms throughout the body, the immune system releases cells that soothe the damage that it has been done.
  
2. PART B: Which detail from the text best supports the answer to Part A?
  - A. "Every year, from 5 to 20 percent of the people in the United States will become infected with influenza virus. An average of 200,000 of these people will require hospitalization and up to 50,000 will die." (Paragraph 1)
  - B. "When T cells specifically recognize influenza virus proteins, they then begin to proliferate in the lymph nodes around the lungs and throat. This causes swelling and pain in these lymph nodes." (Paragraph 6)
  - C. "This results in a prolonged infection and greater lung damage. This can also set the stage for complications including secondary bacterial pneumonia, which can often be deadly." (Paragraph 8)
  - D. "Functionally, influenza infection also hinders walking and leg strength. Importantly, in young individuals, these effects are transient and return to normal once the infection was cleared." (Paragraph 14)
  
3. What is the author's main purpose in the text?
  - A. to encourage people to get vaccinated for the influenza virus to avoid the symptoms
  - B. to show how the immune system actually does more damage than the virus itself
  - C. to explain to people that the worse they feel during the flu, the faster they're healing
  - D. to explain why people feel so horrible when they're infected with the influenza virus
  
4. How does paragraph 9 contribute to the development of ideas in the text?
  - A. It shows how the immune system is responsible for symptoms beyond the parts of the body directly affected by the virus.
  - B. It provides readers with all the symptoms that they will likely experience during the flu, improving their ability to recognize it.
  - C. It emphasizes how the influenza virus is capable of spreading to more important areas of the body through the blood stream.
  - D. It shows how the immune system goes overboard when it's fighting an infection, spreading to areas of the body that are healthy.

5. What connection does the author draw between the effects of the influenza virus on the body and a person's age? Cite evidence from the text to support your response.

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