Virus' invasion sets off battle inside the body

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Like a sleeper agent, the flu virus causes its damage from within, turning an organism's cells against itself. A single virus can hijack a healthy cell and transform it into a virus factory, making thousands of copies in a couple of hours. The cell then bursts, allowing the copies to infect other healthy cells and start the process anew.

The body fights back by launching a self-sacrificing counterattack: molecules designed to kill the hijacked cells before the virus does.

The clash between a viral infection and the body's immune defenses is one of nature's most dramatic conflicts, an all-out battle with cells of the lungs, stomach or sinuses as the innocent casualties. Almost always, the immune system wins, successfully vanquishing the virus after three or four days of fever, coughs and aches.

But public health officials and scientists are concerned that with the new strain of swine flu the balance of power may shift enough to put more patients at risk for severe illness.

There is no doubt that this swine flu is novel to humans, a factor that eases its transmission from person to person. The good news is that, despite worrisome early signs from Mexico, the strain appears to be less dangerous than the one that caused a deadly pandemic in 1918.

"At this point, the virus is more like regular influenza and doesn't show signs of changing," said Peter Palese, professor and chair of microbiology at Mount Sinai Medical Center in Chicago and an expert

on the 1918 strain. "Yes, there is always a concern if something new comes about and we don't know exactly how this is playing out, but in essence it is more likely just an additional influenza virus of a common flavor."

Not all flu particles are infectious, but doctors said it takes only a small number to spread infection, whether via a cough on a crowded subway train or an escalator handrail recently touched by a sick person. A single sneeze can contain billions of viruses, said Dr. Vishnu Chundi, chairman of infectious disease for Our Lady of Resurrection Medical Center in Chicago.

"Influenza is very easy to transmit and that's part of the problem," Chundi said. "Sneeze, and the person next to you is likely to catch it."

Yet for an infection to take root, the virus particles need to get past the immune system's gatekeepers: antibodies. Previous flu exposures and vaccinations build a security system that can recognize and attack viruses the body has already seen, said Patrick Wilson, assistant professor of immunology at the University of Chicago.

"It is the antibody that is going to provide a first line of defense," Wilson said. "With that there, the virus will never make it into our bodies. That's the ideal."

But the swine flu circulating now is a virus humans have not seen before. And while some scientists theorize that previous exposure to strains from the same family, called H1N1, may offer limited protection, for the most part the swine flu virus can sneak untouched through the antibody grid.

From there, the virus is free to pursue its goal: multiplying as swiftly as possible.

"A virus is like a blueprint and a cell is like a factory," said Dr. Kenneth Alexander, chief of pediatric infectious diseases at Comer Children's Hospital at University of Chicago. "The virus carries in its own blueprints and says to the cell: Make this."

The presence of the virus, as well as the husks of cells left by the replication process, alerts the immune system that something is wrong. The body sends out an alarm in the form of molecules called cytokines and recruits attackers called T-cells to kill infected cells before they release their toxic cargo.

These defenses come with a cost. Most of the symptoms we attribute to a flu virus are actually the result of the body's defensive maneuvers. For example, fever occurs when cytokines tell the brain to raise the body's temperature, which helps the immune system fight its enemies.

"Part of the disease is the damage the virus causes and part of it is the body's response to the virus," Alexander said, comparing the process to firefighters extinguishing a fire and causing water damage in the process.

The very young, elderly or sick may have a weak immune system that is unable to keep up with the virus or allows a second infection to take root, sometimes resulting in death. More than 30,000 Americans a year die from influenza-related illness, according to the Centers for Disease Control and Prevention.

Especially alarming to public health officials are flu strains that kill young adults, as was seen in 1918 and is being reported from Mexico now. In these cases, a person's healthy immune system may overreact to the virus, causing a "cytokine storm" that can cause excessive inflammation in a patient's lungs, leading to death.

"It is almost as though the patient self-destructed," Alexander said.

As scientists unravel the genetic makeup of swine flu strains collected in Mexico, the U.S. and New Zealand, they are relieved to find differences between the 1918 strain and the current strain that suggest a lower potential for severe illness. Some experts suggest the virus may be mutating into a less dangerous form as it spreads.

"It might be losing its steam," said Bellur Prabhakar, professor and head of microbiology and immunology at the University of Illinois at Chicago. "What we're seeing in the United States has us hoping that the pandemic may not be as bad."

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