

WHY YOU NEED A FLU SHOT EVERY YEAR

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ONE VACCINE SHOULD BE ENOUGH... SHOULDN'T IT?

Vaccines have changed the course of human history. They eradicated smallpox, pushed polio to the brink of extinction and provide decades of protection against diseases like measles. They all rely on one remarkable feature of our immune system: memory.

Yet, Influenza has found a way around it.

Every year, millions of people are encouraged to get another flu shot because last year's vaccine potentially no longer confers the same protection. Has the vaccine stopped working? Or has the virus changed? The answer lies in one of influenza's greatest strengths: its extraordinary ability to evolve.

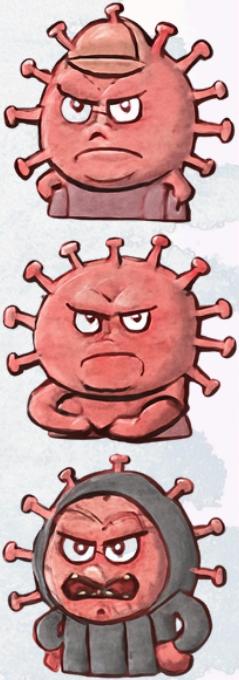
THE BURDEN OF INFLUENZA

For most of us, influenza is an unpleasant week of fever, body aches, relentless coughing and exhaustion before life returns to normal [1]. But for older adults, young children, pregnant women, people with weakened immune systems and those living with chronic illnesses, influenza can become far more serious resulting in more severe symptoms, hospitalization or even death[2]. Each year, seasonal influenza causes an estimated 3–5 million cases of severe illness and up to 650,000 deaths worldwide[3]. Vaccination remains our best weapon against the virus—however it must be updated every single year. The reason is surprisingly simple: influenza is one of nature's greatest shapeshifters.

INFLUENZA'S GREATEST TRICK: ANTIGEN DRIFT

Every time influenza infects a cell, it hijacks the cell's machinery to make thousands of copies of itself. But unlike our own cells, which carefully proofread their DNA for mistakes, influenza has no reliable "spell-check" due to the enzyme RNA dependent RNA polymerase lacking a proofreading ability. As it copies its genetic material, tiny errors (point mutations such as additions, deletions and substitutions) slip in[4].

Most of these genetic mistakes are either harmful to the virus or make no difference, so the viruses carrying them quickly disappear. Occasionally, however, a mutation gives the virus a competitive advantage. It may help the virus avoid recognition by antibodies, infect cells more efficiently or spread more easily between people. Through natural selection, these fitter viruses are more likely to survive, multiply and eventually replace older strains. As these small genetic changes accumulate over time (a process known as antigenic drift) the virus gradually becomes less recognisable to our immune system. This is why last year's flu vaccine becomes less effective over time and why scientists must continually update it to keep pace with an ever-evolving virus.



INFLUENZA'S MUCH MORE DEADLY TRICK: ANTIGEN SHIFT

As remarkable as antigenic drift is, influenza has an even more dramatic evolutionary strategy. Unlike most viruses, which carry their genetic information in one continuous piece, influenza packages its genome into eight separate RNA segments. This unusual design allows something remarkable to happen. When two different influenza viruses infect the same cell, they can exchange entire RNA segments as new viruses are assembled. For this genetic swap to occur, both viruses must infect the same host. Animals such as pigs are often called "mixing vessels" because they can be infected by both human and bird influenza viruses, creating the perfect opportunity for viral gene swapping. This process is dubbed antigenic shift[5] and results in a totally new virus which renders previous vaccines completely useless because of its new combination of surface proteins that our immune system has never encountered before. With little or no pre-existing immunity in the population, the virus can spread rapidly across the globe, increasing the risk of a pandemic. The 2009 H1N1 "swine flu" pandemic is a well-known example of antigenic shift in action.

HOW SCIENTISTS KEEP UP: INFLUENZA SURVEILLANCE

So how do scientists fight a virus that never stops changing?

They don't wait for the flu season to arrive. They track influenza all year round.

Since 1952, the WHO has been conducting worldwide influenza surveillance through the Global Influenza Surveillance and Response System (GISRS). Currently, 192 member states of the WHO have GISRS components that share viral samples and data to benefit one another.[6]

Across the world, hospitals and laboratories collect samples from patients with flu-like illness and analyse how the virus is evolving. Twice a year, experts review this global evidence to predict which influenza strains are most likely to circulate in the coming season. Those predictions guide vaccine manufacturers months before flu season begins.

No prediction is perfect, but without this worldwide collaboration, we would always be fighting yesterday's virus.

Vaccines work because our immune system remembers. Influenza survives because it keeps changing. Every year's flu vaccine represents science's best attempt to stay one step ahead of a virus that refuses to stand still.



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