

The Influenza Virus

Key Facts about Influenza and the Influenza Vaccine

What is Influenza?

The flu is a contagious respiratory illness caused by influenza viruses. It can cause mild to severe illness, and at times can lead to death. Some people, such as older people, young children, and people with certain health conditions, are at high risk for serious flu complications.

Symptoms of Influenza

Symptoms of flu include:

- fever headache muscle aches extreme tiredness dry cough sore throat runny or stuffy nose
- Stomach symptoms, such as nausea, vomiting, and diarrhea, also can occur but are more common in children

Complications of Influenza

Complications of flu can include bacterial pneumonia, dehydration, and worsening of chronic medical conditions, such as congestive heart failure, asthma, or diabetes. Children may get sinus problems and ear infections.

How Influenza Spreads

Flu viruses spread in respiratory droplets caused by coughing and sneezing. They usually spread from person to person, though sometimes people become infected by touching something with flu viruses on it and then touching their mouth or nose. Most healthy adults may be able to infect others beginning 1 day before symptoms develop and up to 5 days after becoming sick. That means that you can pass on the flu to someone else before you know you are sick, as well as while you are sick.

Preventing the Flu: Get Vaccinated

The single best way to prevent the flu is to get a flu vaccination each year between October and December. There are two types of vaccines:

- The "flu shot" – an inactivated vaccine (containing killed virus) that is given with a needle. The flu shot is approved for use in people older than 6 months, including healthy people and people with chronic medical conditions.
- The nasal-spray flu vaccine – a vaccine made with live, weakened flu viruses that do not cause the flu (sometimes called LAIV for "Live Attenuated Influenza Vaccine"). LAIV is approved for use in healthy people 5 years to 49 years of age who are not pregnant.

About two weeks after vaccination, antibodies develop that protect against influenza virus infection. Note that flu vaccines will not protect against influenza-like illnesses caused by other viruses.

Treatment of Influenza

Generally, for healthy adults, no specific medical treatment is needed for influenza infection. Rest, drinking a lot of fluids, and treating symptoms and complications as needed is the usual course of treatment.

In addition, four different antiviral medications have now been developed. While Amantadine and Rimantadine are relatively inexpensive and readily available, some influenza strains have become resistant. While there is less resistance to Oseltamavir (Tamiflu[®]) and Zanamavir (Relenza[®]), they are more expensive and less readily available than the older drugs.

Details about the Influenza Virus

The ABCs of influenza viruses

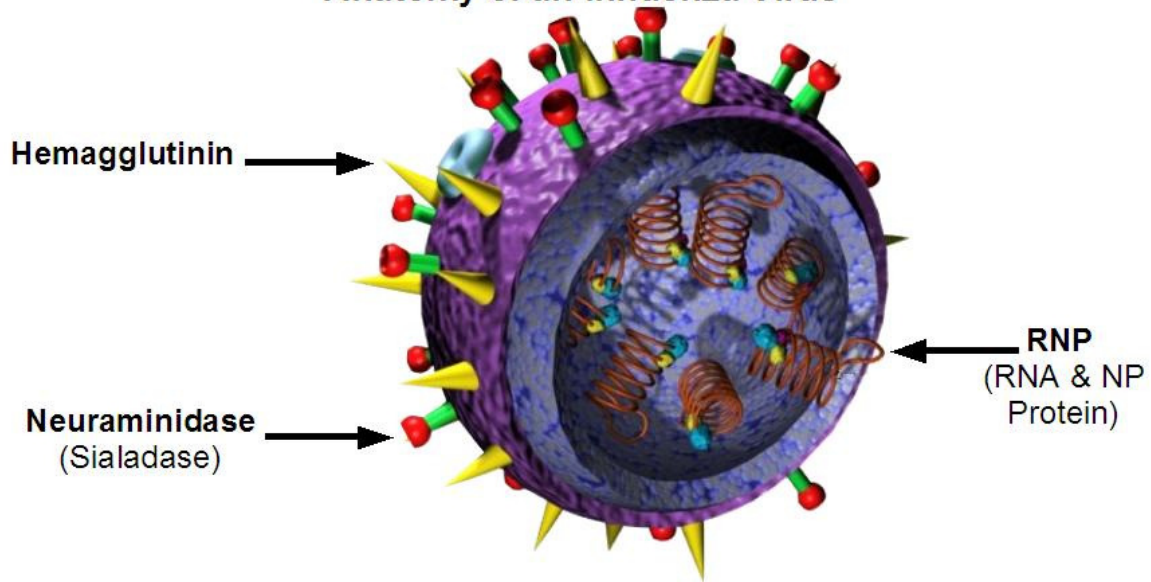
Influenza viruses are single stranded RNA viruses belonging to the family *Orthomyxoviridae*. All influenza viruses are divided into three types — A, B or C — depending on the virus structure. Type A is responsible for lethal influenza pandemics whereas type B causes smaller, localized outbreaks. Less common and more stable than other strains, type C has milder symptoms. Influenza B and C are usually found only in humans. But type A influenza infects both people and animals, including birds, pigs, horses, whales and seals.

Influenza A viruses are divided into subtypes based on the antigenic nature of their surface glycoproteins:

- Hemagglutinin (HA) – the larger protein governs the ability of the virus to bind to sialic acid receptors on the cell membrane
- Neuraminidase (NA) – the smaller protein governs the release of newly formed virus from the cells by cutting the sialic acid receptors on the cell membrane

Fifteen distinct HA subtypes (H1-H15) and nine NA subtypes (N1-N9) exist, but they can combine to form a number of other subtypes, some of which normally are specific to a single species. For example, subtypes H1N1, H1N2 and H1N3 usually cause influenza in humans, whereas H7N7 and H3N8 viruses cause disease in horses. At least 15 flu subtypes affect birds, the most virulent of which is H5N1. Until recently, avian subtypes have rarely been found in humans or in animals other than pigs.

Anatomy of an Influenza Virus



Subtype	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10-15
Human	•	•	•		•		•		•	
Birds	•	•	•	•	•	•	•	•	•	•
Swine	•		•							
Horse			•				•			

Type A influenza viruses are further divided into strains, which are constantly evolving. And it is exactly this — the ability of influenza viruses to change their genetic makeup and to swap genes indiscriminately — that makes them so unpredictable and potentially deadly.

Subtype	Strains/variants	Infected Species
H1N1	PR/8/34	Human
	SW1a/15/30	Swine

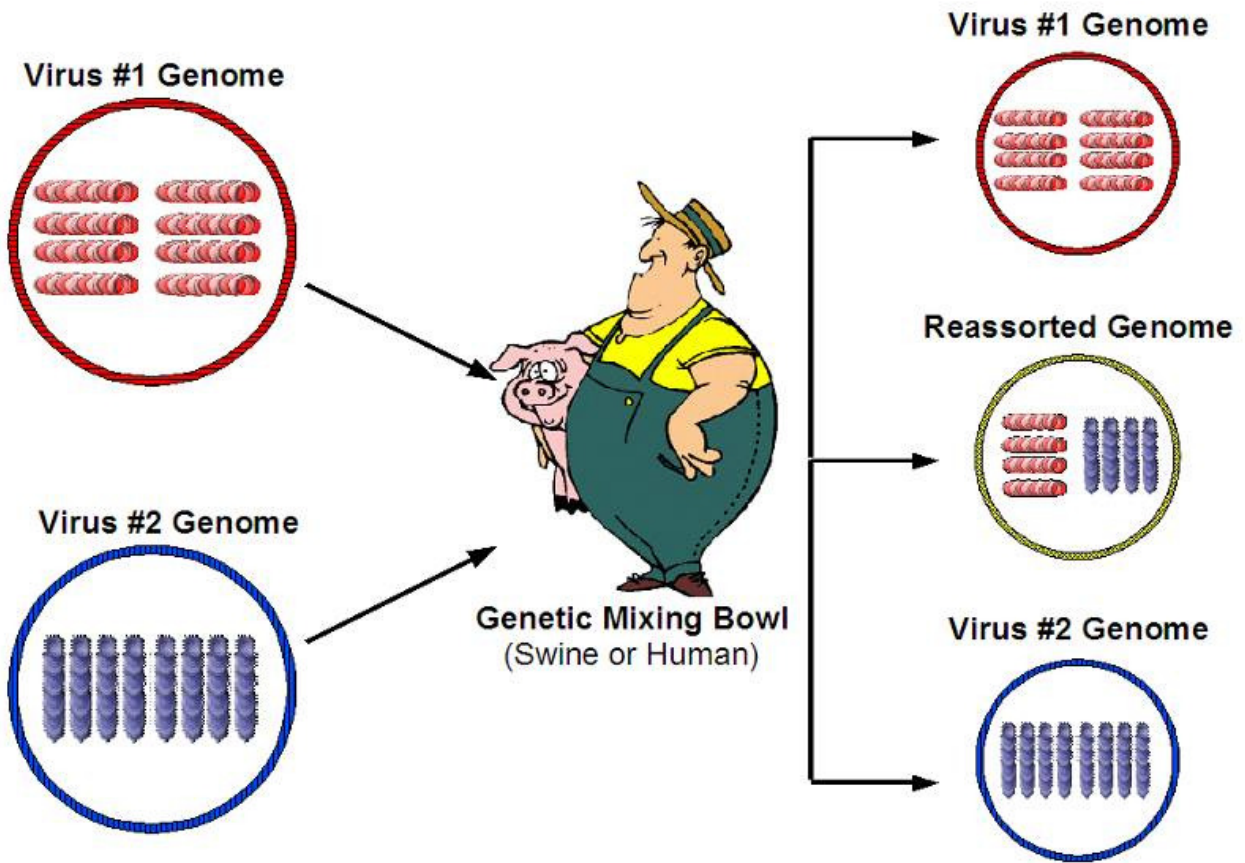
Mutation in Influenza Viruses: Antigenic Drift & Antigenic Shift

All living things change, but influenza A viruses change quickly, constantly and sometimes cataclysmically. This takes place in two ways:

- **Antigenic drift.** These are small, permanent, ongoing alterations in the genetic material of a virus. Because viruses aren't able to repair genetic errors that take place as they reproduce, new strains are continually replacing old ones. Once you have a particular strain of flu, you develop antibodies to it, but those antibodies won't protect you from new strains. In the same way, the flu vaccine you received last season won't ward off this year's virus.
- **Antigenic shift.** This occurs when influenza A subtypes from different species — a bird and a human, for example — trade and merge genes. This reassortment is facilitated by influenza's 8 part segmented genome. The result is an entirely new strain, different from either of the parent viruses. Because no natural immunity to the new strain exists, it can spread quickly, causing widespread illness and death. If one of the original subtypes is a human influenza virus, the new virus has the ability to spread easily from person to person and the potential to become a global epidemic.

It was thought that antigenic shift usually involved humans living in close proximity to both domestic poultry and pigs. Because pigs are susceptible to infection with both avian and mammalian viruses, including human strains, they can serve as a "mixing bowl" for the scrambling of genetic material from human and avian viruses, resulting in the emergence of a novel subtype. Recent events, however, have identified a second possible mechanism. Evidence is mounting that, for at least some of the 15 avian influenza virus subtypes circulating in bird populations, humans themselves can serve as the "mixing bowl".

Antigenic Shift in Influenza



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