How the Flu Virus Can Change: “Drift” and “Shift”

Influenza viruses are constantly changing. They can change in two different ways.

One way they change is called “antigenic drift.” These are small changes in the genes of influenza viruses that happen continually over time as the virus replicates. These small genetic changes usually produce viruses that are pretty closely related to one another, which can be illustrated by their location close together on a phylogenetic tree. Viruses that are closely related to each other usually share the same antigenic properties and an immune system exposed to an similar virus will usually recognize it and respond. (This is sometimes called cross-protection.)

But these small genetic changes can accumulate over time and result in viruses that are antigenically different (further away on the phylogenetic tree). When this happens, the body’s immune system may not recognize those viruses.

This process works as follows: a person infected with a particular flu virus develops antibody against that virus. As antigenic changes accumulate, the antibodies created against the older viruses no longer recognize the “newer” virus, and the person can get sick again. Genetic changes that result in a virus with different antigenic properties is the main reason why people can get the flu more than one time. This is also why the flu vaccine composition must be reviewed each year, and updated as needed to keep up with evolving viruses.

The other type of change is called “antigenic shift.” Antigenic shift is an abrupt, major change in the influenza A viruses, resulting in new hemagglutinin and/or new hemagglutinin and neuraminidase proteins in influenza viruses that infect humans. Shift results in a new influenza A subtype or a virus with a hemagglutinin or a hemagglutinin and neuraminidase combination that has emerged from an animal population that is so different from the same subtype in humans that most people do not have immunity to the new (e.g. novel) virus. Such a “shift” occurred in the spring of 2009, when an H1N1 virus with a new combination of genes emerged to infect people and quickly spread, causing a pandemic. When shift happens, most people have little or no protection against the new virus.

While influenza viruses are changing by antigenic drift all the time, antigenic shift happens only occasionally. Type A viruses undergo both kinds of changes; influenza type B viruses change only by the more gradual process of antigenic drift.