

THE SCIENCE BEHIND THE FLU SHOT

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(1) Every year the medical community urges the public to get the flu shot to prevent people from getting sick with the flu during the flu season. In North America, the flu season typically goes from October to May and peaks in February. Many people choose to get the flu shot but have no idea what it is, how it was created or what it actually does.

(2) The flu is a disease caused by the influenza virus or flu virus for short. A virus is a small but non-living infectious particle. There are many strains of the flu virus. A strain is a variation of the flu virus. These strains all tend to do similar things like give you a runny or stuffed up nose, sore throat, fever, body aches, chills and fatigue.

(3) Some influenza strains are more virulent than others. Virulence determines the ability of the virus to cause disease. A virus with greater virulence is more dangerous. You may catch two different strains of flu virus, but one may be able to make you sicker than the other. The Spanish Flu of 1918 was caused by an extremely virulent strain of the H1N1 influenza virus. Unlike most flu strains that target young, old and sick individuals, the 1918 strain targeted healthy individuals and killed them instead of just giving them the typical flu symptoms. The Spanish flu virus killed 3-5% percent of the world's population (50 million – 100 million people), making it one of the largest infectious disease disasters to date.

(4) Some strains of the flu virus prefer certain hosts over others. A host is the organism that the influenza virus infects. For example, there are different strains of swine flu virus. Most of these strains prefer pigs as hosts. If a cat gets infected by the swine flu virus, it most likely won't get sick because it is not the preferred host. In some cases, the influenza virus can change by mutating and this makes it capable of infecting more than its typical host species. In 2009, there was an outbreak of the swine flu within human populations. When it mutated, swine flu H1N1 developed the ability to jump from its usual pig hosts to human hosts.

(5) Since the influenza virus can mutate, this also allows it to confuse and trick the immune system. Normally, when your body is exposed



to new viruses or bacteria, your immune system will memorize the outside coatings of these microorganisms. Each coating contains a very unique set of proteins called antigens that allow the immune system to recognize the same virus in the future. For example, when children get the chicken pox for the first time, they usually never get it again because their immune systems will be able to memorize the chicken pox virus antigens. If exposed to this virus again in the future, the immune system recognizes the virus immediately and can destroy it before it has a chance to multiply. However, when a virus is capable of mutating, it can change its antigens making it hard for the immune system to recognise it. The chicken pox virus mutates very slowly so the immune system can recognize this virus year after year. The influenza virus, however, mutates quickly and this causes frequent antigens changes, making it difficult for the immune system to detect the virus. This is why a new flu shot needs to be made yearly to deal with the new antigens.

(6) A flu shot is a vaccine that contains antigens from flu virus strains. A vaccine works by “introducing” the immune system to the possible antigens that belong to viruses it has not encountered yet, but may encounter in the future. When the antigens in the vaccine are detected, the immune system will create memory cells which will be able to detect these antigens on real viruses in the future.

(7) The typical flu shot contains vaccines for three strains of influenza virus. Every February, the World Health Organization (WHO) announces the three most likely strains of influenza virus that will hit the public in the upcoming flu season. This will give flu vaccine

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manufacturers several months to create a vaccine with the proper antigens for these three strains. The strains are typically Type A H1N1, Type A H3N2 and a Type B strain. Since there are three strains, this flu shot is called the trivalent vaccine. There is also a quadrivalent vaccine that covers an additional Type B strain. If the WHO correctly predicts which strains will hit the public, the flu shot will be more effective. If they don't predict correctly, then the flu shot is less effective.

(8) The flu vaccine is made by injecting the flu virus into fertilized chicken eggs. Eggs that are 11 to 12 days old are chosen and disinfected.

A small hole is poked into the egg shell and the flu virus strains are injected inside. The hole is then sealed with wax. The virus incubates within the egg at 37°C/99°F for 48 hours during which time the virus will multiply. After 48 hours, the egg is cracked open and the flu virus is obtained in the fluid. The flu virus is then deactivated and the antigens in the viral coating are isolated and purified. The antigens are then used to make the vaccine which is put into an injectable needle or nasal spray. There are also methods to grow viruses in cell cultures that don't involve chicken eggs. This is to prevent some allergic reactions that can occur in people who may be allergic to eggs.

Article Questions

- 1) A _____ is a non-living infectious particle. The different varieties of flu viruses are called _____. The Spanish flu outbreak occurred in _____. The _____ determines which strains of influenza virus will most likely be those that are the most active during the flu season. An _____ is a part of the viral coating that the immune system recognizes. _____ flu shots contain antigens from three strains of flu virus.
- 2) When are you the most likely to get the flu if you live in North America?
- 3) If a certain strain of bacteria was called "highly virulent", what does this mean?
- 4) How was the Spanish flu different from the regular flu?
- 5) What is a host?
- 6) How does your immune system remember a virus that you've been exposed to?
- 7) Why does a new flu shot need to be made each year?
- 8) What host is used to make the flu vaccine and why can this host be a problem for some people?