Dreams of ideal flu vaccine are closer to reality

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Despite modern advances, the half-century-old method of producing flu vaccine still takes six months and requires hundreds of millions of fertilized chicken eggs.

That makes it nearly impossible to act quickly when a deadly new flu strain appears, threatening severe consequences before protection is available.

But change is on the horizon.

Scientists at Stanford University and institutions around the country are researching new ways to boost the immune system and create a more effective vaccine that could be produced faster, without chicken eggs.

Some of the new approaches already are coming to market.

"No one thinks that the standard flu vaccine is a very good vaccine," said Mark Davis, director of Stanford's Institute for Immunity, Transplantation and Infection. "You're making a new drug every year. It's incredibly cumbersome and expensive."

Some researchers are focusing on the as-yet-unattainable ideal: a vaccine that would protect against all forms of the virus, with just one immunization every 10 years or so.

"We could persuade many more people in the United States to get

vaccinated, if indeed we had a better vaccine," said Dr. William Schaffner, chairman of the department of preventive medicine at Vanderbilt University Medical School.

Though egg-based vaccines will remain predominant, the assault on flu has made notable progress since late last year:

In November, the Food and Drug Administration approved Flucelvax, manufactured by Novartis, the first U.S.-licensed flu vaccine that uses cell culture technology. The virus is grown in dog kidney cells, instead of eggs. The cells can be frozen, ready to go quickly into vaccine production if a new virus is discovered. As Schaffner put it: "You don't have to wait for the roosters and hens to do their thing."

Two vaccines will be available next season that protect against four strains of the virus, instead of the standard three: a nasal spray by FluMist and an injectable vaccine by GlaxoSmithKline.

In January, the FDA approved Flublok, by Protein Sciences. It is made in insect cells using a protein from the virus - hemagglutinin, instead of a live virus. Most antibodies that prevent infection are directed against hemagglutinin.

Because the fickle virus is constantly changing, flu protection requires annual immunization with a vaccine designed for the newest strains.

Each February, scientists try to predict the three flu strains that will circulate most widely in the upcoming influenza season. Manufacturers grow those strains in chicken eggs, inactivating or killing the viruses as they make the vaccine.

Some years, including this season, they guess right and the vaccine is a strong match. Yet even with a perfect fit, this year's vaccine is only

about 62 percent effective, health leaders estimate. That's much better than nothing, but not as good as desired.

For decades, flu vaccine production methods changed little.

But in 2009, when the novel H1N1 virus - swine flu - was discovered, the public became aware of how vulnerable we are: The virus grew slowly in eggs and manufacturing a matching vaccine took months.

That, and the discovery of the deadly avian flu virus in 2006, drew an infusion of federal research dollars and a flurry of activity. One major goal: to be able to act swiftly against a virus like the 1918 flu strain, which killed an estimated 50 million people worldwide.

"A couple of weeks could make a big difference in the number of lives saved," said Dr. Cornelia Dekker, medical director of the Stanford-Lucile Packard Children's Hospital vaccine program.

Stanford is one of four sites around the country involved in a clinical trial of a vaccine that uses an experimental DNA approach that does not require eggs or replication of the whole virus.

This vaccine contains only portions of the virus' genetic material. Once injected, it "instructs" human cells to make proteins that elicit an immune response.

Some of Stanford's 89 participants will be immunized with a small, ultrathin needle that injects vaccine into the skin, which is rich in immune cells, instead of deep into a muscle. Researchers want to see if this affects the immune response.

The hope is that the DNA vaccine, either alone or combined with the standard vaccine, will extend immunity beyond the three flu strains in

the traditional shot, moving one step closer to a universal vaccine.

In Davis' lab, Stanford researchers are tackling a broader question: How does the immune system work, and why do some people respond better to vaccines than others? Why is the flu vaccine less effective in seniors, who are among those who need it the most?

"We don't know enough about how even the standard vaccines work," Davis said.

Intriguing clues appear in a study Davis released recently. It had been assumed that the immune system develops a memory of a pathogen - and stands ready to attack it - only after it enters the body.

But surprised researchers discovered that CD4 cells in the blood, which can kick-start the immune response, somehow acquire a memory of dangerous microbes that have never entered the body.

One theory is that this could be a result of exposure to mostly harmless microorganisms in soil and food and on skin, doorknobs, telephones and earbuds. If this is true, it raises questions about the effect of growing up in a squeaky clean, germ-free environment.

"It may even provide an evolutionary clue about why kids eat dirt," Davis said.