

7,707 views | Mar 1, 2018, 09:05am

This Company Is Testing A Flu Vaccine Made In Tobacco -- And Philip Morris Is On Board



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Growing the flu vaccine in tobacco is one of many ideas proposed for improving protection against the virus (Credit: Shutterstock).

In September, just before the start of one of the worst flu seasons on record, a Canadian biotech company called Medicago started a phase 3 clinical trial of its flu vaccine, which it manufactures in tobacco plants. The company hopes to prove that its unusual production method will result in a product that can be churned

out in a fraction of the time it takes to make current vaccines—and that it will provide broader protection, too.

Medicago is one of many companies looking to revolutionize flu vaccines—which, despite many improvements over the years, are frequently hampered by the incredibly wily virus they're designed to thwart. The problem with flu, in a nutshell, is that it rapidly mutates, allowing it transform into subtypes of the virus that the vaccine may not protect against. What's worse, many flu vaccines are grown in eggs, which is not only exceptionally slow, it also increases the propensity of the virus that's used in making the vaccine to mutate, further distancing it from the circulating strains, studies suggest.

No one can say for certain why this year's flu vaccines have been only 25% effective, though FDA Commissioner Scott Gottlieb did say in a statement released Monday that the products were properly formulated to attack the strains that caused most of the reported illnesses. The agency's scientists are launching several studies to try to understand what went wrong, he said, and an advisory committee is meeting today to start the process of selecting the strains that will be contained in next year's vaccine.

“Following that meeting, the FDA will also work to apply all the knowledge that we gain from this year's flu season to ensure that the best possible vaccines are available next season to protect against the flu,” Gottlieb said in the statement.

The scientists at Medicago have set out to show that their technology will result in a vaccine that can recognize and attack circulating flu viruses, even if they mutate. Instead of using live inactivated flu viruses to produce the vaccine—as is done in egg-based systems—Medicago uses “virus-like particles,” which have the structure of the flu virus but not its full genetic code. They believe the particles mobilize special immune cells to eliminate flu-infected cells, regardless of what subtype they may have mutated into.

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But the company also wanted to have the freedom to change the components of the vaccine on short notice, just in case a new strain were to emerge in the middle of flu season, raising the risk of a pandemic. So after years of research, they landed on *Nicotiana benthamiana*, a variety of tobacco species that has a natural ability to make proteins at high speed. Medicago has its production cycle down to about six weeks—far faster than the typical six-month process with egg-based vaccines. The vaccine is produced by introducing genetic material from the flu virus into the plants, which are then incubated for four to 10 days. The plants act like mini-bioreactors, producing the VLPs in their leaves.

Medicago is 40% owned by Philip Morris, which first [invested in the company](#) a decade ago as it searched for ways to diversify beyond the cigarette market. The tobacco giant poured more than \$15 million in the biotech, eventually taking a 40% share. In 2013, [the other 60% of the biotech's shares were purchased](#) by Mitsubishi Tanabe Pharma.

Several other companies are pursuing out-of-the-box ideas for improving flu vaccination. Last summer, Israel-based BiondVax secured a \$22 million loan to begin [late-stage testing of a “universal” vaccine](#) that it hopes to prove will provide broad long-term protection. It contains nine flu “epitopes,” or antigens recognized by the immune system, that the company believes are widely conserved across many strains of the virus. And in January, a spinout from Oxford University called Vaccitech raised \$22 million in a series A financing round [to advance its universal flu vaccine](#), which is designed to recognize proteins on the virus that are prevalent in all strains of influenza A.

While it's too early to predict which technology will prevail in the end, virtually everyone agrees there's an urgent need for a better flu vaccine. During the week

ended February 17—when flu season should have started winding down—[13 children in the U.S. died from symptoms of the virus](#), according to the Centers for Disease Control.

A universal vaccine would be the “holy grail,” says Nathalie Charland, senior director of scientific and medical affairs for Medicago. But she predicts companies trying to develop universal vaccines will need a prohibitive amount of time to prove to regulators that the shots protect patients year after year. Medicago expects to have initial data from its phase 3 trial ready by this fall, she says.

Medicago is based in Quebec City and is making the vaccine for its clinical trials in North Carolina, at a facility filled with tobacco plants. During the phase 3 trial, the vaccine will be compared to a placebo, and the company will be tracking infection rates, measuring the antibody response to the vaccine, and sequencing any viruses that emerge. If all goes well, the company is aiming to launch the vaccine in time for the 2020 flu season. “We see ourselves improving the current version of the flu vaccine. It’s a big unmet need,” Charland says. “We hope we can save lives using a plant that’s had a lot of bad press.”

*I am a science journalist and author who specializes in covering healthcare, pharmaceuticals and biotechnology. I am the author of [Heal: The Vital Role of Dogs in the Search for Cancer Cures](#) (ECW Press 2015) and [Selling the Fountain of Youth](#) (Basic Books 2010). My freelance ... **MORE***

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