Researchers develop mRNA based flu vaccine

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(Phys.org)—A joint research effort by the Friedrich-Loeffler-Institute and pharmaceutical company CureVac, both based in Germany, has resulted in the creation of a new type of flu vaccine. The vaccine, as the team describes in their paper published in the journal *Nature Biotechnology*, relies on the use of Messenger Ribonucleic Acid (mRNA) instead of the cultivation of cultures in chicken eggs, which means it can be created and manufactured in weeks rather than months.

RNA is a molecule that performs various functions in living organisms related to the regulation of expression of genes. mRNA is a type of RNA molecule whose function is to carry genetic information from DNA to the ribosome, which tells cells which proteins to manufacture. Introducing mRNA that has been preprogrammed to specify particular proteins into an animal or person can cause a predictable immune response – in this case targeting an infectious agent such influenza. The researchers report that their designer vaccine has demonstrated an ability to instill protective immunity in mice, ferrets and pigs.

Currently, it takes up to six months to create and manufacture a flu vaccine; cultures of the virus are grown in chicken eggs and once mature are mixed with other ingredients to create a solution that can be injected into a person that causes their immune system to attack if the virus is ever detected in the body. Other new research has focused on cell cultures but that process also takes months. In contrast the new vaccine takes just six weeks to produce and the researchers report that thus far, it has shown itself to be just as effective as traditional vaccines in preventing flu symptoms.

The researchers also report that the vaccine can be easily manufactured in large quantities and unlike other flu vaccines, doesn't require refrigeration. They also noted in addition to providing immunity for averaged age animals, it also worked equally well in both very young and very old mice.

To date, the team has tested the vaccine against several class A flu viruses, which include H1N1pdm09, swine flu and the H5N1 bird flu virus and have found it to be effective against all of them. It is not known yet if the same results might be found with its use in humans, though that the team reports, is the ultimate objective.

More information: Protective efficacy of in vitro synthesized, specific mRNA vaccines against influenza A virus infection, *Nature Biotechnology* (2012) doi:10.1038/nbt.2436

Abstract
Despite substantial improvements, influenza vaccine production—and availability—remain suboptimal. Influenza vaccines based on mRNA may offer a solution as sequence-matched, clinical-grade material could be produced reliably and rapidly in a scalable process, allowing quick response to the emergence of pandemic strains. Here we show that mRNA vaccines induce balanced, long-lived and protective immunity to influenza A virus infections in even very young and very old mice and that the vaccine remains protective upon thermal stress. This vaccine format elicits B and T cell–dependent protection and targets multiple antigens, including the highly conserved viral nucleoprotein, indicating its usefulness as a cross-protective vaccine. In ferrets and pigs, mRNA vaccines induce immunological correlates of protection and protective effects similar to those of a licensed influenza vaccine in pigs. Thus, mRNA vaccines could address substantial medical need in the area of influenza prophylaxis and the broader realm of anti-infective vaccinology.