

Intranasal flu vaccine with nanoparticles offers robust protection, researchers find

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An influenza vaccine administered through the nose and constructed with nanoparticles that enhance immune response offers strong protection against different influenza virus strains, according to

researchers in the Institute for Biomedical Sciences at Georgia State University.

The intranasal vaccine contributed to multifaceted immune responses, leading to robust cross protection against [influenza](#) in mice. The vaccine consists of PEI-HA/CpG [nanoparticles](#). PEI (polyethyleneimine), a robust and versatile delivery system, can simultaneously carry antigens (hemagglutinin, HA) that induce an [immune response](#) in the body, and adjuvants (CpG) that enhance the body's immune response to an antigen for optimal immunoenhancement.

These comprehensive immune responses and cross protection were long lasting, exhibiting defense from [influenza virus](#) over six months after immunization. The findings are published in the journal *ACS Applied Materials & Interfaces*.

Intranasal vaccination is an ideal approach for infectious respiratory diseases such as influenza. Seasonal influenza vaccines generally induce narrow immune responses that rapidly decline, which leaves populations vulnerable to novel influenza strains. Advancements in influenza [vaccine](#) technology are needed to protect against a wide range of influenza viruses. Intranasal vaccination can improve local mucosal immune responses by preventing influenza infection at the portal of [virus](#) entry.

In the influenza virus, HA is a protein that plays a crucial role in the early stages of virus infection. Influenza HA has a head region and stalk region. Current influenza vaccines elicit immune responses against the HA head, but this head region is highly changeable and accounts for lowered efficiency against different strains. The HA stalk region is more conservative across different strains of influenza viruses.

Protein antigens that are administered intranasally are usually less able to provoke an immune response, so adjuvants are needed to have highly

efficient intranasal vaccines. Adjuvants, such as CpG, can enhance and manipulate immune responses, thus improving the potency and breadth of protection.

"The PEI-HA/CpG nanoparticles show good potential as a cross-protective [influenza vaccine](#) candidate," said Dr. Baozhong Wang, corresponding author of the study and a professor in the Institute for Biomedical Sciences at Georgia State. "The combination of PEI and CpG in the PEI-HA/CpG nanoparticle group contributed to the multifaceted immune responses, leading to vigorous cross protection. The incorporation of CpG and antigens into the same nanoparticle enhanced cellular immune responses.

"Our results revealed that the nanoparticles significantly enhanced HA immunogenicity, or the ability to provoke an immune response, providing cross protection against different influenza virus strains. The conserved HA stalk region induced substantial antibodies in the nanoparticle immunization groups."

"Nanoparticle platforms have shown intriguing characteristics and great potentials in the development of next-generation cross-protective influenza vaccines," said Dr. Chunhong Dong, the first author of the study and a postdoctoral fellow in the Institute for Biomedical Sciences. "However, challenges exist to the successful research and development of nanoparticle vaccines. Though no apparent adverse effects were observed in the study, a more comprehensive safety evaluation of the nanoparticle adjuvant system is needed before clinical trials."

More information: Chunhong Dong et al, Polycationic HA/CpG Nanoparticles Induce Cross-Protective Influenza Immunity in Mice, *ACS Applied Materials & Interfaces* (2022). [DOI: 10.1021/acsami.1c19192](https://doi.org/10.1021/acsami.1c19192)

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