Adjuvant-free avian influenza vaccines in the works

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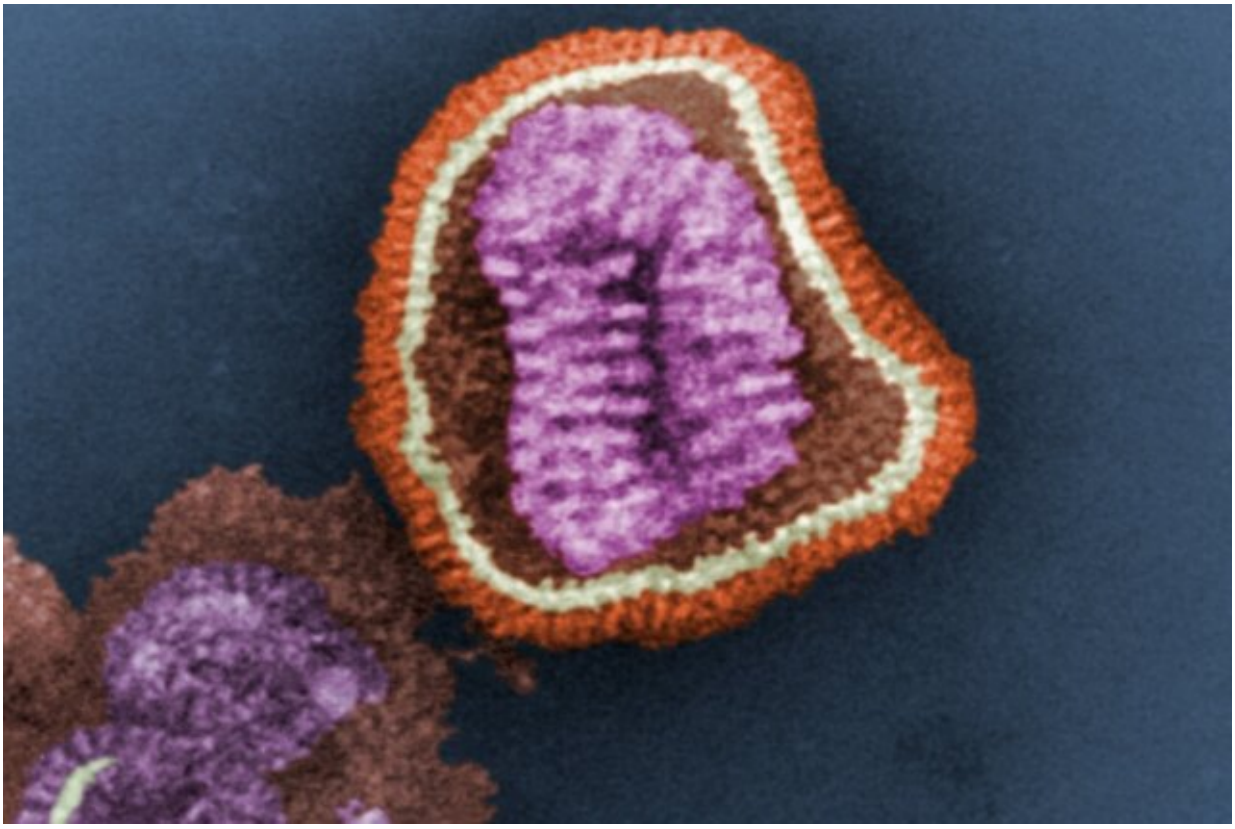


This digitally-colorized transmission electron microscopic image depicts the ultrastructural details of an influenza virus particle. Credit: CDC, Frederick Murphy

Avian influenza, an acute viral infectious disease that occurs in poultry

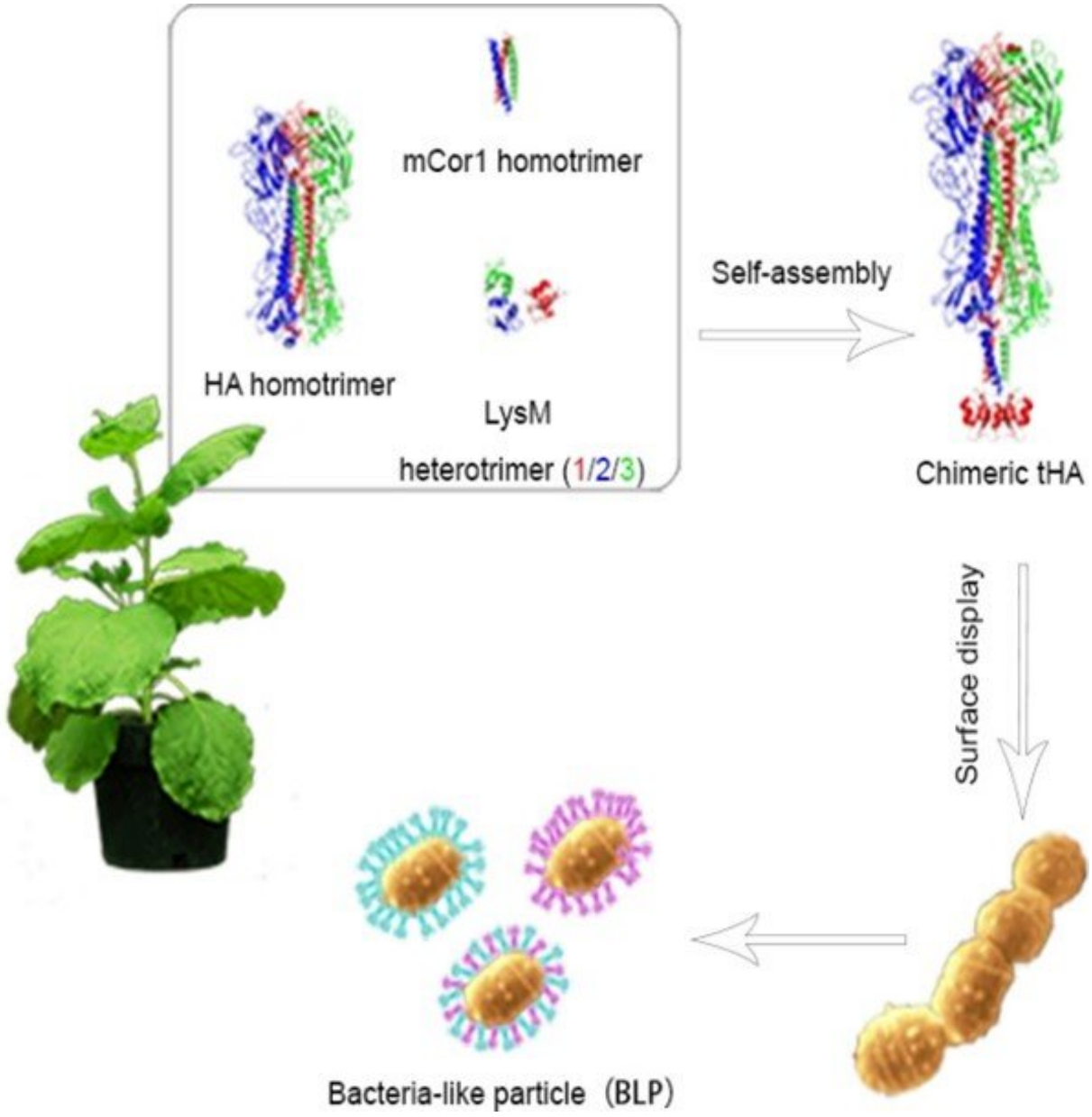
such as chickens, ducks, and migratory birds, has been reported to be transmittable to humans. It is difficult to control because it spreads among migratory birds that travel to China, Europe, and elsewhere. Once it is transmitted, it spreads rapidly. Disposing of infected livestock is not only costly, but also a cause of serious environmental pollution. This is why vaccines against infectious diseases are imperative. To this end, a research team in Korea has recently developed a plant-based, adjuvant-free, recombinant protein vaccine that exhibits a strong immune response.

Professor Inhwan Hwang and Ph.D. candidate Shi-Jian Song of the Department of Life Science at POSTECH—in joint research with Professor Chang Seon Song of Konkuk University, Professor Woe-Yeon Kim of Gyeongsang National University, and Eun-Ju Sohn of Bioapp, Inc.—have developed a multivalent vaccine against a variety of avian influenza viruses that does not require any adjuvant. This research was recently published in *Journal of Integrative Plant Biology*.

Infectious diseases in humans and animals caused by the influenza virus are occurring unpredictably around the world, seriously affecting human health and economic activities like the livestock industry. Various vaccines have been developed and used so far, but concerns have been raised regarding their safety. In particular, recombinant vaccines enjoy high biosafety and specificity, but have the weakness of low immunogenicity and high production cost compared to inactivated virus or live attenuated virus vaccines.

The joint research team focused on developing multivalent vaccines against various avian influenzas based on green vaccine technology. The researchers fabricated a protein trimer (tHA) using plant cells, just like making immune-stimulating drugs from antigenic spikes (haemagglutinin, HA) attached to the influenza virus. By coating this plant-produced tHA on the surface of the inactivated lactococcus

without separation or purification, the researchers succeeded in producing bacteria-like particles (BLPs) that carry antigens.



Schematic diagram of producing the green avian influenza vaccine. Credit: POSTECH

BLPs (tHAs) developed in this way showed strong immune responses in mice and chickens without adjuvants. In addition, injections of a bivalent vaccine with two different formulas led to strong immune response to both antigens. This method shows promise to be produced quickly, economically and safely. In fact, the vaccines from this research were patented and are being commercialized with the goal to advance into China and Southeast Asia.

"Utilizing the green vaccine technology, we have developed a recombinant protein-based vaccine that is safe from exposure to the virus and more," explained Professor Hwang. "Various strains appear at the same time for influenzas, and this multivalent vaccine can combat such strains."

More information: Shi-Jian Song et al, Plant-based, adjuvant-free, potent multivalent vaccines for avian influenza virus via Lactococcus surface display, *Journal of Integrative Plant Biology* (2021). DOI: 10.1111/jipb.13141

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