Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M22-078L
Published: 9/2/2022

## Inventors

**Qiang Chen**
**Haiyan Sun**
**Collin Jugler**
**Huafang Lai**

## Contact

Jovan Heusser
jovan.heusser@skysonginnovations.com

# Method for Producing Self-Replicating, Nucleic Acid-Loaded Virus-Like Particles

-Vaccines are an essential tool in preventing and controlling many diseases. Most approved vaccines are inactivated or live attenuated type, however, alternative platforms like mRNA and virus-like particles (VLPs) are being increasingly explored and approved because they generate potent immune responses with great safety profiles. VLPs are particularly useful because they resemble the size and shape of viruses yet are non-infectious. Further, VLPs are amenable to heterologous sequence insertions allowing the display of an antigen of interest on the surface, broadening the scope of diseases that can be targeted.

Researchers at the Biodesign Institute of Arizona State University have developed a novel self-replicating, nucleic acid-loaded VLP vaccine and drug delivery platform. This plant production-based platform can deliver products for gene therapy and vaccination for multiple different viruses or virus serotypes depending on manipulation of the VLP and DNA replicon within the system. This platform creates a combination vaccine and synergizes the potency of VLP and DNA vaccines. The self-replication mechanism is functional in both plant and mammalian cells.

This novel platform with its use of VLPs which can be nucleic acid-loaded has broad applications in vaccines, drug delivery as well as gene therapy.

Potential Applications

- Vaccines
- Drug delivery (nucleic acids, proteins, CRISPR/Cas9, etc.)
  - Can be optimized to target specific tissue and cell types
- Gene therapy
  - Repress gene expression through RNAi

Benefits and Advantages

- Easily adaptable and versatile vaccine platform
- Replication in mammalian cells can be controlled through manipulation of replicons and separation of replication protein genes from VLP-DNA or RNA area of delivery
- Can develop multivalent vaccines from one VLP
- Vaccine can be made to offer protection from multiple serotypes of the same virus
- Vaccine can be created to offer protection from multiple different viruses in a single dose
- Can integrate shRNA and siRNA into the platform for RNAi gene silencing
- VLP can be optimized to target specific tissue or cell types for delivery
- Greater safety profile vs adenovirus associated platforms because of the inability of plant viruses to infect mammalian cells
  - Minimized off site target effects
- Can be used to package and deliver nucleic acids, protein, antibodies, CRISPR/CAS9 and drugs
- Replication mechanism is functional in both plant and mammalian cells
- Has a mechanism to allow for a limited cycle of replication inside the mammalian host

For more information about the inventor(s) and their research, please see

Dr. Chen's departmental webpage