

A plant-based delivery system for anti-cancer drugs

August 18 2017

An article published in *Experimental Biology and Medicine* (Volume 242, Issue 14, August, 2017) reports that a plant virus-based system can be used to deliver anti-cancer drugs. The study, led by Dr. Nicole Steinmetz in the Department of Biomedical Engineering at the Case Western Reserve University Schools of Engineering and Medicine in Cleveland, OH demonstrates that a complex consisting of tobacco mosaic virus and vcMMAE, a first-line chemotherapy agent for the treatment of lymphoma, can kill cancer cells.

Over 800,000 Americans are living with or in remission from lymphoma, a cancer of the lymph system. Non-Hodgkin's lymphoma (NHL) is the most common type of lymphoma, and patients with this disease have a poor prognosis. The first-line treatment strategy for NHL is chemotherapy. However, this approach is associated with off-target side effects. Nanocarriers are being developed to improve drug delivery and minimize off-target effects associated with [anti-cancer drugs](#). However, the utility of many of these systems in drug delivery may be limited by their spherical shape. Elongated nanomaterials may be superior to their spherical counterparts due to increased target cell interactions and decreased immune cell uptake. Nonetheless, the synthesis of highly uniform elongated nanomaterials is challenging,

The current study used a naturally derived assembly containing components of the plant virus [tobacco mosaic virus](#) (TMV) to overcome issues associated with synthetic systems. TMV was bioconjugated with a valine-citrulline monomethyl auristatin E (vcMMAE) pro-drug used in

treating NHL. The resulting TMVvcMMAE complex entered NHL [cancer cells](#) where it was cleaved to release the active drug and killed the cancer cells. Dr. Steinmetz said "Each platform technology offers unique advantages for drug delivery; plant virus-based nanotechnologies can be manufactured in high yields through molecular farming in plants, the protein-based materials are stable in biological media and the biocompatible nanoscale scaffold offers an unparalleled opportunity for engineering allowing the introduction of various medical cargo. While still early in their development stages, plant virus-based drug delivery systems offer an intriguing platform technology for next-generation drug delivery."

Dr. Steven R. Goodman, Editor-in-Chief of *Experimental Biology and Medicine*, said, "Steinmetz and colleagues have utilized the plant virus TMV as a platform for delivering a valine-citrulline monomethyl auristatin E (vcMMAE) pro-drug into an in vitro model of human B-cell NHL. They observed cell uptake, endolysosomal location and possible cleavage of the prodrug, and cell killing. These studies provide impetus for further testing of this [plant virus drug delivery](#) system for cancer treatment."

More information: Daniel L Kernan et al. Featured Article: Delivery of chemotherapeutic vcMMAE using tobacco mosaic virus nanoparticles, *Experimental Biology and Medicine* (2017). [DOI: 10.1177/1535370217719222](#)

Provided by Society for Experimental Biology and Medicine

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