

# Nanocarriers for Controlled Release of Therapeutics

Tech ID: 2017-4590

## Research Lead:

Daniel Hayes, Ph.D.  
Associate Professor

Department of Biomedical  
Engineering

Huck Institutes of the Life  
Sciences

Materials Research Institute

College of Engineering

## Website:

<https://pennstate.pure.elsevier.com/en/persons/daniel-j-hayes>

## Intellectual Property:

Pending Applications:

- U.S.: 16/630,806
- EU: 18832689.6

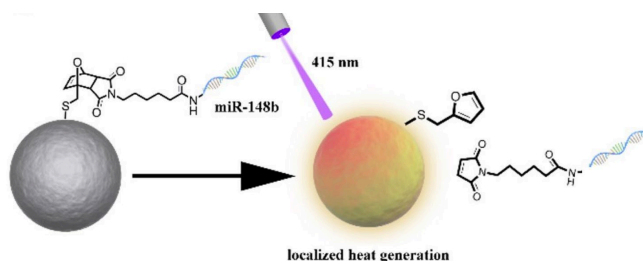
## Licensing Contact:

Dustin Ritter

Office of Technology  
Management

814-863-7070

[dwr18@psu.edu](mailto:dwr18@psu.edu)



## Clinical Need:

Head and neck cancers are common and usually begin in the squamous cells that line the mucosal surfaces of tissues and organs. Patients diagnosed with these cancers are at risk for development of severe side effects from surgical resection, chemotherapeutics and radiation. New minimally invasive approaches to treatment are needed to reduce complications in difficult-to-treat tissues.

## Value Proposition:

To improve outcomes and reduce side effects in cancer patients through application of a light-responsive nanoparticle-based delivery platform that can be photoactivated on demand to provide spatiotemporally controlled release of an siRNA therapeutic.

## Technology Solution:

Penn State College of Engineering researchers have developed a novel stimuli-responsive drug delivery platform to control the release of a therapeutic compound from a nanoparticle using an external stimulus. For example, by applying light at the appropriate time and location to cause local heating around the nanoparticle, a reaction is initiated to release the therapeutic. Proof-of-concept experiments demonstrated successful controlled delivery of siRNA via a light-responsive nanoparticle in a K-ras squamous cell tumor mouse model. A large fraction of nanoparticles were found in the tumor compared to other organs, inducing a significant immune response and resulting in complete tumor reduction in 48 hours.

## Market Opportunity:

Head and neck cancers account for about 4% of all cancers in the U.S. and are the 9th most common malignancy in the world. The global market for head and neck cancer drug sales is expected to increase rapidly with a compound annual growth rate of 20.1%, driven by increased use of immune checkpoint inhibitors (ICIs). While ICIs dominate the drug pipeline for head and neck cancer, there are just a few drugs in development that focus on gene silencing. These therapies may benefit from a targeted delivery mechanism to allow for smaller doses of drugs to achieve their therapeutic aims.

## Path Forward:

NIR activation for deeper tissue penetration will be demonstrated. Researchers will also optimize siRNA sequences and perform testing in a primary tumor model.



**PennState**  
Senior Vice President  
for Research

**Biotech Discovery Day**

June 12, 2020

**invent**  
PENN STATE