# Auburn University

## Innovation Advancement & Commercialization

# RNA-based drug delivery platform


## Contact

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Reference: RNA Drug Delivery


## Status

- U.S. non-provisional (20160082124) patent application has been filed
- Enzyme and temperature mediated release of DNA from a gel system has been demonstrated *in vitro*

## Licensing Opportunities

- This technology is available for exclusive or non-exclusive licensing
- Joint development opportunities include funded research or a joint venture

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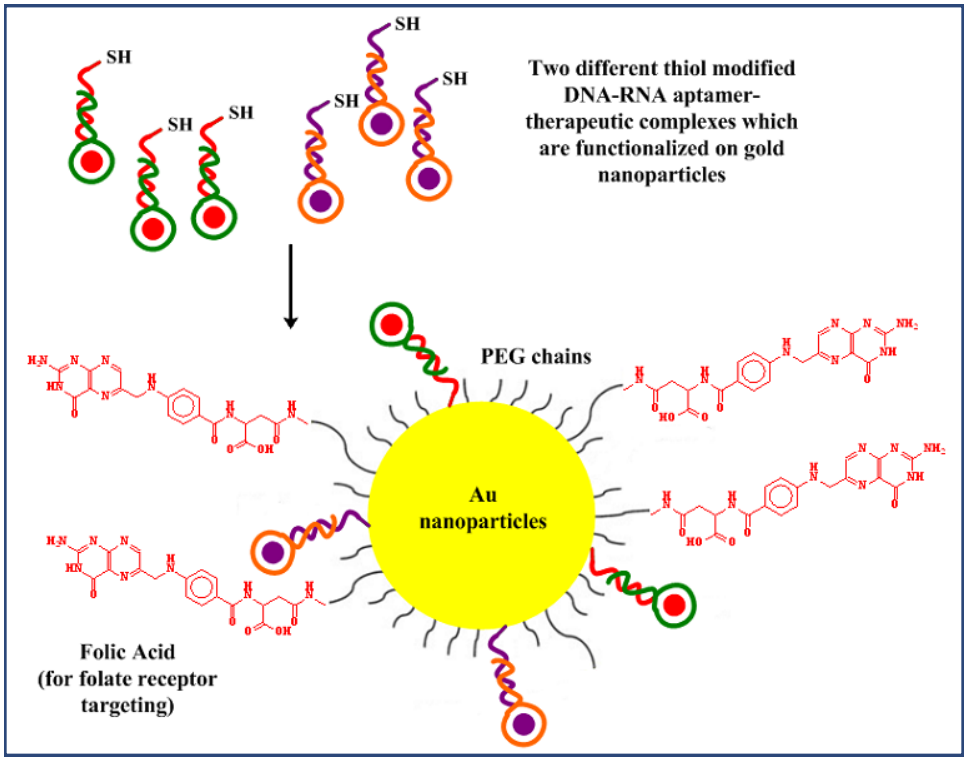
## Overview

Auburn University is seeking a licensee or development partner for a versatile drug delivery platform that can control and modulate the release of a single therapeutic or multiple therapeutics in response to a variety of stimuli. Small molecule drugs and nucleic acid therapeutics such as RNA interference molecules (RNAi) can be incorporated into injectable particulate or implantable drug systems in such a way as to release the drugs under certain conditions. A single formulation can incorporate different drugs that are released at different rates.

## Advantages

- Capable of delivering multiple drugs at differing rates
- Also capable of delivering a single drug at controllable and extended rates
- Release rates and specific release locations can be controlled by a variety of methods
- Can deliver small molecule drugs and/or nucleic acid therapeutics (e.g., RNAi)
- Can be combined with various targeting and passivation technologies
- Uses stabilized, non-immunogenic materials
- Compatible with particulate-based delivery or gel-based implants




***Schematic of proposed nanoparticle multidrug therapeutic platform.***
**Gold nanoparticles can be covalently functionalized with multiple aptamers coupled with two or more therapeutics, which could be released at differing rates. Targeting molecules (e.g., folic acid) and passivation technologies for extending *in vivo* residence time (e.g., PEG) can also be incorporated.**

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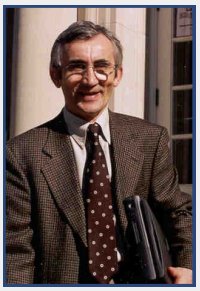
## Inventors



*Dr. Jacek Wower*
Professor
Department of Animal Sciences

*Dr. Mark Byrne*
Associate Professor
Department of Chemical Engineering

*Siddarth Venkatesh*
Doctoral Graduate
Department of Chemical Engineering

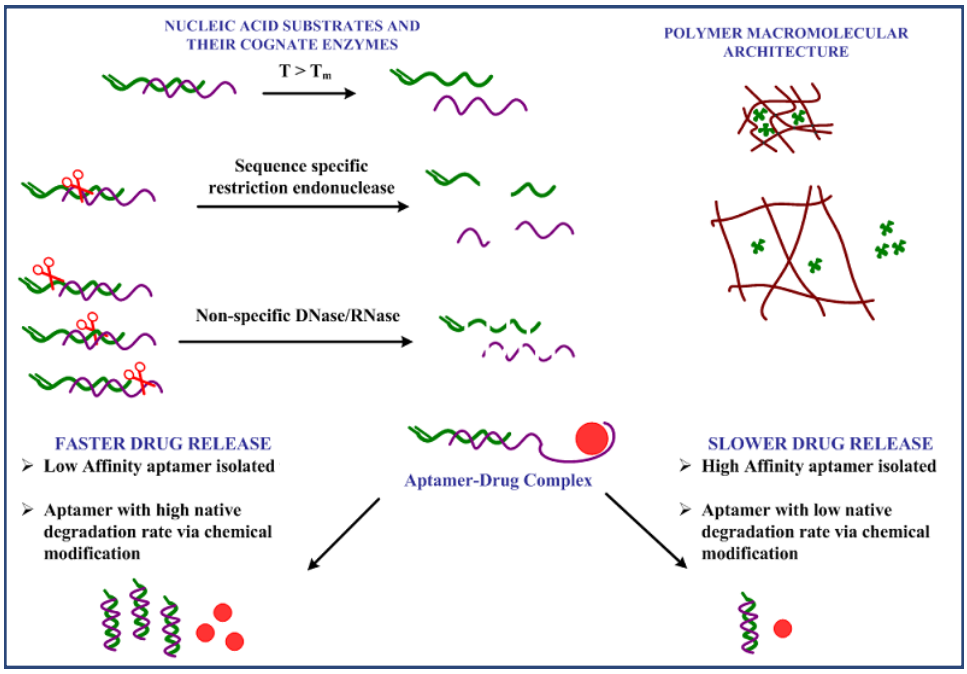
## Description

According to a 2007 NIH study, the design of multifunctional materials for the delivery of multiple drugs is a significant unmet need yet to be realized. This nucleic acid-based system promises to address several of the current needs in drug delivery.

RNA aptamers are oligonucleic acids that bind a specific target molecule, such as a small molecule drug or a specific complimentary strand of RNA or DNA. Through different approaches that allow for mutagenesis, amplification and selection, RNA aptamers specific to certain targets can be obtained. By covalently incorporating these aptamers into delivery constructs (e.g., nanoparticles or hydrogels), the release of single or multiple therapeutics can be exquisitely controlled by a variety of methods. Such methods include:

- *Affinity Modulation* – RNA aptamers with varying affinities can be readily identified using SELEX or other approaches. Aptamers with lower affinities will release their payload more rapidly than those with higher affinities. Aptamer affinity spectrum or distribution can lead to controlled delayed release.
- *Stability Modulation* – Aptamers synthesized *in-vitro* from natural nucleotides will be more susceptible to naturally occurring nucleases than those composed of modified nucleotides, enabling another mechanism to manipulate release rates.
- *Enzymatic Modulation* – Nucleotide sequences recognized by a selected nuclease can be incorporated in the structure of the RNA aptamer, so that release of therapeutics can be tissue or even cell specific.
- *Physical Modulation* – Temperate changes and chelating agents can denature RNA aptamers, releasing the bound therapeutic. Manipulating aptamer responses to those stimuli provides yet another method to control release.

By using different aptamers in the same formulation, multiple drugs can be delivered simultaneously with different release profiles. In addition, the relatively small aptamers have been shown to be non-immunogenic and can also be modified for optimal stability to control degradation by ubiquitous nucleases.

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