Clemson University Research Foundation

Site-specific Therapy for Diseases Affecting Connective Tissues (2017-028)

Nanoparticle therapy that targets damaged elastin and delivers agents for the treatment of connective tissue diseases.

Market Overview

Cardiovascular diseases, including atherosclerosis and other coronary illnesses, are the leading cause of death globally. Current treatments for these conditions such as stents and other surgical procedures present risks of arterial damage, strokes, and potential infections. Additionally, some individuals are altogether ineligible for surgical procedures. Chronic obstructive pulmonary disease (COPD) affects tens of millions of patients worldwide and though anti-inflammatory pharmacological options are available to treat the symptoms, they do not cure the disease. Clemson University researchers have developed an alternative therapy to overcome these challenges. This method has the potential to eliminate the need for invasive surgeries, improve traditional drug therapy by reducing the required dose of an agent, and reduce side effects experienced by the patient. The newly-developed nanoparticles are conjugated with antibodies created against degraded elastin fibers, allowing for the site-specific treatment and imaging of cardiovascular or pulmonary diseases. This method of drug delivery provides targeted, safe doses of therapeutic agents and can be used for a variety of conditions.

Application

Cardiovascular and pulmonary Disease Therapy

Stage of Development

In-vitro and *In-vivo* Animal Studies Complete

Advantages

- Nanoparticles only target damaged elastin fibers, allowing site-specific treatment of diseased connective tissues and sparing healthy connective tissue.
- Delivery of drugs is site-specific, creating a cost-effective approach by lowering the amount and frequency of the dosage required for treatment.
- Nanoparticles protect therapeutic agent, preventing systemic degradation and allowing for reduced toxicity.

Technical Summary

This drug delivery method enhances conventional nanoparticle drug carriers via a novel antibody conjugation. The antibodies are created against sequences of degraded elastin proteins that appear in the extracellular matrix due to the presence of diseased connective tissues. These nanoparticles can carry a variety of therapeutic agents such as anticoagulants, anti-inflammatories, elastin-stabilizing agents, etc. The nanoparticle-antibody complexes allow for site-specific targeting of tissues related to cardiovascular and pulmonary diseases. With these elastin-directed antibodies, any connective tissue would be a candidate for treatment using this method. Consequently, this technology may also be used for skin-care applications. With this in mind, clinicians will be able to tailor the delivery method to the needs of their patients and reduce side effects of systemic delivery procedures.

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	Submitted for filing	N/A	2017-028	Narendra Vyavahare

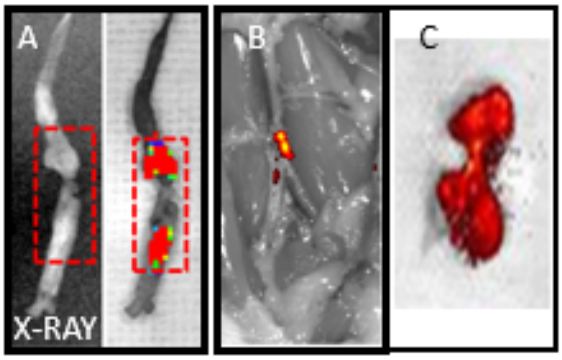
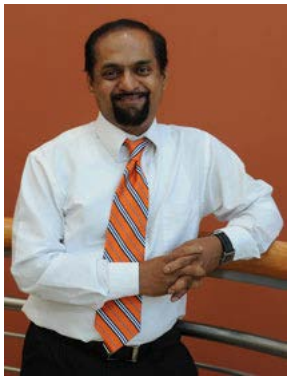


Figure 1: Nanoparticles can be delivered to damaged tissues like calcified aorta (A), aneurysmal aorta (B), and lungs with emphysema in rodents. NPs were loaded with DiR fluorescent red dye to show targeting.

About the Inventor



Dr. Naren Vyavahare is a Hunter Endowed Chair and Professor in the Department of Bioengineering at Clemson University. He earned his Ph.D. in Chemistry from the University of Pune, India. Prior to joining Clemson, Dr. Vyavahare served as a Research Assistant Professor at the University Of Pennsylvania School Of Medicine and the University of Michigan. He holds over 15 issued US and foreign patents and several more in patent pending status. His research interests focus on site-specific to restore extracellular matrix and tissue function in heart valves, aortic aneurysms, vascular calcification, COPD, and skin disorders.

For More Information

To learn more about this technology, please contact:

A. Chris Gesswein

Director of Licensing for Technology Transfer

agesswe@clemson.edu

(864) 656-0797