ADVANCING MEDICINE WITH NANOCARRIERS

With the mindset and discipline of an engineer, Professor Evan Scott seeks to improve drug therapy efficiency and effectiveness for a wide range of diseases.

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> **EVAN SCOTT**
> Kay Davis Professor and Associate Professor of Biomedical Engineering

Tiny, nanometer-scale particles, also known as nanocarriers, could represent the future of medicine. They can be programmed to travel inside the body and target disease sites, delivering high concentrations of drugs to specific areas while minimizing side effects.

Professor Evan Scott sees them as a valuable way to combat all kinds of disease, including cancer, infectious disease, glaucoma, and type 1 diabetes. He has spent much of his career solving medical problems with these tiny nanoparticles, using an engineer's mindset.

"We look at the biology first and ask, 'What is the problem and how do we engineer a nanoparticle to address that?'" says Scott, Kay Davis Professor and associate professor of biomedical engineering at Northwestern Engineering. "Then we try to understand how the immune system responds to that particle."

FROM CANCER TO DRUG DELIVERY

It's a problem-solving path he's followed for 20 years, starting as an undergraduate at Brown University. There, a course in immunology inspired him to learn more about how implanted materials interact with the immune system. That led him to Washington University in St. Louis, where he pursued his PhD, and then to École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland, where he focused on the development of nanoparticles for cancer immunotherapy and HIV vaccines.

Now, that work continues at Northwestern. Recently, he studied the interactions of nanoparticles with blood and how this impacts nanocarrier distributions within the immune system. By engineering nanocarrier surfaces to either stabilize or unravel albumin—a protein in the bloodstream—researchers could tune the nanocarrier's cellular interactions and circulation time.

That could help improve drug specificity, decrease dosage, and minimize adverse outcomes for patients receiving treatments for a variety of diseases, particularly those requiring intravenous drug administration.

A NEW TREATMENT FOR DIABETES

Along with Guillermo Ameer, Daniel Hale Williams Professor of Biomedical Engineering and Surgery, Scott developed a technique for using nanocarriers to re-engineer the commonly used immunosuppressant drug rapamycin to treat type 1 diabetes, potentially limiting or eliminating the need for daily insulin shots.

These nanocarriers may have broad utility for the treatment of a wide range of disorders. Scott is looking to realize that potential, investigating nanocarriers for pain management, endometriosis, and transplant tolerance.

In the near future, Scott hopes to continue his nanotherapy collaboration with Ameer to fight type 1 diabetes. More generally, Scott intends to study the mechanisms behind how nanocarriers target and stimulate cells of the immune system to discover new ways of controlling immune responses in the treatment of disease.

"This is going to be an ongoing field of research that will last for many years," Scott says.

BRIAN SANDALOW

Photography by Matthew Allen