Drug Delivery Research

Researchers at Northeastern are collaborating across disciplines to reimagine drug delivery. The combination of outside-the-box collaborations and innovative technologies to tackle health challenges results in what’s just one example of the University’s excellence in use-inspired research.

Advances in drug delivery are part of Northeastern’s mission to identify solutions to global challenges like health, security, and sustainability.

Northeastern’s Leading Drug Delivery Researchers

Mansoor Amiji, distinguished professor and chair of the department of pharmaceutical sciences

Research focus: Amiji is leading interdisciplinary research into nanotechnology-based methods of drug delivery that could provide breakthroughs in treating diseases like cancer, inflammatory ailments, Alzheimer’s, schizophrenia, and HIV/AIDS.

Recent grants: Amiji is co-investigator on a five-year, $3.2 million Nanomedicine Science and Technology Interdisciplinary Graduate Education and Research Training (IGERT) grant from the National Science Foundation to train doctoral students; a five-year, $2.32 million grant as part of the Cancer Nanotechnology Platform Partnership program; a two-year, $475,000 grant from the National Institute of Neurological Diseases and Stroke to examine a system of delivery that will allow drugs to cross the blood-brain barrier; a two-year, $350,000 grant from the National Cancer Institute to develop more potent therapies for killing cancer cells that become resistant after initial chemotherapeutic treatment.

Vladimir Torchilin, distinguished professor of pharmaceutical sciences, director of the Center for Pharmaceutical Biotechnology and Nanomedicine

Research focus: Torchilin is looking at how drug delivery systems can be improved by pharmaceutical nanotechnology.

Recent grants: $13.5 million from the National Institutes of Health for the Center of Cancer Nanotechnology Excellence; a grant of $1.5 million from the National Institutes of Health for intracellular drug delivery; a $1.36 million grant from the National Institutes of Health’s Cancer Institute to examine new, nanotechnology-based method of drug delivery.

Recent News

Numerous grants are helping to fund health research that harnesses the power of nanotechnology. Pharmaceutical sciences professor Mansoor Amiji, for instance, is leading research into drug delivery that could revolutionize treatment of diseases like cancer, Alzheimer’s, and HIV/AIDS.

The National Institutes of Health (NIH) recently awarded so-called R21 grants to enable the work of Amiji and his collaborators from the Colleges of Science and Engineering.

A two-year, $350,000 grant from the National Cancer Institute will help fund research of nanomedicine techniques for killing cancer cells. Amiji, working with chemistry and chemical biology professors Robert Hanson and Max Diem, will explore whether including the cell killer ceramide as a part of chemotherapy will kill tumor cells that are resistant to other treatments. Using nanocarrier technology, the combination treatment would be delivered directly inside a cancer cell to trigger cell death.

A two-year, $475,000 grant from the National Institute of Neurological Diseases and Stroke was awarded to Amiji and Professor Rebecca Carrier, which will help them to examine a delivery system that will allow drugs to cross the blood-brain barrier.

The process could greatly increase the recovery chances of a patient with Parkinson’s or HIV/AIDS, Amiji said, because “having a system to get these drug therapies to their appropriate place of action is critical.”

The new system could vastly improve the treatment of those diseases that tend to “hide” in the brain, using it as a sanctuary. “If we can take the drug to where the virus is hiding, we will have better therapeutic effects,” said Amiji.
Rebecca Carrier, assistant professor of chemical engineering, principal investigator for the Advanced Drug Delivery Research Lab

**Research focus:** Carrier is leading a program to better understand interactions between biological systems and materials, with a focus on applications in drug delivery and regenerative medicine. Specifically, she conducts mechanistic studies and modeling to aid rational drug delivery system design, and she studies the interactions between biomimetic biomaterials and cells.

**Recent grants:** Carrier is co-investigator on a two-year, $475,000 grant from the National Institute of Neurological Diseases and Stroke to examine a system of delivery that will allow drugs to cross the blood-brain barrier; co-investigator on a two-year, $350,000 grant from the National Cancer Institute to develop more potent therapies for killing cancer cells that become resistant after initial chemotherapeutic treatment.

Graham Jones, chair of the department of chemistry and chemical biology, associate director of Northeastern’s Barnett Institute of Chemical and Biological Analysis

**Research focus:** Jones is investigating targeted ways to deliver antitumor drugs.

**Recent grants:** $1.8 million from the Department of Energy to look for more rapid ways to test drugs at the preclinical stage; $500,000 from the National Institutes of Health to develop a line of chemical agents that target certain tumors that are typically difficult to treat.

Mike Pollastri, associate professor of chemistry and chemical biology

**Research focus:** Pollastri’s primary focus is on discovery of new therapeutics for neglected tropical diseases, such as African sleeping sickness and Chagas disease. His research also centers on the development of new chemical technologies that can enhance and accelerate drug discovery.

**Recent grants:** $2.7 million from the National Institutes of Health to develop a sleeping sickness drug.

Research Highlight

Constantinos Mavroidis, professor of mechanical and industrial engineering, oversees Northeastern’s research in bio-nano robotics, which harnesses the power of peptides, DNA strands, and other naturally occurring “molecular machines.”

One of Mavroidis’s projects involves a V-shaped coiled protein dubbed the nano-tweezer, which opens and closes like tweezer arms when pH levels are altered. Among other uses, it could potentially be used to open and close tiny channels in a drug-delivery device.

Mavroidis and other researchers, including associate chemistry professor David Budil, worked on methods for manipulating the tweezer-like protein. Mavroidis worked on development and design. Budil figured out how to measure the force with which the arms open and close by attaching a magnetic molecule to each arm.