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Immediate Release

Visualizing better cancer treatment

NYU researchers engineer a protein micelle that can be visualized by MRI as it delivers hemotherapeutics

BROOKLYN, New York, Wednesday, March 20, 2019 – A team of researchers from New York University has engineered nanoscale protein micelles capable of both delivering chemotherapeutic drugs and of being tracked by magnetic resonance imaging (MRI).

The innovation falls into the category of "theranostics," meaning that it combines diagnostic capability and drug delivery, allowing researchers to administer therapy while also non-invasively monitoring the therapeutic progress and drastically reducing the need for surgical intervention.

The team is led by NYU Tandon School of Engineering Professor of Chemical and Biomolecular Engineering Jin Kim Montclare, who says: "Think of the analogy of a missile aimed at a target, with the chemotherapeutic drug as the missile and the cancer cells as the target. It's not enough to aim blindly; you need to carefully track the missile's progress and determine to what extent it is effective."

Her research paper, "Protein Engineered Nanoscale Micelles for Dynamic Magnetic Resonance and Therapeutic Drug Delivery," was published in the American Chemical Society journal *ACS Nano*. It was co-authored by Radiology Associate Professor Youssef Wadhghiri at the Center for Advanced Imaging Innovation and Research and the Center for Biomedical Imaging, both at the NYU School of Medicine; Lindsay Hill, a student working with both professors; Priya Katyal, a postdoctoral researcher in Montclare's lab; Minh Hoang and Zakia Youss, both researchers working with Wadhghiri; Joseph Frezzo, Cynthia Xu, and Xuan Xie, all former students of Montclare; and Erika Delgado-Fukushima, an undergraduate student in her lab.

The paper explains that engineered proteins provide an interesting template for designing fluorine-19 (^{19}F) MRI contrast agents, yet progress has been hindered by the unpredictable relaxation properties of fluorine. (MRI relies upon detecting differences in the relaxation rates of the protons of water molecules within tissue, but there are times when the rates do not differ sufficiently between tissue types to produce useful contrast.)

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As a solution, Montclare and her co-authors present the biosynthesis of a protein block copolymer containing amino acid building blocks with ^{19}F, termed "fluorinated thermoresponsive assembled protein" (F-TRAP), which assembles into a nanoscale micelle with noteworthy imaging properties along with the ability to encapsulate and release small therapeutic molecules.

Previously, Montclare had developed a protein-lipid system capable of carrying not only small-molecule therapeutic drugs but nucleic acids for gene therapy at the same time, as a dual payload, in order to treat cancer, diabetes, and other conditions requiring a variety of therapeutic approaches.

"The strides Jin Montclare has made in protein engineering exemplify Tandon and NYU's commitment to collaborative, translational research with the potential to positively impact healthcare for countless patients," said NYU Tandon Dean Jelena Kovačević. "We are proud that she is effectively addressing problems of such great medical and societal importance."

The work on F-TRAP was supported by the National Science Foundation and the National Institutes of Health National Center for Advancing Translational Sciences. The paper is available at https://pubs.acs.org/doi/10.1021/acsnano.8b07481.

About the New York University Tandon School of Engineering

The NYU Tandon School of Engineering dates to 1854, the founding date for both the New York University School of Civil Engineering and Architecture and the Brooklyn Collegiate and Polytechnic Institute (widely known as Brooklyn Poly). A January 2014 merger created a comprehensive school of education and research in engineering and applied sciences, rooted in a tradition of invention and entrepreneurship and dedicated to furthering technology in service to society. In addition to its main location in Brooklyn, NYU Tandon collaborates with other schools within NYU, one of the country's foremost private research universities, and is closely connected to engineering programs at NYU Abu Dhabi and NYU Shanghai. It operates Future Labs focused on start-up businesses in downtown Manhattan and Brooklyn and an award-winning online graduate program. For more information, visit http://engineering.nyu.edu.

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