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Immediate Release

Researchers "tune" gel-forming protein molecules to boost their versatility for medicine applications

BROOKLYN, New York, Tuesday, February 15, 2022 – Self-assembling protein molecules are versatile materials for medical applications because their ability to form gels can be accelerated or retarded by variations in pH, as well as changes in temperature or ionic strength. These biomaterials, responsive to physiological conditions, can therefore be easily adapted for applications where their effectiveness depends on gelation kinetics, such as how quickly and under what stimuli they form gels.

Understanding gelation kinetics for protein hydrogels is important for assessing their utility in medical applications and in the future of biomaterials. For example, fast-gelling systems are clinically useful for in situ gelation for the delivery of drugs or genetic material to target cells or anatomic regions, while slower-gelling systems are applicable for tissue engineering because of their ability to maintain cell viability and their propensity to maintain homogeneity.

To study these dynamics, the NYU Tandon researchers led by Jin Kim Montclare, professor of chemical and biomolecular engineering, used passive microrheology (versus measuring flow behavior through active application of pressure) to extend on earlier research into the phase behavior of gelating protein-based macromolecules. The earlier study investigated different environmental conditions, principally temperature changes — in part to determine the upper temperature point at which the gels disassociate into constituent macromolecules.

In the new study, appearing in the ASC journal *Macromolecules*, the team found, among other findings, that using a pH near the isoelectric point of the protein results in the electrostatic repulsions being minimized, which allows for self-assembly and gelation. They found that the same effect can be induced by increasing the ionic strength to screen any electrostatic repulsions that are present.

"This is important insight in developing gel materials for tissue engineering and drug delivery since the tissue microenvironment has specific pH and ionic strength," said Montclare, who directs the Montclare

Lab at NYU Tandon, and whose study co-authors are Michael Meleties, principal author and Ph.D. candidate; Dustin Britton, a Ph.D. candidate; Priya Katyal, a postdoctoral researcher; Bonnie Lin, an undergraduate research assistant; and collaborators from the Air Force Research Lab Rhett L. Martineau and Maneesh K. Gupta.

She pointed out that microrheology can be done in high throughput to rapidly assess self-assembly/ gelation kinetics of a number of samples in parallel, as opposed to screening individual samples one after the other, which can be time-consuming.

“This can now allow biomaterials researcher to screen a large number of different engineered materials to accelerate biomaterials design,” she said.

The research was supported by the National Science Foundation’s Designing Materials to Revolutionize and Engineer our Future initiative, and its Materials Research Science and Engineering Center.

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. A January 2014 merger created a comprehensive school of education and research in engineering and applied sciences as part of a global university, with close connections to engineering programs at NYU Abu Dhabi and NYU Shanghai. NYU Tandon is rooted in a vibrant tradition of entrepreneurship, intellectual curiosity, and innovative solutions to humanity’s most pressing global challenges. Research at Tandon focuses on vital intersections between communications/IT, cybersecurity, and data science/AI/robotics systems and tools and critical areas of society that they influence, including emerging media, health, sustainability, and urban living. We believe diversity is integral to excellence, and are creating a vibrant, inclusive, and equitable environment for all of our students, faculty and staff. For more information, visit engineering.nyu.edu.

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