NUCLEIC ACID NANOTECHNOLOGY FOR CELL-BASED MANUFACTURING AND BIO-INSPIRED NANOFACTORIES

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Abstract: Structural nucleic acid nanotechnology has the potential to improve cell-based biomanufacturing and enable exciting new synthetic biological manufacturing systems for building nanostructured materials. Using peptide nucleic acid (PNA), a synthetic mimic of DNA that can regulate protein expression, it may be possible to build sensing networks of gene-regulating nanosensors that are responsive to local physical and chemical cues. Thus, feedback loops could be developed to regulate expression as needed in a production process. In addition, PNA has the potential to make those structures inherently enzyme resistant and stable against low salt conditions. Finally, externally controllable nanosystems (in the absence of cells) have the potential to serve as fully-synthetic transport networks between synthesis sites enabling of well-formed products across microns and millimeters. These two cases show how nucleic acid nanotechnology can provide powerful new capabilities for nanomanufacturing.

Bio: Rebecca E. Taylor is an Associate Professor of Mechanical Engineering, and, by courtesy, of Biomedical Engineering and Electrical and Computer Engineering at Carnegie Mellon University (CMU). Her degrees are in Mechanical Engineering with a B.S.E in 2001 from Princeton University and a Ph.D. in 2013 with Prof. Beth Pruitt at Stanford University. During her postdoctoral training she worked in the laboratory of Prof. James Spudich in Biochemistry at the Stanford University School of Medicine. She joined the CMU faculty in 2016 and now combines both microfabrication and nanofabrication to create hybrid top-down and bottom-up fabricated sensors and actuators for nanobiosensing, robotics, and advanced manufacturing applications.