ROBOTICS SEMINAR

FRIDAY, November 1, 2019

6115 GATES HILLMAN CENTER

3:30-4:30 pm

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DNA and gammaPNA in programmable nanomaterials for sensing, robotics and manufacturing

Abstract: When programmable nanomaterials are used in conjunction with rapid microfabrication techniques like two photon polymerization, it becomes possible to rapidly prototype microstructures with nanoscale components. In this research presentation I introduce DNA nanotechnology using a commonly used simple nanotube motif, and I will illustrate how nucleic acid nanotubes can be used in sensing, robotics and advanced manufacturing. In our first example, I will demonstrate how we can modify such a periodic structure to form responsive micron-length nanosprings that can be remotely triggered to change shape on-demand. Next, we will show how functionalized nanotube “micromodules” can be used in hybrid top-down/bottom-up manufacturing of micron-scale articulated magnetic microsystems for robotic applications. This approach enables the formation of microswimmers small enough to swim through human capillaries. Finally, I will present our recent work with gamma peptide nucleic acids (gammaPNAs), in which we developed a PNA-compatible structural motif for programming the growth of micron-scale filamentous structures made entirely from gammaPNA. Unlike the diameter-monodisperse populations of nanotubes formed using analogous DNA approaches, gammaPNA structures can form in organic solvent solutions commonly used in peptide and polymer synthesis appear to grow in bundles. Further, the morphologies of these gammaPNA structures can be tuned by means of solvent solution and by strand substitution with DNA. This approach to gammaPNA nanotechnology may provide a basis for nanofabrication and nanosensing in harsh environments.

Brief Bio: Prof. Rebecca Taylor is currently an assistant professor of Mechanical Engineering, and, by courtesy, of Biomedical Engineering and Electrical and Computer Engineering at Carnegie Mellon University (CMU). Dr. Taylor earned her Ph.D. with Prof. Beth Pruitt in Mechanical Engineering with a Ph.D. minor in Bioengineering from Stanford University in 2013. She received her B.S.E. in Mechanical Engineering and a Certificate in Robotics and Intelligent Systems from Princeton University in 2001. During her Ph.D. studies she developed microfabricated sensors to characterize the electrical and mechanical properties of developing stem cell derived cardiomyocytes. For her postdoctoral studies she turned her focus to the nanoscale, joining Prof. James Spudich’s molecular motors lab the Biochemistry Department at the Stanford University School of Medicine. She now combines both microfabrication and nanofabrication to create hybrid top-down/bottom-up fabricated sensors and actuators for nanobiosensing, robotics, advanced manufacturing applications. Prof. Taylor is the recipient of a NIH F32 NRSA postdoctoral fellowship award and the Air Force Office of Scientific Research Young Investigator Program award.

Host: Matt Travers

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