Translating Molecular Bioengineering from the Lab to the Patient

Abstract:
This talk will highlight recent work from my laboratory that illustrates the clinical translation of molecular bioengineering technologies for point-of-care clinical diagnostics and drug delivery. I will discuss a point-of-care diagnostic that we have developed, in which all reagents are printed and stored on a “non-fouling”—protein and cell resistant—polymer brush. The D⁴ assay, involves four sequential events: (1) Dispense (droplet of blood); (2) Dissolve (printed reagents on chip); (3) Diffuse (across surface), and (4) Detect (binding event). Examples of quantitative dose-response from whole blood and the integration of the assay with a smart phone compatible detector will be presented. In the area of drug delivery, I will highlight two orthogonal designs of genetically encoded peptide polymers—nanoparticles and gels—for drug delivery in two different therapeutic arenas—cancer and type-2 diabetes. In the first design, I will discuss a general method, attachment-triggered self-assembly of recombinant peptide polymers, that packages small hydrophobic molecules into soluble polymer nanoparticles. Because many cancer chemotherapeutics are insoluble small molecules with poor bioavailability, this approach has great utility to increase the solubility, plasma half-life and tumor accumulation of many cancer chemotherapeutics. In the second example, I will discuss an injectable delivery system—Protease Operated Depot (POD)—based on thermally sensitive polypeptides for the sustained and tunable release of peptide drugs from a subcutaneous injection site.

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3pm, refreshments at 2:45
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