277c Applications of Polymeric Materials in Microfluidic Devices

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Scaling down of laboratory workplace into “palm top” devices has shown great potential in developing point of care diagnostic devices, understanding cellular scale phenomena and characterizing various aspects of the “omics” research. Such a system would require a microfluidic based platform in order to manipulate samples, and components that can carry out specific tasks such as directing fluid flow, separation of biomolecules, and detection. We have exploited various properties of polymer materials to create these components. Hard polymers are used to create channels and provide mechanical framework of the microfluidic platform (skeleton). The responsive behavior of soft materials (hydrogels) is used to provide actuation in realizing components such as pump and clutch while the shape changing ability is exploited in making valves and sensors. Various strategies for developing sensors include incorporating sensitive cross-links in polymer-peptide hybrid constructs and coupling with other components to transfer and amplify the signals. In particular we are developing hybrid materials for detecting botulinum neurotoxin. We are also exploring the use of hydrogel nano-environments for use in biomolecular interaction studies via fluorescence resonance energy transfer. A key advantage of using polymer materials for making components is that the properties can be selected and “fine-tuned” as per the requirements by changing the composition of the polymer.