

## Goals and Potential Impact if Successful

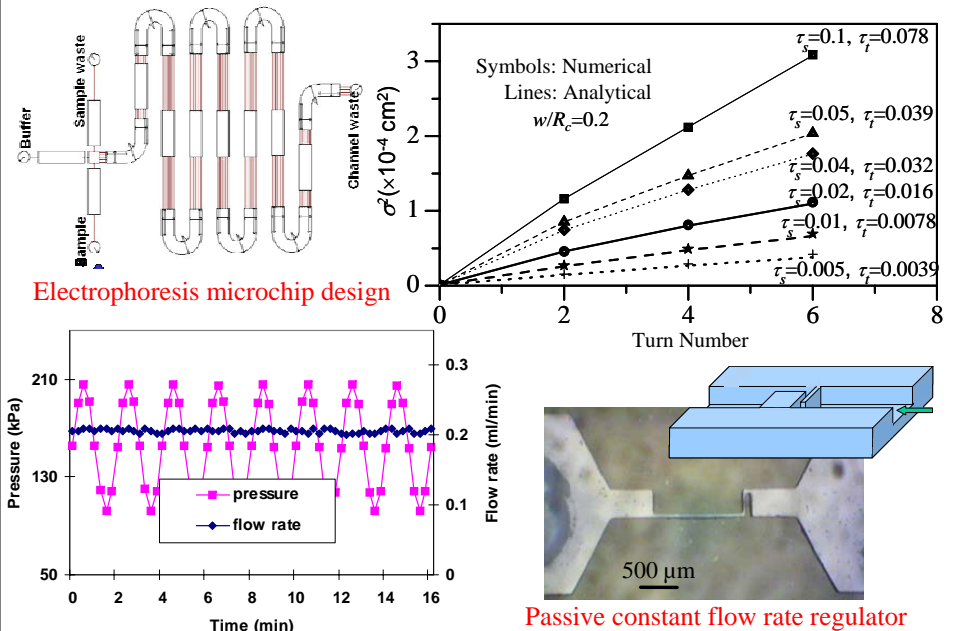
Science and technology for manipulation & characterization of biomolecules in micro/nanofluidic devices and systems:

- Efficient and accurate microfluidic models appropriate for designing complex systems
- Innovative liquid manipulation approaches amenable to lab-on-a-chip integration
- Micro/nanofluidic systems for characterizing fundamental physical properties of biomolecules

These advances will enable/facilitate fundamental understanding of biomolecules in solution, and result in innovative techniques and design methodologies for integrated, complex miniature bioanalytical devices/systems.

## Approach and/or Accomplishments

- Develop parametrized, closed-form microfluidic models by focusing on essential physical characteristics, e.g., models for dispersion of electrophoretic separations in complex microchannels due to diffusion, geometry and Joule heating.
- Exploit unique properties of polymers for innovative micro/nanofluidic manipulation. Examples: compliant polymeric microstructures for passive microfluidic control (e.g., valving, flow and pressure regulation); exploring stimuli-responsive polymers in micro/nanochannels for intelligent micro/nanofluidic manipulation and control.
- Employ microfluidics to characterize physical properties of biological macromolecules, e.g. viscoelastic and thermodynamic properties.



## Bottlenecks and Open Research Questions

- Accurate and efficient models suitable for iterative design at both component and system levels as well as for feedback control. These models are desired to be based on first principles, parametrized, and in closed form.
- System integration: technologies for integrating different functionalities on the same chip; especially methodologies for fluid manipulation and sample preparation that are amenable to system integration.
- Biocompatibility: microfluidic/nanofluidic devices need to work not only in well-controlled environments, but in a way compatible with biologically relevant environments (e.g. human/animal tissue).