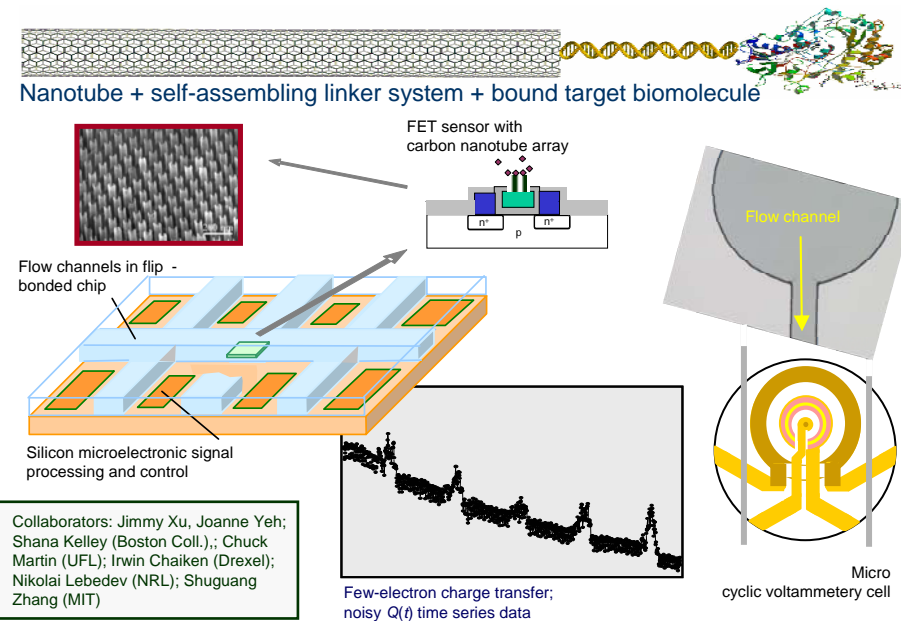


Goals and Potential Impact if Successful

- Scalable protein-specific self-assembly of biomolecules to nanoelectrode arrays
- Reliable and efficient electron transfer between biomolecules and digital electronic readout
- Multiple-molecule real-time *in situ* detection of hazards and metabolic status
- Ultimately, closed-loop sensing and control of biomolecule concentrations *in vivo*



Approach and/or Accomplishments

- Target molecules are redox-active, or can trigger redox activity on binding
- Molecular linkers to recognize target, tether to a nanoelectrode array, and conduct electrons
- Functionalized nanoelectrodes, such as carbon nanotube, synthesized on field-effect transistor gate layer
- Integration of microelectronic signal processing and microfluidic analyte manipulation
- Design of extremely low-level charge and current sense amplifiers

Bottlenecks and Open Research Questions

- Molecule-specific self-assembling for many proteins
- Stability/affinity (mechanical, biochemical, electrochemical...)
- Scaling up (in protein types) and (down in protein numbers)
- Nanoscale electrode fabrication; wiring to nanoelectrodes
- Quantum efficiency of electron capture and transport
- “Single protein” detection at 300 K
- Stochastic signal processing and information extraction