Lloyd Whitman, NIST
Stochastic Sensing

Application

- **Driver:** Label-free, real-time, *in vivo* or *in vitro,* broad spectrum detection;
- **Market size:** Vast application space in biomarkers, IVD, metabolomics, proteomics, genomics;
- **Need:** An integrated chip-based system capable of monitoring stochastic bind and un-binding events and providing the signal processing to translate the binding signatures.

Research Needs

Scientific/technological problems and barriers:

- Sensing surface potential changes with single-molecule resolution;
- Bioinformatics to interpret stochastic signals;
- Biocompatible packaging to prevent bio-encapsulation of the device.

Advantages

Impact:

- Would create a totally new approach to biosensing, allowing the same systems to be used *in vitro* and *in vivo*. With few reagents and broad-spectrum capabilities, may be low enough cost for developing countries.

Benefits/advantages over current capabilities or technology:

- This technology would eliminate the need for microarrays and multi-step labeling assays.

Metric(s) of Progress

3 Year Goal:

- Demonstrate multiplexed, stochastic sensing of 8 analytes in biological matrices with off-chip signal processing.

5 Year Goal:

- Demonstrate multiplexed, stochastic sensing of 64 analytes in biological matrices with on-chip signal processing, and 1 month operation *in vivo* .

10 Year Goal:

- Demonstrate multiplexed, stochastic sensing of 1024 analytes *in vivo* with telemetry.

Resource requirements: - Annual cost : ~$5M/year**; People:**10-15 PI's**; Time:** Near term goals ~ 3 yrs., Long term goals ~ 10 yrs.**; Facilities:** Interdisciplinary teams with access to CMOS and nanoelectronics fabrication and clinical test facilities.