Kelby Peterson
Mentors: Joseph Robertson & John Suehle
Society of Physics Students Summer Internship
NIST Gaithersburg, MA

NANOPORRSE SENSING OF AN ANTHRAX PROTEIN
Nanopore Sensing

Wilner & Katz eds.

A. Noy, et al.

F. Patolsky, C.M. Lieber et al.

AP/WIDE WORLD PHOTOS

QTL Biosensor

http://www.biomedicalblog.com/a-blood-test-for-lung-cancer/31800/

NIST conceived device: future development

Techniques

Biodefense

Clinical Diagnostics
Understanding Anthrax

Anthrax toxin

3 Proteins
- Protective Antigen
- Edema Factor (EF)
- Lethal Factor (LF)

Protective Antigen- Anthrax Protein


Neutron Reflectometry


Optimizing Pore Formation


Michaelman-Ribero et al.
Experimental Setup
Experimental System

\[ I (\text{pA}) \]

\[ V (\text{mV}) \]

- pH 4.5
- pH 7.5

\[ Z_{\text{pore}} \]

\[ Z_{\text{mem}} \]

\[ V_{\text{in}} \]

\[ I_{\text{pore}} \]

\[ R_{\text{gain}} \]

\[ V_{\text{out}} \]
Rate of Insertion

![Graph showing rate of insertion with time in seconds on the x-axis and current in pA on the y-axis. The graph illustrates a decrease in current over time.]
Rate of Insertion

![Graph showing the rate of insertion over time with current values in pA. The graph plots current against time in seconds.]
Understanding Channel Insertion

![Graph showing the relationship between Max Channel Insertion and Slope](image)

- **PA63/FOS-14 pH 6.6**
- **PA63 pH 6.6**
- **PA63/FOS-14 pH 5.5**
Special Thanks

Joseph Robertson, NIST
John Suehle, NIST
Toni Sauncy, SPS
Kendra Redmond, AIP
David Peak, USU
Summary

- Understanding Nanopores is useful
- Goal: Neutron Reflectometry
- Optimize Channel Insertion
- FOS-14 Detergent
  - Repeatability
  - No increased nanopore insertion
Difficulties with the System

With FOS-14 Detergent

Without FOS-14 Detergent
Conclusions

• Detergent does not inhibit nanopore formation
• Detergent decreases variability in measurements
• Detergent does not increase max channel formation

• Although detergent does not increase the total channel formation it may be useful for increasing repeatability of measurements