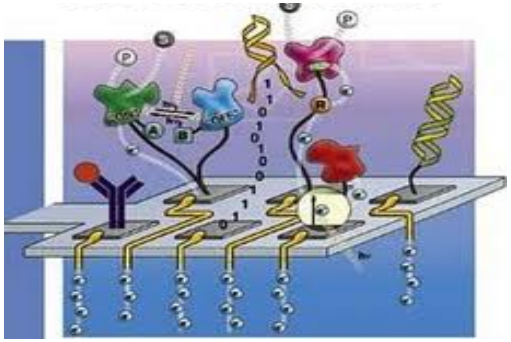
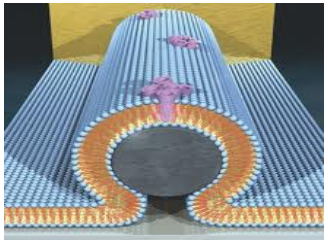
Kelby Peterson
Mentors: Joseph Robertson & John Suehle
Society of Physics Students Summer Internship
NIST Gaithersburg, MA

NANOPORE SENSING OF AN ANTHRAX PROTIEN

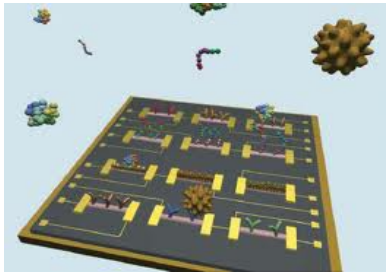
Nanopore Sensing



Wilner & Katz eds.



A. Noy, et al.

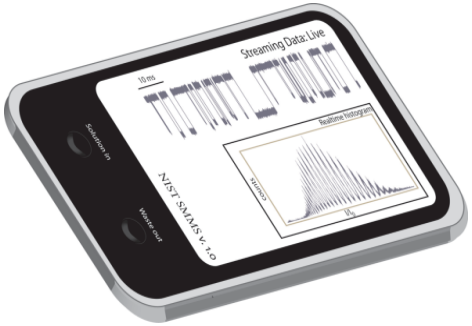


F. Patolsky, C.M. Lieber et al.

AP/WIDE WORLD PHOTOS

QTL Biosensor

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



NIST conceived device: future development

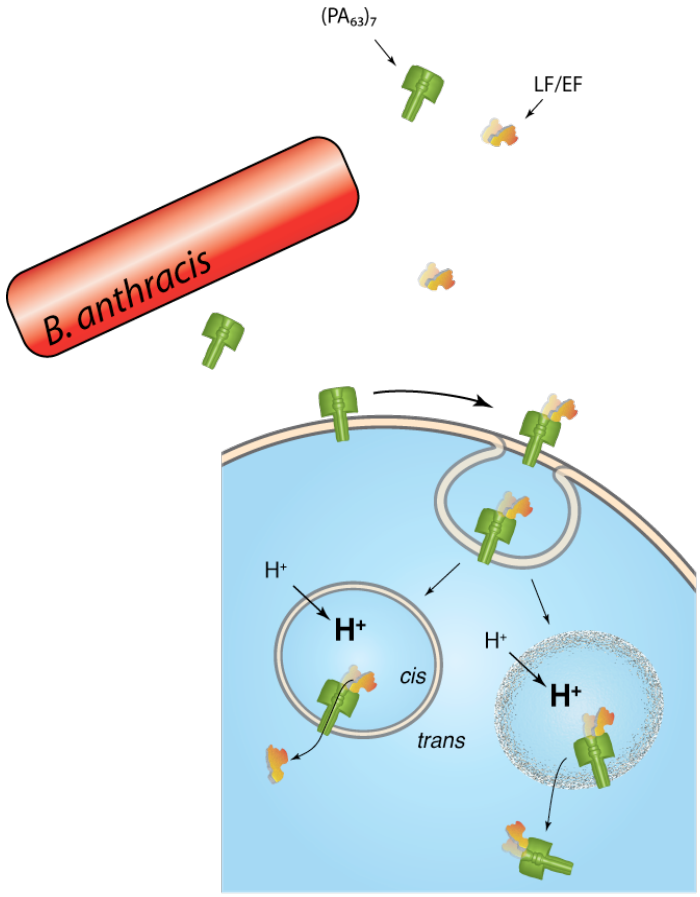
Techniques

Biodefense

Clinical Diagnostics

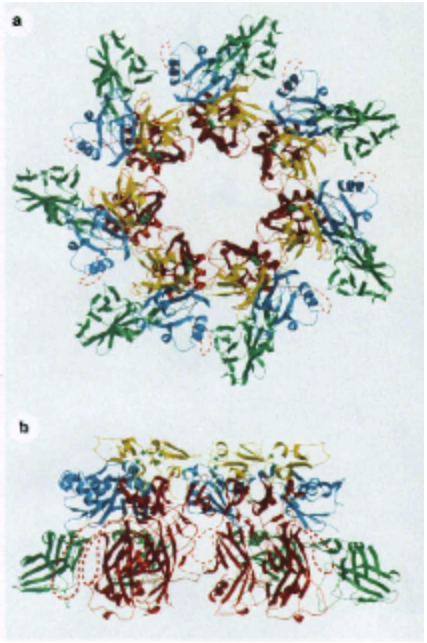
Understanding Anthrax

Anthrax toxin

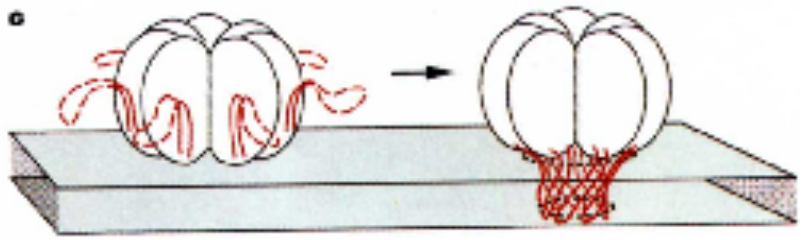


3 Proteins

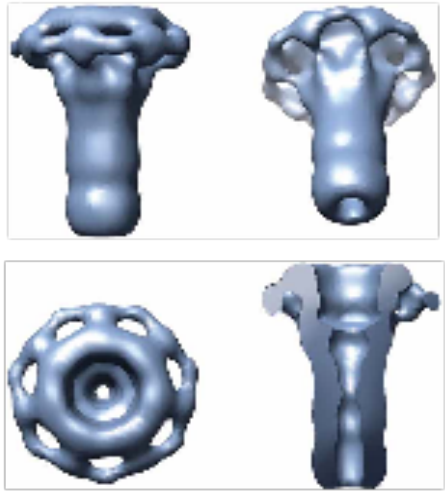
- Protective Antigen
- Edema Factor (EF)
- Lethal Factor (LF)

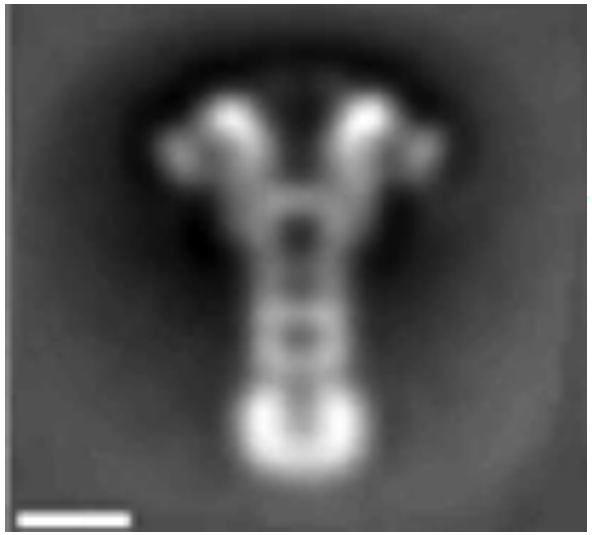


Petosa, C., et al. Crystal structure of the anthrax toxin protective antigen. Nature 385, 833-838 (1997).

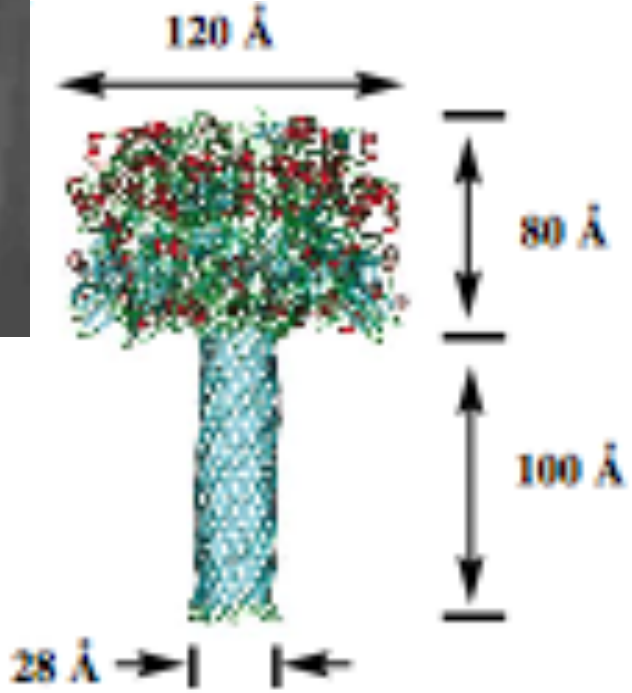


Protective Antigen- Anthrax Protein



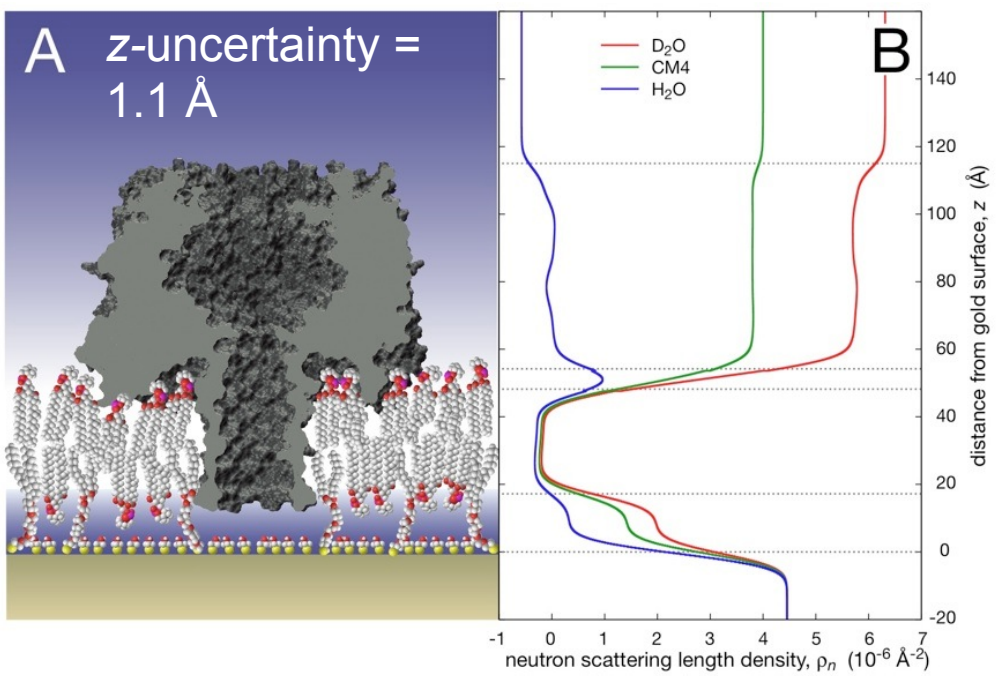


Nguyen, T.L. Three-dimensional model of the pore form of anthrax protective antigen. Structure and biological implications. J Biomol Struct Dyn 22, 253–265 (2004).

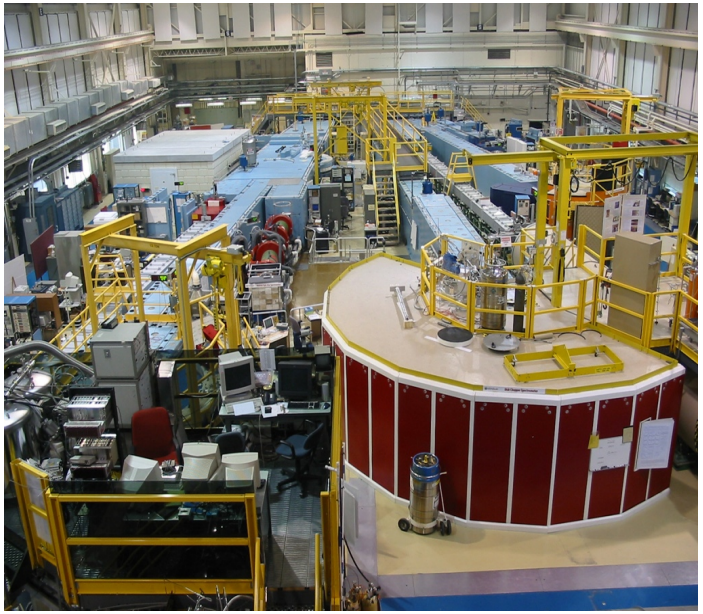


Katayama, h. et al. GroEL as a molecular scaffold for structural analysis of the anthrax toxin pore. Nat Struct. Mol. Biol. 15, 754-760 (2008).

Neutron Reflectometry

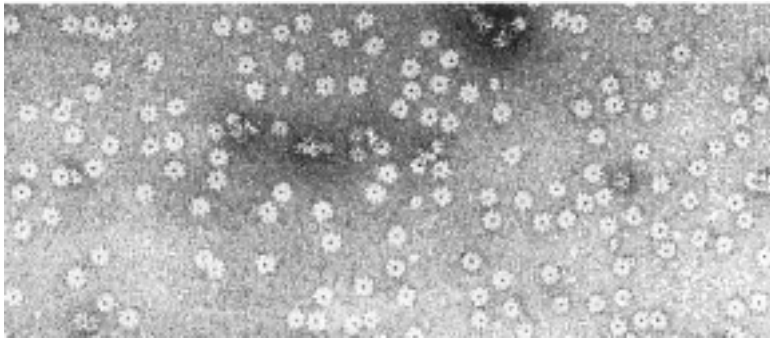


McGillivray, Valincius, Heinrich, Robertson, Vanderah, Febo-Ayala, Ignatjev, Lösche, and Kasianowicz, 2009. Biophys. J. 96, 1547.

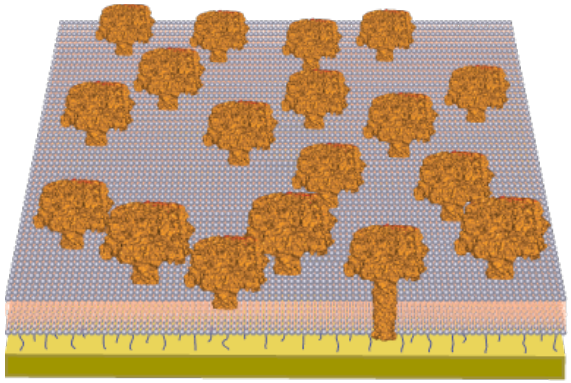


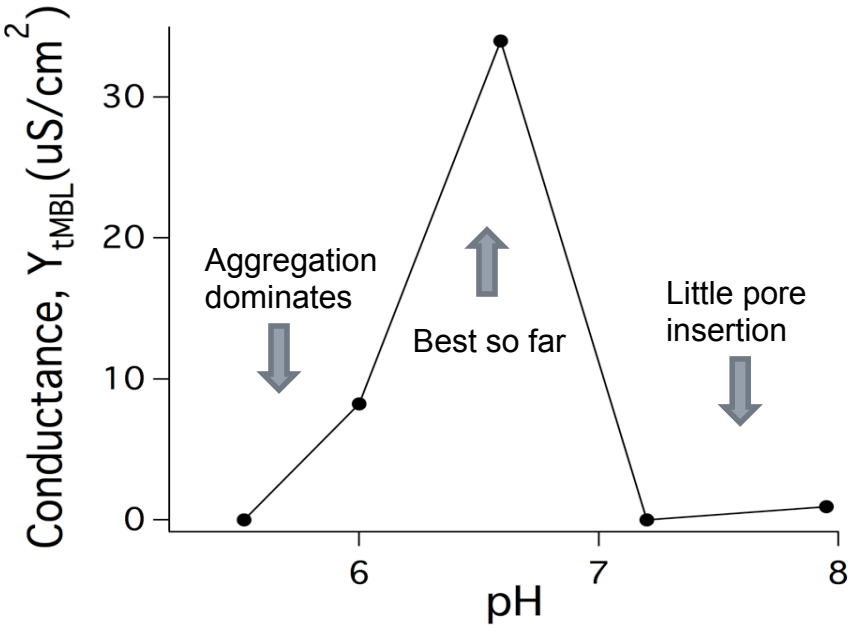
McGillivray, Valincius, Heinrich, Robertson, Vanderah, Febo-Ayala, Ignatjev, Lösche, and Kasianowicz, 2009. Biophys. J. 96, 1547.

Optimizing Pore Formation



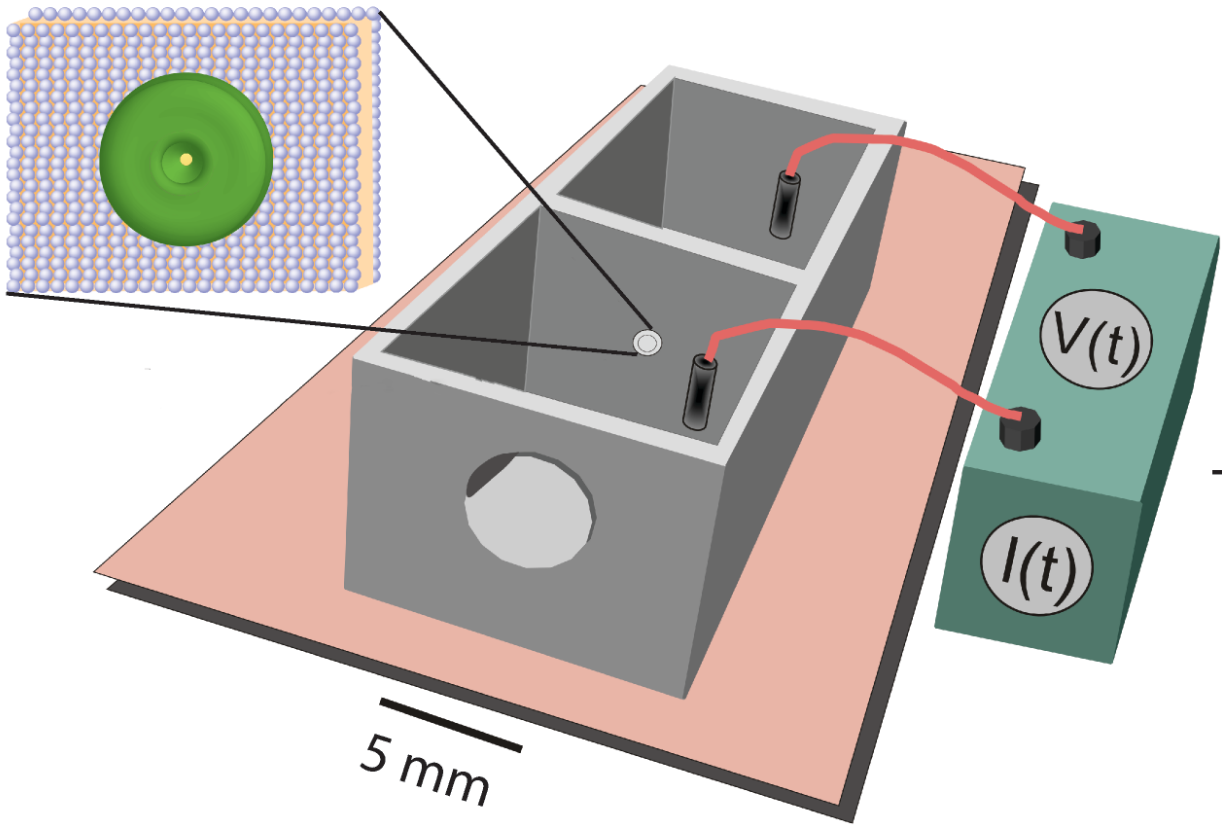
Milne, J.C., *et al*. Anthrax protective antigen forms oligomers during intoxication of mammalian cells. J Biol Chem 269, 20607–20612 (1994).



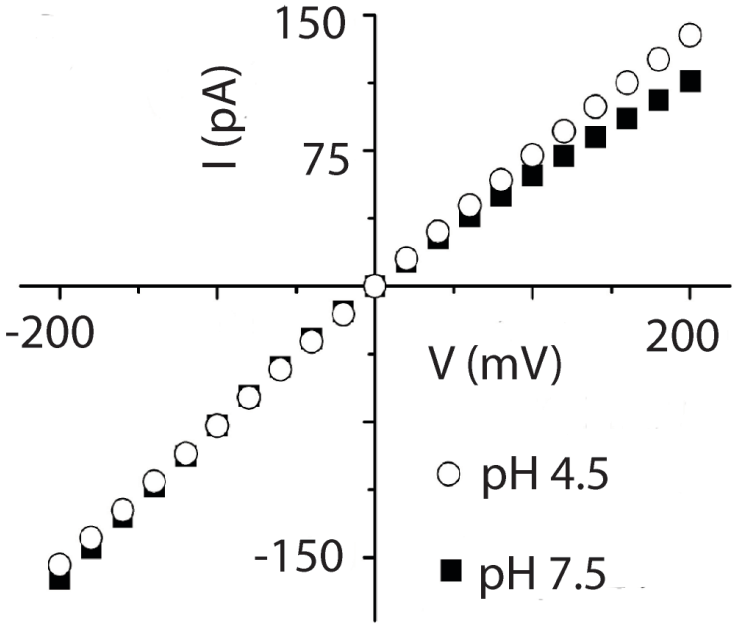


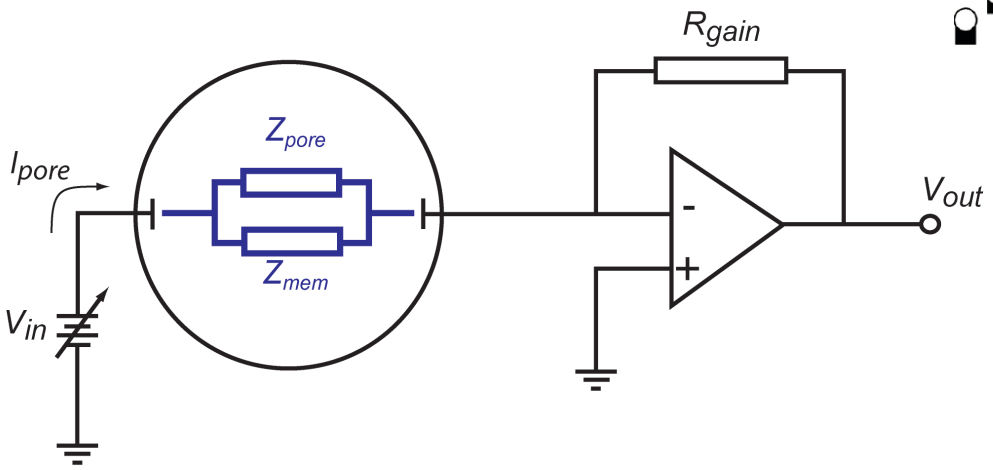
Michaelman-Ribero et al.

Experimental Setup

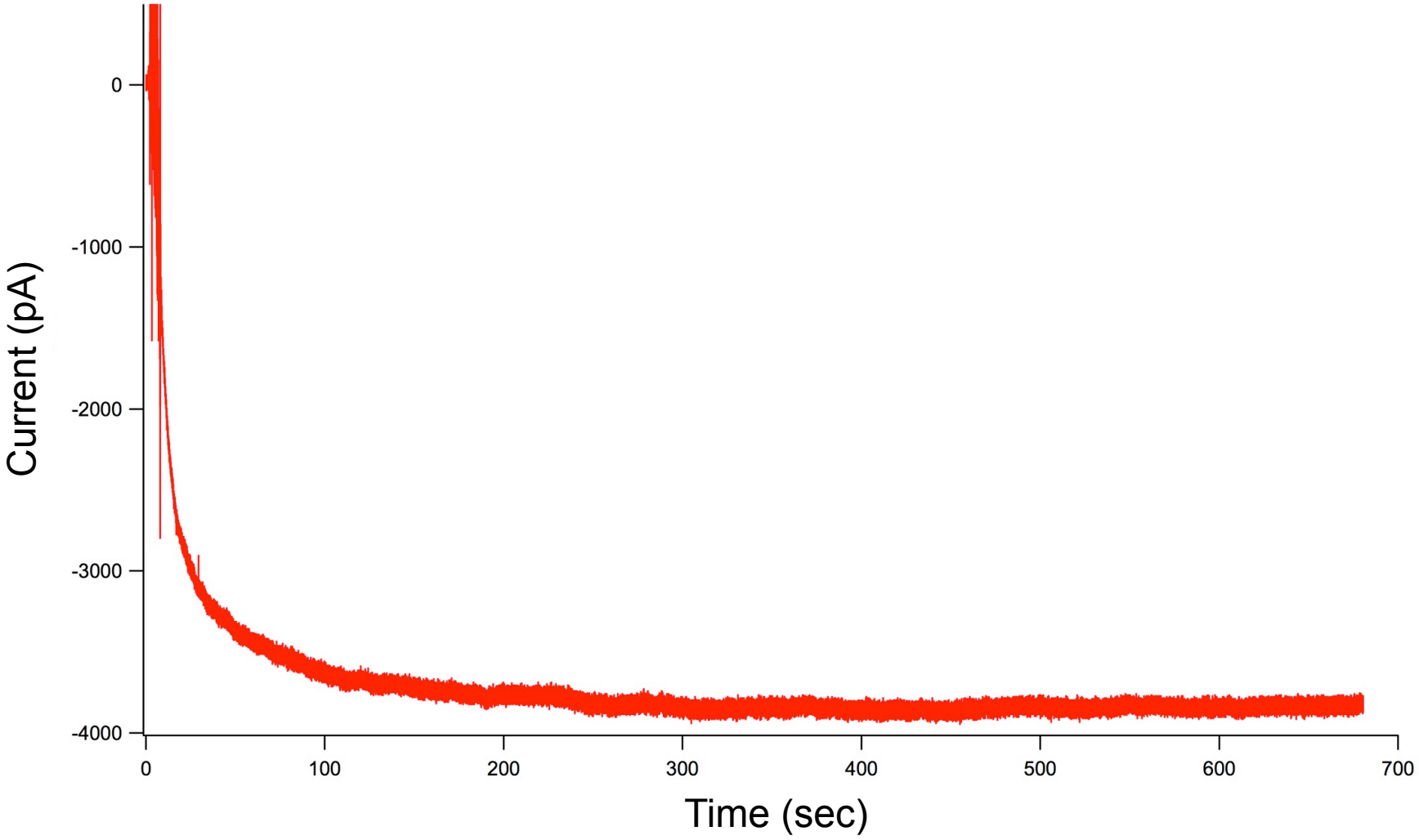


Experimental System

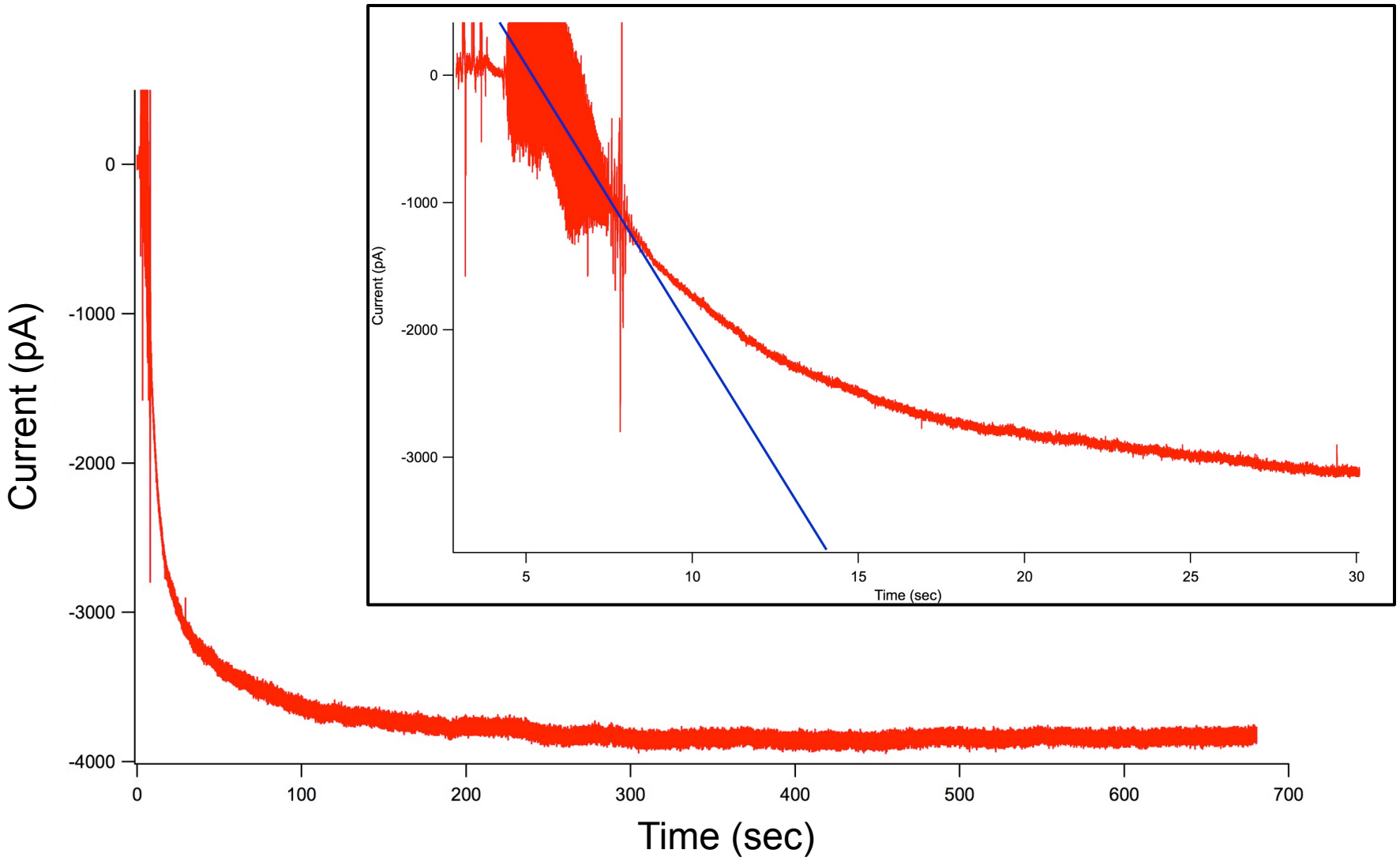




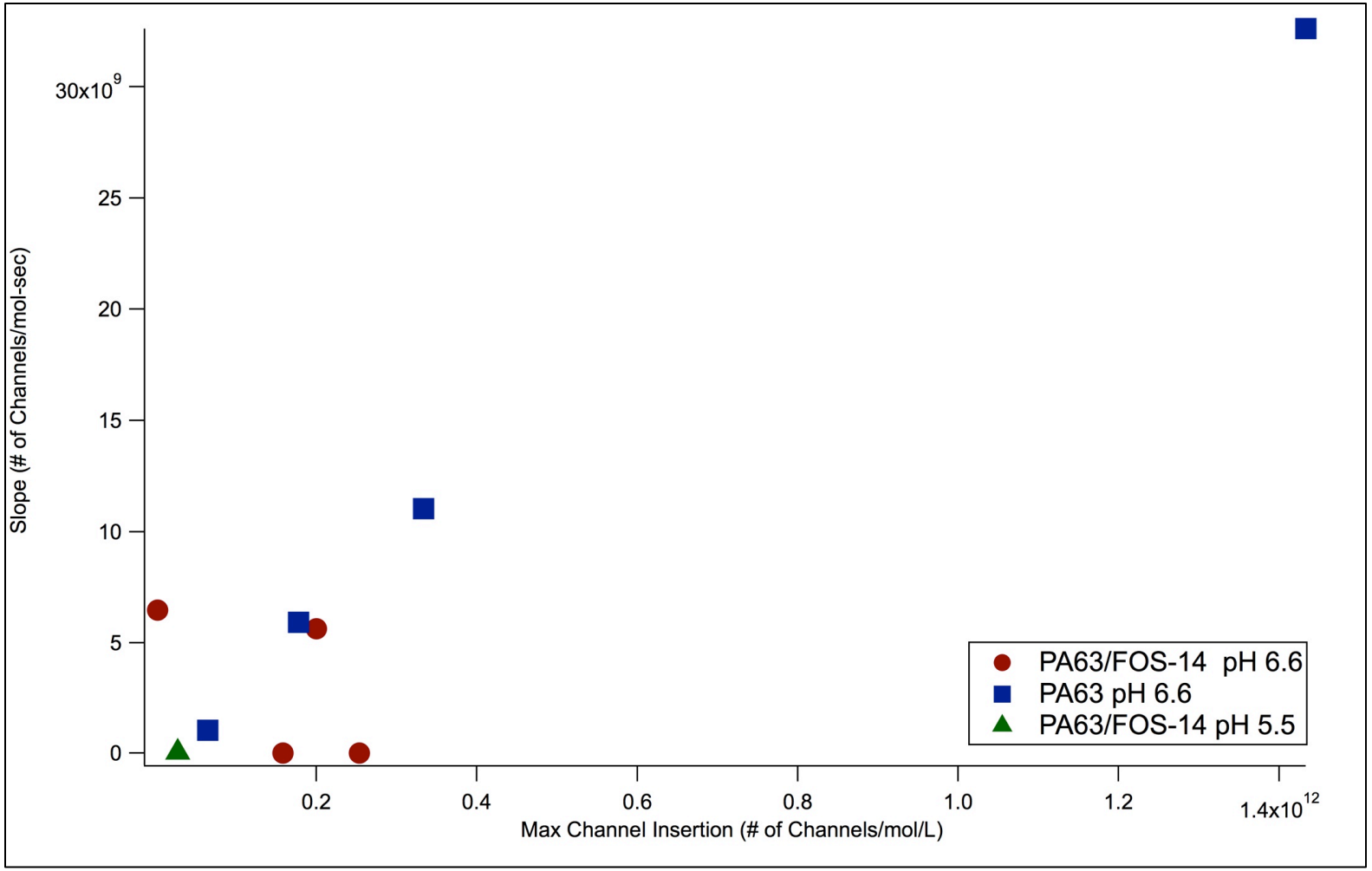
Rate of Insertion



Rate of Insertion



Understanding Channel Insertion



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NIST
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U.S. Department of Commerce

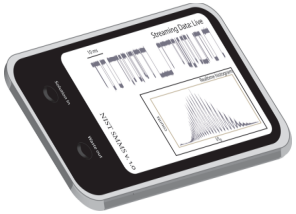
AIP
American Institute of Physics

SPS

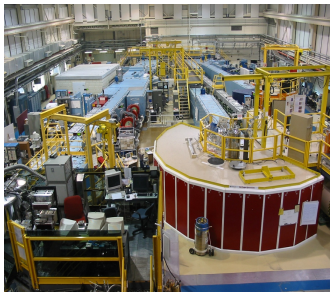
UtahStateUniversity
DEPARTMENT OF PHYSICS

Summary

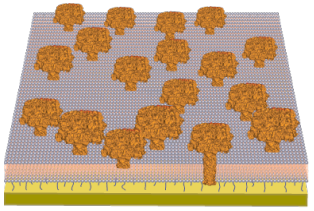
- Understanding Nanopores is useful



- Goal: Neutron Reflectometry

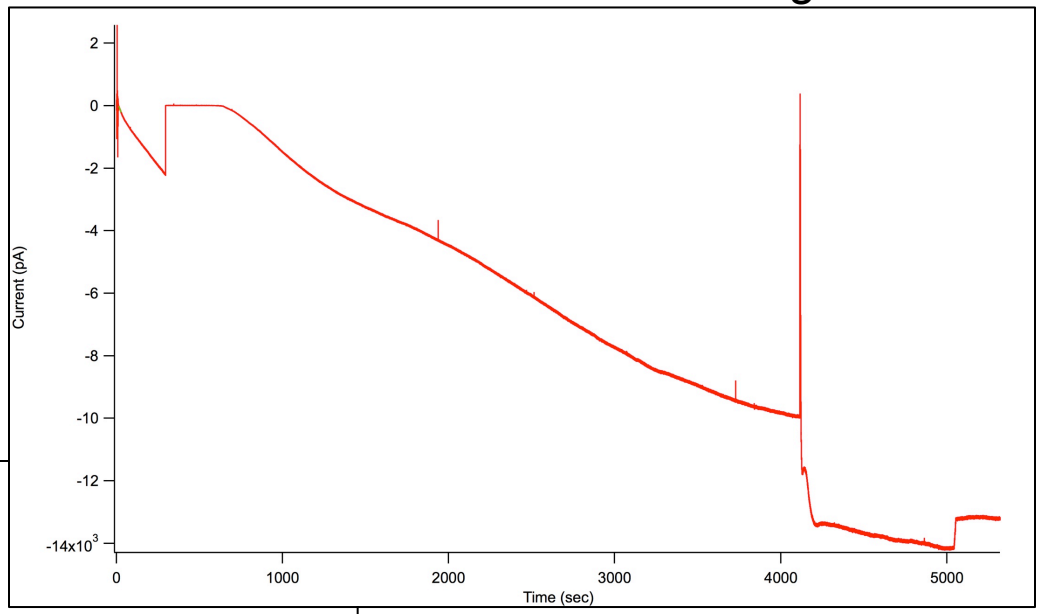


- Optimize Channel Insertion
- FOS-14 Detergent
  - Repeatability
  - No increased nanopore insertion

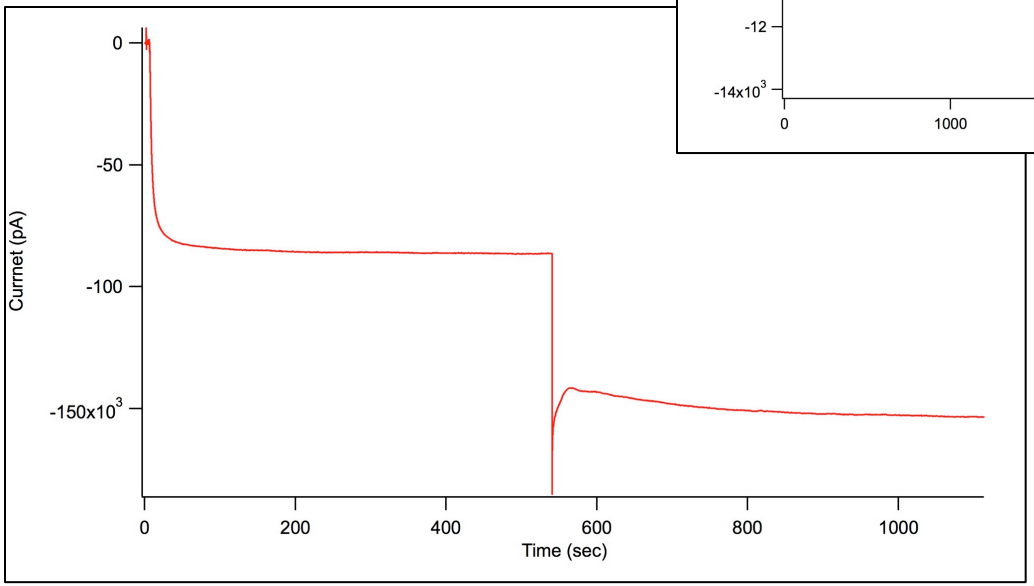


Difficulties with the System

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