Detecting a Protein in its Natural Environment

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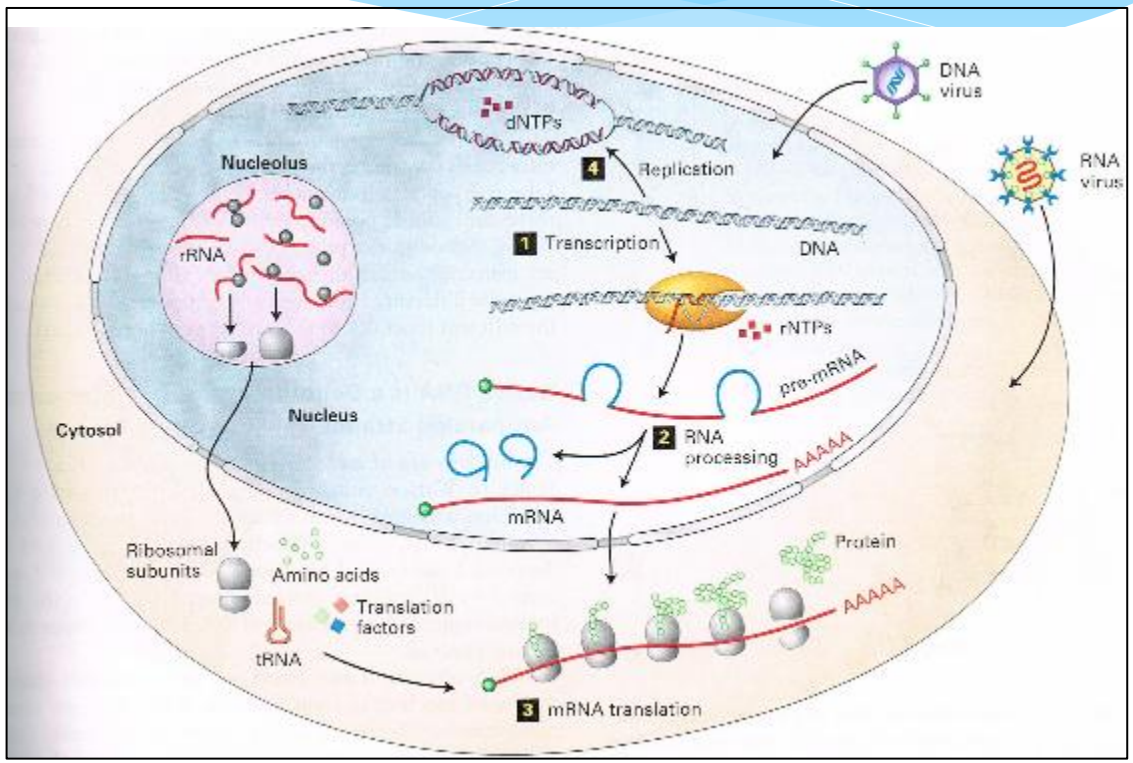
What is a Protein

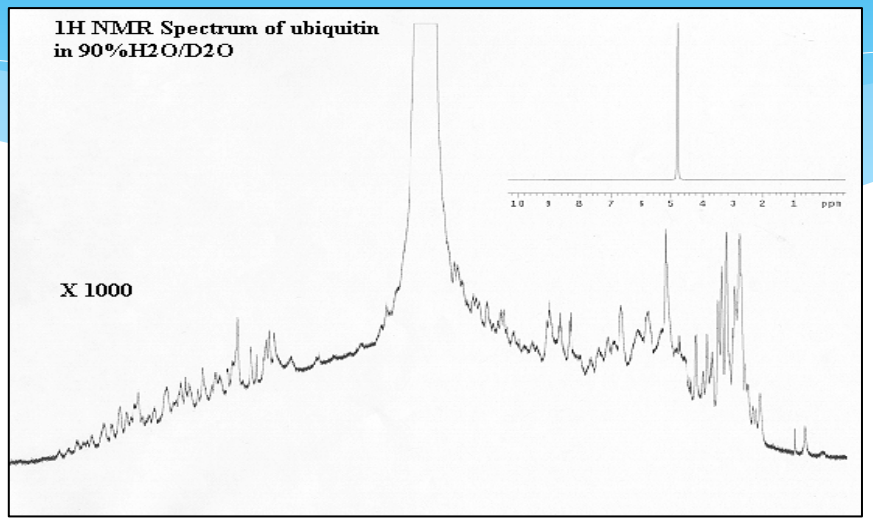
- Functions
- Malfunctions
- Why We Need to Study Them



Picture from Molecular Cell Biology sixth edition by Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh, Mastudaira

Current Methods

- X-ray crystallography, NMR spectroscopy, Electrophoresis
- Time consuming, complicated, and need a lot of material



Picture from Georgetown's 500 MHz Unity INOVA NMR Spectrometer Samples courtesy of Ms. Tao Wang (Prof. David Yang's research group)

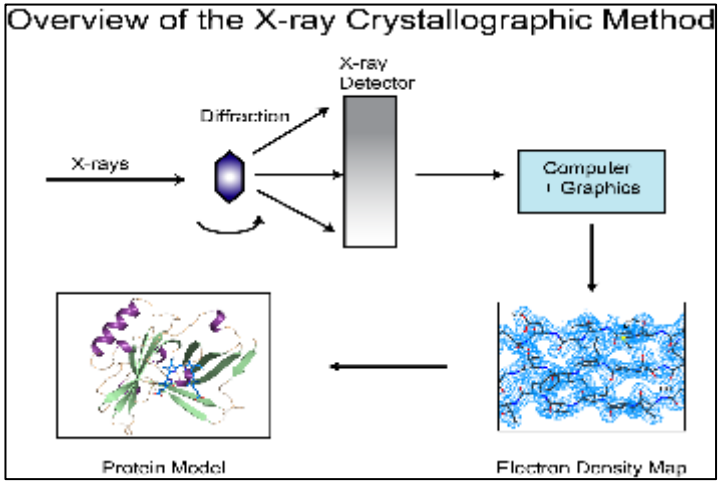
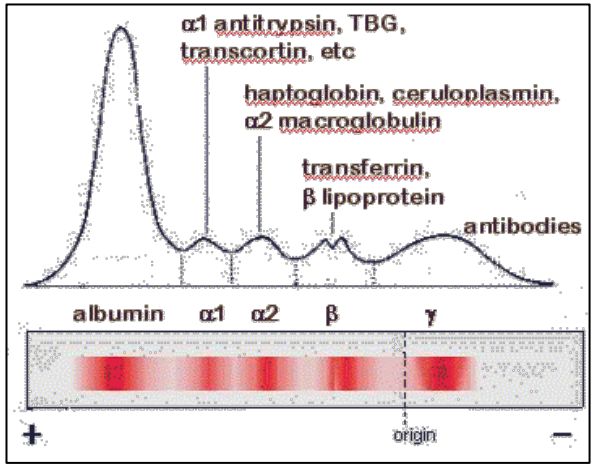


Diagram from Crystal Group, © 2014 The Board of Regents of the University of Wisconsin System



Picture via Wikipedia on serum protein electrophoresis from Google Search

Origin of the Device

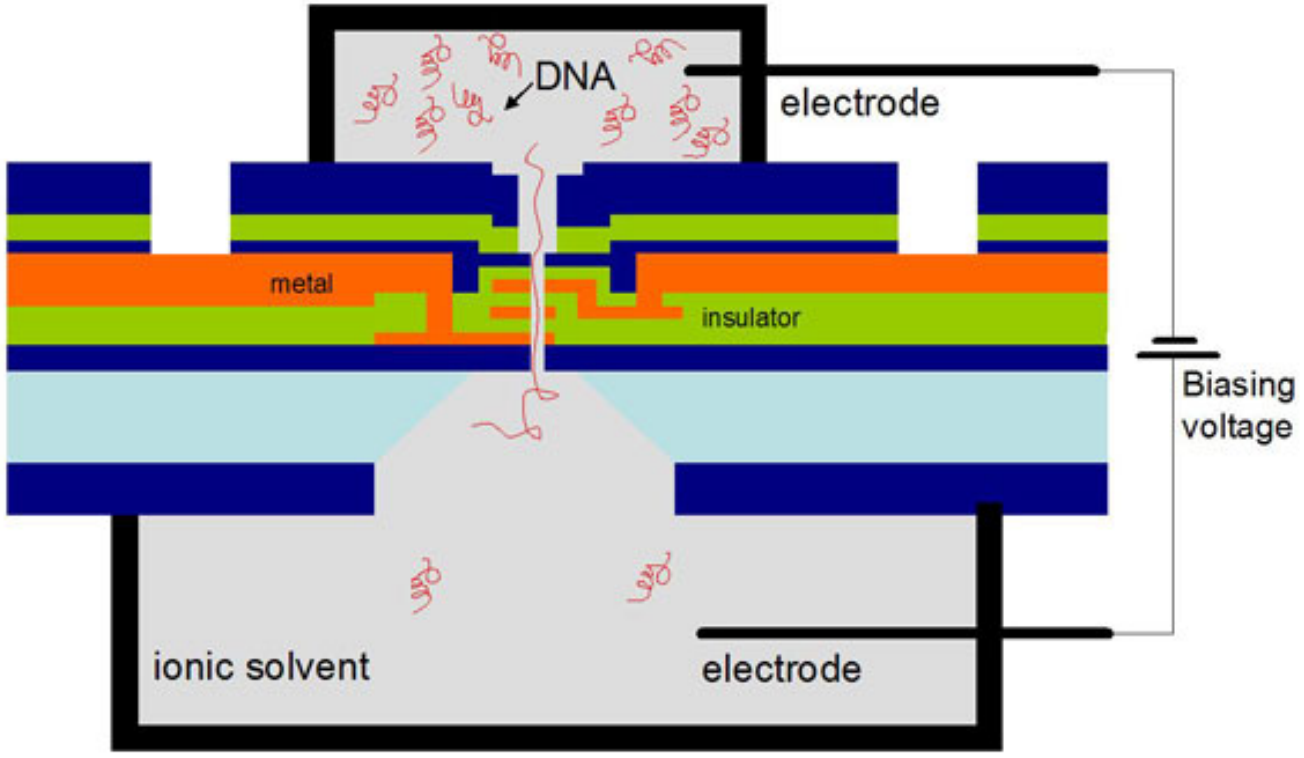
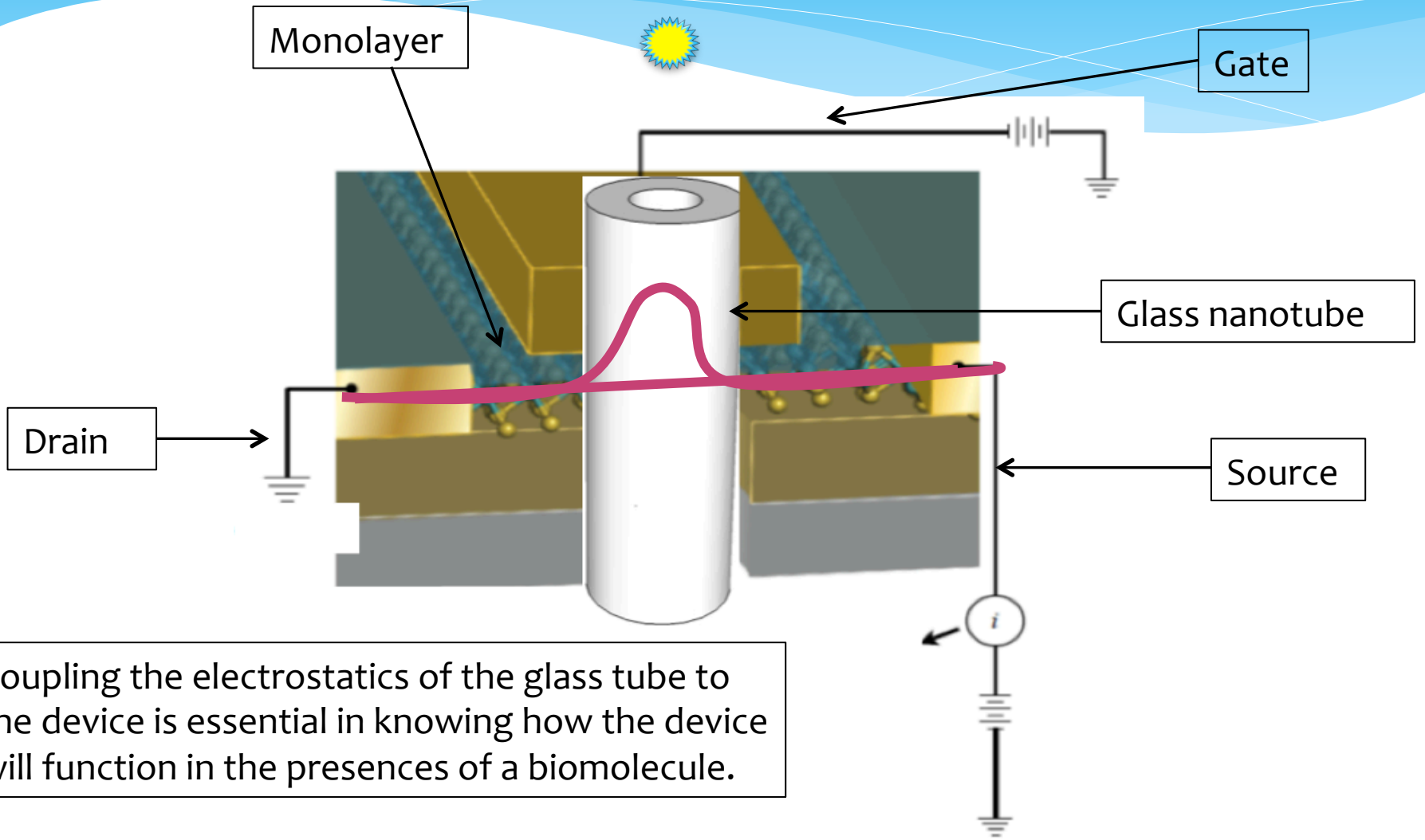


Photo from IBM

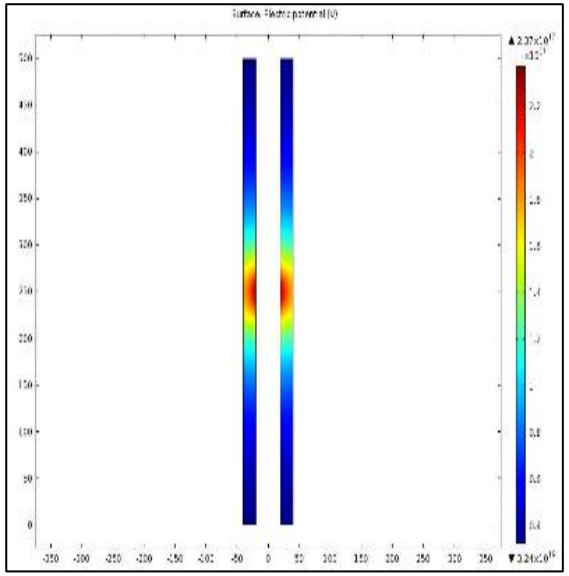
Diagram of the Transistor

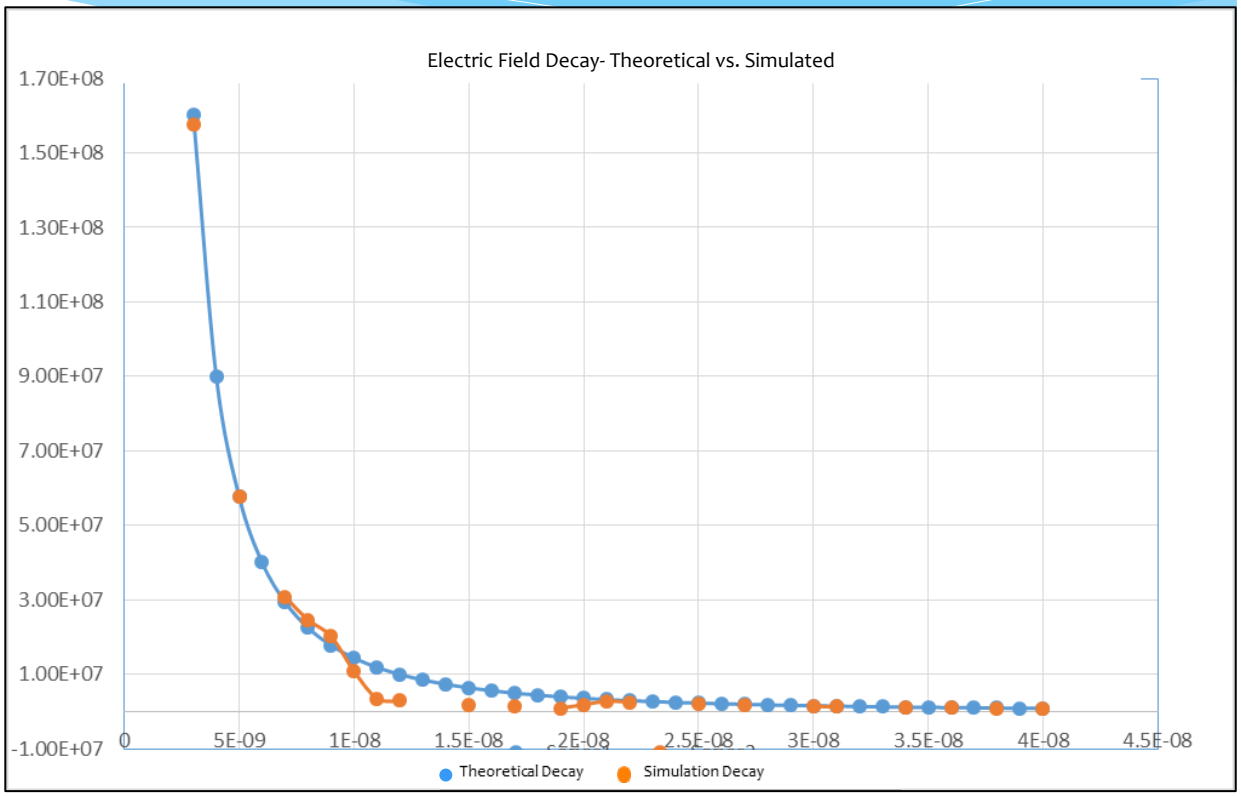


Coupling the electrostatics of the glass tube to the device is essential in knowing how the device will function in the presences of a biomolecule.

A Point Charge in a Glass Tube

Electric potential of point charge inside glass tube (air, glass, air)

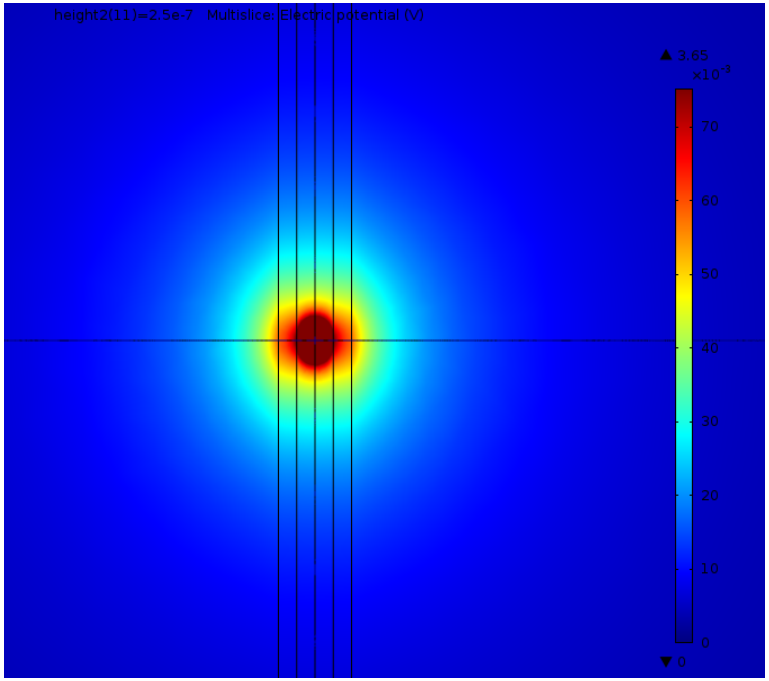




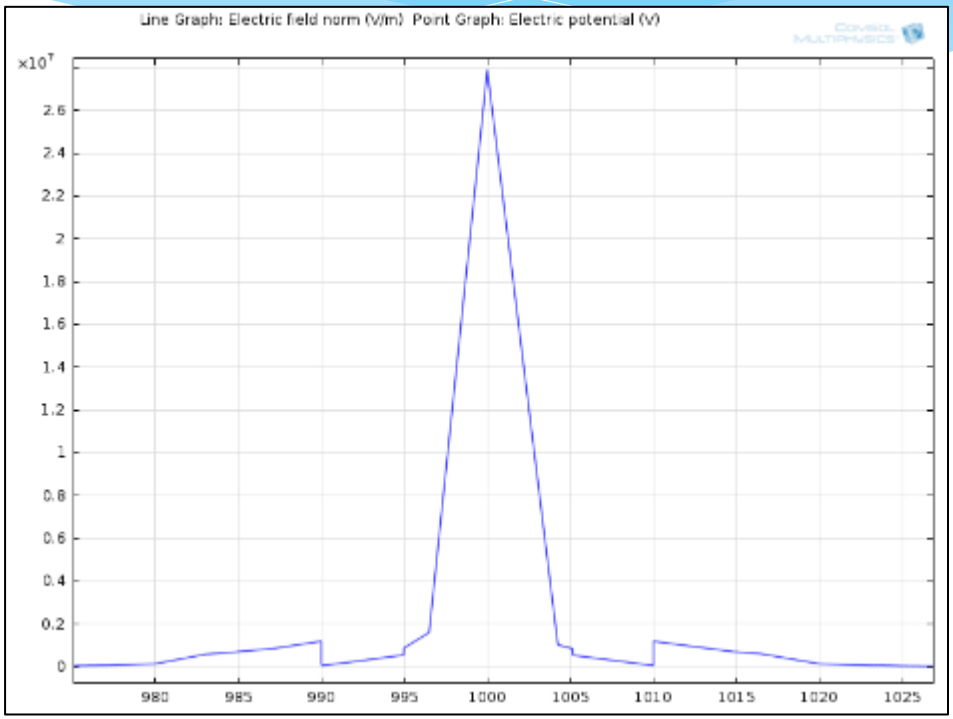
The electric field as it decays through the air, then through the glass, and back through the air confirms the results COMSOL is displaying

Mapping the Electric Field of the tube

Electric Potential of point charge

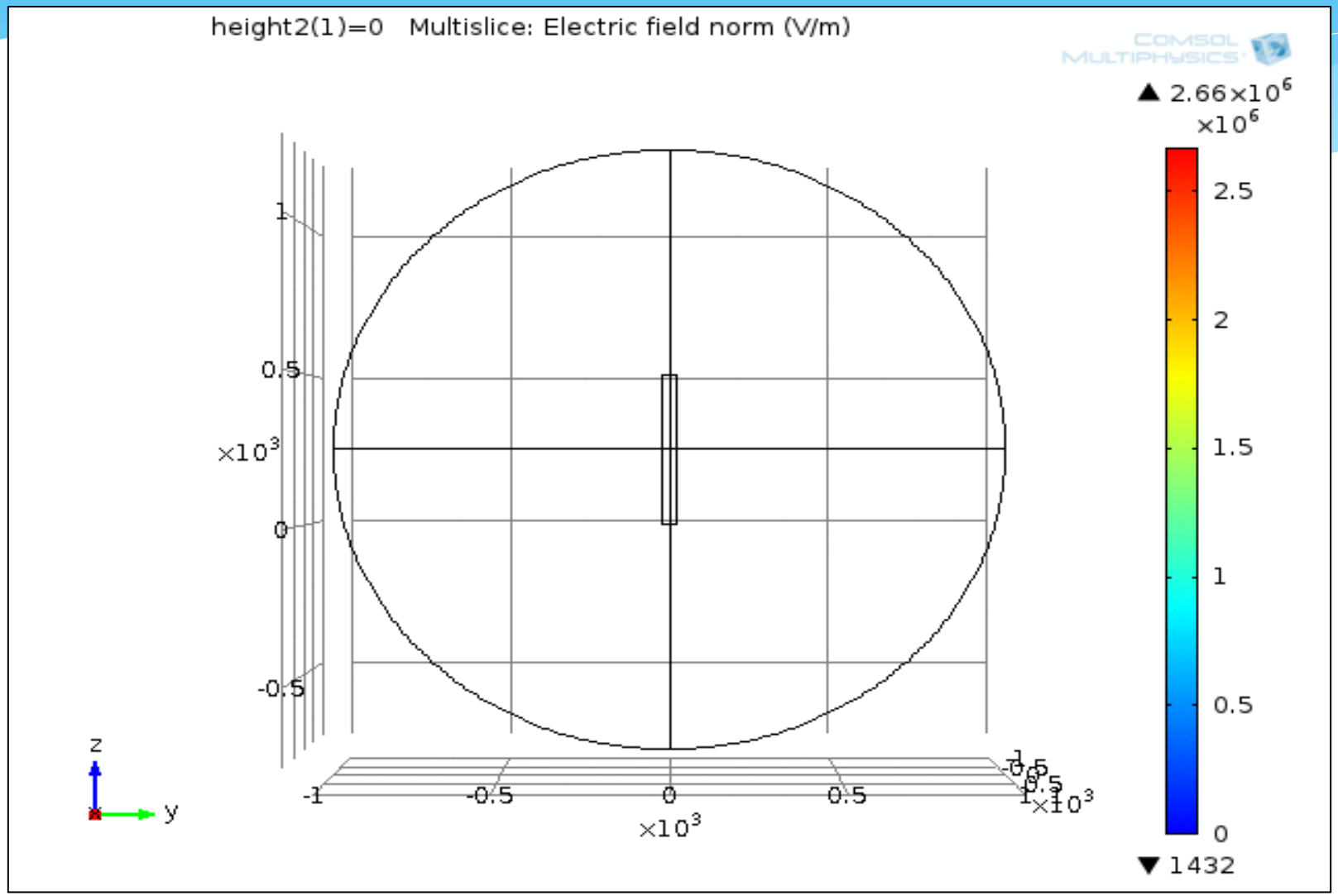


Electric Field of point charge

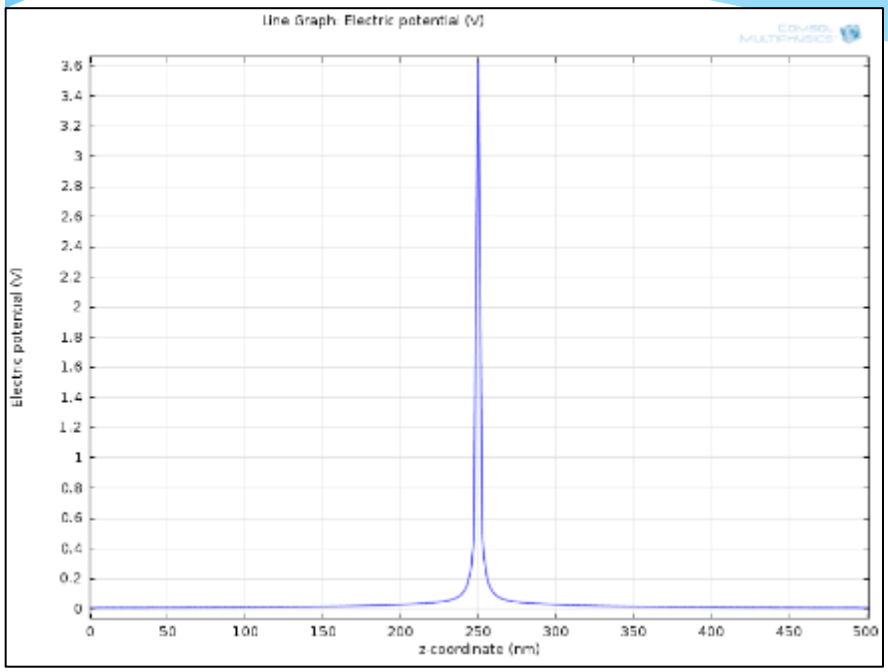


Applying the water on the inside and the monolayer on the outside shows us how the electric field in our device will change because they are the same materials.

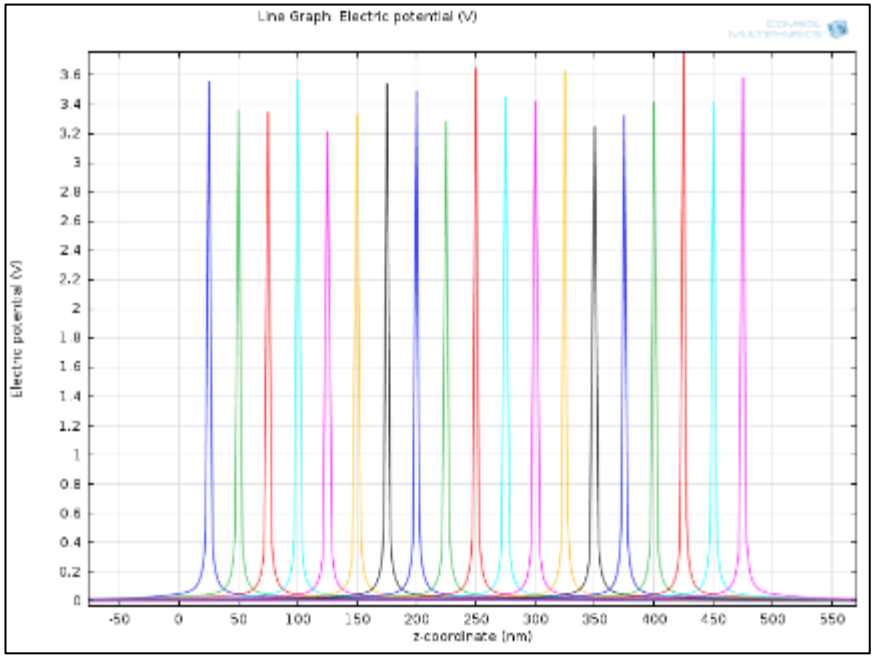
A Point Charge Moving Through a Tube



The Electric Potential from a Moving Point Charge



Mapping the electric potential as a single point charge flows through the tube. Measurements taken at r=2 nm from center



Mapping the resolution of the electron flowing through the tube.

Conclusions of Our Transistor

- Mapping the electric properties of the transistor essential to understanding how the device will work
- Will lead to understanding the building blocks of cellular life
- Help people better combat illness because of the knowledge this transistor will give.
- Our device will be cheaper, faster, and more efficient at studying proteins than the other methods

Special Thanks to…

- AIP and SPS
- NIST
- Dr. John Suehle
- Dr. Arvind Balijepalli
- Everyone here today