

Characterizing
Electrochemical DNA
(eDNA) Scaffold Sensors
For The Detection of
Antibodies in Whole Blood

By Jesse Kasehagen

Research Experience for Teachers Program

July 29, 2011

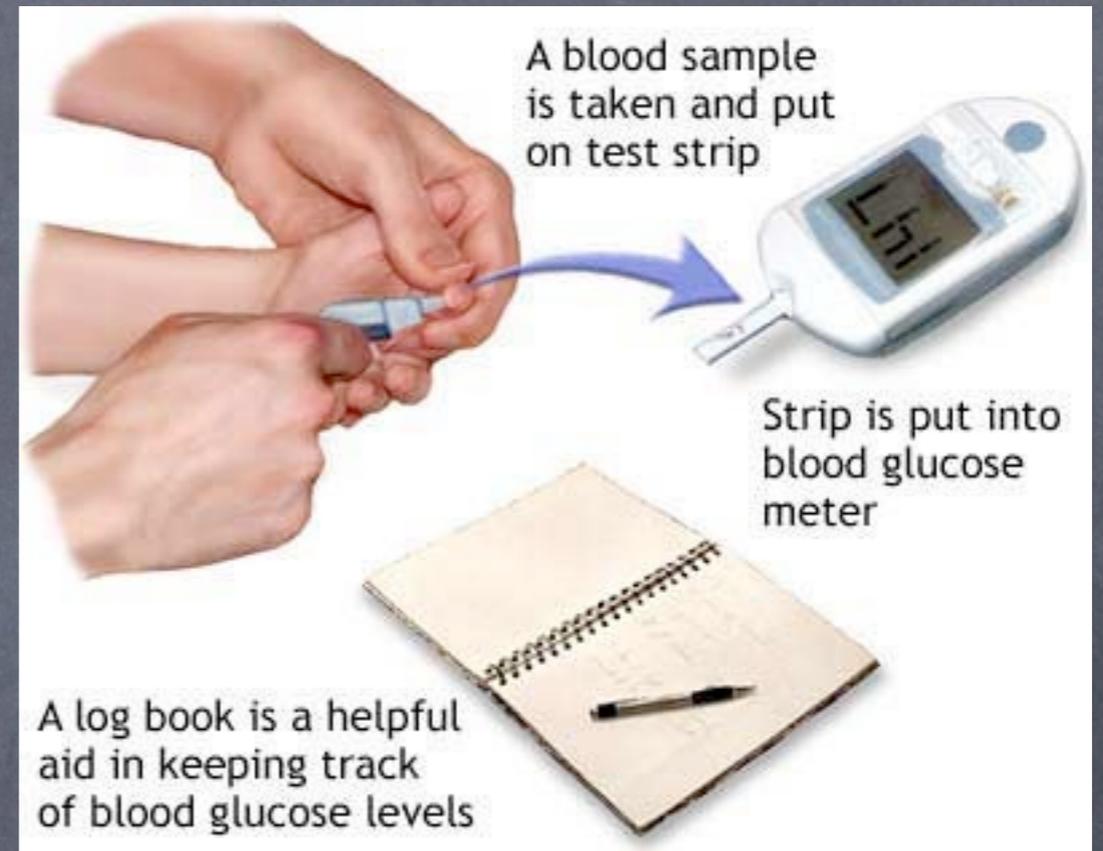
Santa Barbara Middle School Grades 6-9



http://www.noozhawk.com/schools/article/100910_santa_barbara_middle_school_sees_miracle_in_new_campus_acquisition/

What is a Biosensor?

Pulse Oximeter



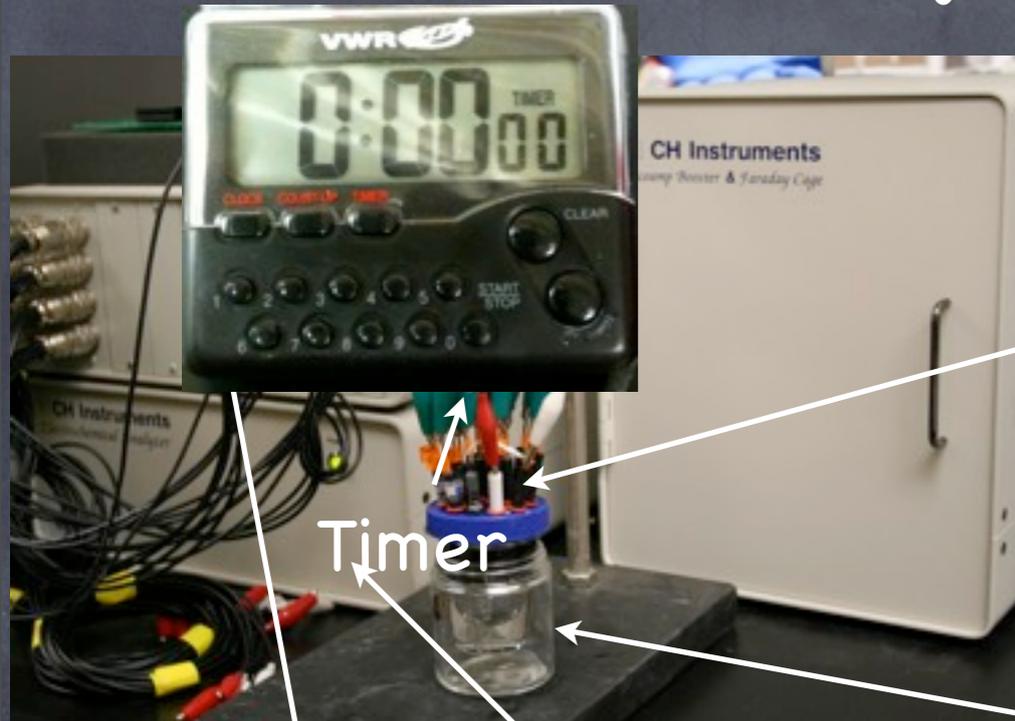
Glucose Meter

My Focus:



1. What is an eDNA sensor?
2. How specific is this type of biosensor?
3. When will this type of sensor "break" in whole blood?

Materials



Au Electrodes



Timer

Glass w/ Buffer

Potentiostat

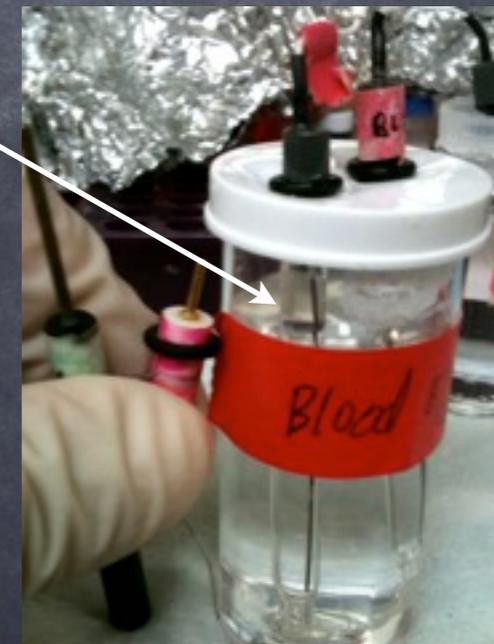
Multiplexer



Ag vs AgCl Reference Electrode



Pt Counter Electrodes



Materials (Cont'd)



Cleaning Solutions



Ethanol + DI Water



Whole Blood



FLAG Ab

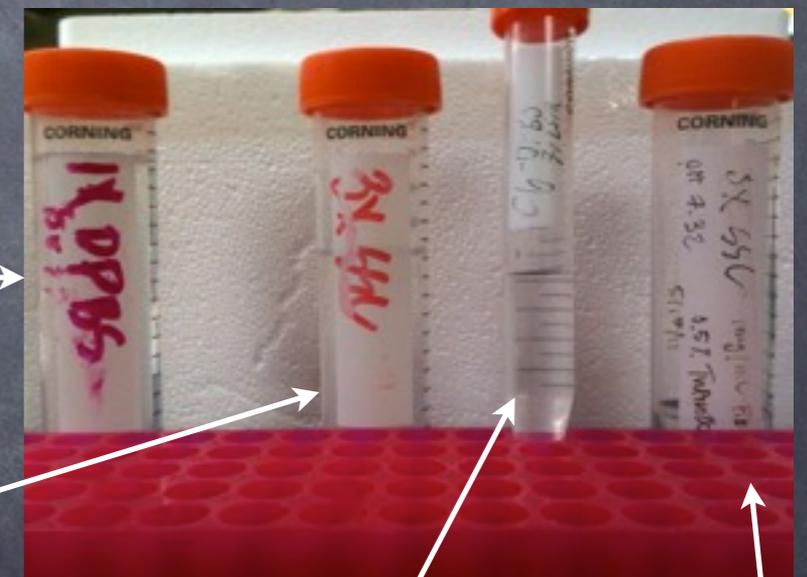
Anchor Strand

FLAG PNA

4B3 PNA

Delbecco's Phosphate Buffer Solution

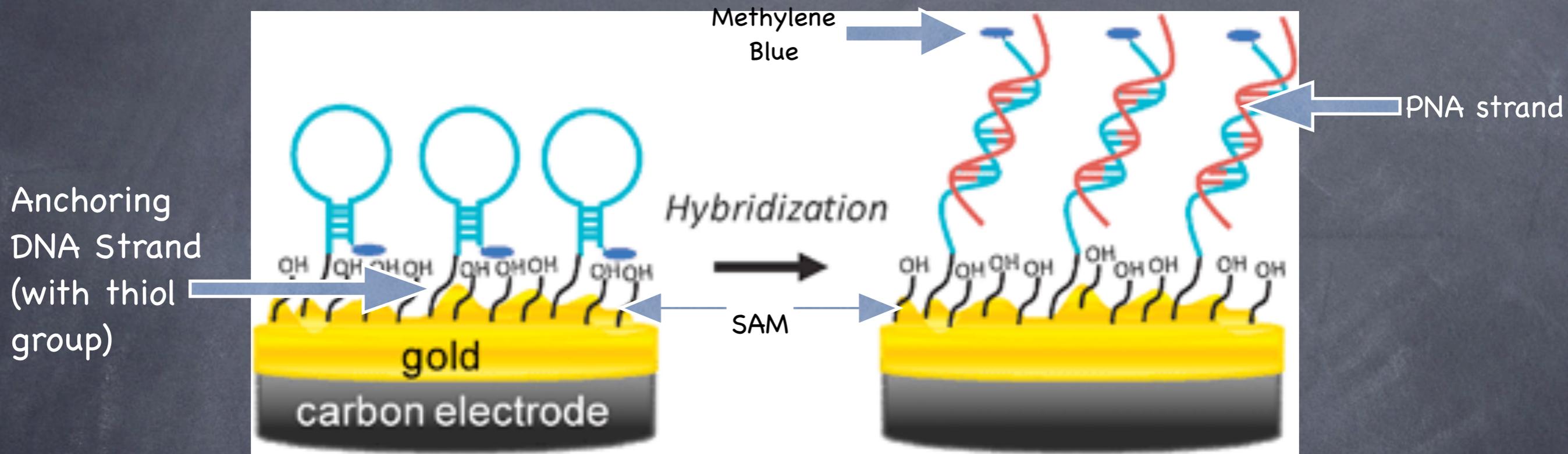
3x SSC



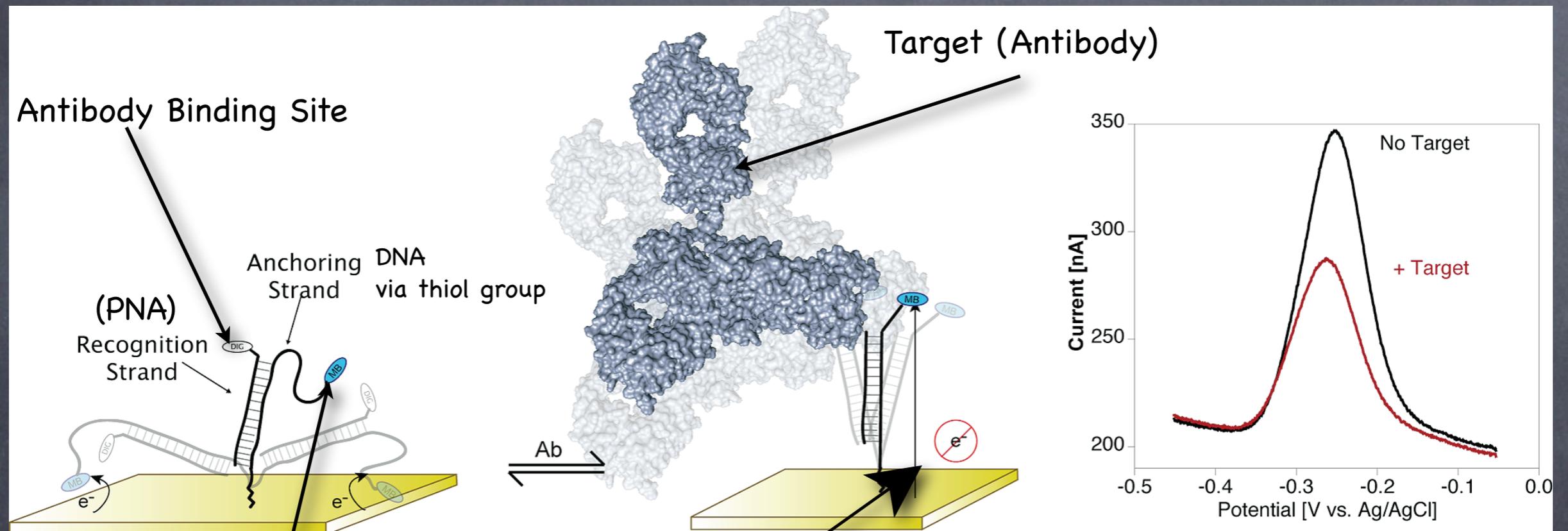
6-Mercaptohexanol + DPBS

Blocker: 3xSSC (500mM sodium chloride) + fibrinogen (a protein that aids in blood clotting) + tween-20 (a detergent)

The eDNA Sensor



How It Works

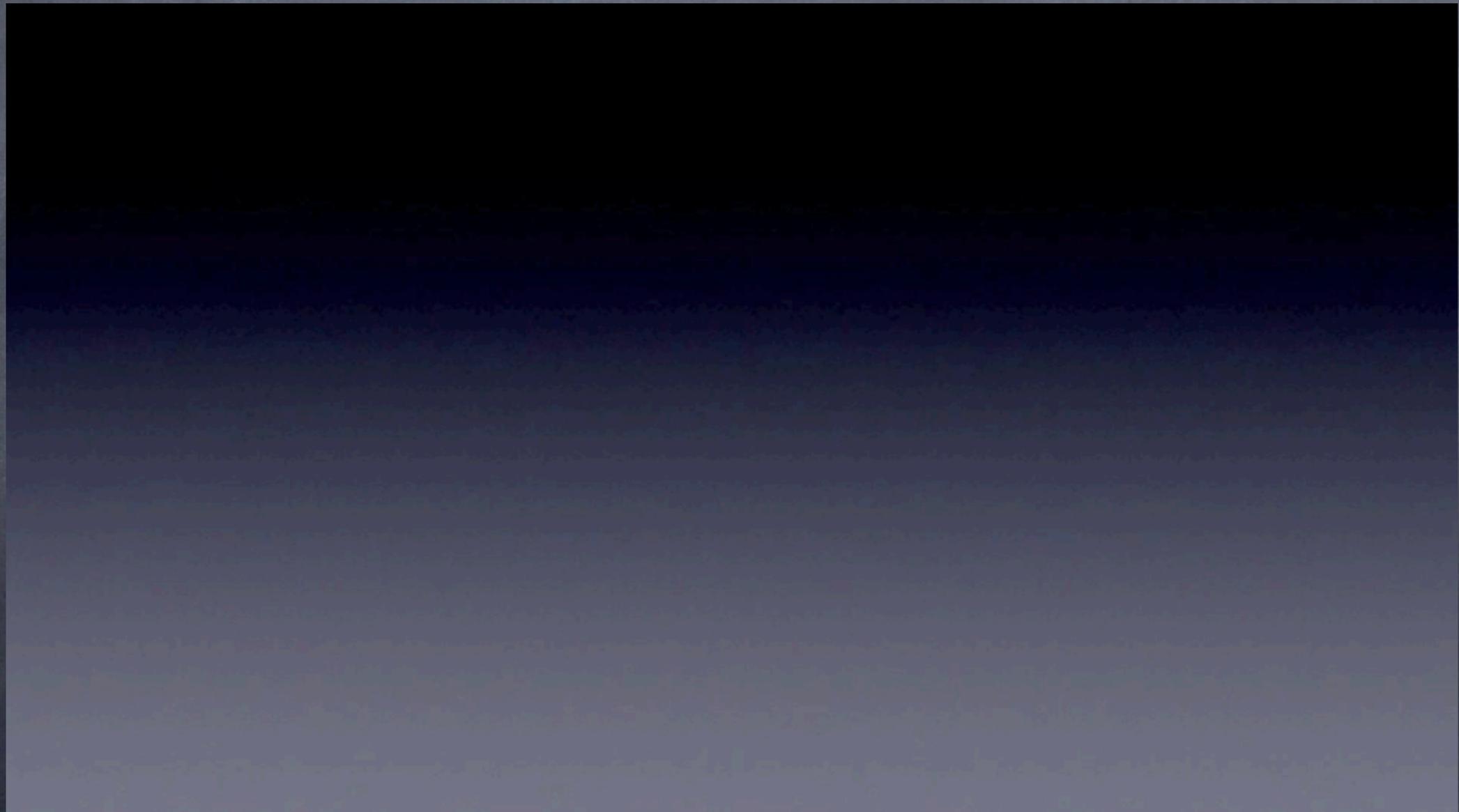


Signal [off] Mechanism

Methylene Blue

The Fabrication Process

- Cleaning the Electrodes takes over 1 hour



The Fabrication Process (Cont'd)

- Preparing the scaffold sensor (DNA + Monolayer + Hybridization)



Testing The Sensor



What is it we are Testing?

How specific is the PNA (containing the recognition element/antigen) binding to its target (antibody) in whole blood

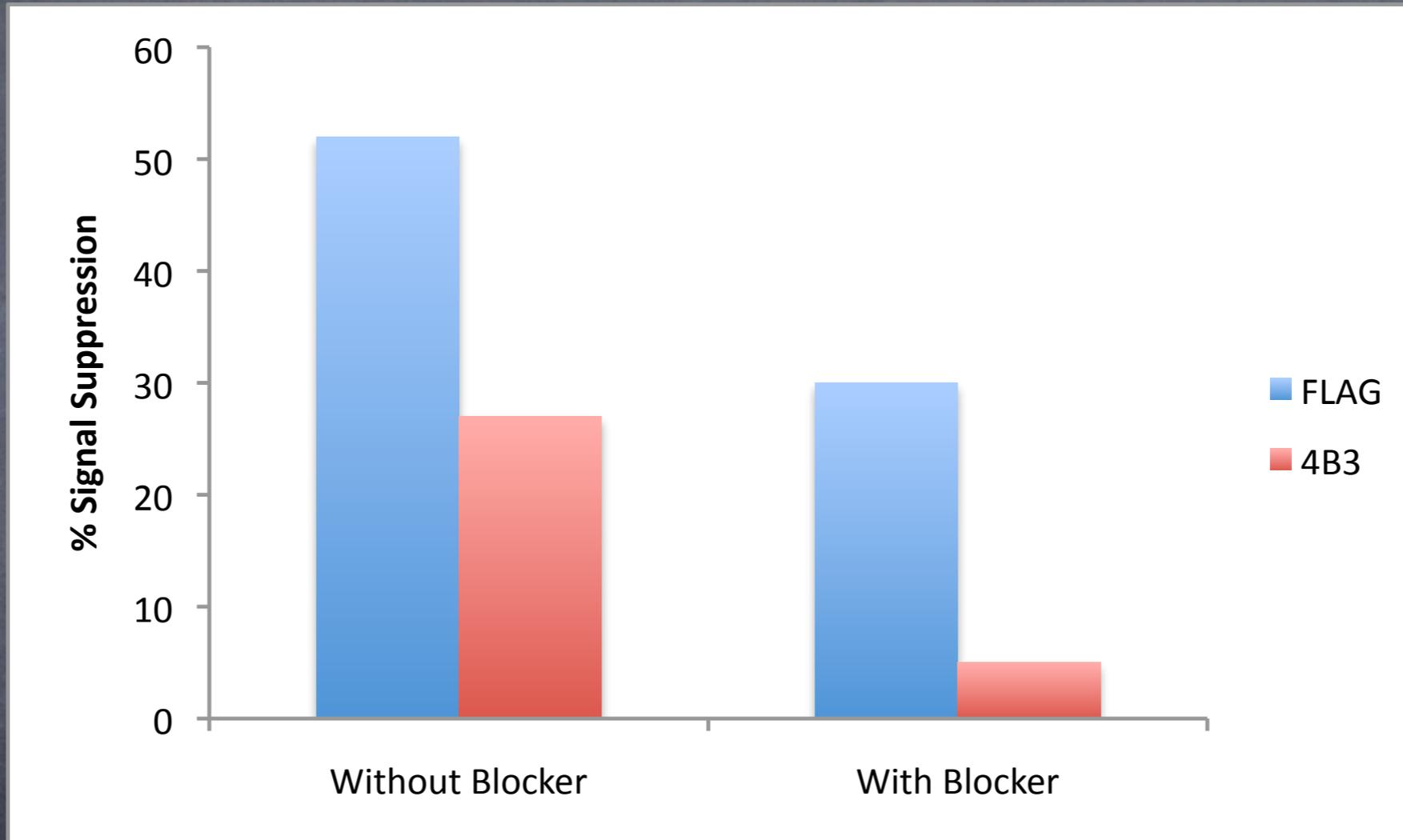


FLAG Ab

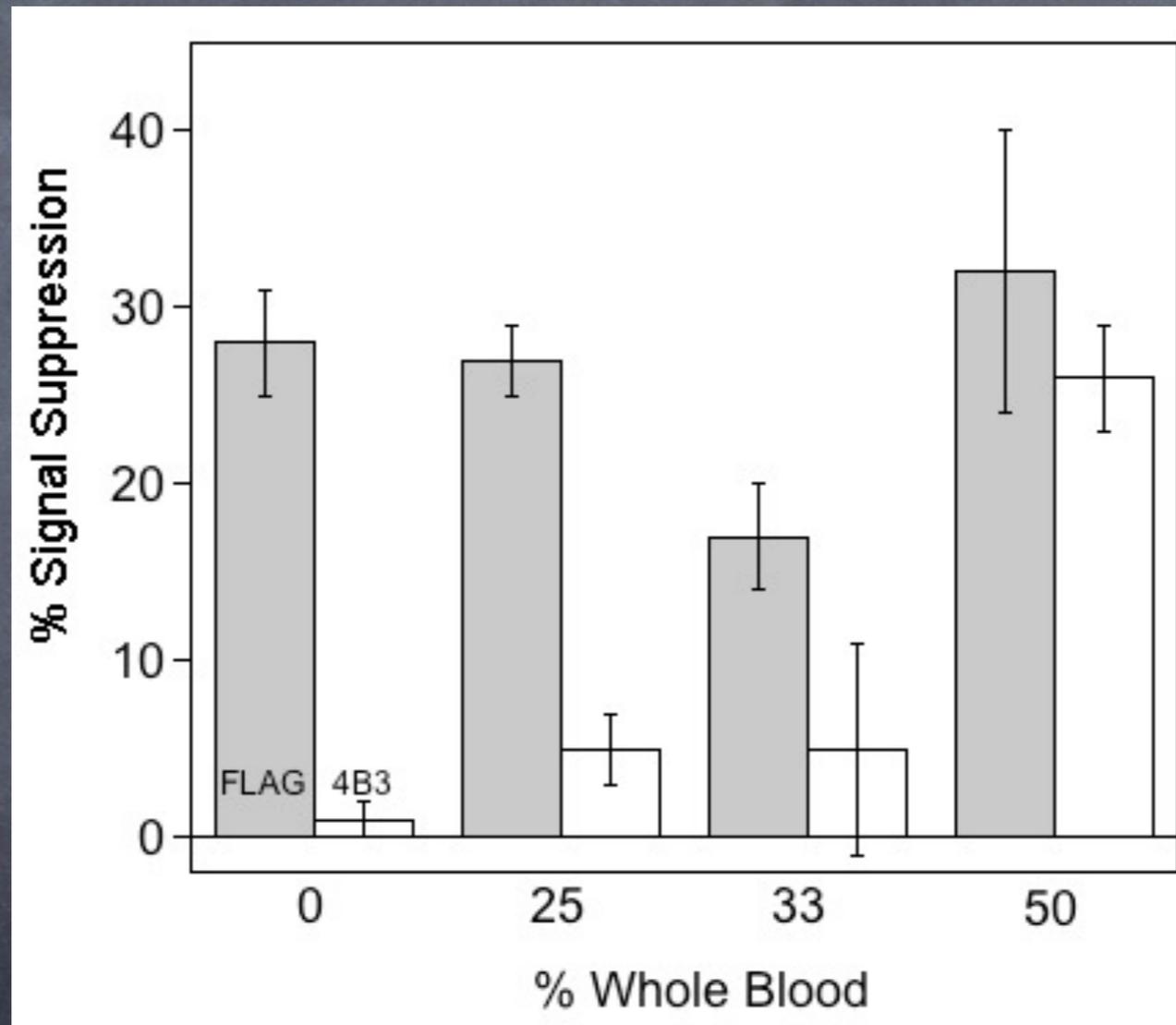
FLAG PNA

4B3 PNA

Efficacy of Blocker Solution at [25%] Whole Blood



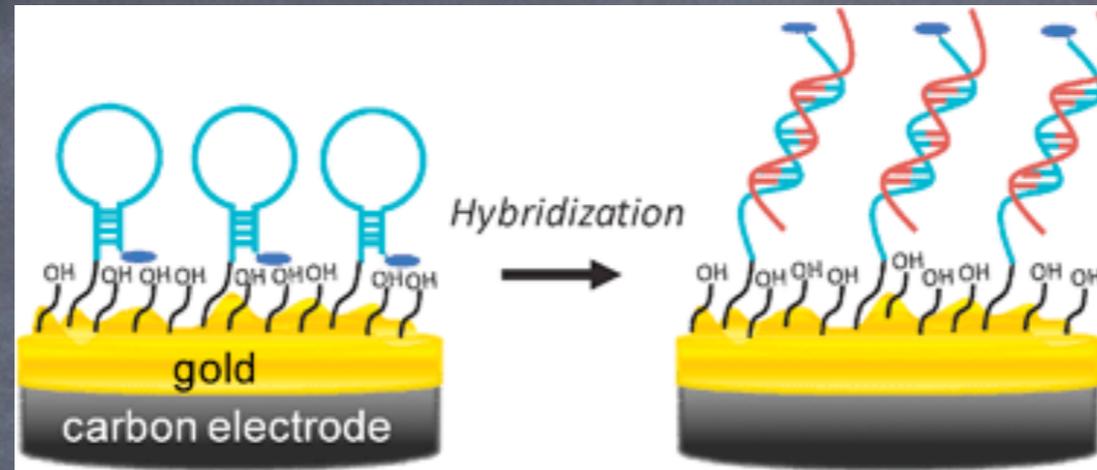
Testing Capability With Blocker



Looking Forward...

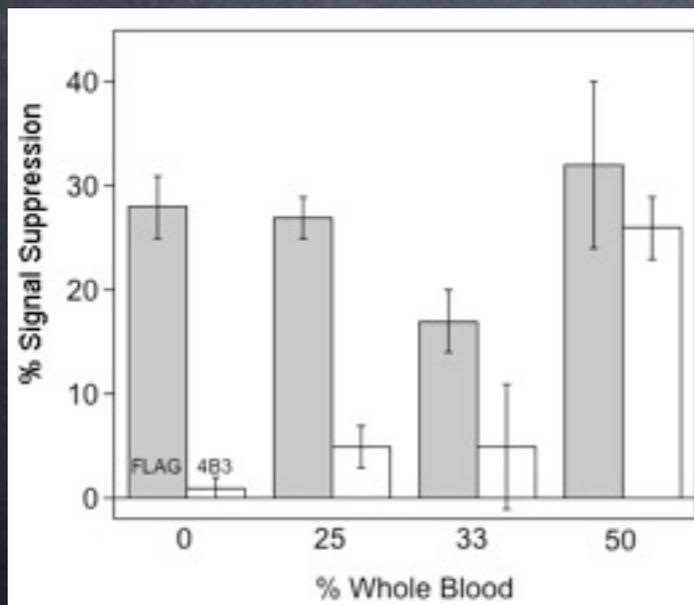
We Know...

1. The eDNA Sensor



2. That even in whole blood, this type of sensor can be very specific

3. With the current blocking solution, our sensor works well in 25% whole blood, and even 33% whole blood



What next?

Find a blocking solution to work in 100% whole blood

As a Teacher...

- A renewed interest in the scientific process (perseverance, "big picture", self checking, and good technique)
- Appreciation for the "nanoscale" world (something exists that you can't actually see with your eyes)

Thank you:



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