Solid-state Nanopores
Single Molecule Sensing With Voltage Detection

Erik Jung, Christopher O'Donnell, Noam Harel,
& Professor William Dunbar

Baskin Engineering
UC SANTA CRUZ

Saving the world one chip at a time

Many lives have been lost by catching cancers and diseases far too late

- Using solid-state nanopore technology we can help doctors diagnose patients by reading their genetic sequences

- Every experiment brings our research closer to a more efficient process and practical use

- By using voltage detection, we are able to read each nucleobase of DNA strands
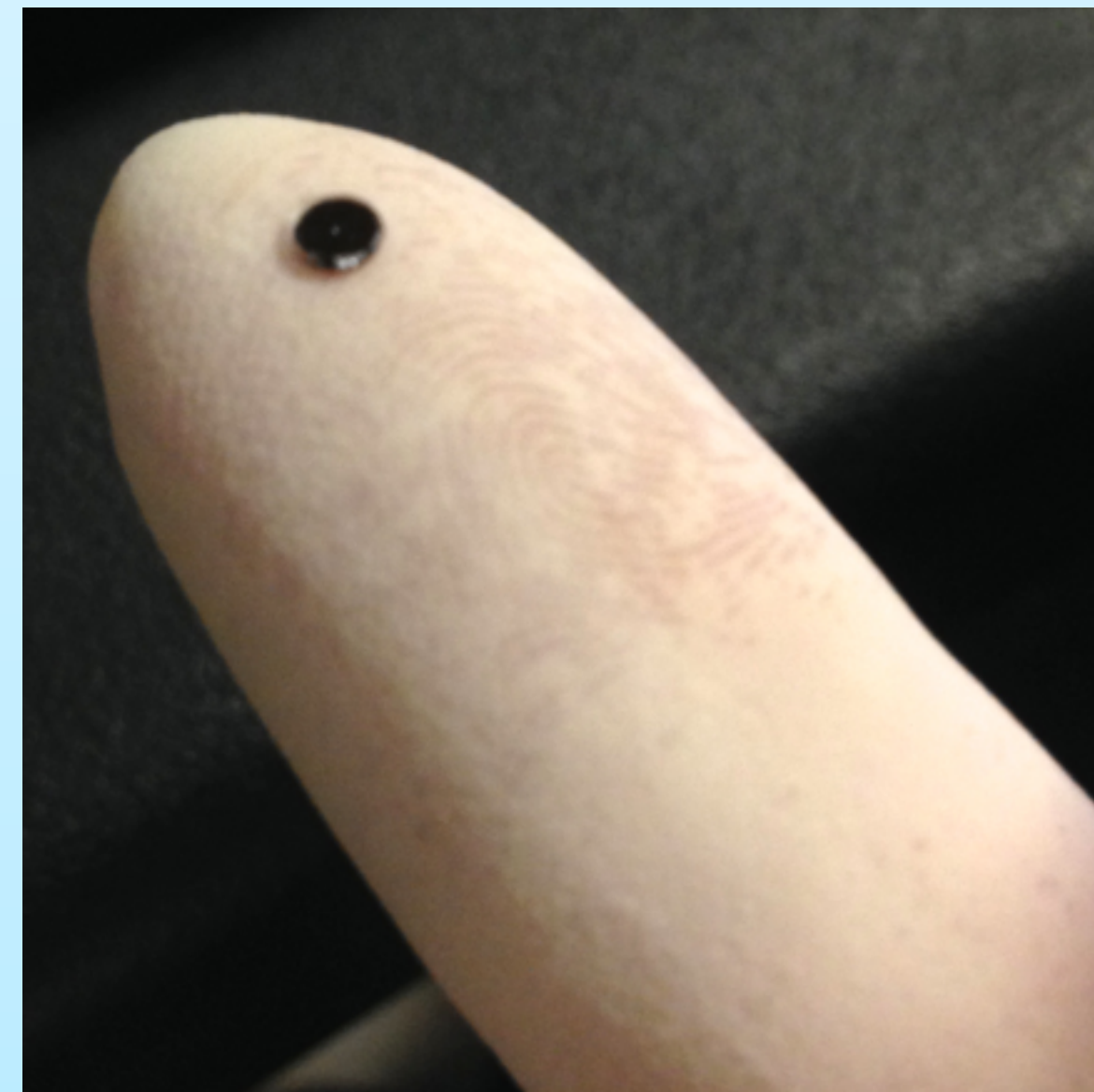
By using our solid-state nanopore technology, the costs of these diagnosis will be fairly cheap and all doctors will require is a single drop of blood from their patients

Nanopores with RecA coated DNA
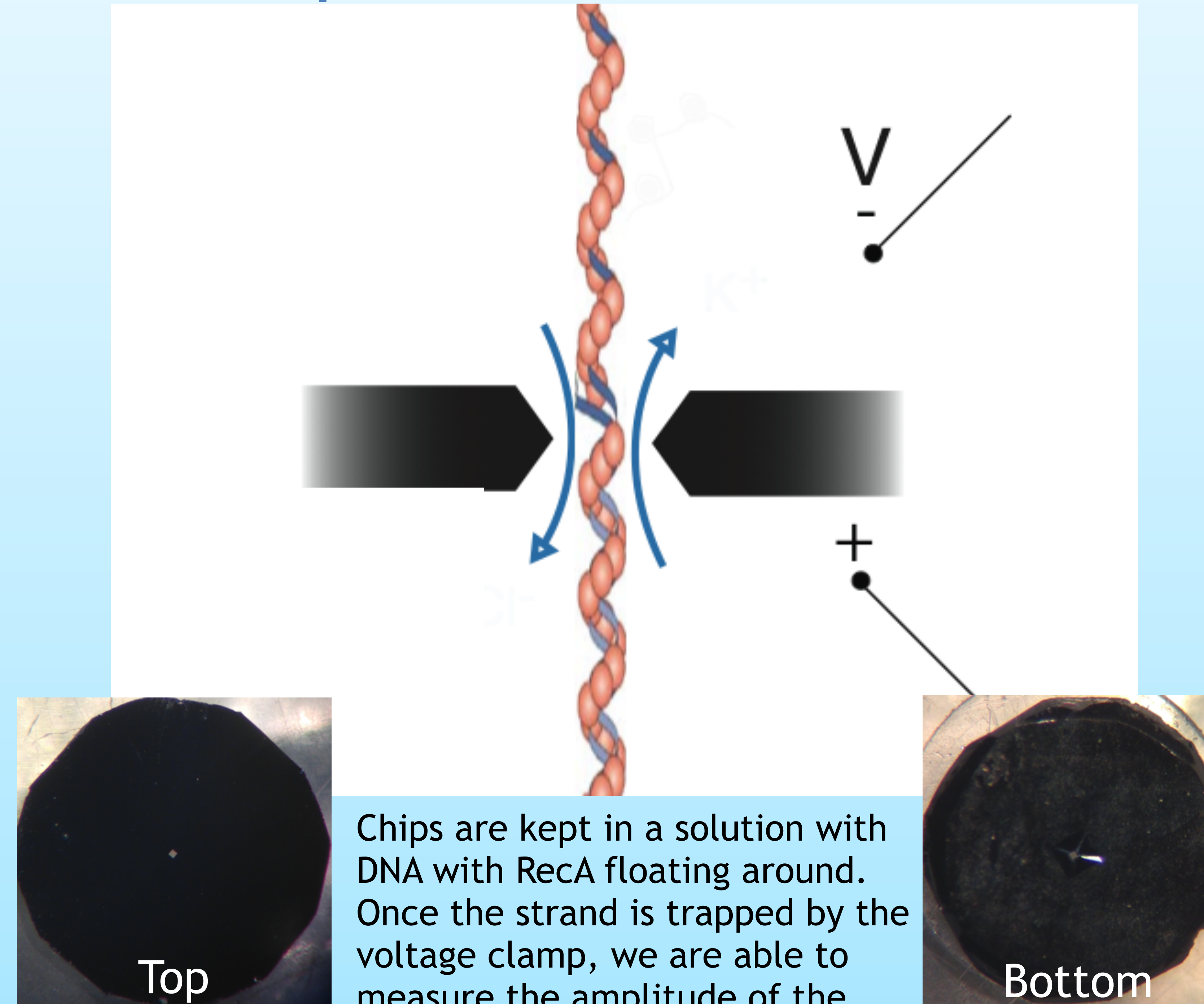
Chips are kept in a solution with DNA with RecA floating around. Once the strand is trapped by the voltage clamp, we are able to measure the amplitude of the current of each single molecule.

Top

Bottom

Bubble Trouble

- 70% of the time spent with the chips is simply removing bubbles

- Our problems with bubbles will soon be alleviated by using a new voltage drilling method to create these precise nanopore holes inside the buffer solution

Moving Forward

- Learning from data analysis, our goal to eventually perfect these methods and experiments of reaching our final product becomes closer and closer

- We are looking in a different style of drilling chips which should eliminate our bubble trouble and directly lead us to collecting data with precise nanometer-sized holes in the nanopore

Nanopores for DNA sensing

- Sequencing DNA for information is valuable

  - It is very difficult to get exact DNA bases, but by using objects like protein it's easier to read DNA with higher voltage drops

- In a saline solution, running voltage connected with the membrane causes DNA translocation (DNA is negatively charged)

  - When DNA is pulled through the pore, the current spikes down to a certain current level which allows us to read the DNA strand

Voltage detection of RecA coated DNA
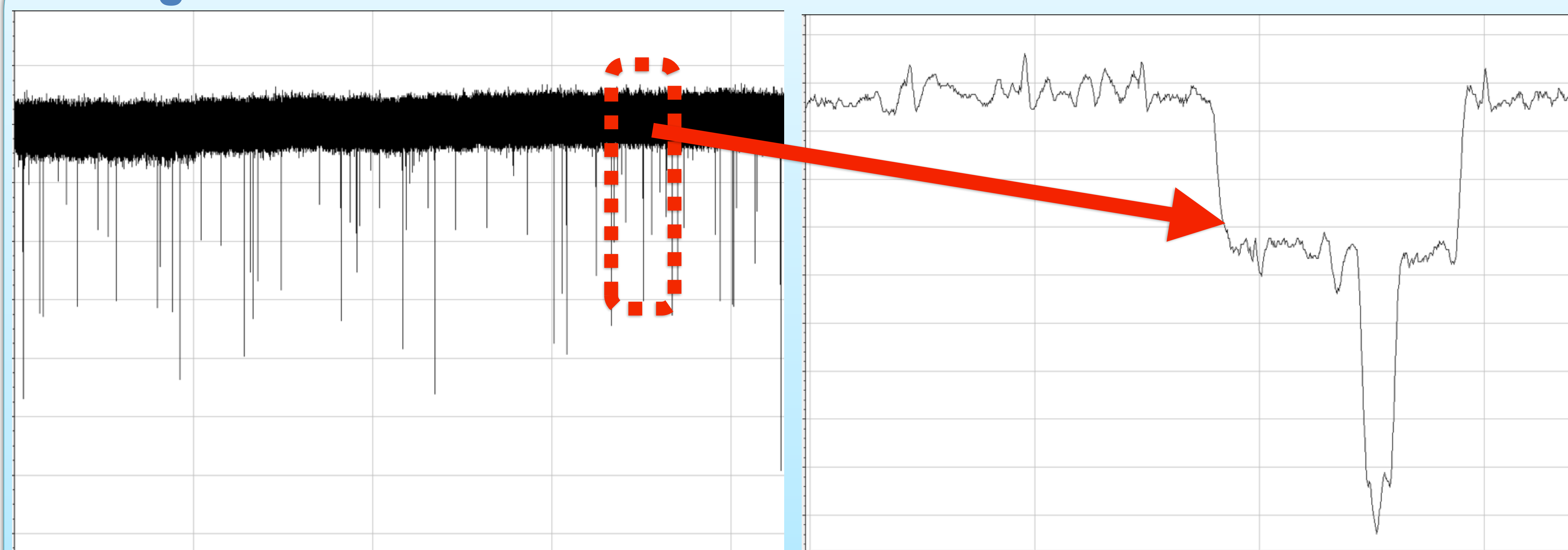
- Recorded results with RecA coated DNA send through the solid-state nanopore

- Each voltage drop shown detects a single DNA with RecA molecule in which we measure through current

Acknowledgements

- **Professor William Dunbar for this opportunity**
- **Christopher O'Donnell for training and guidance**
- **Noam Harel for partnership during research**
- **Members of SURF-IT**
- **Nation Science Foundation for funding this research internship**

Contact Information

Erik Jung
Email: eajung@ucsc.edu
Phone: (510) 387 - 0194