University of Pittsburgh

Petersen Institute of NanoScience and Engineering Seminar

Speaker: **Professor Jed Macosko**
Department of Biophysics, Wake Forest University

Title: ***Getting a handle on the nanoworld: Using beads, vesicles, and cartoon characters to discover drugs, track motor proteins, and help kids learn about molecular machines canning***

Time/Date: **2:00pm, Thursday, July 10, 2008**
(refreshments at 2:00-2:15pm)

Place: **Kresge Conference Center, 1175 Benedum Hall**

Nanoscale objects often require larger "handles" for visualization and manipulation. In our research we have used such handles to attack two projects: discovering drugs and tracking motor proteins. We have also used colorful cartoon characters as a "handle" to introduce children to the world of biological molecular machines.

In the first project, 100-200 nm fluorescent beads are each functionalized with multiple copies of a unique DNA sequence. These unique sequences then capture, by hybridization, specific DNA or PNA (peptide nucleic acid) strands that serve as "barcode tags" for a combinatorial drug candidate library. Since each bead displays a unique DNA sequence, only one type of DNA- or PNA-tagged drug candidate will be captured by each bead. Thus, by using an AFM (atomic force microscope) to isolate beads that bind tightly to therapeutically important targets, and by amplifying and sequencing their unique DNA, the captured drug candidates can be identified. For our second project, we track the intracellular movements of transported phospholipid vesicles, which serve as tags for motor proteins (e.g. kinesin and dynein) that would be otherwise invisible. Drag force, by Stokes' Law, scales with vesicle size and velocity, so we use the size and speed of the vesicles to determine how much force the motor proteins are exerting. Using this information, we construct *in vivo* force-velocity curves of protein motors operating alone and in groups. These curves give deeper insight into how cargo is transported from place to another within a cell. Finally, with the help of an endearing computer animated character named Bruce Spring-gene and his song "Born in the DNA", we have launched BioBotz, a non-profit company dedicated to educational entertainment products for children. Its particular focus is on introducing young people to the often-unheard-of world of molecular machines—the intricate motors and catalysts that give life to every cell on the planet.

Biographical Sketch

Dr. Jed C. Macosko is an assistant professor of biophysics at Wake Forest University. He graduated from MIT with the Merck award for outstanding scholarship and earned a Ph.D. in biophysical chemistry at the University of California, Berkeley in 1999 for his work on the molecular machinery of influenza, HIV, and nerve cells. From 2000 to 2002 his research on molecular machines continued as an NIH postdoctoral fellow in the laboratory of Carlos J.

Bustamante and as an adjunct assistant professor working with David J. Keller at the University of New Mexico in 2003 and 2004. Since August of 2004 the Macosko Lab at Wake Forest has focused on the transport machinery in cells and on new methods of drug discovery, for which he has been awarded funds from agencies ranging from the NIH to the North Carolina Biotechnology Center.