Microbead Behavior in a Nanochannel

Lesa Bishop
Jackson Travis Del Bonis-O'Donnell
Dr. Sumita Pennathur, Dept. of Mechanical Engineering
EUREKA, University of California, Santa Barbara
08/25/11

Future of Nanotechnology

- Study the behavior of particles and biomolecules in nanochannels.

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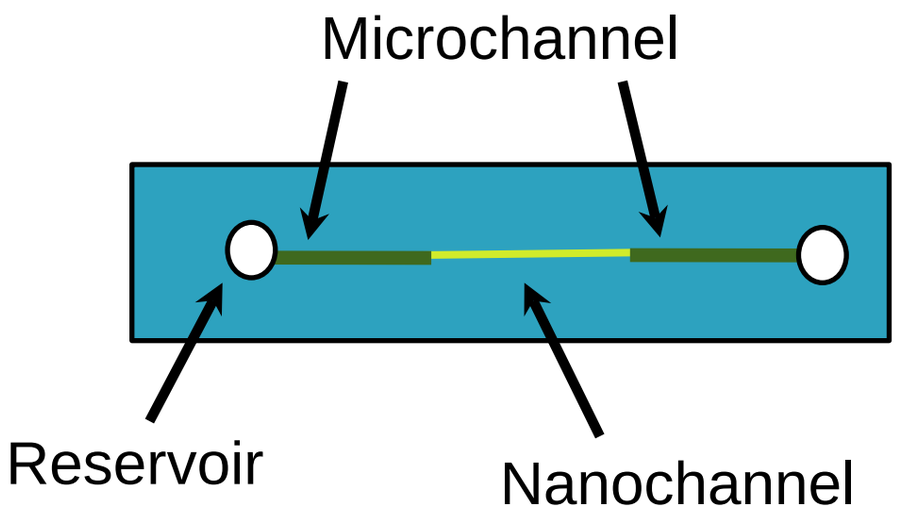
- Will help the design of future Lab-on-a-chip (LOC) devices

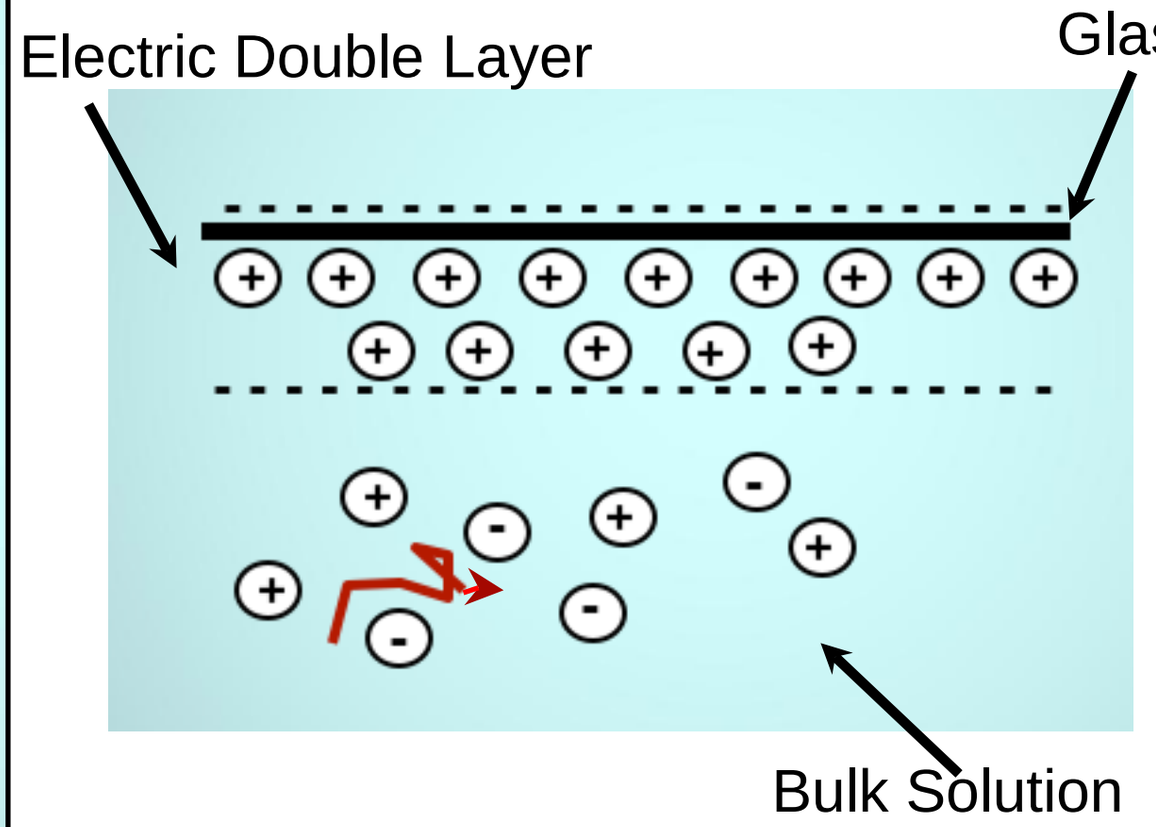
- Revolutionize medicine and forensic identification.

Micro to Nano Channel

Top View of a Glass Chip

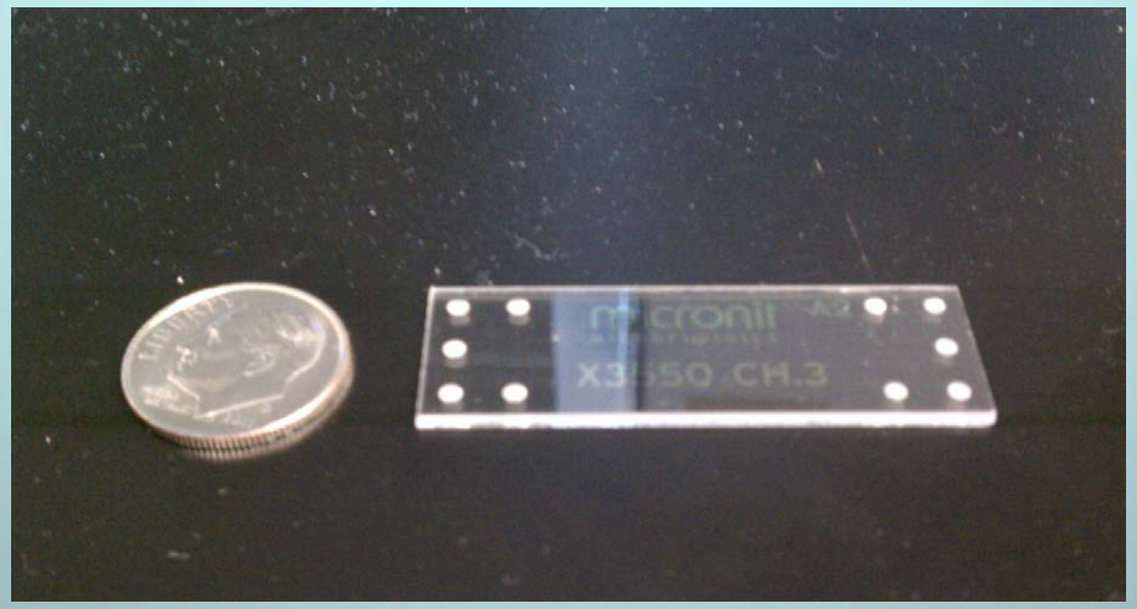


Nanochannel



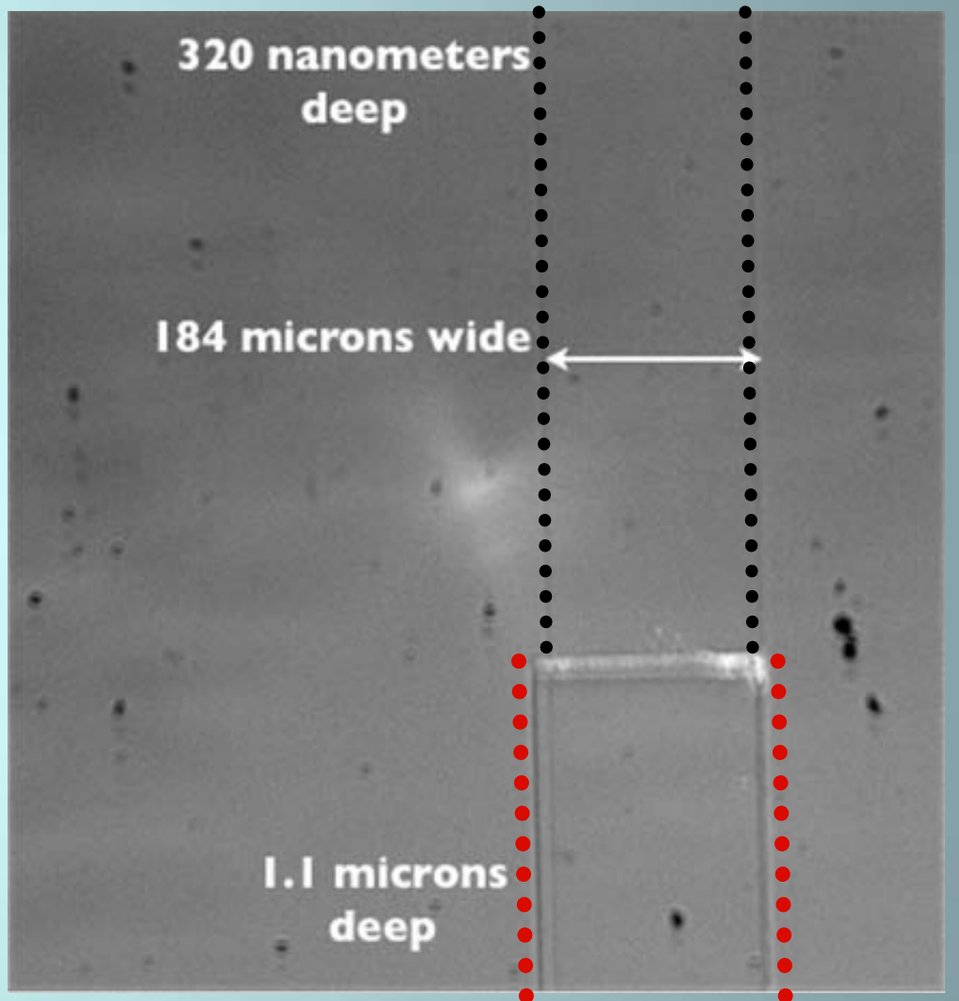
Flow Characterization

- Characterize particle transport and separation in a nanochannel using electric fields and fluorescence microscopy.
- Rapidly separate particles in a nanochannel.

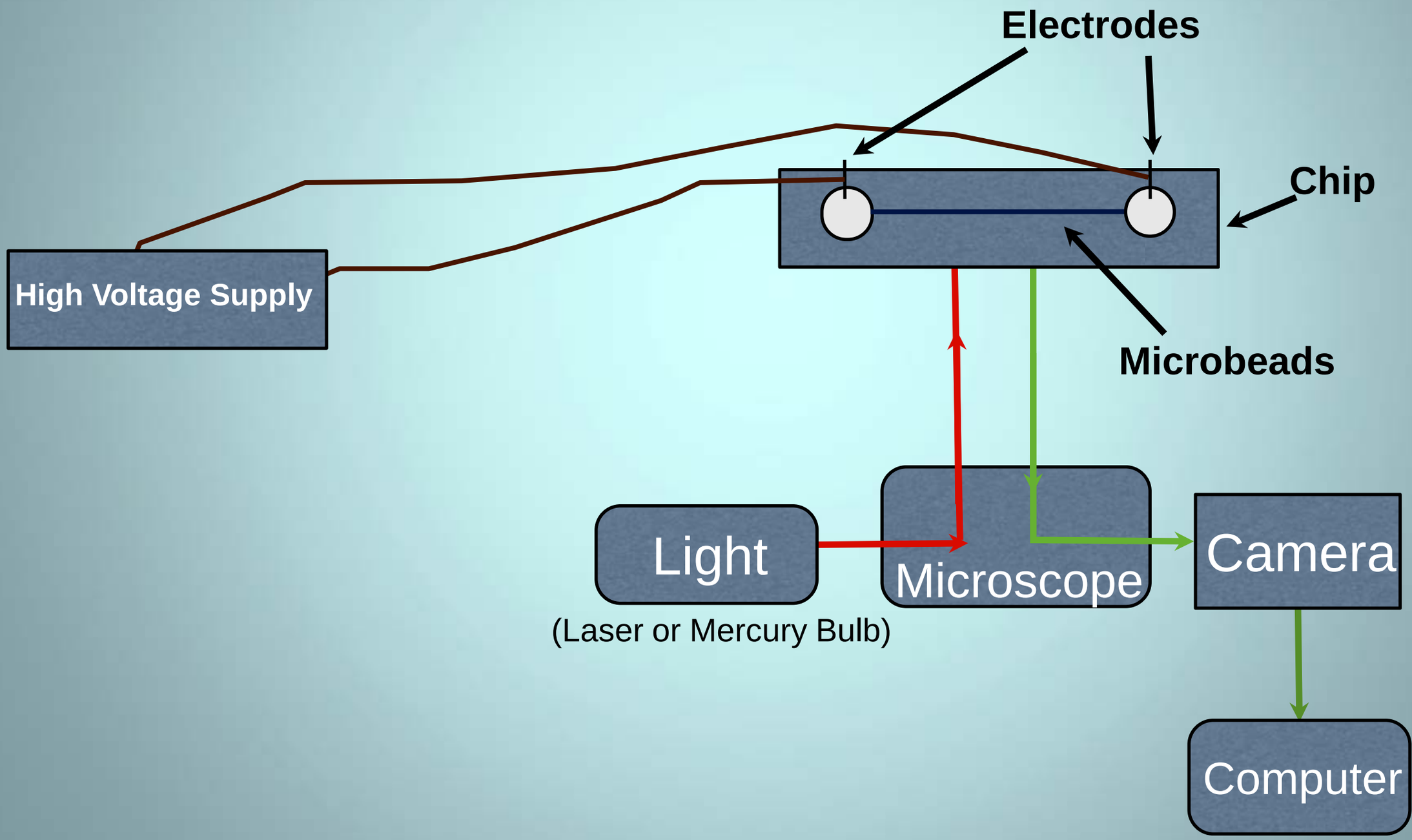


Behavior of microbeads at the Nanoscale

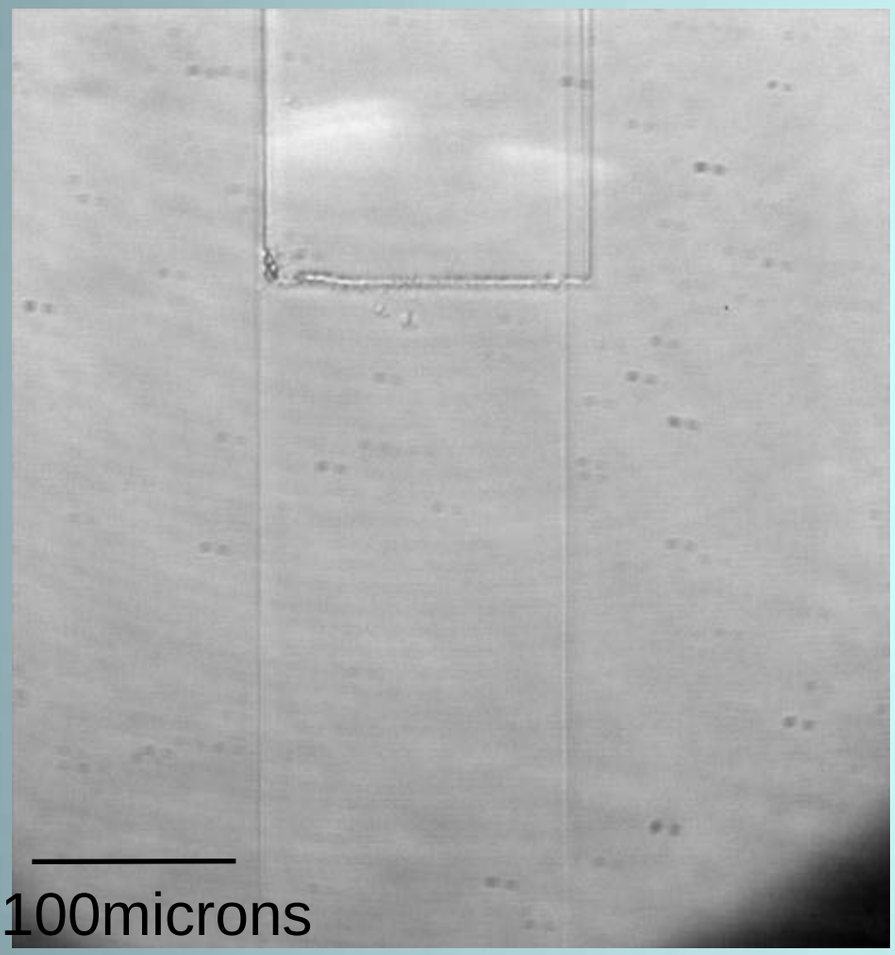
- DNA=Microbeads
- Flow microbeads into the channel with a Tris buffer using electrokinetic flow.
- Microbeads are tagged with dye which fluoresces when exposed to a laser.
- Count the particles that enter the nanochannel and compare to the number in the microchannel.



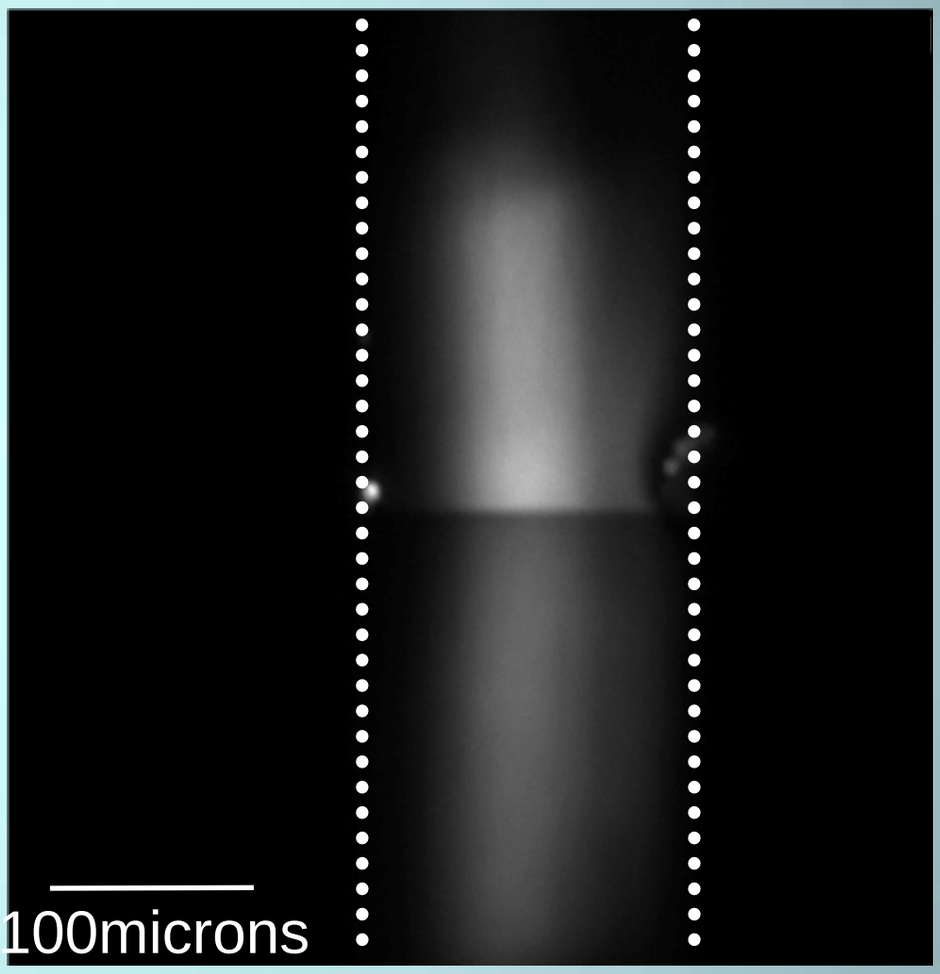
Monitoring Microbead Flow



Micro Versus Nano Flow Rate



Brightfield Image

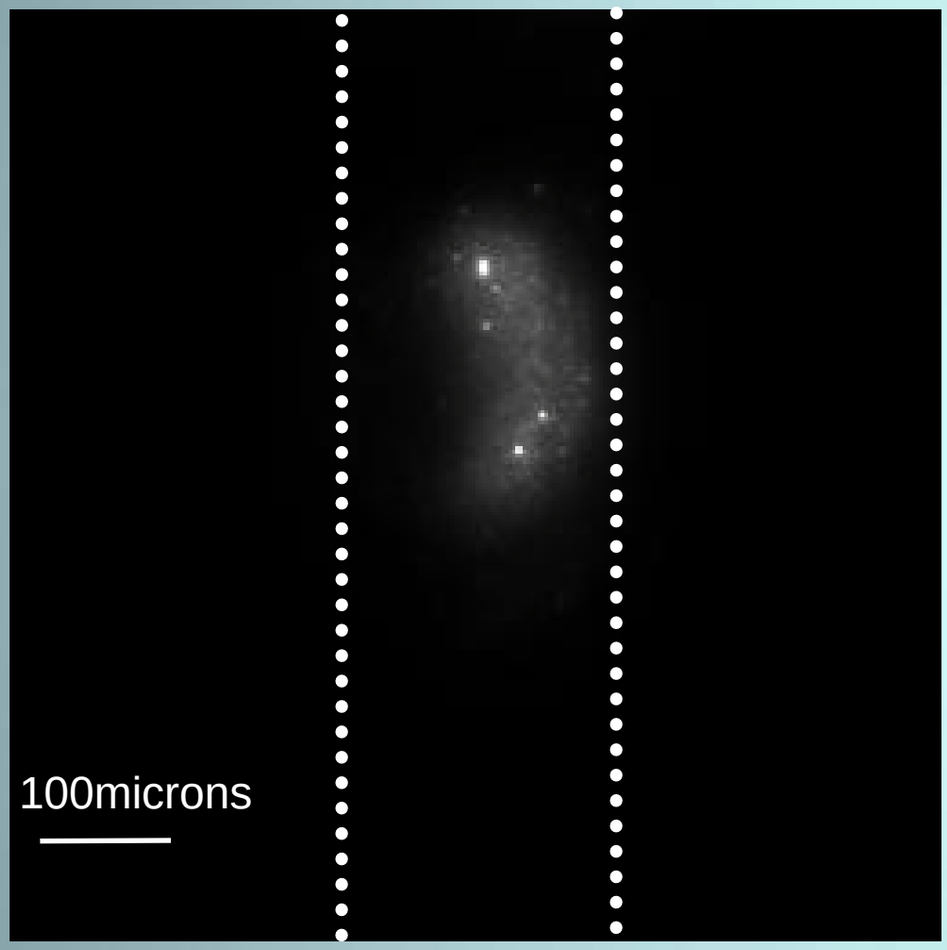


Fluorescence Image

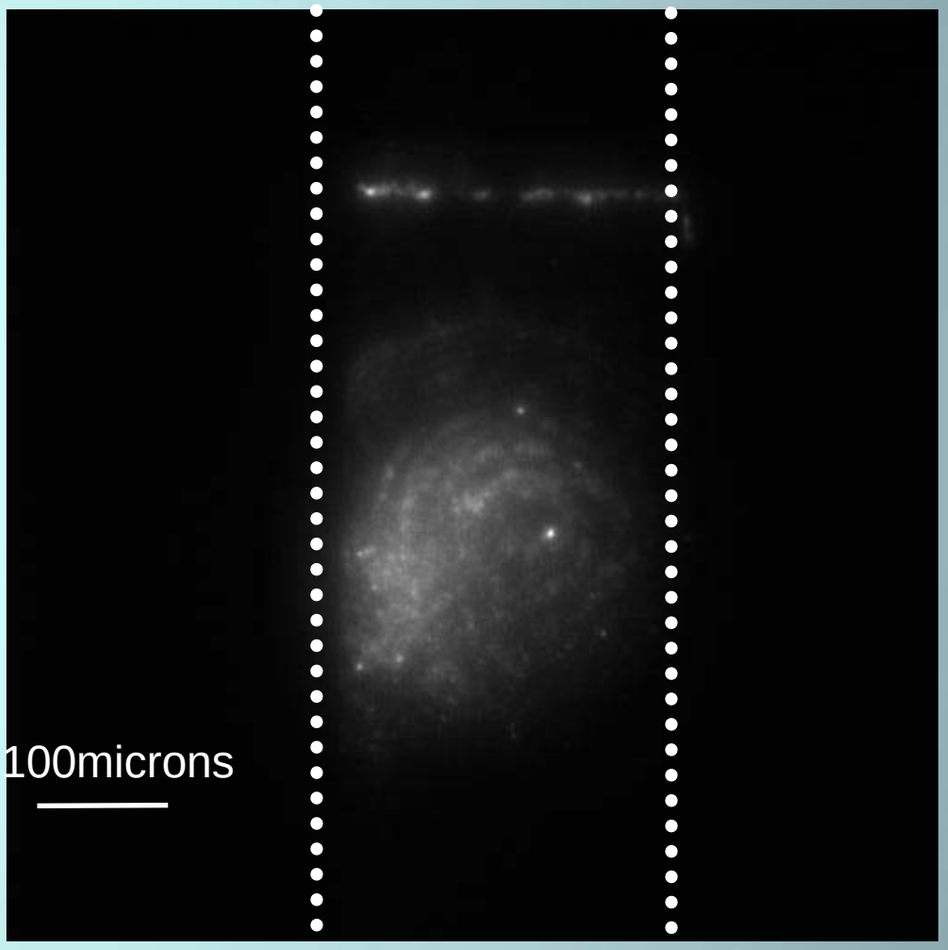
- In the nanochannel the flow of fluids and particles are faster than in the microchannel.

Freely Diffusing Microbeads

No Voltage Applied



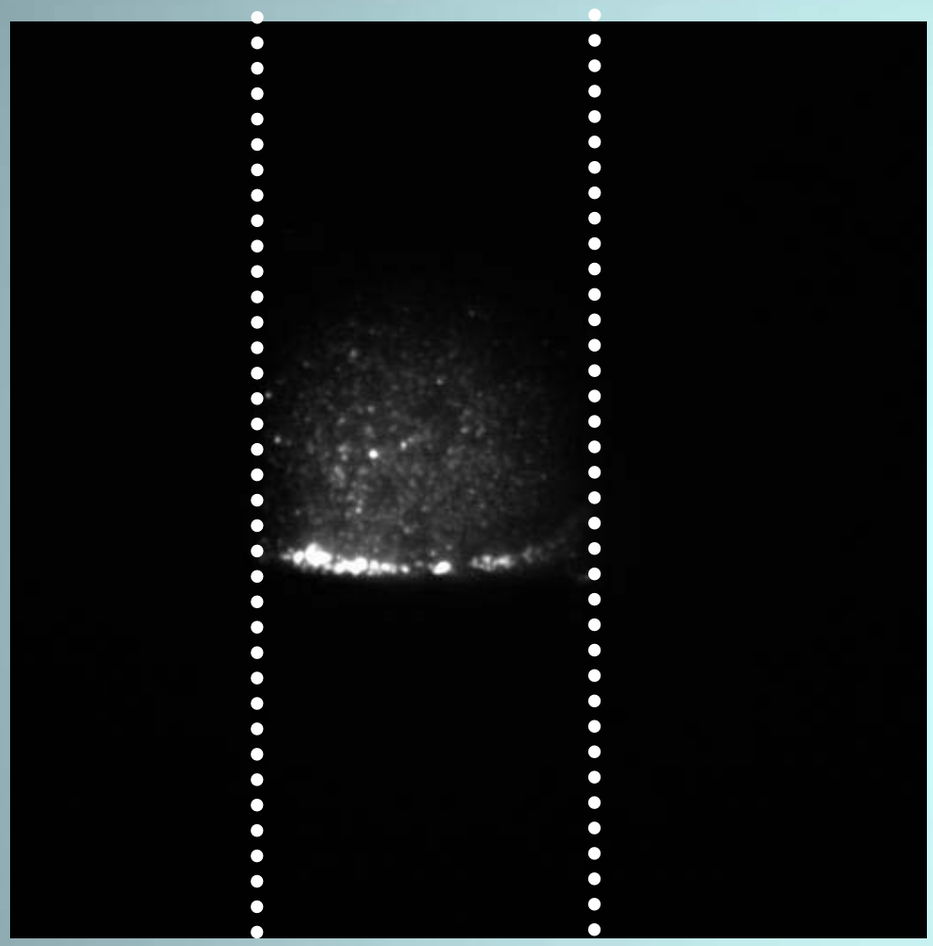
Nano Channel



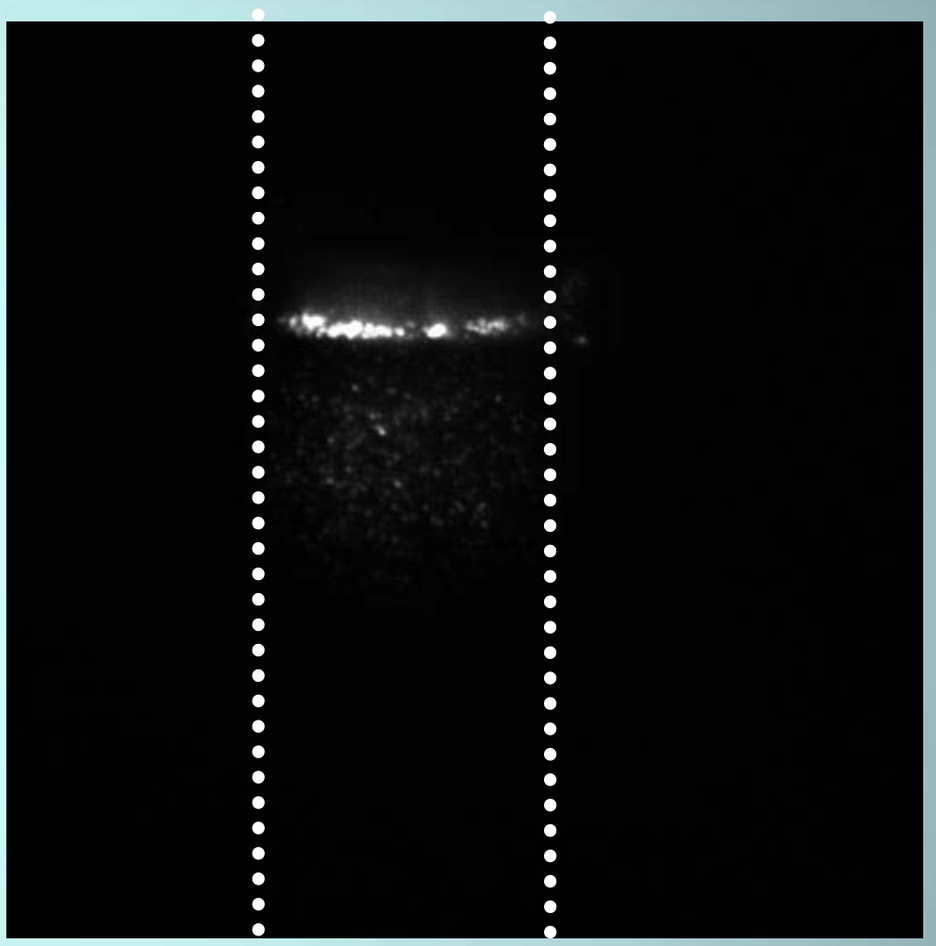
Micro Channel

- The particles stick to the walls of the nanochannel immediately after crossing the interface.

Particle Counting



Micro Channel



Nano Channel

- Some microbeads are lost in the flow from the micro to nanochannel.

Conclusion

- The charged wall in the nanochannel attracts the microbeads making them adhere to one side due to Van Der Waals force.
- The interface is trapping some of the particles.

Future Work

- Vary the ionic strength of the buffer
- Be able to count particles
- Observe the effect the interface has on particle transport

Acknowledgments

- Sumita Pennathur
- Jackson Travis Del Bonis-O’Donnell
- Pennathur Lab
- Arica Lubin
- EUREKA

Questions?