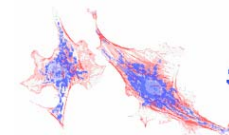


# ***A Scientific Wonderland - Bio-nano Technology for Human Health -***

***Pak Kin Wong  
Aerospace and Mechanical Engineering  
University of Arizona***

***<http://www.ame.arizona.edu/research/sbl>***

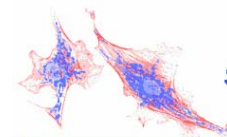
***Sunrise Drive Elementary School  
Oct 4<sup>th</sup>, 2006***



***Systematic Bioengineering Laboratory  
University of Arizona***

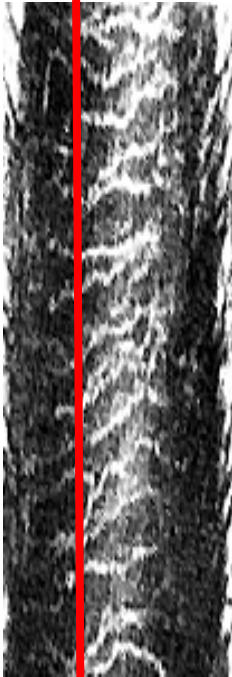
---

***How large is one nanometer?***



## How large is one nano meter ?

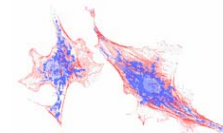
Hair



Slice 100,000 times



Nano meter

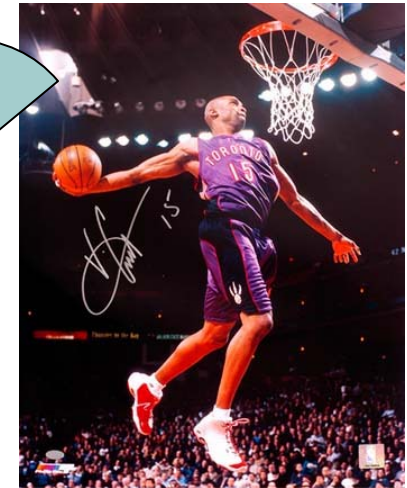


# How large is one nano meter ?

Nano meter



Meter



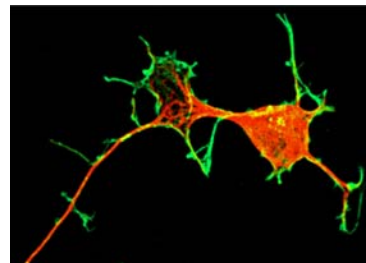
Human

reduce 1000 times



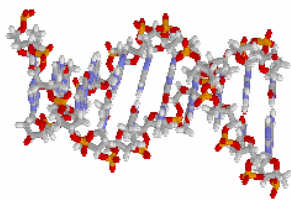
Ant

reduce 1000 times



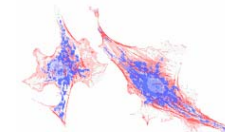
Cell

reduce 1000 times

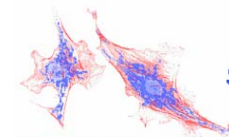


DNA

**Nanotechnology**

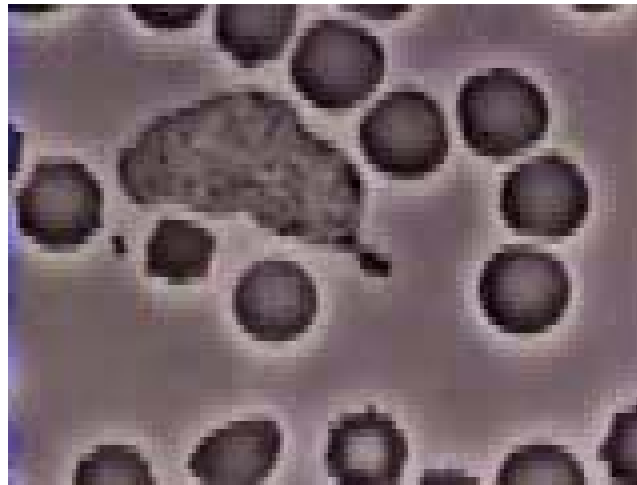


# ***Why do we study cells and molecules?***



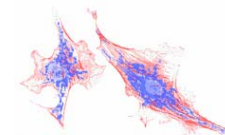
## *To understanding interesting biology*

### **Cellular police**



### **A neutrophil chasing a bacteria**

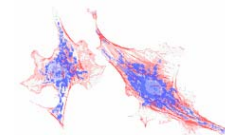
*Rogers, 1950s*



## *Medical Diagnosis*



**2-3 days Cell culture**



# Lab on a chip

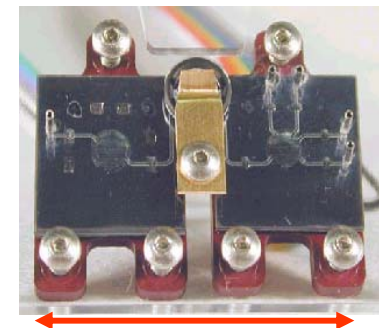
## Labor-intensive Bench Top Process



## Book Size System



## Watch Size Sample Prep.+ Sensor

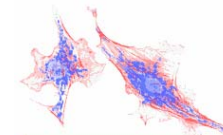


2 cm

Microfluidic  
Bio-nano technology



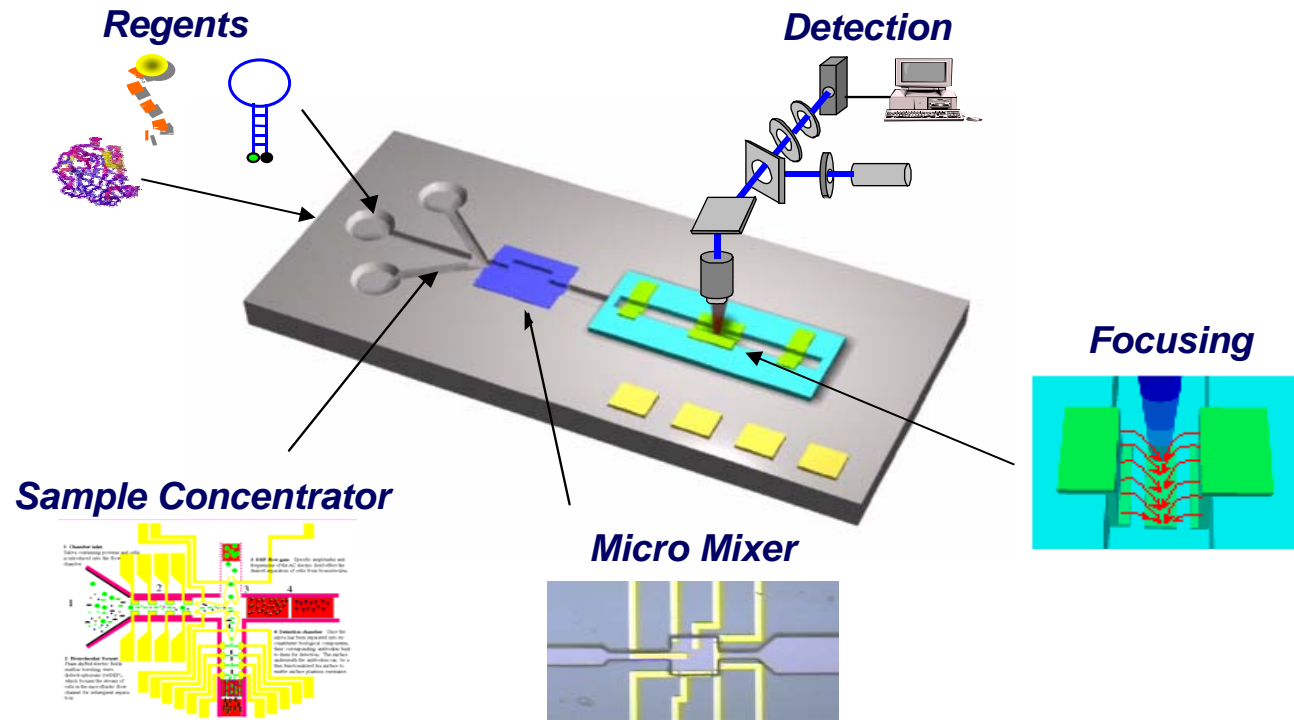
- Rapid
- Sensitive
- Specific



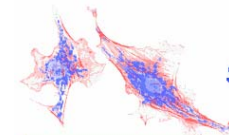
Systematic Bioengineering Laboratory  
University of Arizona



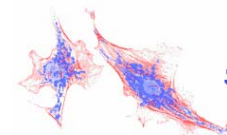
# Lab on a chip



***We have to move cells and molecules ...***

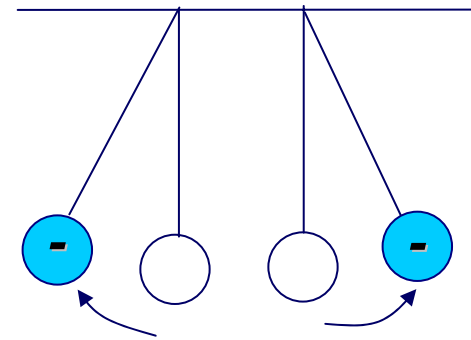
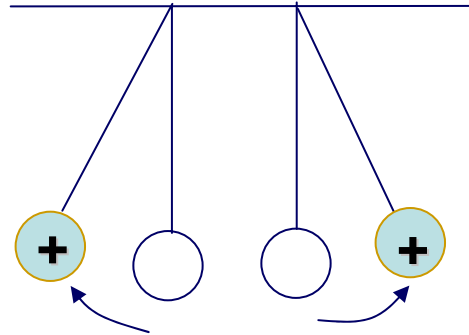


# ***How do we move cells and molecules?***

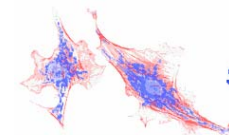
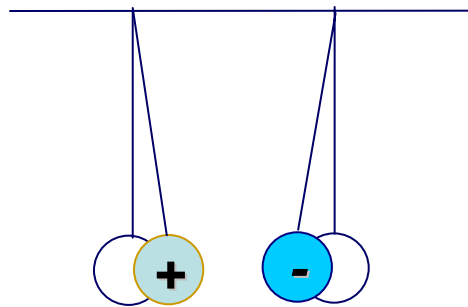


# Electrostatic force

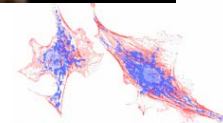
**Objects with similar charges repel each other**



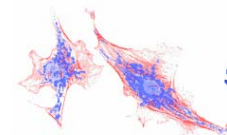
**Objects with different charges attract each other**



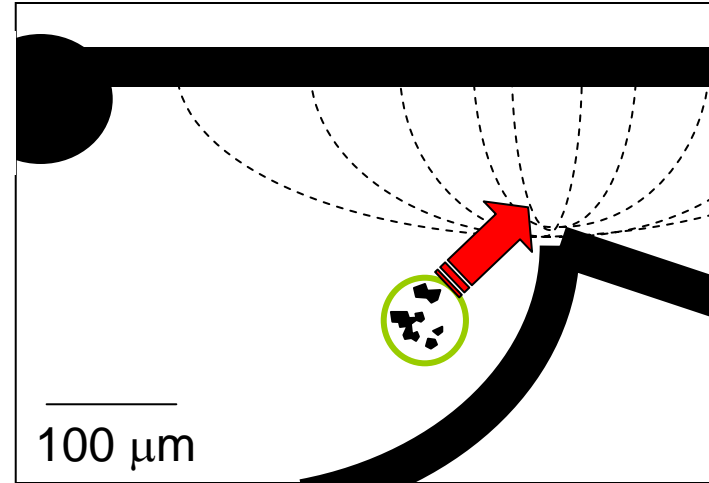
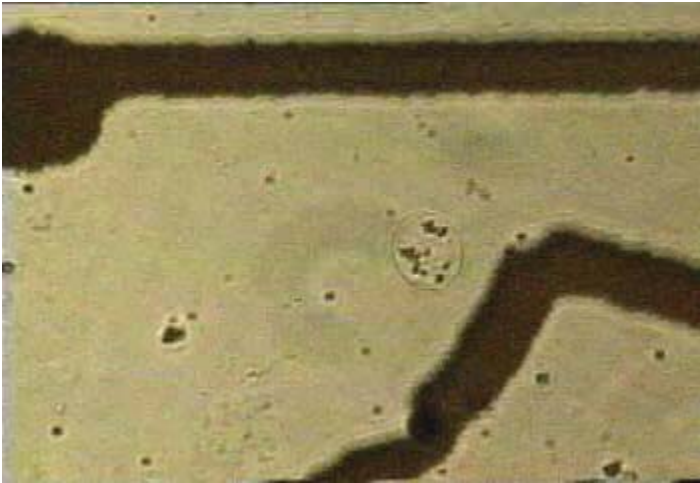
# ***Electrostatic force***



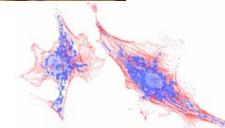
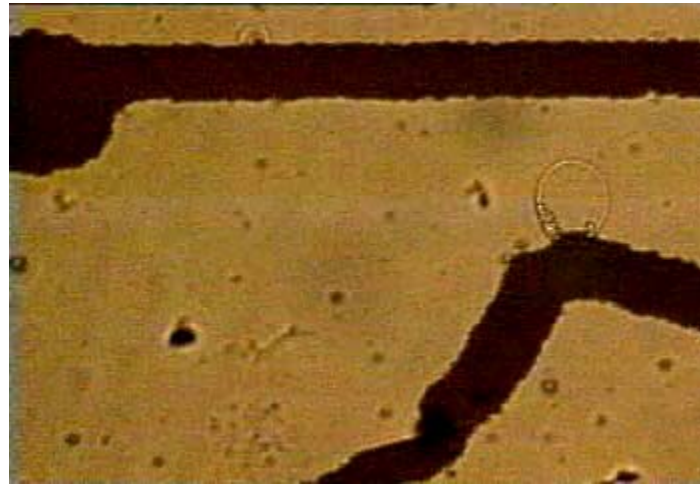
# ***What we do to cells and molecules***



## Move a cell



Wong et al *IEEE/ASME Trans. Mechatronics*

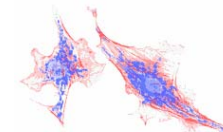
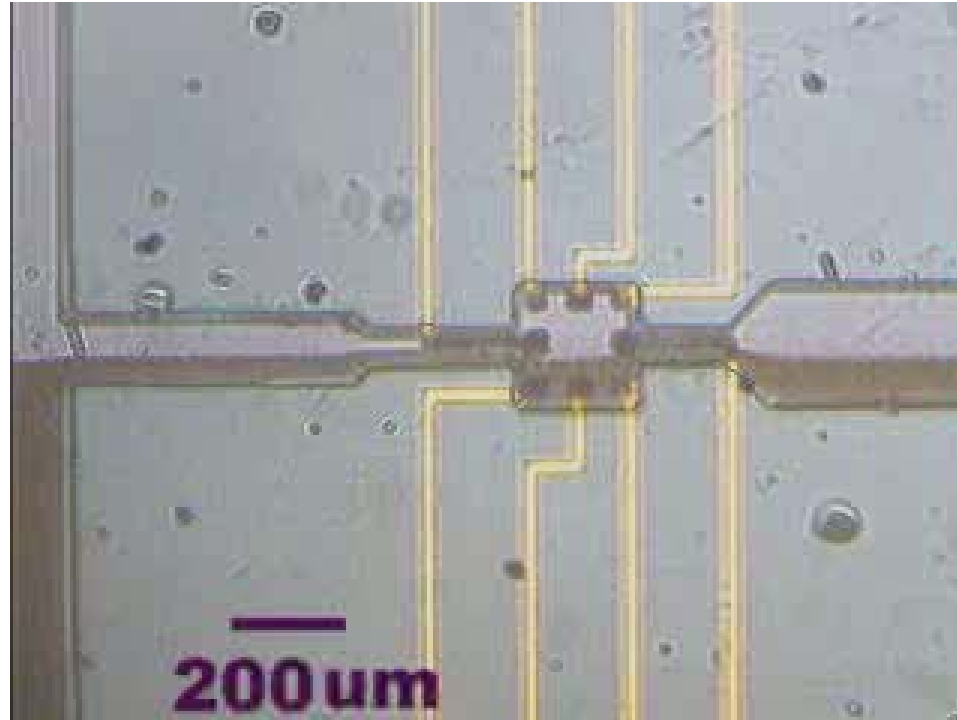


# Mixing

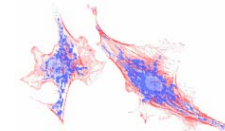
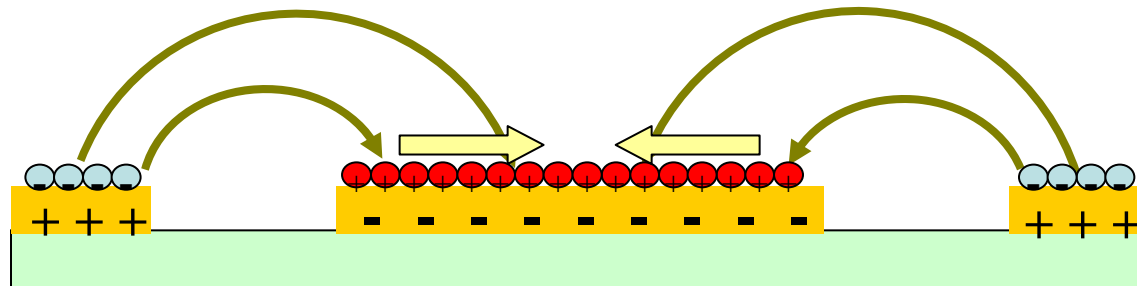
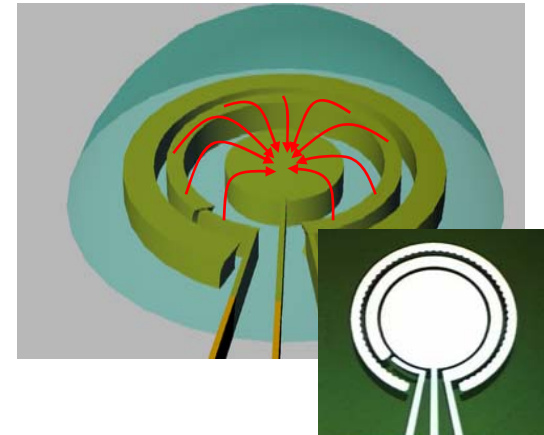
DI water



500nm microsphere  
in aqueous medium

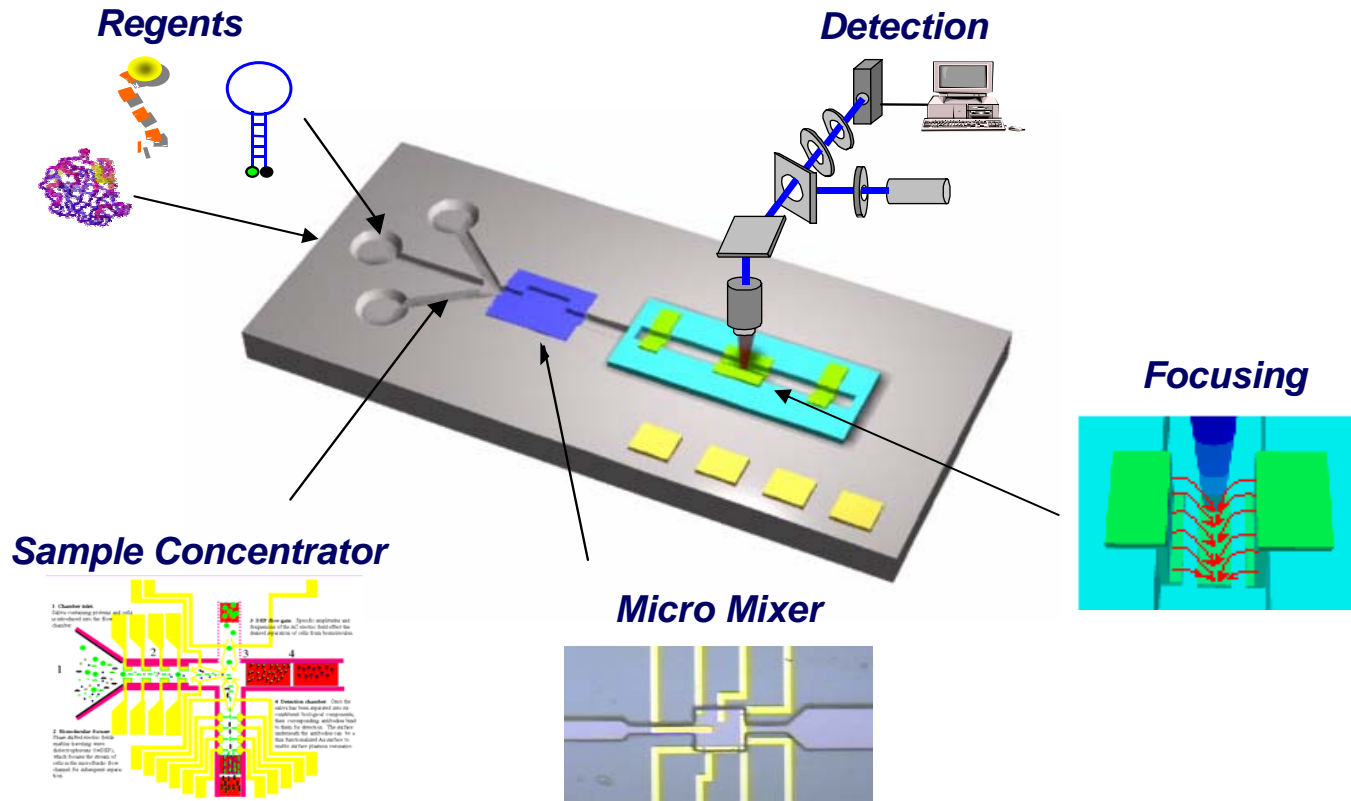


# Concentration





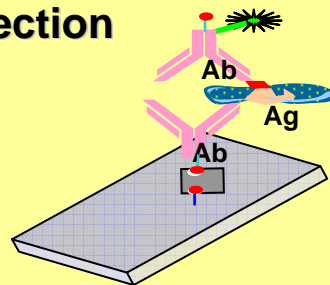
# Lab on a Chip Applications



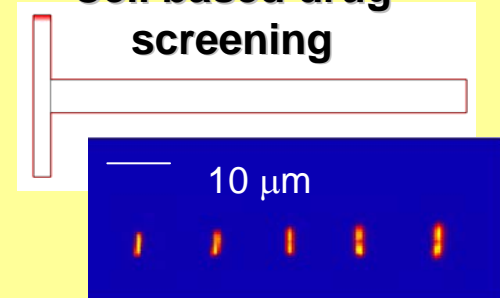
## Uropathogenic *E. coli* identification



## Oral cancer biomarkers detection



## Cell based drug screening



## Summary

- **Bio-nano technologies**  
*understanding our lives – cells and molecules*  
*lots of potential and lots of fun*
- **Lab on a chip**  
*Move, mix, concentrate cells and molecules*  
*rapid, sensitive and specific*

