

**BASIC: BIO-INSPIRED ASSEMBLY OF SEMICONDUCTOR ICs**

ssDNA  
Self-Assembly  
Devices  
Complementary molecules and/or electric field

Assembly and selective placement of silicon on plastics and glass

**Dielectrophoretic Sorting and Separation of Cells**

Cell sorting: live cells (green, positive DEP), dead cells (red, negative DEP)

DEP based micro-fluidic filters and valves

Beads and bacteria  
Electrodes  
Flow  
Detection Chamber  
Output channel

**AFM Imaging of Virus and Bacteria**

Listeria  
Human Corona Virus

Bacteria and virus on micro-fabricated surfaces of biochips

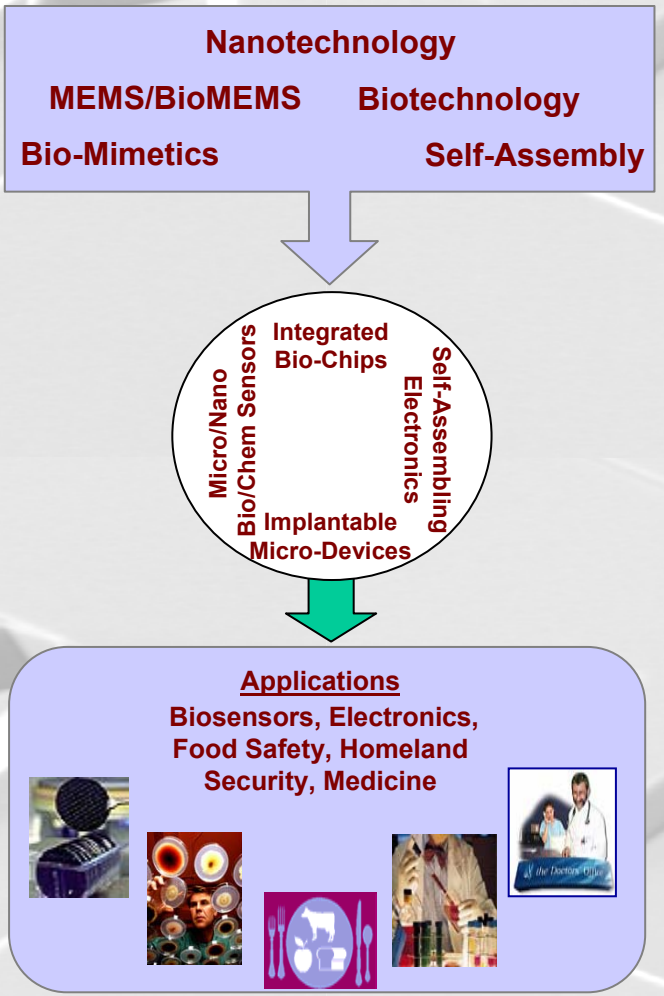
**Ultra-sensitive pH Micro-Sensors**  
 $\Delta pH = 1-10e-5$

Cantilever over a well  
Polymer  
Deflection at the tip ( $\mu m$ )  
pH of Fluid Around the Cantilever  
Cantilevers touched the bottom  
Experiment  
Model  
slope = 18.3  $\mu m/pH$  (range 6-8)

Environmentally sensitive micro-patterned polymer structures on cantilever sensors

# Laboratory of Integrated Biomedical Micro/Nano-Technology and Applications (LIBNA)

PI: Rashid Bashir



For more information visit:  
[www.ecn.purdue.edu/BioMEMS/](http://www.ecn.purdue.edu/BioMEMS/)



**Micro-fluidic Cell Culture Arrays**

Cavities  
Pt electrodes  
Glass side channel  
Input port  
Epoxy adhesive  
700  $\mu m$   
Glass cover  
In/Out ports  
Cavities/Wells

Rapid electrical detection and characterization of cells with on chip dielectrophoretic cell sorting

**Resonant Cantilevers for Biological Sensing Applications**

Cantilever Beam with DNA and *Immobes* bacteria non-specifically attached on the surface.

Ab, BSA and ~80 Bacteria (78.2kHz)  
Ab and BSA (78.7kHz)  
Unloaded (80.7kHz)

Detection of bacterial agents and binding

**Micro/Nano-mechanical Cantilevers for Virus Detection**

Virus Particles  
Media Components  
Virus Size ~200nm X 300nm  
Silicon Cantilever with Western Reserve Strain of Vaccinia Virus  
10  $\mu m$

Technology development for the rapid detection of virus particles from air

**Integrated Bio-Molecular Sensors**

Integrated Nano-wire  
Au  
Silicon  
Metal  
Capture Molecules  
Target Molecules  
Plate Size ~ 20nm X 1  $\mu m$  X 3  $\mu m$   
Wire Size ~ 20nm X 20nm X 3  $\mu m$   
oxide  
N+  
N-P  
P type Silicon  
Integrated Bottom Gate

Bio-sensors with electronic output, capability of dense arrays integrated with ULSI silicon, direct Label Free detection of DNA and Proteins

### Team:

- Prof. Rashid Bashir
- Three Specialist Senior Researchers
- Nine Graduate Students
- On-going Summer Students

### Collaborators:

Ag& Bio Engr., Biomedical Engr.,  
Biology, Chemical Engr., Electrical &  
Computer Engr., Food Science,  
Medicinal Chemistry

### Funding:

US Department of Agriculture, NASA,  
NSF Career Award, National Institute of  
Health, DARPA

### Outreach:

Undergraduate and High School Student  
Projects, Technology Commercialization

### Center Affiliations at Purdue:

- Birck Nanotechnology Center
- Bindley Biosciences Center
- NASA Institute of Nanoelectronics and  
Computing
- USDA-Food Safety Engineering Center

### Positions:

Post-doctoral positions  
available, please visit web-site

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