

Nanowire Biosensors

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- Novel techniques for the diagnosis and intervention of Heart Disease, Stroke and Cancer require an understanding of the pathways that lead to disease at the single cell level.
- We are developing a toolset that will analyze the biomolecular environment of a single cell.
 - ◆ Label Free
 - ◆ Real Time/Short Time Scale
 - ◆ Minimal Impact on the Cell
 - ◆ Very Small Volume and Concentration
 - ◆ Simultaneous Various Target Detection
 - ◆ Minimal Cell Manipulation



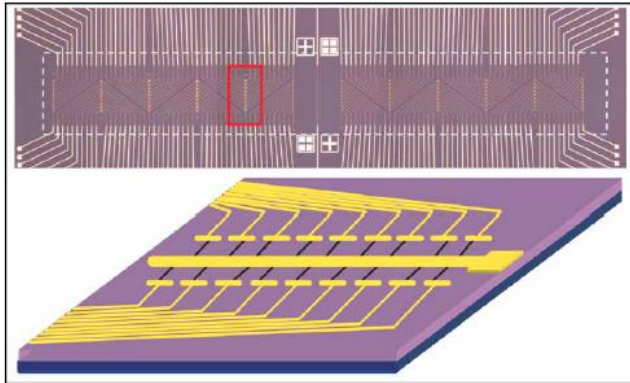
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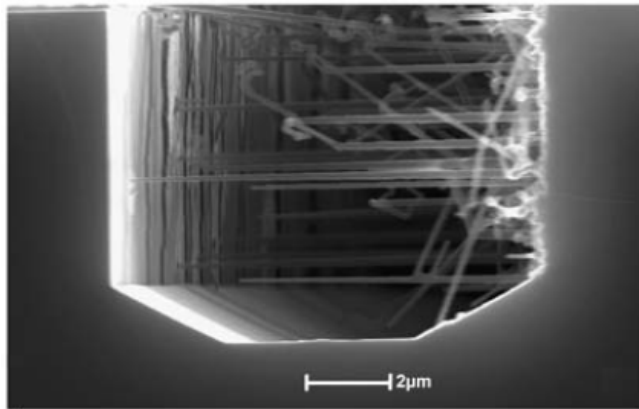
Nanowire Biosensors – Previous Work

- Silicon Nanowire (SiNW) Devices



- Good selectivity and sensitivity.
- Difficult fabrication due to the need for manipulation of individual nanowires and interfacing with electrical connections.

Zheng G, Patolsky F, Cui Y, Wang WU, and Lieber CM. Nature Biotechnology 2005;23:1294-301.



- Potentially very sensitive.
- Very difficult fabrication process due to lack of means to precisely control nanowire growth.

Islam MS, Sharma S, Kamins TI, Williams RS, Applied Physics A 2005;80:1133-40.

- Need a method to create dense, sensitive sensor arrays targeting various biomolecules, without need for individual nanowire manipulation.

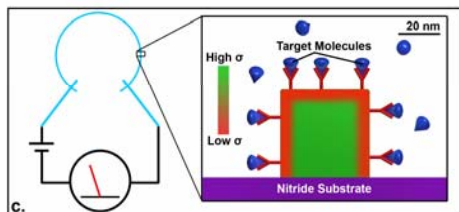
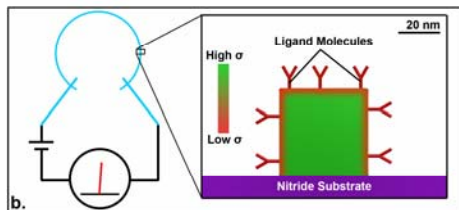
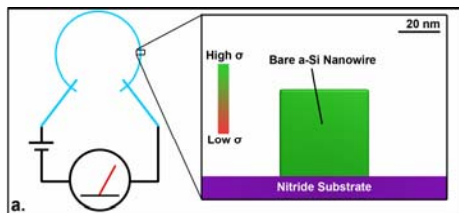
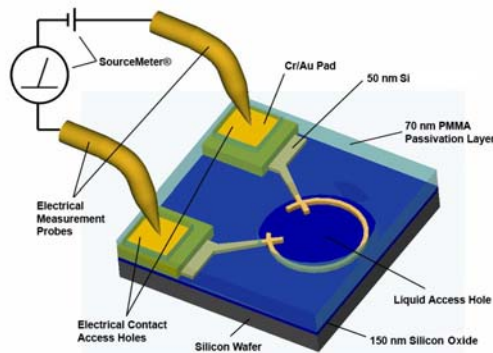


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Nanowire Biosensors – Future Work



Images Courtesy of John Lund



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- Silicon Nanowires created using standard CMOS processing techniques.
- Silicon sensors are functionalized with various biomolecule receptors. Upon binding, the surface potential of the nanowire changes, changing the conductance of the nanowire.
- Monitoring the resistance of the nanowire allows us to convert molecular binding events into an electrical signal.
- High Surface Area to Volume ratio of nanowires makes for very sensitive devices.
- Architecture allows for dense arrays of sensors capable of detecting low levels of various biomolecules.

