Science Harvard's Tiny Probes Painless to Living Cells
Levi Beckerson (Blog) - August 13, 2010 8:44 AM

An optical image of a Harvard team's new nanoFET probe merged with a living cell. (Source: Charles Lieber, Harvard University)

If you had to choose between being poked with a needle and a sharpened telephone pole...

Though the inner working of biological cells of all sorts have become better understood in the past five decades, some of the technology involved in intracellular studies has not progressed at a similar rate. While feats only dreamed of in the 1960s, like cloning and growing new organs from a patient's own cells, have come and gone, the instrumentation used to study these cells has remained largely unchanged.

That is until members of Harvard University's Department of Chemistry and Chemical Biology and School of Engineering and Applied Sciences decided to improve upon the 50 year old technology of invasive cellular probes. In a paper published this week in the journal Science, senior authored by Charles M. Lieber, the Mark Hyman Jr. Professor of Chemistry at Harvard, the researchers have published their work with a nanoscale intrusion device that can study the inside of a cell

without damaging or even bothering the cell's delicate inner workings.

Previous probes used for this type of work were at the smallest about 5 microns, or millionths of a meter, in size. This may not pose much of a threat for cardiac cells, which can be as large as 50 microns in diameter, but for delicate 10 micron nerve cells, it can mean a very traumatic experience.

The Harvard group's new sensor is a field emission transistor (FET), which measures in at about 15 nanometers, can easily poke around in even the smallest nerve cells without leaving much of an indication they were there.

But it's not just the size of the nanoFET's probe that allows it to peer unhindered into the inner workings of these cells. The researchers also coated the nanowire sensor with a layer of phospholipids, the same material that comprises cell membranes. Rather than having to poke the probe into a cell, the cell actively draws the probe into itself by membrane fusion. This is similar to the way cells can swallow viruses and bacteria.

"This eliminates the need to push the nanoFETs into a cell, since they are essentially fused with the cell membrane by the cell's own machinery. This also means insertion of nanoFETs is not nearly as traumatic to the cell as current electrical probes," explains Lieber in a Harvard news release. "We found that nanoFETs can be inserted and removed from a cell multiple times without any discernible damage to the cell. We can even use them to measure continuously as the device enters and exits the cell."

This new probe could lead the way to further non-destructive studies of the the interior of important cells that make up neurons or further understanding the way stem cells react and transform to fit their surroundings.

"Well, we didn't have anyone in line that got shot waiting for our system." -- Nintendo of America Vice President Perrin Kaplan