Nanotech Stars Of Northwestern

University researchers break scientific ground—and start a slew of innovative companies

By Stuart Luman

Stain-resistant clothing and stronger tennis rackets are only the beginning of what scientists promise is possible when they manipulate matter at the nanoscale, the realm of the universe that's roughly 1/100,000th the width of a human hair. At Northwestern University, scientists are employing nanotechnology to create faster and more sensitive medical tests for cancer, electronic components a few molecules wide, and nanoparticles that can coax severed spinal cords to heal.

The university's eight-year-old International Institute of Nanotechnology has 150 research faculty and more than 400 graduate students across university labs, departments, and partner institutions such as the University of Illinois at Urbana-Champaign, Argonne National Laboratories, and the University of Chicago. Says Joseph DeSimone, director of the National Cancer Nanotechnology Center at the University of North Carolina at Chapel Hill: "Northwestern has been a powerhouse in chemistry and physical science for a long time. Then they were fortunate to land some really great people in this new area of nanoscience."

CHAD MIRKIN

In the realm of nano, Chad A. Mirkin, 44, is a giant. The institute's director, he won the highly regarded Feynman Prize in 2002 and was presented in October with an iCON Innovator prize from the Illinois Biotechnology Industry Organization. The No. 1 cited nanoresearcher, according to the Nanomedicine Lab Registry, he is a professor of chemistry, medicine, and materials science and engineering who received his PhD in chemistry from Pennsylvania State University in 1989.

Mirkin's invention of dip-pen nanolithography has allowed scientists to build everything from highly miniaturized electronic devices to a protein nanoarray that tests for diseases such as HIV at much higher speeds and sensitivities than conventional tests. Seven years ago, his research group had only 10 inventions; now it has more than 320. "The fun part of science is making a discovery no one has made before," he says. "Once you experience that, there's no turning back."

His first company, Nanosphere, pioneered the use of gold nanoparticles to detect specific genes and proteins. It has raised more than $130 million, recently got approval from the U.S. Food & Drug Administration to sell its test commercially for genetic sensitivity to the blood-thinner warfarin, and went public on Nov. 1. NanoInk, his second company, is commercializing dip-pen nanolithography, which pharmaceutical companies use to etch minute ID information on individual pills to fight counterfeiting.

But it's also his job to keep all the disparate engineers, biologists, chemists, materials scientists, and business people who collaborate at the institute focused on making discoveries and, ideally, spinning out companies. It isn't easy. Many academics distrust capitalists, while those in business often don't understand why researchers can't simply create a finished, marketable product. The trick is to get both groups to work together. "The name of the game is channeling scientists and engineers toward solving problems that are critical to our society," he says.

SAM STUPP

This is one busy man. Samuel I. Stupp is a professor of medicine, chemistry, materials science, and engineering. He also leads his own lab group of 40 researchers and is director of the university's Institute for BioNanotechnology in Medicine at its downtown Chicago medical school. "There's a lot going on. It keeps me off the streets," he says with a laugh, adding that he goes to a lot of meetings.

But Stupp, who grew up in San José, Costa Rica, before attending the University of California at Los Angeles, still finds time to do groundbreaking work in regenerative medicine. His focus is on molecular self-assembly,

Their ability to manipulate materials and living tissue at molecular levels is at the cutting edge of medicine and electronics

the process used in biology to create proteins, cells, and people. He has spent his life trying to understand that process and replicate it artificially.

He has developed nanoparticles that can repair the severed spinal cords of paralyzed mice. In April, at the Woodrow Wilson Center in Washington, he showed a video of his mice—at first paralyzed and then after treatment, which helped them regain limited movement in their limbs. He hopes there will be human clinical trials in two years. "The expectation is that throughout this century we will learn how to regenerate tissues and organs and restore functions we never dreamed of restoring," he says.

To commercialize his work, he started Nanotope, but it's an uneasy role for a scientist who says he's more comfortable in the lab than in the boardroom. Stupp, who earned a PhD in 1977 from Northwestern in materials science and engineering, is 56 and not used to spinning out companies like the younger generation of scientists. Yet he realizes that the only way to get his work to patients is through business. "If you eradicate paralysis, you really change the world," he says. "To get recognition for all these things in science is great, but somehow right now I don't think that's enough."

TOM MEADE:
After he sold the first of his four companies to Motorola for $300 million in 2000, Thomas J. Meade came up with one bit of advice for colleagues thinking about starting a company. "It is very important to seek independent legal counsel," the 49-year-old warns.

When he started Clinical Micro Sensors at the California Institute of Technology in 1995, where he was doing a post-doc, he wasn't prepared for what it would entail. If he'd had his own lawyer, he might have gotten more from the sale. "I didn't know anything, I was so completely out to lunch," he says ruefully.

Meade, who earned a PhD from Ohio State University in biochemistry, is a professor in chemistry, biochemistry and molecular and cell biology, neurobiology and physiology, and radiology. As if that weren't enough, he has an endowed chair in cancer research and will soon head the university's new 10,000 sq. ft., state-of-the-art molecular imaging facility.

His three new companies come out of his basic lab work. Metaprobe specializes in engineered smart dyes for use with medical imaging technologies such as MRI. These markers can track transplanted cells in the body or illuminate when they encounter unique enzymes that cancer cells release, for example, when they are about to metastasize. Another startup named Ohmx is commercializing his work in biosensors and is developing a handheld device that tests for a variety of proteins, pathogens, and genetic disorders with a quick blood sample, and without the need for time-consuming and expensive lab tests. Meade's latest venture, PreDx, unites his work in smart dyes and adds nanoparticles, providing a host of new properties.

By dividing his time between school and startups, Meade runs into a whole other problem: the mixing of his academic and his corporate work. The goal for academics is publishing, the sharing of knowledge. For corporations, it's often about restricting access to knowledge to make a profit. "One is R and one is D," he says. To keep them separate but equal, he has a no-secret-work policy in his school lab. | BW |

Meade (left), Mirkin, and Stupp seek ways to commercialize their discoveries

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