

A promising niche for nanotech

June 24 2009, By Thomas Lee

In a cluster of rather drab buildings overlooking the Charles River, researchers at the Massachusetts Institute of Technology are incubating a tiny technology that packs an enormous punch.

By manipulating matter at less than a billionth of a meter, MIT scientists are using nanotechnology to create next-generation biomedical therapies that hold enormous promise and peril for Minnesota's medical device industry.

Imagine a stent covered with microchips that can release drugs into arterial tissue at the push of a button. Or a tattoo that changes color as a warning before a patient suffers a heart attack. What about a diagnostic device that "sorts" [cancer cells](#) from healthy cells?

"The societal impacts are quite large just from making relatively small changes" to existing products and technology, Andrew Maynard, a top nanotechnology expert, told a group of leading health and science journalists visiting MIT. He is the chief science adviser to the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars based in Princeton University.

Nanotechnology is not new. More than 40 years ago, scientists discovered that matter less than 100 nanometers exhibited unique properties like increased surface area and flexibility. Since IBM developed microscopes in the mid-1980s that allowed researchers to better examine matter on a nanoscale, companies across several industries, including local stalwarts 3M and Starkey Labs, have used

nanotechnology to develop everything from stickier adhesives to souped-up hearing aids.

Products made from nanotechnology totaled \$200 billion last year, including \$25 billion in health care and life sciences, according to Lux Research, a consulting and research firm based in Boston. By 2015, the market will expand to \$3.1 trillion, Lux predicts.

Experts say nanotechnology holds particular promise for biomedical devices including targeted drug delivery, imaging and diagnostic tools, and tissue regeneration, technologies of value to Minnesota medical device companies.

"Nanotechnology is an enabling technology that we believe over time will provide significant opportunities for unique product solutions in many aspects of the medical arena," according to Destination 2025, a recent report prepared by the BioBusiness Alliance of Minnesota.

Consider the work of these MIT researchers:

- Robert Langer, a professor of chemical engineering, is developing a device with tiny silicon chips containing "wells" of drugs. Once implanted in a patient, doctors can activate the drug by shooting electricity into the chip. Such "pharmacy on a chip" technology could prove useful to drug-coated stents by allowing doctors to inject several types of drugs into clogged arteries and better control when and how the stent releases the drug.
- Jeffrey Karp, a researcher with the Harvard-MIT Division of Health Sciences and Technology at Harvard Medical School, is using nanotechnology to create a kind of GPS device that can guide stem cells toward damaged tissue in sensitive organs like the heart.

- Angel Belcher, a professor of materials science and biological engineering, has found a way to construct lithium ion "microbatteries" powered by nanowires constructed from a living virus. Smaller batteries mean smaller implantable devices. These batteries can theoretically provide a safer and more reliable source of power to implantable defibrillators and pacemakers, she said.

Of course, such technology will take years and millions of dollars to develop. And experts like Maynard say regulators and researchers still need to determine if nanomaterials are safe for humans and the environment.

"There is no immediate clinical nanotech medicine" in use today, said Arthur Caplan, a professor of bioethics at the University of Pennsylvania School of Medicine. "But there is going to be a real need for criteria to bring nanotechnology into the world that involves human and animal testing."

That alone could provide a significant opportunity for Minnesota medical companies.

"When [nanotechnology](#) is applied to products, they will likely fall under increased safety and regulatory oversight until the technology is understood and regulation has become mature _ a new competency that offers Minnesota a chance to be a leader in the application of this rapidly developing technology," the Destination 2025 report said.

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