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Force for Good
Magnetic fields might just save your life.

Healthy Attraction

An Oklahoma start-up uses a big magnet and microscopic particles to fight cancer. BY BRAD COPE

MASAHARU MORIMOTO, call your office. The next winning *Iron Chef* dish will feature a rich blend of iron oxides. Got a notepad? Here's the secret recipe:

1) Combine ferric and ferrous oxides in a solution.

2) Precipitate both elements to create magnetite particles that measure five nanometers, about twice the size of a DNA strand. The magnetite will try to form into clumps like a renegade batch of sticky rice. To keep that from happening, go to the next step.

3) Use a magnetic stirrer to mix the solution, and add a dash of proprietary dispersant. Finish the job with a blast of sound waves from a $30,000 sonicator.

This recipe yields a batch of 10-nanometer magnetite particles which, with a few more tweaks, may one day reverse hearing loss, repair heart tissue, and rout cancerous tumors. How many chefs get to do that?

Some of you budding nanotechnologists out there may have noticed the troubling word "proprietary" in step No. 3. The people

who know the contents of that secret sauce work for a company with the mouthful name NanoBioMagnetics, Inc. Based in the Oklahoma City suburb of Edmond, NanoBioMagnetics specializes in the territory marked out by its name: "nano," for nanotechnology, or engineering on the molecular level; "bio," for biological applications; and "magnetics," for, not surprisingly, magnets. In short, NanoBioMagnetics creates nano-sized particles that treat biological conditions through the use of magnetic fields.

While the name is big, the office is not. The company occupies 1,500 square feet in a nondescript office park and employs five people. President and CEO Chuck Seeney, a 65-year-old industrial polymer chemist, once worked for energy giant Kerr-McGee and industrial chemical maker IMC Corporation. He sports a pair of suspenders and a pencil-thin mustache reminiscent of filmmaker John Waters. He starts my tour of NanoBio in the hallway that bisects the office by pointing at a poster of a canine heart.

"It all started here," Seeney says. "Here" is the company's 2003 attempt to use nano-sized magnetite particles to treat heart disease. Though NanoBio eventually sidelined the project—Food and Drug Administration approval would have taken years—the basic concept informs all of the company's work. NanoBio sells a drug-delivery system: the use of a magnetic field to cause magnetic particles to rush to certain spots in the body. Thanks to technological advances over the past two decades, Seeney's team can attach different drugs to these tiny particles. And since particles smaller than 300 nanometers can pass through human tissue, the company's 10-nanometer products can haul quite a load.

NanoBio's poster child hangs on the wall a few paces down the hall. This one deals with cancer, and it's the company's best chance for attracting the capital needed to prove its system can work. Since the FDA fast-tracks approvals for treatments that target incurable illnesses, NanoBio focused on a disease that kills quickly: inflammatory breast cancer.

The proposed treatment, developed with professor Jim Klostergaard of the M.D. Anderson Cancer Center in Houston, comes straight out of the NanoBio playbook: Attach the chemotherapy drug Paclitaxel to magnetic nano particles, inject the chemical cocktail into the bloodstream, and use a magnetic field to send the mix straight to the tumor.

Since chemo damages everything it touches, the method should protect the body while destroying the cancer—at least in theory. The poster in NanoBio's hallway shows an X-ray of a mouse tumor sprinkled with magnetic particles, proving that the delivery system works. Testing the Paclitaxel payload comes next. Vetting the treatment will take several rounds of tests, about two years, and approximately $5 million.

NANOBIO'S RIVALS, meanwhile, are also racing to roll out treatments. "There are probably 100 small companies in the country trying to bring nano-particle magic into healthcare," says Wade Adams, director of the Richard E. Smalley Institute for Nanoscale Science and Technology at Rice University. "And a lot are working on cancer."

Nanospectra Biosciences also looks promising. The Houston-based company injects gold nanoparticles called "auroshells" into tumors. Since auroshells absorb near-infrared light, Nanospectra hopes to zap them with lasers to incinerate cancer. It's testing auroshells in human trials, about two years ahead of NanoBio.

Heat plays a part in a treatment backed by a team of researchers from M.D. Anderson and Rice University. Anderson and Rice heard about cancer patient John Kanzius' idea to burn gold or carbon nanotubes in the body with radio waves. One test showed the destruction of malignant tumors in rabbits, earning Kanzius and the research group a segment last July on *60 Minutes*.

At least one other group sees the value of magnets over heat: a team of researchers from the Universities of Sheffield, Keele, and Nottingham in the United

Seeney launched XetaComp in 2006 to create only one product: a sunscreen called SunVex. Naturally, SunVex is a nano product. XetaComp packs tiny sunblockers so tightly that SunVex delivers an SPF rating of 30 and could go much higher. SunVex went into production this summer, and Seeney expects the product to start generating revenue by the time this article comes out.

BRAD BURKE, the managing director of the Rice Alliance for Technology and Entrepreneurship, thinks NanoBio could hit it big. And that's not just because the company joined the Alliance. It's also because NanoBio excels in areas that some other Alliance members flub. Successful tech companies need strong protection of intellectual property, and Chuck Seeney has an unusual number of patents. They need an experienced president and CEO, and Seeney qualifies. They need a great advisory board, and NanoBioMagnetics has first-class researchers. They need to have a platform that works in several fields, and they need a proven ability to raise money. Put those things together, and NanoBio's odds of success look pretty good. "Of course," says Burke, "the biggest risk is, Will the technology work?"

M.D. Anderson's Klostergaard believes it will. He and NanoBio envision a two-year set of hurdles, from coupling magnetite with chemo, to effective treatment in animals, to running toxicology studies, to starting human trials. If the technology clears those obstacles, Klostergaard thinks his magnets avoid some of the problems associated with alternative treatments. "Other targeted therapies have to bind to the cancer to work, breeding resistant tumors," he says. "But magnetized particles don't need to bind to work. They go where we tell them."

Ultimately, time—and $5 million in capital—will tell. Until then, Seeney and the NanoBio team will try to lure investors with the company line: Big cures come in small packages.

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