MIT technology insider
FROM THE EDITORS OF TECHNOLOGY REVIEW

CONTENTS | 7.04

KEY

	FUNDING
$	UNDER $2 MILLION
$$	$2 MIL.-$10 MIL.
$$$	$10 MILLION PLUS
	PATENT STRENGTH
	NO CORE PATENTS
	CORE PROTECTION
	DOMINANT POSITION
	TIME TO MARKET
	LESS THAN 1 YEAR
	1-3 YEARS
	MORE THAN 3 YEARS

AN MIT ENTERPRISE TECHNOLOGY REVIEW

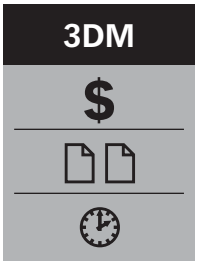
SPINOFF SPOTLIGHT

One to Grow On

3DM MAKES A SYNTHETIC SUBSTANCE TO GROW LIVING CELLS FOR RESEARCH, WITH AN EYE TOWARD FUTURE STEM CELL THERAPY

Shuguang Zhang was studying the genetics of yeast cells in the early 1990s—in the laboratory of biology professor Alexander Rich—when he discovered a strange molecule. With its series of positive and negative charges one after the other, the molecule attracted water in one spot and repelled it in the next. Intrigued, Zhang decided to figure out the molecular structure of his new discovery. What he found looked like an accordion folding back and forth on itself.

His reaction was immediate. "We went to the patent office. We had no clue why it would be useful," says Zhang, who is now associate director of MIT's Center for Biomedical Engineering.



In 1994 Todd Holmes, an MIT graduate student, realized that living cells cling to the molecule Zhang had discovered. Subsequently, Zhang created a substance, now called PuraMatrix, out of his molecule. PuraMatrix acts as a synthetic biological scaffold on which cells can be grown and studied. The alternating electrical charges push water around, causing the material to self-assemble into a hydrogel, a nanoscale 3-D framework of fibers. The structure is important to researchers who want to grow, for example, nerve cells or liver cells whose behavior in a petri dish is similar to their behavior in real life. And because the hydrogel is composed of three common amino acids, it is compatible with living tissue. These characteristics may add up to improved drug development and the creation of new therapies. PuraMatrix went on sale this spring.

Other materials have been available for such 3-D growth, says Zen Chu, president of 3DM, the Cambridge, MA, company that makes PuraMatrix. But the most popular of those materials is grown from mouse tumors, and its biology is neither thoroughly understood nor amenable to consistent manufacturing. Other synthetic materials are available. But while PuraMatrix has tiny nanoscale holes and fibers across which cells can spread, the structure of other synthetics is 100 to 1,000 times larger and appears two-dimensional to a cell. Such larger structures promote cell growth that is less natural.

The more closely researchers can replicate cell growth in the body, the better they can understand both normal and abnormal cell growth, says Lisa Spirio, 3DM's director of research and development and a former postdoc at MIT's Whitehead Institute for Biomedical Research.

Pharmaceutical companies that test drug candidates on cells grown on the scaffolding should get more accurate readings of the drugs' effects on cells, Spirio says. These companies can embark on expensive animal testing with more confidence about the potential of the drugs they test first on the scaffolding.

3DM has a deal with BD, a leading supplier of biological materials based in Franklin Lakes, NJ, to sell the material to researchers in university labs, hospitals, and pharmaceutical companies. The company has also sent free samples to various researchers in the hopes that somebody will develop a new technique or material that is based on the company's product, thereby creating a market for it. Chu likens this marketing approach to the open-source software movement, which makes code freely available so that programs can be optimized and widely distributed. While the material will not be free to most researchers, Chu says 3DM wanted to be open about its development so that other scientists could work with it.

"You want your product to be adopted, to be used by other people," Zhang says. "Give it to them free, and they have nothing to lose."

CONTINUED ON PAGE 2

Growing Old in a High-Tech World

AGELAB'S BEHAVIOR STUDIES OF THE ELDERLY HELP RESEARCHERS DESIGN TOOLS THAT CAN IMPROVE THE LIVES OF THIS GROWING POPULATION

AT A GLANCE

NAME
AgeLab

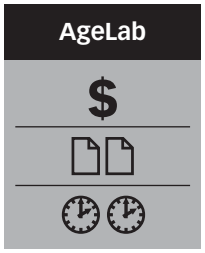
DIRECTOR
Joseph Coughlin

CONTACT
web.mit.edu/agelab

MAJOR PROJECTS
> Driving and personal mobility
> Personal health-monitoring devices
> Strategies for adopting telemedicine
> Data on behavior in aging

The red Volkswagen, dubbed Miss Daisy, looks out of place in an office surrounded by cubicles and computers. But at MIT's AgeLab, the donated vehicle plays a role in figuring out how technology can make cars safer for older drivers.

The VW engine has been replaced with a force feedback unit, providing a simulated driving experience for testers, who sit in the driver's seat and watch a screen through the windshield. By monitoring different people's reactions to on-screen situations, AgeLab researchers can assess the driving of the elderly on the basis of both physical factors, such as decreased night vision and weakened arms, and habits that have become virtually instinctive after decades of driving. Researchers can sketch out different drivers' mental models—what their instincts tell them to do when an obstacle appears, for example.



"We know, for instance, older people don't really know how to use antilock brakes, and young people drive faster," says research scientist Bryan Reimer. "What we'd like to understand is how people behave with different technologies in their car."

Such understanding can help the designers of automobile safety systems. AgeLab is collaborating with MIT's Intelligent Transportation Research Center, which is designing vision equipment to detect whether a car is staying between the lines and to calculate the distance between the car and the vehicle ahead of it. AgeLab's work helps the builders of computer vision systems understand how drivers can use the technology without being distracted or confused by it. "We're asking, How can technology, along with innovative ideas about how that technology is used, help improve the lives of older people and the people who care for them?" says AgeLab director Joseph Coughlin. And as the legions of baby boomers approach retirement age, Coughlin says, government, technology, and business will have to adjust. "We really want to invent an entirely new lifestyle around technology and aging," he says.

Coughlin demonstrates prototypes of new systems aimed at accomplishing that. One is a scanner that would be attached to the handle of a shopping carriage. A shopper would insert a smart card with her medical information into the scanner and swipe the bar codes of foods under the scanner as she shopped. The device would compare each scanned item's ingredients with the smart card's information on the shopper's doctor-recommended diet and suggest, perhaps, a low-salt brand of crackers. The shopper wouldn't have to struggle to read and understand lists of ingredients or buy packaged food only to discover at home that it was not appropriate for her diet.

A computerized kiosk equipped with a blood pressure sleeve and a telephone could be placed in drugstores. Shoppers could use the kiosk to check blood sugar, for instance, and get recommendations for over-the-counter medications that would be right for them. AgeLab is working on the kiosk with Partners Telemedicine, a Harvard Business School program that is developing a system to provide medical information via telephone.

Another AgeLab invention is a variation of the Tamagotchi, a Japanese electronic toy popular in the 1990s. The soft furry creature, with a computer screen on one side, reminds its owner when it's time to take his pills and requires him to push certain buttons on the device to indicate when he has taken his medication. If the patient fails to report having taken the pills, the creature sickens and dies—and can be brought back to life only by a doctor or pharmacist. Forgotten pills cost the health-care industry billions of dollars, Coughlin says, in both wasted medicine and unnecessary visits to the emergency room.

The lab is funded entirely by sponsors, including Hartford Financial Services Group, Procter & Gamble, and the AARP. Five professors are working on current projects, and a dozen others are affiliated with the lab. There are also four visiting industry researchers, a postdoc, nine graduate students, and four undergraduates.

What's significant about the AgeLab is that it develops and combines new diagnostic information about aging, new technologies and policies to deal with aging, and public education, says Michael Kafrissen, vice president for clinical research at Johnson & Johnson, one of the lab's partners. "We think that the institute does an especially good state-of-the-art job," he says.

"We have done some very, very exciting work together," says Beverly Hynes-Grace, vice president of the Hartford's corporate gerontology group. "The work they're doing to take a look at older-driver safety, the breadth and spectrum of it, will always be interesting to us."

Coughlin hopes the lab's work will make aging easier. "With any luck," he says, "it's an issue that all of us will have to deal with."