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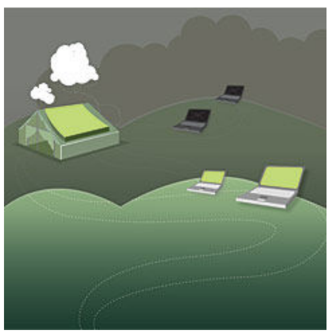

Futurefarmers

--Meryl Rothstein

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Electronic Skin

As fast and small as our electronics and computers are today, there is one major drawback. They are hard and rigid and fragile. Completely the

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opposite of what Stéphanie Lacour is making: bendable, stretchable circuits that will one day be used to make electronic skin and malleable computers.

In 2002, as a postdoctoral researcher at Princeton, Lacour found a way to make metal stretch by embedding it in rubbery silicone. Doing so allowed it to expand to twice its original length without breaking. The next step was building a flexible circuit. Lacour, now heading her own lab at Cambridge University, did this by consolidating all the hard microcomponents of the circuit into tiny rigid "safe zones," which are networked to one another by stretchable metal. The final product is a silicone patch the size of a stick of gum that bends and twists like a rubber band.

The most obvious application is for prostheses. Imagine a computerized hand that can feel heat from a stove or a lover. Lacour hopes to develop the first such prosthetic glove in two to five years. Initially, it will need to be hooked up to a tiny computer to alert the wearer to various sensations. The next step is a system that mimics the shape of neurons and relays signals directly to the brain, enabling the wearer to process tactile information in real time.

But those without prostheses will benefit from Lacour's innovation as well. She envisions T-shirts embedded with electronics that can detect if a baby has stopped breathing and a foldable GPS-enabled map. Then there are the crazier, more fun ideas Lacour dreams up on a daily basis -- things like interactive tattoos that might change from a lion to a tiger to a skull, depending upon your mood or outfit.

--Meryl Rothstein

The Pollution Magnet

Eighty-two thousand people die from cancer in Bangladesh every year, many due to arsenic poisoning. But building upon her discovery of a way to get rust nanoparticles to bind to arsenic, Vicki Colvin has invented a new, astonishingly easy way to clean the water supply: Sauté a teaspoon of rust in a mixture of oil and lye, which breaks down the rust into nano-sized pieces. Retrieve the rust particles with a household magnet. Then immerse the rust-covered magnet into a pot of contaminated water. Pull out the arsenic. The system is up to a hundred times more efficient than existing methods, and requires no electricity or manufacturing infrastructure, so even the poorest of villagers can use it.

Depending upon government regulations, Colvin's extraction system should go global in as few as five years. Yet ultimately, Colvin, a professor of chemistry and chemical and biomolecular engineering at Rice University, has bigger plans. She sees her method as just the first step toward developing an easy point-of-use water-purification system that would cover virtually every pollutant. The filter would have a dipstick to tell you what's in the water and a reader to tell you what you need to add to pull it out -- perhaps silver nanoparticles to kill bacteria or a protein to capture pesticides.

--Christine Ajudua

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Machines That Fix Themselves

There will come a time when computers and robots don't need humans to program them. For mechanical engineer Hod Lipson, that time is now. And it all starts with his four-legged starfish robot.

Beginning with no idea of what it looks like, the starfish makes random motions and measures how it tilts. It then generates about a hundred

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No. 19: Ask the Bible

By A.J. Jacobs

Its commandments answer many of life's most challenging questions. But its

Tonight on *Dateline* This Man Will Die

By Luke Dittrich

Last night, *Dateline NBC* televised its response to Esquire's different hypotheses about what its structure might be, moves itself again, collects more data to determine which models are potentially correct, and behaves accordingly. It continues this process of weeding out less-useful models until an accurate one is found and takes hold, a process inspired by Darwinian evolution. And if anything happens to it -- for example, it loses one of its legs or falls from a table -- it can then generate a new model to adapt to different circumstances, with no human assistance.

Well beyond smart robots, this self-adapting technology could one day be used to erect buildings that can repair themselves, airplanes that anticipate mechanical problems, and bridges that sense and readjust for potential structural pitfalls.

In the shorter term, a self-modeling robot could be used to explore the planets, repairing and reprogramming itself depending upon conditions on the ground.

-- Doug Cantor

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Burying Our CO_2

Kurt Zenz House isn't the first scientist to suggest sequestering carbon dioxide in the ocean. But he is the first to come up with a solution that might actually work.

The key is depth. Whereas other plans to sequester carbon in the ocean were plagued by fears that the CO_2 would escape, House advocates going much deeper -- at least three thousand meters, or two miles below sea level into the seabed. At that depth, House hypothesizes that the extreme water pressure and low temperature will turn the carbon into a liquid denser than the surrounding water, forming a layer that will prevent it from rising back up into the ocean. "We can store all the CO_2 from humanity for centuries, and it wouldn't change sea levels by a centimeter," says House, a Harvard Ph.D. candidate in earth and planetary sciences. "And there isn't any major life at that depth, so the footprint is very light."

Estimated costs are about forty dollars to capture and store a ton of the gas, about the amount of CO_2 produced by a car every 500 to 1,500 miles, depending on the make. House is currently in talks with a major oil company to start field tests while a group of developers from New Jersey wants to build the first power plant that would use his system.

--Christine Ajudua

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The Next Plastic

Plastic has changed little since its heyday in the 1960s. It's still ubiquitous, oil based, and dirty as hell for the environment. Makes you wonder what we've been doing all these years.

For one thing, not listening enough to chemist Geoffrey Coates. In his lab at Cornell University, he's been reinventing plastic. Making it environmentally friendly and biodegradable -- with orange peels.

The key is limonene, a citrusy-smelling chemical compound made from orange rinds that when oxidized and mixed with carbon dioxide and a catalyst can be turned into a solid plastic. The final product can be made into anything from Saran wrap to medical packaging to beer bottles and naturally biodegrades in just a few months. And because it can be produced using recycled CO_2 from carbon-spewing factories, simply making Coates's plastic can help the environment.

Since 1999, when Coates and his colleagues first began experimenting with limonene, they've discovered a number of other natural materials, such as pine trees and soybeans, that can be manipulated into biodegradable polymers as well. And more recently, they've been experimenting with artificially creating polyhydroxybutyrate, a polypropylene-like plastic that is naturally produced by bacteria.

While Coates's natural polymers are more expensive to produce than most current plastics, he stresses that this isn't just another radical innovation that will never make it out of the lab. Novomer, a company he cofounded in 2004, will see its green plastics used in high-end electronics in the next couple of years. Once production is scaled up, less-expensive mainstream consumer products such as food containers will follow soon after.

--Doug Cantor

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