

NEWS SCAN

Going with Golgi

Scientists create an artificial organelle for the first time

BY CHARLES Q. CHOI

sensory cortex, where touch data from the tongue are interpreted.

To develop criteria for monitoring the progress of artificial sight, optometrist Amy Nau of the University of Pittsburgh Medical Center's Eye Center will further test Brain Port, along with other devices such as retinal and cortical implant chips. "We can't just throw up an eye chart. We have to take a step back and describe the rudimentary precepts that these people are getting," she says. Nau is particularly interested in Brain Port because it is noninvasive, unlike implants.

Many people who have acquired blindness are desperate to get their vision back," she points out. According to the National Institutes of Health, at least one million Americans older than 40 are legally blind, with vision that is 20/200 or worse or that has a field of view of less than 20 degrees. Adult vision loss costs the country about \$51.4 billion a year.



'lollipop*' device is an electrode array that stimulates the tongue in a pattern based on the light intensity picked up by a camera.

Although sensory substitution techniques cannot fully restore sight, they do provide the information necessary for spatial orientation.

Wicab had planned to submit BrainPort to the

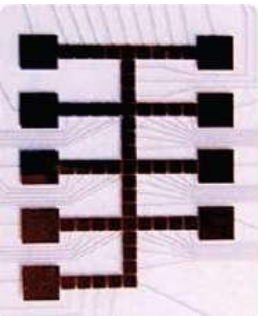
U.S. Food and Drug Administration for approval at the end of August, says Robert Beckman, president and chief executive officer of the company. He notes that the device could be approved for market by the end of 2009 for about \$10,000 a machine.

In recent years scientist have made synthetic versions of key parts of the cell, such as chromosomes and ribosomes. Now researchers have developed the first working artificial prototype of an "organ" of a human cell—the Golgi apparatus.

Made up of a network of sacs piled together like a stack of pancakes, the Golgi apparatus chemically modifies proteins to help make them stable and functional, and it helps to manufacture complex sugars. But it remains one of the most poorly understood organelles. "The sacs are fluid and constantly change shape, so it's difficult to get a handle on," explains Robert Linhardt, a chemist at Rensselaer Polytechnic Institute. "And while we know the general direction of the flow of vesicles between stacks, we don't really know what cargoes they're carrying."

To better dissect how the Golgi apparatus works, linhardt and his colleagues created a synthetic version of it, designing a square-millimeter-size lab-on-a-chip to mimic the assembly line of enzymes that modify a biomolecule within the Golgi apparatus. The sample molecules are attached to magnetic particles suspended in a watery droplet 300 billionths of a liter in size and placed on the chip. When the desired location on the chip for those molecules is electrically charged, it attracts the droplet and causes it to flow there. A larger magnet under that spot can keep in place the magnetic particles attached to the biomolecules. In this way, the drop can be moved through chambers loaded with an assembly line of enzymes, sugars and other raw materials.

In experiments with an inactive precursor of heparin, a widely used blood thinner, the scientists discovered their device could quickly and efficiently modify the anticoagulant to make it functional, findings they detail in the August 12 Journal of the American Chemical Society. The researchers suggest that an artificial Golgi could lead to a faster, safer method of producing heparin than current techniques, which employ animal tissue.



artificial golgi apparatus uses voltage to shuttle molecules among nine electrodes, where they are modified by enzymes.

scientists have experimented with building up cells piece by piece for decades, including the creation of simple artificial cells in the form of bubbles made of synthetic cell membranes, to better understand how life on earth might have begun. In 1997 researchers devised the first

artificial human chromosome. And earlier this year molecular technologist George Church of Harvard University and his colleagues developed artificial ribosomes—bodies inside each cell that make proteins based on instructions from DNA—that functioned under cell-like conditions.

Linhardt and his co-workers plan on creating a synthetic endoplasmic reticulum (ER) as well, the organelle into which ribosomes are studded and where protein synthesis and folding take place. "We'd even like to integrate an artificial Golgi and

ER together," Linhardt says. "We're basically taking pieces of a cell and making them on electronic chips," with the hope of moving to even more complex systems. Charles Q. Choi is a frequent contributor based in New York City.

Research & Discovery

Hunting a Croc Killer

Mass deaths of South Africa's Nile crocodiles puzzle biologists BY NAOMI LUBICK

Carcasses of adult crocodiles do not usually signal the return of winter in South Africa, but mass death seems to be becoming the harbinger of the season. Rangers at the Kruger National Park have found Nile crocodiles floating in the Olifants River or bloated and decaying along its banks. Investigators are rushing to figure out the cause and worry that the deaths might be signaling the presence of toxins or pathogens that could threaten not only the croc population but also the livelihoods of the people living near the river.

The Olifants River runs several hundred kilometers through three South African provinces and into Mozambique. It supplies water to industrial agriculture operations that send food to Europe and to the local rural communities, which also depend on those waters for fishing and farming.

The first sign of croc trouble in the river came in the winter of 2008, when rangers collected 170 dead individuals, sometimes at a rate of 20 bodies a week. A survey at the end of this May showed nearly 400 crocs living in the park's gorge, down from at least 1,000 in 2005. So far, as of August 7, rangers and scientists have found 23 carcasses.

After slicing open some of the crocodile corpses last year, researchers determined some kind of pansteatitis—an inflammation of adipose tissue—was killing the animals. Specifically, their tails were swollen with the hardened, enlarged fat deposits, which had stiffened and immobilized the crocodiles and left them unable to hunt. Samples of the fat showed the deposits had oxidized to bright yellow. The disease may not be limited to crocs. Scientists found the same kinds of fat deposits in fish in the Olifants River. And in the river's gorge just upstream from Massingir Dam in Mozambique, which also has seen croc declines, birds were absent, raising the possibility that they, too, have succumbed to the same agent.

But the cause behind the strange fattening remains a mystery. In June a team led by Henk Bouwman of North-West University. Potchefstroom Campus, in South Africa reported test results from crocodile tissues at two European chemistry meetings. "Everything is there," Bouwman says, referring to the detection of DDT, PCBs, dioxins and brominated flame retardants, "but nothing is screaming, 'it's me, it's me, it's me.' "

One possibility could be related to dino- flagellates and cyanobacteria found upstream in the catchment, which might be releasing toxins similar to those that cause red tides in marine environments, says Peter Ashton, a water resources specialist at the Council for Scientific and Industrial Research in South Africa and the University of Pretoria.

"It never is a quick, easy solution" in which it takes one test to find a culprit, explains Danny Govender, a disease ecologist for South African National Parks. She notes that samples taken from live crocs in 2007 showed that the fat of some

crocodiles was beginning to harden. Along with Bouwman, she hypothesizes that all these toxins, found below harmful levels individually, could be acting together in a deadly brew.

Govender cites changes to the river's ecosystem that stem from infrastructure outside the park, including hundreds of coal-mining operations upstream, where crocodiles have disappeared almost completely, and a dam downstream of the gorge. For the first time in the two decades since it was built, the dam's reservoir was full last year, slowing down the Olifants's flow through the crocodiles' gorge. Govender wonders if the slowed water enabled toxins to build up along the crocodiles' stretch of the river. Indeed, hydrogen sulfide, ammonia and other compounds from river sediments probably caused massive fish deaths in July, scientists have concluded, and crocs eating these contaminated fish could have been affected.

Even if researchers find the culprits, the impacts could reach further than suspected. "We really underestimated [the number of dead] crocodiles from last year's count," Govender adds, noting that their bodies could have been eaten by other crocs or sunk to the bottom of the river. "I suspect we're losing a lot of breeding females," whose carcasses are smaller and more easily scavenged. If that is the case, she says, the gorge's crocodile population may not ever recover, even if scientists can pinpoint the cause of the die-off.

As for the people who depend on the Olifants River, "I don't know what to tell them," Bouwman says. His colleague Henrik Kylin of Swedish University of

Agricultural Sciences in Uppsala wants to go into Mozambique to test fish there, and possibly people, to see if the croc killer kills more than just crocs.

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deadly watws: Nile crocodiles In the 01
Hants River In south Africa are
mysteriously dying en masse.