Chemistry

Richard Lipkin reports from New Orleans at a meeting of the American Chemical Society

Nerve cells meet microelectronics

Realizing a tantalizing science fiction fantasy, Richard S. Potember, a chemist at Johns Hopkins University in Baltimore, and his colleagues are building a chemical bridge between live nerve cells and microelectronics.

Using methods adapted from semiconductor manufacture, the researchers painted textured glass or silicon plates with a synthetic peptide that spurs the growth of fetal neurons. They find that the patterned peptide beds are cozy enough to coax baby rat neurons into sprouting dendrites and axons.

"They're growing," Potember says. "With this peptide on the glass, the fetal cells attach to the plate and mature into viable neurons, forming dendritic and axonal connections the way they normally do inside the body."

The biologically active surface constrains and directs neuronal growth into predetermined, circuitlike patterns. Guiding that growth, the researchers can get the nerve cells to mimic the logical circuits typically carved into semiconductors.

Following chip design rules for storing and processing data, the team aims to forge "live circuits" that could eventually respond to direct, computer-modulated stimulation.

"The interface between biology and electronics is important for biomedicine," Potember says. In the short run, this method shows promise for testing pharmaceuticals and possibly for studying neurological diseases, he says.

In the long run, the team wants to use the new technology in prosthetic devices. "This could be very helpful to someone who's lost an arm or leg," Potember says.

Delivering drugs through the skin

Skin serves mostly as a protective barrier, working to keep things out of the body. Yet, as J. Howard Rytting, a chemist at the University of Kansas in Lawrence, points out, it can also act as a route for getting drugs in.

Rytting and his colleagues have developed a new class of agents that enhances skin penetration and can help ferry certain drugs into the body. The researchers believe the new agents will prove useful in treating arthritis and psoriasis, reducing inflammation, and relieving pain.

The penetration enhancers, known as dialkylamino acetates, can boost absorption rates more than 400 times. Tests on skin shed by snakes, which has an absorption rate similar to that of human skin, showed that the new agents increase penetration of hydrocortisone, used to treat scaly skin, and indomethacin, an arthritis remedy.

Administering some drugs directly through the skin, says Rytting, can avoid certain side effects and bypass the breakdown of active agents in the gastrointestinal tract and liver. If, for example, nonsteroidal anti-inflammatory agents could be applied directly to sore joints, a higher percentage of the drug would reach its destination instead of being dispersed throughout the body. Moreover, patients who are unconscious or nauseated might absorb drugs more effectively through skin patches.

A sensor to sniff out explosives

New biosensors that can sniff out traces of the explosives RDX and TNT may be used to help clean up old munitions sites. Two such sensors, one a flow meter and the other a fiber-optic device, use antibody assays to detect low levels of hazardous agents, says Lisa Shriver-Lake, a chemist at the Naval Research Laboratory in Washington, D.C.

To test soil and water from remediation sites, scientists have had to send samples to laboratories for lengthy and expensive analysis. The new sensors are cheap, fast, and portable, Shriver-Lake says. So far, field tests show they produce accurate data in only a few minutes, hastening cleanup and cutting costs 95 percent.

Paleontology

Doing time over fossils

Peter L. Larson, a commercial fossil dealer, began serving a 2-year sentence last month for violating U.S. Customs limits and for stealing fossils from federal land. The sentence was handed down Jan. 29, following Larson's conviction last year.

The president of the Black Hills Institute of Geological Research in Hill City, S.D., Larson is best known for discovering a largely complete *Tyrannosaurus rex* specimen in South Dakota (SN: 11/11/95, p. 316). In 1992, federal agents raided his business and confiscated the dinosaur, to be used as evidence against the dealer.

Although prosecutors never actually used the fossil in Larson's trial, he was eventually indicted on 39 counts, including stealing fossils from public and private lands and making false statements to Customs officials. A Rapid City jury found Larson guilty of two felonies related to transporting more than $10,000 into and out of the country without declaring the amount. He was convicted of stealing a fossil worth less than $100 from federal lands and of illegally holding another fossil, both misdemeanors.

In addition to serving the 2 years, Larson must pay a fine of $5,000. His attorney, Patrick K. Duffy, calls the sentences unfair. The judge, he says, "didn't throw the book at Larson, he threw the entire New York City Public Library at him."

However, these penalties were not the maximum that Larson could have received, says David L. Zuercher, assistant U.S. attorney in Pierre, S.D. "Given the offenses of which he was convicted, these are pretty moderate sentences."

Larson is appealing his convictions.

If dinosaurs could sing

Paleontologists have teamed up with computer scientists in an attempt to recreate the call of *Parasaurolophus,* an unusual dinosaur with a head shaped something like a trombone.

Arching backward from the skull of this 75-million-year-old herbivore was a 4.5-foot-long hollow crest. Researchers interpret the crest as a display device and possibly as a resonating chamber to produce sounds.

Robert Sullivan of the State Museum of Pennsylvania in Harrisburg discovered a new specimen of *Parasaurolophus* in New Mexico last summer during an expedition with Thomas E. Williamson of the New Mexico Museum of Natural History and Science in Albuquerque. The fossil is only the fourth reasonably complete example of a *Parasaurolophus* known.

The two paleontologists took a CT scan of the skull, hoping to image the internal structure of tubes looping through the crest. To their surprise, they found between 9 and 11 chambers, twice what earlier studies had indicated.

Because the skull was partially crushed, the paleontologists have had trouble discerning how the internal conduits connected. To interpret the CT data, they have enlisted the aid of computer scientists at Sandia National Laboratory in Albuquerque. Using special image-processing algorithms, the Sandia scientists hope to resolve the hidden anatomy of *Parasaurolophus*. They can then make computer simulations of the sound waves that the animal may have generated with its resonant skull.

Richard Penney

Calling all Parasaurolophuses.