Materials Science

Richard Lipkin reports from Boston at a meeting of the Materials Research Society

Cells in gels

The notion of a synthetic material that is alive sounds far-fetched. Somewhat less fantastic, though, is a material that contains, or coexists with, living components.

In an effort to produce such a material, Edward J.A. Pope, a materials scientist at MATECH in Westlake Village, Calif., has produced a transparent gel, made of porous silica, that can encapsulate living cells. The gel forms a clear matrix around the cells, suspending them without killing them — "like raisins in a loaf of bread," he says.

Pope demonstrated the concept by mixing cells of *Saccharomyces cerevisiae*, a type of yeast commonly used to ferment beer, into a gel. The gel formed a porous shell around each organism — trapping it, yet permitting nutrients to flow in and by-products to flow out.

Yeast cells in silica gel.

Pope believes silica gels can encapsulate many types of microorganisms, including genetically altered *Escherichia coli* and *Streptomyces* bacteria. He also sees such gels as someday facilitating cell transplants.

"Silica gel is compatible with living tissues," he says, "so it's a good candidate for implanting live cells into a human body." For instance, insulin-producing cells suspended in gel could be inserted into the pancreas of a diabetic. The gel would permit glucose and insulin to come and go, yet protect the cells from an immune response. Similar implants could help patients suffering from liver failure or thyroid deficiencies, Pope adds.

Taking a walk on the lighter side

Materials that change their shape — moving and bending controllably after exposure to specific wavelengths of light — may make possible a new class of communication devices.

Improvements in such "photostrictive" materials, says Kenji Uchino of Pennsylvania State University in University Park, are progressing to the point where "we may soon see photo-driven relays, robots, and acoustic devices, which will play a key role in the era of optical communication."

Scientists first observed the photostrictive effect 15 years ago, when they saw that light, especially in the purple region, could cause certain ceramics to change shape, though not because of thermal expansion. Subsequent research found that light energy creates an electric field in the material, causing a deformation.

Uchino and his colleagues built a "photo-driven walking device." Made of a lead-lanthanum zirconate-titanate ceramic doped with tungsten oxide, the two-legged walker creeps along a tabletop like an inchworm when the legs are irradiated alternately with light at a wavelength of 366 nanometers.

"The alternating irradiation makes the legs bend," Uchino says. "It walks by remote control without any internal circuitry."

The underlying mechanism of photostriction remains unclear, adds Uchino, though he believes it arises from "some combination of photovoltaic and piezoelectric effects."

Current versions of photostrictive materials react relatively slowly to light. Response times are speeding up, however, Uchino says.

Today's telephones translate sound into electrical signals and back again. Early in the next century, Uchino believes, photostrictive-based "photophones" may convert laser light directly into sound, giving rise to a new type of telephony.

Science & Society

CIAT official kidnapped

On Sept. 23, Thomas Hargrove, a Texas native working for the International Center for Tropical Agriculture (known by its Spanish acronym CIAT), disappeared — and was presumed kidnapped — while traveling to work in Colombia. The captors of CIAT's communications director have now confirmed his abduction with a ransom letter.

"We know that he's alive" but little more, says Fritz Kramer, CIAT's deputy director. Because CIAT's $30 million annual budget contains no reserve, he told SCIENCE NEWS, "we do not have the money to respond to the kidnappers' request."

CIAT employs some 110 researchers and a support staff of about 1,050 in Colombia to work on local projects and help manage others in some 43 countries. The nonprofit group focuses on improving the quantity and quality of tropical forages and food staples — such as beans, cassava, and rice.

CIAT is headquartered in Cali, home of the violent drug cartel that recently assumed control of 80 percent of the world's cocaine trade. Here, Kramer says, little can be done to guarantee safety "short of assigning bodyguards to every staff." And relocating CIAT — an established organization with field sites throughout Colombia — "is a practical impossibility," he said. While CIAT has been rattled by Hargrove's abduction, Kramer maintains that "people who choose a career in international agricultural research know there are risks."

Canada to prune chlorine use

EPA isn't the only agency looking to cut industrial use of chlorine (SN: 2/12/94, p.111). On Oct. 25, Canadian Environment Minister Sheila Copps announced that her government would start "taking aggressive action in dealing with chlorinated substances that pose a threat to [health] and the environment." She said the new chlorine initiative would begin by "eliminating the most harmful chlorinated substances."

The Society of Environmental Toxicology and Chemistry recently called for restricting or banning chlorinated chemicals that are highly toxic, persistent, and bioaccumulative, Copps noted. Dioxins, some pesticides, and polychlorinated biphenyls fit that description.

But editors of a new review of the adverse effects of chlorinated compounds — funded by the chlorine industry and just issued as a 1,050-page supplement to the August REGULATORY TOXICOLOGY AND PHARMACOLOGY — seek to polish chlorine's tarnished image. Studies in the review "clearly indicate that the alarms about chlorine-containing compounds are unwarranted," they say. Indeed, they argue, this report demonstrates that "the mere presence of chlorine in a molecule does not necessarily confer unique toxic properties or bioaccumulative potential."

Fraud panel finds researcher guilty

In the latest installment of a highly publicized case of alleged research fraud (SN: 12/14/91, p.399), the Office of Research Integrity (ORI) — a watchdog of the Public Health Service — has found Thereza Imanishi-Kari of Tufts University guilty of 19 charges of scientific misconduct. Imanishi-Kari conducted the research, on the regulation of immunity, at the Massachusetts Institute of Technology. She published it in 1986 with Nobel laureate David Baltimore, who was not accused.

In a nearly 300-page report released Nov. 25, ORI documents its statistical and forensic analyses to show the false data were not chance errors but conscious ones "aimed at a particular result." Without such fraud, ORI concluded, "[Imanishi-Kari's] experiments would not have been regarded as significant" — thus not warranting publication or follow-up funding.

Notified of these findings 3 months ago, Imanishi-Kari is currently appealing them. If she loses, she would be barred from receiving federal research support for 10 years.