equally hard to accept that ALEPH is seeing new physics where none is expected.

The Holy Grails of particle physics are the Higgs particle—responsible for the way particles acquire mass—and evidence for supersymmetry, a hypothetical higher symmetry in nature in which known particles would have massive partners. "If it were to have a Higgs-like interpretation, we would expect these four jets to have [a different] character," says Thompson. Supersymmetry also appears to be a long shot. In the ALEPH events, the visible collision products seem to account for all the collision energy, "which flies in the face of supersymmetry," says Thompson. "Except for some of the more obscure supersymmetry models," he explains, supersymmetry predicts an energy shortfall.

Wagner and his colleagues at CERN have already submitted a paper that explores one possibility: that the events signal a variant of supersymmetry in which particles with left- and right-handed "spin" can interact differently. They speculate that two supersymmetric electrons, having masses of 48 GeV and 58 GeV, could have briefly materialized in the collisions before decaying into the four jets. But Wagner too advises caution. "Right now, we cannot be sure that this is new physics," he says.

The LEP experimental groups have joined forces in an attempt to resolve the matter, looking for features of the detectors that might explain why ALEPH sees something while the others do not. They are also examining ALEPH's data processing, including the algorithms that pick out the jets. So far, says Dornan, "we don't have an algorithm that will kill it."

What may finally settle the issue is more data, which will come when LEP begins its new runs in May 1997. In the meantime, physicists face a frustrating waiting game. As Frank Close of the Appleton Laboratory puts it, "You can't tell yet whether this is the emergence of a signal, like the tip of an iceberg, or whether it's a small piece of ice that's going to melt away."

–Andrew Watson

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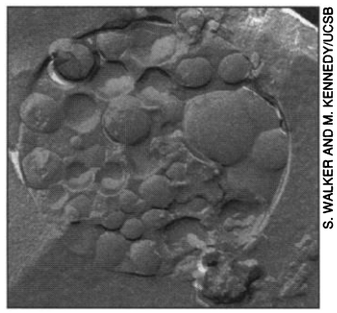
MATERIALS SCIENCE

Researchers Construct Cell Look-Alikes

From cells to shells, biological systems are masters of organization, assembling molecules into structures of ever larger sizes. Scientists looking to imitate this talent have had little trouble getting molecules to arrange themselves into the simplest components—for instance, coaxing layers of fat molecules, or lipids, to curl into tiny spheres, called liposomes. Yet, when it comes to assembling complex structures, biology leaves the imitators behind. But now, scientists from the University of California, Santa Barbara (UCSB), have displayed more than a little organizational prowess, assembling groups of lipid molecules into structures resembling cells, with an outer membrane encasing a series of vesicles.



S. WALKER AND M. KENNEDY/UCSB

Tiny bubbles. Vesicles packaged inside a fatty membrane.

The new work, which was presented last month at the Materials Research Society meeting in Boston, "is a very nice approach to making hierarchical materials," says David Grainger, a chemist at Colorado State University in Fort Collins. The cell look-alikes, dubbed vesosomes, may also boost efforts to use lipid spheres for delivering drugs to tumors and other tissues, says Theresa Allen, a drug-delivery specialist at the University of Alberta in Edmonton. The spheres deliver the drugs as they leak through lipid membranes. Packaging the drugs inside two membranes could slow the release of the drugs, lengthening the time between injections for patients.

To create the vesosomes, the UCSB researchers—materials scientist Joseph Zasadzinski and graduate students Scott Walker and Michael Kennedy—took a two-stage approach. First, they built and grouped together small lipid spheres, then shrink-wrapped the groups in an outer lipid membrane. The first part was easy. Researchers have been making liposomes for years by adding lipids to water and then blasting the solution with sound waves, among other techniques, to induce the fat molecules to assemble into spheres.

Tethering together a cluster of the minispheres was trickier. Liposomes don't usually group together; like charges on their surfaces, for example, often push them apart. So the researchers engineered special, two-part chemical linkers into the outer surface of the liposomes. First, they took some lipid molecules and attached one half of the chemical linker—a small, organic molecule known as biotin. Next, they mixed these with undoctored lipids. When the lipids then assembled into spheres, each had biotin molecules poking out of its surface. Then the scientists spiked the mix with the second half of the chemical linker—streptavidin. Each streptavidin can bind four biotins. This multiple binding drew free vesicles together into big aggregates. They were so large, in fact, that to package them, the team had to cut them down to size by forcing them through an ultrafine filter. The result: tethered groups of liposomes measuring 0.3 to 1 micrometer across.

To shrink-wrap the groups, Zasadzinski and his colleagues again used a two-stage process, first linking the liposome groups to the shrink-wrapping material and then causing it, through chemical sleight of hand, to wrap around the liposome groups. For their wrapping material, the researchers used lipids organized into a different form: sheets rolled up into tiny cylinders. Researchers have been coaxing lipids into cylinders as well as liposomes for years, but those made by the UCSB researchers differed in one key way: They engineered biotin and streptavidin linkers into the cylinders' surfaces. So when the researchers stirred up a soup of cylinders and liposome groups, the linkers again drew the structures together.

The final challenge was getting the cylinders to unfurl so the carpetlike sheets could form large sacs around the groups of smaller spheres. To pull this off, the team loosened some of the calcium bonds holding the cylinders together by adding to the mix a calcium-grabbing compound—ethylenediaminetetraacetic acid. As the cylinders unroll, about 15% naturally wrap themselves around neighboring aggregates, reports Zasadzinski.

Currently, the researchers are trying to improve the efficiency of the shrink-wrapping process. They also plan to see whether their two-membrane vesosomes do, in fact, release encapsulated drugs more slowly than do single-membrane liposomes. Allen notes, however, that as drug deliverers, vesosomes have a few drawbacks. For one, streptavidin is a bacterial protein that could trigger an immune response if injected into a person's bloodstream, she says. Also, she adds, at about a micrometer across, today's liposomes are big enough that they would be cleared quickly from the bloodstream by filtering mechanisms in the liver and spleen.

Zasadzinski says, however, that it should be fairly easy both to replace the streptavidin with nonimmunogenic compounds, as well as produce vesosomes that are tiny enough to remain in circulation. If he's successful, drug delivery experts may soon attempt their own bit of advanced biomimicry.

–Robert F. Service