Cells as sensors

When it comes to detecting tiny amounts of chemicals with great selectivity and sensitivity, nature sets the standard.

Cells usually win out as the best biosensors.

Yet when scientists try to detect small numbers of molecules in complex mixtures, using cells or other analytical techniques, they often run into trouble distinguishing one subtle reaction from another. To solve this problem, Richard N. Zare, a chemist at Stanford University, and his colleagues have devised a new biosensor that joins one living cell with an apparatus for chemical separation.

"People have made biosensors before and done chemical separations before," says Zare, "but this is the first time that a single cell and a separation system have been combined in one device. This system lets you work with very small volumes of material and achieve very high resolutions."

Through genetic engineering, scientists can breed cells with heightened sensitivities to specific chemicals. The sensing device separates a chemical mixture into its components, enabling researchers to see which molecules trigger a reaction, Zare and his colleagues report in the Jan. 6 SCIENCE.

Two biosensors successfully detected minuscule compounds. One sensed the binding of molecules to receptors on the surface of cultured rat cells. The other measured changes in plasma membrane ion permeability in a frog egg.

Zare sees many practical uses for such biosensors. "One goal is to detect neurotransmitters emitted from certain neurons, where the volumes and concentrations are very small," he says. "This will allow us to look for new neurotransmitters."

Another possible use is drug testing. "After giving someone a drug, you could test for metabolites and see what side effects they have [on cells]," Zare adds. "In medicine, you really want to know this kind of thing."

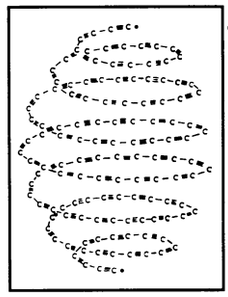
A new form of linear carbon

In addition to carbon rods, tubes, and spheres, chemists now report another form of the element: carbon threads.

Called linear acetylenic carbon, the new allotrope, or form, of the otherwise sooty element shows up as amber-colored, "gossamerlike" threads, whose texture resembles "angel hair," according to Richard J. Lagow, a chemist at the University of Texas at Austin. Lagow and his colleagues report their findings in the Jan. 20 SCIENCE.

Each filament appears as 300 to 500 carbon atoms, lined up in a row and linked together by alternating single and triple bonds, Lagow says. The researchers synthesize the carbon lines by using a laser to blast a thin graphite rod inside a glass reactor filled with argon. The carbon strands splatter the walls of the vessel, from which they are easily removed.

The scientists believe that many of the carbon strands wind into spirals, which through a "zipperlike" reaction become fullerenes or soot. Since the carbon strands are reactive and conduct electricity, the researchers see possible uses for them in microelectronics, diamond synthesis, fuel cells, and jet fuel.



Lagow/SCIENCE

A spiral of linear acetylenic carbon.

Letters continued from p.67

A.W. Sleeswyk and I reconstructed it on the basis of both a description from that dynasty and information about artifacts of the period that have been excavated recently. Our report was published in the journal CHINESE SCIENCE in November 1983.

Nathan Sivin
Professor
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Taking care of new knees

In the article "Mending Joints" (SN: 11/12/94, p.318), Suzanne Dettmer is pictured running after having had a total knee replacement.

I believe a word of caution should be inserted here.

Impact loading does hasten the demise of a total knee replacement through wearing on the high-density polyethylene.

Raymond S. Gruby
The Bone & Joint Center
Bismarck, N.D.

CORRECTION

In "Abandoning Richter" (SN: 10/15/94, p.250), an earthquake of magnitude 1.0 would cause the arm of a Wood-Anderson seismometer to swing one-hundredth of a millimeter. Earthquake moments are measured in numbers such as 2 x 10^{20} newton meters. A 100-watt lightbulb left on for 0.63 second would equal a magnitude -2 earthquake.