Tiny plants challenge greenhouse plan

Evidence from an algal graveyard has thrown a wrench into investigations of the perplexing climate changes of the last ice age. By extension, those same findings raise important questions about a controversial proposal to combat global warming by seeding the Antarctic Ocean with iron.

A decade ago, scientists discovered that carbon dioxide levels dropped by about 30 percent during the last ice age, thereby lowering Earth's greenhouse effect and helping to keep the planet locked in the deep freeze. To explain such atmospheric alterations, oceanographers suggested that microscopic algae in Antarctic waters proliferated during the ice age, drawing carbon dioxide out of the atmosphere and storing it in the deep sea.

Not so, say Richard A. Mortlock and his colleagues at Columbia University's Lamont-Doherty Geological Observatory in Palisades, N.Y. Using sediment cores from the Antarctic Ocean floor, they studied the glassy remains of ice-age algae called diatoms. Contrary to expectations, the scientists found that Antarctic diatoms fared poorly during the glacial age, they report in the May 16 NATURE.

"These results are disconcerting because they all but demolish one potential regulatory mechanism for atmospheric CO_2, one which has been considered quite powerful by many geochemists and paleoceanographers," comments Wolfgang H. Berger of the Scripps Institution of Oceanography in La Jolla, Calif.

The seemingly esoteric topic of Antarctic algae took on headline status last year when an oceanographer suggested enlisting these tiny plants to slow global warming. John H. Martin of the Moss Landing (Calif.) Marine Laboratory proposed that adding extra iron to the Antarctic Ocean would stimulate algal growth, causing the plants to absorb millions of tons of carbon dioxide from the atmosphere each year (SN: 1/26/91, p.63). He reasoned that the same iron-supplement scenario occurred naturally during the last ice age.

The new data challenge Martin's theory about the ice age, but that doesn't necessarily scuttle the entire proposal, says Berger. Some laboratory evidence indicates that adding iron to seawater does stimulate the growth of algae, regardless of what happened in the past. Scientists are now considering an ocean experiment to test Martin's proposal. *— R. Monastersky*

Altered enzyme reverses Gaucher's symptoms

Roscoe O. Brady first proposed enzyme-replacement therapy for Gaucher's disease 25 years ago. A tantalizing series of experimental ups and downs followed, but never quite produced the hoped-for cure. Now, Brady and his colleagues outline a new twist on the enzyme treatment, one that provides dramatic relief from the major symptoms of this debilitating and sometimes lethal disease.

People with Gaucher's disease inherit a defective enzyme that cannot break down a fatty substance called glucocerebroside. As a result, the fatty material builds up in scavenger cells of the immune system, called macrophages. The fat-engorged macrophages cluster in the liver and spleen, causing these organs to swell. Symptoms of the disease, which strikes about one in 40,000 people in the United States, include bone loss, excruciating bone pain, internal bleeding, and severe anemia involving a decrease in the oxygen-carrying hemoglobin within red blood cells.

Previous attempts to treat Gaucher's disease with injections of the fully functioning enzyme failed because scientists couldn't get enough of the lifesaving substance into the patients' macrophages. In the May 23 NEW ENGLAND JOURNAL OF MEDICINE, Brady and his colleagues report that a modified enzyme therapy produced striking improvement in 12 adults and children with moderate to severe Gaucher's. The team used chemically treated enzyme that binds and enters macrophages.

Patients received intravenous injections of the modified enzyme once every two weeks in moderate cases and once a week in severe cases. After six months of treatment, five participants showed a 16 to 22 percent reduction in liver size and all 12 showed a significant reduction (averaging 33 percent) in spleen size. The most dramatic finding, however, was an increase in all patients' hemoglobin, which reached normal levels in seven individuals. Three people also showed signs of increased bone density, and Brady thinks others may follow suit after several more years of treatment.

All volunteers reported less fatigue and most experienced less pain, the researchers note. In two particularly severe cases, children who had been virtually crippled by the disease resumed normal activities, says Brady, of the National Institute of Neurological Disorders and Stroke in Bethesda, Md.

The new treatment "completely reverses the pathology of the disease," he told SCIENCE NEWS. *— K.A. Fackelmann*

Monolayers reveal protein preferences

The chemical complexity of proteins makes them seem quite fickle to bioengineers. On one hand, these molecules often stick to surfaces where they don't belong, fouling contact lenses or leading to clots in artificial blood vessels, implanted valves and other biomedical devices. On the other hand, they sometimes don't stick as well as researchers would like, as in procedures for purifying biotechnology's protein products.

Now, two scientists at Harvard University have developed a technique for figuring out just what makes one protein favor some surfaces over others. In the May 24 SCIENCE, chemist George M. Whitesides and graduate student Kevin L. Prime report developing organic films to test how well proteins stick to different materials.

To make the films, Prime and Whitesides add hydrocarbon molecules called alkanes to an alcohol solution containing a thin strip of gold. The alkanes self-assemble on the gold template and form a single, dense layer of molecules. For their experiments, the researchers used alkanes with methyl, sugar, hydroxyl and polyethylene glycol tails that stick up from the monolayer. This enabled them to create monolayers with known surface structure and composition. They then added various proteins to determine how much each monolayer film absorbed.

"Proteins are complex, so if you can minimize the complexity of the solid surface, then you have a chance to correlate the solid surface's properties with what [absorption] you see," notes bioengineer Joseph Andrade of the University of Utah in Salt Lake City, who also studies protein/surface interactions. "The self-assembled monolayer system provides a degree of control, reproducibility and reliability that is simply unavailable with all other systems."

Whitesides and Prime observed that the five proteins they studied stuck poorly to films containing lots of polyethylene glycol. This tail is so bulky that it forms a slick gel that proteins cannot penetrate. But the proteins seemed to take a fancy to the other films, which readily absorbed the added molecules.

"Now we can understand on a molecular level the interaction of proteins with man-made materials," Whitesides told SCIENCE NEWS. In the past, chemists have relied mostly on trial and error to identify "nonstick" surfaces that absorb less protein. But with the new data, researchers can develop "a prescription for how to modify these surfaces to improve them," Whitesides says. "We want to develop man-made materials that are as non-interactive as possible." *— E. Pennisi*