

simulation a bias that favors continuous, rapid change. There do not seem to be any such mechanisms operating in the real world today.

Lastly, his software organisms arrive in the memory soup completely formed, built out of a series of complex instructions in exact sequence. They can move, locate other organisms, make decisions and reproduce themselves, all from the very beginning of the simulation. They have been designed with these specific characteristics by an intelligent, directed force (the programmer) acting from outside the software "universe." This intelligent force has a complete understanding of the needs of the organisms, and with a conscious desire to see them thrive and succeed, has tuned the software environment to those needs.

Evolutionary theory, in contrast, would expect these complex organisms to come into being by the random interaction of bits within a software "universe" that has no particular interest in seeing them become anything. In this sense, Ray has done more to demonstrate Special Creation than Evolution.

John Schneider
Programmer Analyst
St. Louis, Mo.

Is it possible for Ray to program into Tierra the potential for its inhabitants to "destroy" it? We might learn a lot from that, in a preventive sense.

It seems that right now the keystone predators/parasites in the human system are hell-bent on destroying our planetary medium. Anything we could learn about reversing these powerful, destructive forces would be invaluable.

Marguerite Babcock
Acme, Pa.

I read "Electronic Ecosystem" with both pleasure and alarm. Ray's work will likely be the focus of research by many curious investigators in the future. He should be congratulated on an excellent job of delving into evolutionary forces at work. What alarms me, however, is that these algorithms could get loose.

I have no doubt that Ray took all the proper precautions to isolate his computer so that his "organisms" don't leave it. But what happens as word of his work spreads? Will every investigator take the same precautions? Today we have dozens of viruses written by hackers playing games, taking out revenge or simply being disruptive. Ray's organisms are similar to those of the hackers except for one important difference: His can mutate. All computer viruses to date have been written by people; they can be stopped. Not so with viruses that mutate. What's to stop a hacker from loosing an algorithm organism on the bulletin board networks?

When our society first encountered the possibility of producing new organic organisms, we were very cautious: special laboratories to work on them, oversight committees, but mostly time to see if the new organisms proliferated too rapidly. Fortunately, we found that it was tough to get a new organism going. But what's the limitation of algorithm organisms if they can evolve as spontaneously as your article indicates?

Shawn Buckley
San Jose, Calif.

Beetle bungle

While the headline "Rosy future for beetle juice" (SN: 9/14/91, p.173) has a nice ring to it, cochineal (*Dactylopius coccus*) is not a beetle but rather a scale insect in the order Homoptera. Related to aphids, cicadas and plant-hoppers, the scale insects have piercing-sucking mouthparts. They undergo an incomplete metamorphosis and many are economic pests, primarily because they are vectors for a variety of plant diseases. Beetles undergo a complete metamorphosis in their development and have chewing mouthparts.

Steve Prchal
Director, Sonoran Arthropod Studies, Inc.
Tucson, Ariz.

The report on the carmine-red pigment derived from *Dactylopius coccus* might have appeared on a stone carving circa A.D. 1100. These insects have been dried and pulverized for use as a dye since the time of the Aztecs. The dye has been used for coloring food, drink and medicine, as a cosmetic and as a diagnostic dye.

It has also been associated with at least one salmonellosis outbreak. A 1971 report on the incident, which occurred in a Massachusetts hospital, suggested that heat sterilization at the end of the cochineal dye processing eliminates the salmonellosis hazard.

William L. Krinsky
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Yale University
New Haven, Conn.

The use of cochineal dye for textiles and food dates back at least several centuries. Up until World War II, women were still smearing pulverized bug pigments on their lips in the form of red lipstick.

Because of the huge amounts of insects that had to be harvested and the difficulty of picking them from their prickly perches, scarlet dye always was very expensive, restricting its use to a small financial elite. The "redcoats" of the Imperial British military were, therefore, less a fashion trend than a powerful statement about the wealth and strength of His or Her Majesty, who could afford to dress even common soldiers in expensive scarlet.

Christoph Amberger
Baltimore, Md.

Ice aging

Your statistics on the Greenland Ice Sheet Project ("Tales From Ice Time," SN: 9/14/91, p.168) have me puzzled. I assume that the ice is incompressible; otherwise, deep cores would explode. So there must be a uniform scale of depth of ice with time, which you don't give. You say 151,000 centimeters is "about halfway to the bottom" of the 300,000-centimeter ice sheet, a level reached "about 8,500 years ago." However, double that period is only $2 \times 8,500 = 17,000$ years, not 200,000.

Robert A. Smith
Seattle, Wash.

The age of the ice does not increase uniformly as drillers cut through the ice cap. The ice encountered at a depth of 1.5 kilometers may be about 8,500 years old, but the ice at double that depth is more than 200,000 years old, according to the researchers' calculations. The seeming discrepancy results from ice's ability to flow over long periods of time. The deeper layers of the cap are thinner because their ice gets squeezed by the weight of all the overlying ice. — R. Monastersky

Whale of an idea

"Hungry whales take a bite out of the beach" (SN: 9/14/91, p.167) brought to mind Chapman Grant's explanation for the origin of the Carolina Bays.

Carolina Bays are large-scale oval depressions that occur in the Atlantic Coastal Plain from Maryland to northern Florida and are concentrated in North and South Carolina. The search for an explanation of their origin has led to much speculation. Grant suggested in 1945 that large schools of some extinct fish species congregated around artesian springs in the shallow water along what was then the Atlantic Coast. There they fanned out spawning beds in the sea bottom, producing the initial depressions that became the Carolina Bays.

The whales of Puget Sound may have provided us with a new biological explanation for the origin of the Carolina Bays. Did prehistoric whales take bites out of the beach, leaving pits in the shoreline that led to Bay formation?

Suellen Cabe
Assistant Professor of Geology
Pembroke State University
Pembroke, N.C.

Too soon to say

Mushrush and Mose reported that the cancer rate in homes with high levels of radon in the water was higher than that in homes with low radon in the water ("Eastern radon ranked by region," SN: 9/14/91, p.173). The cancer rate in homes with low radon was 2 percent. The sample consisted of 16 homes. If six people live in each of those homes, the 2 percent consists of two people. This is hardly the size of study on which we should base public policy.

Dale Fast
Associate Professor of Biology
St. Xavier College
Chicago, Ill.

Mushrush and Mose agree that larger studies are needed.
— E. Pennisi

For the record

I must take issue with Karen Schmidt's characterization of my comments in "Air pollution: No place like a mobile home" (SN: 10/19/91, p.247).

I did not say that EPA needed new legislation to define respective roles. What I did say was that some had suggested new legislation, but that EPA had several legal authorities, including the Toxic Substances Control Act, under which it could regulate formaldehyde and was in fact moving to do so. I told her specifically that I had no position on whether legislation would be needed.

Joseph A. Cotruvo
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CORRECTIONS

The photo in "Grasshoppers change coats to beat the heat" (SN: 8/24/91, p. 119) should be credited to Timothy A. Mousseau of the University of South Carolina in Columbia.

The Earth images in "Flyby: The world according to Galileo" (SN: 11/16/91, p.311) should be credited to W. Reid Thompson of Cornell University's Center for Radiophysics and Space Research.