oxygen (O_2) rather than oxygen atoms that was being lost from the air in Biosphere 2. The amount of oxygen atoms present in the water in Biosphere 2 is about 200 times more than the amount of oxygen atoms present as O_2, so the loss of oxygen atoms to the cement was insignificant. Rather, what caused the O_2 loss was the excess of organic matter in the soil, which supported an imbalance of O_2-consuming respiration over O_2-producing photosynthesis. The reaction of CO_2 with the cement only made it a little harder for us to find the true cause of O_2 loss, by scrubbing from the air the telltale product of respiration, CO_2.

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Walford correctly points out that concrete absorbs CO_2, but he does not point out that the $Ca(OH)_2$ responsible for this uptake was obtained by driving CO_2 off of limestone. Because some of the CaO_2 becomes silicate-bound and some remains unreacted, concrete manufacture is a net source rather than a net sink for CO_2. Further, the contribution of concrete manufacture to global CO_2 production is only about 0.2 gigaton of carbon (GiC), compared with 6.5 or so GiC produced by fossil fuel burning and to a continental sink of about 1.7 GiC (S. Fan *et al.*, Reports, 16 Oct., p. 442). Hence, even if limestone were slaked at one region and the concrete were used in another, the impact on the distribution of CO_2 in the global atmosphere would be negligible.

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Green Revolutions

While we appreciate scientists' efforts to increase crop yields (C. Mann, "Crop scientists seek a new revolution," News Focus, 15 Jan., p. 310), it appears that we have not learned from mistakes of the past and that once again we have fallen victim to the old fallacy that science can alleviate the world's pain. The original "green revolution" focused solely on crop yields, while ignoring the subsequent ecological and sociological consequences. It also increased the dependence of developing nations on high-input agriculture (mechanization, pesticide, and fertilizer use)—a dependence that these nations could ill afford. This dependence in turn inflated the national debt of developing countries, contributed to rural displacement, increased poverty, and decreased overall crop biodiversity. At the time, science appeared to be solving world famine, but the real social and ecological ramifications had not been considered. Today, there is extensive literature questioning the basic premises of the green revolution and its impacts. Mann's article says little about such considerations. Instead, we are told once again that science will save us. But we have the opportunity and obligation to examine the potential impacts on our environment before we blindly engineer these high-yield marvels. Shouldn't we be able to learn from our past mistakes?

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Regarding Charles C. Mann's article "Genetic engineers aim to soup up crop photosynthesis" (News Focus, 15 Jan., p. 314), the development of techniques for manipulating chloroplast DNA in plants should have received more credit for renewing interest in altering the RuBisCO (ribulose-1,5-bisphosphate carboxylase-oxygenase) found in C_3 plants. With this advance, placing a foreign RuBisCO into plants was no longer a far-off dream. Furthermore, nature offers several enzymes besides the red algal RuBisCO that might be beneficial in C_3 crop plants.

While the discovery of high specificity in the red algal RuBisCO was unexpected, from the available data its high specificity seems to be associated with a considerable reduction in maximal turnover compared with the typical C_3 enzyme. Consequently, its introduction into plants may actually reduce net photosynthesis because both turnover and specificity determine the overall efficiency of the enzyme.

Using equations for RuBisCO kinetics and carbon dioxide (CO_2) release by photorespiration, we calculate that under current conditions net photosynthesis is more likely to be increased by replacement with a high-turnover RuBisCO enzyme, even if its specificity is somewhat lower. The benefit will be increased in the higher CO_2 environment expected in the next century. Suitable candidates are already known in the green algae and C_4 plants, where evolution of the enzyme has occurred in a high CO_2 environment.

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A Dark Particle?

I write in connection with James Glanz's article "Has a dark particle come to light?" (News of the Week, 1 Jan., p. 13), where the intriguing results of the DAMA (for DArk MAtter) experiment, located underground at the Gran Sasso laboratory in central Italy, are reported. The effect measured by DAMA, if confirmed by the further experimental investigation currently under way to increase statistics, would constitute a major breakthrough in understanding the nature of dark matter in the universe.

Our group (Fiorenza Donato, Nicolao Fornengo, Stefano Scopel, and me) has presented the theoretical implications of the DAMA data in a number of scientific publications (*1*) and at international conferences. We have shown that the DAMA results are widely compatible with an interpretation of a relic super-symmetric particle (neutralino) as a major component of dark matter in the universe. We have also presented in detail the physical properties of this particle and discussed how these features might be investigated at accelerators (the Large Electron-Positron (LEP) accelerator, Tevatron upgrades, or the Large Hadron Collider) and with independent searches for weakly interacting massive particles (by looking for upgoing muons at neutrino telescopes and antiprotons in cosmic rays).

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References and Notes

1. A. Bottino, F. Donato, N. Fornengo, S. Scopel, *Phys. Lett. B* **423**, 109 (1998); other papers of ours on this topic are now in press in *Phys. Rev. D* and *Astroparticle Physics* and are posted on the Los Alamos preprint Web site at xxx.lanl.gov/abs/hep-ph/9808456, 9808459, and 9809239. An independent analysis of the DAMA data (by R. Arnowitt and Pran Nath), limited to supergravity unified models, is posted on the Los Alamos Web site (hep-ph/9902237).

Recovering Seveso

In human-dominated ecosystems, chemical pollution and habitat fragmentation are the two main factors affecting natural environments. In the last 7000 years, we have modified half the global land surface, about one-third since the Industrial Revolution (*1*). Because of continuing environmental destruction and modification of agricultural, industrial, and residential uses of land, it is important to study the remedies. Seveso (population 40,000), 16 kilometers north of Milan, Italy, acquired worldwide notoriety on 10 July 1976 because a vapor cloud containing at least 2 kilograms of 2,3,7,8-tetrachlorodibenzopara-dioxin (TCDD) issued from a reactor producing trichlorophenol over an area inhabited by about 2000 people (*2*). After human evacuation from the 80.3 hectares that were most polluted (up to 20×10^3 micrograms per square meter of TCDD), building demolition and 40 centimeters of earth scarification took place over 43 hectares. The scarified area was planted mainly with oak, with scattered grassy and bushy areas. From 1995 through 1997, we investigated plant and animal ecological parameters in Seveso park, comparing the findings of mutagenic tests with those of 10 urban and suburban parks (*3*). Seveso park is isolated in the urban context, with a high isolation index (–20.7 kilometers) and no wildlife corridors. We monitored the presence and concentration of all 2,3,7,8-substituted PCDD/Fs (polychlorinated dibenzo-p-dioxins and dibenzofuranes), including TCDD. The 1998 TCDD soil concentrations do not exceed 16 picograms per gram of dry soil [compare industrial regions with about 20 picograms of Int-TEs (international toxic equivalents) per gram of soil], with no differences between the topsoil and the soil 15 to 30 centimeters deep; the concentrations in moss and earthworms were 5 to 25 picograms per gram of Int-TEs, and the air concentrations of 15 TCDD isomers investigated were 0.3 to 21 picograms per cubic meter. The park has been colonized by annelids, insects, amphibians, reptiles, birds, and mammals. Birds predominate, with 22 to 24 species