production would not have survived before 3.8 Gyr ago. We wish to point out that a different conclusion is possible, even without challenging the assumptions about impact processes.

Microorganisms exist in very large numbers, and often show great resilience to environmental stress. Consequently, the likelihood of some individuals surviving global catastrophes through special and fortuitous combinations of circumstances can be underestimated by simple models.

In the present case, we can envisage that photosynthetic prokaryotes, returned from deeper water to the new photic zone, could become associated with sea-floor sediments, or with rock surfaces, without reaching the unihabitable uppermost part of the photic zone. It need not be assumed that such organisms would have to occur exclusively in either a free-floating or in a benthic situation. Recolonization of the photic zone and re-establishment of an ecosystem based on photoautotrophy could follow. Photosynthetic metabolism could have been evolving since before 3.8 Gyr ago.

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No barrier to exchange

SIR—Vilaro *et al.* have reported[1] the demonstration of an insulin-regulatable glucose carrier on the endothelial cells of blood capillaries which supply fat and muscle. I have no reason to question their findings, but their suggestion that such a transport system is necessary to overcome the "barrier" of the capillary wall must surely be wrong. It is generally accepted[2,3] that water and small hydrophilic molecules of relative molecular mass 10,000 or less can diffuse freely and rapidly across the walls of normal capillaries. The micro-anatomical site of this diffusion is uncertain but some of it is believed to occur at the inter-endothelial junctions, and it has been calculated that a 40-Å separation of between 3 and 18 per cent of such junctions would account for the observed phenomena[4].

In support of their barrier hypothesis, Vilaro *et al.* cite a paper by Karnovsky[5]. Unfortunately, this paper was concerned mainly with the capillary barrier to the protein macromolecules horseradish peroxidase (40,000) and ferritin (500,000), and its author makes it clear that small molecules like glucose can cross the capillary wall relatively freely.

Further, it is a matter of common observation that even in the brain, where the capillaries are lined with very tightly joined endothelium, and where the glucose carrier system described by Vilaro *et al.* cannot be demonstrated, the cerebrospinal fluid nonetheless contains glucose at a concentration which is as much as 60 per cent of that in the blood.

The glucose transport system proposed by Vilaro *et al.* may well be important to fat and muscle cells, and to the function of the local vascular endothelium. But it cannot be explained directly by invoking a capillary barrier. On the basis of the available evidence, no such barrier exists.

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CO_2 disposal by means of silicates

SIR—If fossil fuels are to be used on a massive scale and the greenhouse effect avoided, carbon dioxide emissions into the atmosphere must be reduced. One way to achieve this is to collect the CO_2 and to dispose of it in empty natural gas fields or the deep ocean. But such a disposal system would need a substantial amount of energy. It would be advantageous if there were an abundant mineral to which the CO_2 could be bound chemically via an exothermic reaction to form a stable, permanent substance.

It is known that about 100 million tons of carbon per year are bound by silicate-weathering throughout the world. This natural process is of a scale that would consume the CO_2 inventory of the atmosphere in 7,000 years. There are other substances to which CO_2 can bind, but the weathering reaction of calcium silicate is slightly exothermic whereas most of the others are endothermic.

$$2CO_2 + H_2O + CaSiO_3 \rightarrow Ca^{2+} + 2HCO_3^- + SiO_2 \quad -29.6\ \text{kcal}$$

One could imagine a process by which pressurized CO_2 is pumped into a closed container containing a suspension of pulverized silicates in water. The resultant hard water and SiO_2 could be drained into the deep ocean and the process repeated, thus disposing of CO_2. This idea may not be practicable because the energy required to dig up and grind the calcium silicate may be too great and the kinetics of the above reaction may be too slow. Experimental work is necessary to determine whether this sort of scheme would be feasible in practice.

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Lithium effect

SIR—Dianna Bowles in her recent News and Views article[1] highlighted the role of signals in the response to trauma of the wounded plant. Two lines of research have been used to discriminate wound healing itself from the induction of a wound signal and its consequences on plant growth. First, non-traumatic treatments such as touch or wind slow the growth rate of stimulated tissues[2,3]: at least four 'touch-induced' genes are involved in this process[3]. Second, the growth responses occurring at a distance from a wounded area can be studied, as such responses clearly do not correspond to the wound-healing process[4].

We would like to draw attention to the fact that, in plants, lithium acts as a potent inhibitor of all these growth responses to stimuli in the range 20 μM to 1 mM. Studying the effect of injury, and of the addition of lithium, on proteinase inhibitor production would be of interest in the light of Bowles' article. It is still not known if the molecular site of lithium action in the control of plant growth is similar to the site proposed for animal cells[5].

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