al responsibility to prevent the premature clinical use of the G8 probe until the information derived from it can be judged accurately. A scientist cannot ignore the social consequences of his work, especially in medicine, and should not abrogate his social responsibility.

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Industrial age leading to the greening of the Earth?

SIR—That the concentration of CO_2 in the atmosphere has increased from 265 parts per million (p.p.m.) in pre-industrial times to 314 p.p.m. in 1958 and more than 345 p.p.m. today has been established by several means, but little attention has been paid to the hypothesis that the enrichment of atmospheric CO_2 may greatly increase plant growth and development[1,2].

A good test of this hypothesis[3,4] is to be found in the secular variation of the seasonal CO_2 cycle amplitude. Does it increase with time in response to an increasing plant growth and decay cycle caused by the rising atmospheric CO_2 concentration?

Recent years have seen several independent confirmations of this scenario (Fig. 1). The three analyses for Mauna Loa, Hawaii, yield very similar slopes and the two analyses for Weather Station P yield essentially identical slopes, evidence which points towards the reality of the phenomenon.

Further support for this view is provided by the latitudinal plot of the mean result for each site shown in Fig. 2. The line connecting the data points of this figure was drawn by eye and forced to intersect the origin. A negligible change in the seasonal CO_2 cycle amplitude in this region is predictable, since the area in the immediate vicinity of the Equator is a mixing zone for the out-of-phase effects of the diametrically-opposed seasonalities of the Northern and Southern Hemispheres. Since this mixing and counterbalancing of effects should decrease both north and south from the Equator, however, we would expect the yearly percentage increase in the seasonal CO_2 cycle amplitude to monotonically rise with increasing latitude, as demonstrated in Fig. 2.

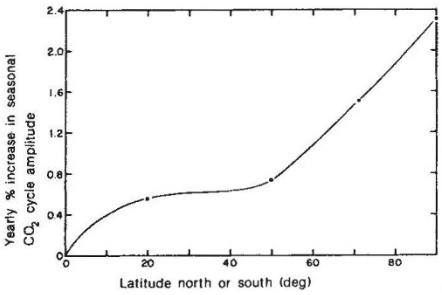

Fig. 2 The mean yearly percentage increases in seasonal CO_2 cycle amplitudes of the four sites represented in Fig. 1 plotted against their latitudinal locations irrespective of north/south designations.

In light of this body of evidence, it is difficult to reject the conclusion that the predicted CO_2-induced "greening of the Earth" is upon us. Pearman and Hyson[5], for example, concluded that "it is most probable that there has been an increase in the summer net ecosystem production of the Northern Hemisphere". Similarly, Cleveland *et al.*[6] concluded that "it is most likely that the CO_2 seasonal behaviour reflects an increase in global photosynthetic activity". Finally, both Bacastow *et al.*[7] and Keeling *et al.*[8] have concluded, respectively, that it seems likely that the increasing seasonal CO_2 cycle amplitude "mainly reflects enhanced metabolic activity of the land biota" and "suggests a heightening plant activity".

May I thus suggest that the elusive "first detection" of global CO_2 effects has in fact been accomplished, and that, as predicted by Wittwer[3], it is "biological, rather than climatic".

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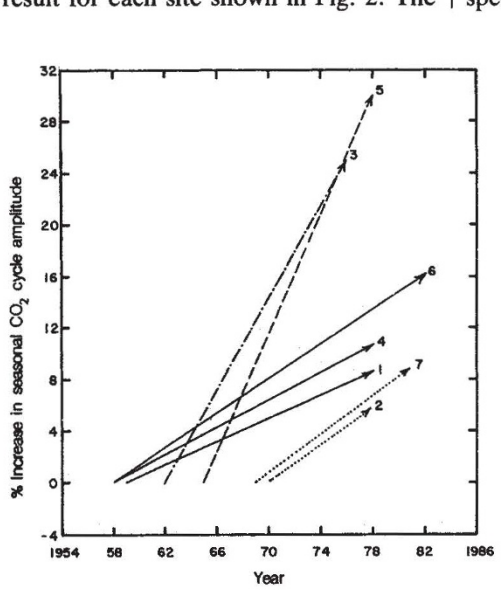

Fig. 1 Linear percentage increases in the seasonal atmospheric CO_2 cycle amplitudes observed at several locations over the time spans indicatd by the numbered arrows. (1) Mauna Loa, Hawaii[5], (2) Weather Station P in the North Pacific[5], (3) Point Barrow, Alaska[5], (4) Mauna Loa, Hawaii[6], (5) South Pole[6], (6) Mauna Loa, Hawaii[7], (7) Weather Station P[8].

How slow is protein conformation change?

SIR—I have recently performed a calculation that leads to a surprising conclusion. The rate at which pepsinogen exposes its binding site during its acid-initiated activation has been measured (Glick *et al.*, *Biochemistry*, in the press). It is a first-order event with a $\tau_{1/2}$ of about 1 s. If one assumes that the conformational change involved in this transformation requires a displacement of 10 Å of the amino-terminal segment (which subsequently will be cleaved off), the rate of movement is calculated to be 2×10^{-9} km per h. This rate seems incredibly slow; but to what may one compare it?

Using the relation $\bar{x}=(2Dt)^{1/2}$, one can calculate a diffusion coefficient; it is 1.25×10^{-15} cm^2 s^{-1}, an exceedingly low value when seen in comparison to the range of diffusion coefficients measured for proteins (10^{-6} to 10^{-7} cm^2 s^{-1}), not to say for peptides of the size of the activation sequence of pepsinogen. It would seem, therefore, that the movement of the activation sequence is not a smooth steering of the amino-terminal segment into its new configuration. During activation, the amino-terminal sequence blindly gropes along, randomly breaking a salt bridge here, forming a hydrogen bond there, until the system nestles in an energy minimum along the reaction pathway.

It would be interesting to know if any of your readers can make similar calculations in systems with which they are familiar.

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