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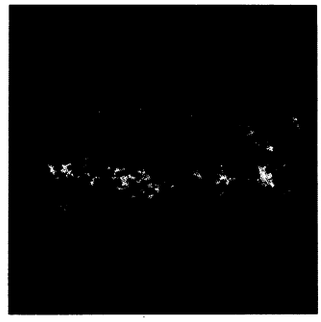
LETTERS

Sources of heat



A. JOHANESSON AND W. MARQUETTE

Changes in solar luminosity can affect climate, but another influence—human-produced greenhouse gases—is greater, says one writer. (At right, dark sunspots and bright faculae on the sun). Awarding a prize for the worst pseudoscience or antiscience TV program is proposed. The U.S. government's role in regulating new vaccines is criticized. The use of calculus as an applied tool (rather than as a theoretical discipline) brings one writer to an "epiphany." In a continuing debate, two scientists argue in favor of an international effort to construct a large-scale fusion reactor. Linus Pauling's valence bond theory is said to explain new structures in metal compounds. And Dr. Strangelove's deepest thoughts are remembered.

Sun-Climate Links

Richard A. Kerr's article about sun-climate links (Research News, 8 Mar., p. 1360) gives short shrift to one important point. The infrared absorbing properties of the carbon dioxide (CO_2) molecule are fairly well known from spectroscopic theory and measurements. It is difficult to imagine feedbacks in the climate system that would render CO_2 heat-trapping effects negligible, while at the same time boosting the effects of smaller changes in absorbed solar energy.

The issue is less a question for "the most sophisticated computer models" than it is a matter of simple arithmetic (*1*). For example, Kerr's second figure shows total solar irradiance rising by a bit less than 4 watts per square meter during the last 450 years. Dividing by 4 ($4\pi r^2/\pi r^2$) to average over Earth's surface, and reducing by a further 30% to account for reflection to space, gives substantially less than 1 watt per square meter. This should be compared with more than 2 watts per square meter of infrared heat trapping resulting from human production of greenhouse gases to date (*2*).

It would be foolish to assume that historical solar luminosity changes are insignificant. We should not, however, make the opposite error and jump to the conclusion that they explain all—or even most—of the climate variations of the past few centuries.

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References

1. J. E. Hansen and A. A. Lacis, *Nature* **346**, 713 (1990).
2. *Climate Change: The 1995 IPCC Assessment* (in press).

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And the Winner Is . . .

The article by Constance Holden about the program "The Mysterious Origins of Man" shown on the National Broadcasting Corporation's network (News & Comment, 8 Mar., p. 1357) discusses only the latest of a series of pseudoscience and antiscience programs to air on the broadcast television networks. Last year, another major network aired a program proposing that there was scientific evidence to support a literal account of Noah and the Great Flood. Meanwhile, programs discussing paranormal phenomena and alien abductions seem to proliferate.

There were two particularly disturbing aspects of the NBC program. First was the repeated implication that the scientific community was involved in a great conspiracy to suppress evidence. Second was the fact that viewers were offered an opportunity to purchase a copy of the program, and the ordering information implied that the network had a financial stake in the sales. I have no objection to any legitimate commercial activity, but the appearance of a financial interest on the part of the network only added to the credibility of the program.

There is no simple solution to this problem. However, one response would be to have an annual citation for programs

that are noteworthy by their failure to present an accurate picture of modern science to the public. Perhaps the networks can be embarrassed into being more responsible in this area.

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Bad Science, Bad Policy?

The gist of Gerald R. Fink's editorial "Bureaucrats save lives" (1 Mar., p. 1213) is that, in 1977, National Science Foundation (NSF) administrator Herman Lewis found a way to circumvent the National Institutes of Health (NIH) recombinant DNA guidelines' prohibition on doing certain cloning experiments in yeast. Fink writes that he and his co-workers were able to do the experiments literally years before they would have been able to otherwise, which accelerated research leading to the ultimate development of a much improved, second-generation hepatitis B vaccine (of which I was one of the Food and Drug Administration reviewers).

Other U.S. researchers who lacked a governmental good Samaritan were stymied for years by regressive, unnecessarily restrictive federal regulatory policies, delaying all manner of important research. Using the Lewis anecdote as an example of the exception that proves the rule, Fink could have observed that bad science makes bad policy, and bad policy has real-world impacts.

While scientifically oriented institutions like NIH and NSF may, indeed, have "a legion of gifted public servants who possess invaluable knowledge and experience gained at the forefront of science," there are precious few at the regulatory agencies, and their policies often reflect it.

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Calculus as a Tool

I read the short article by Barry Cipra about calculus teaching reforms (News, 16 Feb., p. 901) with interest. I studied calculus for an entire year in college, but without really understanding it. Proving all the theorems constituted a considerable portion of the course, but I memorized the proofs. I felt then and feel now that proofs are irrelevant to the great majority of us who use calculus as a tool. In using it in physical chemistry class, ' suddenly experienced an epiphany. The entire topic of calculus became clear in the course of understanding partial derivatives of thermodynamic functions; and in that one second, I learned more than I had ever learned in an entire year of calculus. If calculus were taught as a useful tool rather than as a theoretical discipline, I believe more students would learn it, understand it, and enjoy it. I have taken this same approach to my own teaching, particularly of enzyme kinetics. I find that the traditional way of teaching theory first reaches maybe 10% of students, while teaching the methodology first and then teaching the theory reaches 80 to 90% of students.

I encourage the reformers to continue, particularly in eliminating irrelevant proofs.

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