we all believe in free speech; nobody is trying to follow Lysenko's footsteps and impose a ban on "heretical" scientific views. This being clear, it should also be clear that *all* kinds of speech should be free, including critical speech, and that scientific theories must be subject to critical scrutiny.

Lewis, Rosen, and Deakin, in their letters (17 June, pp. 1270–1272), seem to argue for a "middle of the road" view. The catastrophists have overdone it, they say, but so have the critics, and the truth must lie somewhere in the middle. Do they believe in the general postulate that, given any disagreement, the truth must lie in the middle? Such a claim seems clearly fallacious. If you believe in Nazism and I believe in democracy, how many will argue that the truth must lie halfway between us?

Lewis, Rosen, and Deakin should provide reasons why, in this case, the rule applies. Deakin gives none. He has found a simpler proof of Thom's theorem, but what is being discussed is the applicability, not the truth, of the theorem. By labeling the criticism as "bombastic," without saying why, Deakin is taking an easy way out. Is it the critics' fault if the theories they are presented with are such that little criticism can fail to be "bombastic"? My experience from lecturing indicates that many people who are unfavorably predisposed toward the critics have not read the catastrophists' papers. In my talks I show the audiences what is really there and discuss it. That usually suffices. Sometimes someone says I am being "too harsh," but nobody has so far come up with a refutation of any of the many concrete, specific points that Zahler and I have raised.

Rosen's point is similar to Deakin's. He says it's immoderate to claim that the theory can do nothing on the basis of the experience so far. But it certainly is not immoderate to claim, on the basis of what has been attempted so far, that little has been achieved so far. And that is all we claim. What the future may bring, nobody knows. Maybe catastrophe theory will have great successes. Maybe the philosopher's stone will be found. But, until it is, skepticism seems an appropriate attitude.

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Modern Agrarianism

In these days of rapidly changing energy prices, it is difficult to predict the future economic and social structure of the United States. But if energy consumption is used as the independent variable, an interesting and relevant calculation is possible.

For example, in 1974, the total nonsolar energy expended on food consumption and production in the United States amounted to about 16.5 percent of all energy use (*1*). This figure is the sum of all energy consumed from ground to table. In that year we spent about 7.1 units of nonsolar energy to consume 1 unit of food energy (*2*). About 38 percent of the food calories came from meat and animal products (*2*).

Suppose that somehow U.S. animal feed grain programs were suspended (with the exception of exported feed grains). The only animal products consumed would then be (i) imported meat and animal products and (ii) meat and other products from animals raised on hay, silage, and grazing ground. At current rates of import and production, this change would result in a reduction in the consumption of meat and animal products by approximately one-third (*2, 3*). The decrease in protein consumption need not be reconciled, as Americans apparently consume on the average about 45 percent more protein than required (*4*). However, the protein change could be made up through consumption of vegetable protein grown on a fraction (0.5 percent) of the cropland now used for the same amount of animal protein (*5*). Since a unit of beef protein requires about six times the total energy of an equivalent unit of soybean protein (*5*), such a change would reduce U.S. energy use by about 1 to 2 percent (*2, 6*).

With these assumptions, about 80 million acres of land previously used to raise prime feed grain could be considered released from production. If biomass-electricity production (the growing of crops such as sunflowers, sugarcane, or hybrid trees and their combustion under steam boilers for the production of electricity) took place on this land, we could install about 255 1000-megawatt electric plants (*7*). This is equivalent to approximately half of the electricity generating capacity installed as of 1974 in the United States (*8*). The biomass energy input to the electric plants would be equal to approximately 20 to 25 percent of all U.S. energy use in 1974 (*8*). Biomass cultivation energy use would approximately equal that used in producing the feed grains.

About one-third of all electricity in

1974 was produced from oil and gas (*8*). Therefore, to relieve this use alone, we would need to reduce our meat consumption by only 22 percent to provide biomass production on the newly available land.

The nature of biomass energy production, now as energy-efficient as standard electrical production, is well suited to a distributed population with many more, but smaller and denser, communities than we have at present. Over the long run, with an increasing dependence on biomass energy sources, we would tend toward a new agrarian society, in which not only food energy but all energy would be locally derived. With the modern understanding of sanitation, population control, and communication, this distributed society could probably survive rather well.

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Sociobiology and Scientific Debate

This past June, a symposium was held on an old subject recently given a new name—sociobiology—and much publicity by virtue of E. O. Wilson's book (*1*). I attended this 2-day meeting, along with about 2000 others, hoping to hear a *scientific* debate on what has become a controversial social issue, but deeply curious as to how this would be accomplished given the large proportion of speakers on the program who had no apparent connection with the subject. I came away feeling utterly dismayed. Despite the valiant attempts of two or three speakers to inject a note of scientific discourse, this was not by any standard a scientific meeting, whatever other function it may have served.

Aside from a relatively brief period of disruption by a group of political activists, the program proceeded as scheduled. A single "sociobiologist" was permitted some 30 minutes to expose the fundamental issues. From then on, in more or less random fashion, a cyberneticist, several economists, philosophers, and psychologists, one human geneticist, one anthropologist, and a handful of others rendered opinions, sometimes about sociobiology, sometimes about their personal social and political views. A few appeared to have actually read parts of Wilson's book, but most seemed totally unaware of the scientific strengths and weaknesses, not only of his statements, but of the general premises on which the study of social behavior in organisms is based. The few scientists most competent to tackle these issues chose mainly instead to speak anecdotally about their own research. Concepts such as adaptive fitness, altruism, the origins of culture, and so on, were tossed about but never critically examined.

Given the increasing public disenchantment with science, deserved or not, it would seem, at a minimum, a matter of prudent self-interest and, ideally, of public-spiritedness that those of us who participate in public scientific meetings interpret our ideas in accordance with *scientific* precepts. To do otherwise, whatever the immediate response, is to court ultimate disaster, since sooner or later, if science and its methods are truly relevant to human affairs, someone will expose the sham. If that happens, even the most self-critical scientist will no longer be taken seriously.

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Interfering Satellite

Several months ago we reported (Letters, 11 Mar., p. 932) interference with astronomical observations from a satellite transmitting in contravention of the International Telecommunications Union's Table of Frequency Allocations close to the band reserved for radio astronomical observations of neutral hydrogen. We now have evidence to indicate that these signals originate in one or more satellites of the "SSU" series which were launched from the United States on 30 April 1976. The international designations of these satellites are 1976 038C, 1976 038D, and 1976 038J (*1*). The published period of each satellite is 107.5 minutes, identical with the period which we measure. The orbital inclination of 63.4° is consistent with the number of passes observed each day, with the signal strength, and with distance measurements based on Doppler shifts. The signals are apparently controlled from the ground and occur when the satellites are near Alaska, the Pacific Northwest, and Midwest states.

In addition to the narrow-band signals reported in our earlier letter, we now observe three wide-band ($\approx$ 1 megahertz) signals centered at 1430.2, 1432.2, and 1434.2 megahertz. The wide bandwidth and rapid modulation indicate that the satellites are transmitting large amounts of information or radar pulses. The signals can produce a spectral flux density of 10^{-19} watt per square meter per hertz, a factor of 10^4 greater than the strongest astronomical radio source and 10^9 greater than the weak sources we are currently studying. Thus the signals are so strong that they can be detected on every pass with a simple antenna whose collecting area is only 0.02 square meter.

The frequency band in which these broadband transmissions occur is internationally allocated to the "Fixed and Mobile" services with no mention of space communications. We consider these transmissions to be in violation of the intent of international agreements. Therefore, we urge scientists in the United States who are concerned with the orderly management of the electromagnetic spectrum to press their government to limit the use of bands near radio astronomy allocations to ground-based services.

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