LETTERS

Solar Energy

Philip H. Abelson's splendid editorial "Energy from biomass" (26 Mar., p. 1221) was encouraging to me, and I'm sure to many others. One begins to become a bit insecure about criticizing proponents of either conventional or breeder reactors. When one has suggested that coal, solar energy, geothermal energy, winds and tides, and perhaps, in a major way, conservation might alleviate mankind's hunger for ergs, even distinguished physicists and at least one former Atomic Energy Commission director suggest that signees of such statements of opinion on the nuclear power explosion and the impending plutonium economy are "knee-jerk liberals" who should stick to their knitting, be it biology, physics, chemistry, or any other narrow form of science. Abelson is joined by many concerned and well-informed persons who objectively estimate that the period 1985 to 1990 will see the end of supplies of easily accessible petroleum and high-grade uranium ore. Large petroleum corporations and electric power producers, at home and abroad, have already begun the conversion to nuclear fuel. A major solar energy effort by the government, and by the nation's scientific research centers, might just manage to unburden us, in a decade or so, of much of our heavy dependence on a nuclear future. It would also help assuage our concerns about long-term waste disposal, accidents in transportation and reprocessing of plutonium-enriched reactor products, and the inevitable diversion to weaponry.

CHRISTIAN B. ANFINSEN
National Institutes of Health, Bethesda, Maryland 20014

Pakistan Plant Symposium

The first international symposium ever held in Pakistan took place 1 to 7 March in Lahore and was entitled Genetic Control of Diversity in Plants. The meeting was an attempt to bring together basic plant geneticists, biochemists, and molecular biologists with applied workers who are trying to improve crop plants, particularly those in the Orient. Perhaps the most important consequence of the meeting was the setting up of lines of communication between basic scientists from the West and applied scientists from Pakistan. For example, wheat breeders were to be seen eagerly talking with wheat biochemists and experts on the nutritional aspects of wheat.

The chairman of the meeting was Amir Muhammed, vice-chancellor of the University of Agriculture, Lyallpur, Pakistan, long known in the West for his work on the enzymology of the photoreactivating enzyme from yeast. The guiding spirit behind the organization was Alexander Hollaender, who has been a highly successful organizer of international symposia in a number of developing countries.

Among those who took part in the proceedings were Sir Otto Frankel from Australia, who made an effective plea for preservation of diverse genes in plant species used in agriculture and their wild relatives; Johanna Dobereiner from Brazil, who described her work on nitrogen fixation in grasses; Michael Gale from England, who gave a beautifully clear talk on the relationship between gibberellin insensitivity and dwarfism in wheat and how this could be used in breeding; and Hans Doll and Bjorn Eggum from Denmark, who spoke on the biochemistry and nutritional aspects of cereal proteins. R. C. von Borstel from Edmonton, Alberta, Canada, will be responsible for editing the published volume of the meeting's proceedings.

JANE K. SETLOW
Department of Biology, Brookhaven National Laboratory, Associated Universities, Inc., Upton, New York 11973

Nuclear Power: How Do the People Decide?

Philip M. Boffey (News and Comment, 30 Jan., p. 360) notes that in at least eight states initiative measures to halt or postpone building of nuclear power plants are being or have been recently circulated and reports on legal issues raised over the division of authority between the federal and state governments with respect to matters of regulation of nuclear power reactors. The points raised in this useful article and elsewhere in *Science*'s continued coverage of this significant issue of public policy are valid and important.

The increasing use of the ballot, either through referendum or initiative to deal with the complex issues involving the siting and regulation of nuclear power plants, raises not only the constitutional issues of division of powers between the federal government and the states, but also another issue of immense constitu-

tional importance. Our federal government is a representative government, probably the best designed in human history. The representative chain from citizen-voter to the elected officers of government to the appointed officers of government is a unique and outstanding feature of the American political system. The framers of the Constitution did not provide for ballot issues, but that government policy should be determined by the representatives of the people—chosen because of their capacity to get the facts and weigh the relationships of one problem to another. While the framers of the Constitution wisely did not prescribe the precise way in which the states should regulate their political affairs, and while the Constitution is formally silent on the question of ballot issues, the framers clearly intended that state and local government should be operated on the representative principle as well. Article IV, Section 4, of the Constitution says: "The United States shall guarantee to every State in this Union a Republican Form of Government." This is the only specific reference in the Constitution to the form or structure of state government. It clearly gives to the federal government some measure of responsibility for overseeing the political structure of state and local government and has been interpreted to authorize "Congress and, perhaps to a lesser extent, the President and the Supreme Court to superintend the acts and the structure of the state governments and to inhibit any tendencies in a state that might deprive its people of Republican government" (*1*).

Action both by Congress (in admitting states to the Union which, as territories, had initiatives and referenda) and by the Supreme Court (in reviewing cases in which the guarantee clause was offered as the basis for striking down initiatives and referenda) has firmly, up to now, upheld the constitutionality of the initiative and the referendum. But these decisions were made early in this century in cases which, as far as this constitutional condition is concerned, were argued narrowly. Moreover, this was also before the Warren Court substantially broadened judicial intervention on behalf of the political rights of American citizens. The possibility that the courts might in the near future declare the initiative and referendum unconstitutional is slight, but the history of the judiciary on the issue of political rights certainly leaves that possibility open. More important, while the court has been reluctant to open this immense issue, there has been no reluctance whatsoever on the part of the court or of the other two branches of

government to enter, with the court's approval, into rather direct management of the manner in which state and local government conduct the people's business.

Legal and constitutional arguments aside, the wisdom of deciding issues as complex, technical, and difficult as nuclear plant siting by statewide ballot is clearly in question. My own view is that the very complexity of the nuclear issue illustrates the wisdom of the founders in decreeing a representative form of government. The record of local and state voters in deciding ballot issues is better than many suppose. But situations in which a weighing of scientific questions complicates questions of risk and economic alternatives in the light of substantial technical disagreement are simply not likely to produce an appropriate result. As a state citizen I would feel deprived of my right to a representative government if a decision on nuclear siting were made by a public debate which was not an informed one (and I personally think an informed public debate on this subject is impossible) and in which the persons I had elected to public office to make decisions for me did not have an opportunity to engage in the give and take of the legislative process.

The emotion of the debate over nuclear plants must not be allowed to distort the necessary discussion of what is the wisest way to make such decisions. The Bicentennial year is a good time to discuss the quality of the process by which we govern ourselves as well as the issues resolved in that process.

BREWSTER C. DENNY
Graduate School of Public Affairs, University of Washington, Seattle

References

1. W. M. Wiecek, *The Guarantee Clause of the U.S. Constitution* (Cornell Univ. Press, Ithaca, N.Y., 1972), p. 1.

Random Drilling

H. W. Menard and George Sharman contend in their article "Scientific uses of random drilling models" (24 Oct. 1975, p. 337) that random drilling can find oil better than current industry practices. However, their treatment of the history of total U.S. oil exploration is misleading in at least five respects. First, the authors' random drilling simulation incorrectly uses total exploratory drilling for finding new fields. Actually, about half of this exploratory drilling has been within or near established fields and has no bearing on new-field discoveries. In ef-