age that some parts of the United States experienced during the winter and that the entire country faces in the future. The picture of cheaper energy flowing into the United States from foreign sources sounds inviting but is fraught with problems. First, increased dependence on foreign energy sources requires deep-water ports and better distribution facilities to move the oil or gas from the coasts to the centers of population. Neither of these presently exist, and both are opposed by various environmentalist groups.

A stepped-up American demand for foreign oil is certain to raise the price paid by consumers in Japan and Europe as well. An organization of oil-producing nations already exists that has at least once forced renegotiation of contracts and higher prices. What added purchases would do to our balance-of-payments deficit is another consideration.

The suggestion that abandoning wasteful patterns of energy consumption as a short-term solution to the problem is shear folly. However deplorable these policies may be, they will not change quickly. They are ingrained in the very operation of our society, and consumers will require extensive education and redirection to change. This is not even considering the cost of alternatives to millions of cars and brilliantly lighted cities. Changes such as these have seldom, if ever, happened quickly in the past, although they may be long-term considerations.

The controversy over the fairness of profits that may result if domestic oil prices are increased and controls removed from natural gas requires detailed examination. Certainly the position of the oil industry on the matter must be looked at critically. An interesting article diametrically opposed to Freeman's view appears in the newsletter of the *Oil and Gas Journal* of 5 February 1973 (*1*).

To suggest that the energy problem can be so easily solved seems to ignore too much. If it were so, there probably would not be an impending crisis in the first place.

It does not seem realistic to deplore runaway consumption while attempting to supply cheap energy by any method, either by holding prices artifically low or by increasing imports. It seems almost certain that energy will cost more in the future, and a large share of the cost will be borne by the consumer, for without the demand there would be less of a problem. Maybe in the end that is the only way our wasteful consumption habits will be changed.

RONALD D. STIEGLITZ
Ohio Department of Natural Resources, Division of Geological Survey, Columbus 43212

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The Speed of Light

Without wishing to detract from Evenson's new determination of the speed of light (W. D. Metz, Research News, 16 Feb., p. 670), I think the example used to illustrate its importance was ill-advised. The improved value for the speed of light is no more important in laser ranging now than it was 3 years ago, when this topic was discussed by Bender (*1*), who wrote "there are no important scientific experiments which we are prevented from doing" by the adoption of the conventional value of the speed of light.

The confusion seems to stem from a failure to appreciate the fact that the natural unit of astronomical measurement is the light-second, as is the case with nearly all measures of large terrestrial distances. The only purpose of converting light-seconds into kilometers is a psychological one. People do not like to think of the coordinates of an observatory or the distance between two cities in terms of light-seconds. Similarly, astronomical ephemerides are constructed in terms of astronomical units because an astronomer seems to feel that he can visualize an astronomical unit more readily than he can visualize 500 light-seconds. We are dealing with the inertia of heritage. The change from one adopted value for the speed of light to another in astronomical problems is simply a linear change of scale. It does not involve a change in physical model. In more concrete terms, the distance to the moon, as stated in linear measure, will change, but the residuals between observation and prediction will not. In terms of the physics of the problem, the new determination of the speed of light may be expected to have no more serious consequences than did the redefinition of the conversion factor between inches and meters some years ago. In this context, the only substantive question is, What is the measure of the standard meter bar in light-seconds?

It may be hoped that the realities of present-day measurement technique will eventually lead to both the meter and the astronomical unit being defined in terms of the far more fundamental measure, the light-second. Perhaps then the present confusion will abate.

J. DERRAL MULHOLLAND
Department of Astronomy,
University of Texas, Austin 78712

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Botulism and Nitrites

In their article of 7 July 1972 (p. 15), I. A. Wolff and A. E. Wasserman imply that the addition of nitrite is necessary to prevent the growth of *Clostridium botulinum* in cured meat and smoked fish products. In fact, the conjunction of many factors, of which nitrite is only one, produces the bactericidal effect. It is not known what other combinations of heat, salt, and *p*H might accomplish the same effect in the absence of nitrite.

What is known is that many products, such as bacon, to which nitrites are now added, involve no botulism hazard because they are fried. Others, such as frankfurters, can be processed without nitrite to remove any such hazard. The Berkeley Co-Op, for example, has marketed such a product for some time with great success. As the Fountain subcommittee hearings in March 1971 demonstrated, the use of nitrite in the processing of smoked fish products is a relatively recent practice, and the levels added are frequently far below what the Food and Drug Administration claims to be necessary to prevent botulism. In fact, some states prohibit the addition of nitrate or nitrite to smoked fish products and instead require processing at 180°C to obviate any botulism risk. Japan has totally banned the use of nitrites in fish products.

While it is true that some early reports of *N*-nitrosamines in foods are of questionable validity, some more recent positive findings have been confirmed. For instance, the presence of the carcinogen nitrosopyrrolidine in cooked bacon and sausage has been confirmed at between 30 and 106 parts per billion. The very limited number of samples for nitrosamines taken by the U.S. Department of Agriculture makes any positive findings in the food supply highly suggestive.

It is true that "there is not enough information" to determine the probability of nitrosamine formation in vivo in humans. Nevertheless, nitrosamine formation from the interaction of nitrites and secondary amines have been established in vivo in cats and rabbits, species whose gastric juices have a *p*H similar to that of man. And the presence of nitrosodiphenylamine was detected in the stomachs of 31 human subjects who were fed a combination of nitrate and secondary amines (*1*).

It is precisely the numerous uncertainties and gaps in knowledge about nitrites and nitrosamines which Wolff and Wasserman identify that compel one to disagree with their conclusion that "the hazard is not sufficiently great to cause alarm." Apparently, they would have an unsuspecting public bear the burden of these uncertainties, despite ample evidence that nitrites are not always necessary to prevent botulism and that alternative means of safe processing are available which do not involve risks such as those posed by nitrite. The law and common sense both require that these risks be resolved.

PETER H. SCHUCK
Consumers Union,
1714 Massachusetts Avenue, NW,
Washington, D.C. 20036
HARRISON WELLFORD
Center for Study of Responsive Law,
P.O. Box 19367,
Washington, D.C. 20036

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Schuck and Wellford are to be commended on their concern for the consumer. We, too, share this concern. We also are in accord with the last sentence of their letter. However, we repeat our contention that the resolution of the risks must be based on considered evaluation of all the information available. Furthermore, sufficient foresight must be applied to prevent undesirable effects induced by any changes imposed. Our article was a brief compilation and summary of information from several diverse fields to provide a background, as well as to stimulate thought, interest, and research on a sensitive problem of public health interest. Schuck and Wellford have used in part data published since our paper was prepared to question our conclusions. In the same interval, however, a number of encouraging reports have also appeared, as we indicated they might. Van Logten *et al.* (*1*) reported no tumors or cancerous lesions in rats fed for 2 years on a diet consisting of 40 percent cured meat processed with nitrate in such a manner that 60 micrograms per kilogram (parts per billion) of total nitrosamines were found in the meat. In our laboratory, sodium ascorbate was shown to inhibit or prevent the formation of *N*-nitrosodimethylamine in frankfurters (*2*), and preliminary data indicate *N*-nitrosopyrrolidine formation in bacon may be similarly affected. Modification of manufacturing practices may be required when these results, together with information from other laboratories, are evaluated.

One alternative proposed by Schuck and Wellford does not seem acceptable. According to them, many products, such as bacon, could contain botulin toxin, but there would be no hazard because they are fried prior to consumption. We question whether appropriate regulatory agencies would be willing to approve such products. Consumers and consumer organizations themselves might want to raise serious questions about such an approach.

The urgency stressed by Schuck and Wellford about elimination of nitrate should, in our opinion, be tempered with caution, in view of the many scientific unknowns and the long history of usage with apparent safety. There is still no correlation of the quantities of nitrosamines that might possibly be ingested under normal conditions with the development of harmful effects—either in humans or in animals. The nitrosamines pose a serious *potential* hazard, and intensive investigation of the many facets of the problem is definitely needed and under way. At this time a satisfactory solution to the problem looks promising. This may involve modifications of curing processes, utilization of nitrite substitutes, reduction of nitrite concentration, or in some cases elimination of nitrite. To us it seems somewhat premature to judge the preferred approach or approaches.

A. E. WASSERMAN
I. A. WOLFF
Eastern Regional Research Laboratory,
Agricultural Research Service,
U.S. Department of Agriculture,
600 East Mermaid Lane,
Philadelphia, Pennsylvania 19118

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