Letters

Particle Discoveries

Edward M. Dickson (Letters, 14 Feb., p. 488) expresses several concerns about the circumstances surrounding the discovery of the psi, or J, particle at the Stanford Linear Accelerator Center (SLAC) and Brookhaven. I submit that these concerns are misplaced.

Dickson appears to deplore Goldhaber's writing an article with only three data points in from the experiment. It seems unfair to criticize a scientist for actions taken along the path to publication, rather than for his published work. The SLAC publication (*1*) is clear, accurate, and significant. Goldhaber's action on that exciting Sunday was also quite reasonable. The psi signal was exceedingly strong. It was important to start drawing together the experimenters' thoughts immediately. Within hours, they were besieged with requests for information. The psi signal could be compared to a supernova bursting in the sky in the course of a single night. An astronomer seeing the flash would surely begin shortly to set down his observations.

Dickson suggests that particle physics is an "absurd competition." As with any discipline at the forefront, there is certainly a healthy sense of competition. However, the simultaneous discoveries of the psi particle were not made in competing experiments. The central lines of interest for the two groups were rather different and the technique of production and detection totally orthogonal. No doubt, the two groups were reading the same journals and listening to more or less the same group of theorists. True, within a day or so of the SLAC discovery, experimenters at two other storage ring facilities were looking at the psi particle. In both cases, they moved to research areas where they thought their work would not completely overlap the SPEAR result but would shed additional significant light on the tantalizing development. In the intervening months, there has been little duplication of effort. The lode is far too rich.

In tracing back over the events of last year, including the discovery of neutral currents, the same pattern holds. At least three laboratories scattered around the world, CERN, Fermilab, and Argonne, have made significant contributions, each with a distinctly different flavor.

Was there utility in spreading the news of the psi particle so fast? Yes. One month after the discovery, Fermilab held a special symposium to discuss new experiments relating to the discovery. More than 20 proposals were received. About half of the experiments at Fermilab were directly affected by the discovery.

News of the discovery did make its way into the general news media rapidly, and *Physical Review Letters* (*2*) did question the wide dissemination of the information prior to publication. In reviewing the decision to publish, the editors noted, "When, however, upon consulting our advisors, we became aware of the truly unusual extent to which the entire high energy physics community was involved, we concurred that the news justified early public release."

To me this does not appear to be an absurd competition but an extremely flexible and viable approach to a scientific discipline rich with intellectual challenges.

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Science and the Law

I would like to call the attention of all members of the AAAS who are lawyers to the fact that the American Bar Association (ABA) has recently established a new section on science and technology.

Any lawyers who are members of the AAAS presumably are interested in the relation between science and the law. The Science and Technology Section of the ABA is not only open to them but solicits their interest and membership. The address of the American Bar Association is 1155 East 60 Street, Chicago, Illinois 60637.

The AAAS and ABA have sought to stimulate and encourage thinking about the relation between law and science by establishing a joint conference group composed of seven members of each organization. However, the activities of such a group are necessarily limited both in scope and in the number of participants. Consequently, one of the best ways to encourage the indispensable relation between the disciplines is for those who are interested and eligible to become members of and active in both organizations.

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Feeding the World's Poor

In his editorial "The ghost at the feast" (15 Nov. 1974, p. 589), Roger Revelle faults certain scientists and publicists (whose views he calls an "obscene doctrine") for advocating a "lifeboat ethic"—denying food aid to those nations who do not compel human fertility control—but failing to say how their proposals are to be implemented. Most writings on the world food crisis share this failing. Certainly Revelle's editorial does. I don't know "how" either, but some relevant thoughts need to be taken into account.

Before a significant number of Bengalis can be fed on Kansas grain, at least two things must happen. First, the eating habits of America will have to be changed so that we can afford to export the grain; second, all those people from Topeka to Dacca who will own, manage, and handle that grain will have to fit their thousands of tasks into one massive and coherent grain-moving enterprise—without a profit motive. That any of this will happen spontaneously is about as likely as that all the molecules in an engine cylinder will spontaneously head for the piston; nor will the most learned explanation that "thus-and-such is the best way" have much effect. There is, in Revelle's phrase, "the necessity to change the selfish and shortsighted behavior of many people."

Selfish, shortsighted behavior comes easy; effective concern for humanity in the large, and commitment to long-range goals, do not. To ensure the co-

herent behavior of its members, a society must use some fraction of its resources in creating and maintaining a coherent system of incentives. In human societies, these are largely cultural values—and valuables. Their cost in resources will depend on how tightly organized the society is and on its size: the larger the scale, the more impressive and structured the incentives need to be to overcome the tendency toward selfishness and shortsightedness. Obviously the system now functioning in the industrialized West is too inefficient for extension to a global scale. But can we be sure that eliminating even some of its sillier "inefficiencies" will not weaken its incentive structure so much that, for instance, feeding New York on Midwestern food will be impossible?

There must be a break-even point in expanding the scale of a society, when the increase in availability of resources no longer pays for the increased requirements of maintaining economic coherence. This scale was larger in the now-vanishing era of abundant resources, but now it may be less than continental, and far less than global. If this is so, then a world food bank is rather like a perpetual motion machine of the second kind. This conjecture gives me no joy. I sincerely hope my discussing it will not seem obscene.

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The idea of letting people die, Revelle says, is "obscene." Well, if so, it is just as obscene to let people die in the future as it is to let them do so now. If I could be 99 percent certain that one generation of enforced Western vegetarianism would be followed by a world of plenty, I might try to enforce it on my children and yours. I might do so if I were even 90 percent sure. But I am not even 1 percent sure of a good outcome, let alone a world of plenty, resulting.

By foregoing meat and producing all the food we can, Westerners can prevent starvation this year; of that I am 90 percent convinced. But if we do so, I am also more than 90 percent convinced that non-Western populations will keep growing until we can't feed them, even at great cost to the quality of our soils.

By veritably impoverishing our own we cannot even save the world from death. Sooner or later the bullet must be bitten; I choose sooner. The suffering of a famine in 1980 or 1990 is only more remote than the suffering of one in 1975. Qualitatively, it is the same horror. Quantitatively, more people will suffer the longer it is put off.

We Westerners brought it on ourselves, by saving lives through medical skill and humanitarian generosity. Nobody seemed to foresee the demographic consequences of drastically reducing death rates; or those who did either hoped for some vague miracle or couldn't (wouldn't?) be heard. The millions of lives saved by our medical help became the hundreds of millions of lives that are due to be lost in famines.

Many of those who will die are Hindus. The Hindu ethic, as I recall, enjoins its adherents not to interfere in lives, even to save them. The person who saves life is held responsible for the person whose life he saves.

Western "ameliorists" have ignored this principle in bringing lifesaving medical technology to the East. Now, much of world opinion holds them responsible for the peoples whose overpopulation is traced to Western medical aid. Shall we impoverish the West in order to make the problem even worse, and in the process weaken both our land and theirs?

I think not; this is the essence of the "lifeboat ethic" which Revelle criticizes. Let too many people into a lifeboat and all will sink. The same may well be true of our spaceship called Earth. Murder is obscene. Admitting that someone is dying, is not—even if you could keep him alive for another day by hastening the deaths of others.

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In our opinion, the "lifeboat ethic," as described by Hardin (*1*), is hardly to be considered obscene. The time is now to stop responding emotionally to what all evidence indicates is an impending disaster. We are still harboring the Judeo-Christian ethic, which cannot offer long-term solutions. Revelle's statement that the sharp decline in birth rates of several developing countries is proof that man will voluntarily limit his own fertility conflicts with the evidence. Even were it so that mankind would eventually voluntarily control his population growth, the time required for this to serve as a solution to the problem is a luxury we cannot afford.

Revelle would continue to treat the symptoms rather than the disease of

ever-expanding populations. He states that the rich nations of the world would be "morally justified" in compelling governments to initiate selected social reforms when accepting our aid, but he appears to think it would be unjustified to compel human population regulation. An improvement in the quality of life cannot be expected until population levels consistent with carrying capacities of the environment are attained.

The "Rachet effect," as explained by Hardin (*1*, p. 563), is as applicable to man as it is to all other biological species. The world food bank merely constitutes another turn of the rachet. Revelle's solutions in the absence of population control are inoperable. We must apply the principles of population dynamics developed through years of consideration as well as develop new techniques and new life ethics.

As the problem-solvers of the immediate future who, we hope, possess the training and mental bent to recognize the need for a sociobiological revolution, we are not receiving from either academia or our cultural milieu the tools necessary to cope with the problems. Witness the fact that not one scientific organization has felt it necessary to publicly take a stand on any of the population-associated crises facing mankind. If scientists as a body refuse to accept responsibility in this area, how can we hope to help society as a whole cope with an uncertain future?

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Nobody can look without horror on the prospect, let alone the actual spectacle, of fellow human beings starving to death. It is a monstrous thing, but we live in an age of monstrosities, —some still latent but imminent, unless actively forestalled—and it is literally necessary to consider not only relative degrees of monstrousness, but the fact that some monstrosities are qualitatively more ghastly than others. Overpopulation and starvation are interdependent monstrosities, but of a qualitatively different nature. I believe that the former is far more dire than the latter.

If a quarter of the people in the world starved to death next year, the human condition, in the larger sense, would not be basically or permanently changed. After a few generations, this calamity would leave no basic imprint on our collective consciousness, any more than did the deaths of one-fourth of the people of Europe in the great plague of the 14th century.

However, if the population of the world goes on increasing at the present rate for very much longer, the human condition *will* be basically and catastrophically altered, in an *irreversible* way. We have systematically, in the name of humaneness, eliminated nearly all of Nature's checks and balances on the human population, and in so doing we have moved very far in the direction of creating a Hell on Earth of our own design. We will have no humane way of getting out of it once we are in it. There is only so much human and technological waste this planet can tolerate, no matter how we try to clean it up and detoxify it. There is only so much remaining in the way of minerals and metals and fossil fuel. There is only so much arable land. Much of the land we use today to produce food is productive only because it is fertilized, often heavily. But do we believe the reserves of phosphate rock are infinite?

Not too long ago there was a great and horrible flood in Bangladesh, which killed thousands of people. Nearly everyone would consider the question, What killed these people? a trivial one. The flood, obviously. That answer, however, illustrates the widespread, ostrich-like attitude about the population bomb. It was overpopulation that killed them, because if the country weren't so overpopulated that millions of people are forced to live in an unsuitable and intermittently lethal area, practically no one would voluntarily do so.

The question, What shall we do about starvation in various parts of the world today? also has an obvious answer: Send food. But if we let it go at that and become so busy with this immediate, manifest problem that we fail to get busy with the latent but impending horror of overpopulation, we shall be making our gravest-and-last-mistake. Really effective measures to halt population growth will not be pleasant or popular, and because the consequences of inaction are not an immediate threat, human nature is such that it is natural—but in the

long run tragic—to devote our attention to what seem to be more immediate problems. We should stop looking on starvation as a problem in itself and recognize it as only a symptom of the much more crucial problem of overpopulation.

If a dedication to fighting each immediate, local problem of starvation distracts us from coming to grips with the far more abominable horror of gross overpopulation, then we are just sanctimoniously fiddling while Rome burns. Doubtless, we could, this year, organize machinery to ensure that starvation does not occur, here, there, or everywhere that it presently threatens. Then, of course, next year, we could do the same thing again—on a larger scale. And so on, and on, and on. The problem of starvation, taken by itself, without adequate measures to control population, has no technical solution in the long run. The short-run solution, carried out each year, will, in fact, only accelerate our progress toward the inevitable apocalypse.

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The underlying issue in the above letters is a moral one which I find it difficult to argue, because I am unable to transcend the basic principle of the Judeo-Christian ethic—that all men are brothers. (This is also basic in the ethics of Islam, as it was to Mahatma Ghandi, one of the last great Hindu ethicists.)

It is possible to make a few "scientific" comments. The rates of decline in birth rates since 1960 in South Korea, Taiwan, Hong Kong, Singapore, West Malaysia, Sri Lanka, Mauritius, Trinidad and Tobago, Puerto Rico, and Costa Rica are between 2 and 3 percent per year. These are faster rates than those experienced by any of the presently developed countries during their "demographic transition" of the 19th and early 20th centuries. Many people are also voluntarily limiting their own fertility, and birth rates are declining significantly, though less rapidly, in Cuba, Chile, Panama, and probably Brazil, Egypt, and Tunisia. In most of these countries, the "quality of life" for the majority of the population, as measured by levels of infant mortality, female literacy, health services, and family planning programs, is relatively high compared to other poor countries, or

has markedly improved during the last two decades. Many demographers believe that this is largely responsible for the decline in fertility.

Except for some small "island" nations, the most serious population problem of the present and the foreseeable future in the poorer countries—and it is very serious indeed—is not "overpopulation," but rapid population growth, as it manifests itself in high ratios of children to adults, large families, and a rapid increase in the size of an untrained labor force. Do any of the letter writers seriously think that, if India had a smaller population but the same percentage rate of population growth, the poorer classes would be much better off than they are today? If so, they should visit Chad in central Africa, as I have recently done. Here is a country about one-third the size of India in area, with great potential resources, including two great rivers and millions of acres of arable land, with 0.7 percent of India's population. Yet average incomes are less than half those in India. Thomas Malthus showed long ago (*Essay on Population*, first edition, 1798) that regions with sparse populations and low population densities are just as likely to suffer from "population problems" as large, densely populated ones.

The function of a world food bank would not be, as several of the letters imply, to serve as a vehicle for a perpetual transfer of food from the United States and other rich countries to the poor ones. Rather, it would be a device to even out weather-caused fluctuations in food supplies and the resulting much larger fluctuations in food prices. Experience since World War II shows that several years of bad weather in succession result in a 6 to 7 percent shortfall in world cereal production, while several years of good weather result in a surplus. Through the mechanism of a world food bank, surplus cereals could be purchased and stored during good years and sold at approximately what was paid for them during bad years. The world's farmers and consumers would both benefit. But a world food bank should not be thought of as a substitute for all-out efforts to modernize agriculture in the poor countries.

With presently existing agricultural technology, the possibilities for increased harvests are very large. In India, for example, a tripling or quadrupling of agricultural production over the next several decades is technically and economically feasible, although there are discouraging social and political obstacles. Such an increase in production should not be limited by a scarcity of material resources. Known world reserves of high-grade phosphate rock are sufficient to last for 450 to 600 years, at the expected world rate of use, in the early part of the 21st century. Usable reserves of lower-grade ore are about eight times as great (*1*). The amount of nitrogen in the atmosphere is around 10 million times larger than any conceivable application of nitrogen fertilizers in the future. Within India itself, the future availability of energy is more problematic, even though she possesses more than 100 tons of coal reserves per capita, enough to last for 500 years at present very low rates of use.

As the recent U.N. World Population Conference showed, the number of organizations concerned with population problems is legion, including many U.N. agencies, the bilateral assistance organizations of several rich countries, the Ford, Rockefeller, and other foundations, and numerous voluntary associations, both large and small. Between them, organizations have accomplished a good deal within a very short time, though the future tasks are formidable. As for the claim that no scientific organization has taken a stand on "population-associated crises," it may be sufficient to recall the series of publications of the National Academy of Sciences, beginning in 1963 with a comprehensive statement entitled *The Growth of World Population* (*2*).

After 35 years of careful study of population problems, Thomas Malthus concluded the last edition of his famous *Essay on Population* (1835) with these words: "It is hoped that the general result of the inquiry is such as not to make us give up the improvement of human society in despair . . . . Although we cannot expect that the future happiness of mankind will keep pace with the brilliant career of physical discovery, yet if we are not wanting to ourselves, we may confidently indulge the hope that to no unimportant extent, they will be influenced by its progress and will partake in its success."

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