agreed national IBP plans is not retarded through lack of funds. But there are now 55 countries which formally participate in this program, and a number of others which make contributions thereto. Although the national programs of most are relatively modest compared with that of the U.S., many of their projects have already been in operation for several years, and results are beginning to come forward. A comprehensive index of national projects, which will be published shortly, includes more than 1500 entries classified under the seven main section headings and some 50 themes of the agreed international program.

Take the theme, for example, of the grassland ecosystems of the world: the largest study yet proposed and already underway is the Matador Project in Canada, and there are 40 other grassland projects of some 20 other countries. One of the biggest, in Colorado, will now go forward with a grant of $350,000 from the National Science Foundation. The U.S. is also a major contributor to a coordinated program on the study of human adaptability to living in the Arctic zone. It would be highly regrettable if U.S. scientists had to defer scheduled studies of certain Eskimo populations, but this would not stop other countries which contribute to this particular theme, namely Canada, Denmark, Finland, France, and Sweden, from continuing their parallel investigations on Eskimos, Scolt Lapps, and other Arctic peoples.

The U.S. plans for new biological research under IBP have been carefully developed by many leading scientists, under the guidance of Roger Revelle and Frank Blair as successive chairmen of the national IBP committee. To withdraw or defer these plans will obviously retard, but will not necessarily prevent, the achievement of IBP in reaching its goals. I am sure that all other participating countries, as well as IBP international, trust that ways will be found through the present financial impasse.

E. B. WORTHINGTON

Central Office,
International Biological Programme,
7 Marylebone Road, London, N.W.1

Mathematics: Catalyst to Science

The National Study of Mathematics Requirements for Scientists and Engineers survey reported by G. H. Miller (17 May, p. 742) provides some interesting facts, but omits many others. . . . My major disagreements with the study are:

1) It has assumed that science in the future will consist simply of more people doing the same things being done today. The scientists responding to the survey were reporting on methods they have found to be useful for the problems they have solved. Scientists in the future will be working on problems which are not yet solved; problems for which present methods have not worked. We wish education to prepare scientists to walk new paths, not to retrace the old ones. The history of the partnership of science and mathematics has one lesson: that mathematics has contributed to science with a success fantastically beyond what could be reasonably expected. No one understands why. But certainly, by this time, scientists should expect that great contributions will be made by parts of mathematics which appear, at first glance, to be irrelevant. These contributions, however, can only come about if there are scientists who know and appreciate the mathematics.

2) The questions about use of course content are off the point. The important aspects of mathematics courses are the habits of thought, the ways of approaching problems, the attitudes. For example, although I now work with problems of systems analysis and electromagnetic phenomena, my Ph.D. research and 2 years of teaching experience were in pure abstract algebra. The thought patterns I developed in abstract algebra allow me many insights and a freshness of approach not available to my colleagues. Thus, I "use my algebra" every day, even though I rarely use any of the "content" of abstract algebra.

Most of the theoretical work in organic chemistry and zoology, which were mentioned by Miller as having "less need for advanced mathematics," is in fact almost identical in spirit and technique with much of modern algebra and combinatorial topology. I am dismayed that the scientists in these fields don't seem to know that.

3) For this survey to be meaningful, it needs to be compared with surveys of other groups of scientists, notably (i) scientists who have been successful in the managerial, political, and educational areas of science, rather than being successful researchers in their own right; and (ii) scientists who have not been very productive. The last group would include, for example,

most of the science faculty at most of our colleges and universities; people who put in 5 or 6 years of sweat and tears to produce one mediocre paper. In fact, if NSMRSE could survey only one group, I would select this one. These scientists are acutely aware of the deficiencies in their own education. Their opinions would be far more valuable than those of very productive scientists, who would probably have been just as successful if their education had been in classical Greek or comparative theology.

DONALD R. WEIDMAN
U.S. Naval Weapons Laboratory, Dahlgren, Virginia 22448

Fulsome?

Greenberg (17 May, p. 744) describes the praise by the Institute for Defense Analyses of its academic underpinnings as being fulsome, but the quotations from IDA's 1965 report are anything but fulsome in praise of its academic foundation. One can agree with Greenberg that a university can perform a public service by preventing itself from blowing up [*sic*]. It is no less true that IDA is performing a public service, toward which academic talent has made a contribution, according to the 1965 IDA report. If Greenberg is interested in public service and the national welfare, perhaps he should attack the Students for a Democratic Society for impairing IDA's academic relationships, rather than to attack the extension of the academic world into IDA.

I agree that antimilitary sentiments exist in the academic world, but military force also exists in the world and one should not be surprised when military force overruns and subjugates a society that permits itself to become vulnerable. Those with antimilitary sentiments frequently display a fulsome lack of discrimination between military force employed for aggressive purposes and military force employed for defensive purposes.

FRANCIS J. KENDRICK
National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, Maryland 20014

Please clarify the intended meaning of "fulsomely" in the sentence "Throughout its history it [IDA] has fulsomely praised its academic under-