Letters

Exercise and Heart Disease

One thing that fairly leaped out of the pages of the recent Research News series on heart disease, at least to a running addict like me, was the continued lack of systematic investigation into the role of exercise in prevention of, and in recovery from, cardiovascular disease. The series mentions only that there is a general belief that exercise is beneficial, but that this belief is not based on very hard data, such as controlled clinical studies. Given the pervasive circumstantial evidence that exercise is an important factor in determining the state of an individual's cardiovascular system, and in particular that regular endurance-type exercise may mitigate factors such as obesity and hypertension, which are well-known precursors to heart attacks, isn't it time for well-controlled, long-term studies concerning the effects of exercise regimens on the incidence and recurrence of cardiovascular disease?

Whatever the outcome, the results would be important. Positive results would lead to the refinement of a powerful weapon against heart disease, while negative results would mean that some of us could save a lot of time, effort, and sweat.

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The Biome Programs

The article "An evaluation of three biome programs" by Mitchell *et al.* (28 May 1976, p. 859) is disappointing in its failure to draw useful conclusions from the very limited analysis made by Battelle, Columbus Laboratories, of these programs. While the article identifies both strengths and weaknesses of the biome programs, it falls short in any attempt to analyze the source of these strengths or weaknesses, particularly the weaknesses.

Many of the problems identified by Mitchell *et al.* existed. One would assume that the major benefit to be gained from such an analysis would be to provide insights for assessing future large-scale, team-oriented interdisciplinary research programs and to enable such programs to take advantage of past experience. Statements such as "scientists most likely to pursue integrated research in the future come from programs with lowest administrative costs . . ." or other general statements made throughout the article concerning the role of management contribute little to understanding the nature of the effectiveness or lack thereof of program organization and operation. The three programs analyzed in the study differed significantly in their approach to program organization and differed very significantly in the nature of the organizations through which they were administered, thus making such general conclusions meaningless. Also, the tendency to lump studies of the three biome programs together in conclusions concerning their operation is a substantial disservice to the reader. In many cases it is the differences in operation which can give insight into the successes or shortcomings of specific aspects of the three programs.

A second problem is the timing and context in which the study of the biome programs was carried out. References to "the end of the IBP [Internationl Biological Program] authorization in June 1974" and statements such as "United States participation in the IBP began in 1969 and ceased in 1974" leave the reader with the distinct impression that the biome programs ceased in 1974. It would have been helpful for an understanding of the significance of the review if the authors had made clear that, while U.S. participation in the IBP did indeed end in June 1974, the biome studies did not terminate at that time. Two of the studies, the Grassland (GB) and the Eastern Deciduous Forest (EDFB), have continued to be quite active (GB funding ending in December 1977). It should also be pointed out that the Battelle review took place during a period of approximately 1 year beginning after mid-1974. A clear recognition by the reader of the above allows for a different overall interpretation of the findings. For example, conclusions as to the nature of the program outputs are premature; by design much of the synthesis started after the study by Battelle was completed. In defense of the Battelle group as to some of the shortcomings of their analysis, it is our impression from our interaction with the authors that they were given too little time and too few resources to conduct an in-depth study of programs with such broad scopes. Also, it certainly would have been more meaningful had they been asked to carry out this study, not at the end of IBP, but sometime *after* the end of the funding of the biome programs.

Additionally, several important errors in fact need to be pointed out.

1) The statement concerning the lack of plans for publishing the synthesis volumes is inaccurate.

2) The authors state that the data banks of the EDFB and GB have been essentially useless and, in fact, contain "very little field data." With respect to the GB data bank, this statement does not represent accurately the situation at the time the Battelle group carried out its study and is totally inaccurate at this time. In fact, the GB data bank contains 99 percent of the field data collected from seven grassland-type sites for a period of 3 to 4 years and includes more than ten standard categories of standing crop (biomass) data from each site per year in addition to data from other field and laboratory studies. As noted in the Battelle report to the National Science Foundation (*1*), there were at the time of the study 117 titles and 572 sets of annual data, and more have been added since. Currently the data are 90 percent reviewed and are being made available routinely for modeling and synthesis purposes. It is true that there have not been a significant number of outside data requests filled. This does not represent a problem of the data bank, but rather a lack of knowledge by potential users of the content of the bank and methods for gaining access to the data. It could be termed a shortcoming of the GB program that this information has not been made available.

Little insight is shed on what should be the important question: How can the

organization of large-scale, interdisciplinary research be most effective? The reader interested in this question would be well advised to review carefully the Battelle report (*1*). While suffering from the shortcomings of timing and lack of adequate program review, the report does provide the authors' data base on a program-by-program basis.

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References

1. Battelle, Columbus Laboratories, *Evaluation of Three of the Biome Studies Programs Funded under the Foundation's International Biological Program (IBP)* (prepared for the National Science Foundation, Washington, D.C., 1975; available from the National Technical Information Service, Springfield, Va.).

The purported evaluation of three biome programs of the U.S. International Biological Program (IBP) by Mitchell *et al.* is highly faultable on one major count and is completely wrong concerning another important aspect. The biome studies have the aim of understanding the structure and function of major ecosystems through integrated research. The success of this approach will depend on the success in synthesizing the results of this integrated research.

The results of classifying and comparing the number of titles from IBP and non-IBP research in the journal literature with respect to ecosystem compartments has, at best, peripheral value in an evaluation of the success of this approach. The success of the biome and other integrated research will be measured by the success of the forthcoming synthesis volumes.

This brings me to the one paragraph in the article that is inexplicably and almost completely a misstatement of fact, with such comments as, "There are still no firm plans for the synthesis volumes," or "The biome programs are closing down with indefinite plans for the assembly and publication of large-scale interpretive volumes."

The facts are as follows:

1) In early 1974, while the formal IBP structure still existed in the United States, the IBP program directors requested that The Institute of Ecology (TIE), through its committee on ecosystem studies, assume responsibility for publication of the U.S.–IBP synthesis series.

2) Acceptance of this responsibility was formalized by the TIE trustees on 4 April 1974, and I was asked to chair the IBP publications committee. Three highly respected scientists accepted membership on the committee and still serve on it.

3) Later in 1974, after consultation with various publishers and with representatives of the National Science Foundation and the National Academy of Sciences–National Research Council, a formal contract was signed by the director of TIE and the publishing firm of Dowden, Hutchinson and Ross for publication of the U.S.–IBP synthesis series.

4) The present status of the series is as follows: (i) One volume was in page proofs when the article by Mitchell *et al.* was published and it appeared last summer; (ii) six volume manuscripts have been reviewed and approved by the committee and are in various stages of production; (iii) outlines and editors for 12 additional volumes have been approved by the committee; (iv) two additional outlines are under review, bringing the anticipated number of volumes in the U.S. series to 21.

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From the very beginning, the International Biological Program attracted both converts and critics (*1*) and dominated the funding to ecology and ecological research by the National Science Foundation (see table 1 in our article). An evaluation of the progress and productivity of these programs was inevitable, as they represented a fundamental departure from normal patterns of development and funding.

If an accurate and unambiguous evaluation of the programs was ever to appear, it had to be based on data collected by clearly defined, operational methods. Such data were collected on the scope and breadth of publications, the status of the modeling effort, data banks and synthesis volumes, and on the role of management in development of these programs (*2*). Our efforts required close and open cooperation with biome directors, individuals responsible for the synthesis volumes, and nearly 100 scientists who participated in these programs. We are indebted to these individuals for their immense interest and aid.

Our review encompassed the accomplishments of the tundra, grassland, and eastern deciduous forest biomes from 1968 through 1975 and incorporated additional information on nearly 200 manuscripts that had yet to be submitted for publication. Each program was unique and required separate evaluation. Generalizations were possible only when analysis and comparison of the three programs revealed similar patterns (see p. 863 of our article).

The role of management could only be assessed on the basis of what it proposed to accomplish, what it did accomplish, and how it was perceived by scientists who played an active role in these research programs. Thus, it is not surprising that our conclusions regarding the nature, cost, and effectiveness of management differ from those of the managers themselves.

Internal reports were a characteristic of each of the programs, but they were not intended for wide circulation. Our study evaluated them in terms of their contribution to the internal functions of the programs and did not take them as contributions equivalent to publications. In the main, such "in-house" memoranda were important in integrating the efforts of researchers (see p. 863 of our article).

It would appear that the status of data banks and synthesis volumes has changed over the last 2 years. We are pleased to hear that data banks are now in a more complete and accessible state than we found them and that the synthesis volumes are more numerous than reported in 1975 (*3*).

Whether the timing of our study was appropriate or not is a moot point; but the fact that the programs were being halted and research teams were being dispersed argued strongly in its favor. The presumably bright prospects for final synthesis volumes suggest that a second evaluation might be in order. Certainly we would be interested in conducting it (*4*).

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References and Notes

1. C. Holden, *Science* **187**, 633 (1975).
2. Battelle, Columbus Laboratories, *Evaluation of Three of the Biome Studies Programs Funded under the Foundation's International Biological Program (IBP)* (prepared for the National Science Foundation, Washington, D.C., 1975; available from the National Technical Information Service, Springfield, Va.).
3. In February 1975, W. F. Blair provided us with a status report on the synthesis volumes. At that time, nine synthesis volumes were in outline form. Only three of these (two from the tundra program, one interbiome in origin) had been submitted by the biome programs we studied. See (*2*), pp. II-61–II-62.
4. R. Mitchell is currently a Fulbright Lecturer in India. The time constraints imposed upon us by the editors of *Science* precluded his participation in our response.