deniable, however. Everything was explained by the doctrine of present causes and often most successfully. (Lyell's accounting for climatic change was the only accepted explanation until very recently.)

Of the many topics included in Wilson's 16 rich and informative chapters, Lyell's views on education and his comments on the state of the universities are particularly suggestive for those of us who confront parallel problems. He included these views in his *Travels in North America*, written after his two triumphant tours. Volume 1 ends with 1841 and the Lyells packing for the first of these trips. We look forward to Wilson's account of Lyell's reaction to the exuberant infant republic. We look forward also to further development of the critical relationship of Lyell to the species question and to Charles Darwin. Not least in interest will be the reactions of Lyell and the evolution of his character under the stress of the remarkable success of Darwin, for the reception of Darwin's *Origin* was determined in great measure by the social and polemical climate which Lyell and his uniformitarian doctrine had established, a climate which now has been recreated for us by Leonard Wilson.

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Aspects of Biology

Challenging Biological Problems. Directions toward Their Solution. The American Institute of Biological Sciences 25th Anniversary Volume. JOHN A. BEHNKE, Ed. Oxford University Press, New York, 1972. x, 502 pp., illus. $10.95.

The American Institute of Biological Sciences celebrated the 25th anniversary of its foundation in 1972. Its officers decided to mark this event by the publication of a rather special type of volume. They point out that "Speculation has played a major role in the advancement of science. But its contribution is often not fully appreciated." They therefore set about organizing "a volume of perceptive speculation about ways to solve some of our most interesting and critical biological problems."

But which are the most interesting and critical problems? They wisely decided not to attempt to emulate the prodigious feat performed by Philip Handler and his team from the National Academy of Sciences, who took the whole of the life sciences as their province in *Biology and the Future of Man*. It would, however, clearly have been inappropriate for a body as broadly based as the AIBS to select any one discipline, or even a few related ones, within the whole field of biology. One solution might have been to select from across the whole board problems that are challenging because of their potential impact on the well-being of mankind in the next few decades. However, this is not what the officers of the AIBS decided to do. Instead, they called upon the formidable resources of their organization. Nominations of problems and potential authors were solicited from the AIBS officers, members of the *BioScience* editorial board, and the members of the editorial committee for the book, as well as a wide spectrum of prominent biologists. This brought in a list of 125 problems, from which they finally selected 17; to these they decided to add four chapters dealing with communication in biology, the ethical social, and economic climate for the life sciences, and graduate education. Finally, since the AIBS has a genuine interest in students at all levels, they set about obtaining some contributions from authors who had not yet been awarded their doctorates. This again involved a massive search operation. Letters were sent to 3000 life science departments, and from the resulting haul of fish of all sizes and shapes three were chosen.

This account of the structure and genesis of the book will, I hope, not merely give the prospective reader some essential information about its character, but will convince him that it is essentially impossible to review. One can tell a priori that it will contain a large number of articles on interesting topics written by authors of well above average caliber. And one would expect that the student contributions will be very superior examples of that category of biological literature. Both expectations are amply justified. I can imagine very few biologists who will not find something of genuine interest in the book. Equally, it is difficult to imagine any biologist who will be able to rustle up an interest in everything it contains.

The best a reviewer can do is to give some indication of which areas of biology are, and which are not, touched on, with perhaps a few indications of the manner in which they are treated. Perhaps, in view of the present fashion in biology, the reader will not be surprised to learn that five out of the 17 biological problem areas, and all three of the student contributions, are basically concerned with ecology; and two more contributions, on the regulation of human populations and on evolutionary biogeography viewed from plate tectonic theory, are on the borderline of this subject; and still another, on the integrative approach to biological classification, is not too far away. Of the rest, four are in the general region of cell biology—on cellular mechanisms of learning, abnormal growth, membrane permeabilities, and the aging process. There are two on the importance of cyclic properties, both as timing mechanisms and, in one of the most theoretical articles in the book, as a basis for the integration of whole organisms. There is one article in the area of animal behavior, on aggression; and Joshua Lederberg contributes another of his admirably clear, balanced, and well-thought-out discussions of the whole area of eugenics and genetic engineering. The articles more oriented toward science policy include a short statement of the future challenges for the AIBS; a discussion of the problems of communication in the biological sciences in an era of information overload, and reviews of the present prospects for graduate education in biology and for the profession as a whole in the United States as it is today. Finally, there is an article by the always provocative Kenneth E. Boulding, with the title "Economics as a not very biological science," which might perhaps have had as a subtitle "Biological science as not very good economics."

I will not attempt to list all the topics that are omitted, but perhaps one might mention some old friends whose faces do not show up here, or who appear only as a tail wagged by some other dog. Neurobiology, immunology, evolution theory, recent discoveries about the unexpected complexity of eukaryotic chromosomes, are among those whose voices—I suppose some may claim usually too strident—are here scarcely heard at all.

As to treatment, I must first repeat that all these articles are written by well-esteemed authors. At least in the areas where I feel at least a modest competence to judge, they all have something quite interesting to say. Of course, the articles are not intended

to be exhaustive treatises. They are forward-looking personal viewpoints. One may often find that the lists of references do not include people whose work is often thought of as "the modern classics" in a particular topic; but this is in line with the basic intention to encourage a few chosen authors to put forward their own personal suggestions.

The final question is, how deep and far-reaching are the personal speculations offered about each of these challenging problems? Frankly, I should myself have liked to see people stick their necks out a bit further. This book is intended to be a bit more solid than that "collection of half-baked" ideas published a few years ago as *The Scientist Speculates*, edited by J. Good. At the same time its essential purpose, as I understand what the editors say in the preface, was to be stimulating. I suppose it is an inherent characteristic of biological systems that, when provided with a little pleasurable stimulation, they are not content to be grateful for what they have, but demand more. This book left me with rather that feeling.

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The New Archeology

Explanation in Archeology. An Explicitly Scientific Approach. PATTY JO WATSON, STEVEN A. LEBLANC, and CHARLES L. REDMAN. Columbia University Press, New York, 1971. xxii, 192 pp., illus. $6.

Watson, LeBlanc, and Redman undertake the formidable task of summarizing the many and divergent innovative trends of the last decade's "new archeology." Their book has three major foci: explanation, explanatory frameworks, and archeological applications of the two.

The authors' treatment of explanation follows the heavily deductive-nomological emphasis of many recent discussions of methodology in archeology. Having described this approach, they explore interfaces between it and more traditional archeological epistemologies. While the lack of rigor in the citation of examples of concepts such as *law* and *hypothesis* will bother some readers, this looseness must be seen in the context of the authors' use of the deductive-nomological approach as a basis for thinking about verification and for organizing natural experiments rather than as a final solution to the truth problem.

A number of papers criticizing use of deductive-nomological research strategies have appeared in the last several years, many of them after this book was written. Watson, Redman, and LeBlanc handle some of the objections that have been raised, tackling, for example, the question of how an archeologist might handle the three or four culture-bearing strata that lie between him and the one stratum relevant to his research. However, meaningful comparison of the deductive-nomological strategy and those suggested by other archeologists is limited by the largely hypothetical nature of archeologists' discussions of these approaches. Research results that would permit a more definitive comparison of their relative effectiveness are largely wanting.

The discussion of explanatory frameworks is a concise summary of the more important concepts that archeologists are borrowing from ecology and general systems theory. While both of these theoretical frameworks are identified as rich sources of testable propositions, Watson, LeBlanc, and Redman are hard pressed to provide concrete examples of their use in archeology. This failure should not, however, be placed on their shoulders. For while ecology and, especially, general systems theory have become a part of the rhetoric of new archeology, legitimate applications are still few and far between, given that archeologists' traditional interest in the natural environment and subsistence theory should not be equated with ecology and that the notion that human behavior is organized and patterned cannot be equated with general systems theory.

At a more general level, one must question whether the authors' discussion of general systems theory and ecology exhausts the range of theoretical experimentation that has characterized the new archeology. Its beginnings must be placed within a Whitean cultural materialist mold. But major efforts to deal with more individualistically, behaviorally, and cognitively oriented theoretical frameworks have appeared in the works of some new archeologists. Even among ecologically oriented archeologists there are evident differences between those interested in "ecosystem" ecology and those who derive their inspiration from microprocessual approaches.

Finally, one must mention those archeologists who see the overzealous borrowing of theories and models from other disciplines as a limitation on our ability to understand the past. In many passages throughout their book, the authors emphasize the unique opportunity for the study of long-term behavioral and cultural change that archeological data provide and the need to *construct* models appropriate to this effort. Had they chosen to consider ecology and general systems theory in the context of building these models of change, the authors would surely have produced a more coherent explanatory framework.

In the final section of their book, the authors describe some of the major analytical models that new archeologists have employed. The models in question range from rather concise statistical ones to what would perhaps better be considered theories, locational analysis for example. The consideration of each model is insufficient for providing a working ability with it, but more than adequate for introducing the reader to the model and its applications.

The book is an excellent summary of the major issues that new archeologists have attempted to bring to the attention of their discipline. It provides a concise dictionary of new archeology's conceptual jargon. And it explicitly and implicitly identifies lines of research that must be pursued if the loftier of new archeologist's claims concerning our ability to understand the past are to be satisfied.

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Origins of the Solar System

From Plasma to Planet. Proceedings of a symposium, Saltsjöbaden, Sweden, Sept. 1971. AINA ELVIUS, Ed. Wiley-Interscience, New York, and Almqvist and Wiksell, Stockholm, 1972. 390 pp., illus. $25. Nobel Symposium 21.

The 21st Nobel Symposium dealt with chemical and physical processes that may have been important in the very early stages of formation of the solar system. The proceedings, edited by Aina Elvius, have now been published as *From Plasma to Planet*, a title that neatly summarizes the contents of the volume.

Of the 20-odd long papers presented, most of them by distinguished scholars