humanities at Virginia Polytechnic Institute—would undertake a book on the subject at this late date.

Scientists and scholars generally take one of two attitudes toward pseudoscience controversies. Some want to dismiss such episodes as quickly and quietly as possible so as to minimize the visibility they get. Others seek to recount and analyze the details, hoping that we may learn from the mistakes and avoid similar ones in the future. Bauer is definitely in the latter camp, and his book is not merely "the history of a public controversy." It is a thoughtful and penetrating analysis one of whose purposes is "to make plain what scientists must do, and what they must not do, if they are to be effective in public controversies."

Bauer has divided his book into three parts. Part 1 tells the story of the Velikovsky affair in five chapters, part 2 analyzes what happened, also in five chapters, and the remaining six chapters, part 3, extrapolate beyond. This is not a kindly book, but it is balanced in that Bauer is as critical of the scientists involved as he is of the pseudoscientists, though for somewhat different reasons.

Velikovsky's understanding, particularly of the physical sciences on which his theoretical arguments depend, is shown to be abysmal. Bauer demonstrates this point by discussing at length a rarely cited earlier book by Velikovsky entitled *Cosmos Without Gravity*. Bauer believes the point is crucial because, to him, earlier critics simply missed it, resorting instead to more tawdry tactics that backfired in some respects. He then goes on to level perhaps the most devastating criticism of all, namely that Velikovsky's seemingly bold initiatives were not even original. Despite all the claims for Velikovsky's originality, not to mention genius, it is clear that his main ideas had been developed in considerable detail by earlier authors. Moreover, Velikovsky must have read these works because he references them for lesser details, while crediting the "spectacular stuff" only to himself.

Many of the inept arguments used by the scientific critics of Velikovsky are also exposed, and in a most candid and direct way. These exposés will be of vital interest to those who, like myself, get involved in debunking present-day pseudoscience.

I kept hoping—especially given that he holds his present deanship at the same university where the "dean" of creationism, Henry Morris, once headed the civil engineering department—that Bauer would draw more parallels between the Velikovsky affair and the recent history of "creation science." That too is an example of biblically inspired pseudoscience over which heated debates continue to rage. Certainly there was ample opportunity to explore such parallels, and it might have lent the book a more contemporary air. But it was not to be, and Bauer intends that his next book will be about the Loch Ness monster.

In conclusion, I found Bauer's book very worthwhile. His scientific background as a chemist provides valuable insights, which he conveys in a very clear and understandable way. I think he is somewhat too harsh with some of Velikovsky's critics, but the viewpoints are well argued and the book is rich in educational value, particularly as regards the nature of scientific thinking and inference. I recommend it not only for the lessons that scientist debunkers can learn from it but also for the way it contrasts the strategies of scientists with those of the pseudoscientists and pseudoscholars.

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Ecogenetics

Genetic Variability in Responses to Chemical Exposure. GILBERT S. OMENN and HARRY V. GELBOIN, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y., 1984. xii, 421 pp., illus. $55. Banbury Report 16. From a conference, Oct. 1983.

This book comprises the proceedings of a conference organized by the Banbury Center. It begins with an introductory section that contains interesting and insightful historical overviews of the field by Omenn and Kalow. It is pointed out that there is a conflict between the methods that are usually used to identify a chemical or drug as a potential hazard, which usually involve studies in a small sample of people or animals, and the basic implications of pharmacogenetics and ecogenetics, which are that some small groups are at special risk because of their genes. The section also contains a nice discussion of the transition over time from interest in the narrower subject of pharmacogenetics to interest in ecogenetics, which is concerned with special risks to certain genotypes from all kinds of chemical, physical, and biological agents in the environment, as well as from drugs. Following the introduction, there are 28 papers distributed into six sections, on the P-450 systems, drug and carcinogen metabolism, polymorphisms of metabolizing enzyme systems, oncogene activation and gene markers, immunological and molecular genetic approaches, and population correlations.

Properly, much of the emphasis of the conference was on the cytochrome P-450's, a family of proteins with vast substrate specificity. A highlight of the book is a paper by Gelboin and colleagues that describes the development of specific monoclonal antibodies to individual P-450's, with each antibody inhibiting the activity of a particular P-450. This technique promises to avoid a major problem in the study of P-450's, which is that the overlapping specificities of P-450's have led to difficulty in identifying the contribution of a specific P-450 to the total metabolism of a carcinogen or drug. By the use of the new technique it was found that 90 percent of a certain P-450, placental aryl hydrocarbon hydroxylase (AHH), from women who smoke is inhibited by a certain antibody, whereas monocyte activity is not inhibited at all, indicating that a different P-450 is induced in the two tissues. This kind of analysis may have the potential to unravel the controversy about the nature of the relationship between the induction of AHH and lung cancer. In this connection, a paper by Kouri and colleagues reexamines the question of AHH activity in the lymphocytes of patients with lung cancer and reports higher AHH activity in 14 of 23 patients with lung cancer than in hospitalized patients without lung cancer. The question of causality, however, is far from settled. Papers by several groups summarize excellent progress in understanding the debrisoquine polymorphism, which involves a specific P-450 that hydroxylates not only debrisoquine but several other drugs as well.

The section on oncogene activity and gene markers includes four papers that report work in which the very latest technology was used to explore the fascinating happenings related to oncogene activation and cell transformation. Though the reports present no breakthroughs, they illustrate for the interested reader the kinds of approaches that are being taken to understand the cellular events that may lead to cancer. A paper by Cartwright in the section on population correlations deals with bladder cancer patients and the possible roles of the acetylation and debrisoquine P-450 polymorphisms. Cartwright shows that if one looks at chemical workers as opposed to nonchemical workers the data offer more support for the hypothesis that the slow acetylator phenotype is

associated with bladder cancer. A paper by Kueppers focuses on the effect of cigarette smoking on the development of emphysema in individuals who are homozygous for α_1-antitrypsin deficiency and adds to the documentation that smoking accelerates the deterioration of lung function in these individuals. The latter paper, and what it is and is not able to report, are of considerable interest to this reviewer, because in 1971, in an editorial in the *American Journal of Human Genetics*, I introduced the term "ecogenetics" using just this example. I proposed that air pollution as well as cigarette smoke could very well be leading to emphysema, not only in homozygous but in the much more common heterozygous carriers of the α_1-antitrypsin deficiency gene. However, specific studies of the effects of heavy air pollution on the development and acceleration of emphysema in individuals homozygous or heterozygous for α_1-antitrypsin deficiency have not yet been carried out. In fact, progress on general population and industrial risks has been so slow that King, in her paper in this section, states that the requirements necessary to justify large-scale occupational monitoring programs do not yet exist for any genetic polymorphism. This statement is probably valid. The situations that come closest, in this reviewer's opinion, are those that concern the relationship of α_1-antitrypsin deficiency and emphysema, acetylation phenotype and bladder cancer, and AHH induction and lung cancer.

Those general readers who wish a review of the field of pharmacogenetics and ecogenetics will be disappointed in this book. Most of the papers are short and do not provide adequate reviews of fundamental knowledge concerning the various systems. Further, some notable pharmacogenetic examples are given rather short shrift. These include the acetylation system, in which a great deal of work with animal models has added greatly to the understanding of the system and its effect. The interesting interactions between three pharmacogenetic systems (G6PD deficiency, acetylation, and hydroxylation), which determine the hemolytic potential of certain drugs such as the sulfones, are not discussed. This type of interaction is surely quite common, and this example serves as a prototype. Those researchers who wish an in-depth probing of up-to-date information on their own special interests will also not find it in the book. Most of the papers are summaries of published work for the most part. However, the book should be of considerable value to those scientists who are already introduced to the general field and wish a broad update on newer research findings. Most of the papers have very nice, succinct summaries that place the current work in the context of the broader field.

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Paleoclimatology

Late Quaternary Environments of the Soviet Union. A. A. VELICHKO, Ed. H. E. Wright, JR., and C. W. Barnosky, English-edition Eds. University of Minnesota Press, Minneapolis, 1984. xxviii, 327 pp., illus. $45. Translated from the Russian.

The climatic oscillations that characterize the Quaternary era are among the most dramatic that have ever affected our planet. The combined changes in temperature and precipitation and the growth of continental ice sheets and corresponding regression of eustatic sea level caused alterations in the dynamics of the biosphere rivaled only by mass extinctions of the distant past. An understanding of the causal mechanism for these changes and the construction of an adequate circulation model to predict future climate change require proxy data on a global scale. Quaternary environmental change was more dramatic at middle and high latitudes than in the tropics. The Soviet Union contains the largest land area at middle and high latitudes of any country in the world, yet proxy data from the Soviet Union are often inaccessible to the English-speaking world. This monograph, translated from the Russian, attempts to remedy the situation by summarizing current thought about and the status of research on late Quaternary (the last 130,000 years) environmental change in the Soviet Union. It is the third in a series coordinated by the Paleoclimate group of the US-USSR Bilateral Agreement on Cooperation in the Field of Environmental Protection. The first two volumes cover the same time period for the United States.

The late Quaternary of the Soviet Union can be broadly subdivided into the relatively brief last (Mikulino-Kazantzevo) interglacial, the following Valdai glaciation, which is further subdivided into early and late glacial phases separated by a complex nonglacial interval, and the present (Holocene) interglacial. Proxy data of use in paleoclimatic reconstruction include the records of continental, shelf, and mountain glaciation (seven chapters), permafrost and loess (nine chapters), biosphere changes (three chapters on vegetation, three on vertebrates and insects, and one on human populations), and the complex interaction of the inland seas, particularly the Caspian Sea-Black Sea connection to the Mediterranean (one chapter). The system connecting the two seas, governed by the interaction of eustatic sea-level fluctuations, influxes of isotopically light glacial meltwater, and the diversion of north-flowing rivers by the continental ice sheet, typifies the complexities of Quaternary environmental change. A proposal that a high–sea-level event took place in the Black Sea between 30,000 and 45,000 years ago is sure to stir controversy, as is the relatively warm mid-Valdai marine transgression against the Arctic coast. Five chapters use the proxy data presented in earlier chapters to reconstruct the regional climate.

The evidence is most complete for the Holocene, for which changes in pollen assemblages from continuously accumulated deposits are available across most of the country. These changes document the dramatic amelioration following late Valdai glaciation, the subsequent climatic optimum attained in mid-Holocene time, and a deterioration that began shortly before 3,000 years ago. Some authors suggest that the deterioration marks the onset of the next glaciation. These reconstructions require the correlation of individual pollen diagrams. Except for a few diagrams, however, the radiocarbon control is not of sufficient density to provide an independent chronology for each site, and the standard European Blytt-Sernander sequence is relied on for correlation. Although the reconstructions are undoubtedly correct in overall form, reliance on a climatically defined sequence for correlation forces synchrony, possibly obscuring important leads and lags in the vegetational changes that could in turn provide some of the best clues for the global circulation models.

The correlation of pre-Holocene sites depends even more on an independent geochronology, and the potential for miscorrelation is frequently mentioned by contributing authors. Radiocarbon dating provides control back to about 30,000 years ago, and in some instances to perhaps 50,000 years ago. Absolute ages beyond about 40,000 years ago are primarily controlled by uranium-thorium mollusk dates and thermoluminescence dates. The Soviet Union and other Eastern Bloc countries have been largely