the authors discuss is whether a continuing heavy exposure to radiations may actually cause the extinction of human populations, over and above the consequences in the form of increased numbers of defective individuals. Their answer to this question is on the reassuring side. This is because the 400- to 500-roentgen dose which is sufficient to cause death in half the exposed persons tends to preclude exposure to the very much larger doses it would take to extinguish the population because of whatever dominant lethal mutations might be induced. This conclusion is based, however, on the assumption that human genes and chromosomes are not a great deal more sensitive to radiation than those of fruitflies; but this assumption may be questioned on the basis of the observed sensitivity to low doses of x-rays of human cells growing in tissue culture. It is furthermore too bad that, in appraising the total situation, the authors have neglected to emphasize the relative significance of medical and occupational exposures to radiation. The treatment becomes focused a bit too much on the effects of fallout and possible nuclear war, and not on the multiplicity of exposures that the nuclear age may bring with it.

Let the last word be one of high praise for the efforts the authors have made to clarify a debate often marked by more heat than light. They bring out in their final conclusions the inescapability of making value judgments —far more political in nature than scientific—respecting the relative damage done by fallout and the desirability of a cessation of weapon testing. They point out the deficiencies in our present knowledge as well as the fact that radiation damage to living things is not all genetic damage. They take hope in the fact that mankind has acquired in its evolutionary progression not only a particular genetic heritage but also a means of passing on knowledge and of growing in wisdom through experience. They hope, therefore, that our species will surmount this threat to its continuance even as it has survived the lesser threats of the past. Unquestionably, this is the finest book yet published in the sharp debate over the genetic damage done by nuclear radiations. May it have many readers, and may each one cope manfully with its difficulties until he concludes its final page! He will be amply repaid.

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This Sculptured Earth: The Landscape of America. John A. Shimer. Columbia University Press, New York, 1959. xii + 255 pp. Illus. $7.50.

Americans yearly become more and more travel minded, and John Shimer has written *This Sculptured Earth* for the increasing legions of men and women now criss-crossing the United States.

So this is a travel book. But it will not tell the traveler where to find a motel with a swimming pool, a gourmet's dinner, or an out-of-the-way antique shop. It won't tell the wayfaring American the shortest distance from here to there. But it will tell him how to look at the American landscape.

As we become a nation of travelers, we forget that our landscape has beauty and majesty, that it has a past and a future, that it can evoke awe and wonder, that it can provide inspiration and solace. John Shimer is trying to remind those of us who have forgotten—and tell those of us who have never known —that the physical land mass of the United States is something more than a barrier dividing the Atlantic and Pacific Oceans. To Shimer it is a landscape to be seen, to be understood, to be appreciated, to be treasured.

The author has managed to describe and to explain a vast amount of the physical geography of this country. Are you going to Boston? Then why is there a harbor there, and whence came the islands that dot the bay? Will you know the explanation of the towering Tetons as you drive by them on your way to Jackson Hole, Wyoming? Or (on a more intimate scale) will you understand that ridge of hummocky land that you speed over on the Indiana Turnpike near South Bend?

Shimer does more than describe. He gives us some idea of the vastness of time and the complexity of history behind the American landscape. He even gives us, in places, a glimpse of what another traveler might see in some far future eon.

The book contains a minimum of technical jargon. Needed terms are defined, and most of these appear again in a useful little glossary illustrated with neat line drawings by the author's wife, Florence Henry Shimer. Florence Shimer has also contributed some effective,

Meanders of the White River, Indiana.

simple drawings to the text. These supplement very nicely some 70 photographs, many of which are superb. One by Laurence Lowry, showing the eastern end of Martha's Vineyard, Chappaquiddick Island, Nantucket Sound, Cape Cod, and Massachusetts Bay, is on the cover of this issue of *Science*; another, showing the meanders of the White River near Edwardsport, Ind., is reproduced with this review.

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Free Associations. Memories of a psychoanalyst. Ernest Jones. Basic Books, New York, 1959. 264 pp. $5.

The author of this book, Ernest Jones, was one of the principal contributors to, and developers of, the psychoanalytic theory of personality organization and function. This small and somewhat fragmentary autobiography was interrupted by his death in 1958.

Whatever one's personal views of psychoanalysis as a discipline may be, and I am favorably inclined towards it, Jones' somewhat abbreviated autobiography has severe limitations. Perhaps some of this reaction has to do with the level of expectation with which I approached the book and my subsequent disappointment in it.

It is likely that Jones' reminiscences about his early years will be a matter of interest to his intimates and to those who attach a sentimental significance to him, but they have little to recommend them to the general reader. Because his self-revelations are so fragmentary they do not provide the broad view which one would need in order to obtain a better understanding of the man. While the book is titled *Free Associations*, unfortunately the content is neither free enough to give the reader a reasonable sense of the scope of the man, nor disciplined enough to give the associations an inner coherence. This stands in striking contrast to Jones' earlier contributions to the theory and practice of psychoanalysis, which are marked by his logically consistent and definitive style.

For those who have a particular interest in the development of psychoanalysis as a "movement" (although Jones deplored the widespread use of this term), the latter part of this book has many pertinent historical references. One is impressed by Jones' enthusiasm for the newly developed perspective of personality development, and by the intensity of his drive to communicate the findings to others. The violence of his response to views which deviated from the classically psychoanalytic ones is one of the more remarkable aspects to be observed. These responses are presented with a degree of candor which, while it is hardly one of the more flattering aspects of psychoanalysis, throws light on the impact of radically new ideas in any sphere of science. Such new ideas are significant, among other ways, both as things in themselves and as disrupters of the usually definitive social hierarchy within a given field of endeavor. Then, of course, as the new system of ideas becomes intrenched, it in turn establishes its own hierarchal structure.

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Handbuch der Physik. vol. 44, *Nuclear Instrumentation*, I. S. Flügge, Ed. Springer, Berlin, 1959. vii + 473 pp. Illus. DM. 125.

"Nuclear Instrumentation on a Grand Scale" would be an appropriate title for volume 44 of the *Handbuch der Physik*, which is titled simply *Nuclear Instrumentation*, I. The articles contained here describe the major pieces of nuclear physics instrumentation, the heavy machines most commonly associated with modern experimental physics.

One does not blindly set out to build devices such as are described in these eight articles, and as a consequence, the most interested reader will already be familiar with the general theoretical discussions presented here. It is the specific comments about specific machines that make these articles most lively; the lore of machine building is well represented in this volume of the *Handbuch*.

The first article, by E. Baldinger, presents a thorough treatment of rectification circuits and then discusses cascade generators. R. G. Herb's discussion of Van de Graaff accelerators contains some sage advice for the would-be builders of such machines who would also like to work in experimental physics: "A faithful copy of a generator that is operating can be safely predicted in regard to performance." And conversely!

The magnetic accelerators—cyclotrons and synchrocyclotrons, electron synchrotrons, and betatrons—are discussed by Bernard L. Cohen, Robert R. Wilson, and Donald W. Kerst. Cohen's article contains an interesting tabulation of the characteristics of a large number of cyclotrons and an excellent treatment of the theory and the headaches (the practice) of cyclotron construction and operation.

George K. Green and Ernest D. Courant (Brookhaven National Laboratory), have written a monumental article on proton synchrotrons; they draw heavily on the experience with the Brookhaven, University of California Radiation Laboratory, Birmingham, and Dubna machines. The design features of the alternating gradient synchrotrons at Brookhaven National Laboratory and at the laboratory of the European Organization for Nuclear Research (CERN) are outlined. The latter is now in operation.

Linear accelerators—electron, proton, and heavy ion—are discussed by Lloyd Smith. An article by D. J. Hughes contains selected topics on reactor techniques of particular interest to nuclear physicists.

Very little of the material in these articles will interest those experienced in the design and operation of "his machine," except for comparison purposes. These articles will be of great use to those who wish to be brought up to date on machines with which they are not well acquainted.

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The Gentle Art of Mathematics. Dan Pedoe. Macmillan, New York, 1959. 143 pp. Illus. $3.50.

This is a book for the intelligent layman who wants to know something about modern mathematics and is willing to work a little to attain this knowledge. It starts out entertainingly enough with a discussion of mathematical games. These are used to acquaint the reader with number systems other than the familiar decimal system, although their use in electronic computers is not even mentioned. The next chapter discusses the theory of probability and its many opportunities for paradox. More paradoxical ideas are introduced in the following chapter, which discusses infinity and introduces