There are chapters on vectors, matrices, linear equations, eigenvalues and eigenvectors, and tensor algebra. If the work should run to further editions, one would welcome the addition of a section on relaxation procedures, at least sufficient to enable the research worker or student to know where to look for more detailed accounts and what to seek in them.

Foresight and Understanding. An Enquiry into the Aims of Science. By Stephen Toulmin. 115 pp. Harper & Row, New York, 1961. Paper $1.15.
Reviewed by ***R. B. Lindsay,*** *Brown University.*

The scientific method, when looked at critically, is susceptible of many interpretations, and this makes the philosophy of science a subject of never-ending fascination and a copious source of literature. The volume under review, whose author is a well-known philosopher and historian of science, originated in the thirty-fourth series of Mahlon Powell lectures at Indiana University in 1960. The aim of the book is to consider the central question: what makes a scientific theory, idea, or investigator successful?—in short, what is the meaning of success in science? This program is carried out in three phases: (1) the demolishing of the view that the purpose of science can be epitomized in a single phrase, (2) stress on the importance of "ideals of natural order" in the development of scientific explanation, and (3) introduction of the biological analogy of "survival value" as a test of the worth of a scientific idea.

The plan is attractive and the author's development of it is learned, vigorous, and persuasive. His style is pleasant and his illustrations appealing. If he fails to convince in every respect, it is partly because the magnitude of the task far outruns the space at his disposal. Yet his judgments throughout are highly suggestive and bear close examination. In his first phase, he attacks specifically the rather widely held pragmatic view that the principal purpose of science is to predict experience, and that our confidence in it as a worthwhile activity rests on the success with which it carries out this purpose. He then proceeds to note that different ages inevitably develop different views as to what concepts or "ideals of natural order", as he calls them, are genuinely fruitful; several plausible illustrations are presented from the history of physics and chemistry. Finally, the author draws an analogy between the evolution of scientific theories and biological evolution: scientific ideas survive by a kind of natural selection.

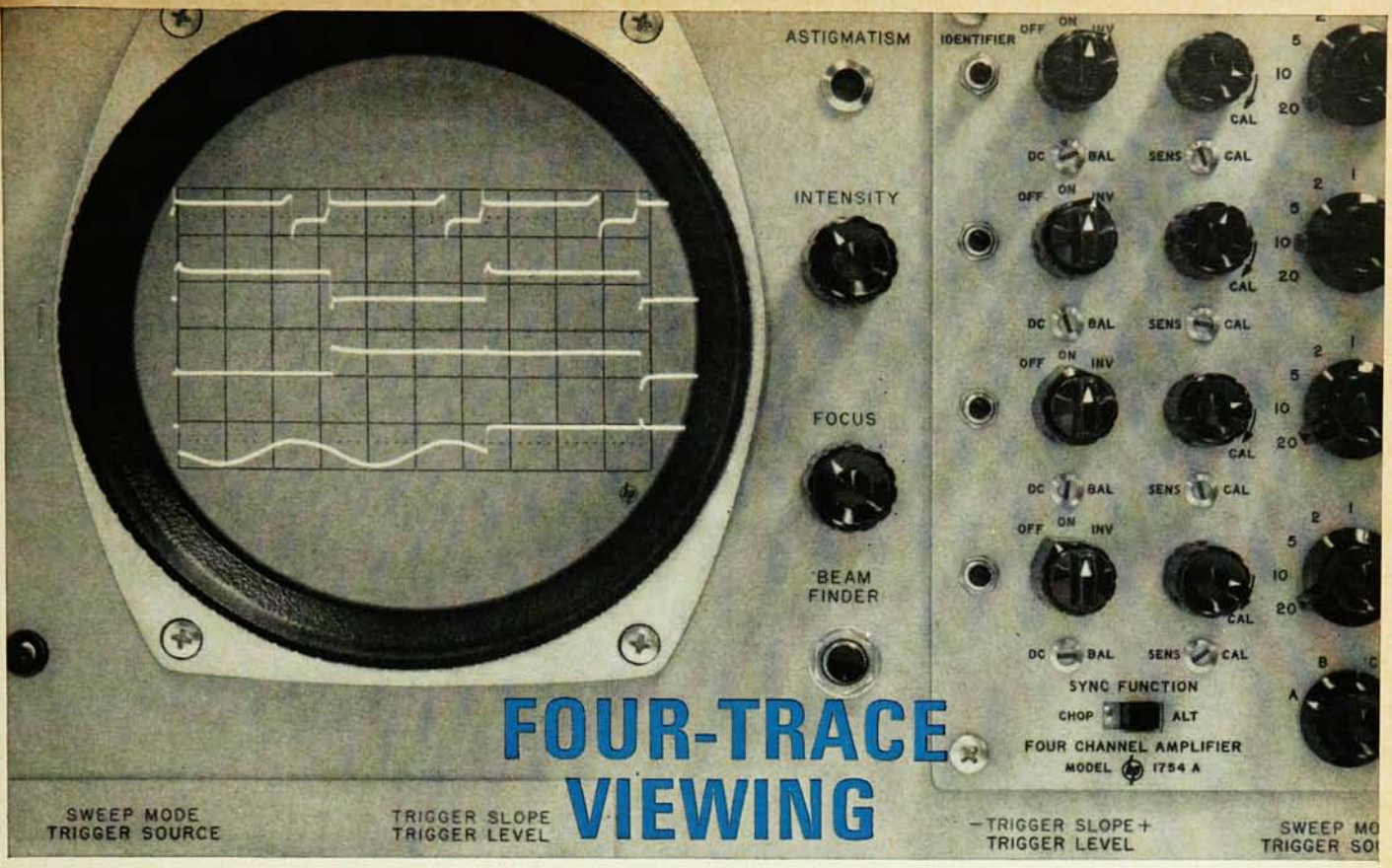
All this makes interesting and suggestive reading. But it leaves many questions open. In the last analysis, a scientific theory is really only a way of talking about a part of our experience, of such a character that it makes us feel we understand it; and if history teaches us anything definite about this, it is that it is a rather arbitrary process in which preference and taste enter decisively. The author's examples illustrate this very well, but emphasis on the point itself seems to be lacking. The same is true of the closely related problem of the extent to which scientific explanation is invention rather than discovery.

But, cavils aside, this is a very stimulating book and should be read by all physicists who have any interest in the foundations of their science.

Entropy. The Significance of the Concept of Entropy and Its Applications in Science and Technology (2nd ed.) By J. D. Fast. 313 pp. McGraw-Hill Book Co., Inc., New York, 1962. $10.75.
Reviewed by ***Joseph G. Hoffman,*** *State University of New York at Buffalo.*

The broad title, *Entropy,* may be misleading because this book deals with what might be called, for lack of better terminology, ideal entropy. The preface points out that there is no reference to the thermodynamics of irreversible processes and the accompanying production of entropy, or to the entropy concept in information theory. Therefore, since there are many new and interesting developments in these latter fields, it is desirable to specify the approach to entropy taken.

It deals primarily with the ideal entropy of reversible systems in equilibrium states. The first chapter describes the entropy concept in classical thermodynamics. Chapter 2 presents essentially statistical definitions. Here, the quantum state is introduced and examples discussed such as the specific



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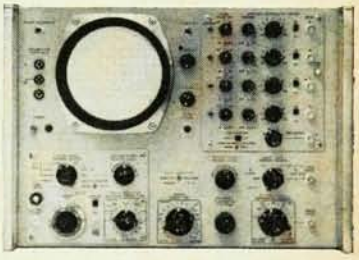

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heat of an Einstein solid, the vibrational specific heat of a gas, and the zero-point energy. Chapter 3 has many excellent applications such as in chemical equilibria, paramagnetism at low temperatures, body-centered cubic metals, substitutional alloys, ferromagnetism, radiation, and fuel cells. The student will find the numerous applications useful because they are developed systematically. There is achieved a fine pedagogic success in Chapter 3 which carries over into the remaining three chapters.

Statistical mechanics is introduced in Chapter 4 in a most readable manner, with a minimum of mathematical machinery; there are only subscripts, no superscripts or primes, etc. Bose-Einstein, Fermi-Dirac, and Maxwell-Boltzmann statistics are reviewed and a comparison made of the three. There then follows a description of electrons in solids. The last two chapters introduce concepts and methods of calculations of entropy of monatomic and of diatomic gases. These chapters are superb teaching materials. For example, in discussing diatomic gases the author has sections on the electronic entropy, the spectroscopic entropy of HCl 35, the comparison of statistical and calorimetric entropy, among many others.

The author succeeds in setting forth the concept of entropy in theory as well as by means of numerous applications in technology. The format is excellent. There is a table of contents and a subject index. This is a highly commendable introductory treatise on special aspects of entropy.

The Nature of Scientific Thought. By Marshall Walker. 184 pp. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1933. Paperbound $2.25.

Reviewed by ***H. H. Bolotin****, Physics Department, Argonne National Laboratory, Argonne, Illinois.*

In the last decade or so, titles similar to that of this volume, have led to various treatments which, for the most part, are largely vacuous and fall short of their mark. Marshall Walker has produced a book which is a welcome departure. This book introduces modern concepts and principles which underlie and govern scientific thought and methods. The definition, concept, and use of *models*, the *hypothetico-deductive* process, *potentials*, *quanta*, and many other past and contemporary scientific concepts are presented in a way that is designed to lead the layman reader to a basic understanding of the foundations upon which scientific thought and the scientific process are built. This is accomplished in an extremely lucid manner which is by no means trivial, dull, dry, or humorless. The treatise is flooded with illuminating examples. However, the arguments, definitions, and expositions are not designed merely to obtain an assenting nod from the reader. The author presents a definite point of view which, at times, may clash with one's own; but it is extremely difficult to find a quick and ready counter-argument that justifies dismissal of his thesis or treatment. The book is highly informative, stimulating, and challenging.

To the layman, it is a challenge to expend the effort and thought that few books with similar titles demand. The effort necessary is not mere perseverance; rather it is associated with the exploration of unfamiliar concepts and arguments. In fact, it would take a serious and dedicated layman to feed upon and digest the concepts and contents, although there is nothing presented which is ostensibly beyond his ken. To the scientist, it may be a challenge to his own point of view, and to his personal conception of the interpretations of the subject matter. The author's treatise is more than ample in scope and content to provide a rewarding experience to both the layman and to the professional practitioner of any of the scientific disciplines. This is *not* a book on the history of science. It *is* a lucid and meaningful exposition of scientific thought and processes as they exist.

The preface to this volume describes the attempt of the author to bridge the "gap" between the scientific and literary communities by presenting an explanation of science to the "general, educated reader" with "no previous knowledge of science or mathematics". In this he succeeds admirably. In addition, he does not fall into the trap of assuming that this is accomplished by directing his book to the casual reader whose primary interest is effortless or entertaining reading. Again, quoting from the volume's pref-