sion-making tools. Methods are discussed in part 2; primary focus is on the simulation of a typical system (the Clearwater River, Idaho) on a digital computer, utilizing synthetic hydrologies derived statistically. Part 3 consists of one chapter (by Maass) on the role of the political process in system design. Realizing the complexity of the problem, the authors preface each part with a general nonmathematical statement; these chapters alone will give the nontechnical reader a good summary of the text.

Interesting material is here for engineers, economists, political scientists, and others concerned with the water problem. Each group will find that some part of the text is written in familiar terms and that other portions will need a second reading. The authors admit the book does not present the final solution to the problems of water-resource design. Emphasis is on the methodology of analysis, and the limitations of various methods and models are freely discussed. It is assumed that the necessary input data are known, but many readers will realize that this assumption is far from valid. It is interesting to note that the difference in net benefits for the test basin, as determined by a rather elaborate machine simulation program and by a conventional manual analysis, is only approximately 10 percent. This suggests that, although the manual methods currently used are certainly subject to improvement, they are not really so bad after all. Much larger errors could conceivably result from improper measurement of the inputs.

The book is well written and shows evidence of careful coordination between chapters. A mathematical approach is used throughout, but there is liberal use of graphic presentation for those who find the mathematics difficult. Engineers may be amused by the rather elaborate discussion of the Rippl or mass diagram which they have utilized for years, and some readers may wonder about the need for the elaborate discussion of the test basin in chapter 7.

The book will certainly be the subject of considerable discussion and almost certainly many points will be challenged; but it is a good beginning that should stimulate useful discussion and further research both within the universities and among practicing engineers.

RAY K. LINSLEY
Department of Civil Engineering, Stanford University

Finite Positive Entropy

The Third Law of Thermodynamics. John Wilks. Oxford University Press, New York, 1961. viii + 142 pp. Illus. $2.40.

Of this book the publishers say, "Although primarily intended to give a comprehensive survey of the Third Law the book should be suitable for undergraduate reading for an Honor School. It therefore includes a treatment of such elementary statistical mechanics as are necessary for an understanding of the Law." In the preface the author writes, "Nernst originally put forward the Heat Theorem which was to become the Third Law in order to predict the equilibrium conditions of chemical reactions. . . . I have attempted to cover all the significant aspects of the Third Law in a manner intelligible to an Honors undergraduate, and have therefore included a treatment of such elementary statistical mechanics as are necessary for an understanding of the Law." He should be congratulated on his evident success. For those not familiar with the required syllabus for the Honors degree in English universities, it should be mentioned that the syllabus, while slowly changing, is somewhat rigid and that it corresponds roughly to what is required for the master's degree in a good American university.

To some chemists the author's statement in the preface about the status of the Heat Theorem in relation to the Third Law will certainly be provocative. Those of us who were educated at the University of California when the late Gilbert Newton Lewis used to preside over countless seminars will remember that the Nernst heat theorem was not held in quite the same awe that it is at Oxford.

There are a number of chemists who feel that the third law of thermodynamics is a consequence of statistical mechanics and the uncertainty principle, as soon as one accepts the second law as established and deduces therefrom the rules of statistical mechanics—for example, equation 6.1 on page 71, for the situation at absolute zero, reduces to $W = g$.

This is exactly the condition for the entropy of such a system at the absolute zero. It is not zero but $R \ln g$.

This point has been discussed by Linus Pauling and by the late E. D. Eastman [*J. Chem. Phys.* **4**, 393 (1936)]. Then on page 8 there is the following statement: "Hence the procedure adopted previously is no use for indistinguishable particles, and in general more powerful techniques outside the scope of this book have to be employed, principally the method of ensembles developed by Gibbs. . . ." In view of the publisher's claim concerning the comprehensive nature of the book, this is a strange statement indeed.

I recommend the book, enthusiastically to those who wish to get a feeling for the variety of physical facts dependent on the third law of thermodynamics. I cannot recommend it as a comprehensive survey for those seriously interested in the subject. It is ideal for university students studying the subject for the first time.

J. G. ASTON
Department of Chemistry, Pennsylvania State University

A Rich Lode

Medical Teaching in Western Civilization. William B. Wartman. Year Book Medical Publishers, Chicago, Ill., 1961. 307 pp. Illus. $7.50.

This admirable anthology, which ranges from Hippocrates to Atchley, has been brought together with perceptiveness and skill by an academician who has a feeling for the sweep of history and a willingness to allow men to speak for themselves. Only in rare transitional paragraphs, which provide both perspective and continuity, does Wartman insert himself. For the rest, the words are those of the great teachers he has selected, as they (or their proxies) describe their purposes and their practices in helping others to become physicians. The book is not designed to be complete, nor to provide a precise evolutionary account of medical education. It is instead a book of men and their works.

Inevitably the choice of material from the classical period and the Dark Ages is limited, but the selected accounts of Greek and Alexandrian teaching, of the appalling irresponsibility in Rome, of the inflexible dogma in the Middle Ages convey vividly the nature of the teaching in those times. With the Renaissance the pace quickens and the words of Vesalius, Boerhaave, Frank, and Sydenham set forth clearly and colorfully the values of the age as well as their methods of instruction.

Most of the volume, however, is devoted to more recent time. In this part, which begins with a charming and informative address by Richard Bright, passes to the profound and visionary ideas of Billroth, and on through Pepper and Welch and Osler to the present day, the minds of thoughtful teachers are paraded to edify those of us who are too confident that we have found something new. American readers will be particularly grateful that a lengthy excerpt from John Morgan's "Discourse upon the institution of medical schools in America" has been included.

By gathering together these documents and the accompanying biographic concordance, Wartman has done a particular service for medical teachers who seek some rule against which to measure themselves, but it is surely not they alone who will find in this small volume a rich lode.

GEORGE E. MILLER
College of Medicine,
University of Illinois, Chicago

Myth, Obsession, Quarry?

Abominable Snowmen: Legend Come to Life. Ivan T. Sanderson. Chilton, Philadelphia, Pa., 1961. xviii + 525 pp. Illus. $7.50.

This is an amazing book. The author, a well-known naturalist, is convinced that there are four types of "Abominable Snowmen" living today, spread out over five continents. These are (i) "sub-humans" (found in East Eurasia and the Orient) of "standard man size," at least some of which may be Neanderthalers; (ii) "proto-pigmies" (inhabiting the Orient, Africa, and possibly Central and Northwest South America), smaller than the average man; (iii) "neo-giants" (occurring in Indo-China, East Eurasia, North America, and South America), taller than the average man by at least a foot or two; and (iv) "sub-hominids" (confined to South Central Eurasia), "in every way the least human," including the original Abominable Snowman, the much-discussed and disputed *Meh-Teh* of the Himalayas.

Unfortunately, the author's concept of what constitutes scientific evidence will scarcely be accepted by most scientists. His standards are unbelievably low. Indeed, his entire argument is based upon two types of evidence, namely, footprints and reports (many of which are obviously of questionable reliability). To these may be added some hand skeletons of doubtful provenance and supposed snowmen scalps which, it has been shown, come from the skin of the serow, a goatlike animal.

It would be foolish, and quite unscientific, to state categorically that creatures of the sort described in this book simply cannot exist. But the burden of proof rests not, as Sanderson obviously believes, on the shoulders of those who do not accept the current "evidence" of their existence. It rests upon the shoulders of those who affirm their existence. And the evidence which Sanderson presents is anything but convincing.

The author evidently is so firm in his belief that he passionately lashes out against those who do not go along with him. He has no use for those whom he terms "experts" or, apparently, for most fellow zoologists. For him, "Most of the skeptics are crackpots, yakking away in a vacuum of make-believe." Indeed, Sanderson gives the distinct impression that he feels there is a sort of conspiracy among zoologists against the chosen few who *know* that Abominable Snowmen are real creatures, not figments. But he believes that the "skeptics" have finally had to give way "to intelligent appraisal by honest men."

I wish that I could at least recommend this book as good, interesting reading. However, although it is written in a rather breezy, journalistic style, I have found it tediously repetitive and long-winded.

As I have already indicated, it is possible that some of Sanderson's "Abominable Snowmen" may actually exist. But valid proof of their existence is not to be found in this book.

WILLIAM L. STRAUS, JR.
Department of Anatomy,
Johns Hopkins University

A New Routine Tool?

Direct Methods in Crystallography. M. M. Woolfson. Oxford University Press, New York, 1961. viii + 144 pp. Illus. 30s.

Crystallography, or, more exactly, the method of crystal structure determination by x-rays, depends on Fourier transforms to obtain a picture of the atoms and molecules from the intensities of scattered radiation. However, as the information about the *phase* of the scattered waves is lost, the method is by no means straightforward, resembling the solution of a huge crossword puzzle. Until recently, the solution of a structure remained an art or intellectual exercise rather than a routine. Various more or less indirect methods have been developed to solve this *phase problem.* They are those of trial and error, the Patterson function, the heavy atom, isomorphous replacement, anomalous scattering, and the like. Direct methods aim at a general solution by a sequence of steps in which any decisions are of purely mathematical nature. They thus threaten to turn x-ray crystallography into another routine tool, such as the microscope. Whether this is a good or a bad thing is left to the reader to decide.

Woolfson's book describes all that is known about direct methods, developed by a handful of devoted avant-garde, up to about 1961. However, as frankly stated in the preface, this monograph is not recommended for the stranger or the comparative newcomer to the field; indeed, a more unsuitable avenue of approach to the subject of crystallography could hardly be imagined. However, to the seasoned crystallographer anxious to add to his armory for solving crystal structures, direct methods have much to offer.

The first part of the book treats simpler direct methods which may be applied by hand. The value of the book is greatly enhanced by many examples of solution of actual structures. In the second part, more advanced methods are discussed, which are suitable for electronic computers, with which Woolfson has had ample experience. Estimates are made of the future potentialities of the direct methods. Detailed derivations of a number of results are given in the appendices. The book discusses Harker-Kasper inequalities, Sayre's sign relationships, the treatment by Cochran and Zachariasen, the Hauptman and Karle method and Cochran and Douglas multisolution procedure, programmed for EDSAC and modified by Vand and Pepinsky for hand calculation. Multisolution methods require additional criteria to select the right solution, such as the upper and lower bound method of Vand and Pepinsky, the zero-check of Cochran and Douglas, and the Z-test of Woolfson.

Direct methods can now solve (not always) not too complex crystal structures. However, progress is rapid and it is hoped that, thanks to computers,