tion 4, "The growing field" (about 150 pages), contains nine contributions. Of particular interest is W. L. Bragg's comparatively short account of the early days of x-ray diffraction. Section 5 contains biographies of 12 of the pioneers in x-ray diffraction. Noteworthy is the first one—Max von Laue's "Autobiography," which was written some years ago.

Section 6, "Schools and regional development," contains accounts of the development of crystallography in Great Britain, France, the United States, Germany, the Netherlands, Scandinavia, Japan, and the Soviet Union. Section 7, "Personal reminiscences," contains contributions from some 35 early leaders in the field. These are of mixed interest; some are very formal but some are delightful, intimate accounts of the early days of crystallography. Section 8, "The consolidation of the new crystallography," is essentially historical and brings the account up to date.

So much for a formal list of the contents of this most important book—and important it undoubtedly is. In the introduction Ewald indicates that he hopes the book will be of service to future historians of science. From this point of view the volume is a tremendous accomplishment, for this is probably the only account of the first half century of a science which has been so thoroughly documented during the lifetime of the individuals whose work is described. However, some questions can be raised: How reliable is the information contained in the volume? Will this book interest scientists other than crystallographers and historians? To the first question, I can say that most of the information seems to be reliable and accurate, but there are some errors and some omissions. Thus (p. 8) reference is made to the wonderful work of Bäcklin who, by measuring the diffraction of x-rays by gratings, was able to revise the value for the charge of the electron. The date given is 1935, but Bäcklin's thesis at Uppsala was published in 1928. The history of the phase problem is mentioned in nine different places, but nowhere is the pioneer work of Ott and Avrami mentioned, although Ott's work was done in 1927 and Avrami's in 1938; Banerjee's contribution, dated 1933, is mentioned in one place only—in the historical account of x-ray crystallography in India which Banerjee himself wrote. Chapter 13, "Problems of biochemical structures" by Ralph W. G. Wyckoff, is certainly most incomplete. From this chapter one would never learn that important research has been done on such materials as starch, viruses, and vitamin B_{12}.

In the section on schools and regional development, 56 pages are devoted to Great Britain, 16 to the United States, and only 5 to the U.S.S.R. Despite the great importance of the English schools, a more even coverage is surely indicated. A name index of the volume would have been most welcome, for so much of the text is tied closely to the individual scientists concerned. Ewald indicates that he hopes to issue a revised edition and would welcome criticism, corrections, and the like. (Such comments should be sent to him at 19 Fordyce Road, New Milford, Conn.)

The second question, whether noncrystallographers will find this book of interest, is one that I cannot answer. I find it a fascinating book, and I hope noncrystallographers will have a similar reaction.

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Contrasting Points of View

Introduction to Theoretical Physical Chemistry. Sidney Golden. Addison-Wesley, Reading, Mass., 1961. xi + 307 pp. $9.75.

Dynamic Physical Chemistry. John Rose. Wiley, New York, 1962. xii + 1218 pp. Illus. $12.50.

Two very different approaches to physical chemistry are presented by the authors of the books reviewed here.

In *Introduction to Theoretical Physical Chemistry*, Sidney Golden has furnished a graduate text dealing with the development of the fundamental theory underlying thermodynamics, statistical mechanics, and quantum mechanics, together with the interrelationships that exist among them. As each of the major divisions is covered in about 100 pages of text, a considerable body of material usually included in treatises on the individual disciplines is here omitted. This condensation is accomplished by holding historical material to a minimum, by giving very little physical interpretation and no numerical examples, and by committing the detailed proofs of many of the equations to exercises at the ends of chapters. There is not a single figure in the entire book, and there are no specific references to the original literature. Each chapter concludes with a helpful summary containing an excellent statement of the logic underlying the presentation.

The author's technique of presenting much of the fundamental material in a postulatory and sometimes cursory manner results in the overuse of the phrases "it should be apparent that . . . ," "clearly . . . ," and "it is evident that . . . ." The student who is not able to leap ahead with the author's admirable facility will soon feel that much of the rigor he expects of a theoretical discipline is lacking. Nor is the author's writing always clear and lucid. For example, he defines a replica in the following terms: "Each replica is such in a precise and formal sense: they all have identical mechanical descriptions, but the values of the mechanical properties may vary from one replica to another." It will be difficult for the uninitiated to determine the author's intent from such an apparently contradictory statement.

It is not easy to determine the audience for which this book should be recommended. The few students that approach the subject of theoretical physical chemistry with considerable mathematical background and facility and with the ability to fill in adequately the lacunae in Golden's sophisticated but precipitate development are also likely to desire the greater comprehensiveness found in a number of existing books on the separate subjects. The book is certainly not for those students who desire a step-by-step treatment of the evolution of the material together with a close coupling of the theory with physical situations.

Dynamic Physical Chemistry, by John Rose, is a comprehensive single-volume "textbook on thermodynamics, equilibria and kinetics." Each of the subjects is developed from certain primary assumptions and experimental or theoretical relationships. In most cases a large number of examples are then presented and used ably for illustration. Within each area the author has included an impressive range and variety of individual topics. For the specific examples presented, numerous references to the original literature are given; others are notably absent. There are no problems or exercises for the student, although some numerical examples are worked out in the text.

Many helpful figures are included, although some—especially in the chapters on phase equilibria—are too crowded, too small, and somewhat crudely drawn. The usefulness of this book as a reference source would be considerably enhanced by including a list of monographs on specialized topics.

Despite the author's attempt to be comprehensive within the bounds of a single volume, there is an unfortunate lack of balance in the overall treatment. The extensive coverage (two chapters) of phase equilibria, including consideration of five- and six-component systems, hardly seems justified when only half as much space is allotted (one chapter at the end of the book) to quantum mechanics, atomic and molecular structure and spectra, and theories of chemical bonding. Many chemists will be disappointed by the author's decision to omit any meaningful discussion of the kinetic theory of gases, the structure of liquids and solids, vibrational and rotational spectra of molecules, electric and magnetic properties of matter, and nuclear reactions. As a consequence some sections—especially those on statistical thermodynamics, theories of reaction rates, and photochemistry—are developed without adequate foundation. Furthermore, in many sections the author uses a descriptive rather than an analytical approach to the principles underlying a particular discipline. The reader will all too often find himself asking the question: "Why is this statement true?" And he will be disappointed by the author's failure to furnish him sufficient explanation.

The book is carefully prepared technically and is largely free of typographical errors. Several unfortunate misstatements appear in the text. In the discussion of the Simon formulation of the Third Law, the observation that "the temperature coefficient of the melting pressure approaches zero at the seventh power (of temperature), so that from 1°K downwards it is practically temperature independent" is based on a mathematics with which I am not familiar.

The usefulness of this book as a general text or reference in physical chemistry will depend strongly on the reader's particular orientation and interests. Many will find that the extent and nature of the material omitted and the abbreviated, qualitative treatments of many theoretical topics will limit its claim to their attention. Within the areas of emphasis, however, the great variety of useful information and the inclusion of many subjects normally treated only in specialized monographs will make it attractive as an authoritative single-volume work.

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Surviving Our Technology

Preventing World War III. Some proposals. Quincy Wright, William M. Evans, and Morton Deutsch, Eds. Simon and Schuster, New York, 1962. 460 pp. $6.95.

The tensions of our times find reflection in the outpouring of recent literature concerned with the problems of peace. Much of this literature has dealt with control of the spiraling arms competition, and much of that has concentrated on the relationship between arms control measures and strategic considerations. However, dissatisfaction with the risks and the costs of mutual deterrence has generated a new freshet of works concerned with the broader problems of peace. These works deal primarily with what might be called the social context of peace, or the contributions that social scientists can make to peace.

This volume belongs in the latter category. Under three headings—Stopping the Arms Race; Reducing International Tensions; and Building a World Society—are grouped 26 specific proposals for reducing international tensions, contributed mainly by spokesmen for the social sciences and humanities. The three editors, Quincy Wright, William M. Evans, and Morton Deutsch, prepared general essays to be incorporated in an epilogue. As symposia go, this one has more than the usual consistency, although to achieve the fairly uniform standard, it was necessary to include five essays previously published elsewhere and a number of others that are repetitive of the well-known views of their authors. The theme is aptly stated by one contributor who wrote: "The problem is to so arrange our affairs that our species can survive its technology." And later he added: "Science appears to have got us into a fix from which science offers us no way out."

Part 1, edited by Morton Deutsch, deals with the arms race. It eschews the by now familiar analysis focusing on stable deterrence, limited arms reductions, and physical inspection techniques. On the assumption that physical inspection of arms agreements cannot be adequate, the essays by Lewis C. Bohn, Seymour Melman, and Ralph W. Gerard, either in whole or in part, treat "non-physical" techniques, including what is referred to as "psychological" or "knowledge" inspection. In addition, there are essays by Karl W. Deutsch, Robert Gomer, and Herbert C. Kelman on what might loosely be termed conditions for effective disarmament. T. C. Schelling's well-known essay, "A special surveillance force," is reprinted here. This section includes a striking essay by a Norwegian philosopher, Arne Naesse, "Non-military defense," which focuses on the values involved in defense from the standpoint of a national of a small country caught in a world of major force. Emile Benoit's essay on the economic implications of disarmament concludes this part.

The second part, edited by William M. Evans, is concerned with reducing international tension. It includes essays by Charles E. Osgood, Erich Fromm, and David Daiches advocating various unilateral measures to reduce international tensions. Jerome Frank gives a perceptive social psychologist's analysis of the problems that nonviolent resistance poses for human nature. Amitai Etzioni and Anatol Rapoport offer imaginative essays on handling international disputes. David Riesman's satire, "The nylon war," is reproduced. Bertrand Russell and C. West Churchman also contribute papers. The section ends with an interesting essay by G. I. Pokrovsky (Zhukovskii Engineering Academy, Moscow) advocating common international efforts to exploit advancing technology for the world's good. He cites as one example the possibility of cooperative international weather forecasting, a field in which work is going forward under the auspices of agencies in the United Nations family.

Part 3, edited by Quincy Wright, is concerned with the long-term construction of a world society. It begins with an essay by Ivan Supek (University of Zagreb) which may be of special interest to readers of *Science*, because it emphasizes universal science as a basis for international cooperation. Zellig S. Harris offers a modest appraisal of the potential contribution of an "international auxiliary lan-