States, and Canada and sometimes Switzerland and Austria, but excluding Spain, Portugal, and Greece. The main focus is on the rate of growth of these economies, especially since World War II, with some attempt at explanation as to why they have had different rates of growth. The overall conclusion is not surprising, that investment promotes growth and that governments can promote investment if they do it wisely.

One is tempted to make a kind of Ripley's "Believe It or Not" out of a lot of the information gathered here. Did you know, for instance, that Sweden had the highest rate of growth of output per head from 1870 to 1913, and that Canada had the lowest from 1950 to 1960, with the United States coming in second to last? Did you know, for instance, that if we measure welfare-stateism by the percentage of the gross national product in transfers, Germany is at the top and the United Kingdom almost at the bottom, beaten only in "un-welfare" by Norway and the United States? Did you know, for instance, that the fastest growing countries had the lowest price increases, or that the big countries no longer dominate the small ones? One could go on at some length. It would be interesting to have a follow-up study investigating the generally held images of these economies and contrasting these images with what might be called the statistical images. There would be an astonishing divergence. The book brings out extremely well the backwardness of the economic policy of the United States and the enormous economic cost of economic conservatism. Maddison and the Twentieth Century Fund are to be congratulated on an illuminating and timely study.

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Trace Elements

The Biology of Trace Elements. Their role in nutrition. Karl H. Schutte. Lippincott, Philadelphia, 1964. xx + 228 pp. Illus. $8.

Trace elements have long been of interest to workers in many disciplines. Their role in biology has been studied variously by botanists, agronomists, veterinarians, nutritionists, physicians, biochemists, and, more recently, physical and inorganic chemists. It is clear that these elements are essential to the understanding of many biological processes, but the varied approaches employed by workers in many different disciplines render complex the task of assessing and interpreting the enormous amount of material now available.

In the not too distant past, discussion of the biological role of trace elements has been tainted with base and ignoble connotations, largely because much of the available information was qualitative, and speculation often substituted for fact. In some instances, this general area of interest served to advance the notions of faddists, and at times those of false prophets, who found their fondest wishes and ideas confirmed, occasionally by data of dubious validity and, at times, by no data at all. It requires a discriminating observer of this inhomogeneous scene to render the important service of integrating the material judged to be of lasting value, while critically evaluating lesser contributions. *The Biology of the Trace Elements* unfortunately does not accomplish this end and even falls short of the still more limited objectives that a writer in this field might be expected to set for himself.

The scope of this book is less broad than the title indicates. More important, there is little evidence of the requisite knowledge and understanding, of either the literature or the problems, to facilitate their appreciation by the uninitiated. Agronomy and botany provide most of the source material, but, again, the information presented is largely phenomenological. Pertinent work from other fields is enumerated in indiscriminate fashion, with little apparent effort to eliminate material that might be of dubious validity. Many speculative ideas formulated in the past are restated here without new documentation concerning their merit. The reader is left to his own devices to distinguish fact from fancy. Important segments of the literature are ignored completely, and, thus, the resulting errors of omission are too numerous to recite. The book, unfortunately, conveys an erroneous impression of the state and scope of the field by including much of what might best have been deleted, while neglecting a great deal of importance. Perhaps one quotation will transmit the flavor of much of the writing. Under the subheading "Psychological phenomena and trace elements" (p. 126) the following may be found:

"Organic illness, malnutrition, and excessive physical strain all result in psychological alterations in man and animals. Diet governs mental health to a considerable degree, so it is not surprising that *essential nutrients* should play some part in psychological processes, although this is seldom stressed. Yet trace elements are known to be involved in some very marked alterations of behaviour.

"In the chapter dealing with reproduction lack of copper, iodine, or manganese was shown to result in a pronounced decrease in sexual urge or libido, although in the iodine deficiency sperm formation was normal [14]. In female animals lack of oestrus does not imply inability to ovulate, at least in iodine-deficient cows or manganese-deficient sows, but the lack of interest in intercourse consequent upon deficiencies results in great economic loss to the farmer.

"Perhaps in this context the effect of high levels of iodine or manganese is of particular interest, as they result in symptoms among which nymphomania is very important [12, 117]. In thyrotoxicosis (Graves' Disease) of humans the high levels of thyroxine produced result in 'a type of woman who is volatile, lively and temperamental, and who, if the disease is not too far advanced, is usually distinctly attractive to the male' [11]."

It is hard to know what one will come across, but *The Biology of Trace Elements* turned out unexpectedly to contain a young man's guide to a successful Saturday night out.

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Analytical Chemistry

Steroid Chromatography. R. Neher. Translated from the German edition (1958) by R. H. Bathgate. Elsevier, New York, ed. 2, 1964. xiv + 389 pp. Illus. $11.

For a number of years Robert Neher, a well-known and outstanding contributor to the specialized field covered by this book, has concentrated on the large-scale application of chromatographic methods to industrial research and development. He has excelled in the design and construction of apparatus and laboratories suitable for this type of work, and his ideas

have found many applications in other types of laboratories. The steroids pose special problems to the analyst, and there is probably no class of substances in which chromatography has been of greater importance in securing the advances that have taken place during the last 30 years with respect to our knowledge of their chemistry, biochemistry, and biology. These problems are not completely dispelled by the use of chromatography, however, so many technical details are somewhat different from those encountered in other fields, or are of greater importance in the achievement of satisfactory results. However, workers in other fields will find this book useful because many of the practical details are potentially of great use in the general field of lipids, and some of them in other fields as well.

Neher has done an excellent job in fulfilling the aims expressed in the preface—to provide a full and reliable guide to the practical problems encountered in the chromatography of steroids, but to include only the minimum amount of theory required to support the practical recommendations given. The book also includes a valuable and complete account of the newer methods that have been applied successfully to the steroids (for example, gas-liquid and thin-layer chromatography), and it is notable for the many excellent figures and diagrams with which technical and practical details are conveyed. The thoroughness and completeness with which the literature has been surveyed will also contribute to its value as a reference work, which it will undoubtedly become. The practical instructions will make it extremely valuable to a variety of research workers: those already working on problems of steroid biochemistry as well as newcomers to the field who find that their work demands that they undertake the estimation or separation of steroids. Newcomers, however, would be well advised to seek expert guidance with respect to their choice of methods because the author, in being so thorough, tends to offer a surfeit of possibilities and sometimes errs on the generous side in not suggesting preferences. This is not a serious defect, however, and in most cases useful preferences are suggested.

There are also a considerable number of new details of techniques and interesting results of investigations of existing techniques with which experienced workers may not be familiar, features which will make the book especially interesting to those already working in the field. There are occasional slips in syntax and some abbreviated forms that jar, but on the whole, the book is well written, clear, and very readable. Neher's colleagues will find this volume most useful.

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Popular Astronomy

The Flammarion Book of Astronomy. Prepared under the direction of Gabrielle Camille Flammarion and André Danjon. Translated from the French edition (1955–60) by Annabel Pagel and Bernard Pagel. Simon and Schuster, New York, 1964. 670 pp. Illus. $19.95 until 25 Dec.; thereafter $22.95.

This enormous exposition of modern astronomy comes to us under a very strange banner indeed. The original version of Camille Flammarion's *Astronomie Populaire* appeared in 1880, the first of many successive editions by a man who was one of the 19th century's great engines of scientific popularization. Astronomy has advanced so far beyond Flammarion's time and so many hands have since revised the first edition, that one may question the wisdom of promoting this lavish volume in the name of it's original author. But then this is not quite the case either for, although the title page does not carry the name of an author, the reader is informed that the volume was prepared under the direction of Gabrielle Camille Flammarion, who, together with André Danjon, of the Paris Observatory, reedited the book.

Actually, there are eight subdivisions. The first four, on the earth, the moon, the sun, and the planets, were rewritten by Danjon, with the assistance of A. Dolfus, an expert on lunar and planetary physics, for part of the essay on the sun; the balance (on solar physics) was completed by R. Michard, director of solar research at the Centre National de Recherche Scientifique. Part 5, dealing with comets and meteors, is by F. Baldet of the Paris Observatory; part 6, on the sidereal universe, is by C. Fehrenbach, director of Marseilles Observatory; part 7, on the instruments of astronomy, is by A. Couder of the Paris Observatory; while the last part, on artificial satellites and space vehicles, brings back Danjon, with the assistance of P. Muller, another astronomer on the staff of the Paris Observatory. Finally, it has all been brought up-to-date and translated by Annabel Pagel and Bernard Pagel of the Royal Greenwich Observatory. The original Flammarion has surely disappeared beneath this sea of current effort. Would it not have been better to publish this volume under the names of so distinguished and so qualified a group of collaborators?

As a whole, this detailed, surprisingly complete essay on astronomy is well done. In it's geocentric discourse, the reader leaves the earth for the moon, sun, planets, and the study of the strays of the system—comets, meteors, and meteorites—before the great leap into the sidereal universe. A separate, but not unimportant, appendage is the last two "books," which are devoted to a discussion of astronomical instrumentation from telescopes to rockets and satellites. The illustrations are lavish and adequate enough for the expository task, and there are occasional ventures into the history of astronomy, but, for half the price, and in half the number of pages, Fred Hoyle's recent book (*Astronomy*, Doubleday, 1962) is more than double the value in every respect.

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Mathematics

Elements of General Topology. Sze-Tsen Hu. Holden-Day, San Francisco, 1964. x + 214 pp. Illus. $8.75.

Choose *Elements of General Topology*, by Sze-Tsen Hu, if you wish a top-notch, one-semester, rigorous, and up-to-date presentation of the topological foundation important to serious students of mathematics. The emphasis on, and the excellent choice and effective use of theorems on, mappings, commutative diagrams, and topological identification contribute to the unification and unique utility of this text. Another distinction is the first readily accessible and elementary treatment of CW-complexes (cellular polytopes, in chapter 4). Other recent results previously available only in the literature are incorporated naturally and simply, creating a spirit of freshness (for ex-