be associated in any stable manner with volume of investment, and that it is important to determine just what the relationship is.

No reasonable reader could expect Salter to cover everything important that is implied by the words "productivity and technical change." Salter does not ask why technical change occurs the way it does, or what determines the rate of saving, for example. Nor does he deal (except incidentally) with the questions of policy—regarding monopoly, capital markets, money, taxes, tariffs, patent laws, agriculture—that concern everyone who asks how economic growth may be accelerated. Salter's is a scientific work—an intelligent and workmanlike piece of scientific work—of the kind needed to put solid ground under policy to stimulate growth.

SOLOMON FABRICANT
New York University and
National Bureau of Economic Research

Pro and Contra Darlington

The Sounds of Language. An inquiry into the role of genetic factors in the development of sound systems. L. F. Brosnahan. Heffner, Cambridge, England, 1961. 250 pp. 25s.

Brosnahan writes well. He has a wide knowledge of linguistic, psychological, and genetic facts and the gift of clear presentation. He is fair in his presentation of other theories and modest in the claims he makes for his own. Nevertheless, I remain unconvinced of any solidity in his fundamental thesis: that inborn factors have an appreciable role in predisposing populations toward developing given types of sounds. The idea is that of the geneticist, C. D. Darlington; Brosnahan attempts to support it as a linguist.

As the author states it, the problem is "why any community of speakers should select, and indeed should be continually selecting certain articulations in preference to others" (page 7). His answer is that over long periods of time there is a tendency to move toward the sounds which are easier to produce and that these are different for each human group, depending on hereditary physiology. The matter seems to be exaggerated. The structure of the mouth and throat and the capacity to hear sounds are sufficiently developed in all humans, with rare individual and no racial exceptions, to handle all sounds used in all the languages of the world. The minor differences can hardly explain the phonetic changes which have occurred in languages. For example, what could have happened to the mouths of the forerunners of the historic Greeks to cause them to change *s* to *h*? Whatever caused this, why did it subsequently permit the Attic Greeks to bring into use new instances of *s* as a replacement for *t* before the vowel *i*? And what did the ancient pre-Greeks have in common with other human groups in scattered parts of the world, which at one time or another made the same transformation of the sibilant?

To carry conviction for this thesis, Brosnahan would have to show sound changes in relation to specific physiological characteristics of the speaking organs, but he deals rather with blood factors. Thus, he presents an apparent correlation between the geographic distribution of the O-factor in the blood and the development of dental fricatives (*th*-sounds) in Europe. Since the blood does not directly participate in the production of sounds, one would have to find some indirect link between the two facts, and this link need not be physiological as such. The development was certainly related to the movement and the influence of Germanic peoples and languages and to the effect upon these of contact with Slavic and other groups. Thus phonetics and blood show a correlation only because both reflect the distribution, movement, and mixing of historic peoples and not for any causal relation between genes and speech sounds.

A few considerations can be mentioned to support the explanation which I have given here and which is opposed to that of Darlington and Brosnahan. First of all, it should be emphasized that the correlation claimed by Darlington and Brosnahan is positive but not closely so. Furthermore, there are evidently other linguistic features with a more or less similar correlation to O-blood in Europe, for example the use of the definite and indefinite articles in Germanic and neighboring languages and the absence of these articles in Slavic and other Eastern languages. Obviously differences in the patterns of word combination cannot be explained by genes, and especially not by the same genes as those supposed to account for phonetic differences. And finally, the changes discussed by Brosnahan are found in other parts of the world, where there is no connection with O-blood.

In only one place does Brosnahan seem to deal with phonetic changes that may be physiologically induced, and that is when he speaks of Chatterji's observation of a tendency toward the fronting of sounds during recent millennia. Conceivably this is related to change tendencies which occurred during the skull's development from long-headedness to round-headedness, changes which were accompanied by reduction of the length of the palate, thereby giving less contrast to the position of back and front consonants; this could favor the elimination of certain phonetic contrasts, which would then need to be replaced by new ones. Yet, even here, the evidence is far from unmistakable. Perhaps the capacity to distinguish sounds has advanced along with changes in the cranium. At any rate there are round-headed populations whose language differentiates more front-back sound types than other, long-headed ones. Any firm conclusion on an interrelationship will have to be based on much careful study.

MORRIS SWADESH
Universidad Nacional Autonoma de Mexico

Structure Analysis

X-Ray Analysis of Organic Structures. S. C. Nyburg, Academic Press, New York, 1961. xii + 434 pp. Illus. $13.

Organic chemists and biochemists who wish to deepen their understanding of the techniques of x-ray structure analysis and the results of its application to organic systems will find here a book tuned to their needs. The author's aim is to provide a foundation, "with the minimum of formal mathematics . . .," on the basis of which the reader will be able "to assess the reliability of the published results [and] appreciate fully the powers and limitations of the method."

The book is divided into two main parts. In the first, comprising a little over one-third of the book, the x-ray diffraction method of structural analysis is developed. The discussion ranges from experimental techniques (chapter 1) through crystal and molecular symmetry (chapters 2 and 3) to Fourier analysis (chapter 5) and the problems of accuracy of structure determinations

(chapter 6). The coverage is comprehensive and the treatment is in general clear. Although the discussion is quite terse in several instances, it will repay the efforts of the initiate.

The second part of the book is devoted to a discussion of crystalline organic structures, ranging from compounds of low molecular weight (chapter 7, 661 references) to crystalline and fibrous macromolecular substances (chapters 7 and 8). The survey is intended to be comprehensive up to the end of June 1958, and in some cases to June 1959. Many useful figures which represent the stereochemistry and dimensions of organic molecules are included. A section summarizes the information on bond lengths in organic molecules. In some cases the discussion of structures is somewhat superficial, but this is perhaps understandable in view of the large amount of material covered.

This book arrives at an opportune time. The technique of x-ray structure analysis of large and complex organic molecules is beginning to emerge as one of the more important methods of unraveling their architecture. For those in this field who are concerned with structural and related problems, this book should provide a good introduction to the x-ray diffraction method and a useful reference to the work which has been done.

S. KRIMM

Department of Physics, University of Michigan

Practical Aid

Scientific Russian Guide. Handbook for students and professionals interested in scientific Russian. Mary A. Emery and Serge A. Emery. McGraw-Hill, New York, 1961. 191 pp. $4.50.

This manual offers elementary science readings for students who have completed approximately a year of Russian language at the college level. There are 40 readings of about 200 to 300 words each: 15 biographies of famous Russian scientists and inventors, 12 selections on various topics in mathematics and physics, 9 abstracts from Soviet journals, and 4 selections that contain some interesting predictions. All but the last four readings are accompanied by a few questions in Russian and by an extensive on-the-spot word list with idiomatic, and generally good, translations.

Appendix materials, which will be useful to some, include expressions often encountered in scientific texts, translations of isolated phrases and clauses lifted from contemporary technical texts, a list of chemical elements, and the equivalents of weights and measures. The end vocabulary is adequate for most of the book, though the authors have not succeeded (despite their claim) in including "all the words used in this textbook." This is especially true of the last four readings.

In general, the readings are related to applied physics, with some attention paid to chemistry and mathematics. Aside from material in the biographies, little, if any, attention is given to biology (and medicine), astronomy, or geology.

All in all, this is an excellent, practical textbook which students at the mentioned level should find helpful.

NORMAN HENLEY

Johns Hopkins University

Reprints

Animal Ecology. W. H. Dowdeswell. Harper, New York, 1961. 223 pp. Illus. $1.50.

Cell and Psyche. The biology of purpose. Edmund W. Sinnott. Harper, New York, 1961. 119 pp. $0.95.

Darwin's Finches. An essay on the general biological theory of evolution. David Lack. Harper, New York, 1961. 214 pp. Illus. + plates. $1.40.

The Evolution of Human Nature. C. Judson Herrick. Harper, New York, 1961. 510 pp. Illus. $2.45.

A First Course in Mathematical Statistics. C. E. Weatherburn. Cambridge Univ. Press, London, 1961. 292 pp. Illus. $2.75.

A Guide to Earth History. Richard Carrington. New American Library, New York, 1961. 284 pp. Plates. $0.75.

The History of Calculus and Its Conceptual Development. Carl B. Boyer. Dover, New York, 1949. 346 pp. Illus. $2.

How to Know the American Marine Shells. H. Tucker Abbott. New American Library, New York, 1961. 222 pp. Plates. $0.75.

Life of the Past. An introduction to paleontology. George Gaylord Simpson. Yale Univ. Press, New Haven, Conn., 1961. 210 pp. Illus. $1.45.

The Molds and Man. An introduction to the fungi. Clyde M. Christensen. Univ. of Minnesota Press, Minneapolis, 1961. 246 pp. Illus. + plates. $1.75.

The Methods of Plane Projective Geometry Based on the Use of General Homogeneous Coordinates. E. A. Maxwell. Cambridge Univ. Press, London, 1961. 249 pp. $1.95.

New Lives for Old. Margaret Mead. New American Library, New York, 1961. 475 pp. Plates. $0.75.

Science and Music. Sir James Jeans. Cambridge Univ. Press, London, 1961. 258 pp. Illus. + plates. $1.95.

A Short Account of the History of Mathematics. W. W. Rouse Ball. Dover, New York, 1960. 546 pp. Illus. $2.

The Social Insects. O. W. Richards. Harper, New York, 1961. 232 pp. Illus. $1.50.

Unresting Cells. R. W. Gerard. Harper, New York, 1961. 447 pp. Illus. $2.25.

New Books

Biological and Medical Sciences

Fluorosis. The health aspects of fluorine compounds. Edward J. Largent. Ohio State Univ. Press, Columbus, 1961. 160 pp. Illus. $3.50.

General Biology. William T. Taylor and Richard J. Weber. Van Nostrand, Princeton, N.J., 1961. 955 pp. Illus.

Genetic Aspects of Dairy Cattle Breeding. Ivar Johansson. Univ. of Illinois Press, Urbana, 1961. 271 pp. Illus. $7.50.

The Human Cerebellum. An atlas of gross topography in serial sections. Jay B. Angevine, Jr., Elliott L. Mancall, and Paul I. Yakovlev. Little, Brown, Boston, Mass., 1961. 147 pp. Illus. $15.

Human Psychological Development. Elizabeth Lee Vincent and Phyllis C. Martin. Ronald, New York, 1961. 527 pp. Illus. $6.50.

Illustrating Medicine and Surgery. Margaret C. McLarty. Williams and Wilkins, Baltimore, Md., 1960. 167 pp. Illus. $8.50.

Immunopathologie in Klinik und Forschung. Und das Problem der Autoantikörper. P. Meischer and K. O. Vorlaender, Eds. Thieme, Stuttgart, Germany, 1961. 710 pp. Illus. $22.50.

Integrated Principles of Zoology. Cleveland P. Hickman. Mosby, St. Louis, Mo., 1961. 972 pp. Illus. $7.75.

Lichen Handbook. A guide to the lichens of eastern North America. Mason E. Hale, Jr. Smithsonian Institution, Washington, D.C., 1961. 188 pp. Illus.

Microbiology. Phillip L. Carpenter. Saunders, Philadelphia, Pa., 1961. 448 pp. Illus.

Milk: The Mammary Gland and its Secretion. vols. 1 and 2. S. K. Kon and A. T. Cowie, Eds. Academic Press, New York, 1961. Illus. vol. 1, 528 pp., $14. vol. 2, 432 pp., $12.

Monograph of Monochaetia and Pestalotia. Emil Frederick Guba. Harvard Univ. Press, Cambridge, Mass., 1961. 349 pp. Illus. $10.

Physiologie Vegetale. R. Bastin. Université Catholique de Louvain, Louvain, Belgium, 1961. 324 pp.

Problems of Infection, Immunity and Allergy in Acute Radiation Diseases. N. N. Klemparskaya, O. G. Alekseyeva, R. V. Petrov, and V. F. Sosova. Translated from the Russian by Lydia Venters. R. Clarke, Ed. Pergamon, New York, 1961. 173 pp. Illus. $7.50.

Progress in Medical Genetics. vol. 1. Arthur G. Steinberg, Ed. Grune and Stratton, New York, 1961. 349 pp. Illus.

The Science of Genetics. Charlotte Auerbach. Harper, New York, 1961. 283 pp. Illus. $5.95.

Studies on Quantitative Radiation Biology. K. G. Zimmer. Oliver and Boyd, London, England, 1961. 121 pp. 15s.