nyms appear (such as "underground, subterranean, subterraneous, below-ground, subsurface . . ."). Typographical errors and misspellings are infrequent and usually unimportant. The book fills a definite need.

THOMAS E. HUGHES
Library of Congress

The United Kingdom Contribution to the International Geophysical Year, 1957–58. The Royal Society, London, 1957. 72 pp. Illus. 10s.

In this official publication a number of interesting and informative facts about the United Kingdom program for the International Geophysical Year are outlined.

Following a brief historical introduction, the participating individuals and institutions in the United Kingdom and the Colonies are listed, and their varied functions are described. The official IGY Calendar, indicating the Regular World Days and the World Meteorological Intervals during the IGY, is reproduced. A comprehensive list of the stations participating directly or indirectly is given, and the distribution of these stations is mapped.

A useful list of the membership of the principal subcommittees of the British National Committee is included.

The Effect of Exposure to the Atomic Bombs on Pregnancy Termination in Hiroshima and Nagasaki. Publication No. 461. J. V. Neel and W. J. Schull. Atomic Bomb Casualty Commission, National Academy of Sciences–National Research Council, Washington, D.C., 1956. 241 pp. Illus. $2.

A little over 12 years have passed since the atomic bombs were dropped on Hiroshima and Nagasaki, and many reports have been issued on various aspects of their effects. Some, like the present one, have attempted to elicit basic information which could help man cope with the new technology rather than help him find better ways to destroy himself. As Americans we can take some consolation from the existence of the former reports and from the knowledge that they have been supported by our Government.

In the authors' words, "The present monograph is designed as a detailed report on certain efforts made during the period 1946–1955 to provide answers to the following two questions: 1. Can there be observed, during the first year of life, any differences between the children born to parents, one or both of whom were exposed to the effects of atomic bombing of Hiroshima and Nagasaki, and the children born to suitable control parents, and 2. If differences do exist, how are these to be interpreted?"

The study was undertaken on the recommendation of an *ad hoc* genetics conference convened by the National Research Council in the summer of 1947. This conference, after recommending that the study be undertaken, made the following statement: "Although there is every reason to infer that genetic effects can be produced and have been produced in man by atomic radiation, nevertheless the conference wishes to make it clear that it cannot guarantee significant results from this or any other study on the Japanese material. In contrast to laboratory data, this material is too much influenced by extraneous variables and too little adapted to disclosing genetic effects. In spite of these facts, the conference feels that this unique possibility for demonstrating genetic effects caused by atomic radiation should not be lost."

The research was actively initiated in March 1948 and was ended in February 1954. The first children to come under the scrutiny of the program were conceived in October 1947, 2 years after the bombs were dropped.

The members of the *ad hoc* committee were not exaggerating when they emphasized the importance of extraneous variables in this population. The reader cannot help but be greatly impressed by the diligence and ingenuity of the authors and their collaborators in overcoming the many complications which confronted them. Nor can the reader fail to be impressed by the generous cooperation of the Japanese victims of the bomb—midwives, physicians, clerks, and many others in the cities of Hiroshima and Nagasaki.

The first six chapters are a detailed and lucid account of the background, the plan, a comparison of Hiroshima and Nagasaki, the criteria of radiation employed in the study, the comparability of irradiation subclasses, and the statistical methods employed in the study.

The amount of radiation received by exposed individuals was estimated as a function of the distance of the individual from the hypocenter of the bomb and of the amount of shielding the individual reported he had had. Each individual was placed in one of five classes: (i) those not exposed to the bomb; (ii), (iii), and (iv), those who were successively closer to the hypocenter of the bomb and who had progressively decreasing amounts of shielding; (v), those who showed epilation, petechiae, or oropharyngeal lesions, singly or in combination, within 3 months of the bombing, regardless of their position or amount of shielding relative to the hypocenter, provided the distance was less than 3000 meters. The estimates of the amount of radiation received by individuals in categories i through v, respectively, are as follows: essentially none; 5 to 10 roentgens equivalent physical (rep); 50 to 100 rep; 100 to 150 rep; 200 to 300 rep. The authors emphasize that these are, at best, very rough estimates.

Six indicators of genetic damage were used: the sex ratio, birth weights, measurements of bodily development, and the frequencies of stillbirths, neonatal deaths, and gross malformations. The data were sorted to obtain nonoverlapping indicators. Thus, a stillborn child with a malformation was considered only as a child with a malformation but not in the stillbirth group; similarly, a live-born child with a malformation was considered only in the malformation group but was not represented in the analysis of the frequency of stillborn versus live-born children. A chapter is devoted to a detailed presentation of the analysis of each of these indicators. These chapters are followed by others devoted to the analysis of the data concerning death during the 9-month period following delivery, the analysis of the anthropometric data, the autopsy findings, and chapters entitled "Recapitulation" and "Permissible inferences," respectively.

Despite the careful analysis of 71,280 pregnancies, the authors were unable to detect a significant effect of radiation on these pregnancies. It should be noted, however, that half of these pregnancies occurred in families in which both parents were in radiation category i, and that 67,599 of these pregnancies occurred in families in which one or both parents were in radiation categories i, ii, or iii. Only 3681 pregnancies occurred in families in which one or both parents were in categories iv or v, those that had received the most irradiation.

The authors point out that the problems posed in employing survey data in an analytical fashion are legion, and "as a consequence, it is doubtful whether, given a body of survey data, any two competent statisticians would evolve essentially the same approach." They have chosen the conservative approach of testing the null hypothesis—that there was no effect of the radiation on the outcome of the pregnancies. It has been suggested that more meaningful information might have been gleaned from the data had the authors chosen to use regression analysis, estimating the irradiation received by each individual and treating him as an individual rather than as one of a group. Fortunately, all the information collected has been coded on I.B.M. cards and will be made available to the investigator who wishes to explore other lines of analysis, provided he meets the costs of duplicating the cards and all shipping charges.

The last chapter of the monograph, "Permissible inferences," is discursive and, to me, seems the weakest portion of the report. It contains a lengthy and seemingly unnecessary and sometimes

hypercritical analysis of H. J. Muller's writings on the effects of radiation on man. It also contains the curious conclusion that, because there are uncertainties in the assumptions made in certain calculations and because "persons not thoroughly indoctrinated in genetics and unfamiliar with the shaky basis of the primary assumptions" may overlook these uncertainties and may as a consequence attribute greater exactitude to quantitative calculations than the investigators mean to imply, no such calculations should be made. It would seem that educated estimates, even though they may be quite inaccurate, are better than no estimates, and that this is especially true at present, when standards of permissible dosages of the radiation are being set.

While I may disagree with some statements made in the final chapter, I heartily concur with the authors' efforts "to emphasize the present inadequacies in our knowledge of the operation of natural selection on human populations, inadequacies which permit widely different viewpoints" and with their statement that, "on the basis of extensive plant and animal work, it seems reasonable to conclude that all levels of the radiation of human populations will result in mutation production. There is a high probability (but not certainty) that under the conditions of western culture such mutation will act to the detriment of the populations concerned." I might add that there is certainty that such mutations will be detrimental, in the overwhelming majority of cases, to those who are homozygous for them.

ARTHUR G. STEINBERG
Western Reserve University

Books Reviewed in The Scientific Monthly, November

The Zeppelin in the Atomic Age, E. J. Kirschner (Univ. of Illinois Press). Reviewed by A. J. Fairbanks.

A Naturalist in Palestine, V. Howells (Philosophical Library). Reviewed by W. Beebe.

In-Service Education for Teachers, Supervisors, and Administrators, N. B. Henry, Ed. (Univ. of Chicago Press). Reviewed by H. E. Wise.

Aspects of River Pollution, L. Klein (Academic Press; Butterworth's). Reviewed by J. Durham.

Introduction to Operations Research, C. W. Churchman, R. L. Ackoff, and E. L. Arnoff (Wiley; Chapman and Hall). Reviewed by S. E. Gluck.

Lecture Notes on the Use of the Microscope, R. Barer (Thomas). Reviewed by O. W. Richards.

The Copernican Revolution, T. S. Kuhn (Harvard Univ. Press). Reviewed by H. N. Swenson.

Inventors and Inventions, C. D. Tuska (McGraw-Hill). Reviewed by A. M. Palmer.

Patent Notes for Engineers, C. D. Tuska (McGraw-Hill). Reviewed by A. M. Palmer.

The Mathematics of Physics and Chemistry, H. Margenau and G. M. Murphy (Van Nostrand). Reviewed by S. S. Ballard.

Coal Science, D. W. van Krevelen and J. Schuyler (Elsevier). Reviewed by H. C. Howard.

New Books

Dry-Battery Receivers with Miniature Valves. E. Rodenhuis. Philips Technical Library, Eindhoven, Netherlands, 1957. 240 pp. $4.95.

Effect of Radiation on Human Heredity. Report of a study group convened by WHO together with papers presented by various members of the group. World Health Organization, Geneva, 1957 (order from Columbia University Press, New York). 168 pp. $4.

Quantitative Pharmaceutical Chemistry. Glenn L. Jenkins, John E. Christian, George P. Hager. McGraw Hill, New York, ed. 5, 1957. 570 pp. $8.50.

Introduction to Riemann Surfaces. George Springer. Addison-Wesley, Reading, Mass., 1957. 315 pp. $9.50.

Rocket Power and Space Flight. G. Harry Stine. Holt, New York, 1957. 182 pp. $3.75.

Nuclear Power Reactors. James K. Pickard, Ed. Van Nostrand, Princeton, N.J., 1957. 350 pp. $8.50.

Comparative Physiology of the Nervous Control of Muscular Contraction. Graham Hoyle. Cambridge University Press, London, 1957. 155 pp. $3.

Les Caractères des Organismes Vivants. Maurice Rose. Presses Universitaires de France, Paris, 1957. 199 pp.

Les Facteurs de la Croissance Cellulaire. Activation et inhibition. J. André Thomas. Masson, Paris, 1956. 425 pp. F. 4000.

Diffusion. Methoden der Messung und Auswertung. W. Jost. Steinkopff, Darmstadt, Germany, 1957. 177 pp. DM. 25.

Prehistoric Men. Robert J. Braidwood. Anthropology, Number 37. Chicago Natural History Series. Chicago Natural History Museum, Chicago, ed. 3, 1957. 187 pp. Paper, $1.25.

Abbreviated Proceedings of the Oxford Mathematical Conference for Schoolteachers and Industrialists. Held at Trinity College, Oxford, 8–18 Apr. 1957. Oxford University Delegacy for Extra-Mural Studies. Times Publishing Co., Printing House Square, London, E.C.4, 1957. 111 pp. 2s. 6d.

Cosmetics, Science, and Technology. Edward Sagarin, Ed. Interscience, New York, 1957. 1452 pp. $25.

Economic Backwardness and Economic Growth. Studies in the theory of economic development. Harvey Leibenstein. Wiley, New York; Chapman & Hall, London, 1957. 309 pp. $6.75.

Behaviour of Metals at Elevated Temperatures. Lectures delivered at the Institution of Metallurgists refresher course, 1956. Published for the Institution of Metallurgists. Iliffe, London; Philosophical Library, New York, 1957. 129 pp. $6.

Radio Astronomy. International Astronomical Union Symposium No. 4. H. C. Van De Hulst, Ed. Cambridge University Press, New York, 1957. 420 pp. $9.50.

The Vertebrate Visual System. Its origin, structure, and function and its manifestations in disease with an analysis of its role in the life of animals and in the origin of man. Preceded by a historical review of investigations of the eye, and of the visual pathways and centers of the brain. Stephen Ployak. Heinrich Kluver, Ed. University of Chicago Press, Chicago, 1957. 1408 pp. $45.

Chemistry of Natural and Synthetic Rubbers. Harry L. Fisher. Reinhold, New York; Chapman & Hall, London, 1957. 215 pp. $6.50.

The Physical and Chemical Basis of Inheritance. George W. Beadle. Oregon University Press, Eugene, 1957. 47 pp. Paper, $1.

Rhythmic and Synthetic Processes in Growth. Fifteenth symposium of the Society for the Study of Development and Growth. Dorothea Rudnick, Ed. Princeton University Press, Princeton, N.J., 1957. 224 pp. $7.50.

The Administrative State. An introduction to bureaucracy. Fritz Morstein Marx. University of Chicago Press, Chicago, 1957. 212 pp. $4.

Copernicus. The founder of modern astronomy. Angus Armitage. Yoseloff, New York, 1957. 236 pp. $5.

The Biologic Basis of Cancer Management. Freddy Homburger. Hoeber-Harper, New York, 1957. 372 pp. $10.

Strength of Materials. F. R. Shanley. McGraw-Hill, New York, 1957. 802 pp. $8.50.

Antiseptics, Disinfectants, Fungicides, and Chemicals and Physical Sterilization. George F. Reddish, Ed. Lea & Febiger, Philadelphia, ed. 2, 1957. 975 pp. $15.

Introduction to Biostatistics. Huldah Bancroft. Hoeber-Harper, New York, 1957. 220 pp. $5.75.

The Handbook of Feedstuffs. Production, formulation, medication. Rudolph Seiden and W. H. Pfander. Springer, New York, 1957. 613 pp. $8.

Handbuch der Physik. Vol. XLII. *Nuclear Reactions III.* S. Flugge, Ed. Springer, Berlin, 1957. 633 pp. DM. 135.

Die Mikrophotographie. Kurt Michel. Springer, Vienna, 1957. 772 pp. $33.30.

The Student-Physician. Robert K. Merton, George G. Reader, Patricia L. Kendall, Harvard University Press (for the Commonwealth Fund), Cambridge, Mass., 1957. 372 pp. $5.

An Introduction to Probability Theory and Its Applications. vol. I. William Feller. Wiley, New York; Chapman & Hall, London, ed. 2, 1957. 476 pp. $10.75.

Laboratory Manual of Batch Distillation. F. J. Zuiderweg. Interscience, New York, 1957. 134 pp. $3.50.

The Fascination of Numbers. W. J. Reichmann. Essential Books, Fair Lawn, N.J., 1957. 176 pp. $4.