out of print and difficult to find, covered the genera and species described through 1889, but the lack of complete coverage of the literature published after 1890 remained a serious handicap for workers in the field. Students of Foraminifera now owe a debt of gratitude to Thalmann for continuing the earlier work of Sherborn and completing an index of genera and species for the 60-year period 1890 through 1950 and to the George Vanderbilt Foundation (Stanford University) for undertaking publication of the important volume. The index is published in an attractive, well-printed, double-column, quarto volume. The following data are given for generic names: reference, type species, family assignment, and geologic age; for species: reference, geologic age, and area from which described. The generic and specific names are printed in boldface type. Some references for years prior to 1890 are given when they were not included in the Sherborn index.

Complete coverage of the well-scattered literature on Foraminifera published through 1950 is now available.

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Selected Overview

Recent Advances in Human Genetics. L. S. Penrose, Ed. Little, Brown, Boston, Mass., 1961. 194 pp. Illus. + plates. $8.

In a field developing as rapidly as human genetics, it would be impossible to handle all recent advances adequately in one volume. As an alternative, Penrose has chosen to select eight specific areas for careful treatment. His choice is excellent, and the style of writing is surprisingly uniform for a book with several contributors. The volume as a whole can be described as illustrative and concise, rather than as exhaustive and detailed.

Each chapter presents an overview of a specific problem, with comments about its historical development and the proper use of relevant terms. Significant principles are stated clearly and illustrated well. Some of the most recent findings are summarized, and the nature of current research problems is indicated.

Readers interested in clinical implications of genetics will appreciate Harnden's discussion of techniques and results in chromosome studies and the review of normal and abnormal sex differentiation by Miller. Penrose points out that birth weight can be studied profitably from the statistical and genetical points of view, and he also reviews the interaction of genetic and environmental factors in congenital malformations. Topics in human biochemical genetics are deliberately omitted in view of their adequate treatment elsewhere.

Statistical methods and theory are discussed by Smith, with an emphasis on procedures for analyzing genetic ratios, gene frequencies, and segregation ratios. Renwick presents a very clear review of methods and results in the study of linkage. At present only three autosomal linkages can be accepted with confidence, and only color-blindness loci are generally useful as sex-linked markers. Penrose outlines assumptions and procedures used in estimating mutation rates and stresses sources of bias which can lead to exaggerated values. Analysis of fingerprint patterns (discussed by Holt) reveals the strong effect of heredity upon pattern size and provides an interesting model for the study of quantitative traits in man.

Gerald's survey of abnormal hemoglobins has clinical implications, but it also highlights some insights and puzzles concerning the genetic determination of complex protein structure. Both qualitative and quantitative alterations in hemoglobin synthesis are described, and genetic interrelationships among the variants are interpreted. Other implications for understanding gene structure and action are included in the chapters on mutation, chromosomes, and linkage.

This book should appeal to a wide variety of readers. Interested laymen and scientists in fields other than genetics will find it a readable and authoritative starting point for understanding the topics discussed. Graduate and medical students and physicians will profit from the clear statement of basic principles and assumptions, as well as from the review of current techniques. For those who wish further details, there is a list of over 500 references (about half are later than 1955).

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On Science and the Scientist

Atoms and Men. Louis Leprince-Ringuet. University of Chicago Press, Chicago, Ill., 1961. 118 pp. $3.

The title page describes this book as a "translation," but it nowhere appears whether this is a translation of a book originally published in France, or whether we have here a translation made directly from an original French manuscript.

The author is director of the laboratory at the École des Hautes Études and is an atomic energy commissioner of France. The book is primarily addressed to the Frenchman who has suddenly become aware (and who is disturbed by all the implications of this awareness) that an absolute condition for the greatness or even the survival of a modern nation is that the nation take its place among the nuclear powers. One section is entitled "Can France Stage a Comeback?" The Frenchman has to take account of two different sorts of things, if he is to understand the implications of becoming a nuclear power. He must understand, as far as possible, the factual scientific background, and he must also understand what manner of man the scientist is to whom the destinies of his country will have to be increasingly entrusted. The author tries to accomplish both these ends by a popular, almost chatty, method of approach. It is somewhat surprising that nowhere in the book is there any explicit mention of the recent French decision to construct their own atomic bomb.

The translation reads smoothly enough, but one cannot help questioning the technical competence of the translator, when confronted with a passage like this (page 103): "It [uranium] is extremely *thick*." The context does not indicate whether "thick" means density or atomic weight. One's confidence in the technical competence of the author himself is somewhat shaken when confronted by: "We know, of course, that one can ascertain the mass of a marble or projectile by throwing it at a certain speed and then spotting the place where it falls" (page 6). And one does not know whether to question the technical competence of the author or of the translator when confronted by: "The piles of projectiles for an accelerator called a bevatron were ready" (page 24). One can only wonder to

what extent the author had his tongue in his cheek throughout the entire book, in view of his remark on page 31: "But make no mistake; one can quite readily become an excellent physicist even if one's intellectual faculties are not highly developed."

The final chapter, "The atomic scientist and the believer," seems quite uncalled for and has no apparent connection with the rest. One wonders whether there is in France an intransigent core of fundamentalists who have to be appeased in some way.

All in all, in spite of its lively style and not infrequent flashes of insight, the book leaves an unpleasant taste.

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Birds, Bees, and Good Society

Communication among Social Bees. Martin Lindauer. Harvard University Press, Cambridge, Mass., 1961. 143 pp. Illus. $4.75.

The Herring Gull's World. Niko Tinbergen. Basic Books, New York, ed. 2, 1961. 255 pp. Illus. $5.

These books are about similar subjects, and you can more than double your enjoyment by reading them one after the other, for then there is the added pleasure of contrasting both the authors and their favorite animals.

Lindauer was a student of Karl von Frisch. And this book carries further the studies summarized in von Frisch's wonderful *Bees: Their Vision, Chemical Senses, and Language*. Lindauer continues by asking specific questions about the society of the honeybees. First he asks how the work is divided among the inhabitants of the hive. He approached the question by watching individual bees, night and day, with stop watch in hand, until he had a detailed time-motion study. Bee No. 107, observed for 177 hours, spent all of 69 hours and 53 minutes just loafing. Between rests, she frequently strolled through the hive, not aimlessly it seems, but on patrol to see which chores—cell cleaning, brood tending, guarding, and the like—needed doing. In the hive, labor is organized by the workers coming across something that has to be done and then doing it, not by directives from above.

Lindauer goes on to consider communication among the bees. In the heat of summer, the bees cool the hive, as much as 35° centigrade, by sprinkling water over the brood cells. Water is fetched to the hive by the older, foraging bees. The number of trips made by the foragers is determined by how quickly the hive bees take the water load. This relationship is demonstrated on a graph in which the number of collecting flights is plotted as a function of the time taken to deliver the water load. When the delivery time is less than 40 seconds, the foragers also give an "alerting" dance, to recruit others to the work. This kind of careful measurement is the mark of von Frisch passed on to his student.

Next Lindauer asks how a swarm of bees selects a new site for a hive. It turns out that the scouts report by means of a dance which shows the direction, the distance, and the quality of a proposed site. The swarm remains, for days if necessary, in temporary quarters until the scouts reach a consensus on the best possibility, then the whole swarm moves off to the new site. These are just samples of the book's contents. Lindauer also discusses the evolution of communication in honeybees, which he studied by observing other species of bees, and some of the sensory and computational problems involved in using the sun as a reference point for the well-known food collecting dances. One fascinating discovery is that bees which have been raised in a cellar under artificial light need to practice for some days before they can navigate by the sun. They must learn how the sun moves. But after seeing the arc of the sun only in the afternoon, they can navigate in the morning on the first try.

Tinbergen's book has a broader goal. For years he watched with infinite, patient care the day-to-day life of the herring gull. His aim was to understand the significance of every movement and of every call and to see how the somewhat rudimentary society of the gullery is organized. Tinbergen's conclusions are drawn mostly from field notes; the relatively few experiments reported here were also discussed in his *Study of Instinct*. The focus of *Herring Gull's World* is not on the experimental analysis of behavior; the volume is, in the finest sense, a work of natural history. He pays particular attention to reproduction and rearing of the young, from the first arrival at the gullery, the establishment and defense of the territories, pair formation, incubation, and the feeding and behavioral development of the chicks. The present book is a slightly revised edition of the work first published in 1953.

These books by Tinbergen and Lindauer are clearly separated by aspiration and by method. Undoubtedly Lindauer's approach is more satisfying to the experimental scientist; we know the questions, the observations, and the numerical results. On the other hand, Lindauer's questions are based on generations of observation of life in the bee hive, exactly the sort of natural history that Tinbergen provides for the herring gull. Both types of work are necessary, and the two books are perfect examples of two levels of scientific exploration. It is somewhat amusing, however, to see that Tinbergen reaches far more sweeping conclusions about behavior in general.

Perhaps in these books there are also line-by-line hints of how the authors' temperaments determine their approach. Tinbergen loves his birds, he delights in their motions and abilities, he writes of them with joy and verve—and his enthusiasm is catching. He also tells a good deal about Niko Tinbergen—every reader will want to meet the charming author. Lindauer writes with precision. He leaves untold his adventures encountered in following bees from Germany to Ceylon to South America; the excitement comes from the subject itself. Both books are well illustrated.

A comparison between the animals only re-emphasizes the astounding complexity of the bees, whose behavior puts most vertebrate societies to shame.

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New Books

Biological and Medical Sciences

British Flies. Empididae. J. E. Collin. Cambridge Univ. Press, New York, 1961. 227 pp. Illus. + plate. $6.

The Cell and the Organism. J. A. Ramsay and V. B. Wigglesworth, Eds. Cambridge Univ. Press, London, 1961. 357 pp. Illus. $9.50.

The Ciliated Protozoa. Characterization, classification, and guide to the literature. John O. Corliss. Pergamon, New York, 1961. 310 pp. Illus. + plate. $12.