there is a unifying concept in the presentations, it is the use of kinetic theory —that is, solving the Boltzmann equation for many different situations.

The title is somewhat misleading in that the book is concerned with effects of the disturbing body on the ambient medium. Physical measurements are usually made by determining the effect of the medium on the body.

Overall, the authors cover many problems and develop in considerable detail analytical solutions on the basis of kinetic theory. The first problems considered are concerned with the density distribution of neutral particles, electrons, and ions about and in the wake of a body moving at high velocity (relative to neutral thermal velocity). Variants to this problem include different flow speeds, the presence of magnetic fields, the relative direction between velocity and magnetic-field vectors, and body size in comparison with Larmor radius and Debye thickness. A considerable effort is devoted to describing the electric field about the disturbing body and the interaction of this field with the flow, again varying the many parameters mentioned above. The authors also present a discussion of the effect of the ambient plasma on an electric field radiated from an antenna element. Fourier (space-wise) spectra of the disturbed flow region are determined for many of the above situations, and the problem of electromagnetic-wave scattering is considered; in conjunction with this quite a few tables and graphs are given to assist in estimating scattering cross sections.

The book presents an excellent demonstration of the kinetic-theory approach and, with the exception of a superficial discussion of accommodation coefficients (p. 33), is well written on a uniformly high level. Unfortunately the editing of the English-language translation was very poor: Equation numbers are occasionally omitted; one complete paragraph (p. 73) is repeated; and there is something missing between the bottom of page 190 and the top of page 191. References to volumes by Landau and Lifschitz give page numbers in the Russian but not in the English edition, and the volume *Fluid Mechanics* by Landau and Lifschitz is referred to as "Mechanics of Continuous Media." It is a pity that just on page 1 a misprint, an error by the authors, and a sentence rendered obsolete by recent discoveries should combine in a manner that could give an unfair impression of the book to anyone who begins reading it: The ratio of charged to neutral atmospheric particles at a height of 300 km is given as 10 rather than as 10^{-3}; five lines later the authors state that "above 1200 to 1400 km molecular hydrogen predominates" (it is atomic hydrogen); and six lines beyond that we find the statement that nothing is known about where the gaseous envelope which moves with the earth ends and where interplanetary space begins—"one can assume that at distances of three to four times the earth's radius we already have interplanetary gas" (the discovery of the magnetosphere has changed all that).

In view of the price of the book, $25, one might have expected a better editorial job.

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The Sex Attractants of Insects

Insect Sex Attractants. Martin Jacobson. Interscience (Wiley), New York, 1965. 154 pp. Illus. $7.75.

About one million living insect species have been formally described to date; according to a recent statistical extrapolation by the British zoologist C. B. Williams, two million more may await recognition. Entomologists are accustomed to finding hundreds or thousands of species living together at single localities. In this welter of predators, parasites, competitors, mimics, commensals, symphiles, and sibling clusters, privacy in communication is surely at a premium. The coming together of the sexes especially must be accomplished with utmost delicacy and precision. In his book *Insect Sex Attractants*, Martin Jacobson succeeds to a considerable degree in showing how much of this communication is achieved by means of chemical secretions.

The study of insect sex attractants dates as far back as von Siebold, who in 1837 proposed that female odors function to entice males while male odors may be used as a stimulus in precopulatory contact. But it was not until 1960 that the first female attractant, a complex alcohol produced by the gypsy moth *Porthetria dispar*, was fully characterized. The past 5 years has seen a rapid growth of research programs on sex substances. Many of them are economically oriented, for as Jacobson and his co-worker Morton Beroza have pointed out, insects depend for their reproduction on these odors, and "frequently they can be attracted by means of a chemical to a trap for detection purposes, or to a toxicant that destroys the insect, or to a substance which makes them incapable of fertile mating." The hope exists that sex attractants can be used to single out individual pest species for destruction without creating the undesirable side effects often associated with general insecticides.

Insect Sex Attractants is a straightforward compilation, written in a laconic style that makes few attempts at generalizations or judgments concerning current controversies. Perhaps this is just as well, for the subject is in that initial, logarithmic phase of its growth when energies are best expended in simply recording new phenomena. A total of 425 references in the bibliography covers most of existing knowledge. Several new generalizations that do emerge may surprise animal behaviorists interested in insect communication. Sex attractants have been demonstrated in almost all insects where they have been deliberately sought, including the housefly, at least one mosquito (*Culiseta inornata*), and the honey bee, species whose communication seemed previously to be dominated by signals in other modalities. Male sex pheromones are shown to be commonplace; some are aphrodisiac in action as envisaged by von Siebold, but others draw females over distances and elicit aggressive sexual displays in a fashion paralleling the female substances. Many of the female substances are not species-specific, for they can attract and induce copulation attempts by males of other, related species. Whether such interspecific signaling is as effective under natural conditions is another matter that awaits field studies.

This book is quite timely. The author has made the gaps in our knowledge obvious and inviting. Competing hypotheses concerning the molecular basis of olfaction and the mode of transmission of the chemical signals through the air, are described clearly and plainly. A section on methods of collecting and identifying attractants, Jacobson's own specialty, will be quite valuable to both chemists and biologists. The discus-

sions of bioassay techniques and biological significance of the phenomena described could have been more thorough and critical; and it is perhaps to be regretted that the author did not allow himself more liberties in generalization that would have added interest to the review without subtracting from its precision. But he will easily achieve his main goal, which is to "provide an incentive for greater discoveries in this fascinating field."

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Ornithology

The Giant Canada Goose. Harold C. Hanson. Southern Illinois University Press, Carbondale, 1965. xxiv + 226 pp. Illus. $9.75.

The giant Canada goose, *Branta canadensis maxima*, was first described formally by Jean Delacour in 1951; the description was based on an unpublished manuscript by James Moffitt. Many years before, sportsmen, particularly William B. Mershon and Ray P. Holland, had called attention to a very large variety of Canada goose in the northern prairies. By the time it was described and named, the race was considered to be extinct. The author of this book discovered that the race still exists when he identified examples in a wintering flock at Rochester, Minnesota, in January 1962.

Breeding and wintering ranges of the giant Canada goose are extended considerably beyond those previously recognized, and more characters that distinguish it from other races are noted. Clines in morphological characters toward those of adjoining races are recognized. The breeding range is defined as the northeastern portion of the grassland biome lying east of the Rocky Mountains. The heavy coniferous forest and rocky Canadian Shield limit its range northward. Adaptations of the giant Canada goose to prairie habitat include a bill modification suited for stripping grass seeds from their stalks.

Breeding Canada geese, which have become reestablished in the former range of *maxima*, are of that race, despite the fact that stocks of other races also have been introduced into the same area. This emphasizes the importance of using representatives of a race already adapted by natural selection to environments where introductions are attempted.

Extensive movements by nonbreeding giant Canada geese were noted, for the geese travel far from their own breeding range and into the ranges of other races to molt. This tendency in geese frequently has complicated study of their taxonomy.

The giant Canada geese that nest in the middle and southern portions of their range have always been relatively sedentary, migrating southward only when forced to do so by lack of open water. The more northern nesters migrate the farthest south, leapfrogging the more southern nesters. A tendency to remain segregated during the winter in small flocks, presumably family units, is characteristic of this race. Wintering grounds are scattered widely in suitable areas where open water occurs in the Great Plains, the Great Basin, and the interior valleys of California.

Most birds return to the breeding grounds in spring before the breakup of ice and start to nest as soon as the thaws begin. Pairing takes place on the breeding grounds when the geese are a year old, but nesting does not occur until their second year. Remating of broken pairs often takes place during the next nesting season. Nesting territories required by *maxima* seem to be larger (not more than two pairs per acre) than those established by some other subspecies.

This book brings together much information on the biology and population dynamics not only of the giant Canada goose, but of all the larger races in such a way that it is a valuable guide to the conservation and management of this popular species.

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Radioactive Isotopes

Radiotracer Methodology in Biological Science. C. H. Wang and David L. Willis. Prentice-Hall, Englewood Cliffs, N.J., 1965. xviii + 382 pp. Illus. $16.

Radiotracer Methodology in Biological Science, by C. H. Wang and David L. Willis, merits high recommendation as a general textbook on the use of radioactive isotopes in biological research. It is written in a style too infrequently found in textbooks; it is very informative without being pedantic; difficult concepts are expressed simply but definitively—in short, it is a pleasure to read.

In content, it is a modern treatise that covers at relative length the principles and practice of scintillation counting with both solid and liquid scintillators. The section on the rapidly advancing field of liquid scintillation counting is particularly valuable because the authors' extensive experience in this important area allows them to speak with authority and to present a balanced appraisal. Ionization chambers and proportional and Geiger-Mueller counters, topics that have been treated at length in other texts, are dealt with briefly but adequately. These sections are supplemented by a series of simple experiments that illustrate the characteristics of radioactivity and the operation of the counting instruments.

The comprehensive section on the preparation of samples for counting also provides 240 references to the original literature. I consider the chapter on the proper design and execution of radiotracer experiments essential reading for beginners in radioisotope methodology. The final section describes six representative experiments that illustrate the application of the principles of radiotracer methodology to the solution of specific problems.

No attempt is made to detail the vast contributions of radiotracer methodology to the advancement of science. This task is properly relegated to textbooks in the appropriate scientific discipline. Nor is this a general reference text with extensive tabulation of physical constants. It is a teaching text in which a real attempt is made to distill the essence of the subject and to express it with brevity, and with clarity. It will be of particular practical assistance to those who are beginning to use radioactive isotopes, but it should also be on the bookshelf of investigators who are already using radioactive tracers but who feel that their understanding of the underlying principles is inadequate. The stated intention was to write "a brief but up-to-date introduction to the field of radiotracer methodology." This—and much more—has been accomplished.

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