Scattering Theory

Quantum Collision Theory. CHARLES J. JOACHAIN. North-Holland, Amsterdam, and Elsevier, New York, 1975. xvi, 710 pp., illus. $89.95.

This is a big, competently done book on scattering theory. Generally speaking it deals with the nonrelativistic theory, but occasionally it uses relativistic kinematics and makes relativistic applications. About half the book is concerned with potential scattering, another 120 pages with general scattering theory, and 200 pages with applications to particles with spin, to the three-body problem, to the construction of optical potentials and their effects, and to more general multiparticle collisions. Specific applications of scattering theory to atomic scattering, simple nuclear reactions, and hadron-nucleus collisions are presented.

The general pace of the book is fairly leisurely and many steps in derivations are explicitly given (a practice that accounts, at least in part, for its bulk). Its strength lies primarily in its explicit presentation of examples, not only in the sections that deal with applications, but interspersed throughout. The level of mathematical sophistication is approximately that of first-year graduate students of physics.

Occasionally the author is careless. For example, he asserts, contrary to fact, that ordinary, unmodified Fredholm theory is directly applicable to integral equations with square integrable kernels. On page 272 he states that the condition for absolute integrability of a function on the interval from zero to infinity is that it tends to zero faster than $(x \log x)^{-1}$. In the chapter on particles with spin there is a very confusing discussion of polarization, in which the polarization vector is defined for pure states only but is applied to mixed states.

On some occasions one misses what is not said. For example, in the discussion of the approach of scattering by a Yukawa potential to that by a Coulomb field, no mention is made of the infinities in the phase or in the second Born approximation. In the derivation of the reciprocity theorem from time reversal invariance, the author does not mention that appropriate phase conventions can then always make the S-matrix symmetric. In fact, in a subsequent treatment of spin-$\frac{1}{2}$ particles he implies that this symmetry automatically follows from time reversal invariance.

Considering the size of the book, it is appropriate to list some topics that are not covered in it. There is no treatment of the multichannel (or close-coupling) method for inelastic scattering, of threshold effects, of the inverse scattering problem, or of the exponential decay law. In the 60-page chapter on the three-body problem, the Efimov effect (probably the most interesting discovery in this field) is not mentioned, and neither are the double-scattering divergencies. On the other hand, I liked the long chapter on the various ramifications of the optical potential.

The book has many references to the literature, and a total of 85 problems related to the material in its first half. It would serve as a reference or as a textbook for a course in scattering theory, except for its price. At $89.95, the book is not even worth buying for most science libraries.

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Psychoendocrinology

Hormonal Correlates of Behavior. BASIL E. ELEFTHERIOU and RICHARD L. SPROTT, Eds. Plenum, New York, 1975. Two volumes. Vol. 1, A Lifespan View. xviii + pp. 1–440. $29.50. Vol. 2, An Organismic View. xviii + pp. 441–806, illus. $29.50. The set, $55.

Various levels of scientific sophistication are represented in this two-volume collection of papers. The discussions of hormones and human behavior by Benson and Migeon (puberty) and Sheard (neuropsychiatric disorders) in volume 1 are descriptive. Certain correlations between endocrine states and human behavior have been noted, but their meaning and the applicability to human beings of principles derived from research on other animals remain to be determined. Several examples of important modifications of hormone-behavior principles are also described in volume 1. Ader presents evidence contradictory to the hypothesis that early experience affects the pituitary-adrenal system so as to modify adult emotionality. Changes in adrenal responsiveness are not necessarily responsible for the influence of early handling on adult behavior. In their chapter on aging, hormones, and human behavior, Eisdorfer and Raskind discuss the evidence that decreased levels of estrogen in the menopausal female lead to irritability, depression, insomnia, and other such symptoms. The authors point out that these symptoms have more often characterized adolescent than menopausal women. The only menopausal symptoms consistently found to be estrogen-responsive are somatic ones, specifically vasomotor instability and atrophic vaginitis. Kling documents the lack of correlation in primates (including humans) between testosterone level and aggression in adults. Neonatal effects of testosterone on the brain, discussed by Edwards and Rowe, may influence the hormone responsiveness of adult aggression in mice. Fighting in female hamsters, on the other hand, appears not to be under the control of testosterone but to be modulated instead by ovarian steroids.

Volume 2 contains good reviews of areas that are infrequently included in treatments of hormones and behavior, namely circadian rhythms (Meier), the pineal (Hoffman), and endocrine effects on feeding behavior (Panksepp). Although causal relationships in these areas are not as well worked out as they are, for example, in reproductive behavior (a topic not included in this book), progress in uncovering some organizing principles is being made. One area that is still plagued by conceptual and methodological pitfalls is the study of avoidance learning and hormones, discussed in chapters by Brush and Froehlich, Sprott, and Stavnes.

The usefulness of these volumes is compromised by the variability of the contributions. Chapters range from detailed and lavishly documented descriptions (such as Meier's on chronoendocrinology) to superficial summaries (such as that by Benson and Migeon on human puberty). For the student, the excellent chapter by Moltz on puberty in the rat in volume 1 should prove helpful. Enough basic physiology is included to make Moltz's evaluations of some of the more puzzling evidence clear and entertaining. The general discussion of maternal behavior and the hormonal changes of parturition in Slotnick's chapter in volume 2 is also clear and readable. John Vandenbergh's chapter, also in volume 2, on hormones, pheromones, and behavior is a lucid and judicious review of a complex topic. With progress in the chemical characterization of pheromones, this field should be producing some exciting research. Vandenbergh's chapter will be a useful reference source.

The volume has a large number of typographical errors and the index is skimpy. Compilations such as this one would be improved by listing the dates of completion of literature reviews.

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