public context of school) with listening (which occurs in the private contexts of family and friends). Girls in the higher grades integrate the two (older girls make explicit that fairness is defined as listening or listening as fairness) or reverse them (not listening is characteristic of authorities in public; unfairness is an attribute of peer relations). Listening becomes a moral concept and fairness an interpersonal one. This concept is useful in other contexts: the phrase "we can't communicate"—oft heard from women talking about their spouses—takes on new meaning. It is about equality and fairness, not simply talk.

The essay on listening and fairness serves as a coda for the book as a whole. It is a plea to listen to adolescent girls, to value their knowledge and relationships, and to shape education to their special ways and needs. That new education, the authors tell us, should entail not just a revision of the curriculum, wherein women authors and books are included, but a reshaping of the manner in which those authors and books are taught. Because girls have a distinctive morality, a sense of connection, they can learn best by collaboration with other students and faculty. The lone-scholar approach devalues and undermines their confidence and development.

The general argument of this book will make a fair number of people unhappy, for difference has been too often equated with inequality, has fed into stereotypes that not only overvalue men but dangerously and mistakenly romanticize women. And although this book has richly detailed interviews over a three-year period, it cannot substantiate its claims that girls, in fact, do have a "different voice." These researchers studied no boys. If we were listening to boys talk, how can we be sure we would hear different struggles? To be sure, there are many studies of boys, but none that address the same issues in the same way. Perhaps we have learned a good deal about adolescence in this book, even if we have not learned the ways it is gendered. But even that praise may be too profuse. For we have learned something about a small slice of adolescents—those who can afford to go to a girls' boarding school. They have more money than most. Their struggles necessarily revolve primarily around relations with other girls (and it is the favorable character of this experience that leads the editors to recommend single-sex education). But the Emma Willard girls' experience of youth is likely atypical in still another important way. Living away from home may well shape the very moral dilemmas, centering on independence and caring, that the authors seek to explain. Often, these adolescents live away from home because their parents are divorced. That, too, might inform the dilemmas they experience in trying to both connect and separate. Neither Gilligan *et al.*'s theory nor their data, then, can bear the weight of their far-reaching conclusions. Gilligan's early work raised important ideas others had not voiced. This collection expands and specifies those. But now it is time to put them to a rigorous test.

NAOMI GERSTEL
Department of Sociology and Social and Demographic Research Institute, University of Massachusetts, Amherst, MA 01003

Condensed Matter

The Superfluid Phases of Helium 3. DIETER VOLLHARDT and PETER WÖLFLE. Taylor and Francis, New York, 1990. xx, 619 pp., illus. $165.

This book provides a comprehensive treatment of the theory of superfluid ^{3}He and thereby illustrates many of the principal themes of theoretical condensed matter physics over the past two decades. Among these are spontaneously broken symmetries and their associated collective excitations (Goldstone modes), topologically stable defects and excitations (solitons), and the utility of algebraic topology for the analysis of complex ordered phases. The superfluid phases of ^{3}He were discovered at Cornell University in 1971. They are the most complex homogeneous ordered states of matter known to date, exhibiting aspects of the orientational ordering characteristic of liquid crystals, of the spin ordering characteristic of magnets, and of the quantum-mechanical phase ordering characteristic of superconductors and superfluid ^{4}He. The particularly exotic properties of superfluid ^{3}He arise because these three apparently distinct aspects are not really independent, since they all derive from a single quantum-mechanical order parameter with the properties of a two-particle wavefunction with total orbital angular momentum $L = 1$ and total spin $S = 1$. For example, an entirely new absorption line appears in nuclear magnetic resonance because of Josephson tunneling between superfluid spin components parallel and anti-parallel to an external magnetic field, the motion of liquid–crystal-like textures can cause the decay of an otherwise stable superfluid flow, and the formation of vortices in the rotating superfluid generates a small spontaneous magnetic moment.

Vollhardt and Wölfle begin with a concise but reasonably thorough review of the theory of normal ^{3}He, using the phenomenological framework due to Landau and his school. Here and in what follows, the treatment highlights another theme of modern condensed matter theory: the most interesting properties of a physical system on a particular scale of length and energy depend on the underlying microscopic structure only through the symmetries of the microscopic constituents and their interactions and through the values of a small number of effective interactions. After summarizing the generalized BCS (Bardeen-Cooper-Schrieffer) pairing theory and the experimental properties of superfluid ^{3}He, the authors turn to an extensive treatment of broken symmetries and their relation to macroscopic order and of the closely related topics of superflow and textures, defects in the order parameter field, and the dynamics of the nuclear spins as probed by nuclear magnetic resonance. The discussions of broken symmetries, textures, and defects make extensive use of group theoretical methods. I found this to be the most successful and self-contained part of the book. The following chapters treat the dynamics of superfluid ^{3}He from three perspectives: hydrodynamic theories appropriate at very low frequencies and long wavelengths, the kinetic equation for Bogoliubov quasiparticles and its application to the calculation of transport coefficients, and the quantum kinetic equations needed to describe collisionless collective modes and their interactions with sound waves. The presentations here are less complete and frequently need to be supplemented by reference to the original literature. The book concludes with a brief discussion of some very weak but exotic consequences of the macroscopic quantum coherence of the superfluid phases.

This book covers a large and important subject from a coherent point of view and will be a valuable reference for anyone working on superfluid ^{3}He or on the closely related topics of unconventional superconductivity in heavy-electron metals and superfluidity of neutron star interiors. In their preface, the authors say that they have tried to give an account that will be accessible to anyone with a general background in quantum mechanics and statistical physics. Here they have been less successful. The introductory sections have a tendency to repeat conventional shorthand explanations that will be understood by experts but will leave many beginners bewildered. A reader who has not previously encountered a quasiparticle or a spontaneously broken symmetry will probably not find this to be an adequate introduction. On account of its breadth of coverage, this book will without question be the standard reference on superfluid ^{3}He for many years to come. From this point of view

the book is something of a disappointment. Too frequently only an approximate result is given, even when an exact result is known, and sometimes the approximate nature of the result is not even noted. For example, the discussions of the static response functions and collective mode frequencies in the B-phase are all flawed in this way. I also have the sense that the authors occasionally have sacrificed both excitement and clarity in the interest of diplomacy. In particular, the hydrodynamics of ^{3}He-A has generated heated controversy and, eventually, important and elegant new insights. While Vollhardt and Wölfle note that the topic has been controversial and give many references, they do not tell us what the controversies were about or which of the references finally got things right, in their opinion. This is a shame, for it drains the subject of much of its motivation and vigor. In summary, this is a valuable book but not as lively or definitive a book as its subject deserves.

JOSEPH W. SERENE
Complex Systems Theory Branch, Naval Research Laboratory, Washington, DC 20375–5000

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Squid as Experimental Animals. DANIEL L. GILBERT, WILLIAM J. ADELMAN, JR., and JOHN M. ARNOLD, Eds. Plenum, New York, 1990. xxxii, 516 pp., illus. $75.

Many readers will be aware that research on the squid giant axon provided the foundation for our current understanding of many roles played by ion channels in regulating activities of living cells. Few life scientists, including squid specialists, however, are likely to appreciate the range and number of basic discoveries that also have stemmed from research on squid and its cephalopod cousins, the octopus and the cuttlefish. Much of this work has utilized the giant axon system to provide insights into active transport of ions and metabolites across cell membranes, microtubule-based organelle transport, and synaptic transmission, but there have been numerous contributions in other areas as well, such as hemocyanin-based oxygen transport.

This broad body of work is emphasized in a unique way in the 22 papers that constitute *Squid as Experimental Animals*, the long-overdue follow-up to *Guide to Laboratory Use of the Squid* published in 1974 by the Marine Biological Laboratory at Woods Hole. Each chapter is written with two goals: to review the scientific results in a particular area of research and to provide a concise, practical summary of the relevant experimental techniques. Thus, this book is intended to serve both as an up-to-date information source about cephalopod biology and as a sophisticated laboratory guide. In both of these capacities, *Squid* is a success.

Divided into six major sections, the new book covers a broad spectrum of squid biology, with major emphasis on neuro- and cell-biological aspects of the giant axon and sensory systems. Most of the chapters hit the intended mark and are well written, comprehensive, and richly documented with references. As in any collection there are, of course, both highlights and disappointments.

In Evolution, History and Maintenance (part 1; four chapters), a fine chapter on maintenance, rearing, and culture discusses important problems involved in ensuring a supply of healthy animals and the advantages of alternative cephalopod species for particular research needs. The two chapters that make up Mating Behavior and Embryology (part 2) add little information beyond that appearing in the 1974 guide. Neural Membranes (part 3; five chapters) includes a wealth of detailed technical information for those interested in pursuing classical approaches (internal perfusion/dialysis and voltage clamp) to giant axon and synapse physiology. One chapter introduces the "cut-open axon" to modern patch clamp techniques in an elegant way. Cell Biology (part 4; five chapters) features some solid chapters devoted to the cytoskeleton and axoplasmic transport, lipid metabolism in the nervous system, and isolation of synaptosomes from the brain. Sensory Systems (part 5; three chapters) provides a nicely balanced treatment of structural, functional, and developmental aspects of the visual and statocyst systems. Finally, Integrated Systems (part 6; three chapters) sports the chapter "Squid as elite athletes: locomotory, respiratory, and circulatory integration," an intriguing account of the squid's high-speed, jet-propelled life style and the challenges it imposes.

The only real problem with *Squid* is the seemingly arbitrary choice of topics. Obviously, all areas of squid experimental biology could not be covered, and the editors excuse the omissions with "lack of space." Judicious editing could have generated a good bit of space, however. For example, some experimental methods are described in unnecessary detail and some appear redundantly—there are no fewer than four treatments (15 pages total) of how to remove the giant axon from *Loligo pealei*. More significantly, several chapters do not seem appropriate for a work of this sort. While it may be amusing to learn the details involved in the naming of *L. pealei*, this information could have been profitably replaced by material designed to increase the utility of the volume to new students of the squid, such as a good basic description of internal anatomy. One must also question the inclusion of a chapter (on tissue culture) based entirely on unpublished work when rich areas like learning in cephalopods are excluded.

Despite its shortcomings, this book is an important contribution. These chapters go a long way toward putting what we know about squid and their use as experimental animals into one accessible volume for the researcher or advanced student. This is a valuable accomplishment, not only because it will stimulate new work on many aspects of squid biology, which is of intrinsic importance, but also because it will point the way to additional possibilities of using these animals as model systems for problems in vertebrate physiology. In today's biomedical research world, where studies on mammalian systems are predominant, it is important to remember what squid, and other invertebrates, have taught us and to retain vision enough to sense what secrets they still hide.

WILLIAM F. GILLY
Stanford University, Hopkins Marine Station, Pacific Grove, CA 93950

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