Vignettes: Retelling

It is extremely difficult to report on the opinions of others, especially when they closely agree, border and cross one another. If the reporter goes into detail, he creates impatience and boredom; if he wants to summarize, he risks giving his own point of view; if he avoids judgments, the reader does not know where to begin, and if he organizes his materials according to principles, the presentation becomes one-sided and arouses opposition, and the history itself creates new histories.

—*Johann Wolfgang von Goethe* in *Materialien zur Geschichte der Farbenlehre*, as quoted by Karl J. Fink in *Goethe's History of Science* (Cambridge University Press)

Much has been written about the Manhattan Project and the scientists who participated in it . . . . If there was ever a time when eyewitness accounts could be obtained uncontaminated by hindsight and by many previous tellings, it is long past.

—*James Gleick*, in *Genius: The Life and Science of Richard Feynman* (Pantheon)

2-D Physics

Two-Dimensional Crystals. IGOR LYUKSYUTOV, A. G. NAUMOVETS, and V. POKROVSKY. Academic Press, San Diego, CA, 1992. xiv, 423 pp., illus. $99. Translated from the Russian edition.

Two-dimensional (2D) crystals, the subject of this volume, are not just mathematical abstractions; they are a real part of our three-dimensional (3D) world. They frequently form at the outer surface of a 3D object: The cell walls of a biological cell can be crystalline, and the outer facets of 3D crystals often harbor surface crystals with distinct properties of their own. A crystal is a state of matter containing an ordered pattern that persists over long distances, like the repetitive lattice structure of atoms in solid gold or the regularity of molecular orientations in liquid crystals.

The properties of 2D crystals are not simply a subset of the properties of 3D crystals, and this volume emphasizes those phenomena that are unique to two dimensions. One example of this is dislocation-mediated melting. Dislocations are crystal defects which, in 2D, can proliferate at some temperature and cause a melting of the crystal lattice. This melting is unique in two ways: first, it is a so-called continuous transition (unlike the more conventional abrupt melting of 3D crystals); second, the resulting phase is not a disordered liquid but a so-called "hexatic" phase that retains some remnant of crystalline order. Another phenomenon that has special importance in two dimensions is incommensurability, in which two different 2D crystals, when brought in contact with one another, can exhibit orderings that are incompatible with each other (such as lattices with different lattice spacings). Adsorbates on the surface of a crystal often form an incommensurate crystal; unique to two dimensions is the possibility that the adsorbate lattice will be rotated with respect to the underlying surface (this is known as "orientational epitaxy"). I commend this book for recognizing that these are essential topics in 2D physics and giving them thorough coverage.

In fact, this book achieves remarkable scope within its 423 pages; besides the topics just mentioned, it touches upon the properties of free-standing films, wetting and adsorption on 2D surfaces, catalysis, and roughening and faceting. The authors, who are theoreticians, are remarkably conversant with the experimental techniques that are used to study 2D crystals; they devote two introductory chapters to reviewing them. They are also very aware of the experimental data that bear on each of the theoretical topics they address, and each chapter has a very useful section discussing current experimental results. (However, I found no references more recent than 1989, when the Russian-language edition of the book was published.)

I think this volume will have the greatest value for the experimentalist who is interested in pursuing new work in this field and wants to get a feeling for the most important theoretical principles and results. It will also be very useful for experienced theoreticians who want to have a source volume for a wide variety of results in 2D physics; it will be an excellent place for them to get into the original literature on these subjects. However, because of its comprehensiveness, the derivations presented are necessarily very short, in many cases too condensed for a beginning graduate student or researcher. A graduate course instructor is warned that it will be necessary to supplement the material contained here with more expanded course notes or discussion. On the other hand, he or she will not find another book that covers this material in such a thorough and consistent way.

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Vertebrate Adaptations

Environmental Physiology of the Amphibians. MARTIN E. FEDER and WARREN W. BURGGREN, Eds. University of Chicago Press, Chicago, 1992. viii, 646 pp., illus. $135; paper, $47.50.

Following on the three-volume *Physiology of the Amphibia*, edited by John Moore (1964) and Brian Lofts (1974, 1976), this book is the latest in a continuum of excellent treatises on amphibian physiology. An assemblage of 16 chapters by some 40 authors, the overall product is a most interesting and comprehensive review (with over 4000 references) of the physiology of this vertebrate class. A good background in physiology will prove helpful to any reader; beginning graduate students will have to grow into the book.

The growth and maturation of the field since the volumes of *Physiology of the Amphibia* were published are mirrored in the organization of the new work. Rather than dealing with systems such as excretion or respiration in isolation as the former volumes did, the chapters address how various systems, ranging from biochemical to behavioral, interact in processes like gas exchange or ion regulation. Articulate overviews of each of the four main sections, written by the editors, contribute to the integrative outlook. The book summarizes the state of the art of environmental physiology and gives hints about where the field might focus next; questions such as how fitness is related to a particular physiological property, how much individual variation in a given physiological feature exists within a species, and to what extent a given characteristic is heritable are addressed in a few chapters.

In the overview that introduces the book Feder points out that more than 80 percent of the research done on amphibians has involved members of the genera *Rana*

and *Xenopus* that comprise no more than 0.2% of the species in the class. Therefore, generalizations about "the frog" derived from these studies are not likely to characterize other amphibians accurately, nor can the characteristics they identify be taken as representing an evolutionary link between "the fish" and "the rat." Feder details a number of common misconceptions that result from an incomplete understanding of the diversity of lifestyles and habits of amphibians.

Although most of the contributors to this volume utilize a comparative approach in their own research by studying members of other classes along with amphibians, some chapters lack the benefits of such a viewpoint. Avian endocrinology, under the leadership of John Wingfield, has moved out of the laboratory into the field, and one of the resulting findings is that the hormonal profile of an animal in the laboratory often bears little resemblance to that of a member of the same population in the wild. Comparisons of reptilian endocrinology in the field and laboratory by Paul Licht have yielded similar results. The chapter on endocrinology in this volume not only fails to specify whether a particular finding was obtained in the laboratory or in the field but does not discuss the possibility that future laboratory research should be complemented by field studies.

In the last few years considerable attention has been focused on the worldwide decline or extinction of amphibian populations, a problem the scope of which only became evident while the book was in preparation and that receives little attention in it. The environment of amphibians includes more than just heat, gases, water, and ions, and amphibians are now confronted with as yet unidentified environmental changes involving *p*H, heavy metals, pesticides, ultraviolet radiation, pathogens, or toxins that have recently exceeded their tolerance levels. Environmental physiologists need to join in efforts to identify the causes of amphibian extinctions and to try to reverse the trend. Additionally, new areas of study not represented in this book, such as immune function, need to be explored. Though some physiological ecologists may hesitate to become engaged in what appears to be "applied" research, the message is clear: the directions for future research detailed in this book may become impossible to pursue because few amphibians will be available for study.

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