possible to observe the new phenomena. It is difficult to discern from Pais's account the influence Gell-Mann and Weinberg have had as theoreticians. Similarly, the experimental practice of the 1970's, with the change that occurred in the kind of high-energy events looked for, is not contrasted with that of the '60's. Nor is the sociology of the high-energy physics community taken up. But as Pais emphasizes in his introductory chapter, he has written one man's account of particle physics. We have other accounts to enrich our understanding: Pickering's *Constructing Quarks*, Galison's article "How the first neutral current experiment ended," and Brown and Hoddeson's histories of particle physics in the '30's and the '50's.

Although the first part of *Inward Bound* should be understandable to a layperson the book is largely addressed to the physicist and mathematician with good background in relativistic quantum mechanics. It should become required reading for graduate students in physics, as it offers a lucid map of the road taken in arriving at the present understanding of the fundamental laws of nature. It is regrettable, however, that the book does not contain a single illustration, not even a Feynman diagram. An illustration of Geissler's pump, for example, would have made the discussion in the text much clearer.

Undoubtedly, exception will be taken to some of the emphasis in Pais's presentation. Some might have put greater emphasis on nuclear physics during the '30's—in particular, nuclear reactions and their theoretical descriptions. Others might weigh the role of renormalizability or of symmetry breaking differently. It is, however, unlikely that a more careful or a more masterful presentation will be forthcoming soon.

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Australian Bird Populations

Birds of Eucalypt Forests and Woodlands. Ecology, Conservation, Management. A. KEAST, H. F. RECHER, H. FORD, and D. SAUNDERS, Eds. Illustrated by D. McFarland, D. Milledge, and J. Trompp. Published in association with the Royal Australasian Ornithologists Union by Surrey Beatty, Chipping Norton, NSW, Australia, 1985. xvi, 384 pp., illus. $43.

In Australia, perhaps more than elsewhere, the biology of birds and the structure of bird communities are influenced by the dominant plants. These plants, the eucalypts, are a uniquely Australian tree lineage including over 500 endemic species. In addition to abundant nectar and sap, eucalypts produce manna in response to insect attack, and lerps and honeydew are secreted by sap-sucking insects. These carbohydrate resources and the unique arthropod communities of eucalypts have been instrumental in molding the adaptations of eucalypt forest birds. Knowledge about the birds of eucalypt forests is provided in this valuable compendium with emphasis on three general topics: ecology and behavior of bird species, dynamics of bird populations and communities, and responses of birds to selected human impacts. Many authors incorporate information about eucalpyts and the arthropods associated with them into their presentations.

Some papers resurrect old saws, but many explore ecological pattern with depth and insight. For example, the complex interactions of food supply, interspecific competition, population dynamics, and community structure are clearly illustrated by the bell miner (*Manorina melanophrys*) studied by Loyn and others. Bell miners aggressively exclude other birds from their territories, which generally support large populations of psyllid insects, the primary food of the bell miner. Upon removal of bell miners from their territories, an immediate influx of other birds occurs and, within a few months, psyllid populations crash. Many colonizing bird species then disappear from the area.

Many papers focus on the relationship between food abundance and bird densities (Pyke, Paton, Bell, Woinarski, and others). No general conclusions emerge. Birds undoubtedly do respond in very complex ways to changing food abundances, and likely respond differently at different times under varying circumstances. Thus simple univariate relationships between bird populations and their food supplies are elusive.

Species respond individually to produce communities that vary with latitude (Milledge and Recher), elevation and microtopography (Loyn), vegetation structure and plant species composition (Gilmore), temperature, rainfall, and food resource pattern (Pyke), and nest site availability (Noske). Birds may even regulate insect populations and thus determine aspects of tree health (Ford).

Autecological studies of Australian birds contain many lessons in evolutionary biology. The importance of carbohydrate resources such as those available to the Australian avifauna is unprecedented on other continents, and—a matter not discussed in this book—plantations of introduced eucalypts outside Australia typically support few birds and arthropods because species that have coevolved with eucalypts are not present. Cooperative breeding systems predominate among Australian birds more than among birds in other geographic areas. In eastern yellow robin (Marchant), for example, clutch size is higher for pairs with auxiliary helpers than for pairs alone, perhaps because auxiliaries provide extra food supplies during courtship feeding.

Many authors discuss methods for ameliorating effects of such modern perturbations as clearfelling for timber and woodchips, altered fire regimes, and land clearing for agriculture. One especially interesting chapter by Loyn examines the population dynamics of forest island relict birds. He found that the number of forest species preserved by a complex of small reserves was similar to the number preserved by a large reserve of similar total size, an observation very germane to the "SLOSS" (single large or several small preserves) controversy. However, he also showed that populations in the most fragmented combinations were very low in density and consisted mainly of transient individuals. Thus, although the birds occur in small forest patches, their presence may not indicate viable populations.

The volume concludes with high-quality color photographs depicting both eucalypt forest habitats and birds. Regrettably, no effort was made to cross-reference the photographs with papers in the text. The extensive data tabulations included will be valuable long after the theoretical ideas presented have passed.

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Angiosperm Reproduction

Plant Breeding Systems. A. J. RICHARDS. Allen and Unwin, Winchester, MA, 1986. xiv, 529 pp., illus. $75; paper, $34.95.

A. J. Richards, well known for his research on breeding systems of vascular plants, particularly the genetics of agamospermy in dandelions and various facets of floral heteromorphism, has written a book he describes as a textbook, but one that will interest advanced researchers in a field that has witnessed an "explosive expansion" of activity in recent decades. The plants of its title are almost exclusively angiosperms. Richards includes a diversity of topics beyond reproductive systems, such as theoretical matters, genetic structure of populations, resource allocation, foraging theory, and

recognition phenomena in the operation of incompatibility systems. He admits, however, that the book is biased toward his own research interests and that another book (by another author) is needed to deal with the theory and mathematical modeling that he covers less thoroughly. One-fifth of the text is devoted to Richards's interests: heterostyly (51 pages) and agamospermy (53 pages).

The introductory chapter makes some statements easily subject to misinterpretation; for example that "hermaphrodites can self-fertilize whereas unisexuals cannot" (p. 2) could be read to mean that plants with perfect flowers *do* self-fertilize (thus excluding the important role of incompatibility or other mechanisms that prevent this in many species). This statement also does not distinguish two kinds of hermaphroditic individuals: plants with perfect flowers and monoecious ones with unisexual flowers. This confusion is compounded in the glossary, which refers to monoecious flowers as well as to monoecious individuals; the term correctly refers to plants and not flowers. Likewise that "self-fertilization tends to reduce genetic variability" (p. 2) surely is not what the author intended to say; the distribution of variability may differ in xenogamous and autogamous breeding systems, but the level of variability is dependent on selection and is not an artifact of the breeding system alone. "Self-incompatibility will lead to more outbreeding and greater genetic variability than will self-compatibility" (p. 3) is a statement that is true only if accompanied by qualifications concerning levels both of outbreeding and of genetic variability. An "interesting feature" of monoecious species is "that they can change sex" (p. 4); the sentences that follow this puzzling assertion explain what the author means, but it is a showstopper for an informed reader and probably an uninformed one as well. The glossary poses additional problems. The term "breeding system" does not appear there. A monocarpic plant is one that "only flowers once." A carpel is "the segment of an ovary." Definitions of the Darwinian terms "legitimate" and "illegitimate" for classes of pollination of heterostylous plants exclude tristylous species.

Richards is to be commended for dispelling the common notion that agamospermy (the production of seeds without syngamy) is an evolutionary dead end. Indeed, anyone who has attempted to maintain a lawn free of dandelions will have an intuitive suspicion of this assertion. Most agamospermous species that have been studied appear to be facultatively so, and retain some level of sexual reproduction combined with asexuality. The balance between relative levels of sexuality and asexuality in successive reproductive phases may vary and seems to be under environmental control, though the specifics of this control are scarcely understood. Richards contrasts the "real world" of agamospermy with the "hopelessly naive" mathematical models that assess its long-term success in a given evolutionary line. His own work with the dandelion genus *Taraxacum* has gone a long way toward providing an understanding of the mechanics and significance of sexuality and asexuality combined in the same organism.

Botanists, in particular, do not always distinguish clearly between inbreeding as a term of population genetics and the various factors, such as levels of selfing and of assortative mating or population size, that contribute to levels of inbreeding. Indeed, one commonly finds the term "inbreeding" used interchangeably with "selfing." Richards, however, keeps the distinctions clear and realizes that the mechanics of reproduction must be distinguished from the genetic consequences of different reproductive modes.

The flaws mentioned above may diminish the value of this book as a textbook, but a seasoned reader will doubtless recognize most of the infelicities as such and benefit from the book's many positive qualities. The book is wide-ranging in coverage, provides an excellent review of many interrelated topics, and lacks the doctrinaire quality and sketchy literature reviews of some recent volumes that cover some of the same territory. It also points to many general topics that require investigation; the "explosive expansion" of research that Richards refers to will doubtless continue.

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Petrology

Fluid-Rock Interactions during Metamorphism. JOHN V. WALTHER AND BERNARD J. WOOD, Eds. Springer-Verlag, New York, 1986. x, 218 pp., illus. $44. Advances in Physical Geochemistry, vol. 5.

In the last few years a lively debate regarding the nature of fluid-rock interactions at depth has been carried on in the geological literature. This debate has centered on the amount of fluid involved in metamorphism (lots vs. almost none), the sources of the fluid phase, and the mechanisms of fluid migration through material with low permeability. A review of current thinking on the mechanical and chemical aspects of fluid-rock interactions has been sorely needed.