

## Quest for a Particle

**The Higgs Hunter's Guide.** JOHN F. GUNION, HOWARD E. HABER, GORDON KANE, and SALLY DAWSON. Addison-Wesley, Redwood City, CA, 1990. xvi, 425 pp., illus. \$49.50.

Through the pioneering work of Glashow, Salam, and Weinberg, we now understand that electricity and magnetism and weak radioactive decays are different aspects of the same deep theory. The long-range nature of electromagnetic forces and the pointlike interactions responsible for nuclear beta decay—discordant physical phenomena—emerge physically from the same theory as a result of the spontaneous breakdown of a local underlying symmetry. This excellent monograph by Gunion, Haber, Kane, and Dawson explores the consequences of this symmetry breakdown's being triggered by elementary scalar excitations. Even though this is the simplest possibility, it remains in many ways the most compelling. Furthermore, as this book attests, it leads to a very rich phenomenology.

When spontaneous breakdown occurs through the self-interactions of some fundamental scalar field, at least one massive, spin-zero excitation appears in the spectrum of the theory. This particle is the famous Higgs boson, whose traces Gunion and friends search for in their book. Finding this excitation experimentally would provide unrefutable evidence for the mechanism responsible for the symmetry breakdown, with deep implications for our understanding of the fundamental interactions.

The main focus of this monograph is on the expected signals and detection techniques for Higgs bosons. The authors explain with care what the main properties of the "standard" Higgs boson are and how such a particle can be seen in both electron-positron and hadronic collisions. Equally praiseworthy is their general discussion of the two-doublet Higgs model, which, although necessarily rather detailed, manages to convey in a crisp way the new features expected when one enlarges the Higgs sector. For my taste, however, their treatment of the minimal supersymmetric extension of the standard model is a bit too exhaustive. I suspect that all but the most faithful reader will get lost in the maze of details.

Although it is understandable given the thrust of the book, I was also a bit disappointed that the authors spent so little time discussing possible alternatives to symmetry breakdown by scalar fields. However, this omission is compensated for by a lovely discussion of the general theoretical bounds, and some particular experimental bounds, that exist for Higgs bosons. I found the treatment

of this topic really quite good, putting into perspective and correlating a large amount of otherwise rather disjoint material that appears in the primary literature.

On balance, I believe that *The Higgs Hunter's Guide* is a very timely and useful addition to the growing literature on the standard electroweak theory. It is a well-written book that covers in a comprehensive manner one of the few remaining areas that remain open in the theory of electroweak interactions. As such it belongs on the bookshelves of all active researchers in the field. Its pedagogical approach should also make it quite a useful book for students who are trying to enter into the field.

ROBERTO PECCEI  
Department of Physics,  
University of California,  
Los Angeles, CA 90024

## Embryogenesis

**This Side Up.** Spatial Determination in the Early Development of Animals. ROBERT WALL. Cambridge University Press, New York, 1990. xii, 436 pp., illus. \$110. Developmental and Cell Biology Series, 24.

During the last decade, largely owing to the combined use of genetic or molecular analysis and experimental embryology in studies of development in *Drosophila melanogaster*, *Caenorhabditis elegans*, and *Xenopus laevis*, solutions to such long-standing problems as the molecular basis of spatial determination seem finally within reach. Emphasis on fewer species, however, has considerably narrowed the perspective of embryological research. A glance at leading journals might suggest that the only animals worthy of embryological interest are worms, fruit flies, frogs, and, for anthropomorphic reasons, the mouse. Robert Wall expounds the opposite philosophy in this book, which examines the processes and mechanisms of spatial determination throughout the animal kingdom. The hope is that by understanding information obtained from different animals, embryologists will be inspired to mount a more rational attack on the most general features of development.

This book focuses on the question of whether spatial determination is controlled "mosaically" by tissue-specific determinants sequestered in the egg or epigenetically by inductive cell interactions that arise during the formation of the embryo. It begins with a consideration of how much pattern is already laid down in the egg during oogenesis, then proceeds through the generation of new spatial patterns during ooplasmic segregation, cleavage, and gastrulation, and

ends with a summary in which the processes and mechanisms of spatial determination are compared in different species. The theme is developed cleverly, first by considering data obtained with a particularly relevant species, such as ascidians for tissue-specific determinants and sea urchins for cell interactions, and then by surveying different animal groups. The nematode worms, fruit flies, frogs, and mammals are not forgotten in this book but are given the same emphasis as hydrozoans, ctenophores, mollusks, other arthropods, echinoderms, ascidians, birds, and so forth. Obviously, there are dangers to this approach. Wall has to deal with a voluminous and sometimes contradictory literature (about a fourth of the pages are devoted to bibliography) and must try to explain and integrate species and data that are out of line with the general trends. Wall has handled these pitfalls quite well; the book is superbly organized and readable, and the examples are critically selected and integrated into a comprehensive theory of spatial determination in the final chapter.

Although the primary focus of the book is on experimental embryology, existing molecular data are also evaluated for each animal group. Through this exercise it becomes clear that a large portion of the molecular research that was done before the recent focus on just a few species is irrelevant to the fundamental questions that need to be addressed by modern embryologists. Perhaps most of these molecular details could have been left out, but in considering them the author drives home his lesson that molecular embryologists should pay attention to the rules that govern development as well as those that govern the behavior of molecules.

The author's general conclusion is that cell interactions, rather than tissue-specific determinants, are responsible for spatial determination in most species. The title, *This Side Up*, is meant to convey the idea that the animal egg contains little developmental information other than instructions needed to specify the poles of the embryo. One of the crucial facts used to negate the existence of tissue-specific determinants is that maternal effect mutations that affect a somatic cell fate directly have yet to be found. The author's bias is transparent here; he fails to point out as strongly and frequently that this negative evidence has been obtained only in those few species in which sophisticated genetic analysis is possible. Otherwise, however, the subject matter is treated fairly. For example, Wall admits that determinants, rather than cell interactions, may function in determining the germ line and some somatic cell fates in rapidly developing organisms, such as ctenophores and ascidians. Whether or not they all agree with Wall's approach and

conclusions, embryologists of different persuasions could profit from reading this book.

Wall has given us a book that is quite different from, but no less significant than, for example, Jonathan Slack's *From Egg to Embryo* or Eric Davidson's *Gene Activity in Early Development*. Indeed, it complements these volumes and will be an important addition to the developmental biologist's bookshelves. A next milestone in embryology will be the integration of the vast molecular data currently being generated into a comprehensive theory of spatial determination in animals. This book should have a unifying influence on such an endeavor.

WILLIAM R. JEFFERY  
Bodega Marine Laboratory,  
University of California,  
Bodega Bay, CA 94923

## Archeology in Context

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**A History of Archaeological Thought.** BRUCE G. TRIGGER. Cambridge University Press, New York, 1990. xvi, 500 pp., illus. \$59.50; paper, \$17.95.

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Over more than two decades Bruce Trigger has produced a series of thoughtful, sometimes provocative, and always valuable articles and books on the history of archeology. The present book, something of a distillation of these earlier works, constitutes a reasoned comment on the nature of anthropological archeology. It not only describes the main currents of the discipline's development but reviews critically its current state, in which rapidly developing excavation strategies and theoretical orientations often vie with one another.

After amorphous beginnings in association with the Renaissance discovery of history, archeology gradually developed its own focus and methodology. Trigger's early chapters describe the gradual shift from an antiquarian interest in the classical era and the mysteries of its medieval successors into the 19th century, when, with the discovery and acknowledgment of a long *prehistory*, archeology was forced to develop a methodology in which the excavated object supplanted the written record as the only datum from which that more distant history could be known. For all intents and purposes it is here that a scientific archeology begins, in great part because of its kinship with geology, whose proven methods it adopted. It is here, too, that classical archeology, with its "elitist" emphasis upon great works of creative importance more allied to the history of art and literature than of society, diverges

from a "populist" prehistoric archeology whose data are the fossilized fragments of the daily behavior of peoples who have left no other record. Such a shift from history to prehistory and the demonstration of a human antiquity reaching into the geological record and farther than anyone had realized raised important questions about the nature of human history and its underlying processes. Heirs to the universal historians of the Enlightenment and reacting to the ethnic and political separatism engendered by Romanticism, the New Historians, armed with the documentation provided by the new archeology, reasserted a faith in a universal progressive history and the unity of the species that it implied. The emphasis upon stratification that prehistoric archeology drew from geology, as well as the increasing data of ethnography, led easily to a notion of history as a series of superimposed stages leading from a "primitive" base to civilization's summit. In his discussion of what he terms the "imperial synthesis" Trigger condemns these ethnocentric pseudohistories in what is now the commonplace castigation of the classism, colonialism, and racism of our intellectual ancestors. In this I think he distorts the record by imposing something of a presentistic judgment without raising the appropriate question whether there can be or could have been a culturally value-free archeology or history. For all of their culturally derived bias, these later Victorians upheld the idea of a common humanity, recognized the value of the archeological record in documenting a history that had been purely speculative, and recognized in the commonality of the human experience the possibilities of the use of ethnographic analogies for creating from the raw products of the archeologist's pick and spade an understandable grammar of some long-lost sociocultural system. That they were naive in much that they did and culture-bound in much that they thought is insufficient grounds for condemning them to purgatory.

In a subsequent chapter in which he discusses the emergence of regional and national archeologies as a reaction to the excesses of the universal historians at both ends of the century, Trigger quite properly and usefully emphasizes the role of romantically inspired nationalisms in supporting the use of the archeological enterprise for national and ethnically chauvinistic purposes. This is an interesting and important movement that has led to fraud, distortion, and exaggeration of the archeological record. But, as before, Trigger short-changes an American archeology and nascent anthropology whose concern with the remnants of the native past was inspired in part by the new nation's

search for a past, purer than and distinct from that from which it had separated itself. More particularly and more consciously, in the development of both the archeology and the ethnography of Native Americans, the practitioners were engaged in a sometimes frantic effort to discharge their responsibilities to science, as Joseph Henry urged, by preserving for future generations the data below ground and above that were rapidly being destroyed. Today one may regard this effort as exploitation and destruction; but if it had not been made, what would we now know of the past? This is the price of history.

Throughout this section, despite its sometimes presentistic approach, Trigger writes on two levels. The first and most didactic is that of narrative history. This history is detailed and instructive, populated with significant figures such as Thomsen and Montelius who are lost in most historical accounts, and worldwide in scope, providing a sketch of what was going on outside the Euro-American sphere. Trigger's greater interest, however, is the context within which the discipline is embedded. In this sense, the discipline is itself a cultural artifact. As he passes archeology through history's screen, Trigger subjects it to an examination against the changing contexts from which it derives and to which it contributes its parcel of meaning. He concludes this historical review with a chapter on Soviet archeology that is of value not only as an account of an archeology about which we in the West know little but as a case study of the effect of a forceful and politically imposed ideology on the development and the practice of the discipline.

The final chapters describe the archeology of the most recent half-century, during which, in the fusion of anthropological and evolutionary (in the Darwinian sense) concepts with its own methodological refinements, the discipline has reached its maturity. Understandably and appropriately, Trigger gives particular attention to V. Gordon Childe (whose biography he has written) and to Graham Clarke, both major figures in the reorientation of contemporary archeology. These chapters provide a useful guide for those, students and others, who wish to understand the directions in which archeological practice and thought are moving.

Finally, Trigger's discussion in his introductory chapter of the nature and uses of the history of archeology, the appended bibliographical essay, and the extensive bibliography are themselves very useful tools for anyone interested in the discipline—or any other discipline—and the various social milieus in which it has found itself.

In such a comprehensive and thoughtful