misperceptions, some noted by others and some not. In the first category, Baucom agrees with Gregg Herken, the author of this review, and others that many key individuals, such as science adviser George Keyworth, were not brought into the decision-making loop until very late in the game. In addition, Edward Teller emerges as an important figure but not, as in many accounts, the single most important progenitor of the defense idea. Teller is not mentioned extensively in *The Origins of SDI* until nearly two-thirds of the way through the book.

Overall, Baucom's narrative is thoughtful and detailed. But the book's short (four-page) epilogue, offered as almost an afterthought to the text, is an exception and would have been better left out. In this seeming apologia for the SDI, Baucom offers up a number of questionable conclusions. The SDI "forced" the Soviets "into a responsive mode," "defused" the freeze movement, created a new political consensus, and "contributed significantly to the West's triumph in the Cold War." This simply goes too far. To be sure, SDI was a contributing factor in the Cold War struggle, but not an overriding one. Baucom's assertions do not take into account major internal changes taking place in the Soviet Union that had very little to do with U.S. actions or, at home, the influence of the freeze movement in bringing the administration to a more serious and realistic internal assessment of arms control.

Absent the epilogue, however, Baucom does make a good start toward achieving his stated purpose of setting the SDI decision "firmly within its historical context." The book does serve as a good beginning for anyone looking into the SDI phenomenon.

**G. Allen Greb**
*Nuclear History Program, College Park, MD 20742*

■

## A Disease in Resurgence

**Cholera.** DHIMAN BARUA and WILLIAM B. GREENOUGH III, Eds. Plenum Medical, New York, 1992. xx, 372 pp., illus. $59.50. Current Topics in Infectious Disease.

A publisher could not wish for more help in promoting a series on Current Topics in Infectious Diseases than that provided by the explosive cholera epidemic spreading through Latin America. As of December 1992 the outbreak had resulted in more than 700,000 cases of cholera and claimed 6323 lives.

The editors of this contribution to the series are cholera veterans. It was Barua who first reported the intriguing connection between blood group O and increased risk of cholera gravis, and he has a long association with the World Health Organization program for diarrheal disease control. Greenough is a codiscoverer of the role of cyclic AMP in the pathogenesis of cholera and participated in early clinical trials of oral rehydration therapy, the use of which is largely responsible for the remarkably low mortality rate associated with the current epidemic.

The book begins with a brief illustrated history of cholera, one of humankind's oldest documented diseases, and ends with an epilogue devoted to the Latin American epidemic. The chapters in between cover the bacteriology, genetics, and ecology of *Vibrio cholerae* and related vibrios; the epidemiology and pathogenesis of cholera; its pathophysiology, laboratory diagnosis, and clinical management; immunity and vaccine development; and the prevention and control of diarrheal diseases.

For the growing numbers of health professionals who are treating cholera patients for the first time, the chapters on clinical management of and pathophysiological responses to the disease should prove helpful. The detailed discussion of methods of prevention, control, and laboratory diagnosis could function as a practical guide for the public health community in recently affected areas. Standard diagnostic techniques are described, but newer procedures involving recombinant DNA technology are not discussed.

The chapters on *V. cholerae* bacteriology and diagnosis overlap but complement the section on "non-O1" (that is, nonepidemic-serogroup) vibrios. Characteristics used in identifying these opportunistic pathogens capable of causing cholera-like diarrhea are described. This information should be helpful to physicians and lab workers in and around estuarine environments where cholera infections are likely to increase.

Comparison of the epidemiology and ecology chapters illustrates the impact of recent findings concerning *V. cholerae* ecology on older concepts of disease transmission. Prior to the introduction of molecular epidemiology (when most of the studies covered in the epidemiology chapter were conducted) it was thought that epidemic cholera persisted within a reservoir of subclinical infections disseminated during outbreaks by contaminated water or food. Newer ecological studies have revealed that *V. cholerae* O1 is, in fact, ubiquitous in aqueous environments, often in "non-cultivatable" forms that may require intestinal growth for resuscitation. These data have spawned debates regarding what constitutes an "epidemic strain" of *V. cholerae* and whether non-toxigenic O1 serogroup isolates should be included.

The enterotoxin chapter, subtitled "a historical perspective," is more of an introspective treatment of the subject, in which the author voices his unique opinion on the evolution of cholera and *Escherichia coli* enterotoxin research and its impact on vaccine development. More current and provocative is the treatment of genetics, pathogenesis, and immunity and vaccine development. The chapter on genetics describes the control of expression of *V. cholerae* virulence factors including the environmentally triggered "regulon" cascade controlling expression of cholera enterotoxin, toxin-coregulated pili, and outer-membrane proteins and adhesins. Information about new *V. cholerae* "toxins" ZOT (zonula occludens toxin) and ACE (accessory cholera enterotoxin), discovered in the chapter author's laboratory, is too recent to have been included. These and other, as yet undiscovered virulence factors revealed by new in vivo growth selection techniques (such as the IVET system; see *Science* **259**, 686 [1993]) will likely revolutionize traditional concepts of *V. cholerae* pathogenesis.

The fiercest competition in cholera research is in the development of vaccines that can emulate the solid protection afforded by the disease itself. Leading candidates are genetically engineered live *V. cholerae* that are capable of producing all of the components (except active toxins) expressed by wild-type vibrios in the appropriate environment (that is, the small intestine). Other promising formulations contain killed vibrios supplemented with controversial protective antigens (for example, pili proteins or hemagglutinins). The chapters on pathogenesis and vaccines and immunity discuss these and other vaccine strategies and inform the reader of the latest developments.

*Cholera* is historically oriented and lightly edited, but it makes interesting reading for cholera devotees and novices alike. With the expanding boundaries of cholera coming ever closer, those who may have to face this old disease sooner than they realize should acquaint themselves with this book.

**Stephen Richardson**
*Department of Microbiology, Bowman Gray School of Medicine, Winston-Salem, NC 27157*

■

## Andean Imperialism

**Provincial Power in the Inka Empire.** TERENCE N. D'ALTROY. Smithsonian Institution Press, Washington, DC, 1992. xii, 272 pp., illus. $42.50.

The New Archeology is no longer new in North America, having been accepted into the mainstream of academic thought well

## Vignettes: Second Thoughts

The Nobel prize-winning scientist Sir Peter Medawar has called science "the art of the soluble." While this description is accurate, it does nothing to specify what counts as a solution.

—*Stephen H. Kellert*, in *In the Wake of Chaos: Unpredictable Order in Dynamical Systems* (University of Chicago Press)

It is a profoundly erroneous truism, repeated by all copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle—they are strictly limited in number, they require fresh horses, and must only be made at decisive moments.

—*Alfred North Whitehead*, as quoted by John D. Barrow in *Pi in the Sky: Counting, Thinking, and Being* (Oxford University Press)

It is . . . worth remembering that not all myths are simply false stories. We should remain open to the possibility that the killer-ape myth became popular not only because it reflected the tensions of the cold war, or because it retold the familiar story of Eve and Adam, but because it is—at least in some symbolic way—essentially true.

—*Matt Cartmill*, in *A View to Death in the Morning: The Nature of Hunting Through History* (Harvard University Press)

over a decade ago. Yet the Andean area has proved surprisingly resistant to inroads from the processual studies the New Archeology espouses, especially regarding the formation of complex societies. It is for that reason that *Provincial Power in the Inka Empire* is something of a milestone: a volume that presents a formal theoretical model, drawn from the literature on state development as well as the ethnohistoric documents pertaining to the Inkas, and tests it with data from a particular region. The new and useful features of the work are, first, D'Altroy's theoretical discussion of the development of the Inka empire, which benefits greatly from his cross-cultural perspective, and second, the presentation and testing of his own "hegemonic-territorial" model to account for the development of the Inka state.

The hegemonic-territorial model focuses on the costs and benefits of different strategies of incorporation, which range from the hegemonic (indirect control using pre-existing political structures to rule) to the territorial (direct control using personnel of the empire to rule). The model explains how strategies in the Upper Mantaro region of Central Peru were different from those used in other areas, taking into account differences in the local environment, indigenous political development, and other factors. It also provides a very useful description of the energy limitations placed on the Inkas by transport and other logistical considerations. These limitations are seldom given a place in other views of the Inka empire.

The model is applied in two ways in this volume, at the empire level and at the regional level. It is at the empire level that general comparisons are made with other archaic states and the shared and unique characteristics of the Inkas are elaborated. At the regional level, D'Altroy applies the model to the Upper Mantaro region to show its utility at a smaller scale. One of the greatest strengths of this book is its attention to detail and the support of theory by data. D'Altroy has the advantage of having at his disposal the results of the Upper Mantaro Archaeological Research Project (UMARP), perhaps the most intensive research project ever conducted in an Andean region. He uses the data effectively, combining extensive artifactual, settlement-pattern, and environmental data with rigorous statistical tests to go beyond the results presented by UMARP members over the past decade to achieve a synthesis of the information that is greater than the sum of its parts.

Any model is subject to evaluation on the basis of its premises. Most models of Inka statecraft, including this one, are founded on premises derived from the ethnohistoric documents dealing with the Inka empire and its interpretation by early Spanish writers. Some Andean scholars will take issue with particulars of D'Altroy's model with regard to interpretation of the historical record. The evidence that is presented supports the model, however, and the model provides the means to generate hypotheses for researchers in other areas to test with their own data. Whether they find supportive or contradictory evidence will be the true test of its utility.

One of the most controversial aspects of D'Altroy's model is the emphasis it places on three forms of power: military, political, and economic. D'Altroy deliberately deemphasizes ideology as a significant factor in the development of the Inka state, a choice sure to raise the hackles of many Andeanists, as he anticipates. He has theoretical and methodological reasons for doing so. Theoretically, he takes the view that "a materialist and energetic approach is more satisfactory for strategic analysis than an approach that relies on ideological rationales because the former directly addresses the most basic requirements of conquest, consolidation of control and extraction of resources." Methodologically, he finds problems with verifying the meaning of ideological systems with archeological research. The latter, of course, is a matter of ongoing argument between processual and post-processual archeologists, and one that this volume will not be able to resolve. Though D'Altroy states that his work does not deny a central role to ideology, his general perspective seems to be that ideology is more a legitimatizing factor of the state than a central factor in its formation. Many would argue with this perspective.

This brings up one shortcoming of the book: it ultimately fails to explain why the Inkas expanded out of their heartland around Cuzco. It is perhaps in this realm that the importance of religion is to be placed, as Conrad and Demarest (among others) have suggested. Where the volume *is* successful is in explaining *how* the Inkas incorporated one particular region into the empire and why there is variability from one region to another. The utility of D'Altroy's model is particularly clear in the explanation of the latter.

In sum, this volume is more than a very thorough analysis of the way in which one province was incorporated into the Inka empire; it is a systematic assessment of Inka statecraft itself. The reader will find thoughtful discussions of Inka political organization, the decimal hierarchy system, and the way local elites were used to achieve imperial goals, all within the framework of the theoretical model provid-

ed. One will learn a great deal about the Inkas from this volume, which is long overdue in Andean studies.

*Michael Malpass*
*Department of Anthropology,*
*Ithaca College,*
*Ithaca, NY 14850–7274*

■

## Mechanisms of Learning

**Perceptual and Associative Learning**. GEOFFREY HALL. Clarendon (Oxford University Press), New York, 1991. xii, 300 pp., illus. $45. Oxford Psychology Series, 18.

In the traditional view of associative learning in humans and other animals, stimuli become associated either because one stimulus reliably precedes and thus signals the occurrence of the other or because the stimuli occur at (approximately) the same time. In the traditional view of perceptual learning, by contrast, stimuli become more distinct or differentiated through repetition. Not surprisingly, these two approaches have often been proposed to account for different phenomena.

In *Perceptual and Associative Learning* Geoffrey Hall successfully bridges the disparate literatures that represent these two approaches. He begins by demonstrating that in even the simplest forms of learning traditional associative-learning principles have problems accounting for certain results. For example, the repeated simultaneous presentation of two stimuli (such as a tone and a light) may result in a change in behavior (such as less orienting to the stimulus compound). After only a few presentations of the stimulus pair one finds considerable generalization of the behavioral change to its individual components. With an increasing number of presentations, however, this generalization actually decreases. This process, called stimulus configuring, demonstrates that gestalt-like perceptual properties (that is, the compound is treated as more than the sum of its components) can develop with repeated presentations of the compound.

Hall presents associative and perceptual accounts of such examples and then evaluates the empirical support for each. Although one may surmise from his extensive research experience with associative-learning phenomena that Hall has a vested interest in such an approach, he presents refreshingly objective and integrative interpretations of the data. Hall appears comfortable concluding that an alternative theory to his own provides a more satisfactory account of the data or that the data may support more than one theory equally well.

In this book, the clearest and most thorough integration of associative and perceptual learning models is accomplished in the two chapters concerned with learned distinctiveness. If stimuli are treated differently during pretraining, they are presumed to acquire distinctiveness, which should facilitate their association with different responses later, whereas if they are treated similarly, they are presumed to acquire equivalence, which should retard the development of such associations. According to perceptual learning theory, prior experience with stimuli allows for attention to task-relevant similarities and differences between them. According to associative theories, on the other hand, the prior association of stimuli with different outcomes (for example, food versus water) results in central (brain) representations that are more distinctive than those produced by the original stimuli and thus there is less generalization between the stimuli.

More recently, associative theories have been modified to include parameters that allow for changes in the degree of associability of certain properties of a stimulus, depending on prior experience. Hall provides a fair evaluation of these expanded theories and concludes that, although it may not now be possible to specify the functioning of the associability parameter, any successful theory must include such a parameter.

Hall's strategy is to continue to modify the "standard associative model" to allow it to encompass phenomena that have often been explained in perceptual learning terms. For example, he proposes that if the concept of stimulus element (traditionally meant to include such physical attributes as size, shape, intensity, duration, and wavelength) is broadened to include the property of novelty/familiarity, a modified version of the associative model can account for many more data. According to this modified view, all novel stimuli have the common property of novelty, but if a given stimulus is repeatedly presented, early presentations (when it is novel) will be represented differently from later presentations (when it is familiar). Such a mechanism makes it possible to account for (among other things) the finding that pigeons can learn to perform well on a task in which each of a large number of stimuli is presented twice but responding is reinforced only on the first presentation (that is, when the stimulus is novel).

With regard to these modifications of the theory, it seems quite reasonable to conclude, as Hall does, that "some may object that what has emerged is no longer a purely associative theory but one that incorporates non-associative, perceptual mechanisms, but this is surely to be seen not as a shortcoming but as a worthwhile achievement."

*Thomas R. Zentall*
*Department of Psychology,*
*University of Kentucky,*
*Lexington, KY 40506*

■

## Books Received

**Atomic and Ionic Spectra and Elementary Processes in Plasma**. I. I. Sobelman, Ed. Nova, Commack, NY, 1992. xii, 171 pp., illus. $86. Proceedings of the Lebedev Physics Institute, vol. 192. Translated from the Russian by Yuri Karzhavin.

**Becoming Men**. The Development of Aspirations, Values, and Adaptational Styles. Daniel A. Hart. Plenum, New York, 1992. xiv, 220 pp., illus. $32.50. Perspectives in Developmental Psychology.

**Catching the Light**. The Entwined History of Light and Mind. Arthur Zajonc. Bantam, New York, 1993. x, 388 pp., illus. $24.95.

**Democratic Values and Technological Choices**. Stuart Hill. Stanford University Press, Stanford, CA, 1992. xviii, 267 pp., illus. $37.50.

**Energy, Plants and Man**. David Walker. 2nd ed. Oxygraphics, Brighton, U.K., 1992. xvi, 278 pp., illus. Paper, £17.50.

**Field Theory, Disorder and Simulations**. Giorgio Parisi. World Scientific, River Edge, NJ, 1992. vi, 503 pp., illus. $65.

**Guidelines for Laboratory Design**. Health and Safety Considerations. Louis J. Diberardinis *et al.* 2nd ed. Wiley, New York, 1993. xiv, 514 pp., illus. $59.95.

**The History of Chemistry**. John Hudson. Chapman and Hall, New York, 1992. x, 285 pp., illus. $59.95; paper, $24.95.

**Introductory Differential Geometry for Physicists**. A. Visconti. World Scientific, River Edge, NJ, 1992. viii, 415 pp., illus. $68; paper, $32.

**James Hutton and the History of Geology**. Dennis R. Dean. Cornell University Press, Ithaca, NY, 1992. xvi, 303 pp., illus. $38.50.

**Living Laboratories**. Women and Reproductive Technologies. Robyn Rowland. Indiana University Press, Bloomington, 1992. xiv, 367 pp. $35; paper, $14.95.

**Mark Kac Seminar on Probability and Physics**. Syllabus 1987–1992. F. den Hollander and H. Maassen, Eds. Centrum voor Wiskunde en Informatica, Amsterdam, 1992. x, 179 pp., illus. Paper, Dfl. 60. CWI Syllabus 32.

**Nobel Lectures Including Presentation Speeches and Laureates' Biographies**. Physics, 1971–1980. Stig Lundqvist, Ed. World Scientific, River Edge, NJ, 1992. xii, 603 pp., illus. $76; paper, $38.

**Organic Peroxides**. W. Ando, Ed. Wiley, New York, 1992. xvi, 845 pp., illus. $330.

**Paul Broca**. Founder of French Anthropology, Explorer of the Brain. Francis Schiller. Oxford University Press, New York, 1992. x, 350 pp., illus. Paper, $18.95. Reprint, 1979 ed.

**La Région d'In Gall-Tegidda N Tesemt (Niger)**. Programme Archéologique d'Urgence, 1977–1981. Vol. 4, Azelik-Takadda et l'Implantation Sédentaire Médiévale. Suzy Bernus and Patrice Cressier, Eds. Institut de Recherches en Sciences Humaines, Niamey, Niger, 1991 (distributor, Institut Français de Recherche Scientifique pour le Développement en Coopération, Paris). vi, 390 pp., illus. Paper, 250 F. Études Nigériennes, no. 51.

**Science After '40**. Arnold Thackray, Ed. History of Science Society, Philadelphia, 1992 (distributor, University of Chicago Press, Chicago). x, 307 pp., illus. $39; paper, $25. *Osiris*, vol. 7.

**Tobacco or Health**. Status in the Americas. Pan American Health Organization, Washington, DC, 1992. xiv, 387 pp., illus. Paper, $20. Scientific Publication no. 536.

**Universal Constants in Physics**. Gilles Cohen-Tannoudji. McGraw-Hill, New York, 1993. 116 pp. Paper, $9.95. Horizons of Science Series. Translated from the French edition (Paris, 1991).