



Vignettes: Unexpected Outcomes

Constrained, structured thinking has been the predominant habit of successful operators in both business and science for at least two millennia. . . . Only occasionally have surprising discoveries upset the equilibria of scientists, and then only for a little while. Surprises are soon reconciled with old pictures of reality; structure and constraint reign once more. But in the disequilibrium of the interim, believers in a free lunch have a field day.

—Garrett Hardin, in *Living Within Limits: Ecology, Economics, and Population Taboos* (Oxford University Press)

Apart from anything else, scientific research can be rip-roaring good fun. . . . When a new experiment or calculation comes out right, one shares a bit of the triumphal exultation common to all creators. When things go wrong, there is at any rate the consolation of communal suffering. Description of my most recent failure (" . . . and, as a result of a small error in setting up the observing files, I am now the world's foremost expert on molecular gas ten minutes of arc south of the Crab Nebula") has elicited a similar anecdote from every astronomer I've told it to."

—Virginia Trimble, in *Visit to a Small Universe* (American Institute of Physics)

Sensing Scents

Cell Biology of Olfaction. ALBERT I. FARBMAN. Cambridge University Press, New York, 1992. xii, 282 pp., illus. \$59.95 or £35. Developmental and Cell Biology Series.

Special neurons in the nose—the olfactory receptor neurons—detect odors and tell the brain what we smell. Olfactory neurons can discriminate a myriad of odors, transducing them into changes in membrane excitability that result in excitation of some neurons and inhibition of others. The mechanisms underlying odor detection and transduction have long engaged the attention of investigators. Even more intriguing is how the olfactory system retains its perceptual fidelity. Unlike other neurons, when olfactory neurons age and die, they are replaced with new neurons derived from a population of progenitor cells in the nasal epithelium. New olfactory neurons develop, acquire chemosensitivity, and form synaptic connections in the olfactory bulb of the brain. This process of neurogenesis occurs continuously. Despite constant turnover of the sensory cells, the sense of smell is quite stable: Odors do not take on new qualities with time and are not suddenly confused with one another, and chemosensitivity to a particular odor does not disappear abruptly. Olfactory transduction and the stability of the olfactory sense raise fascinating

questions about the nervous system.

Cell Biology of Olfaction contains a detailed examination of the structure and function of the olfactory bulb, the vomeronasal organ, and non-neuronal olfactory cells, as well as coverage of transduction and neurogenesis. Discussions of the anatomical and structural features of the olfactory system—the more mature areas of the field—are particularly thorough. In the past few years new research methods, especially in electrophysiology and molecular biology, have accelerated the pace of discovery in the field. Yet we still understand relatively little about the nature or diversity of mechanisms underlying odor transduction or about the regulatory features that control development of olfactory neurons. Even the definitive identification of the family of receptor proteins cloned from olfactory tissue as odor receptors still awaits the demonstration of odorant binding and odor-elicited functions. These and several other topics are briefly and critically evaluated; interestingly, Farberman's assessments remain valid in spite of a recent flurry of reports of breakthroughs in our understanding of olfaction.

Although this book is very much "one man's view of the field," it is not a myopic account, and both students and researchers will find it a valuable resource. The range of topics covered is broad, and the extensive (62-page) list of references contains citations through 1991. The field would be well served by a similarly com-

prehensive account of olfactory physiology and the neural mechanisms underlying odor discrimination.

Vincent E. Dionne

Department of Pharmacology,
University of California at San Diego,
La Jolla, CA 92093-0636

Higgs Hunting

Perspectives on Higgs Physics. GORDON L. KANE, Ed. World Scientific, River Edge, NJ, 1993. xviii, 467 pp., illus. \$98 or £69; paper, \$48 or £34. Advanced Series on Directions in High Energy Physics, vol. 13.

According to the standard model of particle physics, which unites the strong, weak, and electromagnetic interactions into a single quantitative theory, all matter is made of quarks and leptons and all forces arise by the exchange of gauge bosons. The simplest gauge boson is the photon that mediates the electromagnetic interaction. The two nuclear forces are mediated by the other gauge bosons, the eight gluons and the *W* and *Z*.

The standard model is so successful that it is now being tested at the 1 percent level. Despite its great success, however, the theory leaves open many important questions, including those concerning the origin of mass. In particular, it does not explain why the photon is massless, while the *W* and *Z* bosons have masses about 100 times that of the proton. In the standard model all mass originates through interactions with a new particle, the so-called Higgs boson. The problem is that at present there is no experimental evidence for this particle, even from the precision measurements.

Fortunately, the standard model is inconsistent if the Higgs is missing, or if it has a mass much greater than 1000 times that of the proton. This places the Higgs in the range of the Superconducting Super Collider (SSC). Indeed, the primary motivation behind construction of the SSC is the search for this particle, or whatever is in its place. Once it is found, investigators can begin to decode the origin of mass.

A book that summarizes our current knowledge about the Higgs and its various alternatives is thus both timely and useful. *Perspectives on Higgs Physics*, edited by Gordon Kane, does an excellent job of presenting the current state of the field. A collection of specially commissioned review papers, it covers the theory, phenomenology, and even cosmology of the standard model Higgs boson.

The opening paper by M. Veltman provides a lovely introduction to the Higgs

system, with special emphasis on the history of the Higgs boson, the formal structure of the Higgs Lagrangian, and the theoretical constraints on their properties. Veltman also discusses the "screening theorem," which explains why the precision measurements at CERN and SLAC are insensitive to the Higgs mass.

The book then goes beyond the standard model to treat various alternatives to the minimal Higgs boson. At present the particle physics community is engaged in a vigorous debate about whether the alternatives will be weakly or strongly coupled, and Kane has been wise to include contributions from both sides of the debate.

Ibáñez and Ross present the case for weak coupling in a beautiful report on the minimal supersymmetric standard model. They discuss in detail the radiative breaking scheme, which ties electroweak symmetry breaking to the mass of the top quark. Union then outlines the prospects for detecting supersymmetric Higgs bosons with existing and future colliders.

The strongly coupled scenario is presented nicely by Einhorn; his task is made difficult by the fact that, at present, there is no compelling model that agrees with experimental results. The challenge of constructing such a model is emphasized by Georgi in "Why I would be very sad if a Higgs boson were discovered," a personal view of the state of the art. The problems are also addressed by Chanowitz, who provides a thorough model-independent discussion of the strongly coupled phenomenology.

Perspectives on Higgs Physics is written by and for particle physicists. However, it should be accessible to those interested in the physics of the SSC. The contributions are of uniformly high quality and deserve to be studied by every serious student of particle phenomenology. The volume could have been strengthened by the inclusion of the current bounds on the Higgs and its couplings, even though they will soon change. Also, I think the choice of contributors is too heavily skewed toward the friends and colleagues of the editor. Even so, this is an excellent book. It should be in the collection of every particle physicist, as well as in every major research library.

Jonathan A. Bagger

Department of Physics and Astronomy,
Johns Hopkins University,
Baltimore, MD 21218

Books Received

Analytical Biochemistry. David J. Holme and Hazel Peck. 2nd ed. Longman Scientific and Technical, Harlow, Essex, U.K., and Wiley, New York, 1993. xvi, 507 pp., illus. Paper, \$49.95.

The Angry Gut. Coping with Colitis and Crohn's Disease. W. Grant Thompson. Plenum, New York, 1993. xiv, 350 pp., illus. \$26.95.

Animal Behavior. An Evolutionary Approach. John Alcock. 5th ed. Sinauer, Sunderland, MA, 1993. xiv, 625 pp., illus., + plates. \$46.95.

Animal Behaviour. Psychobiology, Ethology, and Evolution. David McFarland. 2nd ed. Longman Scientific and Technical, Harlow, Essex, U.K., and Wiley, New York, 1993. xiv, 585 pp., illus. Paper, \$47.

Biosystematic Monograph of the Genus Cucumis (Cucurbitaceae). Botanical Identification of Cucumbers and Melons. Joseph H. Kirkbride, Jr. Parkway Publishers, Boone, NC, 1993. x, 159 pp., illus., + diskette. \$47.50.

Bloodsucking Witchcraft. An Epistemological Study of Anthropomorphic Supernaturalism in Rural Tlaxcala. Hugo G. Nutini and John M. Roberts. University of Arizona Press, Tucson, 1993. xiv, 476 pp. \$40.

Boeing's Ed Wells. Mary Wells Geer. University of Washington Press, Seattle, 1993. x, 179 pp., illus. \$19.95.

The Brain Has a Mind of Its Own. Insights From a Practicing Neurologist. Richard Restak. Crown, New York, 1993. xiv, 210 pp. Paper, \$12. Reprint, 1991 ed.

Cancer. Robert M. McAllister, Sylvia Teich Horowitz, and Raymond V. Gilden. Basic Books, New York, 1993. xvi, 329 pp., illus. \$22.

Chance and Chaos. David Ruelle. Princeton University Press, Princeton, NJ, 1993. xii, 195 pp., illus. Paper, \$9.95. Princeton Science Library. Reprint, 1991 ed.

Desert Geomorphology. Ron Cooke, Andrew Warren, and Andrew Goudie. UCL, London, 1993 (U.S. distributor, Taylor and Francis, Bristol, PA). viii, 526 pp., illus. Paper, \$59.95.

Deserts. The Encroaching Wilderness. A World Conservation Atlas. Tony Allan and Andrew Warren, Eds. Oxford University Press, New York, 1993. 176 pp. \$35.

Development of X-Ray Analysis XX. Lawrence Bragg, D. C. Phillips and H. Lipson, Eds. Dover, New York, 1992. viii, 270 pp., illus. Paper, \$8.95. Dover Books on Physics and Chemistry. Reprint, 1975 ed.

Developments in Partial Differential Equations and Applications to Mathematical Physics. G. Buttazzo, G. P. Galdi, and L. Zanghirati, Eds. Plenum, New York, 1992. viii, 246 pp., illus. \$69.50. From a meeting, Ferrara, Italy, Oct. 1991.

East Africa's Grasses and Fodders. Their Ecology and Husbandry. Joseph G. Boonman. Kluwer, Norwell, MA, 1993. xviii, 343 pp., illus. \$236. Tasks for Vegetation Science, 29.

Ecology and Our Endangered Life-Support Systems. Eugene P. Odum. 2nd ed. Sinauer, Sunderland, MA, 1993. xvi, 301 pp., illus. Paper, \$18.95.

Encyclopedia of Materials Science and Engineering. Supplementary vol. 3. Robert W. Cahn and Michael B. Bever, Eds. Pergamon, Tarrytown, NY, 1993. xvi, 756 pp., illus. \$500. Advances in Materials Science and Engineering.

Final Choices. To Live or to Die in an Age of Medical Technology. George M. Burnell. Plenum, New York, 1993. xxii, 374 pp. \$27.50.

Fossil Elephantoids from the Hominid-Bearing Awash Group, Middle Awash Valley, Afar Depression, Ethiopia. Jon E. Kalb and Assefa Mebrate. Doris Tischler, illustrator. American Philosophical Society, Philadelphia, 1993. xvi, 114 pp., illus. Paper, \$15. *Transactions of the American Philosophical Society*, vol. 83, part 1.

The Foundations of Magnetic Recording. John C. Mallinson. 2nd ed. Academic Press, San Diego, CA, 1993. xvi, 217 pp., illus. \$54.50.

From Bones to Behavior. Ethnoarchaeological and Experimental Contributions to the Interpretation of Faunal Remains. Jean Hudson, Ed. Center for Archaeological Investigations, Carbondale, IL, 1993. xviii, 354 pp., illus. Paper, \$30. Occasional Paper no. 21. From a conference, 1991.

Handbook of Intelligent Control. Neural, Fuzzy, and Adaptive Approaches. David A. White and Donald A. Sofge, Eds. Van Nostrand Reinhold, New York, 1992. xx, 568 pp., illus. \$59.95.

Hate Crimes. The Rising Tide of Bigotry and Bloodshed. Jack Levin and Jack McDevitt. Plenum, New York, 1993. xviii, 287 pp. \$23.95.

Hedgerails and Fairy Candles. The Lives and Lore of North American Wildflowers. Jack Sanders. Dawn Peterson, illustrator. Ragged Mountain (TAB), Camden, ME, 1993. viii, 232 pp., illus. \$21.95.

The Hematopoietic Microenvironment. The Functional and Structural Basis of Blood Cell Development. Michael W. Long and Max S. Wicha, Eds. Johns Hopkins University Press, Baltimore, MD, 1993. xiv, 306 pp., illus. \$140. Johns Hopkins Series in Hematology/Oncology.

In the Wake of Chaos. Unpredictable Order in Dynamical Systems. Stephen H. Kellert. University of Chicago Press, Chicago, 1993. xiv, 176 pp., illus. \$19.95. Science and Its Conceptual Foundations.

In the Wake of Galileo. Michael Segre. Rutgers University Press, New Brunswick, NJ, 1993. xxii, 192 pp., illus. Paper, \$14. Reprint, 1991 ed.

Insect Cell Culture Engineering. Matthew F. A. Goosen, Andrew J. Daugulis, and Peter Faulkner, Eds. Dekker, New York, 1993. xii, 245 pp., illus. \$115. Bioprocess Technology, 17.

Introduction to Electronic Document Management Systems. William B. Green. Academic Press, San Diego, CA, 1993. xiv, 250 pp., illus., + plates. \$44.95.

Marine Biotechnology. Vol. 1, Pharmaceutical and Bioactive Natural Products. David H. Attaway and Oskar R. Zaborsky, Eds. Plenum, New York, 1993. xx, 500 pp., illus. \$89.50.

Marine Climate, Weather, and Fisheries. The Effects of Weather and Climatic Changes on Fisheries and Ocean Resources. Taivo Laevastu. Wiley, New York, 1993. xii, 204 pp., illus. \$49.95.

Marine Mammal Sensory Systems. Jeanette A. Thomas, Ronald A. Kastelein, and Alexander Ya. Supin, Eds. Plenum, New York, 1992. xiv, 773 pp., illus. \$149.50. From a symposium, Moscow, Oct. 1991.

Mechanisms of Molecular Evolution. Introduction to Molecular Paleopopulation Biology. Naoyuki Takahata and Andrew G. Clark, Eds. Japan Scientific Societies, Tokyo, and Sinauer, Sunderland, MA, 1993. x, 250 pp., illus. \$34.95. From a symposium, Mishima, Japan, Nov. 1991.

Polymer Surfaces and Interfaces II. W. J. Feast, H. S. Munro, and R. W. Richards, Eds. Wiley, New York, 1993. xvi, 297 pp., illus. \$75. From a symposium, Durham, U.K., July 1991.

Population Politics. The Choices That Shape Our Future. Virginia D. Abernethy. Plenum, New York, 1993. xx, 350 pp., illus. \$26.50.

Post-Implantation Development in the Mouse. Wiley, New York, 1992. x, 315 pp., illus. \$75. Ciba Foundation Symposium, 165. From a symposium, London, June 1991.

The Return of Common Sense. The Demise of Relativity. Robert L. Henderson. Common Sense Press, Sun City, AZ, 1992. vi, 217 pp. Paper, \$15.

Risk and Tenure in Arid Lands. The Political Ecology of Development in the Senegal River Basin. Thomas K. Park, Ed. University of Arizona Press, Tucson, 1993. xxviii, 383 pp., illus. \$29.95. Monographs on Arid Lands Development.

Robert Mayer and the Conservation of Energy. Kenneth L. Caneva. Princeton University Press, Princeton, NJ, 1993. xxiv, 439 pp., illus. \$49.50.

Rubbish! The Archaeology of Garbage. William Rathje and Cullen Murphy. HarperPerennial, New York, 1993. viii, 263 pp., illus. Paper, \$12. Reprint, 1992 ed.

Signal Transduction in Lung Cells. Jerome S. Brody, David M. Center, and Vsevolod A. Tkachuk, Eds. Dekker, New York, 1993. xvi, 639 pp., illus. \$195. Lung Biology in Health and Disease, 65. From a symposium, Woods Hole, MA, Oct. 1991.

The Social Impact of AIDS in the United States. Albert R. Jonsen and Jeff Stryker, Eds. National Academy Press, Washington, DC, 1993. xiv, 322 pp., illus. \$34.95.

Solid-Earth Sciences and Society. Commission on Geosciences, Environment, and Resources. National Academy Press, Washington, DC, 1993. xxii, 346 pp., illus. \$49.95.