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, Farbman'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 comprehensive account of olfactory physiology and the neural mechanisms underlying odor discrimination.

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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