Robinet (1735–1820), Buffon (1707–1788), and, at great extent, Lamarck (1744–1829); the British James Burnett (1714–1799) and Erasmus Darwin (1731–1806), Charles's redoubtable grandfather; and the German Lorenz Oken (1779–1851). Then he proceeds to biologists who dominate the first half of the 19th century: Cuvier (1769–1832) and Etienne Geoffroy Saint-Hilaire (1772–1844) in France; Robert Grant (1793–1874), Robert Chambers (1802–1871), and Richard Owen (1804–1892) in Britain; von Baer (1792–1876) in Germany; and the Swiss-American Louis Agassiz (1807–1873). Owen and Agassiz were ardent anti-evolutionists. Ruse skillfully shows how the temper of the times, most particularly optimism about cultural progress, pervaded these early biologists' highly speculative theorizing. Whether his application of the three-pronged test amounts to a "proof" of the case, as he would have it, is for me uncertain and of little consequence.

The study of biological evolution becomes seriously scientific with Charles Darwin's (1809–1882) publication of *The Origin of Species* (1859). Darwin systematically accumulated evidence (bringing in artificial selection, biogeography, and other considerations that previously had received scant or no attention) making a strong case for the evolutionary origin of organisms; and, of greatest import, he discovered natural selection, the causal process accounting for evolutionary change and diversification. The evolution of organisms became accepted by professional biologists and the subject of much public discussion.

Yet, as Ruse sagaciously discerns, the study of evolution remained a matter for amateur, rather than professional, investigations; it was not until well into the 20th century that it became accepted as a proper subject for academic research and was incorporated into the curriculum. The journal *Evolution*, the first periodical dedicated to the subject, first appeared in 1947. It would be the 1960s before courses dedicated to evolution became common at academic institutions and departments of "evolutionary biology" or "ecology and evolution" started to proliferate. "Nothing in biology makes sense except in the light of evolution," wrote in 1973 the great evolutionist Theodosius Dobzhansky. Yes, would say Ruse, but it has taken a full century and more for biologists to notice it.

Thomas H. Huxley (1825–1895), who famously battled Bishop Wilberforce at Oxford, is emblematic of the schism in the split that existed between the subjects he taught to university students or the research he pursued professionally, mostly physiology and anatomy, and the evolutionary theorizing of his popular writings and speeches. Ruse also expounds Alfred Russel Wallace (1823–1913), co-discoverer of natural selection, and other late-19th- and early-20th-century evolutionists. He insightfully scrutinizes at length the mathematical evolutionists R. A. Fisher, J. B. S. Haldane, and Sewall Wright, whose major contributions started in the 1920s, and the great biological theorists Theodosius Dobzhansky, George Simpson, Ernst Mayr, and G. Ledyard Stebbins, who between 1937 and 1950 completed the integration of evolution with genetics, paleontology, systematics, and botany. The exertions of even these greatest of all evolutionists are tainted, Ruse concludes, by a belief in progress, however nuanced. Ruse then brings the story to the present and to those of us still in the trenches pursuing evolutionary research with theory and experiment. He sees that the ideology of progress subtly persists, even as this is explicitly denied by evolutionists. He proclaims that "we should not expect progressionism to disappear from evolutionary theory anytime soon . . . , however professional and mature evolutionary studies become" (p. 539). By this time and on this point, Ruse and I have parted company.

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Comparative Volcanology

Volcanoes of the Solar System. CHARLES FRANKEL. Cambridge University Press, New York, 1996. xiv, 232 pp., illus. $70 or £40, ISBN 0-521-47201-6; paper, $24.95 or £14.95, ISBN 0-521-47770-0.

Volcano Instability on the Earth and Other Planets. W. J. McGUIRE, A. P. JONES, and J. NEUBERG, Eds. Geological Society, Bath, UK, 1996 (U.S. distributor, AAPG Bookstore, Tulsa, OK). viii, 388 pp., illus. $125 or £75; to society members, $58 or £35. ISBN 1-897799-60-8. Geological Society Special Publication no. 110. Based on a conference, May 1994.

Volcanoes and the dynamic processes by which they are formed are inherently intriguing topics in Earth and planetary science, in part because of the many remaining mysteries associated with them. Indeed, recent discoveries suggest that volcanism is manifested in a variety of unique forms throughout the solar system, as well as on the terrestrial ocean floor. Two newly published books on this subject are considered here, the first an introductory survey, the other a collection of state-of-the-art research papers thematically linked by one of the most compelling new paradigms of volcano evolution. Each offers something for the reader interested in volcanoes, whether it be a synopsis of eruptions on the Jovian satellite Io or a treatment of new techniques for monitoring the deformation patterns on historically unstable terrestrial volcanoes.

In his solar-system–wide survey of volcanoes and the processes by which they are formed Charles Frankel addresses a broad range of readers without many of the esoteric details that lie behind the theories presented. Frankel's treatment is synoptic and includes some captivating images of newly discovered volcanic landforms on Venus as well as from the outer solar system. It is assumed that the reader has a rudimentary knowledge of geological principles. The underlying theme is that of comparative planetary volcanology. The text presents a very understandable case for comparing volcanoes across all of the rocky planets of the solar system by employing several interesting analogies. Indeed, the author captures many of the newly developed paradigms that have emerged as a result of global reconnaissance by spacecraft of bodies such as the moon, Venus, Mars, and Io. While excellent treatments of this subject have been published in the past few years (for example, P. W. Francis's *Volcanoes: A Planetary Perspective*, Oxford Univ. Press, 1993), *Volcanoes of the Solar System* seeks to captivate the reader by providing a high-level review in the form of an inventory. Indeed, the book reads at times rather like a voyager's guide to planetary volcanoes. On this basis, the book succeeds and offers an enticing, albeit uneven, presentation of how volcanism is manifested in the solar system.

It is unfortunate, however, that Frankel's treatment of such an inherently interesting subject is flawed by inattention to detail and other limitations. For example, early in the book a classic image of Earth as viewed by Apollo 17 is incorrectly oriented with north to the left. In addition, Frankel misrepresents one of the most significant remote-sensing discoveries of the past 20 years—the dramatic realization of ocean floor topography from geodetic-precision spaceborne ocean radar altimeters—by attributing these results to laser altimetry, a method only recently employed for the first time in Earth orbit. He also misrepresents the current state of topographic knowledge of the terrestrial seafloor in suggesting that we now have a better global dataset on the physiography of the surface of Venus and Mars than we do for terrestrial ocean basins. Global images of the surfaces of the Moon, Mars, and Venus are available with spatial resolutions that average 100 to 200 meters, but such data are in no way equivalent to global topographic datasets that quantify the relief characteristics of the surfaces of any of the silicate planets. Indeed, global

topographic maps of Earth, Venus, Mars, and the moon at present all have the same approximate spatial resolution (~10 km).

In summary, *Volcanoes of the Solar System* is a readable attempt to provide an integrated perspective of volcanism throughout the solar system, from Earth to Triton, Neptune's intriguing largest satellite. A paucity of illustrations to document the full spectrum of volcanic landforms on the bodies described, coupled with occasional inaccuracies in the text, weakens the treatment. Furthermore, the perspective presented is a limited one, given the references cited, and it fails to capture the full range of concepts that have recently been developed in the field.

In contrast with Frankel's introductory review, *Volcano Instability on the Earth and Other Planets* presents an in-depth treatment of a recent revolution in thinking concerning the evolution of volcanoes. Though at times esoteric, this compilation succeeds by virtue of its breadth and provides several levels of detail as to how large, polygenetic volcanoes evolve by means of flank collapse. That volcanic landforms are inherently unstable has been observed for at least a century, but the importance of their instability and the catastrophic effects associated with flank failure was recognized only after the 1980 eruption of Mount Saint Helens. The 26 chapters of *Volcano Instability* offer an up-to-date, comprehensive treatment of volcano instability and how it operates, how it can be monitored, and even how it has been most recently recognized on planetary bodies such as Mars and Venus. Indeed, in the opening chapter of the book, the lead editor presents a most readable review of the instabilities associated with terrestrial volcanoes and compellingly articulates their importance not only in terms of volcanology but also for people living near such unstable volcanoes as Mount Rainier. This overview readily allows a reader to identify where in the volume treatment of particular subjects might be found.

Topics of particular interest that are well described in the volume include volcano instability on the planets (especially Venus and Mars), the history of instability at the infamous Mount Etna, and new techniques for measuring and monitoring instabilities at terrestrial volcanoes. One of the most compelling themes in this regard is the building body of evidence for massive flank collapse episodes in association with oceanic volcanoes, such as those in the Hawaiian islands, on the island of Reunion, and in the Canaries archipelago. Chapters treating aspects of slope failure at these island volcanoes demonstrate the emerging recognition of submarine slope failure deposits and features at most polygenetic volcanoes, including those of basaltic composition. High-resolution side-scan sonar observations have revealed remarkable evidence for massive structural failure at many oceanic edifices, often with deposits that exceed 100 cubic kilometers in volume. Continental volcanoes at which voluminous debris avalanche deposits have been recognized include Colima and Popocatapetl in Mexico and Mount Shasta in the United States. The human hazards associated with catastrophic flank collapse and long runout debris avalanches are now known to be appreciable, and monitoring methods that may provide early warning of such events are under investigation and refinement.

Volcano Instability on the Earth and Other Planets offers any reader interested in volcanoes an extremely current view of one of the most significant elements of the evolution of volcanic landforms.

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Neurobiology

Nerve Growth and Guidance. C. D. McCAIG, Ed. Portland, London, 1996 (U.S. distributor, Ashgate, Brookfield, VT). xii, 174 pp., illus. $96 or £60. ISBN 1-85578-085-2. Frontiers in Neurobiology, 2.

These are heady times in the study of axon guidance. Recent editorials in this journal and elsewhere have expressed the excitement felt in this field. The rapid pace of recent progress, the discovery of guidance cues, and the plethora of innovative techniques brought to bear have given real hope that this complex problem may be solved. Thus, a comprehensive book on axon guidance is timely and will attract great interest among neurobiologists and scientists in general. *Nerve Growth and Guidance* results from a meeting organized by Colin McCaig in 1995. There are several thoughtful and informative chapters. Of particular note are those by Davenport, Bandtlow, and Bush *et al.*, which update advances in this field since the appearance of the best volume addressing axon guidance, *The Nerve Growth Cone* (Raven Press), which is now five years old. Still this new book, like most meeting-derived books, suffers from the long publishing time. A novel feature of the volume is advocacy of galvantropism, the hypothesis that physiological electric currents guide nerve growth, to project it from "the poor relation of axon guidance to one of its aristocrats" (editor's words). I do not believe the editor has served his cause well in this respect. His chapter is entirely too strident and concerned with redressing past wrongs. Inclusion of a chapter on electric currents in embryos that is only peripherally related to nerve growth seems inappropriate given the book's brevity and the current wealth of more relevant topics. It is always possible that such iconoclastic ideas may establish the new paradigm, but those wishing to overturn dogma must do so with rigorous and unrefutable experiments. Fields at their formative stages deserve an evenhanded presentation of the facts and controversies confronting them. This book seems less balanced and thus inappropriate for the naive reader.

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Books Received

Careers in Science and Engineering. A Student Planning Guide to Grad School and Beyond. Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, Institute of Medicine. National Academy Press, Washington, DC, 1996. xxiv, 134 pp., illus. Paper, $11.95.

Clouds and Climate Change. Glenn E. Shaw. University Science, Sausalito, CA, 1996. xiv, 21 pp., illus. Paper, $17. Global Change Instruction Program.

The Collision of Comet Shoemaker-Levy 9 and Jupiter. Keith S. Noll. Harold A. Weaver, and Paul D. Feldman, Eds. Cambridge University Press, New York, 1996. xiv, 373 pp., illus. $69.95. Space Telescope Science Institute Symposium 9. From a workshop, Baltimore, MD, May 1995.

Cosmology and Astrophysics through Problems. T. Padmanabhan. Cambridge University Press, New York, 1996. 486 pp., illus. $90; paper, $34.95.

The Cougar Almanac. A Complete Natural History of the Mountain Lion. Robert H. Busch. Lyons and Burford, New York, 1996. 144 pp., illus., + plates. $25.

Human Gene Mapping 1995. A Compendium. A. Jamie Cuticchia *et al.*, compilers. Johns Hopkins University Press, Baltimore, 1996. vi, 1768 pp. Paper, $150.

Intracellular Signal Transduction. The JAK-STAT Pathway. Andrew F. Wilks and Ailsa G. Harpur. Landes, Austin, TX, and Chapman and Hall, New York, 1996. viii, 209 pp., illus. $69.95. Molecular Biology Intelligence Unit.

Introduction to Physical Oceanography. George L. Mellor. AIP Press, Woodbury, NY, 1996. xiv, 260 pp., illus. Paper, $55.

A Laboratory Guide to RNA. Isolation, Analysis, and Synthesis. Paul A. Krieg, Ed. Wiley-Liss, New York, 1996. x, 445 pp., illus. Spiralbound, $64.95.

Malaria Vaccine Development. A Multi-Immune Response Approach. Stephen L. Hoffman, Ed. ASM Press, Washington, DC, 1996. x, 310 pp., illus. $75.

The New Penguin Dictionary of Geology. Philip Kearey. Penguin, New York, 1996. x, 366 pp. Paper, $13.95 or £6.99 or A$16.95 or C$17.99.

Online Searching. A Scientist's Perspective. A Guide for the Chemical and Life Sciences. Damon D. Ridley. Wiley, New York, 1996. xx, 344 pp., illus. Paper, $39.95.

The Phospholipase C Pathway. Its Regulation and Desensitization. Andrew B. Tobin. Landes, Austin, TX, and Chapman and Hall, New York, 1996. xvi, 223 pp., illus. $69.95. Molecular Biology Intelligence Unit.

Phthalocyanines. Properties and Applications. C. C. Leznoff and A. B. P. Lever, Eds. VCH, New York, 1996. xii, 524 pp., illus. $150.

Superconductivity of Metals and Cuprates. J. R. Waldram. Institute of Physics, Philadelphia, 1996. xiv, 410 pp., illus. $180 or £90; paper, $60 or £30.

The Terrestrial Eocene-Oligocene Transition in North America. Donald R. Prothero and Robert J. Emry, Eds. Cambridge University Press, New York, 1996. xiv, 688 pp., illus. $95.