BOOK REVIEWS

Causation in the Courts

Bendectin and Birth Defects. The Challenges of Mass Toxic Substances Litigation. MICHAEL D. GREEN. University of Pennsylvania Press, Philadelphia, 1996. xiv, 368 pp. $29.95 or £28.50.

Bendectin, an antinausea drug widely prescribed to pregnant women in the 1970s, was alleged to have a role in causing birth defects. Merrell, the producer of the drug, took it off the market, endured nearly 20 years of litigation, and incurred millions of dollars in legal costs. Although about 40 percent of the plaintiffs won damage awards, there was never any scientifically compelling evidence that the drug caused the defects.

There is a large legal and scientific literature examining aspects of this case. Much of it is inflammatory. Peter W. Huber, a well-known critic of toxic tort cases, uses Bendectin litigation as a classic case of "junk science in the courtroom." Defenders of tort law have responded with impassioned attacks on Huber's arguments. Green's contribution is to tell the story of Bendectin in a well-researched and studiously balanced fashion.

Understanding the issues in the Bendectin case requires knowledge of science, specifically toxicology and epidemiology, of the intricacies of toxic substances law, and of the regulatory role of the Food and Drug Administration (FDA). Green provides careful explication of each area and helpfully suggests in his preface which chapters readers with expertise in one or another might skip. The chapters of technical background will be slow going for some readers, but the story is never lost. Green captures the personalities and motivations of many of the key players, from the Mekdeci family, who brought the first case, to a cast of lawyers whose tenacity, creativity, and competitiveness sustained the litigation in the absence of credible evidence of causation. The story acquires power not from colorful or imaginative writing but because it emerges from the facts and observations set forth dispassionately.

Perhaps the most valuable lesson from Green's study is the pivotal importance of individuals and serendipitous events. Mrs. Mekdeci's agony at the birth of her defective child drives her to try to uncover causation. Her persistence keeps the momentum up despite the overwhelming odds. Her chance call to "king of torts" Melvin Belli, who neglects the plaintiffs while titillating the tabloid press, expands one family's sorrow into a nationwide hunt for victims. The vulnerabilities of the defendant company, with its ties to thalidomide and its cavalier attitude toward research, provide "an attractive allegory for lawyers."

There are no winners in the Bendectin story. Most children with birth defects go home with nothing. The lawyers come across as crass competitors who view their plaintiffs as inventory, not people. The drug manufacturer appears to be driven primarily by profit, and loses millions of dollars. The law fails to find the truth. The biggest loser, however, appears to be "science." Toxicology, epidemiology, and teratology are all perverted by the inexorable demands of law.

We like to think of science as a tool for understanding the universe. In a courtroom, it is harnessed to a need to find winners and losers. It is all black and white, there are no shades of gray. Green explains well how the courts have struggled in the causation quagmire. With regard to the Supreme Court's recent effort to establish criteria for evaluating scientific evidence he writes, "Science is a multifaceted discipline, the potential for error or abuse quite variegated, and its application in litigation quite diverse. Broad standards . . . will inevitably require substantial amplification with more specific and contextual principles." From a reading of this book, it is hard to have confidence in the judiciary's ability to develop those standards.

Green's knowledge of the particulars in this case makes him cautious about drawing broad lessons from it. Indeed, the measures he suggests for improving the legal environment are by his own admission marginal. He recommends developing some form of "regulatory standards" defense in court. Such a defense would allow defendants to assert that compliance with FDA requirements shelters them, in varying degrees, from liability. He also suggests greater consideration and use of court-appointed experts rather than individuals hired by one side or the other. Each of these suggestions is raised and briefly discussed. The lesson is that there are few lessons that can be generalized from this case. The danger, according to Green, is overreaction. This conclusion is in stark contrast to the work of Huber and others who see Bendectin as illustrative of the sins of tort law. Green's message is that improvement is most likely to occur through the evolution of rules on a case-by-case basis in the courts.

His conclusions are sobering. Solutions are not close at hand. Indeed, this year's congressional debate over product liability reform reinforces the lack of consensus on the problems in the law. A modest reform bill narrowly passed the Congress in March 1996 and was vetoed by the president in May. The rhetoric was divisive and emotions ran high.

Green offers no panacea in his book, but what he does give us, balanced information and appeals to caution, are important contributions in their own right.

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Also Noteworthy

The Mismeasure of Man. STEPHEN JAY GOULD. Second edition. Norton, New York, 1996. 444 pp., illus. $25 or C$33.99; paper, $13.95.

This new edition of Stephen Jay Gould's widely noted (see for example *Science* **215**, 656 [1982]) work of 15 years ago was prompted, according to the author, by the "latest cyclic episode of biodeterminism" represented by Herrnstein and Murray's *The Bell Curve*. In a 32-page introductory essay in the new edition Gould discusses the rationale for the original work, which he emphasizes was not a critique of biodeterminism generally but an examination of "*one particular form of quantified* claim about the ranking of human groups: the argument that intelligence can be meaningfully abstracted as a single number capable of ranking all people on a linear scale of intrinsic and unalterable mental worth"; defends his credentials as a critic; and gives some of the background of the new edition. "Since I wrote about the great and original arguments, and virtually ignored the modern avatars of 1981," he writes, "this revision required few changes, and the main text of the current version differs very little from the original book," which included accounts of pre-Darwinian craniometry, late-19th- and early-20th-century craniology, American intelligence testing, and factor analysis as developed and used by Cyril Burt

and others in what Gould characterizes as the "reification of intelligence." Apart from the introduction the new edition is distinguished mainly by the inclusion of a reprinting of two reviews by Gould of *The Bell Curve* and three essays, gathered under the heading Three Centuries' Perspective on Race and Racism, that discuss the ideas of the British physician Thomas Browne, of the German naturalist J. F. Blumenbach, and of Darwin as represented in a pamphlet entitled "The Moral State of Tahiti."

Katherine Livingston

The World According to Wavelets. The Story of a Mathematical Technique in the Making. BARBARA BURKE HUBBARD. Peters, Wellesley, MA, 1996. xx, 265 pp., illus. $34.

Wavelets. Theory and Applications. GORDON ERLEBACHER, M. YOUSUFF HUSSAINI, and LELAND M. JAMESON, Eds. Oxford University Press, New York, 1996. xii, 510 pp., illus. $55 or £39.50. ICASE/LaRC Series in Computational Science and Engineering.

Since the mathematical decomposition technique known as the wavelet transform made its appearance in the 1980s a library of the subject has been building up. Accounts of six books on wavelets, including works authored by Yves Meyer, Ingrid Daubechies, and Charles K. Shui, have appeared in *Science* (**257**, 821 [1992] and **262**, 1589 [1993]). This season brings two further entries.

Hubbard's book is something of a new departure in the field, being an attempt by a nonexpert to explain this inevitably technical subject to an audience with little or no mathematical background. Expanding on an effort initiated for a National Academy of Sciences "Frontiers of Science" volume, Hubbard has set out to give an account that will include something of the "human side" of the subject. The first section of the book expounds wavelets without the use of any mathematical formulas, beginning with a description of Fourier analysis, of which they are an extension, giving some of the history of their development, and concluding with a consideration of their applications in signal processing. A second and longer section (Beyond Plain English) gives a more mathematical treatment of various aspects of the subject, and an appendix further explains some relevant mathematical concepts and operations. There are also a bibliography, a listing of software sources, a reference list, and an index.

The work edited by Erlebacher *et al.* is in a more directly tutorial mode, being based on a 1993 "short course" whose "emphasis was on providing as much as possible the practical knowledge which will enable applied scientists to evaluate objectively how useful these new tools are in relation to their needs." The volume opens with two introductory chapters in which Jameson and Strang, respectively, discuss the application of wavelets to partial differential equations and wavelets from filter banks. Tchamitchian then provides a 100-page account of the mathematical origins of wavelets and lays out their theoretical framework. Ensuing chapters deal with wavelet-based fast numerical algorithms (Beylkin) and with wavelet algorithms for partial differential equations and studies of turbulence (Liandrat). Finally, Arneodo provides a 150-page discussion of wavelet analysis of fractals. Each chapter has its own reference list, and there is an index to the work as a whole.

Katherine Livingston

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Vignette: Infoworld

The old British Museum reading room provided an architectural interface to the vast book stacks that lay beyond. From outside, the classical, columnar facade functioned as an icon—signifier of an access point. From within the circular, domed reading room (which looks in plan like a sectored hard disk), books could be summoned up by the action of specifying a call number. Library attendants would then retrieve volumes from the stacks for use at a reading table. . . . the cycle would be completed by performing the task of reshelving the books until they were needed again. Functionally, the whole thing was a very large, very slow version of what computer technicians now know as a database server.

—*William J. Mitchell*, in *City of Bits: Space, Place, and the Infobahn* (MIT Press)

Books Received

The Artful Universe. John D. Barrow. Oxford University Press, New York, 1995. x, 274 pp., illus., + plates. $27.50.

At War Within. The Double-Edged Sword of Immunity. William R. Clark. Oxford University Press, New York, 1995. xii, 276 pp. $25.

Bangs, Crunches, Whimpers, and Shrieks. Singularities and Acausalities in Relativistic Spacetimes. John Earman. Oxford University Press, New York, 1995. xii, 257 pp., illus. $35.

The Cells of the Body. A History of Somatic Cell Genetics. Henry Harris. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1995. xii, 263 pp., illus. $59.

The Domestic Dog. Its Evolution, Behavior, and Interactions with People. James Serpell, Ed. Cambridge University Press, New York, 1996. xii, 268 pp., illus. $69.95; paper, $19.95.

The Ecology of Fire. Robert J. Whelan. Cambridge University Press, New York, 1995. x, 346 pp., illus. $59.95; paper, $27.95. Cambridge Studies in Ecology.

Ecology of Infectious Diseases in Natural Populations. B. T. Grenfell and A. P. Dobson, Ed. Cambridge University Press, New York, 1995. xii, 521 pp., illus. $59.95. Publications of the Newton Institute, 7. Based on a workshop, March 1993.

Free Radicals in Organic Chemistry. Jacques Fosey, Daniel Lefort, and Janine Sorba. Wiley, New York, and Masson, Paris, 1995. xiv, 307 pp., illus. Paper, $39.95.

Freud Scientifically Reappraised. Testing the Theories and Therapy. Seymour Fisher and Roger P. Greenberg. Wiley, New York, 1996. xiv, 353 pp. $37.95.

Handbook of Media for Environmental Microbiology. Ronald M. Atlas. CRC Press, Boca Raton, FL, 1995. iv, 540 pp. $99.95.

How We Learn; How We Remember. Toward an Understanding of Brain and Neural Systems. Leon N. Cooper. World Scientific, River Edge, NJ, 1995. x, 395 pp., illus. $99; paper, $53. World Scientific Series in 20th Century Physics, vol. 10. Reprints of selected papers.

Immune Responses in the Nervous System. Nancy J. Rothwell. Bios Scientific, Oxford, UK, 1995 (U.S. distributor, Books International, Herndon, VA). xvi, 233 pp., illus. $130 or £365. Molecular and Cellular Neurobiology.

India and Antarctica During the Precambrian. M. Yoshida and M. Santosh, Eds. Geological Society of India, Bangalore, 1995. xvii, 412 pp., illus. Paper, $50 or Rs. 400. Memoir 34.

Jurassic Magmatism and Tectonics of the North American Cordillera. David M. Miller and Cathy Busby, Eds. Geological Society of America, Boulder, CO, 1995. vi, 425 pp., illus. Paper, $95. Special Paper 299.

Lavoisier in European Context. Negotiating a New Language for Chemistry. Bernadette Bensaude-Vincent and Ferdinando Abbri, Eds. Science History Publications/USA (Watson), Nantucket, MA, 1995. x, 303 pp., illus. $45.95. From a workshop, May 1994.

Modern Glacial Environments. Processes, Dynamics and Sediments. John Menzies. Butterworth-Heinemann, Stoneham, MA, 1995. xxvi, 621 pp., illus. Paper, $69.95. Glacial Environments, vol. 1.

Particle Physics. Perspectives and Opportunities. Roberto Peccei *et al.*, Eds. World Scientific, River Edge, NJ, 1995. xii, 301 pp., illus. $82. Based on a workshop, Baltimore, MD, May 1994, and a meeting, Albuquerque, NM, Aug. 1994.

Quantum Mass Theory Compatible with Quantum Field Theory. Petar K. Anastasovski and Trevor M. Benson. Nova, Commack, NY, 1995. viii, 165 pp., illus. $87.

Science and Technology Policy Yearbook 1995. Albert H. Teich, Stephen D. Nelson, and Celia McEnaney, Eds. American Association for the Advancement of Science, Washington, DC, 1995. xii, 357 pp., illus. Paper, $24.95; to AAAS members, $19.95.

Technology's New Horizons. Conversations with Japanese Scientists. Hiroaki Yanagida, Ed. Oxford University Press, New York, 1995. xviii, 161 pp., illus. $35.

The Visual Brain in Action. A. David Milner and Melvyn A. Goodale. Oxford University Press, New York, 1995. xviii, 248 pp., illus. $62. Oxford Psychology, no. 27.