cal commentary. This is followed by a brief summary of the ERAB panel's report and a closely reasoned critique of the experimental evidence for cold fusion. The case against the claimed phenomenon can perhaps best be stated as: No evidence has been found for nuclear reaction products (whether high energy or low) of sufficient quantity to account for the claimed levels of heat production. As the matter was put in the ERAB panel's final report, "the present evidence for the discovery of a new nuclear process termed cold fusion is not persuasive."

I particularly appreciated Huizenga's discussion placing the cold fusion saga in the broader context of the scientific process. How could two respected researchers go forward with a press conference and rush into publication on the basis of fragmentary and inconsistent evidence? An example of such an inconsistency is that the claimed levels of nuclear reaction products accounted for less than 10^{-8} of the claimed heat production. Good experimentalists, when confronted with anomalous readings, first suspect their experimental technique. They ask such questions as: Have I investigated all possible sources of systematic errors? Have I done adequate control experiments? Can the effects be replicated? Peer reviewers ask the same questions. In the rush for publication and priority the temptation to skimp on this essential checking naturally arises; Huizenga documents recurrent instances of publication by press conference of isolated, irreproducible, poorly calibrated, poorly controlled experiments.

The history of science documents many cases of "pathological science," which has been defined by Nobel laureate Irving Langmuir as "the science of things that aren't so." Huizenga consigns cold fusion to this category, placing it in the ranks of scientific mistakes such as polywater, N-rays, Lysenkoism, and laetrile. Although cold fusion retains a small group of vocal proponents to this day, the skeptics await a single experiment confirming nuclear reaction products sufficient to produce macroscopic amounts of heat in an electrochemical cell. In the words of Carl Sagan, "extraordinary claims require extraordinary evidence."

The book concludes with a discussion of lessons and cautions to be gleaned from the cold fusion saga. The scientific community is warned against premature publication, press conferences that bypass the peer-review process, secrecy in basic research, lobbying before congressional committees, and funding of large research initiatives of questionable scientific basis. Huizenga concludes that the cold fusion fiasco illustrates once again that the scientific process works by exposing and correcting its own errors.

Scientists are often motivated by visionary dreams: Wouldn't it be wonderful to discover a new nonpolluting energy source having an inexhaustible fuel supply? This contributes to what might be termed the conflict between the romantic and rationalistic in the scientist. Can the beauty of the dream sometimes overpower the rational evaluation of the data?

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Vignettes: Lines of Credit

If the positive side of [Joseph] Black's failure to publish was a belief that he had made his doctrine public enough, then the negative side was an almost paranoid fear of plagiarism. . . . When [James] Watt tried to get him to publish on heat in the 1780s . . . Black responded by making a comparison with the situation if Watt himself were to write on the steam engine. As an author Watt would be obliged to show a conventional modesty, and to describe his invention "in such a Cold and modest manner that Blockheads would conclude there was nothing in it, and Rogues would afterwards by making trifleing Variations vamp off the greater Part of it as their own and assume the whole merit to themselves."

—*Jan Golinski*, in *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge University Press)

Peter snorted, "Oh, no, he's not bad, is he? It's just his unfortunate manner, is it? I suppose he can't help stealing the credit for other people's ideas, can he? What about your pet *drosophila sub-obscura*? Who wrote the article about them in the *Journal of Genetics*? You know you did, but your name did not appear at all. It was all a contribution to science by that brilliant young geneticist—Doctor Ian Porter."

Mary smiled and said, "Well, I *was* working under him, wasn't I?"

—From *Unholy Dying*, a 1945 detective novel by R. T. Campbell (Dover paperback)

Leo's most famous books were *In the Beginning* (Routledge & Kegan Paul, 1965) and *Royal Essence* (Weidenfeld & Nicolson, 1971). These were still on the reading lists. They were mentioned and quoted in student essays and dissertations. The extracts quoted were always the same ones. This was because they were copied from other dissertations and textbooks. For over twenty years the authors of books and learned articles in the field had been building on each other's work, and no one now could have identified the lone pedant who originally quarried *In the Beginning and Royal Essence*.

—From *The Grown-Ups*, a 1989 novel by Victoria Glendinning (Knopf; paperback, Ivy Books)

Biotechnological Progress

Vaccines. New Approaches to Immunological Problems. RONALD W. ELLIS, Ed. Butterworth-Heinemann, Stoneham, MA, 1992. xviii, 478 pp., illus. $95. Biotechnology Series, 20.

Microbial pathogens are rapidly yielding their secrets to the tools of modern biotechnology. As a result extraordinary progress has come about in the creation of new vaccines and the improvement of old ones. The development of effective vaccines against even stubborn old scourges such as malaria and virulent new foes like human immunodeficiency virus is held to be an achievable goal, despite the many challenges to be overcome.

The rational development of a vaccine first requires an understanding of the cellular, and frequently the molecular, basis of microbial pathogenesis and the critical interactions of a microorganism with the host's immune system. Advances in biotechnology have vastly accelerated the acquisition of such knowledge. Live attenuated vaccines such as cholera can therefore be custom-designed by specific deletion mutations of known virulence genes. Also, mechanisms for precisely identifying the critical immunogenic components of a

pathogen have led to the concept of the modern subunit vaccine. For example, hybridoma technology can be utilized to pinpoint the immuno-critical epitopes of a pathogen, and genetic engineering or peptide technology can be used to create vaccine antigens that could not otherwise be acquired in sufficient quantity or purity. However, as all who work in vaccine development can attest, many vaccines that look promising in the laboratory fail the test of the clinical trial, reminding us of deficiencies in our knowledge. Nevertheless, the information garnered from vaccine "failures" may provide the inspiration for future successes. For instance, the shortcomings of the first subunit malaria sporozoite vaccines accelerated efforts to investigate the safety and efficacy of newer adjuvants in humans and focused interest on cellular immune mechanisms of protection against *Plasmodia*.

In *Vaccines*, the editor, Ronald W. Ellis, and contributors consider new technologies in molecular biology, biochemistry, and immunobiology as they apply to vaccine development. Fourteen of the 20 chapters focus on vaccines against human viral, bacterial, and parasitic infectious diseases, and another discusses antitumor vaccines. Later chapters review vaccinia- and adenovirus-based expression vectors, applications of anti-idiotypic antibodies as vaccines, the use of synthetic peptides in subunit vaccines, and passive immunoprophylaxis with monoclonal antibodies. There is an enthusiastic and thought-provoking contribution on adjuvants and their mode of action. Each chapter on a particular vaccine tell its own interesting story. For instance, the evolution of *Haemophilus influenzae* b (Hib) vaccines is reviewed from the first polysaccharide vaccine to the currently licensed conjugate vaccines, which effectively overcome the nonresponsiveness of the T-independent polysaccharide immunogen in young children. All the conjugate vaccines markedly increase the immunogenicity of the polysaccharide antigen and also alter the antibody subclass response to the polysaccharide. In addition, the choice of protein conjugate may affect the age at which a child is immunologically capable of responding, and monkey studies suggest that immunologic priming with the conjugate protein may affect the subsequent antibody response to the polysaccharide. The Hib conjugate vaccines are now licensed and available to protect infants and children from life-threatening invasive disease. Furthermore, the lessons learned about polysaccharide-protein conjugate vaccines can be applied to other pathogens, such as the pneumococcus and meningococcus. I found the chapter on helminth vaccines fascinating. In the cases of schistosomiasis and filariasis, our biotechnology has put us in the interesting position of knowing more about the protein and carbohydrate antigens that can be identified at various stages of the life cycles of these complex organisms than we do about the biology of the parasites. In particular, we are reminded that the lack of a suitable test animal is a major impediment to progress in vaccinology, and technological advances thus far have not found a way to replace the experimental model.

In the preface, the reader is informed that this volume is not intended to cover vaccinology in an exhaustive manner, but rather to illustrate the modern process for developing a vaccine through pertinent examples. The book clearly achieves this goal and can be recommended as a source of current information on a select number of vaccines in an area where rapid progress is being made. For those who desire a truly comprehensive work on vaccines, *New Generation Vaccines*, edited by Woodrow and Levine (Dekker, 1990), is an excellent resource.

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Books Received

Advances in the Astronautical Sciences. Bernard Kaufman *et al.*, Eds. Published for the American Astronautical Society by Univelt, San Diego, CA, 1992. 3 parts. lxxvi, 2563 pp., illus. $390. Astrodynamics 1991, vol. 76. From a conference, Durango, CO, Aug. 1991.

Alternatives to Deforestation. Steps Toward Sustainable Use of the Amazon Rain Forest. Anthony B. Anderson, Ed. Columbia University Press, New York, 1992. xvi, 281 pp., illus. Paper, $19.50. From a conference, Belem, Brazil, Jan. 1988. Reprint, 1990 ed.

Biomedical Research. Collaboration and Conflict of Interest. Roger J. Porter and Thomas E. Malone, Eds. Johns Hopkins University Press, Baltimore, MD, 1992. xiv, 230 pp., illus. $45.

Boundary Integral and Singularity Methods for Linearized Viscous Flow. C. Pozrikidis. Cambridge University Press, New York, 1992. xii, 259 pp., illus. $69.50; paper, $27.95. Cambridge Texts in Applied Mathematics, 8.

Causality Electromagnetic Induction and Gravitation. A Different Approach to the Theory of Electromagnetic and Gravitational Fields. Oleg D. Jefimenko. Electret Scientific, Star City, WV, 1992. xii, 180 pp., illus. $29.50; paper, $19.75.

Chemistry for the Protection of the Environment. L. Pawlowski, W. J. Lacy, and J. J. Dlugosz, Eds. Plenum, New York, 1992. xvi, 824 pp., illus. $149.50. Environmental Science Research, vol. 42. From a conference, Lublin, Poland, Sept. 1989.

Directory of Chemistry Software 1992. Wendy Warr, Peter Willett, and Geoff Downs, Eds. Cherwell Scientific, Oxford, U.K., and American Chemical Society, Washington, DC, 1992. iv, 204 pp. $34.95.

Directory of Electronic Journals, Newsletters and Academic Discussion Lists. Michael Strangelove and Diane Kovacs. Ann Okerson, Ed. Association of Research Libraries, Washington, DC, 1992. xii, 241 pp. Paper, $25; to ARL members, $12.50.

Electron Tomography. Three-Dimensional Imaging with the Transmission Electron Microscope. Joachim Frank, Ed. Plenum, New York, 1992. xii, 399 pp., illus. $85.

Endocrinology. Mac E. Hadley. 3rd ed. Prentice-Hall, Englewood Cliffs, NJ, 1992. xxviii, 608 pp., illus. $63.

Florissant Butterflies. A Guide to the Fossil and Present-Day Species of Central Colorado. Thomas C. Emmel *et al.* Stanford University Press, Stanford, CA, 1992. x, 118 pp., illus., + plates. $35; paper, $14.95.

Forensic Engineering. Environmental Case Histories for Civil Engineers and Geologists. Gerard Shuirman and James E. Slosson. Academic Press, San Diego, CA, 1992. xx, 296 pp., illus. $49.95.

General Chemistry. Annotated Instructor's Version. P. W. Atkins and J. A. Beran. 2nd ed. Scientific American Books, New York, 1992 (distributor, Freeman, New York). xx, 918 pp., illus., + supplementary material. $59.95.

The Genome of *Drosophila melanogaster*. Dan L. Lindsley and Georgianna G. Zimm. Academic Press, San Diego, CA, 1992. x, 1133 pp., illus., + plates. $79. Revision of ***The Genetic Variations of Drosophila melanogaster***.

Great Ideas in Physics. Alan Lightman. McGraw-Hill, New York, 1992. xiv, 250 pp., illus. Paper, $17.91.

Guide to Technical Editing. Discussion, Dictionary, and Exercises. Anne Eisenberg. Oxford University Press, New York, 1992. x, 182 pp., illus. Paper, $17.95.

Guidelines for Surviving Heat and Cold. Thomas Adams. Stipes, Champaign, IL, 1992. vi, 143 pp. Paper, $14.80.

Hazop and Hazan. Identifying and Assessing Process Industry Hazards. Trevor Kletz. 3rd ed. Institution of Chemical Engineers, Warwickshire, U.K., 1992 (U.S. distributor, Hemisphere (Taylor and Francis), Philadelphia). viii, 150 pp., illus. $49.50.

Hidden Technocrats. The New Class and New Capitalism. Hansfried Kellner and Frank W. Heuberger. Transaction Publishers, New Brunswick, NJ, 1992. xii, 246 pp. $29.95.

Interspecific and Intergeneric Crosses in Cultivated Plants. A. Belea. Akadémiai Kiadó, Budapest, 1992. viii, 255 pp., illus. $32. Translated from the Hungarian.

Linear Kinetic Theory and Particle Transport in Stochastic Mixtures. Gerald C. Pomraning. World Scientific, River Edge, NJ, 1992. xii, 235 pp. £28. Series on Advances in Mathematics for Applied Sciences, vol. 7.

Megaherbivores. The Influence of Very Large Body Size on Ecology. R. Norman Owen-Smith. Cambridge University Press, New York, 1992. xvi, 369 pp., illus. $79.95; paper, $34.95. Cambridge Studies in Ecology. Reprint, 1988 ed.

Methane and Methanol Utilizers. J. Colin Murrell and Howard Dalton, Eds. Plenum, New York, 1992. xiv, 286 pp., illus. $69.50. Biotechnology Handbooks, vol. 5.

Number Words and Number Symbols. A Cultural History of Numbers. Karl Menninger. Dover, New York, 1992. xiv, 480 pp., illus. Paper, $14.95. Reprint, 1969 ed. Translated from the German by Paul Broneer.

Origine(s) de la Bipédie Chez les Hominidés. Yves Coppens and Brigitte Senut, Eds. Centre National de la Recherche Scientifique, Paris, 1992. xvi, 301 pp., illus. Paper, 420 F. Cahiers de Paléoanthropologie. From a symposiuum, Paris, June 1990.

Playback and Studies of Animal Communication. Peter K. McGregor, Ed. Plenum, New York, 1992. x, 231 pp., illus. $75. NATO Advanced Science Institutes Series A, vol. 228. From a workshop, Thornbridge Hall, U.K., Aug. 1991.

Ribbon of Sand. The Amazing Convergence of the Ocean and the Outer Banks. John Alexander and James Lazell. Algonquin, Chapel Hill, NC, 1992. xiv, 238 pp., illus. $18.95.

Searching for Women. A Literature Review on Women, HIV and AIDS in the United States. 3rd ed. Multicultural AIDS Coalition, Boston, 1992. x, 164 pp. Spiral bound, $11.50. A Work in Progress.

Toxins and Targets. Effects of Natural and Synthetic Poisons on Living Cells and Fragile Ecosystems. Dianne Watters *et al.*, Eds. Harwood, New York, 1992. xxii, 199 pp., illus. $39.

Victor Moritz Goldschmidt. Father of Modern Geochemistry. Brian Mason. Geochemical Society, San Antonio, TX, 1992. xii, 184 pp., illus., + plates. $40; to GS members, $30. Special Publication, 4.

Wealth and Hierarchy in the Intermediate Area. Frederick W. Lange, Ed. Dumbarton Oaks Research Library and Collection, Washington, DC, 1992. xii, 463 pp., illus. $36. From a symposium, Washington, DC, Oct. 1987.