

Voodoo Science: The Road from Foolishness to Fraud by Robert L. Park. New York: Oxford University Press, 2000. x + 230 pp. \$25.00. ISBN 0-19-513515-6.

Robert Park's book has the worthwhile purpose of exposing junk science, fraud in science, and poor reporting. With a classic skeptical bent, Park skewers cold fusion, perpetual motion machines, healing magnets, a manned space program, and extrasensory perception, among other things. But do his ends justify his means? Was he accurate, as must be required of skeptics in much greater degree than it is from scientific pioneers?

Thirteen book reviews of Park's *Voodoo Science* have been located so far; why should *JSE* print another? Because, of the 11 reviews checked so far, 9 reviewers failed to note a single example of Park's technical blunders, and failed to object to his methods of ridicule, character assassination, and selective omission (Comarow, 2000; Drew, 2000; *Economist*, 2000; Foster, 2000; Frazier, 2000; Grossman, 2000; Kogon, 2000; Regis, 2000; *Res. Tech. Mgmt.*, 2000). Only the review in *The Washington Post* exposed one of the blunders, the denial of excess heat in certain electrolysis cells (see below), and omission of published information. This *Post* reviewer notes that "Such tactics are reminiscent of the behavior of a zealous DA who is so convinced that a suspect is guilty that he feels entitled to withhold some information from the jury." In a later exchange of letters: "He [Park] didn't bother to visit laboratories, read papers, verify facts, or talk to people whom he attacked. Some may be frauds, but better journalism [than Park's] is needed to establish this." (Platt, 2000). The reviewer for *American Scientist* objected only to the character assassination of Edward Teller (Sherman, 2000).

For example, in attacking homeopathy, Park used logical argument (as did ancient Greeks), which is not scientific evidence; ridicule, which is not a legitimate tool of honest skeptics; and the refutation published in *Nature* by a research group at University College London (which Park could not resist calling "a well-respected group") of Beneviste's claim, also published in *Nature*, that biological responses could be achieved at very high dilution. Their refutation was based on a failed attempt by the research group at University College to repeat Beneviste's results. Only this third approach is that of a gentleman and scholar.

Had Park used only that last method to refute the medical effectiveness of magnets, we might be persuaded to discount any health value of magnets. Park wrote that the evidence for the relief of pain by magnets was "three celebrity endorsements, three 'explanations' by people who are neither scientists nor medical researchers, and one cartoon of a magnet healing an injury by a process that is clearly wrong". He goes on to note that some magnets sold for healing have a field strength of 800 gauss, measured at the surface, that such flat magnets have alternating poles, and that the field strength drops off just 1 mm from the surface, indicating that the field could not possibly penetrate the

outer layers of human skin. My quick web search turned up a list of 21 papers in peer-reviewed journals that showed beneficial effects of magnets or pulsed magnetic fields on pain relief or wound healing (www.coloradohealthnet.org). The two most definitive were (1): A placebo-controlled crossover study of the effect of magnetic footpad insole devices on pain caused by diabetic neuropathy done at Phelps Memorial Hospital, North Tarrytown, NY. These were said to have a 475 gauss steep field gradient with a penetration of 4 cm. The results “suggest that a legitimacy exists for magnetotherapy as a safe and unique therapy in neuropathic diabetic foot pain. These data need to be validated by a larger longitudinal study” (Weintraub, 1999); and (2): At Baylor College of Medicine, Houston, TX, it was found in a double-blind study that the application of 1.5 mm thick magnets with concentric alternating poles delivering 300–500 gauss over a pain trigger point in postpolio patients resulted in significant and prompt relief of pain (Valbona et al., 1997).

Professor Park’s concept of a chemical compound is not what I taught to college students. A compound is a substance in which all the molecules are alike (except for isotopes, perhaps). Different compounds are known to differ in their physiological effects. It should be no surprise that a pair of compounds so closely related as sodium chloride and potassium chloride have different effects in humans, perhaps not only on blood pressure. Park wrote

Scientific pharmacology seeks to identify and purify the active ingredient in an herbal remedy. Only then is it possible to carry out controlled studies of its effects and dosage. Aspirin, for example, was originally found in the bark of willow. Not until it was isolated and synthesized a hundred years ago... (p. 66)

Aspirin is acetylsalicylic acid, and it is not found in nature. It was first synthesized in 1853 from salicylic acid, a different compound, which was found in traces in a few plants, but the acid was itself first made in quantity by hydrolysis of methyl salicylate (oil of wintergreen), a different compound. Later the salicylic acid was synthesized from benzene derived from coal tar, and one of its salts, sodium salicylate, a different compound, was, for about 50 years, the preferred palliative treatment for arthritis before the milder side-effects of aspirin were recognized (Kauffman, 2000; Windholz et al., 1976).

In a discussion of the placebo effect Park wrote (p. 51): “Before 1940 about the only medicines doctors had in their bags were laxatives, aspirin, and sugar pills.” A perusal of the *U. S. Pharmacopæia (USP)* of 1942 indicates that the facts are otherwise. Leaving out aspirin, sugars, laxatives, diuretics and emetics, the following medicinals were found, which in my opinion were effective and not placebos: acetophenetidin, alcohol, aloe, antiscarlet fever serum, antimeasles serum, antimeningococcus serum, antipneumococcus serum, arphenamine, atropine, barbital, bentonite, butacaine sulfate, caffeine, chloramine-T, cocaine, cod liver oil, codeine, digitalis, diphtheria antitoxin, ephedrine, epinephrine, ergot, estrone, ethyl chloride, halibut liver oil, homat-

ropine, insulin, iron and ammonium citrate, isotonic sodium chloride, linseed (flaxseed) oil, morphine, niacin, nitroglycerin, nitrous oxide, opium, pamaquine, parathyroid injection, pentobarbital, phenobarbital, pituitary injection, potassium bromide, procaine, quinacrine, quinidine, quinine, rabies vaccine, riboflavin, saccharin, scarlet fever streptococcus antitoxin, scopolamine, smallpox vaccine, sulfanilamide, sulfapyridine, sulfathiazole, sulfarsphenamine, terpin hydrate, tetanus antitoxin, tetracaine, theobromine, thiamine, thyroid, thyroxin, typhoid vaccine, and vitamins A, B complex, C, D, E (*USP*, 1942). More than half of these are still in use today. In addition, the 1936 *Remington's Practice of Pharmacy* contributed: collodion to seal small wounds, amyl nitrite for angina, chlorobutanol as a dental anesthetic, phenolated olive oil as an external antiseptic, cannabis as analgesic, ergot to maintain labor in childbirth, capsicum as a rubefacient, liver extract to treat pernicious anemia, hyoscyamus and stramonium as intestinal antispasmodics, barium sulfate for GI X-rays, silver nitrate as an ocular germicide, antipyrine and amidopyrine as antipyretics, fluorescein to detect corneal lesions, chloroform, ether and ethylene with oxygen as anesthetics (Cook et al., 1936).

Earth science is no safer from Robert Park's assertions. He supports the common but erroneous belief that carbon dioxide is the most important greenhouse gas in the Earth's atmosphere (p. 32), and that burning things that contain carbon will cause potentially dangerous increases in the temperature of the atmosphere. In an experiment this writer carried out on 28 Jun 99, the infrared spectrum of air in Philadelphia was determined from 4000–200 cm^{-1} . Fully 92% of the infrared absorption was due to water vapor and 8% to carbon dioxide. (No methane was detected.) Park wrote "The average temperature of the Earth has risen by perhaps one degree Fahrenheit in this century" [meaning the 20th]. He implies that the rise has been steady; this is totally wrong; the rise was from 1900 through 1955 with some ups and downs, but with no lasting change since then, when corrections are made for the urban heat island effect. The increase in carbon dioxide content of the atmosphere has been almost exponential, most of the increase occurring after 1960. One can see that there is no correlation whatever. You should check the graphs yourself (Singer, 1999). Measurements on the Vostok ice core have established the relationship between carbon dioxide concentration and temperature increases during the transition from an ice age to an interglacial period. During the last three deglaciations, the carbon dioxide increase was found to lag the temperature increase by about 600 years. This finding would seem to rule out carbon dioxide as the cause of the warming (Fischer et al., 1999).

Professor Park saved his greatest dose of vitriol for the reports of "cold fusion", which were anomalous heat effects from electrolytic cells. The initial electrifying report was not that of an accident of amateurs; it was a press conference on 23 Mar 89 at the University of Utah by Professor Martin Fleischmann and by Professor Stanley Pons, Chairman of the Chemistry Department, based on 5 years work by these experienced electrochemists. Certain

electrolytic cells with platinum (Pt) anodes and palladium (Pd) cathodes were loaded with deuterium (D) to about 1:1 D:Pd (a lengthy and uncertain process), and immersed in an electrolyte of deuterium oxide (D_2O) in which some lithium (Li) was dissolved to form lithium deuterioxide ($LiOD$) to permit conduction. Some of these cells became much hotter than expected, sometimes in bursts (Beaudette, 2000). Park wrote:

When reports came in from [other] groups that found no evidence of cold fusion [actually no excess heat], Pons and Fleischmann would explain that it took several days to 'load' the cathode with deuterium before the reaction could begin. When these groups still saw nothing after a week, the Utah scientists said it sometimes took ten days, or three weeks; or the cathode was the wrong size; or that they weren't using the right electrolyte; or it only worked with cast palladium and not with extruded. The rumor spread that Pons and Fleischmann were deliberately misleading researchers to conceal 'the secret' while they negotiated with potential investors. (p. 21)

Allan Bromley, said to be the head of the Yale nuclear physics lab, who was invited to Washington as potential science advisor to President Bush, "confidently informed the president that the reports out of Utah were in error" (Park, p. 25) based on a report from a collaboration between Moshe Gai (Yale) and Kelvin Lynn (Brookhaven) that they found no neutron emission from *their* "cold fusion" cell, thus implying that there could not have been any cold fusion. This is like saying that a diesel engine cannot operate because it has no spark plugs. Lowell Wood at Lawrence Livermore National Laboratory attempted to reproduce the Pons and Fleischmann experiment and had an accidental explosion. "The blast shattered his apparatus and ended his quest for cold fusion" (Park, p. 26). "[James] Patterson's claim [of transmutation in 1996] sounded suspiciously like the discredited [sic] 'cold fusion' claim made seven years earlier by Pons and Fleischmann" (Park, p. 11). In July of 1989 the Department of Energy panel headed by John Huizenga submitted its preliminary report stating that additional research into cold fusion was not justified (Park, p. 123). In fact, Pons and Fleischmann were hounded out of the USA. And finally, as the most compelling evidence against cold fusion, Park cited the finding of an Italian court in 1996 that Pons and Fleischmann and 3 Italian scientists could not sue the newspaper *La Repubblica* for libel for saying that they were all scientific frauds.

Most American physicists believe that they are qualified to make judgments about electrochemistry and calorimetry, and that Pons and Fleischmann were guilty of error or fraud and that their work was never replicated. What is the truth? By 1992, Professor of Physics Wilford N. Hansen, Utah State University, and R. H. Wilson, General Electric Corp., had reexamined the original data of Pons and Fleischmann and confirmed that excess heat had been observed. By March, 1995, at least 20 confirmations of excess heat in cells of many different designs, and with the calorimetry done in diverse ways, were reported, 8 published as peer-reviewed papers, of which 5 were in journals other than *Fu-*

sion Technology. More recently, by the end of 1996, building cells that would show the anomalous heat effect of Pons and Fleischmann was $\geq 50\%$ successful (Beaudette, 2000). Another review cited 39 published examples of excess energy including ones from cells equipped with nickel and niobium cathodes (Storms, 1996). Park omitted mentioning any of this body of work, let alone refuting a single report in detail.

Storms also lists 17 reports of neutron emission and 11 reports of tritium emission from cells producing excess heat; but these appear in odd amounts and/or times and cannot account for the excess energy. However, the hard-to-detect non-radioactive helium-4 is found in significant amounts. Therefore, at least one heat-producing nuclear reaction is probably a complex and unusual form of D-D fusion. So it seems that Pons and Fleischmann did not, after all, go overboard in referring to their excess heat effect as “cold fusion”.

Writing on the fate of Pons and Fleischmann, Park noted that

Technova [a research company with a laboratory located in France supported by Toyota] had finally given up on cold fusion. Stanley Pons was let go [sic] and is reportedly living in near seclusion on a farm in the south of France. In ten years [sic], he had done little but repeat the flawed [sic] experiments that were done at the University of Utah. Martin Fleischmann is back in Southampton and is said to be in poor health. They have fallen out and no longer speak to each other. Fleischmann now tells people that cold fusion was a victim of a campaign of distortion of the oil industry. (p. 124)

Beaudette wrote

The overwhelming adverse publicity made their positions in the chemistry department at the University of Utah untenable...

The two were offered an opportunity to start afresh by Minoru Toyoda, a senior member of the Toyoda clan, the founders and principal owners of the Toyota Motor Company. A laboratory was set up to their specifications in a technology park in Provence, France. They worked together there from 1992 until 1995, when Fleischmann retired. Pons retired in 1997 and the venture was ended...

Fleischmann, sixty-eight-years old [in 1995], retired to his home in Tisbury, England...

At the ten year anniversary [1999] Fleischmann was still active in retirement attending the international conferences and contributing much to them. Pons had left scientific employment and had purchased a farm in Provence. There were some indications that he was doing a modicum of consulting work. (pp. 31, 122, 252)

What have we here, *Rashomon*? Whom do you believe?

Pons and Fleischmann were not the only victims of personal attacks. Distinguished Professor of Chemistry at Texas A&M University, John O'M. Bockris, began experiments in 1989 and verified anomalous heat and tritium formation, publishing a number of papers, including one in *JSE* in which he noted that the production of tritium from deuterium in Pd has more than 100 published confirmations (Bockris, 1996). Twice there were efforts by other Distinguished

Professors to have Bockris relieved of his title *Distinguished* because of “fraud”, and twice these failed. Sadly, the ringleader was said to be a fellow chemist, Distinguished Professor F. A. Cotton (Mallove, 2000).

An entire chapter of *Voodoo Science* was devoted to an argument against manned space exploration and supporting robotic methods. This topic is not related to junk science, and does not fit the rest of the topics in this book.

Are Park’s criticisms of James Patterson, Joe Newman, Quentin Bowles, John Hagelin, Samuel Hahnemann, Gerard O’Neill, Ira Magaziner, Garabed Giragossian, Robert Fludd, Dennis Lee, Randall Mills, Nancy Wertheimer, Ed Leeper, Dan Rather, Edward Teller (who accepted the possibility of cold fusion in 1989, Park, p. 26), Lowell Wood, Deepak Chopra, Michael Guillen, Robert Jahn, Dean Radin and others justified? Perhaps so, but in view of the evidence above, should we believe that Park has done an honest investigation and report on every one of them?

One of the book reviewers went so far as to recommend that Park’s book should be required reading for all science writers, journalists and politicians (Drew, 2000). I would support this if *Voodoo Science* were accompanied by *The Protocols of the Elders of Zion* and *Mein Kampf* with appropriate cautions. Seriously, the appalling scientific illiteracy, and the toleration for Park’s sarcasm, ridicule, innuendo and omission on the part of most of the reviewers are even more dreadful than *Voodoo Science*.

Addendum

After completion of this review, the reviewer was informed by Henry Bauer of a review by Richard Milton for *Network* magazine. Milton supports my overall conclusions about Park’s methods and defamations, and gives similar evidence to mine on the reality of the cold fusion effect. Milton exposed one of my own biases by citing a paper [Knipschild, P. (1991). *British Medical Journal*, 302, 316–323.] in which 105 published studies of homeopathy included 81 trials with a positive effect compared with a placebo, and that further study is warranted.

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Dogs That Know When Their Owners Are Coming Home by Rupert Shelldrake. New York: Crown Publishers, 1999. xiv + 352 pp. \$25.00. ISBN 0-609-60092-3.

This book provides descriptions of the abilities of some animals to communicate with their owners (or each other) without the recognized sensory channels. No previous author has published such a valuable compilation of widespread observations of paranormal behavior by animals. Shelldrake, however, has gone farther than most of his predecessors in studying this kind of animal behavior. He has engaged in experiments with which he has eliminated chance correspondences between an animal's behavior of expectancy and its apparent stimulus, such as the owner's intention to return home. He has also excluded the possibility of normal sensory clues, such as the sound of a familiar vehicle