be so, so it isn't so. Our ancestors were less inclined to think they knew the limits of the possible. So they took matters as they found them, proposed hands-on remedies. Thus we find Marcellus Sidetes, in or around the first century, taking a thoroughly pragmatic approach to the problem, what should we do about werewolves?

> Men afflicted with the disease of so-called lycanthropy go out by night in imitation of wolves or dogs in all respects, and they tend to hang about tombs until daybreak. These are the symptoms that will allow you to recognise sufferers from this disease: they are pallid, their gaze is listless, their eyes are dry, and they cannot produce tears. You will observe that their eyes are sunken and their tongue is dry, and they are completely unable to put on weight. They feel thirsty, and their shins are covered in lacerations which cannot heal because they are continually falling down and being bitten by dogs. Such are their symptoms. One must recognise that lycanthropy is a form of melancholia. You will treat it by opening a vein at the time of its manifestation and draining the blood until the point of fainting. Then feed the patient with food conducive to good humors. He is to be given sweet baths. After that, using the whey of the milk, cleanse him over three days. After the purification use the antidote to viper bites. As evening arrives and the disease manifests itself, apply to the head the lotions that usually induce sleep and anoint the nostrils with scents of this sort and opium.

Compare such measures with those taken in, say, 16th-century France, when werewolves, like witches and sorcerers, were judged in the light of the Church's teachings, and where death at the stake was prescribed instead of sweet baths and whey. Such insights into the thinking of our Greek and Roman forerunners remind us that progress is by no means a continuous process.

The compiler of this collection has done us all a favour by providing us with this excellent resource book. There is an extensive bibliography, a good index, cross-references galore. It is all that a reference book should be: accessible, navigable, convenient. What's more, it is both instructive and entertaining to read.

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Science or Pseudoscience: Magnetic Healing, Psychic Phenomena, and Other Heterodoxies by Henry Bauer. University of Illinois Press, 2001. 296 pp. $29.95 (cloth). ISBN 0-252-02601-2.

Paranormal and other unexplained phenomena are inherently fascinating because of their mystery and challenge. From the general public's view, scientists are disappointingly uninterested in exploring such things as the existence of the Yeti and the workings of extrasensory perception. (The Loch

Ness monster, in fact, has received an unusual amount of scientific attention, considering it is a prime example of these kinds of mysteries.)

The deterrent for scientists when it comes to studying these phenomena is their inherent unyieldingness. There may or may not be something there, but the existence of that something is hard to establish. Scientists want solvable problems that can give them satisfaction and recognition in their own lifetime. Granting agencies usually do not support projects that cannot show a track record of successful preliminary research. And there is the larger philosophical matter: science is supposed to be the pursuit of intersubjectively ascertainable knowledge. Subjective knowledge of events, however true for an individual or group witnessing an odd phenomenon, does not naturally fall within the realm of science.

Although today's scientists typically stay away from mysteries, there are two organizations who make exploration of these their special task. The basic attitude of the Committee for the Scientific Investigation into Claims of the Paranormal (CSICOP) is a debunking one, whose journal *The Skeptical Inquirer* seems dedicated to demonstrating the spuriousness of paranormal claims. Rationality is celebrated, and science is seen as the epitome of reason and critical thinking. In contrast, the Society for Scientific Exploration (with which I am only now becoming acquainted) is deliberately pushing the boundaries of science in various ways. Its members are much more willing to admit the fallibility of science and the irrationality of scientists. Meanwhile, both societies are addressing issues that are beyond what practicing scientists would usually count as science.

In *Science and Pseudoscience*, Henry Bauer is trying to save the exploration of the unknown from the debunkers' or ''CSI-cops''' all-too-ready pseudoscience label. He introduces a novel category, which he calls 'anomalistics'. Anomalistics is preoccupied with the mysterious, the unexplained. It pays attention to things that regular science ignores. As an area of inquiry, it is free for all, often pursued as a hobby (p. 24). But scientists who are interested in these kinds of phenomena (and many are) had better be dealing with anomalies in other fields than their own, Bauer notes! (Bauer himself is a chemist who has been fascinated with the Loch Ness monster for some 30 years. His chemistry colleagues do not seem to mind, he says, but notes that things would be different were he, say, a biologist [p. 30].)

Although *anomalistics* is in the first place a term intended to rescue subjects called 'pseudoscience' (in addition to the Big Three, parapsychology, ufology, and cryptozoology, it includes also such subjects as ancient astronauts, astrology, biorhythms, creationism, dianetics, Kirlian photography, near-death experiences, orgone energy, the Shroud of Turin, Velikovsky's claims, and so on [p. 14]), this term also refers to the large mass of unexplained phenomena found in science (some 40,000 ''anomalies and curiosities of nature'' listed, for instance, by Corliss in 1994 [Bauer, p. 14]).

The study of the unexplained is something that people, including scientists, are naturally drawn to. But science is divided into disciplines and follows or-

thodoxies. It is hard to get new claims accepted in science even within a field—there is the problem of "resistance to scientific discovery by scientists" (Barber, 1961; this paper in its time got over 500 reprint requests [see Segerstrale, 2000a, p. 63]). What, then, about claims that have no clear field, or phenomena that may have no existence in the first place? Bauer wants to give a name to what he calls "intellectual adventuring", free of disciplinary boundaries, involving unconventional methodologies and hunches and operating in a space somewhere between the natural and social sciences. For him, anomalistics captures the unfettered scientific spirit so often lost in standard research.

There is something of a rebel in Bauer as he speaks up for phenomena declared not to exist or various kinds of underdog theories. "Why not!" is his clarion call, against those cautious establishment types who are all too ready with their "yes, but!" "All progress has resulted from people who took unpopular positions", he quotes Adlai Stevenson as saying (p. 181). "Absence of evidence is not evidence of absence" he emphasizes against those who declare that "extraordinary claims demand extraordinary proofs" (p. 48). (Indeed, the proof doesn't really have to be *that* extraordinary: the most concrete triumphs of the heretics against the upholders of orthodoxy have been live specimens found of animals believed to be non-existent.)

What makes anomalistics so different from science, according to Bauer, is that science is searching in the "known unknown", while the space of anomalistics encompasses the "unknown unknown" (p. 25). Interestingly, however, in science, too, things occasionally pop out of the unknown unknown! Among things that no one would have considered possible are radioactivity, quantum mechanics, relativity theory, compounds of inert ("noble") gases and buckyballs (carbon atoms arranged like miniature soccer balls) (p. 26). But scientists are not trained to appreciate this. Their whole experience is with established theory, method and fact, and they react to anomalies in a similar way as they react to any radically new claim. "There is a richly funny literature recounting the host of 'expert' predictions that turned out to be absolutely wrong, including assertions about what would never be possible", Bauer notes (p. 225). The experts are often right, he admits, but only on average; in any specific instance, there is no authority to turn to—we have to form our own views.

One argument in favor of anomalistics is that one-time mysteries may well become science at a later point in time. The coelacanth actually turned out to be real, and so did the meteorites which learned professors earlier removed from museums because they "could not" have fallen from the skies. Then again, many mysteries may turn out to be mistakes of various sorts, and so fall off the path to science or end up as case studies of "pathological science"—an expression coined by the Nobel laureate in chemistry, Irving Langmuir.

Pathological science is a funny category because it is typically a label that is invoked only post hoc when it turns out that something didn't work. In the

heat of a new discovery, few scientists would raise a finger and say: ''that's pathological science!'' There are of course critics who doubt the whole thing, but that is often the case in science anyway. This makes Langmuir's famous criteria for pathological science less useful than perhaps believed. (The criteria include such things as great consequences claimed by marginal effects and an unwillingness to investigate closer whether the phenomenon might actually be the product of scientific error.) This was the way that the N-rays, polywater, cold fusion and many other phenomena are seen to have made their entry into the annals of would-be science. But, as Bauer points out (p. 111), the same criteria for pathological science also fit quite nicely the discovery of prions (the agents causing kuru and mad cow disease), for which a Nobel Prize was awarded in 1997.

Bauer's chapter on pathological science is excellent. For instance, he compares the enthusiasm for superconductivity with the enthusiasm for cold fusion—two temporarily closely related cases (late 1980s), both with prima facie wild-seeming claims going against the common sense of science. However, Bauer blurs the distinction between real and pathological science more than I would. Even though *during* a discovery process it is hard to tell if something is real science or not, surely at some point *after* the event and after the scientific process has kicked in, it will be possible to evaluate whether something was indeed pathological science. (And this is what I imagine that scientists would typically do, too; not being philosophically minded, they have little interest in holding out for claims that do not seem to be true.)

Today most people consider cold fusion something that did not hold up. Bauer gives cold fusion somewhat more credence. It is true that cold fusion is still being pursued in some places in the world, while mainstream science has abandoned the hope of cold fusion. This happened after serious investigations into this whole affair by internationally known physicists and others (serious, because if true, cold fusion *would* have been such a peach; I know of physicists who were quite thrilled about cold fusion in its very early stages in 1989).

What is perhaps more surprising is that, citing some Science Studies scholars, Bauer describes cold fusion research as ''science at its best'' and as representing ''the state of 20th century science'' (p. 98). Compared to the behavior of the scientists involved in the research on superconductivity, the scientists in the cold fusion story are said to be paragons of good science (p. 109). Bauer also suggests that the protagonists in this scientific episode, Stanley Pons and Martin Fleischmann, received an unfair amount of criticism because they turned out to be wrong. Although this seems quite plausible, there may be other reasons. ''When and why should the protagonists have concluded that the initial success of their experiment was spurious?'' asks Bauer, emphasizing the importance of scientists persisting in the face of negative results (p. 99). However, according to physicist and Washington insider Robert Park (2000), there *were* such points. He actually describes cold fusion as a case of ''voodoo science''—the type of research in which self-deception slowly leads

to fraud. He goes as far as faulting the protagonists for unethical behavior, dragging feet in regard to obvious experiments that *could* have been conducted to settle the matter faster, not showing up at conferences, and other misbehavior from a scientific point of view.

My reading of the polywater case and Felix Franks' book is also somewhat different from Bauer's. My understanding is that the polywater research went on at an international scale for some 10 years, roughly between 1960 and 1970, and that hundreds of papers were published on this topic. In other words, the polywater affair *could* be classified as a waste of time and money, if one were a stickler for this kind of accountancy. In the end, it turned out that an impurity was involved, causing seeming polymeric water, although it had been generally believed that impurities had been eliminated. Could not the (even unexpected) impurity have been found if someone had looked more closely? I think Bauer is somewhat more lenient than Franks himself (whose presentation, by the way, I consider a paragon of fairness, and use in my own teaching).

Likewise, in the infamous Jacques Benveniste ‘‘water with a memory'' case (extreme dilution of a substance still being able to cause an immune response), I am surprised that Bauer does not mention the possibility of ‘‘experimenter effect'' (getting the results one expects) or foul play. In the articles surrounding the case at the time (1988), it was noted that at least one of Benveniste's collaborators was supported by the homeopathic industry to which the lab's research results were perceived as closely related. This fact should at least be mentioned. I was also missing a discussion of a real mystery: how was it possible that three independent laboratories could have actually replicated Benveniste's odd results (also reported in the literature in *Science* and *Nature* at the time)?

With anomalistics, it is not easy to specify what the subject matter is, Bauer points out (p. 15), which is why the field in some ways resembles early natural history. But that doesn't mean that anomalistics should be automatically considered pseudoscience. Bauer suggests that anomalous phenomena have different degrees of plausibility and implausibility. He cites people who have tried to classify the actual likelihood of the existence of, say, sea serpents and UFOs (p. 222). He himself seems to have a default position that accepts particularly sea serpents, UFOs and extra-sensory perception as worthwhile objects of study, while he pooh-poohs ‘‘commercial trash'' such as *National Enquirer* reports or astrology columns, which those with a more undisciplined appetite for oddities may buy into. Another category, ‘‘frontier trash'', is not much better, according to Bauer. All kinds of quick and exaggerated claims of ‘‘genes for'' this or that behavior belong here (p. 114).

Bauer warns us that the demarcation between science and pseudoscience is hard to uphold, especially because it changes over time. Look at some phenomena that were believed to be non-existent and are now recognized, for instance, sick building syndrome (p. 143). Phrenology is now consid-

ered classic pseudoscience—but what is it that makes current IQ research obviously plausible? Bauer asks (p. 143). Indeed, there are those researchers today who consider IQ research and sociobiology pseudosciences because they are not ''molecular'' enough (see Segerstrale, 2000b, especially chapter 14).

The issue is whether to trust the empirical evidence or contemporary scientific theory, Bauer maintains, and suggests that for parapsychology, for example, it is the theories that are in dispute, not the raw facts (p. 167). This formulation makes it sound as if everybody agreed on the facts of parapsychology. But it seems to me that it is exactly the facts that are usually in dispute, or rather, what *passes* for a scientific fact. A scientific fact is typically repeatable, or at least intersubjectively ascertainable; it has to have some kind of objective existence. As far as I know, the problem with most parapsychological studies has exactly been that the facts have not been reproducible in a scientifically satisfactory way, and in some cases, unfortunately, rampant data selection or outright fraud has been demonstrated, weakening the overall claim (I am not sure one can refer to Rhine, for instance, without discussing various accusations of experimenter bias [see e.g., Cromer, 1993, chapter 8]). From a scientific viewpoint, parapsychology seems to be a field where the lack of rigorous scientific control makes research especially vulnerable, and where all sorts of mental biases haunting the inquiring mind may be given unusually free reign. Meanwhile, from an anomalistic point of view, there may well exist a satisfactory body of facts. But those facts are not necessarily what scientists would count as facts. I believe Bauer is switching hats and sympathies too fast here between anomalistics and science.

Bauer is irritated not only with outsiders' tendency of lumping together all kinds of anomalistic research under the same one label of pseudoscience, but also because this puts genuine knowledge seekers together with obvious confidence tricksters. The driving motive in anomalistics is intellectual curiosity, not personal gain, he points out (p. 147). At the same time, Bauer notes that anomalistics is poorly protected against such things as exaggeration, error and fraud. Because it falls outside established science, it does not benefit from the norms and procedures (e.g., peer review) that science has established to minimize error and increase quality control. Meanwhile, as soon as something anomalous is indeed found—such as the coelacanth or megamouth shark in cryptozoology—this quickly becomes incorporated into mainstream science. By the same token, Bauer calmly suggests, ''should a Nessie be found, biology will accommodate it'' (p. 165). (He seems not to give too much weight to those biologists who argue that for Loch Ness monsters to survive, there would have to exist a viable population of them [p. 167].)

Although Bauer's primary aim is to introduce and defend the field that he calls anomalistics, his book can at the same time be read as a compendium of useful insights about ''real'' science. This may sound paradoxical, but this possibility of reading the book is not accidental, it is consistently worked in-

to the structure of the narrative. *Science or Pseudoscience* represents the other side of the same coin that we saw shining first in Bauer's 1992 book, *Scientific Literacy and the Myth of the Scientific Method*: his deep interest in the actual workings of science, both the reasoning of scientists and the scientific process. Bauer uses anomalistics to throw light on these. A little biography is useful here: Bauer belongs to those scientists who were originally attracted to the new field of Science Studies in the mid-1970s exactly because scholars there seemed willing to abandon scientific hagiography and simplistic philosophical and sociological explanations and get down to the business of unraveling ‘‘real'' science, warts and all. (Well, it did not work out quite like that; the field was soon hijacked by so-called social constructivists, who provided a new orthodoxy. For an account, see Bauer, 2000; Segerstrale, 2000a.)

The overall impression one gets from *Science or Pseudoscience*, however, is that Bauer here is not merely using anomalistics as a tool for exploration of science but is himself balancing somewhat precariously on the fence between science and anomalistics, coming down now on one side, now on the other. But although Bauer's sympathies sometimes do seem to be more with anomalistics than with science, in the book's last pages, he beautifully argues for the scientific benefits of exploration of the unknown. Bauer does capture something of an almost forbidden spirit of science, openly expressed only by the truly creative and daring, when he writes:

> The mysteries, the puzzles, are truly marvelous ones, for the possible explanations are so peculiar, so weird; they contradict common sense, they're so improbable—and yet periodically one of these quests is vindicated, at least in part, and we're reminded once again that anything that did happen can happen. (p. 238)

This sense of awe and wonder has surely permeated science from its very beginning, but we don't see much public expression of it today. An unexpected benefit of Bauer's book is that it may help us connect with the pleasures and imaginations of scientists from earlier times.

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