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BOOK REVIEW

On the Fringe: Where Science Meets Pseudoscience by Michael D. Gordin

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ESSAY BOOK REVIEW

SPEAKING OF "PSEUDO-SCIENCE" ENTAILS SCIENTISM: THE IMPORTANCE OF NOT BEING EARNEST ABOUT SCIENCE

Context

In contemporary society, "science" signifies authoritative understanding of the natural world; therefore "pseudo"-science means claimed but *in*authentic, *false* knowledge about nature; and "fringe" science, between those two, means doubtfully trustworthy knowledge.

In any case, whether or not it is a conscious decision and whether or not it is admitted, attributing authoritative understanding to science entails accepting the religion of scientism, the belief that scientific knowledge is superior to any other claims of knowledge.

But the content of "science" is created by human beings. Once it is conceded that science is fallible, as all human activities are bound to be, it becomes clear that any mainstream "scientific consensus" is also fallible; and therefore heterodox claims of knowledge should be greeted, initially at least, with a degree of tolerance and a willingness to consider evidence, to seek objective facts before judging something to be false knowledge, or, in contemporary jargon, "fake news."

The subtitle of this essay was inspired by the life (and work) of Oscar Wilde, who was only one among an uncountable host of human beings who have suffered seriously from the intolerance of their fellow human beings, the intolerance of the societies in which they lived. The intolerance Wilde faced may have had nothing directly to do with science, but it did indirectly: Declaring and believing his sexual preferences to be "unnatural" and therefore abhorrent presumed, with great dogmatic earnestness, that we command authentic knowledge about what is natural.

All forms of intolerance are rooted in the belief that one's opinions are unquestionably, absolutely true. But that sort of certainty belongs only to the God who created the universe and everything in it—if, of course He or She actually exists. And even if They actually exist, human beings are incapable of knowing for sure His or Her mind. That quite a number of people have claimed to know the mind of God is anything but convincing or reassuring: The stark and vigorous disagreements among those would-be Prophets is rather sound proof that their various claims are ill-founded.

So it behooves human beings to display a certain degree of tolerance for the views of those who disagree with them, and a sense of humor would be a welcome corollary, one which never seems to partner with intolerance.

The evil that intolerance can bring was described, for me most cogently, by Jacob Bronowski (1973, p. 186), as he mused at a pond near the remains of the crematorium at the Nazi concentration camp at Auschwitz:

> Into this pond were flushed the ashes of some four million people. And that was not done by gas. It was done by dogma. It was done by arrogance. It was done by ignorance. When people believe that they have absolute knowledge, with no test in reality, this is how they behave. This is what men do when they aspire to the knowledge of gods.

Nowadays the belief that one's views are based on unquestionably true knowledge is held not only by some adherents of God-type religions but also by huge numbers of people who take "science" as the touchstone and guarantor of certain knowledge. In other words, adherents to scientism. One indication of this reliance on science, of making science into the religion of scientism, is the use of epithets like "fringe science" or "pseudo-science" to label anything that one wants to discredit and denigrate. "Junk science" is even more emphatic, as is the currently popular label of "denialism," a yet more passionately applied criticism, often intended to imply base motivation as well as unwarranted refusal to accept the truth offered by science.

The book under review reveals its implicit scientism most clearly in its discussion of "denialism," but it is also evident in how it handles the various examples of what the author calls and what gets labelled as pseudo-science.

As to denialism, the book's "key reference" (p. 109) is *Merchants of Doubt* (Oreskes & Conway, 2010), which argues that nefarious, politically right-wing institutions and scientists, together with commercial interests, notably energy and tobacco companies, deliberately try to create doubt where there should be none, for instance about the reality of human-caused global warming or the deleterious health consequences of smoking cigarettes.

In terms of objective evidence, however, there is indeed uncertainty—doubt—on each of those issues. The mainstream belief in both cases is based on statistical data, and statistical analysis is inherently incapable of delivering 100% certainty, the "yes-or-no" certainty sometimes attainable in physics or chemistry when dealing with not-too-complicated systems. "Statistically significant" merely means a certain probability of being right, with a cut-off that is arbitrary, and typically, in social science and medicine, quite weak at 95% ($p \leq 0.05$). Asserting that a statistically significant result must be accepted as true, like claiming that objective criteria enable the ability to distinguish "science" from imposters, amounts to "conjuring certainty where there is none" (Bauer, 2014).

As for global warming and climate change, innumerable books, articles, websites, and blogs have presented evidence over the last several decades that human activities are *not* the chief culprit. For the most recent and authoritative work pointing out that alarmist rhetoric and cherry-picked numbers greatly exaggerate the present impact of human activities on climate, see *Unsettled* (Koonin, 2021), whose main points are cited in a recent review (Bauer, 2021a).

As for health consequences of smoking cigarettes, it is not being questioned that smoking cigarettes is not good for health; I do believe that inhaling tobacco (or any other) smoke is unhealthy.[1] But it is also possible to exaggerate the degree of risk and the specific type of risk associated with smoking. For example, the dangers of second-hand tobacco smoke have been unreasonably hyped (Kabat, 2008, ch. 6); and the common shibboleth that "smoking causes lung cancer" is misleading[2]: because in common usage, "A causes B" implies *always*, that A is sufficient to cause B, not that A is one among a number of "risk factors" for B to occur. However, "only" about 10–20% of smokers contract lung cancer,[3] smoking is just one among a number of factors capable of increasing the risk of lung cancer.

A common tactic in (ab)using statistics is to cite misleading data. About 80–90% of lung cancers are indeed found in smokers, but that does not specify the risk of lung cancer in those who smoke: About 80–90% of smokers *do not* get lung cancer. So the bald statement "smoking causes lung cancer" is misleading; perhaps even as *deliberately* misleading as the *creation* of doubt excoriated by Oreskes and Conway (2010).

The misapplication of percentages in this sort of reverse way is a common stratagem, an illustration of "how to lie with statistics" (Huff, 1954; see also Best, 2001, 2004). I. J. Good (1995, 1996) illustrated that nicely in connection with publicity about the notorious trial of O. J. Simpson: Should a wife-battering ex-husband be the most likely suspect if his former wife was murdered? A crucial distinction has to be made between two questions easily confused. First: How likely is it that a jealous former husband with history of wife abuse *will murder* his former wife? Second: *Once a woman has been murdered*, whose former husband had battered her, how likely is it that the former husband is the murderer? The probability in the first case is quite low—most wives who have had a battering husband are never murdered by them. But in the second case the probability is reasonably high.

It would certainly have been quite appropriate for *Merchants of Doubt* to point out that commercial interests like the tobacco industry, as well as socially and politically conservative groups and individuals, seek to over-emphasize uncertainty without giving the other side appropriate due, but they had no need to *create* uncertainty.

Even the most devoted groupies of science will admit, if pressed and in the abstract, that science is not always absolutely right—even as, *in any particular case*, they insist that it is not to be questioned; for instances of this, take the self-styled "Skeptics," accurately described by Marcello Truzzi (1987) as *pseudo*skeptics.

Pseudo-skeptical faith in the absolute trustworthiness of science is often said to be justified by the purported fact that science is self-correcting and that it is guarded from error by application of the scientific method. However, the scientific method is more myth than actual practice (Bauer, 1992, 2017), and if self-correction is ever called for it means that what was earlier promulgated was incorrect. Any contemporary pronouncement of what science knows or understands is therefore subject to an irreducible degree of uncertainty because it cannot yet be known whether this is a case of error just awaiting future self-correction.

At any rate, detailed reasons for doubting the "science" of harm from smoking and about global warming have been set out above. Dismissing those evidence-based reasons without explaining what is wrong with them is an illustration of pervasive, if implicit, scientism.

In *On the Fringe*, implicit scientism may be most obvious in the discussion of denialism, but it is also discernible in the sections on particular instances of fringe science or pseudo-science, for they all assume that the mainstream view is correct, an approach facilitated by a rather large number of substantive errors.

Disclosures

Any book that promises insights about the relationships among science, fringe science, and pseudo-science is surely of prime interest to anomalists and scientific explorers. But what to do if it is a bad book? That is, if its proffered insights are spurious, misguided, misleading, or plain wrong?

Perhaps it would best be ignored. But this particular bad book happens to have been published by Oxford University Press, an academic as well as commercial publisher of long-standing high repute, and the book's author is a distinguished historian at Princeton University. Moreover, the dust jacket offers a positive comment from an eminent philosopher of science, and several published reviews of the book are positive.[4] Amazon readers rated it 4.2/5, but with an unusually high proportion of negative written reviews: three negatives and only two positive. At goodreads.com the rating was 3.7/5.

Details of what is wrong in this book are set out below, but first the biases of this reviewer need to be disclosed. Gordin and I had exchanged e-mails a decade ago after I had written quite a positive review (Bauer, 2013) of his earlier book, *The Pseudoscience Wars* (Gordin, 2012). So I was looking forward to reading his new book on a topic central to my interests for a long time, and which I had written about long ago (Bauer, 2001). I was then enormously disappointed as well as astonished that this new book is so flawed. I admire historians in general for the characteristic depth and holistic character of their work, and Gordin's *The Pseudoscience Wars* fits that bill quite well, whereas *On the Fringe* is shallow and poorly researched, and where it is not superficial it is muddle-headed or plain wrong.

Content Overview

An eight-page Preface is followed by Chapter 1, "The Demarcation Problem," about how to distinguish science from other matters. Without an objective criterion, pseudo-science would not be definable or distinguishable from real science. For philosophers, the issue traces back at least to classical Greece: how to distinguish true knowledge from mere opinion?

Contemporary confusion and floundering about "pseudo-science" comes about because the conventional wisdom now equates "science" with "(assumed true) knowledge." Philosophers may still see the demarcation problem as how to distinguish true knowledge from false, but pragmatists point out that "science" cannot stand for true knowledge since "science" comprises a host of disparate human enterprises—physics, psychology, biology, etc.—doing different things in different ways, studying a huge variety of matters (Bauer, 1992, 2017) with no logical or practical common thread other than the semantic one of labeling them all as "science."

Gordin properly agrees with Laudan (1983) that no "bright line" demarcation like Popper's falsifiability withstands scrutiny; in other words, there is no objective, logical criterion for what is science and what is not. That ought to end the matter; but then the waters are muddied by the suggestion that "more dimensions that corresponded to the heterogeneity of scientific practice" might work (p. 12).

Fringe doctrines are then grouped into four categories: vestigial, hyper-politicized, counter-establishment, and supernatural (positing extraordinary powers of mind). Chapter 2 is about the Vestigial Sciences, citing astrology and alchemy. Chapter 3 is about Hyper-politicized Sciences, for example, Aryan Physics, Lysenkoism in the Soviet

Union, and eugenics. Within the Counter-establishment (Chapter 4) the book mentions phrenology, creationism, cryptozoology, cosmic catastrophism, extraterrestrial aliens on Earth including UFOs, and Flat-Earth theories. Chapter 5, "Mind Over Matter," discusses mesmerism, Spiritualism, and "University Parapsychology."

Chapter 6 acknowledges in its heading that "Controversy is Inevitable." It discusses polywater, water memory, cold fusion, and "Fraud and the Replication Crisis." Chapter 7 has the puzzling[5] heading, "The Russian Questions," which turn out to be "Who is to blame?" and "What is to be done?" It includes a section on "Denialism" and concludes that "the only way to eliminate pseudoscience is to get rid of science, and nobody wants that" (p. 101).

Finally, there are lists for further reading: Astrology, Alchemy, Science and National Socialism, Eugenics and the Racial Science, Phrenology, Creationism, Cryptozoology, Ufology, Flat Earth, Mesmerism, Spiritualism, "ESP and Debunking," "Polywater, water memory, and cold fusion," "Fraud and the replication crisis," and Denialism.

Criticisms

"Tackling pseudoscience focuses on the problem of what counts as truth" (p. viii). Yet in the rest of the book this criterion is not applied, perhaps because of the book's already cited final conclusion, "the only way to eliminate pseudoscience is to get rid of science." Indeed, because the only workable definition of "pseudo-science" is that the scientific mainstream "consensus" has so labeled it.

"Pseudo" equals pretending to be what it is not. If "science" is not a manifestly definable object whose definition is for all intents and purposes settled and agreed, as indeed it is not (Bauer, 1992, 2017; Laudan, 1983), then "pseudo-science" has no settled and agreed meaning either. "Pseudo-science" is simply an epithet deployed by those who want to discredit something, *period*. There is no other common thread among the examples cited in this book, or for that matter, wherever else the term is used. Semantics-based confusion is everywhere, including throughout this book. Its title implies that "Fringe" is a border between science and pseudo-science, yet vestigial sciences, just (p. 14) described as among *fringe* doctrines, are then referred to as *pseudo*-sciences (p. 15).

The inadequacy of this book's attempted grouping into four categories is illustrated in a number of ways, most comprehensively because all the examples separated here into four categories could fit into just one: counter-establishment. It is the Establishment, the mainstream consensus, that underlies all the labeling of things that are *not* mainstream as "pseudo" (bad) or "fringe" (not really good). Thus the topics included under "hyper-politicized sciences" are certainly counter to what the global contemporary mainstream consensus holds. Again, it is not obvious why eugenics is not grouped among vestigial sciences, since it was regarded as proper science in the first decades of the 20th century. Flat-Earth theories, too, surely ought to have been among the "vestigial." The book itself says "Most pseudosciences are vestigial" (p. 27). But the "vestigial" category is almost a priori unsuitable since science itself, as well as all the topics labeled (at some time or other) pseudo or fringe, are not unchanging entities; all of them have changed over time to greater or lesser degrees.

"Creationism" could surely have been included in the "Mind over Matter" group since it is no less supernaturally motivated than is "Spiritualism," unless one would like to include it too under "vestigial," where it would fit quite well; indeed, it could be viewed as an earlier incarnation of "intelligent design."

In other words, the book's classification of specific examples of pseudo-science into these four categories is muddled, ambiguous, self-contradicting; it provides no useful insights.

Again, when discussing the demarcation problem, the book cites approvingly as a "local criterion" (p. 13) the label of "pathological science" coined by Irving Langmuir for the cases of N-rays and extrasensory perception; yet elsewhere the book includes extrasensory perception in the "Mind over Matter" category. Langmuir didn't get it right, by the way, in labeling N-rays as somehow pathological instead of simply an understandable if sad mistake made by a distinguished scientist who happened to be fallible, as human beings are, even the most distinguished and accomplished among us.

Gordin's earlier book, *The Pseudoscience Wars*, had focused explicitly on the *social context* of the arguments over "pseudo-science," ignoring as a criterion whether the substantive claims happen to be true. But that is not done in the present book, and it could hardly work here since the social contexts of the particular topics discussed have no commonality. In the earlier book, focusing heavily on the Velikovsky Affair (Bauer, 1984), the context was specifically the intellectual milieu in the United States soon after World War II. But the topics mentioned in this recent book share no common social or even chronological or geographic context. All they share is denigration by the mainstream establishment.

So the book offers no insights into general issues concerning topics on the fringe, or those totally outside the mainstream scientific community and out of keeping with the conventional wisdom about science. Sadly, the discussions of individual topics is also superficial, less than

illuminating, and sometimes simply wrong.

Thus it is far from clear what one learns from the assertion that astrology held a position in early modern Europe "analogous to economics in the early twenty-first century" because it was so empirically and mathematically grounded and was criticized for its assumptions and failing predictions (p. 17). Is there warrant here for designating contemporary economics a pseudo-science?

It is also bemusing to read that "The problem with the Nazi and Soviet cases is not that the science was 'political' or even 'politicized'—climate science and knowledge of reproductive health are often politicized today"—as though politicizing science could ever be acceptable. Unless science is impartial and disinterested, it cannot properly serve society and its policymakers.

As to the Soviet Union, the claim that "Lysenkoism was atypical" because the Soviet Union "heavily invested in science" confuses apples with oranges. In point of fact, other sciences were also corrupted there on political grounds, for instance the then-modern theory of chemical bonding was banned as contrary to dialectical materialism.

Regarding cryptozoology, to suggest that Bigfoot matters were *not* monetized or otherwise exploited (pp. 51–2) ignores the doings of Erik Beckjord and his California "museum" in the Trancas Restaurant in Malibu, and the widely publicized Patterson-Gimlin film. That funding was not forthcoming for sonar or submarine searches at Loch Ness (p. 52) would surely mislead readers: Mini-subs were nevertheless deployed more than once (Mackal, 1976: ch. IV, 305–6), and there have been dozens of sonar searches with strikingly positive results, recording echoes from large moving objects, often at considerable depths (Bauer, 1986, pp. 25, 90, 140, 162; Mackal, 1976, ch. IX, App. E).

It is again misleading to credit Immanuel Velikovsky with "some successes in predicting unusual properties of Venus and Jupiter" (p. 53). His basis for the predictions was the fanciful scenario that Venus was hot because it was once a comet-like body ejected from Jupiter; but "hot" is hardly a meaningful term here—"hot" compared to what? (Bauer, 1984, pp. 18–19, 47–48, 86–87, 161, 260, 270).

Few, if any, mainstream researchers would agree with this book that "parapsychological findings have had a profound impact on the methodology of experiment that has reshaped mainstream research . . . [and] pushed psychology to ever greater sophistication in both the laboratory and in data analysis" (p. 60). And few would agree that the commission of 1874 investigating Mesmer's claims initiated "a tradition in parapsychology that continues to the present" (p. 63). Equally plucked from some imaginary world is the assertion that those investigations represented "the introduction of randomization into experimental trials," which "soon migrated from the murky domains of parapsychology to become perhaps the most important change in experimental practice of the last two centuries" (p. 66). A well-known founding guru of statistical analysis, R. A. Fisher, had introduced the protocol of randomization in 1925 (Hall, 2007).

A more trivial error is describing the Committee for Scientific Investigation of the Paranormal (CSICOP) as a "commission" (p. 72). And Brian Josephson is hardly "the most prominent name in the parapsychology community at present" (p. 73). He is certainly referred to because his Nobel Prize in physics is thought by some naïve groupies of parapsychology to lend respectability to their interest, but much more cited within the parapsychology community is the enormous body of work published by the PEAR group at Princeton University under the leadership of Robert Jahn.

The notion that "one of the triggers for what has come to be called the 'replication crisis' in psychology" was an article by Daryl Bem (p. 74) is a novel suggestion indeed. The lack of reproducibility of results that are based on statistical analysis, most prominently in the social sciences, had been pointed to and deplored long before and besides Bem's article. The actual crisis is the failure of so much published work to be subjected to the test of replicability, owing to pressures to publish as well as incompetent peer-reviewing and journal-editing (Ritchie, 2020, p. 34 & *passim*).

Here, as also when discussing "denialism," the book seems to view anything that is not mainstream as thereby faulty, thereby displaying the author's no doubt unconscious obeisance to scientism. For instance, the phrase "Rhine-style statistics" (p. 74) is derogatory innuendo implying that J. B. Rhine's statistics were faulty. However, while Rhine's work can be and has been criticized for experimental protocols that may not have guarded well enough against cheating, there was nothing wrong with his statistical calculations. Similarly speculative innuendo is directed at Pons and Fleischmann for their claim of "cold fusion," that "they stage-managed the announcement to heighten the effect" (p. 84). The reality was that the administration of their university, learning that Steven Jones[6] at Brigham Young University was planning to make public a similar claim, decided to hold a press conference; Pons and Fleischmann have testified that they would have preferred to wait until their already-in-press article had been published. Nor were Pons and Fleischmann "disgraced, and both moved to France in 1992" (p. 85); they moved there because Toyota, the Japanese auto manufacturer, enabled a well-funded laboratory for them there. In 2012 it was reported[7] that Mitsubishi and Toyota were continuing to fund research into "low-energy nuclear reactions" (LENR), the label that has replaced "cold fusion." Yet this book asserts that the original findings were "an experimental

artifact (like polywater), experimental overinterpretation (like water memory), or deliberate fraud" (p. 85); although it then backtracks (p. 86) by admitting that "the death of cold fusion has been greatly exaggerated." What is a reader to make of this? Or that "some, but not all, cold-fusion researchers are labeled today" as "pseudoscientists"? The book has given no clear definition of "pseudoscientist," naturally enough since it has given no clear definition of "pseudoscience" other than giving examples of some topics so labeled; presumably then a person who is actively pursuing a topic that is pseudoscience would be a pseudoscientist. So why only "some"?

It is this sort of thing that causes me to describe this book as "muddled."

A brief reference to peer review on p. 88 is in the context of articles failing the replication test but managing to get published. Much more would need to be said here if it were to offer useful insight into the role of peer review in connection with fringe science and pseudo-science.

The concluding Chapter 7 states that pseudo-sciences abound now as they always have. Of course they do, since they are the same as holding a minority view opposed to official doctrine or mainstream consensus. But having said that, what insights does the book offer? What *could* it offer? Presumably, critical discussion of particular cases labeled pseudo-science, but the cursory treatment given specific cases in this book is inadequate, as illustrated for some of them in the criticisms made above. The dubious familiarity with each topic is exemplified also by the statement that "the tiny scale at which the strings ostensibly operate leaves the [string] theory largely inaccessible to empirical confirmation" (p. 91); it is not the tiny scale that hampers empirical test, it is the enormous energies that would be required for actual experiments.

As to what distinguishes cranks or pseudo-scientists from proper scientists (p. 92), the book would have done better to cite Jack Good (1998): Geniuses are cranks who happen to be right, and cranks are geniuses who happen to be wrong.

Denialists are said to "engage in a common set of behaviors and share personal connections that render the designation reflective of a sociological reality" (pp. 92–93). I would be interested personally in what those commonalities are supposed to be, given that I have been called an HIV/AIDS denialist as well as a climate-change denialist. And yet I was quite unaware that my "strategy of denialism" was created by the "public relations firm . . . Hill and Knowlton" in 1954 (p. 93). Of course, "once you understand how the denialist strategy works . . . the particular label matters less" (p. 95). Does not recognizing the strategy depend on first applying the label?

Antagonism to vaccination is lumped with denialism, and suffers the same problem of over-generalizing, for instance that "Anti-vaxx bases its position" on Andrew Wakefield's claims (p. 97). But it is only a small proportion of "anti-vaxxers" who are against *all* vaccination; some, like me, recognize that HPV vaccines, for example, do cause harm (Reiss, 2017) in exchange for no proven benefit. Perhaps that is why "A distinctive feature of anti-vaxx as compared to other fringe movements is the prominence of women in its ranks" (p. 98)—HPV vaccines were introduced, after all, to prevent cervical cancer, whose occurrence is only in women. But then the book muddles again by conceding that women were also prominent in Spiritualism. Indeed; it was actually originated by women, as were Christian Science, theosophy, and the aquatic-ape theory of human evolution.

The superficiality, the lack of depth of these discussions may be explainable by the absurdly small and unrepresentative items listed as "Further Reading."

Regarding astrology, sorely missing is Michel Gauquelin,[8] whose astrology-like statistical correlations ("the Mars effect") stimulated a reaction that led to the founding of CSICOP. Also deserving mention here is Suitbert Ertel,[9] who continued along the same lines as Gauquelin.

As to creationism, all the titles are by debunkers, while missing are works by the founder of modern creationism, Henry Morris, or by other proponents; or anything about the "scientific" version, "intelligent design."

Under cryptozoology, it is simply wrong to assert that the "literature . . . is divided into case studies by creature" (p. 107). Bernard Heuvelmans, founder and pioneer of cryptozoology, published books covering a wide range of "unknown" animals,[10] as did Roy Mackal,[11] and as Karl Shuker continues to do,[12] and then there are the compendiums by George Eberhart[13] and Loren Coleman.[14]

For ufology, only a journal article is listed. Yet there are encyclopedias[15] as well as innumerable books that anyone interested in the topic ought to be aware of. For "Polywater, water memory, and cold fusion," once again only debunking sources are cited. "Fraud and the replication crisis" ought surely to have mentioned Broad and Wade's *Betrayers of the Truth: Fraud and Deceit in the Halls of Science* (1982), which first brought attention to the increasing frequency of dishonesty in modern science. Stuart Ritchie's (2020) *Science Fictions*, a necessary reference here, may have appeared too recently for this book to mention it. All the titles under "Denialism" are by people (instances of Truzzi's *pseudoskeptics*) who presume that the mainstream consensus is always right.

There should also surely have been some further reading on the general topic of the book, for example, Martin Gardner (1957), whom Gordin had rightly characterized

in his earlier book as "the writer who probably did more than anyone else in the post-war period to turn discussions of alleged pseudoscience into debunking crusades" (Gordin, 2012, p. 12).

Recommendation

The book should not be recommended to anyone who wants to learn about the scope and nature of science, fringe science, or pseudo-science. Anyone who reads this book ought to be made aware also of the criticisms set out above.

A very general moral is that whenever matters of public policy are at issue, it would be wise to consider minority views, not merely the contemporary mainstream scientific "consensus" (Bauer, 2021b).

NOTES

[1] It is a major regret that I ever took up smoking, albeit I did so at a time when "everyone" was smoking and when "most doctors prefer[ed] Camels," when it was polite to offer your cigarette-pack or cigarette-case for others to share when you felt like having a smoke. Fortunately, having *not* smoked for three decades now, it seems that the earlier decades of smoking caused me no identifiable long-term harm.

[2] Oreskes and Conway (2010) acknowledge some of the caveats set out here, but they make such bald statements as "Tobacco caused cancer. That was a fact" (p. 14).

[3] For instance, https://www.medicinenet.com/what_percentage_of_smokers_get_lung_cancer/article.htm; https://www.verywellhealth.com/what-percentage-of-smokers-get-lung-cancer-2248868#toc-lifetime-risk-by-smoking-status; https://www.reuters.com/article/us-cancer-lung-nutrients-sb/nutrients-may-be-why-some-smokers-avoid-cancer-idUSTRE65E5JW20100616

[4] https://www.theguardian.com/books/2021/jun/02/on-the-fringe-by-michael-d-gordin-review-why-pseudoscience-is-here-to-stay
"A fascinating exploration of the line between science and pseudoscience takes in anti-vaxxers, ufology and spoon-bending physicists at the CIA"
https://www.publishersweekly.com/978-0-19-755576-7
"This will be helpful to anyone curious about how to separate the wheat of science from the chaff of pseudoscience."
https://www.sciencenews.org/article/on-the-fringe-book-science-pseudoscience
"In his latest book, historian Michael Gordin shows how hard it is to define pseudoscience."

[5] The questions are said to be Russian because they are "the titles of (not very good) nineteenth-century Russian novels: Alexander Herzen's *Who Is to Blame?*, published in 1845–1846, and Nikolai Chernyshevsky's *What Is to Be Done?*, published in 1863. (The latter title was also used by Vladimir Lenin for a political treatise in 1902)" (p. 90). That illustrates that the book's author is an historian specializing in matters Russian, but it is hardly relevant to fringe science or pseudo-science.

[6] The book directs derogatory innuendo also against Steven Jones (p. 86).

[7] Steven B. Krivit, "Mitsubishi reports Toyota replication," 7 December 2012
http://news.newenergytimes.net/2012/12/06/mitsubishi-reports-toyota-replication;
"Toyota and Mitsubishi collaborate on new LENR research in Japan"
https://energycatalyzer3.com/news/toyota-and-mitsubishi-collaborate-on-new-lenr-research-in-japan

[8] Gauquelin's many books include *L'influence des astres* (1955), *The Cosmic Clocks* (1967), *The Scientific Basis of Astrology* (1969), *Astrology and Science* (1970), and *Cosmic Influences on Human Behavior* (1973).

[9] *The Tenacious Mars Effect* (1996).

[10] Notably *On the Track of Unknown Animals* (original French ed., 1955; latest English ed., 1995).

[11] *Searching for Hidden Animals: An Inquiry into Zoological Mysteries* (1980).

[12] Many books are listed at http://www.karlshuker.com/books.htm, for instance *Extraordinary Animals Worldwide* (1991), *In Search of Prehistoric Survivors: Do Giant 'Extinct' Creatures Still Exist?* (1995), *The New Zoo: New and Rediscovered Animals of the Twentieth Century* (2002).

[13] *Mysterious Creatures: A Guide to Cryptozoology* (2002, two volumes).

[14] *Cryptozoology A to Z* (1999, with Jerome Clark).

[15] By Jerome Clark (3rd ed. 2018); an earlier encyclopedia was by William Birnes (2004).

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