

# UC Office of the President

## Research Grants Program Office (RGPO) Funded Publications

### Title

How Skepticism (not Cynicism) Can Raise Scientific Standards and Reform the Health and Wellness Industry.

### Permalink

<https://escholarship.org/uc/item/871902t6>

### Journal

International Journal of Sport Nutrition and Exercise Metabolism, 33(3)

### ISSN

1526-484X

### Authors

Tiller, Nicholas B

Phillips, Stuart M

### Publication Date

2023-05-01

### DOI

10.1123/ijsnem.2023-0037

Peer reviewed



1 Superstition and pseudoscience extend back to the dawn of civilization. In  
2 Mesopotamia—the birthplace of writing and recorded history—illnesses were  
3 ‘treated’ by offering amulets and incantations to the evil spirits believed to have  
4 inflicted disease in retribution for the “sins of mankind” (Retief & Cilliers, 2007). The  
5 Ancient Greeks thought that gladiator blood could cure epilepsy and infertility; they  
6 at least had the good manners to wait until a gladiator had fallen in battle before  
7 rushing to the field to drink from the open wounds (Moog & Karenberg, 2003). In  
8 Ancient Rome, surviving gladiators would use a tool called a strigil to scrape sweat  
9 and dirt from their bodies to sell in vials to women of the upper classes to use as  
10 face cream (Finan, 2021). Beliefs remained steeped in superstition throughout the  
11 Middle Ages. In 14<sup>th</sup> century Japan, urine therapy was often used to ‘treat’ asthma,  
12 diabetes, hypertension, and cancer (Savica et al., 2011). The practice endured well  
13 into the Renaissance. Later, traveling ‘medicine men’ toured the Old West,  
14 espousing miraculous healing properties of oil they claimed had been extracted  
15 from the Chinese water snake. It wasn’t until the emergence of analytical chemistry  
16 in the early 1900s that the tincture was inspected and found to contain no active  
17 ingredients, forever synonymizing the term ‘snake oil’ with deceptive marketing and  
18 health care fraud.

19         These ‘therapies’ appear primitive when viewed through the lens of modern  
20 science. We are fortunate to benefit from technologies our ancestors could never  
21 have imagined, enabling us to determine, often to a high degree of accuracy, which  
22 interventions are useful and which are not. But pervasive misinformation, lax  
23 consumer regulations, and blunted critical faculties have allowed health and  
24 wellness snake oil merchants to endure, even thrive. Today, they sell ineffective fad  
25 diets, supplements, exercises, complementary and alternative medicine, garments,  
26 gadgets, and other quick fixes, many marketed on baseless claims and  
27 pseudoscience. The products and services that find their way into mainstream  
28 practice could have devastating consequences for population health, clinical  
29 practice, and high-performance sports (Tiller et al., 2022). Moreover, while some  
30 vendors suffer consequences for their misleading claims (see **Table 1**), most do  
31 not. As scientists, we have a responsibility to help reform what has become a  
32 harmful health and wellness paradigm.

33

34         **Table 1 here.**

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34

According to Laplace’s Principle, “The weight of evidence for an extraordinary claim must be proportioned to its strangeness” (Gillispi et al., 1999). Carl Sagan said it more pointedly: “Extraordinary claims require extraordinary evidence”. Commercial health and wellness claims, tending to be both extraordinary and supported by little-to-no evidence, violate the principles of Laplace and Sagan at nearly every turn. The most appropriate way to navigate the industry is, therefore, with a healthy dose of skepticism. However, “skepticism” should not be confused with cynicism (to routinely dismiss assertions out of hand) or contrarianism (to hold a contrary position by default); nor should we allow the misunderstood and stigmatized form of “skeptic,” due to its common prefixes “climate change” and “vaccine,” to discredit its true meaning.

To be skeptical in science is to judge the validity of claims based on objective, empirical evidence, or at the very least, to withhold judgement until such evidence is at hand (Normand, 2008). “It is a capital mistake to theorize before one has data,” wrote Author Conan Doyle as everyone’s favorite detective, “Insensibly, one starts to twist facts to suit theories instead of theories to suit facts.” Essentially, skepticism is about asking important questions to discern an ‘objective truth’. But the competency with which we achieve such objectivity depends on how well we understand and mitigate our biases; how well we understand and prioritize the scientific method above the conclusions we subconsciously desire; and the depth and reach of our scientific, media, and social media literacy. Note that humans do not have these skills ingrained. Logic and reason evolved for navigating hypersocial groups and for pattern recognition, not for unravelling a tangled web of consumerism, bad science, and social media that has emerged from the rapid cultural shift of the past few decades. Being a responsible skeptic, therefore, requires a comprehensive set of critical thinking skills that, like any other, can only be acquired through diligent study, refined and honed through frequent use.

Unfortunately, there has been little emphasis on critical thinking in our educational institutions’ overcrowded curricula. When critical thinking is taught, it is rarely before students reach university. Then, it is often paired indiscriminately with ‘Research Methods,’ despite data showing that Research Methods failed to reduce the prevalence of false beliefs, particularly those related to pseudoscience (Dyer & Hall, 2019). It is also the case that while many of the most prominent skeptics have

1 been revered scientists (e.g., Carl Sagan, Richard Feynman, Stephen Jay Gould), a  
2 grasp of scientific facts and concepts is only weakly related or completely unrelated  
3 to pseudoscientific beliefs (Goode, 2002; Johnson & Pigliucci, 2004). Thus, even a  
4 science education may be insufficient to provide immunity against misinformation  
5 and bias. This may explain why it is troublingly common for clinicians to become  
6 homeopaths, physiotherapists to become chiropractors, and nutritionists/dieticians  
7 to advocate ineffective supplements and fad diets. We must avoid a similar fate by  
8 not assuming we are immune to flawed and misinformed beliefs. Critical thinking  
9 skills are not for *other people*.

10 For most individuals, a degree of self-directed learning of skepticism and  
11 critical thinking is probably warranted. Fortunately, there are numerous resources,  
12 several of them essential, that can be used to sharpen critical faculties, including  
13 books (e.g., Carl Sagan's *The Demon-Haunted World*, James Randi's *Flim Flam*,  
14 Michael Shermer's *Why People Believe Weird Things*, Ben Goldacre's *Bad Science*);  
15 magazines (*Skeptical Inquirer*, *The Skeptic*, *Free Inquiry*); lectures (by Steven  
16 Novella, Susan Blackmore, Stephen Jay Gould); podcasts (*The Skeptic's Guide to the*  
17 *Universe*; *Geologic*; *Body of Evidence*); and debates (those pitting theology against  
18 secularism usually offer lucid examples of good and bad logical construct).  
19 Engaging in skeptical discussions with friends and colleagues is another practical  
20 way to identify and mitigate weaknesses in forming reasonable arguments.

21 As competent skeptics and critical thinkers, we can challenge the current  
22 health and wellness model, particularly its devotion to "fitness influencers" and  
23 concurrent disdain for legitimate experts. In doing so, we must first ensure we are  
24 not inadvertently promoting or giving platforms to unproven/disproven ideas. Try  
25 and cleave space for doubt in your preconceptions and subject them to intense  
26 scrutiny before dissemination to clients, colleagues, and students. This shortens the  
27 shelf life of biased or erroneous advice. Second, proactively challenge baseless  
28 claims and pseudoscience when they arise in the "public square". The clinical oath  
29 *primum non-nocere* (first do no harm) not only compels scientists and practitioners  
30 to administer reasoned and evidence-based advice but also to rally in removing  
31 absurdity and falsehood from circulation so it cannot contaminate decision-making.  
32 Misinformed beliefs can be challenged through corrective messaging (debunking),  
33 and this is most effective when messages are rational, fact-based, and supported by  
34 valid sources (Tiller, 2022). Third, in line with critical thinking lore, we must educate

1 others on *how* to think rather than *what* to think. This axiom obligates teaching  
2 basic critical appraisal but also exploring more nuanced strategies like ‘prebunking’  
3 and ‘inoculation theory’—the notion that individuals can be protected against  
4 persuasive attacks on their attitudes by exposing them, in advance, to weak forms  
5 of misinformation (Compton, 2013). We have an array of pragmatic tools at our  
6 disposal.

7       Lastly, an important note about extending skepticism to our work and the  
8 methods we use to test our hypotheses and validate our interventions. As scientists  
9 and skeptics, we lean heavily on findings from scientific research. As David Hume  
10 asserted: “In our reasonings concerning matter of fact, there are all imaginable  
11 degrees of assurance... A wise man, therefore, proportions his belief to the  
12 evidence.” Unfortunately, our assertions, however well-intentioned, are only as  
13 accurate as our procedures of scientific inquiry. Kinesiology and related disciplines,  
14 despite making enormous strides in knowledge since their inception, are still  
15 relatively young. In our view, the field has become reluctant to acknowledge its  
16 methodological shortcomings. Data show that publication pressures, competition for  
17 grant income, and an overemphasis on quantitative performance metrics (e.g., h-  
18 index) have incentivized questionable research practices. As a consequence, the  
19 discipline suffers from inflated false positivity rates, diminished scientific quality and  
20 rigor, and a profound replication crisis (Tiller et al., 2023). Embracing the ethos of  
21 scientific skepticism may be the first step toward lasting reform: encouraging a  
22 culture shift in research to emphasize quality rather than quantity, and moving the  
23 field toward improved standards of practice across domains.

24  
25       To conclude, pseudoscience and mis/disinformation have no professional  
26 boundaries, thriving in commercial culture and wherever critical faculties are found  
27 wanting. Much of their proliferation has been compounded by social media and the  
28 erosion of expertise (Nichols, 2018). Even the sacred domain of scientific research is  
29 not immune. Scientific skepticism, with its emphasis on process and objectivity,  
30 ethics and humility, is a viable solution, but only if we strive to further understand  
31 its principles and independently integrate its tenets into educational curricula,  
32 scientific research, and professional practice. As a collective, we can then share in  
33 the urgent tasks of challenging baseless claims in health and wellness and holding  
34 manufacturers to account for their sensational rhetoric. Do not leave this important

1 work to others. Only by having the courage to confront health and wellness  
2 pseudoscience will we alter the paradigm and reverse the current emphasis on  
3 marketing over science.

4

## 5 **REFERENCES**

6

7 Compton, J. (2013). *Inoculation theory*. *The SAGE Handbook of Persuasion:*

8 *Developments in Theory and Practice*.

9 Dyer, K. D., & Hall, R. E. (2019). Effect of Critical Thinking Education on

10 Epistemically Unwarranted Beliefs in College Students. *Research in Higher*

11 *Education*, 60(3), 293–314. <https://doi.org/10.1007/s11162-018-9513-3>

12 Finan, C. C. (2021). *Ancient Rome (X-Treme Facts)*. BEARPORT Publishing Company

13 Incorporated.

14 Gillispi, C. C., Fox, R., & Grattan-Guinness, I. (1999). Pierre-Simon Laplace, 1749-

15 1827: A Life in Exact Science. Charles Coulston Gillispie , Robert Fox , Ivor

16 Grattan-Guinness. *The Quarterly Review of Biology*, 74(3), 331–332.

17 <https://doi.org/10.1086/393172>

18 Goode, E. (2002). Education, scientific knowledge, and belief in the paranormal.

19 *Skeptical Inquirer*, 24-27.

20 Johnson, M., & Pigliucci, M. (2004). Is Knowledge of Science Associated with Higher

21 Skepticism of Pseudoscientific Claims? *The American Biology Teacher*, 66(8),

22 536–548. <https://doi.org/10.2307/4451737>

23 Moog, F. P., & Karenberg, A. (2003). Between horror and hope: Gladiator’s blood as

24 a cure for epileptics in ancient medicine. *Journal of the History of the*

25 *Neurosciences*, 12(2), 137–143. <https://doi.org/10.1076/jhin.12.2.137.15533>

26 Nichols, T. (2018). *The Death of Expertise*. Oxford University Press.

1 Normand, M. P. (2008). Science, skepticism, and applied behavior analysis. *Behavior*  
2 *Analysis in Practice*, 1(2), 42–49. <https://doi.org/10.1007/BF03391727>

3 Retief, F. P., & Cilliers, L. (2007). Mesopotamian medicine. *South African Medical*  
4 *Journal = Suid-Afrikaanse Tydskrif Vir Geneeskunde*, 97(1), 27–30.

5 Savica, V., Calò, L. A., Santoro, D., Monardo, P., Mallamace, A., & Bellinghieri, G.  
6 (2011). Urine therapy through the centuries. *Journal of Nephrology*, 24 Suppl  
7 17, S123-125. <https://doi.org/10.5301/JN.2011.6463>

8 Tiller, N. B. (2022, August 29). From Debunking to Prebunking: How Skeptical  
9 Activism Must Evolve to Meet the Growing Anti-Science Threat | Skeptical  
10 Inquirer. *Skeptical Inquirer*, 46(5). [https://skepticalinquirer.org/2022/08/from-](https://skepticalinquirer.org/2022/08/from-debunking-to-prebunking-how-skeptical-activism-must-evolve-to-meet-the-growing-anti-science-threat/)  
11 [debunking-to-prebunking-how-skeptical-activism-must-evolve-to-meet-the-](https://skepticalinquirer.org/2022/08/from-debunking-to-prebunking-how-skeptical-activism-must-evolve-to-meet-the-growing-anti-science-threat/)  
12 [growing-anti-science-threat/](https://skepticalinquirer.org/2022/08/from-debunking-to-prebunking-how-skeptical-activism-must-evolve-to-meet-the-growing-anti-science-threat/)

13 Tiller, N. B., Sullivan, J. P., & Ekkekakis, P. (2022). Baseless Claims and  
14 Pseudoscience in Health and Wellness: A Call to Action for the  
15 Sports, Exercise, and Nutrition-Science Community. *Sports Medicine*  
16 *(Auckland, N.Z.)*. <https://doi.org/10.1007/s40279-022-01702-2>  
17  
18



**Table 1. Manufacturers facing consequences for false and/or misleading health and wellness claims.**

<b>Product</b>	<b>Date</b>	<b>Manufacturer</b>	<b>Claim(s)</b>	<b>Consequence(s)</b>
Perkins' Metallic Tractors	Circa 1795	Elisha & Benjamin Perkins	Cures inflammation, rheumatism, and pain in the head and face	Expelled from the Connecticut Medical Society for being "a user of nostrums"
Clark Stanley's Snake Oil Liniment	Circa 1890	Clark Stanley	Cures pain and "lameness", among many other claims	Fined \$20 (Pure Food & Drug act of 1916) for "misbranding and false representation"
Activia Yogurt	1987	Danone	Relieves irregularity; prevents colds and flu	Fined \$56 million by FTC for deceptive advertising; class-action lawsuit
Multivitamin supplements	Circa 1994	Greenlife Wellness / Naturecare Wellness	Promotes general health	Closed by Insolvency Services (UK) for false claims; manipulative sales tactics
Vitamin Water	2000	Coca-Cola	Promotes healthy joints; reduces risk of eye disease	Fined \$2.7+ million in class-action lawsuit for misleading claims
SENSA dietary supplement	Circa 2006	Alan Hirsch	Promotes satiety; promotes weight loss	Fined \$26.5 million by FTC for misleading advertising
Power Balance bracelet	2007	Power Balance	Improves balance, strength, flexibility, & athletic performance	Corrective messaging; court-ordered consumer refunds for misleading advertising
New Balance "toning" sneakers	2010	New Balance	Increases calorie expenditure; tones muscles of the lower limbs	Fined ~\$4 million by FTC for false advertising
Shape-Ups "toning" sneakers	2010	Sketchers USA	Promotes weight loss; strengthens and tones muscles	Fined \$40 million by FTC for false advertising
Green Coffee Bean capsules	Circa 2012	Applied Food Sciences Inc.	Promotes weight loss; promotes fat loss	Fined \$3.5 million by FTC for baseless weight loss claims

Premium Green Coffee pills	Circa 2015	Sale Slash LLC	Promotes weight loss	Fined \$43+ million by FTC for unsubstantiated claims; fake endorsements
Luminosity "Brain Training" program	2015	Lumos Labs	Prevents Dementia/Alzheimer's; improves school performance	Fined \$2 million by FTC for deceptive advertising

---