BAD SCIENCE BY BEN GOLDACRE

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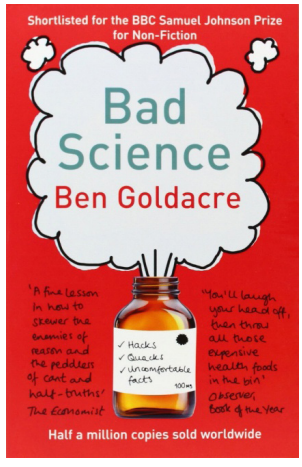

Rarely does one come across a book as scathing and steeped in acerbic wit as Ben Goldacre's "Bad Science". The book has at its core one central and very important objective, namely, to weed out and expose the band of charlatans and quacks within our midst masquerading under the banner of science. Once identified, the author systematically subjects the claims and promises of these pseudo-scientists to

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austere methodological rigour, borne out of his own experience as a physician and epidemiologist. Initially, his espousal of the scientific method appears tinged in a self-protective narcissism as he appears to exude a disdain for any practice outside of the realm of mainstream western medicine he was trained in. However, as the text expands its scope of critique, we discover that Goldacre is by no means ignorant of the inherent flaws within mainstream medicine and cites research from within its esteemed quarters as the very nadir of bad science. The book is rendered highly accessible to a wide audience through the author's clear explication of research methodology and couching of serious information with such scathing wit. Despite its sheer entertainment value as a text offering considerable comic respite, the true value of this book lies in its capacity to edify its readers who will emerge from this text equipped with the requisite intellectual interrogation tools to help withstand the spectre of spurious science pervading society. What will follow is a review of the text and the various dubious practices left reeling in its intellectual wake.

The first hapless victim in Goldacre's marauding assault on the vacuous pseudo-sciences is the proselytisers of detoxification programs and their claims of miraculous benefits (Chapter 1). Through recourse to actual principles of science and tried and tested laws, Goldacre demonstrates how much of this industries tricks are constructed around smoke and mirrors borrowed from the magic industry. The author's contempt for such practices knows no bounds and he derisively shows how such industries survive on one absurdly preposterous act, namely, "...the invention of a whole new physiological process" (Goldacre, 2008, p. 10). The author shows how there is nothing like a "detox system" within a medical textbook and that it is entirely a marketing invention with considerable cultural capital. Goldacre guts through the full gamut of detoxification practices demonstrating very precisely their complete lack of scientific credibility. That said, such practices continue to proliferate and expand within the market space. The author contends that the appeal of these practices stem from their powerful cultural currency as secular "purification" and "cleansing" rituals, which obfuscates the fact that they operate within an evidentiary void. The primacy and power of cultural forces to override scientific mechanisms will become a critical theme throughout the text.

Goldacre's vitriol drips with disdain for the intellectual dross that is "Brain Gym" (Chapter 2). Coursing through the education system like an intellectual carcinogen, Goldacre asserts that "Brain Gym" has inculcated levels of misunderstanding utterly at odds with scientific principles. Take for example the following piece of advice banded about by the "Brain Gym" proponents as one of its foremost benefits: "… increased oxidation for efficient relaxed functioning" (Goldacre, 2008, p.15). Goldacre kindly points out to the reader that "oxidation" is what causes rusting and that "oxygenation" would be a more appropriate scientific term to describe this process. The fact that the "Brain Gym" manuals consistently jumble this information is a very transparent indicator that the institution lacks scientific substance. In

fact, "Brain Gym" and its minions of misinformation can be better understood as an extension of the vast neuro-faddism seen in contemporary society. The success of these pseudo-sciences derives from their misguided use of neuropsychological terms as an instrument for legitimizing their practices. Goldacre's derision for these variants of intellectual "decoration" is clear: "quacks…have been adding science sounding explanations for their products as long as quackery has existed" (Goldacre, 2008, p.17). While Goldacre tempers his disgust by acknowledging some of the benefits of "Brain Gym" such as exercise and classroom breaks, he maintains that these benefits are not worth the distortion of scientific evidence and inculcation of misinformation in our children.

Next up in Goldacre's pseudoscience inquisition is a fairly obvious target: the cosmetic industry (Chapter 3). Again, what Goldacre wants the reader to take away here is the understanding that the success of such industries is a cultural construction that plays on the emotional fragility and perceptual biases of human subjects. Specifically, the cosmetic industry cannot operate without the western construction of "ideal beauty", a concept devoid of ontological stability but so suffused with semiotic substance that it is able to exert significant social influence. Within this framework, the illusion and psychosomatic effect of beauty enhancement is far more important than actual measurable outcomes. Further, in a contemporary postmodern landscape where surface trumps substance, the cosmetic industry is able to flourish. Goldacre's biggest gripe with these industries is that they are very effectively selling scientifically suspect shortcuts to the unhealthy and actively undermining empirically established mechanisms for healthy ageing i.e. exercise, eating well. Throughout the text, Goldacre's theses rings clear, namely, that these dubious practices are not merely innocuous "alternative strategies" but have the potential to perpetrate considerable harm.

Up to this point in the text, the reader has been shifting fairly smoothly through their intellectual gears without too much of a challenge. In the remaining chapters in the book, the author makes somewhat stronger intellectual demands on the reader. The methods of attack remain the same, namely, debunking dubious knowledge through the espousal of scientific principles. However, the book begins to take on a more didactic tone as we become acquainted more closely with scientific methodology. The book at times reads like the perfect research methodology primer, wonderfully articulate and suffused in humour. I would strongly recommend it as an important adjunct to any undergraduate course in research methodology as it fleshes out the banality of textbook research with fascinating examples couched in heaps of hilarity. While the purpose of this review is to cover the major focus areas within the text, certain components of research methodology will be elucidated in the remaining discussion to contextualize the author's position.

In chapter 4, Goldacre's illusion-destroying crusade against quackery takes aim at those most ardent of complementary medicine campaigners: homeopaths.

Homeopathy has grown into an institution of considerable influence with multitudes of followers. The biggest attraction of homeopathy stems from the oft-erroneous conflation of this industry with that resplendently sublime signifier - "natural". To the lay person, homeopathy offers symptomatic respite without the perilous side effects of mainstream medicine. People swear so strongly by the efficacy of homeopathy that anything to suggest the contrary is an affront worthy of vehement dispute. The author surveys a series of infantile diatribes homeopaths have directed at him over the years, which do not warrant recollection here. What does collect comment is the fact that homeopathy operates within an evidentiary vacuum and deploys such dubious vehicles of validation that it is truly difficult to fathom just how they exert such a strong influence on consumer health behaviour. But then is it? You see, obfuscation is a primary ploy within the pseudo-sciences, and to the untrained eye, incredibly difficult to detect. But fear not, Goldacre goes to great pains to ensure that you as the reader are not left in the dark when confronted with the fundamentalist fervour of the homeopath advocates. For instance, here are some reposts you may offer up when your position of righteous scepticism is aggressively undermined: "I am sure it works very well, but then again, so does the placebo effect" or "another explanation for what you might perceive as symptom alleviation may also be 'regression to the mean'". Regression to the mean speaks to the fact that people usually consult an alternative practitioner when their condition of ill-health is so extreme that the only likely trajectory is toward a modicum of improvement. While these improvements may be erroneously perceived as a response to homeopathy treatment, research suggests that it is in fact the inevitable downward curve of any illness following a period of symptom exacerbation. Having introduced the reader to basic principles of scientific measurement, Goldacre uses this rudimentary knowledge base as scaffolding for exploring somewhat more sophisticated components of research. We are told about blinding, randomization, controls, manipulation, and various other important procedures that are paramount in truly establishing the efficacy of an intervention. He then demonstrates how the vast majority of studies on homeopathy are so peppered with methodological flaws that any claims of efficacy lack validity. To illustrate this, Goldacre introduces us to that most glorious conglomerate of clever minds, the Cochrane Collaboration. The Cochrane Collaboration has deployed meta-analytic procedures to determine the overall effect size of studies claiming homeopathic efficacy. This landmark meta-analysis was published in the distinguished medical journal, *Lancet*, and demonstrated unequivocally that homeopathy performs no better than placebo (Shang et al., 2005).

To help elucidate the cultural phenomenon of the perceived efficacy of homeopathy and other alternative therapies, Goldacre provides the reader with a detailed exposition of the placebo effect in chapter 5 of the text. An adequate understanding of this procedure is wrapped up in the intricately complex connection between mind and body. Drawing on some fascinating anecdotes from the annals of

medical history, Goldacre shows just how powerful the placebo effect can be. For instance, there are published accounts of patients reporting a complete reduction in cancer pain after receiving saline solution injections under the guise of morphine. The author contends that the cultural meaning attached to the process of receiving an injection may have an extremely powerful effect irrespective of what is actually inside the injection. This becomes a major component of Goldacre's argument, namely, that there is immense cultural meaning and value in ritual and homeopathy is in many ways the perfect example of value in ceremony. With their protracted clinical interviews, dose specific pill regime, foray of physical exams, and gamut of other procedures, homeopaths mimic the conventions of mainstream medicine with the added gloss of "natural" and "safe". The cultural currency inherent in these procedures provides an important explanation into the perceived efficacy of homeopathy. To explore this premise empirically, Goldacre introduces us to a series of well thought out studies testing the power that the placebo effect can have when parading as mainstream medicine. Some of the results are truly astounding, for instance, it has been shown that sham ultrasound is beneficial for dental pain (Kaptchuk et al., 2006), placebo operations are beneficial for knee pain as well as been shown to treat a condition as serious as angina (Linde, Gadler, Kappenberger & Ryder, 1999). Now all of this throws up some very compelling ethical quandaries. Specifically, if placebo based interventions like sham surgery and homeopathy do to some extent have a positive impact on illnesses, then why should they form the subject of such concerted critique. Goldacre is balanced in his assessment of this question and weighs up critical evidence for and against these practices. In the end, it is clear that the dangers of the wholesale prescription of a placebo based intervention like homeopathy as a panacea for illness far outweighs its benefits. Goldacre backs this assertion up by surveying the many recorded fatalities as a consequence of such indiscriminate practices.

In the next four chapters of the book (Chapters 6, 7, 8 and 9), Goldacre accords particular attention to another emerging powerhouse in the sphere of spurious science: nutritionists. He first tackles the "free radical theory of ageing" punted by so called "nutritional scientists" and establishes very clearly that there isn't an iota of empirical evidence to support the aggressively marketed benefits of antioxidants as the ultimate elixir against the ravages of time. While Goldacre's full explication of his rebuttal is rather protracted and complex, he concludes by citing actual empirical evidence showing that people receiving high doses of antioxidants were in fact at greater risk of dying from either cancer or heart disease (see Offit, 2013). These studies were published well over a decade ago and yet receive no media coverage. The Cochrane Collaboration alluded to earlier analysed trials of over 100, 000 participants and found exactly the same statistical trend, namely, an increased risk of major illness such as cancer and heart disease among those taking higher doses of antioxidants (Bjelakovic et al., 2008). This is yet another illustration of how an

atomized, simplistic view of a dietary mechanism promulgated by people devoid of scientific intellect can pose serious harm to society. Goldacre next turns his attention to what he perceives as the very nadir of spurious science and offers a damming portrait of the quasi-nutritionist's malnourished intellect: "Dr" Gillian McKeith, and "Professor" Patrick Holford. Apart from their tendentious touting of questionable credentials, Goldacre is somewhat more interested in the complete lack of scientific understanding that these two beacons of alternative medicine possess. Take McKeith and her advocating of "Horny Goat Weed" as been shown by "controlled research" to promote sexual satisfaction. Not only does she fail to articulate any scientifically known mechanism for the ostensible efficacy of this supplement, but McKeith appears to confuse anecdotal evidence from a single case study with empirical evidence derived from controlled experimentation. This is unforgivable when one considers the considerable sway McKeith has over public opinion in Britain and beyond. "Professor" Holford is no less guilty in this regard as he commands an audience that far transcends that of McKeith. And yet he is as prone to the same appalling lapses in scientific logic with potentially more severe consequences. Holford claims in his *The New Optimum Nutrition Bible*, a million copy bestseller, that his specially formulated multivitamins are able to prevent as well as cure AIDS and cancer. How does Holford demonstrate this – by "cherry picking" studies ostensibly revealing this link. Cherry picking is a practice that Goldacre holds in particular disdain and it involves seeking out studies that appear to superficially provide a modicum of support for your theses. Goldacre meticulously combs through the cited studies and subjects them to careful methodological appraisal. What emerges are a series of studies so methodologically flawed that the vast majority of them have either been retracted or left under a spectre of suspicion. The much lauded and controversial Professor Tim Noakes (you will notice an absence of inverted commas here) recently goaded Holford for the lack of scientific substance behind his claims on the South African television show *Espresso*. Noakes exuded his customary arrogance and appeared somewhat cold and detached in the exchange. Having read *Bad Science* and its complete appraisal of Holford, one begins to perceive Noakes castigation through an entirely different lens.

While on the subject of South Africa, now would be an opportune time to revisit one of our most embarrassing and indefensible moments of ignorance: the vitamin pills and HIV/AIDS debacle (Chapter 10). Goldacre reviews this ingenious incident in our history by seeking out its origins. Here we learn of the vitamin pill entrepreneur, Matthias Rath, who single handily inculcated in the minds of our foremost politicians the spurious notion that vitamins would be a superior alternative to antiretroviral medication in treating AIDS. It is common knowledge now that President Thabo Mbeki's entire presidential reign is overshadowed by the singular inexplicable decision to cease funding the provision of antiretroviral medication in South Africa in favour of vitamin and other alternative medicines. It is now estimated that more

than 347, 000 deaths could have been prevented in South Africa between 1999 and 2007 had antiretroviral medication been made available. Goldacre contends that there a few more natural case studies of the disastrous effects of following medically questionable advice as the AIDS debacle cultivated by Rath during Mbeki's reign.

In the next few chapters of the book (Chapters 11, 12, 13 and 14), Goldacre covers the evils of mainstream medicine. He commences the discussion with an important caveat, namely, that it is entirely possible for doctors to be utterly awful and incompetent, but that the philosophy driving evidence based medicine is not. Goldacre contends that by far the most malign manifestation of mainstream medical treatment is the unscrupulous practices entrenched within the pharmaceutical industries. The author uses selective serotonin reuptake inhibitors (SSRI's) as a compelling vehicle for delivering his critique. An important context to this discussion is the gradual decline in the discovery of new drug molecules in the past twenty years. Against this backdrop, drug companies have had to engineer clever ways of peddling the existing panoply of pharmacopeia beyond their traditional usages. In this regard, SSRI's are a resounding success story. Like most psychotropic drugs, the benefits of SSRI's in treating depression were stumbled upon while testing the drug for other uses. This trend of abandoning hypothetical deductions about drug benefits and simply extrapolating their benefits to every possible variant of pathology has taken on new heights with SSRI's. The drug is used to treat anything ranging from depression, restless legs syndrome, anxiety, weight problems, sexual identity difficulties and a host of other existential enmities. Yet this apparent success story elides masses of negative data. Most empirical data does not only suggest that SSRI's are dangerous but that they in fact perform no better than placebo. Goldacre surveys a series of statistical tricks one might employ to get data to provide the desired picture. It would appear that suppressing negative results and hiding harm is a common practice within the pharmaceutical industry and extremely difficult to detect to the untrained eye. Goldacre endeavours to equip the reader with this critical skillset in the chapter titled "Bad Stats". One can only marvel at the menacing mendacity at work within the realm of statistics. Of particular interest here is the manner in which probability values can be played with to fit the researcher's hypothesis. Conservative p-values are often deployed to reflect statistical differences when they support the hypothesis and more stringent p-values are implemented when statistical differences do not align with proposed hypotheses. In other words, the mischievous use of statistics affords unscrupulous researchers the opportunity to play with their findings with a view to supporting their hypothesis. It is unnerving to think that when it comes to the pharmaceutical industry, people's lives hang in the balance in this precarious practice of statistical stylizing.

The final two chapters (Chapters 15 and 16) are reserved for a cautionary note on the media and their pernicious role in creating a culture of fear. Whether it is the now infamous vaccine scare or the dietary dangers of "frankenfoods", tabloids have

the potential to terrorize the uninformed lay public. Goldacre uses his specialized insight as a medical journalist to reveal some of the strategies journalists use to sell their stories. A thorough understanding of this tabloid trickery provides the perfect antidote to the unfounded fear and anxiety one may experience when accosted by the multitude of mendacious media headlines.

In sum, Goldacre's book is a revelation. In the tradition of Upton Sinclair's *The Jungle* (1906), the book peels back the blinkers from an oft uninformed and disempowered public, galvanizing them to stand up against the many puerile purveyors of dubious "scientific" practices. It is thoroughly entertaining and deeply edifying and would prove the perfect accompaniment to any tertiary education course in research methods.

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BIOGRAPHICAL NOTE

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