

From anti-GMO to pro-science: 'A Layman's Guide to GMOs'

Knowing whom to trust on the touchy issue of GMOs (biotechnology) is a thorny issue—especially on the Internet, where tensions flare to a 100 with an absence of nuance and body language. Leaning on an authority is, of course, a shortcut. Who has the time these days to understand a field as diverse and comprehensive as biotechnology? Very few of us; in that light, it is a perfectly reasonable shortcut—provided one seeks out the correct authorities, that is.

That is why appeals to authority are the main weapon on both sides of the e-divide on GMOs. However, in many ways, many such arguments fall flat on their face as they exhibit fallacious reasoning (often called the [argument from authority fallacy](#)). The trick, of course, is finding an authority one can trust and that is right—no easy task.

Genetic Literacy Project guest contributor Fourat Janabi—author, [blogger](#), and photographer—wrote [***The Lowdown on GMOs: According to Science***](#) to provide just such a guide.

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What happens if one picks the wrong authority and psychologically ties oneself to a person expressing an argument, rather than to the evidence—doing just that is a quirky trait of human psychology. Over the past few years, this is the dilemma that I faced. The authorities I trusted in were wrong. Thus began the project that led to my book.



But before I get to the details of my book, let me circle back and dwell a little more on the subject of authorities and how I came to write this. An appeal to authority is a legitimate argument and can form a perfectly coherent foundation from which to move forward provided, however, it satisfies one, two, or all three of the below conditions.

- 1 – The authority referenced is an expert on the exact subject involved
- 2 – There is consensus among experts from the field in question
- 3 – The consensus is based on high-quality, replicated data

Drawing on the above three conditions, the more an argument satisfies, the stronger the argument becomes.

The first two apply to any field, and the third is required when the field is scientific. A scientific appeal to authority exhibits fallacious reasoning if one or more of the above conditions are not met.

Number ‘one’ is important as modern science has become so specialized that a scientist well-versed in one field might have little to nothing to say on another (whether or not they think they have something to do is another matter entirely). When it takes 4-8 years to become an expert in one little scientific sub-field, one has very little time to become an expert on an adjacent sub-field. Peter Diamandis expressed it quite well in his book [*Abundance: The Future is Better Than You Think*](#). In the below quote, he attempts to explain to his grandfather what his degree allowed him to specialize in:

“Grandpa,” I would begin, “do you see the dirt over there?” “Are you a soil expert?” he might ask. “No. But in the dirt, there is this microscopic life form called a bacterium.” “Oh, you’re an expert in that!” “No,” I’d respond. “Inside the bacteria, there’s this thing called DNA.” “So you’re an expert in DNA?” “Not quite. Inside the DNA are these segments called genes—and I’m not an expert in those either—but at the beginning of those genes is what’s called a promoter sequence...” “Uh-huh ...” “Well, I’m an expert in that!”

Quite the small subject to dedicate 4-8 years of one’s life to; yet, that is the life of a modern scientist, for better or worse. The life sciences are among the most specialized of fields today. In biotechnology, to name just a few, there is biochemistry, bioinformatics, chemistry, molecular ecology, and microbiology. Just these few involve the further specializations of virology, bio-mathematics, epidemiology, and dozens more, which in themselves involve specialist jobs as diverse as biochemists, biophysicists, bio-technicians, and epidemiologists. How can an hour, day, month, or year at the ‘University of Google’ contend against that?

Appeal to authorities are all well and handy, but those arguments most likely to be correct should come from authorities in the fields represented; otherwise the argument is more likely to be wrong. This goes doubly for a subject as granular as molecular biology—things on the microscopic scale just do not adhere to one's macroscopic common sense (the fictitious divide between species being one example).

Number 'two' makes the claim that the experts are more likely to be right than the lay public, so if a majority of those experts are in agreement, the evidence in favor of the argument being made is that much stronger. This is hardly a surprise and applies not only to science. When one has an electrical wiring problem, one calls an electrician trained in the accumulated knowledge of a century of experimentation and trial and error; but, perhaps you get an electrician that tells you that blowing on your broken lamp three times will fix it and leaves you to do it yourself considering his work done. He might be an expert electrician and scored straight A's in his course, but recently had a change of heart and believes instead that three blows will suffice to fix your unique problem. Here, his expertise is indicative of nothing in relation to the physical problem of electrical wiring.

While this exercise is purposefully silly, it is meant to show that just because he is an expert (satisfying condition 'one'), does not make his judgment automatically right. His judgment is in contradiction to accepted fact; not ideologically, but physically and practically. In practice, what condition 'two' entails is that no person, however credentialed, can make his opinion fact by his (or her) credentials alone—in a scientific sense, that is.

[Image via Chicago Tribune.](#)

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[Image via Chicago Tribune.](#)

Numbers 'one' and 'two' are applicable to any field; however, the claim number THREE makes applies specifically to the scientific enterprise. The evidence the consensus has been built upon must be high quality. Anecdote, for example, is not evidence; and the plural of anecdote is not data. High quality data is almost always peer-reviewed, both academically and publicly. It must be replicable (that is, in theory, persons in China, Brazil, and the USA should happen upon the same result if performing the same experiment in the same conditions). It must also be capable, at least in theory, of being falsifiable (being proved wrong). The methodology and data must be made public (warts and all), and the conclusion should derive inductively from the data. Wrestling truths from nature is not, and never will be, easy. Googling is not enough to derive or validate a hypothesis—ever.

Given these three conditions science—which is where our concern lies in relation to GMOs—will, given

enough time, approximate nature to the best of present abilities. And given that the scientific method is the most reliable adduced thus far in pursuit of objective truths in the world, an appeal to authority that satisfies these three conditions is more likely than others to be reliable, which would give confidence enough to accord the appropriate justification to act in light of conclusions deduced thereby.

So...in applying the three criteria to the current authorities pontificating on GMOs, what do we find? Have a think about that. Before I answer I must articulate what I am not saying: none of this insinuates that disputations and opinions cannot be made against a prevailing consensus; or that the present consensus is the final *be-all, end-all* of objective truth. An authority doesn't need to tick all three boxes to be correct. I, for example, do not meet condition 'one'. However, my formulations of biotechnology come in part from considerations of 'two' and 'three'. The scientific world will not ignore conclusions presented by one who fails to satisfy 'one' and 'two' yet presents a rigorous 'three'; It's just unlikely that one who fails to satisfy 'one' or 'two' will do so.

Science involves a ruthless skepticism of all new ideas regardless of their origin to ensure that it satisfies scientific criteria (falsifiability, replication, invoking plausible mechanisms of action etc.). Einstein, for example, famously satisfied only the third condition when he presented his Special Theory of Relativity, however his conclusions (derived from empirical results and mental thought experiments) deduced as a result were unequivocal in their explanation of reality: he was right and nobody could deny it. However, that doesn't make anybody who presents contrary opinion, data, or theory to the prevailing consensus of the time an Einstein. Einstein's data worked whether or not the majority of physicists liked it. By sheer strength of his theoretical, experimental, and empirical results did physicists relent. So swinging back around to the question I posed at the beginning of this paragraph: from a scientific perspective, we find there are numerous violations of not only one, or two, but of all 3 criterion. In fact, I would not be surprised if the majority of so-called authorities on GMOs failed to satisfy a fraction of one of these conditions.

Michael Pollan, arguably one of the most influential writers on biotechnology in the USA, is a journalist. Journalists do not learn a thing about molecular biology during the course of their university studies (strike one); the consensus of journalists on biotechnology weighs very little, if not nothing (strike two); and journalistic data do not pass the rigor required of scientific data (strike three...take a walk). Yet, despite all this, he is hailed as a hero and showered with fame and book deals. In the scientific world, he may as well be a unicorn. One may as well ask a newly arrived Eskimo for his opinion on the greatest NBA players all of time. What possible chance does he stand? What kind of insult does that send to sports commentators and those who've invested decades into the sport? The only difference between the Eskimo and Pollan is that [the latter pretends to know](#).

As the e-debate rages on, it is quite clear that the public has been roped in by the wrong authorities—proverbial Eskimos, if you will. Authorities that are, by the above proscribed logic, about as far as one could be from being an authority. (Hereafter called faux authorities). Furthermore, many of them stand to gain quite a lot if their anti-GMO opinion becomes the dominant one—ironically, a charge usually projected in reverse to those who accept the evidence. [Jeffrey Smith](#), the anti-GMO former yogic flying instructor and ex- member of the Natural Law party, fails to satisfy even one iota of one of the above three precepts, yet flies around the world on speaking engagements and earns a living selling his anti-

GMO screeds to the laity. He stands to lose a lot of fame, notoriety, and money should he decide to have a change of heart. Joe Mercola, the natural supplement seller and frequent purveyor of anti-GMO literature, [makes millions](#) scaring people into buying his supplements. How objective might they be when they stand to lose their social circles, future lucrative earnings, and elevated sense of self-worth?

From a societal perspective, this is a disaster. It sends incorrect signals to our elected governing authorities thus distorting their priorities: do they listen to the public who votes for them or the smaller group of scientists whose votes do not matter, yet base their conclusions on evidence? The answer is, as [evidenced by European policy](#), the former (albeit other considerations—protectionism for one—also conspire to mold European policy). The only place one finds genetically modified produce in Europe is out of sight and minds way: on farms feeding the cows and pigs. Everywhere else, they are greeted with hysteria.

Food policy is no trivial matter. It affects poverty, health, disease, and security, and not one of them for the better! The higher the price of food, the higher global poverty rises as the World Bank has highlighted in their twin reports: *Poverty Effects of Higher Food Prices*; and *Implications of Higher Global Food Prices for Poverty in Low-Income Countries*. The price of food also plays a role in political stability—instability, rather. The livelihoods of billions depend on how we in the affluent West tackle the future of food. We do not live in a bubble insulated from the rest of the planet; our choices radiate out in untold ways affecting, in the case of food, negatively the possible future of all. Nathanael Johnson [wrote at Grist](#): “We have more people, eating more food, every year, and farm yields that are stagnating. Add to that the forecast for increased droughts and severe weather, and you have a recipe for rising food prices.” Do we, the lucky billion born in the land of science and technology, want to influence that future on anything less than on the most expert, informed decisions, and evidence?

Those that attempt to influence the GM debate, whatever their dime-a-dozen intentions are, should keep the following in mind: “You become responsible, forever, for what you have tamed.”

Solving food security challenges, now and in the future, will take every tool we can muster, quite a bit of luck on top, and cooperation on a global scale. Yet, as a result of misinformation by faux authorities, much of the public is signaling to elected authorities that the detriments of biotechnology (mostly theoretical) outweigh the practical benefits (reduced pesticide use and increased yield) and that organic farming (with a lower land-use efficiency) should be our answer to stagnating yields, rising hunger, and rising food prices! Rome burns while the gladiators bleed and the crowd cheers. Now, this is not to say if only we allowed GMOs all our problems would be solved; there is no single answer. However, the polarized debate has made finding common ground difficult and tackling ancillary issues that just are as important all the harder. We need all options on the table, and for those options to be evaluated using on-the-ground facts by those in-the-know and for conclusions deduced thereof to be either deductively or inductively derived.

With the subject of authorities dispensed with, this brings me back around to myself: one year ago I was anti-GMO. (Just thinking about it is embarrassing.) Luckily enough, I was snapped out of it by Ray Kurzweil's book [The Singularity is Near](#). Ray Kurzweil is an authority on technology (and ticks 2 of the above 3 boxes). I dove into his book knowing GMOs were bad. I left it pretty certain I was wrong, yet I

found it difficult to shake that gut feeling that lingers after a rational choice conspires to reverse an emotional certainty.



Genetically modified golden rice. Image via The International Rice Research Institute.

After reading Mark Lynas' speech '*Time to call out the anti-GMO conspiracy*' several months later in January of 2013, I finally became convinced, both rationally and emotionally, that I was wrong. I changed my mind not only because I trusted the authorities (Kurzweil and Lynas), but because the quality of their arguments, irrespective of whether I liked/trusted them or not, rose beyond the shallow rhetoric, simple conclusions, and into real-world secondary effects that broke me out of my First-World bubble that nobody in my social circle or of my faux authorities considered. They highlighted the disastrous consequences of First-World activism in places like Africa and Asia from Vitamin A deficiency that afflicts millions of children to substantial loss of yields in the poorest parts of the world due to poor farming conditions and lack of basic equipment. The evidence they presented in their argument's favor went beyond their social circles and ideological brethren to Academies of Science' around the world and different research teams operating out of independent labs separated geographically, culturally, and temporally.

Then, it was in a [Q&A with public scientist Dr. Kevin Folta](#) that I discovered there is almost no debate at all—hardly a whimper—in the mainstream scientific world about the safety, utility and applicability of GMOs to our world of "*more people, eating more food, every year, and farm yields that are stagnating.*" However, without first being exposed to Kurzweil, I might have dismissed Lynas as an industry stooge (as many have), and yet without Lynas' speech, I might have dismissed Folta's proclamation as propaganda (as many do). Yet, where would I be without having read their works (in that order, no less)? I wouldn't even know enough to be embarrassed.

This highlights the importance of not only getting information first-hand but, at least in my case, tangentially. From there, a farmer found me to express his side of the GMO kerfuffle, and even a small biotech company reached out to me to air their side of the story. I combined these three Q&As into *The Lowdown on GMOs* on my blog.

It was highly controversial, to say the least. *The Lowdown on GMOs with Kevin Folta* alone was shared thousands of times across Facebook, Twitter, and Google+. Yet, despite Dr. Folta ticking all three boxes

above (he practices in the field in question, his peers all across the world are in consensus on the issue, and the data from which that consensus emerged is high-quality, peer-reviewed, and replicable) the majority of comments consisted of vitriol, slander, or at best, outright bewilderment. This is almost uniformly the case on any article that accurately represents the data and evidence gathered on the subject. (A few months earlier one of those comments might have been left by me!)

Whatever the problem was, a key part is that such information was not finding its way to the public with the relevant context, and I resolved to do my part to shorten the dividing bridge and, perhaps, add a couple of lanes too. After all, I might not have been so receptive to Dr. Folta without first being introduced to Kurzweil's and Lynas' arguments. Biotechnology is more than a single field, and I didn't snap out of my black-and-white la-la land until I heard it from a technologist, a historian, and a scientist.

Another key roadblock between the public and expert authority is that the experts generally have their opinions filtered via ideological conduits. An example is one of thousands of studies that show GMO consumption to be safe emanating from the scientific sphere having to pass through ideological filters before it hits the public's mind (i.e., Greenpeace, GMWatch et al.) who do not present a fair analysis of the results. Furthermore, those studies that show GMOs are bad (which are almost always universally flawed) make their way through such filters with nary a footnote indicating apprehension or skepticism. This leaves in its wake a flawed perception of what the scientific literature actually says and what the public thinks. Therefore, the gap between the scientific world of evidence, peer review, and replication, and the public's understanding of them is vast, and unfortunately, most often traversed by those who stand to gain by its misrepresentation. It does not help that the studies are technical, occasionally hidden behind paywalls, or only seen (as mentioned) after having passed through the ideological horses' eye. This instant gratification age does not seem to be helping either as many are taken in by a person's persona, instead of their evidence, and ascribing post-facto faux authority status.

The public needs easy access to authorities that are actually authorities! They also need to know why they are authorities and why their opinion means more than nothing. It was then that I decided I needed to compile a book on the subject. I would call it *The Lowdown on GMOs: According to Science*. I started reaching out to scientists, farmers, and journalists who actively participated in the GM debate, and who, to the best of their abilities, represent the consensus and evidence of the field. I did not know what to expect or whether anybody was interested, but I was soon blown away by the caliber of folks who joined.

Historian and author Mark Lynas; Adjunct professor and former organic farmer Mike Bendzela; Social scientist Cami Ryan (PhD); Free-lance journalist Keith Kloor; and science advisor to the Obama administration Alan McHughen (PhD). Julie Kay contributed a remarkable piece of the divide between those who favor the science and those who eschew it. Anastasia Bodnar (PhD) and Karl Haro Von Mogel (PhD), co-directors of the non-profit [BioFortified website](#), along with plant pathologist Steve Savage (PhD) all contributed powerful chapters. Ramez Naam, author of the superb book [The Infinite Resource](#) jumped in with both hands and feet. You will hear how a farmer in Uruguay uses GMOs to lighten his environmental load on the soil and reduce his CO2 output, and from a former medical researcher on how *The Union of Concerned Scientists* manipulates their reports to give false conclusions of GMO yields and much, much more.

Some of the folk mentioned above tick all three boxes; others (like me), tick one or two, but one thing was unequivocal: We did not invent or cherry pick our conclusions or misrepresent what the science says. Nobody tows the party line because, well, there is no party line in the world of independent empirically based science. *The Lowdown on GMOs: According to Science* is a public service announcement on GMOs.

Each chapter tackles a different piece of the puzzle. Taken together, they essays educate and inform the reader as to what the evidence says, and how best to evaluate and elucidate the real-world implications of our actions. It is a calm and calculated response to the emotion, hysteria, and misinformation surrounding this most important of subjects. In the next 40 years we have, at the very least, one overarching, imperative goal that we must meet: to feed everyone in a sustainable manner. Solving that will take humanity a substantial way forward to meeting our water needs, addressing climate change, mitigating disease burdens, alleviating poverty, reaching developmental goals, and increasing health for all—not just those in the First World and not at the expense of the forgotten poor half a world away.

The Lowdown on GMOs: According to Science is now available...free. The first accessible primer that aims to instill a comprehensive understanding of biotechnology to a new-comer to the debate.

You can download it here at the [Smashwords](#) in Kindle, ePub (for non-Kindle devices), and PDF. Please share it freely, review it, argue against it, for it, or write about it in general. There are many difficult decisions out there that we, as a species, will need to make both now and in the future; the issue of GM food should not be one of them, and I hope this book goes some way in addressing those concerns. Thank you.

Fourat Janabi, author, [blogger](#), and photographer, wrote [*Random Rationality: A Rational Guide to an Irrational World*](#), [S3: Science, Statistics and Skepticism](#), and contributed to [*The Lowdown on GMOs: According to Science*](#).