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IDEAS THAT LEAD

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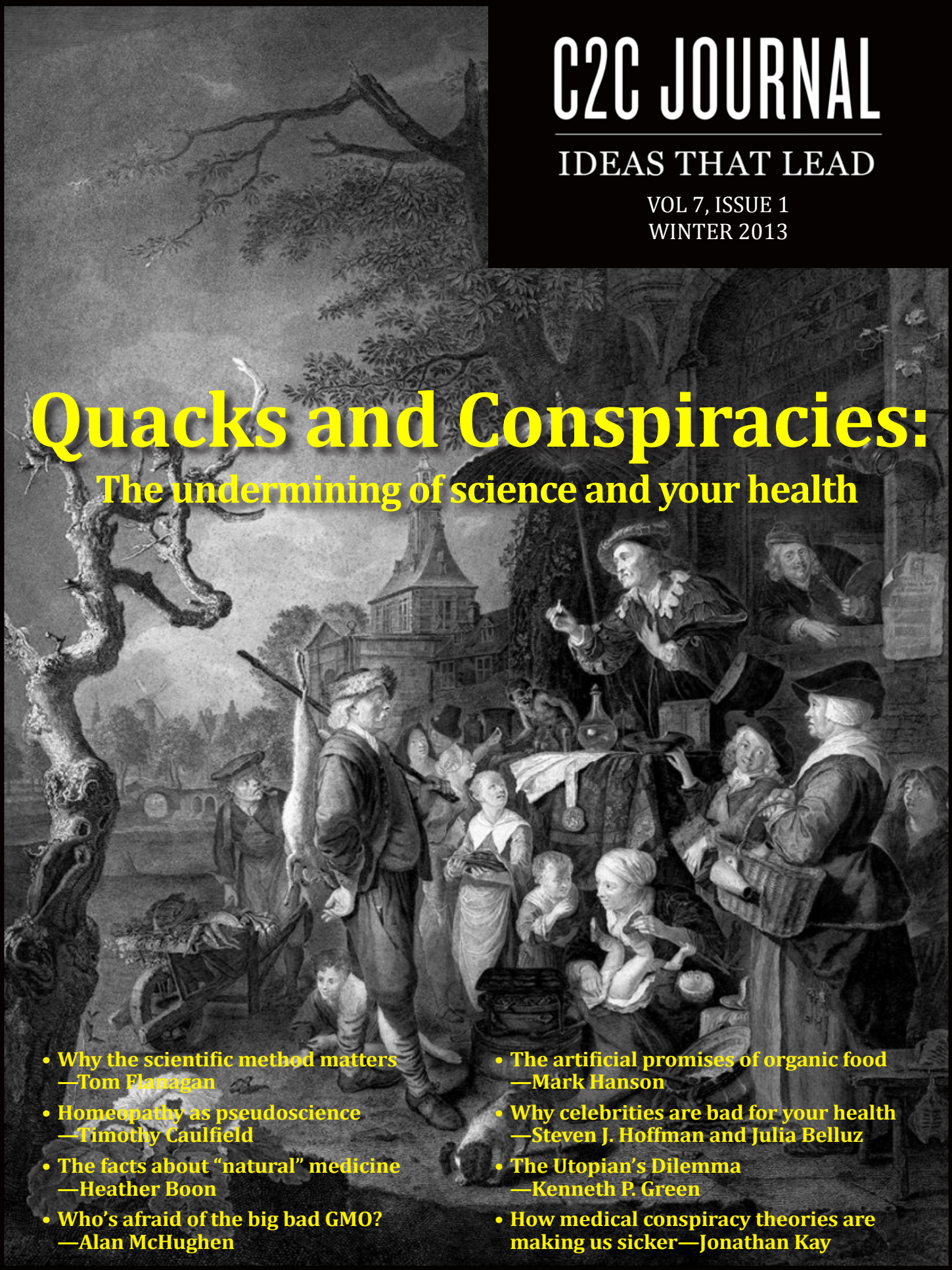

Quacks and Conspiracies:

The undermining of science and your health

- Why the scientific method matters —Tom Flanagan
- Homeopathy as pseudoscience —Timothy Caulfield
- The facts about "natural" medicine —Heather Boon
- Who's afraid of the big bad GMO? —Alan McHughen
- The artificial promises of organic food —Mark Hanson
- Why celebrities are bad for your health —Steven J. Hoffman and Julia Belluz
- The Utopian's Dilemma —Kenneth P. Green
- How medical conspiracy theories are making us sicker—Jonathan Kay

Why science matters

In 2003 when a cancerous tumour was discovered on the pancreas of Steve Jobs, the brilliant, mercurial co-founder of Apple refused to undergo surgery to have it removed. "I really didn't want them to open up my body, so I tried to see if a few other things would work," Job later told his biographer, Walter Isaacson.

For Jobs, those other "things" included his already strict vegan diet, fresh carrot and fruit juices, as well as acupuncture, herbal remedies and some other treatments he discovered on the Internet. He also submitted to a regimen proscribed by a "natural" healing clinic that advised juice fasts, bowel cleansings, hydro-therapy and "the expression of all negative feelings." Another "treatment" was eating horse feces. With reference to the latter, one friend later told Jobs "he was crazy."

Nine months later, Jobs eventually agreed to surgery. But by then the cancer had spread. "During the operation, the doctors found three liver metastases," wrote Isaacson. "Had they operated nine months earlier, they might have caught it before it spread, though they would never know for sure."

Indeed, one cannot always know with certainty what causes this or that cancer or what allows it to spread. But I note Jobs (who survived another eight years though not without chemotherapy and radiation and additional operations) because his was a life that did not necessarily have to end early.

If, what we do know from scientific investigations and advances over the decades had been availed by Jobs early, perhaps Jobs might still be with us today. What we do know is that surgery, chemotherapy, radiation and other scientifically-tested and proven treatments can help save some people from an early death from cancer.

That doesn't always work for everyone but a natural question is why someone as brilliant as Steve Jobs—he wasn't crazy—would forego actual proven help for his illness, this in favour of "treatments" that were untested, or already falsified, or simply the 21st century equivalent of 19th century quackery and snake oil. After all, in his professional career, Jobs would not have abandoned known methods for assembling a circuit board in favour of having employees chant over raw materials with the vain hope that fully formed I-Macs would magically result.

This issue of C2C Journal aims to help answer the question of why too many people oppose, abandon, or are unduly skeptical about science and its benefits. We zero in some controversies that have arisen and are connected to our bodies, e.g., claims about homeopathy or the 100-mile diet to name just two. With the help of authors from across North America and who have developed a deep knowledge of specific issues, be it the scientific method, organic foods, GMOs, so-called "alternative" medicine, or why people are attracted to conspiracy theories, we try to help answer that query.

There are obvious proven benefits to living a healthy life. Fresh fruits are preferable to rotten ones; foods with Vitamin C and D trump soda pop and Doritos as an aid to keep a body healthy; greens are better for you when compared with three beers and two fatty steaks every night. But it is one thing to note the obvious, the added benefits of healthy choices for a body; it is quite another to assert that they can replace scientifically-proven medical treatments to treat diseases already present.

In this issue of C2C Journal, we take the side of science and the scientific method over ad hominem attacks, foggy reasoning, magical thinking, and outright chicanery. Science and a proper understanding of it matters for many reasons but in the context of personal health, it matters even more.

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Contents – Winter 2013

The scientific method and why it matters

By Tom Flanagan

The scientific method is the most powerful tool yet devised for discovering truths about the world. The essential feature of the scientific method is the systematic testing of theoretical speculations against empirical evidence. For example, Aristotle claimed that men have more teeth than women do. We do not know how many mouths he looked into, but he may in fact have been correct in his day. Women tended to die younger than men did because of the rigours of childbirth, and wisdom teeth erupt later in life (I am now getting two at the age of 68). Aristotle is often derided for his alleged mistake, but the important thing is that this great philosopher thought it was meaningful to gather such humdrum empirical evidence.

In modern scientific research, the gold standard is the hypothetico-deductive method, which operates through the following stages:

1. Inductively gather information through observation.
2. Formulate an explanatory theory.
3. From that theory, deduce a hypothesis (prediction).
4. Compare (test) that hypothesis against systematic empirical evidence.
5. If the prediction is accurate, consider the theory tentatively supported (i.e., not yet falsified) but continue to derive other predictions for empirical testing.
6. If the prediction is falsified, revise or abandon the theory, and start the cycle over again.
7. Let other researchers replicate the experiment to ensure that results are not a statistical outlier or perhaps due to some quirk of the researcher.

As Karl Popper taught us, the crucial element is the quest for falsification. One cannot properly test Aristotle's claim about the number of teeth in men and women by finding a few cases to support the dictum. Argument by adducing favourable cases is the hallmark of rhetoric whose purpose is to build political

coalitions, not to discover the truth about the world. In contrast, willingness to look at all the evidence is central to the scientific method.

How the scientific method falsifies claims

The most trustworthy method of testing a theoretical prediction is the controlled experiment, in which confounding factors are either eliminated or statistically controlled. In contemporary medicine, this takes the form of the double-blind, randomized clinical trial. Psychological factors are minimized, because neither patients nor doctors know who is getting the treatment and who is getting a placebo. Confounding factors are controlled by matching members of the treatment and controlling for as many factors as possible, such as age, sex, ethnicity and health conditions. The clinical trial is the capstone of other less conclusive forms of research such as epidemiological studies that identify candidate causes of pathology and experiments with animal models whose anatomy and physiology are similar, but not identical, to those of human beings.

Thanks to the scientific method, we have accumulated vital information about medical conditions: Surgery, chemotherapy and radiation lower the mortality rate from cancer, whereas reliance on homeopathic remedies is a death sentence. Fluoride in proper amounts reduces dental cavities, although too much fluoride can lead to mottled and brittle teeth. Despite what Jenny McCarthy says, the MMR vaccine dramatically reduces the likelihood of contracting measles, mumps and rubella without increasing the incidence of autism. We know all these things because of properly conducted and replicated studies.

“Despite what Jenny McCarthy says, the MMR vaccine dramatically reduces the likelihood of contracting measles, mumps and rubella without increasing the incidence of autism. We know all these things because of properly conducted and replicated studies.”

Of course, our knowledge is not final. As research continues, the scientific method sometimes upsets the conventional scientific wisdom. Until Barry Marshall swallowed a Petri dish of *Helicobacter pylori* in 1984 and quickly developed stomach ulcers, which then responded to treatment with antibiotics, the medical community thought ulcers were the result of stress and improper diet. Subsequent studies confirmed the role of bacteria, and Marshall won the Nobel Prize in 2005. The treatment of stomach ulcers was revolutionized. The moral of the story is that while conventional scientific wisdom may be wrong at any point in time on any subject, the scientific method is a continuing source of correction and improvement. We do not know everything, but we do know how to test what we think we know and how to develop better approaches over time.

Why “alternative” medicine is attractive: three hypotheses

If the scientific method is so effective, why is there so much fascination with non-scientific “alternative” medicine including osteopathy, naturopathy, homeopathy and chiropractic? Let me suggest three plausible explanatory hypotheses, while emphasizing that plausible does not mean proven.

Because the scientific method is restrained, patient and dependent on systematic empirical evidence, there are times when it offers little or no hope. Multiple sclerosis, for example, is a terrible disease that adversely affects both the length and quality of life. We know a lot about its neural mechanisms, but we do not understand its causation. There is no cure, and existing symptomatic treatments are only moderately effective and have unpleasant side effects. Is it any wonder, then, that sufferers turn to Dr. Paolo Zamboni’s venoplasty treatment (enlarging allegedly constricted blood ves-sels in the neck) even though it is supported mainly by flimsy anecdotal evidence? I might try it, too, if I suffered from MS.

The scientific method is not a natural mode of thought for human beings. Survival in ordinary life often depends on making timely decisions based on whatever evidence is available. That was true when early Homo sapiens stalked rhino on the African

savannahs, and it is true today when a woman with a lump in her breast has to decide whether to see a surgeon or seek homeopathic advice. She may be more influenced by what she hears from friends and female relatives about the effects of mastectomy than by any consensus in the medical literature. We depend on limited anecdotal evidence in almost everything we do, from buying a new computer to seeking medical treatment.

The scientific method seeks truth, but other forms of communication have other objectives. The purpose of political communication – rhetoric – is to build supportive coalitions in the pursuit of power. Half-truths, quarter-truths and downright lies are the daily currency of politics and public affairs. Contrary to the scientific method, the test of effectiveness in rhetoric is not whether a prediction matches the evidence but whether a statement strengthens the coalition that the speaker is trying to build. It is, therefore, not surprising that politicians will pander to believers in alternative medicine. Their votes count just as much as non-believers' votes. Demands for action led the federal government to authorize a $6-million clinical trial of Dr. Zamboni's venoplasty as a treatment for MS even though the procedure is supported mainly by anecdotal evidence and not the combination of basic science, epidemiology and trials with animal models that usually precede the expensive decision to proceed to trials with human subjects.

The problem of paranoia

Ordinary political rhetoric has a curious Doppelgänger in the form of individual paranoia. Paranoia is the construction of an imaginary, negative coalition that is out to destroy the individual; the coalition is usually populated by prominent figures such as kings and popes and by secretive organizations such as the CIA. There is not always a bright line between paranoid fantasy and real politics. The *Protocols of the Elders of Zion* would look like a paranoid fantasy if they were believed by only one person, but when believed by many, they became (and still are) a mainstay of anti-Semitic ideology.

The U.S. political scientist Michael Barkun has written about the "culture of conspiracy," which emphasizes "stigmatized knowledge" not approved by social authorities. In the strange world of the "culture of conspiracy," extraterrestrial aliens mingle with the Bavarian Illuminati and de-votees of satanic rituals. Alternative medicine naturally is drawn in, along with junk science of all kinds. If the authorities are lying about flying saucers at Roswell, New Mexico, they could just as well be lying about medical research and the scientific method. It is an irresistible milieu for paranoids who are drawn to "stigmatized knowledge" like moths to a flame.

Increased levels of formal education do not seem to discourage the "culture of conspiracy"; indeed, the Internet actually promotes it by allowing true believers from all over the world to exchange "stigmatized knowledge" more freely than ever. If politics is part of the human condition and if paranoia is a distorted, individualized form of politics, then alternative medicine and junk science are likely to flourish no matter how much time is spent explaining the virtues of the scientific method.♦

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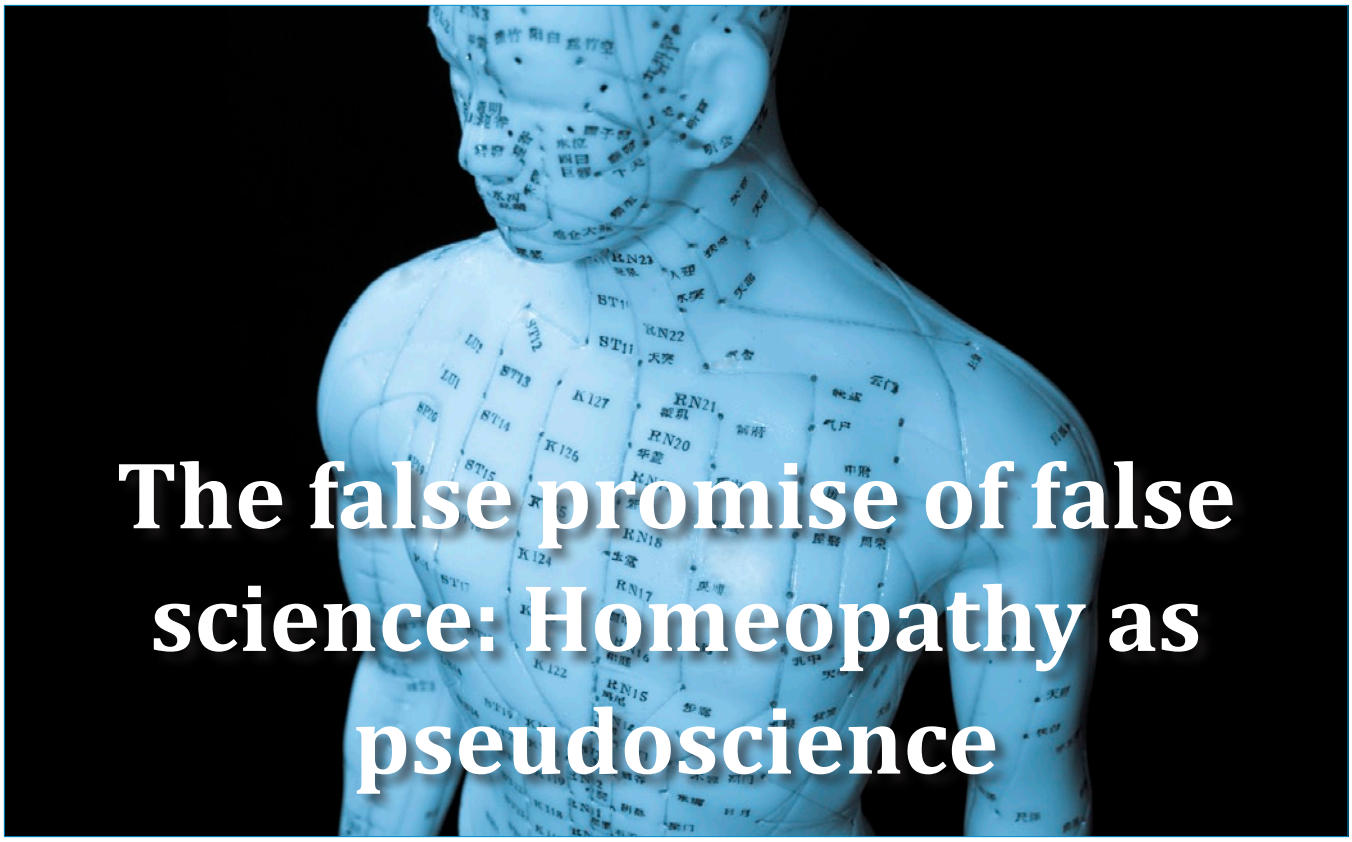

The false promise of false science: Homeopathy as pseudoscience

By Timothy Caulfield

"By granting self-regulation, we're attesting, as elected representatives, to the public that we believe the practices that will be engaged in by professionals are safe and that they're effective and that they meet the highest possible standard."

The above statement was made earlier this year by the Alberta Health Minister, Fred Horne, during a press conference to announce the granting of regulated status to naturopaths. The mood at the press conference, which received a good deal of coverage, appeared to be upbeat and positive. It was portrayed as a good-news story. It was, apparently, a victory for those who want more health-care options. It was a victory for patient choice, autonomy and open-mindedness.

My reaction was somewhat less than positive.

The granting of regulated status – which includes the creation of the College of Naturopathic Doctors of Alberta – may seem a relatively benign political act. It will lead to more standardization and, I guess, promote safety.

However, it may also foster a misunderstanding about the services provided by these practitioners. It may create the impression that the therapies are supported by good science. It casts a veil of legitimacy over the work of naturopaths and, one could argue, implies that all services that are offered are efficacious. Indeed, Minister Horne was explicit. He said that the granting of self-regulation demonstrates to the public that the Alberta government "believe[s] the practices … [are] effective."

Really?

Welcome to the world of pseudoscience

Allow me to lay my admittedly love-of-science, rant-tainted cards on the table. In general, the services provided by naturopaths reside either in the realm of commonsense lifestyle advice (get lots of sleep, eat well and stay active!) or they have little empirical evidence to support their use. In fact, many naturopathic practices are based on a semi-spiritual theory (the healing power of nature) and have no foundation in science. They reside largely in the realm of pseudoscience.

Am I being too harsh? I recently worked with a University of Alberta colleague on an analysis of the web sites for the naturopaths in Alberta and British Columbia. We wanted to get a sense of what is being

offered to the public. In Alberta, the number-one most commonly advertised service is homeopathy.

Homeopathy has been around for hundreds of years. The basic philosophy behind the practice is the idea of "like cures like." A homeopathic remedy consists of a natural substance – a bit of herb, root, mineral, you get the idea – that "corresponds" to the ailment you wish to treat. The "active" agent is placed in water and then diluted to the point where it no longer exists in any physical sense.

In fact, practitioners of homeopathy believe that the more diluted a remedy is, the more powerful it is. So, if you subscribe to this particular worldview, ironically, you want your active agents to be not just non-existent, but super non-existent.

The bottom line: For those of us who reside in the material world, where the laws of physics have relevance, a homeopathic remedy is either nothing but water or, if in capsule form, a sugar pill.

How homeopathy conflicts with the laws of physics and chemistry

Of course, "like cures like" and super dilution have absolutely no foundation in science. There is no evidence to support the idea that the active agents – the herb, root, mineral – correspond in any biologically meaningful way to the particular ailments that the homeopathic treatments are meant to treat. (One popular homeopathic Web site nicely illustrates the ridiculous nature of this idea by saying, "[I]f the symptoms of your cold are similar to poisoning by mercury, then mercury would be your homeopathic remedy.")

Of course, the idea that a super-diluted solution could have some measurable impact on our bodies conflicts with the known laws of physics and chemistry. If a homeopathic solution contains *no* true ingredients, how can it have a physical impact on the body? http://www.ukskeptics.com/homeopathic-dilutions.php This is not the same thing as using a vaccine, where there is an actual biologically active agent present that interacts with our immune system.)

One might argue that, sure, from a scientific perspective, homeopathic remedies sound silly, but who cares if perhaps in some instances they do work?

What does the clinical evidence actually say?

Here's why: Because despite claims to the contrary, there are hundreds of studies on homeopathy. What the good research consistently tells us is that homeopathic treatments do not work any better than placebos do.

For example, a 2002 systematic review – a rigorous analysis of all available evidence – concluded that the best available evidence "does not warrant positive recommendations for its use in clinical practice." A 2010 review of the "best evidence" concluded that homeopathic remedies have no "effects beyond placebo." Even the U.S. National Institutes of Health National Center for Complementary and Alternative Medicine, an entity that has a specific mission to be open-minded about unconventional treatments, concluded, "[t]here is little evidence to support homeopathy as an effective treatment for any specific condition."

To be fair, there *is* observational evidence that suggests that patients who seek out homeopathic remedies often *feel* better, but research tells us that, as with many alternative treatments, this is likely nothing more than the placebo effect – which is, no doubt, a powerful force.

In summary: There is no evidence that homeopathy works, and given the absurd nature of the proposed mechanism of action, no scientifically plausible reason that it should work.

Some might argue it is unfair to analyze homeopathy and use that to critique naturopaths. Homeopathy is a "treatment" so obviously devoid of scientific merit that it is consistently mocked on TV shows, by comedians and, of course, by skeptics.

Welcome to bogus treatment endorsed by a pandering government

Nevertheless, for naturopaths, homeopathy is not some fringe practice utilized by a few rogue clinics that have decided to shun modern science. Homeopathy is central to naturopathic medicine. The web site for the newly formed Alberta college has a picture of an

attractive naturopath dispensing what looks to be a homeopathic solution. The text under the picture proudly notes the use of homeopathy. The president of the new college reiterated this message in the speech he delivered after Minister Horne gave his speech. And, of course, it is a practice that is taught in Canada's leading school of naturopathic medicine.

When Minister Horne tells the world that the Alberta government believes that the practices of naturopaths are effective, he is talking about homeopathy. This is not implied legitimization of a bogus treatment; this is official and overt legitimization of a bogus treatment.

Every time I speak or write about the pseudoscientific nature of homeopathy, I elicit one of three reactions. Reaction one: It is alleged that homeopathy *does* work (this is usually in the form of "It worked for me!") and that I must be in the pocket of Big Pharma. Two: It is noted that many remedies provided by conventional doctors also do not work any better than placebos do, and I must be in the pocket of Big Pharma. Three: I must be in the pocket of Big Pharma.

These arguments do not take us very far down the road of rational debate. To simply assert something works does not make it so. Moreover, personal experience is the most unreliable form of evidence. Indeed, in many ways, the scientific method was developed to fight the perverting influence of personal perceptions.

> "The bottom line: For those of us who reside in the material world, where the laws of physics have relevance, a homeopathic remedy is either nothing but water or, if in capsule form, a sugar pill."

"Big Pharma" and "Big Naturopath": Both have vested interests

The claim that many conventional therapies are ineffective is absolutely true. And pharmaceutical interests – and, for that matter, other corporate interests – *have* had a terrible impact on the way evidence is produced and used. Many forces and vested interests twist what we hear about biomedical research but embracing unproven therapies does not help this situation. On the contrary, it moves health-care policy in the wrong direction – further away from science and empirically provable, efficacious and safe treatments.

The public should not forget that many special interests also exist in the context of homeopathy and naturopathic medicine. The makers of homeopathic remedies want to turn a profit just as much as any pharmaceutical company. After all, homeopathic solutions are not made by water fairies and distributed free of charge. Nor do naturopaths donate their time and services.

How to puncture bias and special interests: Return to the scientific method

There are biases and vested interests everywhere. One should be aware of these biases, but their existence does not help prove that homeopathy works. In fact, the concern with vested interests should push us toward, not away from, a reliance on the scientific method. It is the use of carefully constructed scientific studies and the dispassionate assessment of available data that will ultimately tell us what works – whether we are talking about conventional or alternative therapies.

Many caring and thoughtful alternative practitioners will likely continue to assert that homeopathy is effective, but the argument that 2+2=5 is still incorrect no matter how sincere, caring and "holistically" motivated the proponent. The values or disposition of the proponent may be relevant to questions of bias, but not, in the end, to whether a claim of efficacy is accurate.

I do not know if my arguments will convince a single person to stop using homeopathy. Homeopathy is a faith-informed practice and, as such, largely impervious to rational argumentation. No amount of evidence (and there is a mountain of it) will convince advocates that homeopathy is merely water. But I do hope that, in the future, provincial governments across Canada will take more care in the way they address these regulation issues that is, unless they wish to abandon evidence-based approaches to health care and embrace the supernatural and pseudoscientific.♦

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Why natural medicine is not the same as safe medicine

By Heather Boon

It's natural, so it's safe … or is it? As a researcher studying the safety and efficacy of natural health products such as herbs and vitamins, I often hear the claim that these products are safe simply because they are natural. Many myths about natural health products continue to circulate despite growing research – more than 5,000 studies on herbal medicine alone have been published in the last five years. Natural health products are not always as natural as many people think, nor are they always safer or better for you than medications designed in a laboratory. Claims of effectiveness are often exaggerated. Only careful study of such claims in clinical trials will help us understand what works and what does not.

In some ways, natural health products are not that much different from any other medicines. Some appear to be beneficial for individuals with specific conditions, and since they work by having some action on the human body, this means natural health products can also have *adverse* effects or undesirable drug interactions.

What is "natural"?

Canada defines natural health products (known as dietary supplements in the United States) as a group of products used for health-related purposes whose active ingredients "exist in nature." Most herbal medicines, vitamins, minerals, probiotics and essential fatty acids available for purchase in Canadian pharmacies and health food stores fall into this category. To check a specific product, look for the Natural Product Number on the label, which is a sign that the product is approved for sale under some of the strictest regulations in the world for these types of products. The regulations generally guarantee that what is on the label is in fact what is in the bottle. This is more than can be said for herbs and other supplements purchased in many other countries or over the Internet. However, many assumptions about natural health products (and the regulations) are simply not true.

For example, natural health products are not necessarily made from natural sources. Your "natural" product may in fact be synthesized in an unnatural laboratory. For example, vitamin C, chemically known as ascorbic acid, is much easier and cheaper to synthesize from scratch in a laboratory than it is to isolate from natural sources. As long as the final product (ascorbic acid) is chemically identical to ascorbic acid found in nature (e.g., in an orange), it qualifies as a natural health product. As a scientist, I will argue that your body cannot tell the difference between vitamin C synthesized in a laboratory and vitamin C isolated from natural sources. Some people purport to care a great deal about how their natural products are made. If this matters to you, read the

label carefully – if it does not say it is from a natural source, it probably is not.

Do "natural" health products work?

A second assumption is that if a product is legally sold in Canada and the label says it is good for treating headaches, it actually works for treating headaches. What you may not know is that a natural health product can be approved for sale in Canada in one of two ways. One way is to present scientific evidence that the product works for something: It prevents colds or helps you sleep, for example. The other is to provide information that the product has been used in a "traditional system of medicine" (for example, traditional Chinese medicine or Ayurvedic medicine from India) for a specific condition for a minimum of 50 consecutive years.

Some people may want to purchase a medicinal product that has been used for a long time by traditional healers, but this is not the same as scientific evidence of efficacy. For eons, people believed the earth was flat, but that did not make it so. Use by billions of people for thousands of years is not proof that something is effective.

> "As a scientist, I will argue that your body cannot tell the difference between vitamin C synthesized in a laboratory and vitamin C isolated from natural sources."

Research, specifically double-blind, placebo-controlled clinical trials, is needed to test the medicinal claims associated with natural health products. Sometimes these studies confirm the traditional use, but more often, the studies show that natural health products do not work as well as originally thought. For example, according to The Cochrane Collaboration, a group dedicated to finding and summarizing all the clinical study evidence on specific products, cranberry juice or tablets really do help to prevent urinary tract infections. In contrast, studies of echinacea for colds have had mixed results. It appears that if it does work, you may not notice a big effect if you take it (e.g., your symptoms may resolve only slightly faster than they would without an intervention).

Yet, people continue to believe that "natural" products (or at least products composed of compounds found in nature) are somehow better for them than are medicines designed and synthesized in a laboratory. There is no evidence that the body somehow "knows what to do with" natural products any more than it "knows what to do with" with other types of medicines. Many things exist in nature that humans are not meant to ingest. Scientists are becoming increasingly sophisticated at figuring out exactly how the body works (and thus what happens when we become sick) and at designing medicines that are specifically targeted to interact with receptors on cells or specific metabolic pathways in order to help mitigate human disease.

Natural does not = safe

Just as natural does not mean "better for you," it also does not mean it is safe. Imagine a picnic in the country with your family. While playing, your children find some mushrooms. Unless you are a trained botanist, it is unlikely that you are going to suggest adding those mushrooms to your meal given they might be poisonous! However, if someone picks those same mushrooms, dries them, puts them in a capsule and labels them as a natural health product, many people suddenly assume that they must be completely safe for everyone.

Some of the most potent toxins in the world come from natural sources – arsenic and snake venom for example. Also, natural products can have adverse effects, cause allergic reactions and interact badly with other medications. For example, St. John's wort is a herbal product that clinical trials tell us is almost as effective as conventional medications for treating depression (see The Cochrane Collaboration review of the evidence at http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000448.pub3/abstract). However, it causes the body to metabolize a number of conventional medications faster than normal (see a recent warning issued by Health Canada at http://www.hc-sc.gc.ca/dhp-mps/medeff/advisories-avis/prof/_2000/hypericum_perforatum_hpc-cps-eng.php). Therefore, if one takes St. Johns wort with warfarin (a blood thinner) or the birth control pill, the effects of these conventional medicines may be decreased and they may not work as intended. Other herbal products, such as comfrey, have been associated with liver problems (the Food and Drug Administration in the United States issued a warning

about comfrey products in 2001: http://www.fda.gov/Food/DietarySupplements/Alerts/default.htm). Under Canada's regulatory system, known adverse effects, drug interactions and contraindications are listed on the labels of natural health products. Nevertheless, the assumption that these products are completely safe is so strong that some people might not think to check this information.

Too good to be true

Finally, if something seems too good to be true, it probably is. Although there is growing research into the safety and efficacy of natural products, it takes seconds to make a claim about a product and years to test that claim properly. Scientific research is slow in part because natural health products are complicated. Unlike most conventional medicines, which are single chemical entities (which we know a lot about since we constructed them), natural health products often contain many active compounds (sometimes hundreds), thus making it challenging to figure out how the whole product affects the human body. Clinical research is time-consuming and expensive, so we need to make sure the specific product we choose to test contains enough of the "active ingredients" to be a fair test of its effects.

For example, much preliminary work is needed to determine what part of the plant should be used, when it should be harvested, how it should be processed and what dosage should be given. If this preliminary work (sometimes called pre-clinical studies) is not completed properly, scientists risk spending millions of dollars on a clinical trial only to discover that the reason the product seemed not to work in the trial is that they used the leaves instead of the root, or they did not give the trial participants the right dosage. Scientists are making progress, and each trial teaches them something about these products, but it is still a lot easier to make a claim about a natural health product than it is to do the research to test the validity of that claim.

Given the pace of the science, claims of miracle cures from natural health products abound for health conditions that are notoriously difficult to treat (such as cancer). There is simply no reason to believe these claims. Similarly, conspiracy theories that large pharmaceutical companies are trying to keep us from knowing about a herbal product that will cure conditions such as cancer are highly overrated. Rather than being the enemies of natural health products, pharmaceutical companies are big promoters of them since they own some of the most popular natural health product brands. For example, Wyeth Consumer Healthcare, a division of Pfizer, a multi-national pharmaceutical company, owns Centrum®, a well-known multivitamin (and thus a natural health product). Pharmaceutical companies now market "natural" options of familiar products such as Gravol® that are actually natural health products with no relationship to the original products Original Gravol® is a chemical called dimenhydrinate; natural-source Gravol® contains the herb ginger.)

Canada has some of the highest quality natural health products in the world, because of our strict regulatory system. Natural health product labels have lots of useful information about the safety of the products; however, not all the claims on the labels are supported by scientific evidence. That they are composed of materials found in nature does not mean natural health products are safe for everyone. Moreover, there is no reason to think that they are somehow better for us than other medicines. The bottom line is that natural health products should be treated like any other medicines. Scientific research clearly shows that some natural health products can be beneficial, but consumers should beware of unrealistic claims of safety or efficacy.♦

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Who is afraid of the BIG BAD GMO?

By Alan McHughen

Just mention "GMO" (genetically modified organism) and some people run scared – why? GMOs are products of technologies developed during the 1970s and 1980s that allow researchers to take DNA (i.e., genetic information) from any plant, animal or microbe and combine it with the DNA of any other plant, animal or microbe. The resulting transgenic organism (e.g., a bacterium with a human insulin gene inserted) remains essentially identical; however, it now expresses insulin per the example or whatever the new trait of the inserted DNA is.

For various reasons, this recombinant DNA technology, rDNA, is scary to some. Prince Charles, the Prince of Wales, does not like it for moral and ethical reasons. Back in 1998, he wrote in the *The Daily Telegraph*, that "I happen to believe that this kind of genetic modification takes mankind into realms that belong to God and to God alone." Others base their fear along naturalistic notions, asserting that humans are undermining Mother Nature's species barrier by moving genes from one species to another. People who hold this view are invariably befuddled when confronted with examples of genetic modification where the perceived species barrier is not violated – e.g., where genes are transferred within the species or where undesirable genes are removed.

Still others fear the apparently uncertain safety record of the GMOs and the idea that this technology may inadvertently introduce safety hazards into foods. Finally, another large segment fears not the technology *per se* but rather the idea of technology and big multinational corporations dominating the food supply. Leading GMO seed developer Monsanto, for example, is the company many people love to hate.

Politics makes for strange bedfellows. When these disparate groups come together to fight passionately against GMOs, it means they are locking arms with those who were, and will be again, enemies on other issues.

Some facts: Not one documented case of harm in three decades

GMO technologies have been around since the early 1970s and have given us many useful products, from human insulin to safer crops grown with fewer pesticides. Moreover, in over 30 years of experience, according to authoritative sources such as the U.S. National Academies and the American Medical Association, there is not one documented case of harm to humans, animals or the environment from GM products.

That is an impressive track record, considering the extent of GM products in pharmaceuticals, agriculture, food and industrial applications. So why are so many still fearful of this technology? One simple answer is

junk science and its carefully crafted use as a weapon of mass fear.

Send in the (junk science) clowns

Jeremy Rifkin was the first junk dealer to make big money by scaring people about the potential dangers of genetic engineering. Rifkin is no scientist, but an economist and prolific story spinner – the author of numerous books such as *Algeny* (1983) and *The Biotech Century* (1999). They are all, apparently, classified as non-fiction. Unlike most other science and medical books, however, none is peer reviewed. The late evolutionary scientist Stephen Jay Gould referred to Rifkin's 1983 book *Algeny* as "a cleverly constructed tract of anti-intellectual propaganda masquerading as scholarship," and in 1989, *Time* magazine ran a story titled "The Most Hated Man in Science." Still, Edgar Allen Poe made money from selling horror stories – why not Rifkin?

In the peer-review process, the usually anonymous reviewers make suggestions for improvement prior to publication, thus protecting the author from the public embarrassment of publishing a flawed work. But one of the hallmarks of the junk scientist is an unnaturally disquieting lack of shame. When the fatal scientific defects are exposed to the world, the junk scientist is not the least bit embarrassed, responding instead with an ad hominem attack on the whistleblower, accusing him or her of being in league with the devil or, worse, Monsanto.

In reality, biotechnology is not Rifkin's main targets. The real bugbears are capitalism and modern agriculture; the hybrid progeny of these two foretell, according to Rifkin's junk science portrayal, the demise of humanity.

Not to be outdone in the chase for money from fear-mongering, Greenpeace and other special interest groups, such as Friends of the Earth and the U.K.'s Soil Association, deployed their considerable media-manipulating machinery to spread more scare stories.

Activists claimed they were performing a public service by alerting locals in Africa that GM foods from the United States would render the men impotent. In the Philippines, people were told, and some convinced, by activist scaremongers that merely walking through a field of genetically modified corn could turn heterosexual, virile men gay. European activists went to Zambia during the height of the 2002 famine and convinced then president Levy Mwanawasa that the GM corn in food aid contributed by the United States was "poison." As reported by the British Broadcasting Corporation, Mwanawasa duly locked up the food in warehouses – the same GM corn eaten without incident by millions of Americans – and then watched his subjects die, insisting such a fate was preferable to eating "poison." That is, until the starving Zambians broke into the warehouses and gorged themselves healthy on the allegedly poisonous corn.

> "Other examples of junk science being used to deny access to valuable GMOs include the so–called terminator technology, which in theory renders seeds sterile but has never been shown to actually cause seed sterility in practice…Apparently, no one thought to ask the obvious question of how these supposedly sterile terminator seeds can even sprout, let alone pass on the trait to offspring, as they themselves are sterile."

Junk science and politics

Other examples of junk science being used to deny access to valuable GMOs include the so-called terminator technology, which in theory renders seeds sterile but has never been shown to actually cause seed sterility in practice. But that fact has not impeded the widespread misbelief that terminator technology is present in most or all GM seeds. In 2010, Indian scientists were seeking approval for insect resistant GM brinjal (eggplant) from India's Minister of Environment and Forests. Opposition spokesperson Bharat Mansata pleaded with the Minister to reject the GM eggplant because "… *once the terminator seeds are released into a*

region, the trait of seed sterility can pass to other non-genetically-engineered crops and plants, making most or all of the seeds in the region sterile!" Apparently, no one thought to ask the obvious question of how these supposedly sterile terminator seeds can even sprout, let alone pass on the trait to offspring, as they themselves are sterile.

Meanwhile, the New World spawned another popular junk scientist in the person of Jeffrey Smith, who has penned several books decrying his perceived hazards of modern agriculture, saving the most potent venom for genetically modified crops and foods. Smith's self-published, non-peer-reviewed *Genetic Rou-lette*, for example, expounds upon already questionable reports – almost all from non-peer-reviewed sources – in a confident, technical voice that suggests that he actually has some scientific or medical credentials. However, closer inspection of Smith's CV reveals that the closest he has come to scientific credentials is working as a ballroom dance instructor and a flying carpet yogi. *Genetic Roulette* is so packed with scientific misunderstanding and misinformation that a group of actual scientific experts established a Web site to counter and explain, point by point, some 65 false claims.

> "...the junk scientist, when called out on an incorrect prediction, simply moves on to the next issue or the next book. No accountability, no defending past statements when they are shown to be false. Social media fuel the fire, as anyone can publish any outlandish junk science claim on the Internet."

Distinguishing real scientists from junk scientists: credentials and associations

Whatever became of credentials? The media have an ethical obligation to present balance – both sides of a story – especially for a controversial topic. When, say, an evolutionary biologist publishes a study opining on when our ancestral humans diverged from Neanderthals, the media typically interview another credentialed scientist with a different interpretation of the findings. This is how science advances – objectively collected evidence is peer reviewed and opened for discussion among experts in the field. Disputes can be passionate, which spawned what is known as Sayre's Law: "Academic politics are so bitter because the stakes are so low."

But the ultimate result is an increase in overall understanding of how nature works. Academics are held accountable; colleagues and rivals remember an academic's proclamations. After too many erroneous predictions, the academic loses credibility in the eyes of his or her peers and is banished to the dank basement of the Ivory Tower. But the junk scientist, when called out on an incorrect prediction, simply moves on to the next issue or the next book. No accountability, no defending past statements when they are shown to be false. Social media fuel the fire, as anyone can publish any outlandish junk science claim on the Internet.

But when a plant breeder develops a strain of rice that is enhanced to help overcome vitamin A deficiency, rampant in poor tropical countries, the media interview (and give prominence to) pseudoscientific scaremongers like Smith instead of authentic experts in nutrition or agronomy, people who might actually bring legitimate questions and concerns to the discussion.

Entertainers Penn & Teller applied reductio ad absurdum (reduce to absurdity) to a video to illustrate the lunacy of such a lopsided media "balance." It highlights the difference between scientist and Nobel laureate Norman Borlaug, and Greenpeace activists (see http://www.youtube.com/watch?v=tIvNopv9Pa8). Borlaug is the father of the Green Revolution and credited with saving the lives of a billion humans by breeding better crops in developing countries. In other words, unlike some well-fed 20-something anti-technology activists with no credentials or qualifications who were attempting to disparage modern agricultural technologies, Borlaug knows about science and also about saving human lives.

Curiously, the junk scientists are fond of selectively quoting "scientific studies" (some of which are even peer reviewed) purportedly supporting their agenda. Revealingly, in a desperate futile appeal to authority,

but these same people rarely, if ever, cite solid peer-reviewed studies that reject their position. This cherry-picking of data favourable to a set agenda and ignoring or discrediting contrary data is particularly pernicious when it creeps into the scientific realm.

Recently, French scientist Gilles-Éric Séralini and his team published a peer-reviewed paper that claimed harm to test animals after they were fed GM corn for two years. Séralini boasted that his paper was the first long-term GM feeding trial. But Séralini, and later his disciples, failed to note the many other peer-reviewed, long-term GM feeding studies, including one in the journal in which his claims appeared, that concluded the opposite about the effect of GM food on animals: that such food was as safe, or safer, than regular non-GM food and feed.

Double standard Séralini also refuses to disclose his data, in violation of not only standard scientific ethics but also of the demand from his disciples for transparency in releasing scientific data pertaining to GMO safety.

Scientists are, assuredly, hu-mans and come in all political stripes and flavours. It is not difficult to find scientifically cre-dentialed individuals who have let their subjective passions override their scientific objectivity and allow their biases to drive their scientific endeavours. Typically, such conflicted scientists design and conduct experiments with the express purpose of generating data to support a predetermined conclusion rather than designing for the true scientific process of allowing the data to illuminate the truth.

The response for lay people

So what is a poor interested layperson to do? Even when cognizant of the fact that the bulk of information about GM technology on the Internet is wrong and that each side of a controversial issue like GM food safety garners support from some (apparently) qualified scientists, where does the layperson turn to find accurate and objective information?

Fortunately, there are sources. Unfortunately, the sources suffer from relatively low conventional and social media profiles – they tend to appear near the bottom of Internet searches – but rank at the top of scientific credibility. They are mainly the professional scientific and medical associations, groups such as the U.S. National Academy of Sciences, the British Royal Society and the American Medical Association. Such groups effectively moderate the extreme individuals who inhabit the fringes of every community. When these groups conduct a study on a given issue, all viewpoints are represented and the final assessment includes due consideration of the whole body of knowledge, pro and con, surrounding the issue.

These groups are also immune to the charge often leveled by pseudo-scientists and anti-technology activists that the private sector lies, cheats and steals to show its products in a good light, and the fudging of GMO safety data is therefore *de rigueur*. In the same vein, and applying the old sports maxim that the best defence is to be offensive, any public academic scientist who dares challenge the junk science is labeled an industry shill.

The real evidence

When it comes to the safety and sustainability of GM technologies in agriculture and food production, the U.S. National Academies of Science have conducted expert reviews of GMO safety going back to 1986. All are freely available online, if one knows where to look. Every single one of these studies has reached the same general conclusion: GMOs are no more hazardous than are other forms of breeding. A major investigation in 2004 into the safety of genetically engineered foods concluded that GM technology is not inherently hazardous and asserted, "*To date, no adverse health effects attributed to genetic engineering have been documented in the human population.*" There have been no verified reports of adverse effects subsequently, either.

A more recent study, from 2010, investigated the impact of genetically engineered crops on farm sustainability in the United States. This study concluded that genetic engineering technology has produced substantial net environmental and economic benefits compared with the use of non-GM crops. Sensibly, the report does caution that the continuation of GM crop benefits requires diligence and good risk management.

Similar studies are also conducted by public scientists in other countries around the world. That includes the last bastion of backward thinking against agricultural GMOs, the European Union. There, anti-science advocacy groups have been successful in scaring much of the public. To support the European political leadership that has sought scientific justification for banning GMOs, the European Commission has been a major sponsor of public research into the safety of GMOs for over 25 years. Unfortunately for the European politicians who'd hoped to reveal some new hazards, all of the EU-funded research to date concludes the same as all other public studies into the safety of GMOs: that GM technology poses no new risks.

However, the EU scientific community continues to thwart the EU political agenda. In 2001, the EU scientific community issued a report summarizing its research findings: Eighty-one research projects into GMO safety conducted by 400 teams of public scientists in non-commercial labs at a cost of 70-million euros concluded that GMOs are no more hazardous than are other forms of plant breeding. A follow-up report published in 2010 continued the same theme, documenting 50 additional GMO safety projects funded by EU taxpayers and involving more than 400 public, non-commercial labs at a cost of more than 200-million euros.

The conclusion: GMOs are no more hazardous than other forms of breed-ing are. Is it not strikingly odd that these diverse professional scientific associations all came to the same general conclusion about the safety of GMOs? And is it not equally odd that the junk scientists and their followers rarely cite these peer-reviewed scientific studies?

> "It is not difficult to find scientifically credentialed individuals who have let their subjective passions override their scientific objectivity and allow their biases to drive their scientific endeavours. Typically, such conflicted scientists design and conduct experiments with the express purpose of generating data to support a predetermined conclusion rather than designing for the true scientific process of allowing the data to illuminate the truth."

Unfortunately, the junk dealers and anti-technology NGOs use social media skillfully, and they recruit impressionable students each year to help "save the planet." This domination of the Internet and the free workforce of volunteers overwhelm the efforts of legitimate scientist educators, few of whom actually have public education or outreach in their job descriptions. Overcoming junk science and allowing a truly informed public debate on both the risks and benefits of GMO crops and foods require supporting legitimate research into GMO safety and providing the results to the public in a transparent manner. It also requires credible experts who can help the interested public understand the nuances that are often beyond the ken of the anti-technology activists. Until this occurs, the junk scientists will continue to solicit donations by invoking the Big Bad GMO in order to strike fear into the hearts of the unsuspecting populace. ♦

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Peeking behind the veil:
the artificial promises of organic food

By Mark Hanson

It is reasonable to assume that most people would want farmers to grow sufficient quantities of healthy food in a manner that is sustainable for the environment and for humanity. Yet, as we become further removed in our daily lives from farms and the people who grow our food, it is easy for misunderstandings to cloud how best to achieve this end. One option that has grown in popularity is organic food, but the misconceptions about its benefits and its means of production are highly problematic. Propelled by a general scientific ignorance, a dogma has developed around organic food. The result is the spread and promotion of irrational fears that actually detract from our ability to achieve the goal of abundant food for all.

The reality about "organic" food

In the fall of 2012, Dr. Crystal Smith-Spangler of Stanford University and her colleagues published a systematic review[1] that evaluated the scientific literature around differences in the health effects and nutrition of organic foods as compared with conventionally produced items. This review attracted extensive media and public attention, as the authors concluded that there is no strong evidence supporting the contention that organic food is any more nutritious than conventionally grown food. They did note that eating organic food could result in less exposure to pesticide residues and antibiotic-resistant bacteria, though the health benefits in these reductions are not necessarily meaningful.

The reaction of organic proponents to the Stanford study typically fell into two categories: first, those who claimed that the argument that organic food is more nutritious was never a selling point (a disingenuous claim at best) and, therefore, the study is of no concern. The second defense has been that, in fact, the study does show the health benefits of organic versus conventional food due to the reduction in potential exposure to pesticides and potentially harmful bacteria. Therefore, they argue, organic is still the preferred means of food production.

The latter of these arguments, especially around pesticide exposure, has a number of unspoken assumptions that need to be stated clearly. First, there is a general belief that no pesticides are used or allowed in organic production. Second, exposure to pesticides at the concentrations found in conventional food results in adverse health outcomes. Third, conventional agriculture is a monolith that employs a uniform set of practices in stark contrast to those dictated for organic agriculture, and, therefore, the only healthy choice,

for us and the environment, is organic.

Each of these assumptions is built on a number of myths and misconceptions about what organic food is and how it is produced. Let me deconstruct all of them.

Reality check: Even organic foods use pesticides

The average person tends to believe that organic food is produced without any pesticides. This is untrue. Under Canadian law[2], to be certified organic, a product must meet strict guidelines developed under the auspices of the federal government in terms of what can and cannot be used in its production[3,4]. Pesticides are not banned; only synthetic pesticides are disallowed. Synthetic pesticides are those that have been manufactured using modern organic chemistry techniques.

So, what is the difference between a synthetic pesticide and a non-synthetic pesticide? In reality and in practice, nothing. Both types are employed to control pests, whether insect, fungus or other organism that threatens the productivity of a crop.

Within organic prod-uction in Canada, a farmer is allowed to use copper compounds to control fungus outbreaks, and naturally derived chemicals such as pyrethrum, rotenone, spinosad and the toxin-producing microbe Bacillus thuringiensis (Bt) to control damage by insects and other invertebrates.

All the compounds used in organic farming pose a risk to the environment and human health in the same way that synthetic pesticides do. The only true difference is that they are derived from natural sources, such as plants or bacteria, as opposed to being produced by employing synthetic chemistry, or in the case of Bt, expression by genetically modified organisms. Natural chemicals can be just as toxic as synthetic ones. A case in point is the bacteria-produced botulinum toxin (the cause of botulism) which is the most toxic compound currently known.

What are these natural sources of pesticides and how do we access them? In the case of pyrethrum (a collection of similar compounds), it is derived from the flowers of chrysanthemums. These flowers are grown primarily in East Africa, and the resulting pyrethrum is exported from there, with Kenya as the globally dominant producer, followed by Australia as the next leading exporter.

That should raise this question: are they using organic techniques to grow a crop that provides organic farmers halfway across the globe with a natural, non-synthetic pesticide?

In some instances, yes, but in many cases, the answer is no. Similar to any plant crop, chrysanthemums are subject to damage by pests and can require synthetic pesticides (in addition to synthetic fertilizers) to maintain productivity and to protect yields. They also require modern chemical methods to extract the compounds of interest in a useable form.

Are there other op-tions besides growing chrysanthemums for pyrethrum? Yes! An entire class of synthetic pesticides based on the chemistry and biological activity of the pyrethrums exists – the pyrethroids. These chemicals are similar in terms of their environmental fate, toxicity and human health risk to those compounds that constitute pyrethrum. The pyrethroids are inherently less wasteful to produce in terms of resources. In addition, they come with the same benefits and without the mental gymnastics of trying to reconcile using conventional agricultural techniques to produce a "natural" pesticide for use in organic farming.

These arguments alone should make them the more obvious choice when trying to develop a sustainable agricultural practice to feed the people on this planet. The only reason pyrethroids are not allowed in organic agriculture is that they are synthetic. The take-

home message from this policy is that items that are synthetic are inherently bad, and items from nature are inherently good. This "natural" fallacy permeates much of the thinking around organic production.

Reality check: Pesticides are not killing you

The assumption that the reduction in pesticide exposure from eating organic versus conventional fruits and vegetables will result in any health benefit is completely unproven.

Health Canada's Pest Management Regulatory Agency is in charge of approving pesticides. The scientists' and re-gulators' job is to protect health in relation to our exposure to all pesticides.

Can exposure to pesticides result in adverse health outcomes? Yes, because at the right concentrations, all chemicals can result in toxicity. Insecticides that act on the nervous system (like pyrethrum) can be especially hazardous to the environment and us if used improperly, which should not surprise to anyone.

Yet, when we look at mortality and morbidity statistics, life-spans in Canada (and pretty much everywhere else) are still increasing, and the risk of a person developing or dying from cancer (a common refrain from those fearing synthetic chemicals) has not changed in any meaningful way for decades.

> "The take-home message from this policy is that items that are synthetic are inherently bad, and items from nature are inherently good. This "natural" fallacy permeates much of the thinking around organic production."

If pesticides are truly affecting health, it is not obvious how. In the end, simple actions, such as washing your produce prior to eating or cooking, can reduce the pesticide residue significantly, making the exposure differences between organic and conventional next to meaningless. The benefits of eating more fruits and vegetables to our overall health are unambiguous. One of the single largest barriers to people eating more fruits and vegetables can be the cost. Ironically, "organic" food is much more expensive than the conventional variety.

Reality check: There is no such thing as conventional agriculture

An interesting comment by the lead author of the Stanford study was her surprise at the diversity of non-organic agricultural practices and techniques employed by farmers[5].

Outside the organic envelope, no single set of rules or approaches exists for farming. Are some conventional farmers better than others in terms of protecting and enhancing soil and crops and the surrounding ecosystems as well as avoiding wasteful application of pesticides?

Absolutely. Yet, we forget that in many cases, the fields and areas where the farmers work and earn a living are the places where they were born, and it is where they raise their families.

They have a clear vested interested in maintaining the productivity of their fields and the cleanliness of the water they drink and the air they breathe. They can employ evidence-based practices to improve crop yields and reduce environmental impact. If something does not work, they can discard it, and when it does, they can employ it.

Farming approaches not typically allowed in organic include integrated pest management with synthetic pesticides and the application of nutrient-rich biosolids from human and animal waste, as they can contain synthetic compounds (Note: while biosolids can appear off-putting at first, they have been employed in some way for millennia.) In conventional agriculture, there are no ideologically driven rules, only attempts to improve best management practices for sustainable production. Organic farming creates the false premise of choice between only it, and bad' conventional methods. In fact, only organic farming has a single set of dogmatic rules. Conventional farming contains an entire spectrum of practices. This false dichotomy between the two misrepresents the diversity of modern agricultural practices.

The junk science at the heart of the organic food movement: vitalism

Whether the modern organic farmer realizes it or not, at the heart and soul of the organic movement is the non-scientific belief in vitalism. The tie to vitalism in organic pre-dates the advent of synthetic pesticides

[6]. The Canadian guidelines make a subtle nod to this legacy, where they state that organic production "maintain[s] the organic integrity and vital qualities of the products" [3]. Vitalism is essentially the notion that life can only come from life.

This means that "dead" things, such as synthesized molecules, lack this "vital" property (usually an unnamed "energy"), and, therefore, they cannot sustain life. The resulting conclusion then is that synthesized molecules are inherently harmful to our health and the health of the ecosystem.

This belief gained steam in organic circles a century ago when the ability to synthesize nitrogen fertilizers from atmospheric nitrogen was discovered. No longer were farmers required to apply only animal manure or compost (both living sources) to a field to supplement nutrients; they could use material acquired from the air (something not alive). Of course, this totally ignores the well-understood global cycles of nutrients and elements such as nitrogen.

Vitalism as a belief system has been effectively debunked for decades, if not since the early 19th century, starting with the first syntheses of organic molecules by chemists. Despite this, the belief in vitalism, sometimes in the form of our innate connection to soil and land[6], persists in organic circles and elsewhere, regardless of whether the land knows we are there or not.

Vitalism is also indicative of superstitious thinking where conscious purpose is attributed to something despite the fact that no conscious purpose exists. For example, the soil is there to provide nourishment to the plant, and the plant exists to provide nourishment to us. This is a child-like belief in how the world works[7]. Ironically, if anything can be argued as having "purpose," it is the things we create with a function in mind.

The lack of any evidence for "vital" forces or any physical, chemical or biological distinction between naturally derived and synthesized molecules (ask yourself where your vitamin C pill comes from, and the answer is not from oranges) does not convince organic proponents that there is nothing inherently wrong with a synthetic pesticide.

People fear synthetics even though there is no evidence they do any harm. This lack of evidence should lead organic proponents to consider this scenario: Imagine a synthetic pesticide that controls an important crop pest in a way that results in no harm whatsoever to the environment and no risk to human health. Would this synthetic pesticide be allowed in organic production?

The answer, at least from proponents of "organic" food, would be a simple "no." And the reason would be that organic food proponents rely on pseudoscientific appeals to the innate, unmeasurable differences in those molecules that are produced by living and non-living things. The result, insofar as the anti-science organic movement continues to grow, is that the world will have one less valuable tool available to feed the planet. ♦

> "Yet, when we look at mortality and morbidity statistics, life-spans in Canada (and pretty much everywhere else) are still increasing, and the risk of a person developing or dying from cancer (a common refrain from those fearing synthetic chemicals) has not changed in any meaningful way for decades."

Dr. Mark Hanson *completed his undergraduate degree at the University of Toronto in zoology and chemistry in 1997, followed by a Ph.D. at the University of Guelph (Ontario Agricultural College) in 2002. He held a post-doctoral fellowship at the Insitut National de la Recherche Agronomique (INRA) in Rennes, France, after which he started a faculty position at the University of Manitoba (Department of Environment and Geography) in 2004 and where he is currently an associate professor.*

Dr. Hanson's research program focuses on characterizing the impacts of stressors in freshwater ecosystems, with an emphasis on macrophytes and invertebrates. He has published extensively on the impacts of pesticides, metals, nutrients and emerging contaminants such as pharmaceuticals and halogenated compounds. A core focus (and a recognized global expertise) in his research program has been in the use of model ecosystems such as mesocosms. Mark teaches extensively in the areas of water quality, toxicology, critical and scientific thinking, and ecological and human health risk assessment. In addition, he is an associate editor for the journal Science of the Total Environment and the book review editor for the journal Ecotoxicology.

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Why celebrities and TV doctors can be BAD FOR YOUR HEALTH

By Steven J. Hoffman and Julia Belluz

The 20th century popularity of TV talk shows simultaneously gave rise to the celebrity TV doctor. Up to five times each week, we are told about new health products, cutting-edge treatments and scientific discoveries in chatty language we can all understand.

Thus, a new industry has been born. TV shows lead to book deals, which lead to newspaper columns, specialty Web sites and access to the lucrative speakers' circuit. Celebrity doctors are omnipresent. And as society ages and the audience for TV doctors (mostly women aged 25 to 54[1]) becomes increasingly health conscious, one can only expect this industry to further ripen and grow.

Successful TV doctors perform theatre; they invite us in, speak sensationally and have a commanding presence. They use phrases such as "miraculous cure," "unbelievable finding" and "magical treatment." Everything works for everyone, and in the world they create for us, no problem is without a solution.

Part of what makes the TV doctor so popular is that

the host either believes the act or at least pretends well. TV doctors preach simple and positive messages of hope, and they promise miracles to those who are looking for them. They inspire belief and a religious following in people who want to improve their health and are looking for the best – and often easiest – way of doing so.

This act also works because we want it to work. Who does not want a quick fix for the thing we like least about ourselves – our flabby belly, high cholesterol, low energy or receding hairline? And we want these messages to work because we like the messengers. Unlike many of our own physicians, TV doctors are charismatic and engaging, and they are moved by our concerns. It does not hurt that they tend to have movie-star good looks, which studies of human psychology have long shown can inspire our confidence.[2] Just think about the chiseled features and dreamy blue eyes of Dr. Travis Stork, star of The Doctors, one of the United States' most popular TV talk shows. He is an emergency physician and infinitely easier on the eyes than most any clinician at your local emergency room.

> "Successful TV doctors perform theatre; they invite us in, speak sensationally and have a commanding presence. They use phrases such as "miraculous cure," "unbelievable finding" and "magical treatment." Everything works for everyone, and in the world they create for us, no problem is without a solution."

TV doctors fill a void left by the medical community, too. For example, they give us their time, much more than the 18 or 23 seconds that real-life doctors allow us to explain a problem before interrupting.[3] They speak clearly, reveal the secrets of science in simple sound bites and convince us with their winning smiles that we can change our lives for the better.

But if contemporary TV doctors are one part belief and another part confidence, they are seriously lacking in the science department. Quite simply, their advice can be wrong. Sometimes it can be dangerous. Yet, many of us take it in and eat it up.

Medical "advice" from the Wizard of Oz

For example, examine the science of Dr. Mehmet Oz, perhaps the world's most successful TV doctor. In various shows and columns, this scrub-wearing surgeon recommends taking multivitamins each day to keep all sorts of maladies away. He claims, "A multi ensures that you get all the essential vitamins and minerals recommended for each day, keeping your engine running smooth and adding protection against chronic illnesses such as breast cancer, colon cancer and heart disease."[4]

This all sounds great, except that the claims are not true for everyone and we have known this for a while. A 2006 synthesis of nine randomized controlled trials found no important benefit from taking multivitamins to prevent cancer, cardiovascular disease, cataracts, macular degeneration or hypertension.[5] More recent studies are not any better. A 2011 prospective cohort study found no significant associations between multivitamin use and decreased mortality from all causes, cardiovascular disease or cancer. Multivitamin intake also did not correlate with any change in the likelihood of developing cancer.[6]

And unfortunately, it gets worse: A 2011 retrospective study of 38,772 postmenopausal women even showed an association between multivitamin supplementation and increased risk of death, highlighting the possibility of harm from using "health products" that are prescribed en masse rather than tailored to an individual's health needs.[7]

As another example of Oz's medical follies, he recommends everyone take a daily 1,000 IU vitamin D supplement. On one show segment titled "The Power of Vitamin D," he discussed its benefits for colon, breast and uterine cancers.[8] On another episode, "The One Quick Pill Fix," he emphasized the importance of vitamin D supplementation for preventing over 20 diseases.[9]

In this case, some of what Oz says about vitamin D was once thought to be true, especially for people with both a deficiency of this vitamin and cardiovascular disease risk factors such as hypertension.[10] However, today's evidence suggests otherwise. In numerous

randomized controlled trials and several systematic reviews – which offer the most comprehensive and least biased information as syntheses of the best-available global evidence – no link has been found between vitamin D and reductions in blood pressure, lipid fractions, glucose, cardiovascular outcomes or mortality.[11] The United States Preventative Task Force, the Institute of Medicine and Health Canada have all judged the evidence linking vitamin D supplementation to fewer cancers to be scant.[12]

Oz also invites special guests onto his show, the "superstars of the alternative medicine movement," who outside of the daytime TV universe are widely viewed as outright quacks. Take Dr. Joe Mercola, an anti-vaccine campaigner who warned people that the H1N1 vaccine would cause widespread Guillain-Barre Syndrome (which did not happen)[13] and who advocates using coconut oil to prevent and treat Alzheimer's disease (which clinical studies do not support).[14] In keeping with Mercola's anti-science stance, Oz's series on alternative therapies took on a conspiratorial tone when discussing the medicine other doctors apparently do not want us to know about.[15] "You've shown you're not afraid to test the time-honoured traditions of alternative medicine, so why is your doctor?" Oz asked, suggesting that physicians are colluding to keep patients away from effective treatments.

How real science works

It is true that medicine is confusing. Health recommendations change all the time. One day red wine is good for the heart; the next day it causes cancer. Screening for breast and prostate cancers used to be a lifesaver; now, expert panels say these tests do more harm than good for some people.[16]

But medicine is supposed to change and keep on changing. It is the scientific method that is not supposed to change: We start with a hypothesis, test it and revise our thoughts accordingly. As we conduct more and better tests, we continually update our thinking.

In science, we always remain cautious and critical. Early positive results on mice do not trigger a change in medical practice or lead to new health recommendations. Instead, we wait for human trials, and sometimes multiple human trials and other types of studies. Treatments are "proven" once enough evidence has been mustered that doctors (and sometimes government regulators) are convinced of their potential benefits, effectiveness and safety in practice.

The result is that over the past 100 years we have developed robust processes to ensure the credibility of approved health products and treatments that are prescribed by one's own medical professional. The appearance of a product or treatment on a TV show, even one hosted by a certified medical doctor, is not one of them.

It is true that this phenomenon of celebrity doctors and medical theatre is nothing new. The days of snake oil salesmen and carbolic smoke balls for the flu are not so far behind us.

But something has changed. Science is more complex and confusing than ever. There is more research output than ever before. Scientists' promises of looming cures for the greatest scourges have raised public expectations of what is scientifically possible. The continued expansion of mass media communications, especially TV and Internet, gives celebrities the most powerful and far-reaching microphone they have ever had. That microphone is also continuously on in this age of the 24-hour news cycle. With mandates to inform but also entertain – up to five times each week! – entrepreneurial doctors end up sensationalizing slow-paced science and packaging it in ways that are good for contemporary TV audiences but incompatible with the nature of science.

As concerning as the TV doctors' grip on millions of people may be, they are, after all, medical doctors. Oz, for example, is board-certified in a grueling surgical specialty, a professor to medical trainees and vice-chair of the Department of Surgery at the prestigious Columbia University College of Physicians and Surgeons in New York City. He graduated from Harvard College, Wharton School of Business and the

University of Pennsylvania School of Medicine.

Who knew Playboy models and movie stars were experts on health issues?

But Oz is not the only person who influences us from afar. We have all emulated our favourite celebrities, be they models, pop singers, Olympic athletes, religious leaders or former politicians; many people buy their clothes, wear their perfumes or drink their preferred soft drinks based on such associations. This pattern becomes more troubling when we trust these public figures with our health.

Jenny McCarthy is a well-documented example. The former Playboy model tries to scare us with nonsense about vaccines causing autism; she has thus influenced the critical decision of parents about whether to vaccinate their children. But we also see more-credible celebrities such as former U.S. president Bill Clinton promoting particular diets and Adam Levine of the chart-topping pop rock band Maroon 5 serving as the face of an ADHD awareness campaign.

They, like TV doctors, are all part of a long history of celebrity involvement with science and the health product industry. Schuyler Colfax, vice-president to Ulysses Grant, spoke well about a throat lozenge. Vin Mariani – wine laced with cocaine and marketed to treat a range of ailments from insomnia to the flu – was endorsed by Pope Leo XIII, light bulb inventor Thomas Edison, author H.G. Wells, Nobel Prize-winning writer Anatole France and French composer Charles Gounod.[17]

> “It is true that this phenomenon of celebrity doctors and medical theatre is nothing new. The days of snake oil salesmen and carbolic smoke balls for the flu are not so far behind us.”

In more recent times, actress Lauren Bacall peddled a macular degeneration medicine by Novartis, Olympia Dukakis put her face on Lidodern for shingles pain and Sylvester Stallone backed the cholesterol medication Pravachol. Australian cricket star Shane Warne promoted nicotine replacement products as his trick for keeping New Year’s resolutions to stop smoking – except that he never actually stopped smoking and was paid $200,000 Australian for his publicity efforts.

The impact of such entanglements is far-reaching. Surges in popularity for alternative therapies can be attributed to celebrities’ devotion to them. The U.K.-based academic Dr. Edzard Ernst calls alternative treatments “celebrity-based medicine,” because of the range of therapies – most backed by no evidence that they work better than a placebo – that are promoted by the rich and famous, from Kate Moss’s acupuncture to Uma Thurman’s Gem therapy and model Christy Turlington’s Ayurveda.[18]

Other famous folks, from Tina Turner to Prince Charles, to the physician of Queen Elizabeth II and even physics Nobel Laureate Brian Josephson, have used their credibility in areas such as entertainment or the natural sciences to promote homeopathy. This, despite the mountain of evidence that demonstrates that homeopathic remedies are akin to ineffectual, over-priced, sugar-water solutions.[19]

The good news is that we now have better ways of protecting ourselves from these celebrities and TV doctors and their abuses of science and scientific language. For we now unequivocally know that medical decisions are better when based on the best-available evidence; we also know that research studies are not all equal in providing the different types of evidence needed. In countries such as Canada, with publicly funded health care systems, we fortunately have access to real doctors who know us and can help us wade through the evidence regardless of our ability to pay.

Celebrities run amok in an age of information overload

This leads us to the real question: If the science of celebrities and TV doctors can be so spectacularly false, why does it pass many people’s “smell test” and move people to make decisions about their health on nothing more than a famous person’s endorsement?

Part of the problem is that our noses are insufficiently tuned to the odours of quackery. The avalanche of health information facing us overwhelms the senses, and there is a paucity of digestible resources to help us wade through it. We trust people who are famous, thinking they are better informed and more skilled than people who are not famous. Perhaps another reason is that in a democratic age, people mistakenly believe that one opinion is as good as any other, even though fact-based opinions are one thing and faith-based opinions, quite another.

Regardless, improving health literacy and arming people with knowledge is only part of the solution. Changing the systems, markets and cultures that perpetuate this abuse of science is another. The incentives and professional cultures of the media, industry, research and medical communities are not always aligned to promote our health and often contribute to the problem. For example, newspapers sometimes feature sensationalized and potentially harmful headlines to attract readership, just as health product companies naturally promote their wares to anyone willing to take them. Researchers are not rewarded for explaining their findings to patients or journalists, and doctors are not usually compensated for public outreach activities.

Shared responsibility for this problem means there is a shared responsibility for investing in enduring solutions. The necessary system changes will not be easy, but progress is being made. People are increasingly being held accountable. Doctors are participating in the blogosphere, academics are fighting disease-mongering efforts and journalists are debunking unhelpful myths about vaccines, vitamins and viruses with the explicit goal of better informing their readers' or viewers' health decisions.

> "Part of the problem is that our noses are insufficiently tuned to the odours of quackery."

In the meantime, we can be assured that "miracle" products and treatments that sound too good to be true probably are. Even when a high-quality study initially suggests a treatment may be staggeringly effective, this effect usually dampens as further experiments are conducted and science progresses.[20]

In a world where celebrities and TV talk show hosts run amok, a healthy dose of skepticism mixed with some basic medical literacy is what the real doctors prescribe. Knowledge about science is our best protection against those who abuse it.♦

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BOOK REVIEW

The utopian's dilemma:
In praise of the 10,000-mile diet

The Locavore's Dilemma: In Praise of the 10,000-Mile Diet.
Pierre Desrochers and Hiroko Shimizu (2012).
New York: Public Affairs, 2012, 256 pp.

Reviewed by Kenneth P. Green

For the sake of disclosure, I should state right up front that I know and like Pierre Desrochers, find his sense of humour (and his Québécois accent) charming, and though I have not met his wife, Hiroko, I am sure I would like her, too. I have also had my doubts about the whole 'eat local' and 'eat' organic movement. So, I would have been predisposed to like the dynamic duo's dissection of the latest in food faddishness, the obsession with eating locally and organically.

Fortunately for me, I did not have to resort to favoritism in deciding if I liked Locavore's Dilemma, the new book from Desrochers and Shimizu. The couple has put together a fascinating book. It traces the origins of the eat local and eat organic movement (origins that were much further back in time than I imagined), examines the fundamental precepts of the locavore philosophy, dissects the many mythical and magical thoughts expressed by leading proponents of "locavory" and warns of the strong likelihood of adverse consequences for people and the planet should this fad be pursued more extensively.

Kitsilano conscience chic: The 100-mile diet

One of the more thorough concept demolitions in *Locavore* relates to the idea of food miles, which are a measure of how far food travels before it is consumed. The basic idea is that low food miles are better: They are better for the environment; they bring you better, more-flavourful food; and they are better for the local community and the local farmers. This idea is also at the heart of the 100-mile diet, in which another intrepid Canadian couple document a year spent eating only foodstuffs that were grown and/or reared within 100 miles of their home in Kitsilano, British Columbia.

In a chapter called "The Basic Problems with Food Miles," Desrochers and Shimizu point out that food miles are a poor proxy for environmental impact:

> Despite its popularity, the concept and its underlying rationale have been convincingly debunked in numerous Life Cycle Assessment (LCA) studies [LCAs are essentially cradle-to-grave analyses of environmental impacts] .... Not surprisingly, it turns out that food miles can only be taken at face value in the case of identical items produced simultaneously in the exact same physical conditions but in different locations – in other words, if everything else is equal, which is obviously never the case in the real world.

The discussion of transport in this section is particularly illuminating. It turns out that, in fact, transportation contributes only a small share to a food's environmental impact or the production of greenhouse gas emissions related to its production and use. Desrochers and Shimizu review the literature on the issue, pointing out that according to one study:

> [Eighty-two] percent of the estimated 30 billion food miles associated with U.K.-consumed food are generated within the country, with car transport

> from shop to home accounting for 48 percent and tractor-trailers (what they call HGVs – heavy goods vehicles) representing 31 percent of food miles.

So, unless one anticipates walking that 100 miles to gather one's own food, limiting one's diet to 100 miles would not really do much for the environment, at least in terms of greenhouse gas emission reductions.

Desrochers points out that other factors also undermine the food-miles issue. This includes the tendency of those who rely most on local and organic food to report increased food waste; that offsets whatever environmental benefits may have been gained by reducing food transport. In addition, there is the irony of more energy being used to ensure local refrigeration to store foods that are more highly perishable than are foods that are more conventionally produced, packaged and transported from further away.

"...there is the irony of more energy being used to ensure local refrigeration to store foods that are more highly perishable than are foods that are more conventionally produced, packaged and transported from further away."

Welcome to Utopia—again!

What I found most fascinating in Locavore's Dilemma was that the very same family of fallacies and coalitions of crusaders that Desrochers and Shimizu dissect map neatly onto many other realms of public policy.

In that sense, The Locavore's Dilemma may be misnamed: It could well be named The Utopian's Dilemma, as the myriad of fantasies that the authors dissect infect a broad swathe of public policy. We see these fantasies time and again in policies on trade, energy, transport, urban planning and the environment. Since I specialize in energy and natural resource policy, I will focus my examples there.

One of the first fallacies the authors take on is a classic called the broken window fallacy. As Desrochers and Shimizu show, advocates of locavory exist in denial of the potential negative consequences that might attend their choice:

> The basic logic of what Bastiat enthusiasts have dubbed the "broken window fallacy" similarly applies to the short-sighted reasoning of local food protectionists. By forcing people to buy more expensive local food, locavorism impoverishes consumers who will then have less money to spend on other things, including other locally produced goods and services.

We see virtually the same sentiments expressed within the energy policy arena, where advocates of renewable energy sing the praises of creating green jobs, as then presidential candidate Barack Obama did in 2008: "We'll invest $15 billion a year over the next decade in renewable energy, creating five million new green jobs that pay well, can't be outsourced, and help end our dependence on foreign oil."

As Bastiat would undoubtedly demonstrate, to the extent that all this renewable energy is more costly than conventional energy, citizens will have to spend more of their earnings to pay for energy. That will leave less in their budgets for dining at the local pub, shopping at the local merchant and so forth. And, in fact, this has been exactly the result. In study after study, the evidence is that the pursuit of green energy jobs has cost more jobs than were created. In Italy, for example, researchers Carlo Stagnaro and his colleagues at the Instituto Bruno Leoni demonstrated that for every green job created in Italy, 4.8 jobs were lost in the general economy.

Food security: Not by relying on local conditions

Another fallacy that Desrochers and Shimizu tear apart is the notion that eating locally somehow increases food security. Walking through security sub-issues such as overspecialization and food security; locavorism and military security; peak oil and locavorism; and climate change, Desrochers and Shimizu conclude:

> Paradoxically, a world where in a few decades 9 billion people could afford to purchase their food from 90 million highly efficient farmers using the planet's most productive locations would be incredibly more food secure than one in which a few billion farmers feed their neighbors but lack

the infrastructure to ship their products over long distances.

Again, the food security fallacy maps nearly identically onto the arguments made regarding energy security, i.e., that sticking with local production keeps jobs here, reduces military risks, reduces the threat of supply interruptions, price shocks and so forth. As Robert Bryce, a prolific writer about all-things-energy points out:

> In summary, the reality of the energy sector is this: energy security – whatever the favored definition for that term – means interdependence. And that interdependence goes far beyond energy commodities like diesel fuel, gasoline, natural gas, and neodymium. The US is a vital player in the global marketplace for a myriad of commodities, ranging from iPods and tennis rackets to fresh flowers and bottled water. The sooner the US discards the hypertrophied rhetoric about energy security and energy independence and accepts the reality of our interdependence, the more secure and prosperous it will be.

A third fallacy that Desrochers and Shimizu examine is the somewhat quaint notion that one can protect oneself from things like environmental fluctuations with sufficient reserves, as determined by some clever planner. Oil reserves, helium reserves, who does not like a good reserve? Michael Pollan clearly likes the idea, as his push for a government-run strategic grain reserve in order to control grain prices falls under the scrutiny of Desrochers and Shimizu. Such a reserve, Pollan is quoted as saying, would "prevent huge swings in commodity prices" and "provide some cushion for world food stocks." But as with people who think that oil reserves can mitigate the risks of price fluctuations, people calling for food reserves miss a fundamental economic point. As Cato's Jerry Taylor and Peter Van Doren point out with regard to the U.S. Strategic Petroleum Reserve (SPR):

> So what's wrong with using the [Strategic Petroleum Reserve] to douse the market with crude whenever gasoline prices get out of control? Well, it's better than hoarding oil to hedge against an embargo that will never come. Still, oil economists of all stripes acknowledge that maintaining public stockpiles discourages the accumulation of private inventories and perhaps even public inventories abroad because foreign governments have an incentive to 'free ride' off U.S. inventories given that a U.S. release would reduce oil prices everywhere in the world.

Indeed, the idea that governments (rather than private individuals) can manage reserves in a way that makes them profitable in the long haul is just another example of Friedrich Hayek's fatal conceit:

> The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate 'given' resources—if 'given' is taken to mean given to a single mind which deliberately solves the problem set by these 'data.' It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge which is not given to anyone in its totality.

In other words, nobody could know how much of any particular grain to keep in reserve because nobody would have enough information about future market conditions, environmental conditions or other social conditions to make rational use of the reserve in order to control price fluctuations effectively.

No book review is complete without a bit of criticism, of course, and if there were one thing that could have been done better in *Locavore*, it would be in terms of the book's narrative structure. While it is easy to summarize the conclusions of some of the book's investigatory sections, others are somewhat wandering and some chapters seem to bury the lead. Summary paragraphs at the end of the book's many sub-sections would have made my life as a reviewer

a bit easier. However, this is a relatively small quibble with an otherwise excellent book that is highly recommended.

Indeed, as a tribute to the fine work of Desrochers and Shimizu, I would suggest periodically pairing your reading with a bit of cheese or chocolate from abroad, some fine coffee or tea (from abroad), and perhaps, on concluding, a fine Cognac, from France, *naturellement.*♦

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The Suzanne Somers effect:
How medical conspiracy theories are making us sicker

By Jonathan Kay

The term "conspiracy theory" summons images from *The X-Files* and the stories of Thomas Pynchon. But as I argued in my 2011 HarperCollins book, *Among the Truthers*, conspiracy theories can have real and corrosive effects on the marketplace of ideas and on the political sphere that depends on it. How, for instance, does one have an intelligent debate about national security policy with someone who believes 9/11 was an "inside job" hatched by Dick Cheney? How does one have an intelligent discussion about U.S. domestic politics with someone who thinks Barack Obama is an illegal alien who was born in Kenya?

In the medical realm, the pernicious effects of conspiracy theories are especially tangible. Consider the 30-year-old conspiracy theory that the U.S. Army created AIDS at its Fort Detrick, Maryland testing facility as part of a genocidal plan to kill black people. In a 2010 study of 214 Los Angeles-area African-American men undergoing treatment for HIV, 31 per cent of respondents said that AIDS "is a form of genocide, or planned destruction, against blacks." The study found that a belief in such AIDS conspiracy theories correlates negatively with adherence to prescribed antiretroviral drug regimens.

In the domain of medicine, conspiracy theories can have life-and-death consequences.

Common conspiracy theory 'threads'

In the course of my research, I have met people who believe a bewildering range of conspiracy theories – from Holocaust deniers, to followers of David Icke (who promotes the idea that our political leaders are the terrestrial manifestations of giant inter-dimensional space lizards), to the vaccine-related conspiracy theories described below. Yet all of these theories, I concluded, are bound together by two main elements:

1) Evil. Except in rare cases, conspiracy theories purport to address the problem of evil in the world and, more specifically, the age-old question of why bad things happen to good people (the branch of thought known to theologians as theodicy). In this sense, conspiracism acts as a secular replacement for supernatural devil figures, projecting responsibility for human suffering onto Jews, Freemasons, the New World Order or other more obscure villains. This aspect of conspiracism explains why conspiracy theories always proliferate in the shadow of mass human-suffering events or sociologically traumatic expressions of evil such

as World War I, the Holocaust, the assassination of JFK, 9/11 and the AIDS epidemic of the 1980s. On a personal level, conspiracy theories often are embraced by people afflicted with private traumas such as a bankruptcy or (as discussed in more detail below) a medical catastrophe.

2) Distrust. Conspiracy theories reflect widespread distrust in powerful institutions – including not only national governments, but also NGOs, the United Nations, the mass media and the health-care industry. Many 9/11 conspiracy theorists, for instance, told me that the defining moment in their political evolution came when U.S. forces failed to find weapons of mass destruction following the 2003 invasion of Iraq. "The government lied to us – and I wanted to find out what else they were lying about" was a common refrain. Of course, all citizens rightly treat government pronouncements with a degree of skepticism, but for hard-boiled conspiracy theorists, this skepticism becomesall-encompassing – and the entire world of politics, mass media and even public health is seen as one giant lie.

The Fort Detrick AIDS thesis, described above, is one example of how these two elements – distrust and the need to explain human suffering – combine to produce a stubbornly popular conspiracy theory that inhibits life-saving medical therapies. Another example lies with anti-vaccine activists who falsely claim a proven linkage between the widely administered MMR (measles, mumps and rubella) vaccine and autism spectrum disorder.

> "Far from being a dangerous toxin, fluoride is a naturally occurring element in many communities' water supplies...Yet from the beginning, scattered activists became bothered by the idea that the government was adding something, anything, to their drinking water."

Conspiracy theories about the medical world

Of all the medical conspiracy theories that traffic on the Internet, this is one of the most durable and widespread – in large part thanks to the advocacy of celebrity laypersons such as former Playboy model Jenny McCarthy. Since 1998, when the theory was first put forward in a study published in the Lancet medical journal (subsequently retracted in 2010 and further discredited by a detailed investigation by journalist Brian Deer, untold millions of parents across the Western world have avoided vaccinating their children, leaving them exposed to deadly, and entirely preventable, diseases such as measles, whooping cough and Hib influenza.

Vaccines typically are administered to small children in the first two years of life, at around the same time that the first behavioral symptoms of autism manifest themselves. Many doctors believe autism is a genetic disorder programmed into a child's brain before birth. But parents cannot see their child's genes. What they can see are the steel needles injecting a mysterious foreign substance into their then-apparently-perfect bundles of joy. When this experience is closely followed by a devastating diagnosis, many parents forge a link between the two experiences – a link that, as many will confess quite candidly, can never be shaken by science.

The myth that vaccines cause autism permits emotionally vulnerable parents to blame politically accountable, human evildoers – the big pharmaceutical companies and their apologists at the Food and Drug Administration (FDA) and Health Canada – for a trauma that might otherwise be seen as a mere act of God. The myth thereby allows them to substitute their frustration and disappointment with the more psychologically manageable emotion of anger.

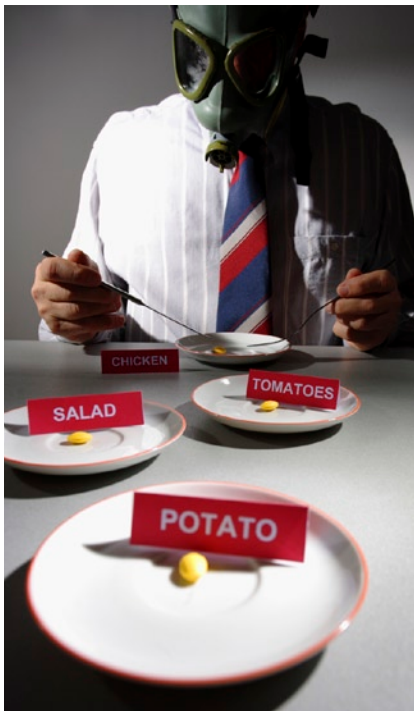
Such myths provide another psychotherapeutic dividend: hope. The debunked vaccine-autism link is actually two conspiracies in one. Not only have McCarthy and her followers argued that the medical establishment is covering up evidence that its drugs are harming children's brains, they also promote the piggyback conspiracy theory that vitamins and other natural remedies can be used to "heal" the damage done by vaccines and that this cure is falsely discredited by the very same medical establishment evildoers.

Other conspiracists I have interviewed have experienced other forms of harrowing, life-threatening medical crises. These stories tend to follow the same pattern: Doctors tried to cure their condition with expensive drugs and painful surgical procedures – but

failed. It was only once they had turned to a "natural" cure – faith healing, homeopathy, Gerson Therapy (a crackpot diet-based cancer treatment), and so forth – that their condition went away. In the aftermath of this experience, they become convinced that profit-obsessed pharmaceutical companies and the medical establishment have been conspiring to prevent ordinary citizens from discovering the power of these natural cures.

Fears of fluoridation

Of course, such theories have been around for generations. The campaign against water fluoridation, for instance, has been suffused with conspiracist themes since the practice became widespread in the 1950s.



Far from being a dangerous toxin, fluoride is a naturally occurring element in many communities' water supplies. This is how the United States Public Health Service first noticed the correlation between fluoride and tooth-decay prevention in the 1930s. Mainstream scientists judged the practice to be safe; and over the last 60 years, numerous epidemiological studies have done nothing to shake this consensus.

Yet from the beginning, scattered activists became bothered by the idea that the government was adding something, anything, to their drinking water. As Gretchen Ann Reilly reported in the 2004 book "The Politics of Healing," these often were the same activists who objected to mass polio vaccination: Both public-health campaigns tapped into the same instinctive human fear surrounding body integrity.

The fact that mainstream scientists supported fluoridation did little to discourage such activism: Paranoiacs such as Dr. Leo Spira — author of the wonderfully titled "The Drama of Fluorine: Arch Enemy of Mankind" — argued that all the major laboratories, journals and research institutions had entered into a grand conspiracy to suppress dissenting views (much in the same way that today's climate-change skeptics imagine a similar conspiracy afoot in regard to anthropogenic global warming).

The Internet has turbocharged the spread of such conspiracy theories by permitting their propagandists to create blogs — complete with high-quality video propaganda – that speak directly to patients stricken with specific health conditions. Doctors I have interviewed describe their frustration in dealing with such patients, who often arrive at medical appointments with thick dossiers of printouts from their favourite Web sites.

Arguing with these patients can be difficult. In many cases, they are so psychologically invested in their conspiracy theories that they reject or ignore any argument offered on behalf of mainstream medical science, no matter how compelling the available peer-reviewed medical data may be. The result: frustration for the practitioner and increased health risks for the patient.

So, how can medical practitioners combat the spread of conspiracy theories?

Let me answer that question by reference to the two ingredients in all conspiracy theories: evil and distrust. Obviously, doctors cannot put an end to the former, but they can do something to abate the latter.

The medieval views of Ms. Suzanne Somers

By way of explanation, it is worth considering a particular case study – that of Three's Company sitcom star and ThighMaster pitchwoman, Suzanne Somers, a breast-cancer survivor who has become an outspoken critic of chemotherapy, conventional cancer drugs and mainstream oncology more generally.

In her 2009 alternative medicine manifesto, Knockout: Interviews with Doctors Who are Curing Cancer, and other best-selling books, Somers follows in the path of other alternative medicine advocates by describing the human body in essentially medieval terms. According to this view – of which there are endless variations, each with its own cult following and mail-order industry – we all have a natural energy field that becomes compromised when

exposed to artificial Western foods, medicines and medical therapies. Vitamins, obscure extracts, oils, balms, herbs and meditation are presumptively good. Prescription drugs, radiological treatments and surgical interventions are presumptively bad. It is a distinction upon which Somers herself is willing to stake her life: She tells readers that, if again faced with a cancer diagnosis, "my choice overwhelmingly would be to use only alternative treatments."

Knockout promotes a variety of dubious therapies – such as laetrile, an apricot extract that was proven ineffective decades ago, and the Gonzalez protocol, a regimen involving twice-daily coffee enemas (you read that correctly). If only the medical establishment and the FDA took these treatments seriously, Somers argues, researchers would receive the funds needed to prove their effectiveness. Instead, the health-care industry and its cynical government allies conspire behind closed doors to protect the cash cow of conventional cancer therapies.

Somers' case against conventional cancer treatments is built around her own (admittedly accurate) observation that such treatments often are painful and debilitating. Specialists assure her that this pain and debilitation is worth the sacrifice in the long run. But following that advice is an act of trust. And as noted, trust is something that conspiracy theorists hold in short supply. And so, patients such as Somers follow the only thing they do trust: their five senses – a path that more often leads them to herbs, roots and special spas than to the pharmacy or hospital.

As maddening as all this may seem to trained medical professionals, these trends speak to powerful psychological forces that affect a large swathe of the population. Indeed, the pervasive influence of amateur Internet-circulated media, coupled with survey results that show steadily increasing levels of popular distrust in all public institutions, suggests the problem may get worse.

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The most viable strategy for medical professionals to use to address this trust deficit is building trust at a personal level with patients who are at risk of embracing conspiratorial views of the health sciences. By creating strong person-to-person relationships with patients, doctors and other practitioners can escape the jaded attitude that many people exhibit toward the medical establishment in general. Doctors and hospitals might also facilitate the creation of support groups of similarly situated patients who can speak to one another on a peer-to-peer basis about the beneficial effects of their therapies.

Obviously, the best approach to such trust building will differ on a case-by-case basis, but in general, I would say that such an approach would de-emphasize appeals to statistics and epidemiology and highlight case studies that speak directly to the patient's circumstances. Doctors might also choose to couch their recommendations in references to the knowledge they have gained in their clinical practice, since such information is more difficult to dismiss as industry propaganda.

Many patients who come to embrace conspiracy theories do so because they were proselytized by someone within their own trusted circle of contacts – a relative, neighbour or fellow parent in the schoolyard. If a doctor can gain a comparable level of social trust through an ongoing checkup and treatment regimen, he or she will be in a position to advocate on an equal footing for evidence-based medicine and thereby help patients avoid the conspiracy theories that are doing a brisk and dangerous trade in the medical marketplace of ideas.♦

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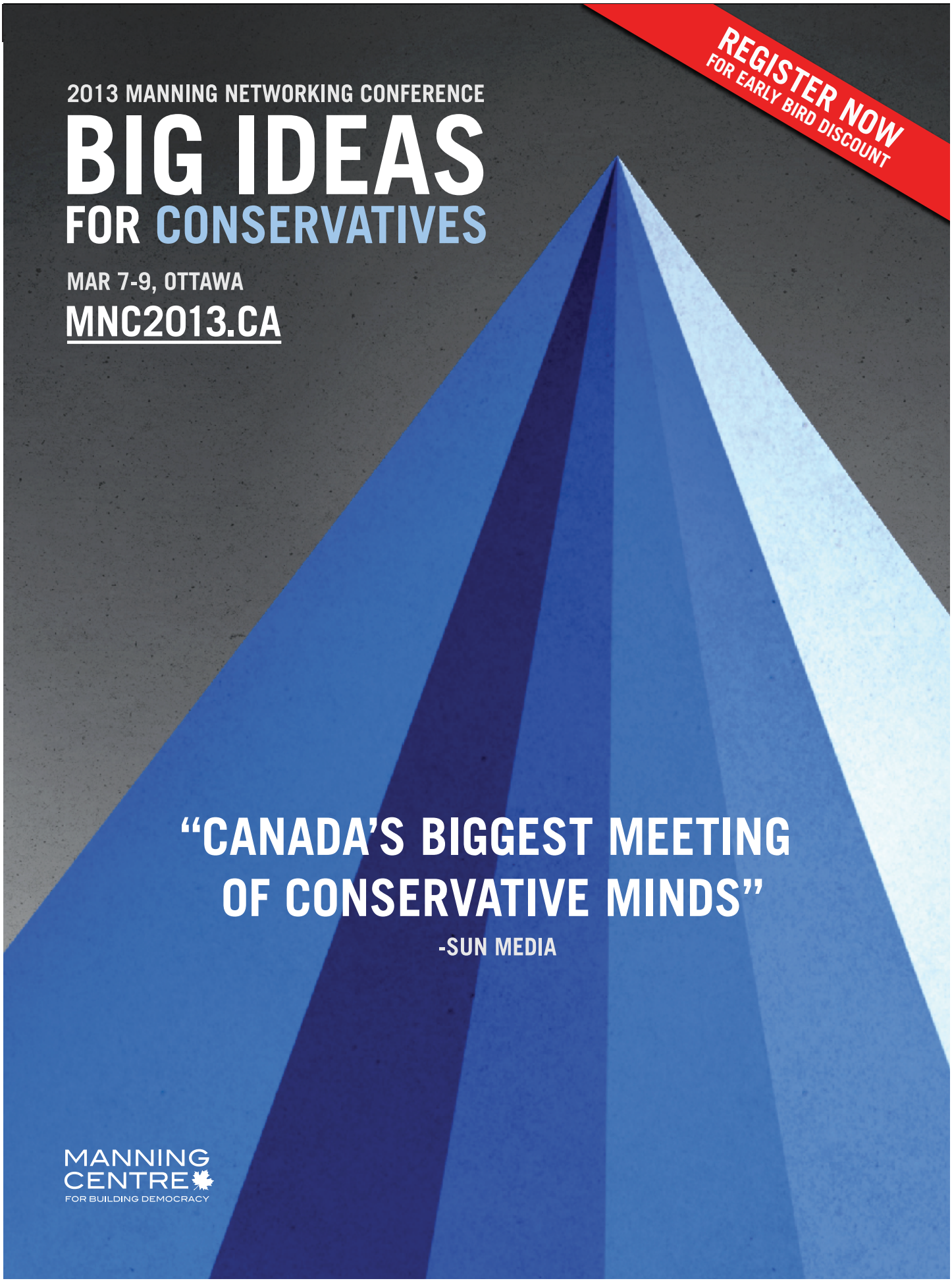
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