

# Inquiring Minds Topic – 23 February 2018

Moderator, Bill Bartholet – paper from Bill Lupfer

## Reason on the Ropes

**It has been a grim year.** In the U.S. and the U.K, tribalism and anti-intellectualism seem to have triumphed over facts and reason. The effects have rippled around the globe. Some nations, such as China, stand to benefit while historical science powerhouses stumble.

**Moving forward** will require understanding the cultural and psychological reasons people reject scientific thinking. Many researchers are reconsidering their traditional detachment from politics and learning that public opinion is a force to take seriously.

Elections, as they say, have consequences. In the U.S., the Trump administration threatens to roll back environmental protections, cut research funding and undermine the very concept of objective truth. The U.K.'s decision to leave the European Union is destabilizing science throughout Europe. Not everyone is moving backward: some nations, such as China, see opportunity in the upheaval. But it's safe to say that everyone with a stake in the future of science is asking themselves, What comes next?

### Why People Refuse to Believe Scientists

 [scientificamerican.com/article/why-people-refuse-to-believe-scientists/](https://www.scientificamerican.com/article/why-people-refuse-to-believe-scientists/)

*By Katharine Hayhoe, as told to Jen Schwartz*

*Although she's technically Canadian, atmospheric scientist Katharine Hayhoe might understand America's polarized attitudes toward science better than anyone. Her bona fides have serious range: she is co-director of the Climate Science Center and a political science professor at Texas Tech University, CEO of a climate-impact consulting group, creator of the myth-busting Web series Global Weirding and an electric-car-driving evangelical Christian. Self-described as “on the fringes of many tribes,” Hayhoe is equally adept at presenting to church groups and speaking on panels alongside people like Barack Obama and Leonardo DiCaprio. As a result, she has become one of the most lauded and sought-after climate communicators in the country—and the recipient of much hate mail. Hayhoe spoke with Scientific American about the war on facts and the forces driving climate skepticism. Edited excerpts from that conversation follow.*

Science denial is basically anti-intellectualism. It's a thread that has run through American society for decades, possibly even centuries. Back in 1980, Isaac Asimov said that it's “nurtured by the false notion that democracy means that ‘my ignorance is just as good as your knowledge.’” Today we're dealing with its most recent manifestation, at its peak.

Climate change is a special case of science denial, which of course goes back to Galileo. The Catholic Church didn't push back on Galileo until he stuck his head out of the ivory tower and published in Italian rather than in Latin, so that he could tell the common people something that was in direct opposition to the church's official program. Same with Darwin. The church didn't have a problem with his theory of evolution until he published a popular book that everyone could read.

Similarly, we've known about the relationship between carbon dioxide and global warming since the 1890s. It's been about 50 years since scientists warned President Lyndon B. Johnson about the dangers of a changing climate. But scientists back then didn't get the deluge of hate mail that I get now. So what shifted? It started, possibly, with [Columbia University climate scientist] James Hansen's testimony before Congress in 1988. He announced that a resource we all rely on—and makes many of the world's biggest companies rich—is harming

not just the environment but all of humanity. I think it's no accident that Hansen is the most vilified and attacked climate scientist in the U.S. because he was the first person to emerge from ivory tower and start talking about global warming in a sphere where its implications became apparent for policy and politics.

So you can see that the problem people have with science is never the actual science. People have a problem with the *implications* of science for their worldview and, even more important, for their ideology. When anti-intellectualism rises to the surface, it's because there are new, urgent results coming out of the scientific community that challenge the perspective and status quo of people with power. Renewable energy is now posing a very significant threat to them. The more viable the technologies, the greater the pushback. It's a last-ditch effort to resist change, which is why denial is at a fever pitch.

Today, although many of the objections to climate science are couched in science-y terms—*it's just a natural cycle, scientists aren't sure, global cooling, could it be volcanoes*—or even religious-y terms—*God is in control*—99 percent of the time, that language is just a smokescreen. If you refuse to engage these arguments and push through for even five minutes, the conversation will naturally lead to profound objections to climate change *solutions*.

## What's Really at Play

The number-one question I get from people is, “Could you just talk to my father-in-law, my congressman, my colleague? If you just explain the facts to them, I'm sure it will change their mind.” This is a trap. It turns us into Don Quixote, willing to tilt with these people and say, “Here's how we know it's not a natural cycle!” It almost never works. The only way to have a constructive dialogue with a dismissive person is on the level at which he or she really has the issue.

How did the narrative of climate change become a polarized, faith-based system? If we look at surveys, the level of political polarization in the U.S. now compared with 20 or 30 years ago is staggering. Polarization implies a rise in tribalism: an unthinking, unquestioning adherence to the tenets of my tribe. Unfortunately, because climate solutions appear to challenge the ideology of the right-hand side of the political spectrum, it's become one of the most polarized issues in the U.S. We've become so tribal that if you're on the left, it's like a statement of faith to say climate change is real. And if you're on the right, it's a tenet to say climate change isn't real. That's why this “belief” language has come in more naturally rather than artificially.

That said, climate change is deliberately framed as a false religion by those who want people of faith to reject it. You'll see some conservative politicians say, “I'm a true believer, I reject that God is not in charge.” It's a very clever messaging technique because if I'm a Christian—and more than 70 percent of Americans are—I'm taught to beware of false prophets. Beware of people saying things that sound good but are actually leading you to worship the created instead of the creator, Earth instead of God.

After presentations to skeptical audiences, I've had people say to me, “You know, this makes sense, and I wish I could agree with you, but I just can't because that would mean I'm agreeing with Al Gore.” Any perceived Earth worship immediately triggers an ingrained response to reject. One of the funny images I show in some of my talks is called the Church of Climatology, with Al Gore as the preacher, and other politicians and celebrities as the choir. Once somebody photoshopped my head onto one of the choir members. And I thought it was absolutely hilarious because, yes, I get how people feel. We have to laugh together before we can move on to talk about beliefs versus evidence.

That's why Al Gore is one of the best and one of the worst messengers for climate change. The best because he's so passionate and informed and has such a great reach. At the same time—I know he recognizes this—in this politically polarized society, he firmly belongs to only one tribe. So by definition, it means the other tribe must reject him—and everything he stands for.

Climate change, of course, is also a tragedy of the commons, and it requires communal action. Yet the U.S. is the number-one most individualistic country in the world, founded on a revolt against big government and

taxes. For many Americans, we have to talk more about market-based and technological solutions that appeal to their values instead of trying to change their identity. Take [Australian cognitive scientist] John Cook, who founded the blog Skeptical Science, which evaluates and pushes back on global warming denial. John couldn't even get his own father to accept climate change. But then his fiscally conservative dad used a rebate program to get solar panels on his house. He saved all kinds of money and started telling everyone how wonderful these panels are. And later, his dad says to John, "You know, this climate change thing, it's probably real, and I'm doing my part." He didn't need to be a wide-eyed tree hugger saving the whales; he could now align climate change with his own identity.

Even in the science community, there's so much confusion over how to communicate. The deficit model—just give them the facts!—does not work in public discourse unless everybody is politically neutral. That's why social science is increasingly important. I was the experimental method in a recent paper where a researcher asked me to speak at an evangelical Christian college. He asked the students about global warming before and after my talk and found statistically significant differences on their perspectives. Many people are now doing this kind of message testing. How humans interact with information is an emerging area of research that's desperately important.

Scientists also tend to understate the impact of climate change. We tend to, in the words of one researcher, "[err] on the side of least drama." We tracked 20 years' worth of studies and found that we systematically underestimate the rate and speed of change. Climate science is under such a microscope now that we like to be 99.9 percent sure of results before we say anything. But are we being too conservative? It's a challenge I confront every day.

## The Work Ahead

Look, we can't fix all these issues—cultural, political, psychological—before we take necessary action on climate change. People say to me, "Well, if you could just get everyone onboard with the science..." I'm like, good luck with that! How did that work out the past few centuries? This climate problem is urgent. The window is closing. We have to fix it with the flawed, imperfect society we have today.

We have to start by asking what people's values are, where they're coming from, what they love, what they fear, what gets them up in the morning. I say, "We can agree to disagree, but don't you support solar energy bringing all these jobs to Texas? Did you know Fort Hood gets energy from solar because it's cheaper?" If someone thinks solar power protects us from immigrants or terrorists or the Antichrist, then great, fine. With some groups, I don't even use the words "climate" and "change" sequentially. With Christians, we talk about the Bible's message of stewardship. With libertarians, we talk about free-market strategies. With moms' groups, we talk about pollution affecting our kids' health. With farmers, I say, "Hey, you're the backbone of our food system, how have drought patterns changed?" I don't validate the concept that there is a left and right side to climate science. And neither should the media. We should focus instead on solutions and impacts.

My number-one piece of advice for people doing climate—or any science—outreach is, Don't focus on the dismissive people. They're really a very small part of the population, and they're primarily older white men. Granted, the majority of them seem to be clustered in Washington, D.C., these days. Still, for people who react so emotionally, it's because they've staked their identity on that denial. It's as much a part of them as their kidneys or heart. When you're asking them to change their mind, you are literally seen as a threat. It's worth standing up to them in a public forum and saying, "You are lost. Here is the evidence." Not for the purpose of changing their mind but to show everybody else that we have answers.

Because here's the thing: If you look at Yale University's climate communication surveys, most Americans agree that climate change is real, that humans are causing it and that it's important to do something about it. But the number-one problem we're facing is that most Americans do not think climate change affects them personally. They think it's a problem for poor people in poor counties or for future generations. It's in our psychology to deny an overwhelming problem that isn't immediately bearing down on us. And until recently, we've been

shielded by our infrastructure, our crop insurance and home insurance programs. Of course, all of that is up against the wall now, and it's my job to connect those dots.

That's why we [the authors of the government's National Climate Assessment] decided to write a supplemental Climate Science Special Report this year. It's the first time we've done it, and it's the most comprehensive, definitive report on climate change that the government has ever published. It's going through federal clearance now, slated for release in November, so we'll see what happens. We made a lot of effort to write in a language that people can understand, and I think it really shuts down the whole “blue versus red” debate. It brings the science down to the level of where we live. You can see how climate change is affecting our food, water, economy, agriculture, infrastructure and security.\*

The goal of the report is to provide a scientific basis for anyone who wants to know both broadly and specifically why climate change matters to us, now. Many, many more people in this country are in the cautious, disengaged category, but they often seem very quiet. We have to filter out the noise from the dismissive people and talk with those who are lurking at the edges, listening, not sure what they think yet about what should be done but open to dialogue. So forget this elaborate smoke screen. By falling for the illusion that climate deniers can be convinced with more facts, we are distracted from engaging with a much larger group of people who want to understand why and how we should move forward with solutions. And that's exactly what the deniers want.

*\*Editor's Note (9/18/17): Prior to being posted online, this paragraph was edited to remove an error that appeared in the print edition.*

## Can Scientists Convince the Public to Accept CRISPR and Gene Drives?

 [scientificamerican.com/article/can-scientists-convince-the-public-to-accept-crispr-and-gene-drives/](https://www.scientificamerican.com/article/can-scientists-convince-the-public-to-accept-crispr-and-gene-drives/)

By Brooke Borel

In 1999 Robert Shapiro, then head of Monsanto, gave a stunning mea culpa at a Greenpeace conference in London. Monsanto's first genetically engineered (GE) crops had been on the market for only three years, but they were facing fierce public backlash. After a botched rollout marred by lack of transparency, the company, Shapiro said, had responded with debate instead of dialogue. “Our confidence in this technology ... has widely been seen, and understandably so, as condescension or indeed arrogance,” he said. “Because we thought it was our job to persuade, too often we've forgotten to listen.”

The damage was already done. Fifteen years later only 37 percent of the Americans thought that GE foods were safe to eat, compared with 88 percent of scientists, according to the Pew Research Center. Regulatory bodies in the U.S. fought for years over whether and how to label GE foods. In 2015 more than half of the European Union banned the crops entirely.

Science doesn't happen in a vacuum. But historically, many researchers haven't done a great job of confronting—or even acknowledging—the entangled relation between their work and how it is perceived once it leaves the lab. “The dismal experience we had with genetically engineered foods was an object lesson in what happens when there's a failure to engage the public with accurate information and give them an opportunity to think through trade-offs for themselves,” says R. Alta Charo, a bioethicist and professor of law at the University of Wisconsin–Madison. When communication breaks down between science and the society it serves, the resulting confusion and distrust muddies everything from research to industry investment to regulation.

In the emerging era of CRISPR and gene drives, scientists don't want to repeat the same mistakes. These new tools give researchers an unprecedented ability to edit the DNA of any living thing—and, in the case of gene drives, to alter the DNA of wild populations. The breakthroughs could address big global problems, curtailing health menaces such as malaria and breeding crops that better withstand climate change. Even if the

expectations of CRISPR and gene drives do come to fruition—and relevant products are safe for both people and the environment—what good is the most promising technology if the public rejects it?

Credit: Amanda Montañez; Source: “What Is the ‘Science of Science Communication’?” by Dan M. Kahan, in *Journal of Science Communication*, Vol. 14, No. 3. Published Online August 25, 2015

“Without transparency, we might see a kind of hyperpolarization,” says Jason Delborne, a professor of science, policy and society at North Carolina State University. Concerned groups will feel marginalized, and advocates won't receive critical feedback needed to improve design and safety. “This puts the technology at risk of a knee-jerk moratorium at the first sign of difficulty,” he notes.

To avoid that outcome, some researchers are taking a new tack. Rather than dropping fully formed technology on the public, they are proactively seeking comments and reactions, sometimes before research even starts. That doesn't mean political and social conflict will go away entirely, Delborne says, “but it does contribute to a context for more democratic innovation.” By opening an early dialogue with regulators, environmental groups and communities where the tools may be deployed, scientists are actually tweaking their research plans while wresting more control over the narrative of their work.

Take evolutionary geneticist Austin Burt. In 2003 he published the first theoretical paper on GE gene drives. Shortly after, with funding from the Bill & Melinda Gates Foundation, he and his colleagues launched a research project to see if gene drives could control *Anopheles* mosquitoes, which spread malaria. Back then, in the pre-CRISPR days, the technology was so speculative that doing outreach “didn't seem worth taking up people's time,” Burt says. Now that a working gene drive may be ready for regulatory assessment within five years, it's essential to talk to communities where the technology may be deployed, he adds, “so we can make things that are going to be acceptable not just to regulators but to the public at large.”

This push for reflection has especially come from those wielding the checkbooks. In 2016 the National Academies of Sciences, Engineering, and Medicine published *Gene Drives on the Horizon: Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values*. The sponsors—various federal agencies, the Gates Foundation and the Foundation for the National Institutes of Health—specifically asked for comprehensive recommendations on ethics and public engagement, says Keegan Sawyer, project director for the report. Other National Academies reports have included these elements, but the combination that appeared in the gene drive report was “unusual,” Sawyer says.

DARPA is among those listening to the guidelines. Its new Safe Genes initiative, which will fund seven research projects aimed at understanding how to deploy and control gene drives, requires all its projects to have thorough public engagement plans. One DARPA grant recipient is a team at N.C. State, which includes Delborne. He is overseeing social engagement on a gene drive project that aims to remove invasive mice from remote islands to protect seabirds and other wildlife. Although the research is under way, Delborne says the partners “have been really clear since the very beginning that if people reject this technology for ethical reasons or because there are concerns about the risks—even if the scientists don't see it that way—there is essentially a pathway to no.” Simply put, the scientists are willing to halt the project.


On the even more extreme end of this trend is Kevin Esvelt, an evolutionary engineer at the Massachusetts Institute of Technology. He's considering genetic technologies to alter wild mice so that they cannot carry and spread the pathogen that causes Lyme disease. Last year, before starting any work in the lab, Esvelt visited Lyme-plagued Nantucket, Mass., to gauge if residents would be interested in genetic approaches—including gene drives, although he advised against this option because he doesn't think it is suitable in this case. Nantucket followed Esvelt's lead on gene drives, although the community is exploring the possibility of an alternative technology to immunize mice against the pathogen.

Esvelt was addressing head-on a special ethical quandary of gene drives, which are designed to spread and persist in the shared environment: Who should get to decide whether and how to use such technology? “To me, it is mind-boggling that we got so much attention just for going to the communities before we did anything

else,” Esvelt says. “I think that says something about how science is typically done.”

Whether the emergence of these efforts will reduce fear and skepticism “depends on how responsive the people listening to the engagement are to those concerns,” says Jennifer Kuzma, co-director of the Genetic Engineering and Society Center at N.C. State. In other words, researchers must be willing not only to hear the public's confusion and pushback but also to adapt—even if that means shelving a technology they think could change the world.

## How Brexit Is Already Destabilizing Science throughout Europe

 [scientificamerican.com/article/how-brexit-is-already-destabilizing-science-throughout-europe/](https://www.scientificamerican.com/article/how-brexit-is-already-destabilizing-science-throughout-europe/)

By Inga Vesper

British society has always prized the scientific mind, producing such luminaries as engineering whiz Isambard Kingdom Brunel, developmental biologist Anne McLaren and World Wide Web inventor Tim Berners-Lee. But in June 2016 the U.K.'s reputation as a future-looking nation suffered a devastating blow. Fifty-two percent of voters decided they wanted to leave the European Union, a club of nations that foster peace and economic growth. On March 29 the government officially started the exit, or “Brexit,” process: a tangle of 143 British and E.U. negotiators must make some 1,000 changes to existing laws and determine what to do with the three million Europeans living in the U.K.—and the 1.2 million Brits living in the E.U. David Davis, the Brexit minister, has called this endeavor “as complicated as the moon landings.”

Brexit voters framed their choice as a move toward sovereignty. But for scientists caught in the fray, the referendum sparked an ongoing nightmare of depleting talent, funding uncertainty, and turmoil that is both political and personal. “There isn't a clear plan,” says Mike Galsworthy, an anesthetics researcher who co-founded the London-based pressure group Scientists for EU in the run up to the vote. “Britain is fundamentally less stable, and that makes it hard for scientists to have a career or do any long-term planning.” An ongoing survey by the group found that more than a fifth of scientists said they were considering leaving the country or knew someone who was. The consequences of a scientist diaspora from the U.K. could throw the entirety of European research into disarray.

Brexit is exposing how modern science is an increasingly interconnected system in which political and societal shocks reverberate. One country's instability has repercussions for all its partners, as well as for the scientists who reside there, regardless of whether they are citizens or foreigners. Scientific work depends on collaboration, yet a central theme of Brexit is limiting free movement. As politicians pander to right-wing views on immigration by suggesting open borders hurt the U.K.'s economy, many scientists are reporting that their European partners are wary about working with, or in, the country. For example, Anne Glover, a biologist at the University of Aberdeen in Scotland and a former chief scientific adviser to the president of the European Commission, says that student intake from the E.U. is markedly down at Aberdeen and that some European staff have already left. Cesare Terracciano, an Italian cardiologist at Imperial College London, reports that discussions about collaborations between his institution and European laboratories have been put on hold. U.K. heads of European projects, such as Gerry Gilmore, who leads the European Commission's Optical Infrared Coordination Network for Astronomy, could lose their roles as institutions move to mainland Europe.

These anecdotes are borne out in numbers that are a harbinger of the chaos to come. According to the U.K. Office for National Statistics, a total of 117,000 Europeans permanently left the nation in 2016, a 36 percent increase compared with the previous year. The science world looks to be particularly hard-hit: around 18 percent of those who hold non-British E.U. postdoctoral positions in the U.K. are looking for jobs elsewhere, according to a report for the British government's Science and Technology Select Committee. With the fall of the pound, postdoc salaries are now less competitive, especially compared with compensation in the U.S. The Higher Education Workforce Survey, released on July 31, found that about a third of universities reported a negative impact from Brexit on recruiting or retaining E.U. staff.

The fallout goes beyond practical logistics: a flagrant expression of anti-immigrant sentiments is also on the rise. Scientists for EU says that some researchers have been abused in the streets and that their children have been bullied at school. “They are now mindful of their accent or the language that they speak with their kids, so it's a much more uncomfortable environment,” Galsworthy says. For German-born Stefan Söldner-Rembold, who heads the particle physics department at the University of Manchester, these “soft” factors can be just as powerful as financial decisions when it comes to deciding where to pursue a career. “There are difficulties for colleagues, whose families are being told, ‘Why are you still here?’” he says. “You want to make sure your kids and partner have a perspective in this country. Right now that's not clear.”

## Exposing Fragility

A major threat to the continuity of European science is the question of the U.K.'s membership in the 33-year-old E.U. framework for funding research. Horizon 2020, the program's current installment, has a hefty budget of €80 billion to be allocated between 2014 and 2020; its successor, Framework Program 9, is pegged at €120 billion. The U.K. is one of its most successful participants and has received about 15.5 percent of Horizon 2020's total awarded funds so far.

Horizon 2020 is open only to E.U. member states or associated countries, such as Norway. If a non-E.U. country wants access, it must pay a share into the common pot based on its gross domestic product. The political mood in the U.K. is such that any payments to the E.U. post-Brexit will be aggressively opposed. Under Prime Minister Theresa May, the government has tried to reassure scientists by saying any potential loss of funding would be matched with homegrown money. But scientists are not buying it. “Looking at the state of the British economy, this funding will likely not be replaced in the same way,” Söldner-Rembold says.

Glover, who has been involved in multiple Horizon 2020 projects, asserts that the program's value goes beyond money. When she works with the U.S., for instance, scientists from each country have to submit separate bids and hope that both get green-lit. But Horizon 2020 members can whip up a single application for each project. “It allows me to work seamlessly with colleagues in, say, Estonia or Italy,” Glover says. “Science is an international pursuit. You can't hope to be at the leading edge of achievements if you cannot collaborate freely with the best in the world.” And, Galsworthy adds, if freedom-of-movement restrictions affect permits and visas, “it could well mean we will be cut out of Horizon 2020.”

With that potential outcome on the horizon, neighboring competitors—as well as emerging science giants such as China and India—are eager to welcome scientists fleeing from the U.K. The nation may produce some of the highest-quality papers in the world, but other E.U. countries are catching up in terms of both publication volume and esteem. The E.U. now produces 34 percent of global research output, and countries such as Germany, France, Sweden and the Netherlands see Brexit as an opportunity to poach talent.

Indeed, the U.K.'s science is excellent but fragile. With a population of just 65 million, the country is fairly small, and its labs rely on teams of handpicked, international experts, with 20 percent of its scientists coming from the E.U. Lose one hyperspecialized expert, and an entire organization might fall apart. According to the lobby group Universities UK, more than half of the U.K.'s research output stems from international collaborations, compared with less than 40 percent in the U.S. Shocks to its system could destroy the country's leadership position.

The idea, however, that what hurts the U.K. will somehow elevate its neighbors is preposterous, says Thomas Jørgensen, senior policy coordinator at the European University Association, an interest group for universities. The U.K. hosts some of Europe's best scientific institutions, including the University of Oxford and the University of Cambridge, which regularly top global rankings. (Both universities get around 13 percent of their research funding from the E.U.) The British science system is unique in Europe, not least because it uses a language that nearly every European child learns in school. “Britain does well because its research environment relies on an infinite amount of variables that you cannot simply re-create,” Jørgensen explains. “Science is not a factory. You cannot just take it somewhere else.” He fears the damage from turning off the talent tap will



weaken the scientific competitiveness of the entire continent: “On the systemic level, diminishing the strongest partner is bad for everybody.”

Now many universities, often accused of being detached from the hullabaloo of emotionally driven politics, are acknowledging they are painfully dependent on it. Scientists for EU is pushing to ensure that the British government uses empirical facts to facilitate Brexit, but it is an uphill struggle in a political climate dominated by slogans and misinformation. Late last year the Science and Technology Select Committee recommended that the newly founded Department for Exiting the European Union take on a chief scientific adviser to provide fact-based evidence around Brexit. That post remains unfilled. Of course, Brexit was never about facts and logic. The referendum narrowly won on a narrative of hurt pride and citizens feeling short-changed. Subsequently, in a strange reversal, frustrated European scientists are voting “leave” with their feet.

Terracciano, the cardiologist from Italy, has spent many sleepless nights worrying about British science, which, he fears, is on the brink of a vicious cycle. The potential loss of funding, coupled with a damaged reputation, makes the country less attractive for research, which will in turn compound the loss of talent, he says. Yet Terracciano understands what is motivating his fellow Europeans to seek new research homes. “People are leaving because their years of service and dedication are unrecognized,” he says. “We are all angry that we have invested in the wrong horse.”

## The Deficient Deficit Model

The gold standard for science communication used to be the deficit model, which assumed that the key to acceptance was education. Just explain the science of vaccines or GMOs to the skeptical public, and distrust will fall away. But recent work by researchers, including Dan M. Kahan of Yale Law School, suggests a more complicated relation that involves personal identity and belief. Kahan’s work shows that people with contrasting political values will draw different conclusions from the same evidence even when they are scientifically literate.

