Bulletin of the Atomic Scientists

When politicians distort science

By Robert Socolow, Roger A. Pielke, Jr. , and Randy Olson | 20 October 2011

Republican presidential candidate and Texas Gov. Rick Perry recently questioned the science of climate change in ways so unsupported by evidence that Glenn Kessler, the "Fact Checker" columnist at *The Washington Post,* gave him a rating of "four Pinocchios." Perry's is but one scientific misstatement among many that regularly roil the US political scene. What is the proper scientific response to the political distortion -- or even outright rejection -- of science? In coming weeks, three *Bulletin* experts will offer authoritative and at times provocative analysis.

Glass houses of accuracy? Randy Olson | 22 December 2011

For my final essay in this Roundtable, I want to shift momentarily from the distortion of science in the public sphere to the distortion of science within the profession itself.

Today the world of science is drowning in information. When I speak to my former colleagues (I left my tenured professorship at the University of New Hampshire in 1994 to become a filmmaker), I hear the same, consistent refrain: "There's just too much information." When you run too much of anything through a processing system, the inevitable result is reduced assimilation efficiency. It happens when you feed animals too much food (they can't digest all of it), and it happens when you overwhelm a profession with too much information (it can't process it all).

Too much information causes decreased accuracy in transmission. I've seen this in the limited experiences of my own career in science. Recently, I poked my head back into the literature of my former field, marine biology, and to my surprise saw that much of the work I published in prominent journals in the 1980s has not been cited for more than two decades.

I wrote about this to a dozen of my old colleagues (some of whom are now members of the National Academy of Sciences), and their basic response was, "Get used to it." Following a suggestion from one of them, I looked at the instructions to authors for a journal I used to subscribe to, *Trends in Ecology and Evolution*, or *TREE*. The instructions tell authors this, verbatim: "Concentrate on the seminal references of the past 2-4 years (most references should be no more than five years old)."

How does that work if one is engaged in actual science? What happens if the seminal references occurred 25 years ago? You're supposed to ignore them and focus on recent work, even if the recent stuff is trivial? What sort of a message does that send to authors? This message: It's not about searching for the truth; it's about searching for the current. My colleagues assure me this practice is part of a broader general ethic in scientific publications.

On another note related to scientific accuracy, last fall articles in *The Atlantic* and *The New Yorker* commented on the dangerous amount of noise in current scientific literature caused by "false positives," which are, roughly speaking, studies that tell a good story but aren't actually true. I spoke at a recent epidemiology conference where the attendees confirmed this trend. They contended that it's relatively easy to get funding to demonstrate that Chemical X causes cancer. But if someone has already published that finding, and you suspect it to be incorrect, it's almost

impossible to get funding to set the record straight. It's a general standard of seeking the next new and exciting thing, rather than attending to the boring job of maintaining complete accuracy in the literature.

So to bring the argument of this Roundtable back to Rick Perry and the political distortion of science: The battle supposedly focuses on the accurate propagation of science in the public arena, but I'm increasingly concerned about the accurate propagation of science within the profession itself.

How can scientists not care about accuracy within science -- accepting the routine dismissal of "old" literature and the regular proliferation of false positives -- but then simultaneously express shock about the inaccurate propagation of scientific information outside the profession? Yes, the political distortion of science by candidates for public office is frustrating and deserves concern, but there is a serious risk of a glass-houses situation. If the science world doesn't give more thought to maintaining standards within the profession, first and foremost, it will have little ability to combat the distortion of science in the wider culture.

Politics is about acting alike, not thinking alike Roger A. Pielke, Jr. | 15 December 2011

I have enjoyed the exchange between Randy Olson and Robert Socolow on the need for effective communication of science, and not simply as a means of conferring content but as a two-way process that builds trust and legitimacy. In my final commentary in this exchange, I'd like to return to discussing Socolow's central claim that science is under attack and needs defending from the anti-science brigades.

In short, I find the evidence for such a claim sorely lacking. In these cynical times, science is among the few institutions in society that is held in high regard. (Others include the military and first responders to disasters.) The most recent survey of public attitudes about science by the National Science Foundation found that 84 percent of Americans expressed support for government funding of basic research, and Americans have more favorable attitudes toward the promise of science and technology for our future than do Europeans. Further, Americans ranked scientists higher in prestige than 23 other occupations (and at a level similar to firefighters), a view that has remained virtually unchanged in the 35 years that the NSF has conducted its surveys.

These data hardly show an institution under attack or even a loss of support for science. Yet Socolow warns ominously that "an age of darkness could lie ahead" and worries about the "alienation of large segments of the public from the scientific enterprise." I have a hard time making sense of such general expressions of extreme concern, which are by no means unique to our exchange.

As I argued in my first essay in this roundtable, the justification of political actions in terms of science is a common feature of our politics, expressly because science is held in such high regard. Everyone (many scientists included) seems to think that by invoking the scientific correctness of his or her positions, he or she can reach a moral high ground that will trump the arguments presented by opponents (who, typically, also appeal to science). Science is thus viewed as a way to circumvent political discourse over values and interests.

For instance, we began this exchange with an invitation to respond to a question motivated by the statements made by Republican presidential candidate Rick Perry, who expressed skepticism about the science of climate change. While we've been having this discussion, the Obama administration has decided to overrule the recommendation of an FDA science advisory committee on the safety of an over-the-counter contraceptive for girls under age 17.

While many observers cast both examples as anti-science, neither has anything to do with being anti-science and everything to do with politics and values. For instance, the Obama administration does not want to go

into an election year having just made available the so-called morning after pill to 13 year-olds. It is far easier to justify the decision based on appeals to science rather than values. However, the central problem in invoking science as the basis for what are ultimately political decisions is that it risks politicizing the scientific community in pathological ways, especially when the scientific community plays along as a willing participant. Thus, the larger problem that we face these days is not a public that rejects science, but parts of a scientific establishment that at times appear to welcome, if not encourage, the politicization of their own institutions.

The risks are thus not a looming anti-Enlightenment era among the American public, but rather an expert community that is willing to trade on the authority and legitimacy of science in the political battles of the day. Ironically enough, those positing that they are defending science in highly partisan political debates may be helping to reduce its legitimacy in those very same debates.

What is needed from scientists is leadership that is willing to clearly explain that science does not offer political cover for politicians who seek to avoid making difficult decisions by hiding behind science. Instead, there is a need to push such discussions in the direction of the underlying values that are at stake and away from science as a proxy battlefield for those disputes over values. Decisions about climate change and over-the-counter contraceptives (and the like) are ultimately political decisions. They involve considerations of science, but science neither dictates the outcomes of these decisions nor favors one side's values over the other.

As members of the scientific community express their political leanings in public debate, they would do well to remember some sage advice from Walter Lippmann: The goal of politics is not to get everyone to think alike, but instead, to get people who think differently to act alike.

Reliable, confirmable, universal, welcoming: Attributes of science that convey its power and uniqueness Robert Socolow | 8 December 2011

Randy Olson is right: "Superior" is a badly chosen word. Saying, as I did in Round Two, that science is a "superior way of knowing" contradicts my first-round essay, which argued that science is not just one of many belief systems, but a different way of knowing. To explain how science should not be defended, I invoked the scene on Mount Carmel staged by Elijah, where the God of the Jews sets a pile of wood on fire after Baal is unable to do so. I said: "Science is not just another point of view."

I used the word "superior" just once, in the headline, and I lost Randy Olson in the process. I am surprised that he didn't feel obliged to come up with alternative language. I hereby invite him and the other member of this roundtable, Roger Pielke, to join with me in this final round to identify forceful and productive -- yet inoffensive -- language that justifies giving priority to science in children's education and in the processes of government. (Here I am assuming they agree that such priority is warranted.)

I have been collecting adjectives that others have used to describe what is different about science. Paul Nurse, now head of the Royal Society, wants students to be able to distinguish astronomy from astrology; he thinks the key is to show that science is "reliable." Stewart Brand, founder of the *Whole Earth Catalog*, says science is "confirmable." Spencer Weart, a historian of science, asserts that science is "universal," in no way owned or controlled by any nation or sect. To this list let me add that science is "welcoming," in the sense that it nourishes the counter-argument. "Reliable, confirmable, universal, and welcoming" is a good package that succinctly bundles what I wrote in Round One: "Science is a process of searching, always incomplete. Its norms include strict evidentiary standards and transparency. Anyone working anywhere can overturn a prior consensus."

The case for the distinctiveness of science is treated skeptically by practitioners of "science studies," a relatively new, cross-cutting research area found in many universities, but usually not in their natural science departments. The science studies researcher can be expected to assert that science is not universal to the extent that it is culturally determined; not welcoming to the extent that it imposes conformity; and not reliable or confirmable to the extent that it is the expression of self-interest. The problems we are facing today in our public discourse about science have some of their roots in an agreement to disagree, dating to nearly half a century ago, between those who believe there is an underlying reality that science accesses uniquely and those who see science as only one enterprise among many, all with feet of clay. Forthright dialogue between natural scientists and science studies researchers is overdue. Conceivably, it will lead to a level of mutual understanding sufficient to reduce the current level of discord regarding what science aspires to and has already achieved.

We were asked, at the beginning of all this: "What is the proper scientific response to the political distortion -- or even outright rejection -- of science?" Indeed, this is one of the most critical questions of our times. The stakes are very high; I warned that "an age of darkness could lie ahead." The central task is to "retain -- or perhaps regain -- the public's trust." Science at its best is widely admired (I likened science to a palace). Friends of science who are not scientists can be especially helpful.

In pursuit of the goal of countering the rejection of science as a way of knowing, my principal recommendation is to put much more effort into communicating how science is done nearly all of the time -- its norms and strategies. Thanks to the creativity and diligence of a generation of science communicators, the heroic accomplishments of science -- from the structure of DNA to the mapping of black holes -- are broadly appreciated. Arguably, however, these efforts have done little to reduce the alienation of large segments of the public from the scientific enterprise. Perhaps, if the communicators of science put comparable effort into explaining the processes that make science distinctive, a more profound and trusting relationship between the layperson and the professional will emerge.

Arrogance as a way of alienating Randy Olson | 23 November 2011

Something unfortunate has happened here. I liked and agreed with both of my colleagues' first-round essays (Roger Pielke on the importance of fairness and honesty; Robert Socolow on science not being "just another point of view"). But I'm afraid Socolow has overturned the table with his second essay, starting (and ending) with his title.

In today's digital, networked world, language is crucial. Entire political campaigns implode and careers end because of poorly chosen words. Sometimes the offense can be caused by a single word. For example, on the same day he filed to run for president in 2007, then-US Sen. Joe Biden created a media maelstrom by using the seemingly innocuous word "clean" in reference to African American candidate Barack Obama. Words are powerful: They can convey history and agendas, sometimes without the sources of the words realizing it.

The word "superior" in the title to Socolow's piece ("Relativism gets us nowhere. Science is a superior way of knowing.") has this characteristic. It speaks powerfully of one thing -- arrogance. To say that science is "a superior way of knowing" might seem innocuous to a fellow scientist. But try running that usage by the people at the Discovery Channel whom I mentioned in my last essay -- the people who feel the words "science" and "scientist" are elitist. You know what they would say to Socolow's title? "Yep, we told you so; they think they are superior."

I am talking perception here, not reality. If the general public perceives you to be arrogant, you can forget about being widely heard.

I first addressed the issue of arrogant scientists in my 2006 movie, *Flock of Dodos: The Evolution-Intelligent Design Circus*. Many evolutionist friends I spoke with during the making of the movie told of public debates in which they "out-facted" their creationist opponents. But when my friends looked to the audience, they saw cold stares that said, "Who do you think you are, Mr. Know-It-All?"

Hosted by Town Hall Seattle, a 2006 debate between an evolution professor and a spokesman for intelligent design vividly displayed the dynamic of scientific arrogance. The evolutionist trampled his opponent all night, cutting him off, telling him he was "full of crap," and eventually interrupting him by saying the word "no" 18 times in a row.

By the end of the evening, science grad students who attended told me, no one cared what the evolutionist had to say. He had come across as so arrogant -- radiated such an air of superiority -- that the audience was sick of him.

One organization that knows how not to come off as arrogant is the Centers for Disease Control and Prevention (CDC). Over the past year, I've made four visits to its Atlanta headquarters and conducted five workshops there. The CDC seems to have a natural ability to communicate with broad audiences, perhaps because the word "public" is part of the name of the profession: "public health."

The CDC's brilliance was seen this year in the agency's zombie disaster preparedness campaign, which used a graphic novella, social media, and a blog to tell of the spread of a strange new disease that turns ordinary people into zombies. In the project, the CDC explained in hilarious deadpan the emergency kits and plans citizens should make to prepare for such a zombie apocalypse (and, it just so happened, more mundane emergencies like hurricanes, earthquakes, and real pandemics).

The project cost $87 to create and went viral on the Web, bringing the CDC and its preparedness mission the equivalent of millions of dollars in media exposure. When it comes to communication, the CDC understands the need to listen, to avoid arrogance, and to engage the audience on its own terms, even when the terms involve zombie movies.

In the end, this roundtable is supposed to focus on politicians who distort science. But at the core it's about reaching the public. If the distorted version of science comes from a charming, friendly, good old boy, while the accurate version of science comes from a cold and robotic authority figure who proclaims his way to be "superior," to whom do you think the public will listen?

I thought Socolow's first essay was excellent, and I completely agreed with its message. But the title of his second piece was a faux pas of enormous scale, undermining whatever substance was associated with it. If scientists can't develop a much higher level of sensitivity to the power of language -- and the importance of word choice -- it will not matter how absurdly the Rick Perrys of the world distort science. Far too often, they will be believed, and scientists will not.

Relativism gets us nowhere. Science is a superior way of knowing. Robert Socolow | 10 November 2011

In Round One of this Roundtable discussion, I drew the distinction between distortion of the substance of science and rejection of science as a way of knowing. I asserted that distortion is less dangerous than rejection. The scientific process itself sorts out distortions, often quickly. Rejection of science, on the other

hand, lacks self-correcting mechanisms. Rejection is dangerous not just for science, but for civilization. I wrote: "Another age of darkness could lie ahead. … Our opponents present science as dogma and construct a symmetric conflict: their dogma vs. our dogma. … There is no such symmetry."

In the second and third rounds, I hope I can persuade my tablemates, Roger Pielke and Randy Olson, to reflect on this distinction. Through this lens, here's how I read their first-round essays:

Olson, as best I can tell, shares my sense that something fundamental is amiss, and worse now than a few decades ago. He contrasts the early 1960s, when President Kennedy's administration "seemed to embody the idea of knowledge as the foundation to a bright and secure future" with today, when a television producer confides to him that "the words 'science' and 'scientists' are now actively avoided at the Discovery Channel because 'they are perceived as elitist.'"

Pielke, it seems, may not agree with my premise that the scientific way of knowing is privileged. He writes: "If a scientist says that life on Earth evolved over billions of years, anyone else has the right to counter that view by expressing his or her belief in creationism. ... Experts should never forget that in democracies, citizens have every right to make bad decisions or hold the wrong views." As statements about free speech and making "decisions" governing individual behavior, Pielke's assertions are fine. But Pielke carries his relativism and evenhandedness to the societal level when he creates a parallel construction to report to us that: 1) "Jimmy Carter set a goal of achieving 20 percent of the US energy supply from renewable sources by 2000, even though he was told it would be infeasible"; and 2) "Ronald Reagan wanted creationism taught in schools."

These statements are not parallel. Carter is working within the domain of science; Reagan is rejecting the primacy of science. Evenhandedness is appropriate at the individual level, but not the societal level. Yes, we're all entitled to our opinions -- but, no, all principles are not equally valid. Relativism must not dominate decisions about what a child should be taught. Democratic societies have made a collective decision to use the classroom to undermine racism, and, at essentially the same level of discourse, to teach the primacy of science.

A word about Climategate: Olson says that "Climategate should have been a wake-up call: It should have been seen as a 9/11 for the science community." It is not that simple. The purloined emails from and to the University of East Anglia's Climatic Research Unit were an embarrassment to the scientific community and difficult to defend. Phil Jones, the professor at the middle of the affair, showed admirable contrition when he said: "I have obviously written some pretty awful emails." Their impact on public opinion was so substantial precisely because so many people had put science on a pedestal. The public expected generosity of spirit and found meanness. They expected objectivity and found combat. Climategate revealed how many friends science has, because so many friends made it known that they were disheartened.

Olson distorts reality when he proposes that there are two sides -- scientists on one side (naïve and well meaning "Cub Scouts"), and a ruthless Mafia on the other. Scientists are not alone. In countering Texas Gov. Rick Perry and affirming their "belief" in science, New York Mayor Michael Bloomberg and former Utah Gov. Jon Huntsman helped science more than any scientific leader could have. Our best defenders are third parties.

More accurately, we scientists are in charge of the building where everyone lives: We are its janitors and plumbers and architects. Nearly everyone is proud to live in this building, including the mafiosi, but still there is discontent. Looking from its windows, people see palaces in the distance. It is our responsibility to find the

arguments that will persuade our fellow residents not to abandon the building, for the palaces they see are only flimsy tents in the desert.

The non-defense of science Randy Olson | 3 November 2011

To ask for the proper scientific response to the political distortion of science is kind of like asking what sort of defense a team of dwarves should run in a basketball game against the Los Angeles Lakers. I suppose I could recommend that the dwarves run a zone defense, but it really doesn't matter because nothing they try is going to work. The dwarves' problems are fundamental and systemic, and until they are addressed at the large scale, nothing will succeed.

Sliding downhill. I was born in 1955 and grew up in a country led by John F. Kennedy, a president who surrounded himself with scholars and whose administration seemed to embody the idea of knowledge as the foundation to a bright and secure future. But those Camelot dreams not only have failed to come true, they have faded.

Just look at the progression downward in television -- still the most powerful medium of mass communication -- where the quality and depth of news has atrophied. We've gone from Edward R. Murrow to Dan Rather to Stewart and Colbert. In 2008, the *New York Times* asked, "Is Jon Stewart the most trusted man on television?" and suggested the answer is probably yes.

Instead of at least the dream of a day when the average citizen would evaluate scientific data to make up his or her own mind on complex issues like human-caused global warming, today most people -- including, unfortunately, politicians and media personalities -- are simply lost on the big issues. The country needs leaders to explain these complexities and deal with the politically driven disinformation that confuses science-related issues.

Cub Scouts versus the mafia. These days the profession of science is under attack. There are the blatant, obvious attacks, like the Climategate offensive of 2009. And there are the less public elements of erosion of confidence in science -- such as a television producer friend of mine telling me the words "science" and "scientists" are now actively avoided at the Discovery Channel because "they are perceived as elitist."

The result: a weakening of the science community and an increase in its vulnerability to attack. I made two movies about science controversies: *Flock of Dodos* is about anti-evolution efforts; *Sizzle: A Global Warming Comedy* is about attacks on climate science. While making the first movie, I came up with a humorous alternative subtitle, "The Cub Scouts against the Mafia," which I never used. But as I made the second movie, I found myself drawn to it again.

The subtitle refers to the naïveté of scientists, who are often as trusting as a bunch of Cub Scouts (both groups having honesty as one of their founding principles). In contrast, the anti-science forces seem to have minimal ethics -- as was seen in Dover, Pennsylvania in 2005, when a federal judge accused two anti-evolution school board members of perjury, and with Climategate in 2009, when the attackers of climate science were not only willing to commit theft, but their followers never even questioned the ethics of stealing emails.

What to do about science distortion? There is a basic norm in the profession of science that all decisions must be made by committees. This is perhaps a reflection of the core belief in the peer review process; if all research must be approved by a committee of peers, then no policy decisions should be made without a committee. As a result, potential lead organizations like the National Academy of Sciences and the American

Association for the Advancement of Science lack the ability to lead, because their directors are little more than mouthpieces for the sluggish committees that reside within.

The overall effect is slow, limited leadership, leaving the science community vulnerable to attack. And this is exactly what happened with Climategate. When word got out that climate scientists' emails had been stolen and were being used -- falsely, as it turned out -- to suggest that some aspects of climate science were fraudulent, there was no voice of leadership on the scientists' side. In fact, there was nothing but chaos, as Fred Pearce of Yale Environment 360 detailed in an article with the blunt title, "Climategate: Anatomy of a public relations disaster."

A body with no head. So this is at the core of most science communication failures: no effective leadership. Today, Republican presidential candidates like Rick Perry espouse anti-science nonsense in debates. But the next morning, who is combatting the distortions in the media? Nobody.

In a perfect world, the National Academy of Sciences would have a loud, powerful, and charismatic leader, who -- on the morning after anti-science debate rhetoric is spewed -- would provide the comforting voice of scientific accuracy and have the media savvy to get a rebuttal onto the home page of major news websites.

That response mechanism doesn't exist. There are individuals and small groups attempting to fill this void. For example, three scientists (one of whom is a senior member of the National Academy) organized a Climate Rapid Response program, and the Science Debate 2012 group is seeking to push presidential candidates to talk more about science issues. But the large science organizations shy away from politics and are largely inept when it comes to communication.

One thing that major science groups could easily do to level the playing field would involve taking an aggressive stance not on the interpretation of science (which is inevitably political), but against attacks on the profession of science itself. Large science organizations should be ready for battle. There is nothing political about defending peer review or the advancement of ideas. Again, though, such an aggressive orientation would require bold leadership.

For now, science is stuck with a "strategy" that boils down to pretty much every scientist for himself or herself, which is what happened with Climategate. As a result, the only advice I can offer is that the strategy has to change. Climategate should have been a wake-up call: It should have been seen as a 9/11 for the science community. It should have brought cries of "Never again!" and a new awareness among scientists of the value of clear and timely communication. But that didn't happen, which means that, for now, presidential candidates can spout all the egregious anti-science they want, knowing that the response will be underwhelming and delivered with the ferocity of a pack of Cub Scouts.

Enter with caution Roger A. Pielke, Jr. | 27 October 2011

Here we go again. The US presidential campaigns of 2004 and 2008 saw some in the scientific community seek to exert influence on the elections. In 2004, scientists mounted an aggressive effort to unseat George W. Bush, and four years later sought to raise the profile of science in the election by calling for a presidential debate on science. Neither effort bore much fruit.

But hope springs eternal. As the 2012 campaign gets under way with a focus on the Republican nominees vying for the ticket, the scientific community is once again trying to figure out how it can impact the process. A seemingly obvious way is for scientists to do what any citizen can: evaluate the claims made by candidates,

factor those into their judgment as to whom to support, and, if desired, actively work to help get those candidates elected.

The situation is, of course, more complex. Scientists are not just ordinary citizens; they have specialized expertise. So what should scientists do when a political candidate expresses a perspective that they -- as individuals or within groups -- hold a different view on? In our system of democracy scientists can speak out, and because scientists are held in high regard within our society, they are more likely than the average citizen to have their voices amplified (if not treated with deference) by the media. I've been known, on occasion, to use my own blog to call out politicians for misrepresenting the state of science related to my own work.

Of course, there are several pitfalls that scientists should be aware of when making a decision to speak out and express a view differing from a politician's.

First, although scientists are not like every citizen, all citizens have the right to speak out. So if a scientist says that life on Earth evolved over billions of years, anyone else has the right to counter that view by expressing his or her belief in creationism. Depending on one's view of the merits of democracy and expertise, this feature of American political life may be viewed as a positive or a negative. Experts should never forget that in democracies, citizens have every right to make bad decisions or hold the wrong views -- if we define "bad" decisions and "wrong" views as those which are counter to the perspectives held by experts.

Second, when scientists speak out publicly, they will quickly learn that it is not just candidates for office who have their views scrutinized. For instance, this roundtable was apparently motivated by Texas Gov. Rick Perry taking issue with aspects of climate science that many in the research community have long viewed to be settled science, with only a few outliers taking issue. Perry's views prompted rebukes from scientists and fueled reverberations through the blogosphere's echo-chambers for weeks.

Yet in sharp contrast, when President Barack Obama sought to explain the recent Texas drought as a consequence of human-caused climate change, few (if any) of those same scientists found fault with his views, despite the overwhelming consensus (also disputed by a few outlier voices) that individual events cannot be attributed to the human influence on climate because such changes are observed as statistics that play out over several decades and longer.

The selective behavior goes to process as well. When NASA scientist James Hansen was told by the Bush administration that he could speak with the press only when accompanied by agency "minders," the scientific community loudly and quite rightly expressed outrage. Yet, when the Department of Health and Human Services under President Obama recently announced a similar policy, virtually all of those once-outraged voices were mute.

An observer of this selectivity might note that significant parts of the scientific community have a political preference for Democrats over Republicans. For instance, a survey of the membership of the American Association for the Advancement of Science found only 6 percent registered as Republicans, and almost 10 times more registered as Democrats. Scientists who take on politicians in the name of science risk being perceived as simply using science as a fig leaf of expertise to advance what ultimately are political preferences.

That politicians express misleading or incorrect views (on scientific issues or anything else) will not come as a surprise to most any member of the general public, whether that person has specialized expertise or not. In our recent book on presidential science advisers, Roberta Klein, managing director of the Center for Science

and Technology Policy Research at the University of Colorado, and I documented controversial claims made by each president going back to Eisenhower, including both Democrats and Republicans. For instance, Jimmy Carter set a goal of achieving 20 percent of the US energy supply from renewable sources by 2000, even though he was told it would be infeasible. Ronald Reagan wanted creationism taught in schools. The area of national security seems particularly perilous. Bill Clinton bombed a Middle East chemical factory based on supposed scientific proof that ultimately did not exist. George W. Bush justified claims that Iraq had WMDs, also on supposedly scientific evidence. And the list goes on.

Of course, for those wrapped up in partisan debates, a favorite pastime involves argument about which political party is worse in its deviation from facts accepted by the scientific community. Such debates are certainly fun -- especially on blogs and during cocktail hour -- but they have little connection to real-world issues that most people care about. (In case you are curious, most Republicans think Democrats are worse, and vice versa.)

When scientists go into political battles armed with their expertise and invoking science as the basis for their claims, they may think that they are working to improve the factual basis underlying political debates. This of course is a worthwhile ambition, and to the extent such efforts are successful, they will help to improve the quality of policy discussion.

But if scientists are not mindful of the pitfalls that accompany their efforts to insert themselves into the bright glare of political campaigns, they may find that rather than making politics more scientific, they have instead made science more political. Prominent scientists and leading scientific organizations face much greater risks in this regard than do rank and file scientists. No matter how well intentioned, actions that exacerbate the politicization of science diminish both our science and our politics.

Yes, science is being distorted. But, much more dangerous, it is being rejected. Robert Socolow | 20 October 2011

This roundtable explores "the proper scientific response to the political distortions of science." Indeed, distortions abound regarding both what science understands and how science is conducted. Of even greater concern, however, is the rejection of the scientific way of knowing -- or rather its relegation to the status of just one of many equally valid ways of knowing. If the scientific method loses its place as a privileged way of knowing, the consequences will be devastating. Developing effective responses to the rejection of science, however, will take scientists into unfamiliar territory.

Distortion. The scientific enterprise encompasses both what is understood about the natural world and a set of professional norms. Both can be distorted, out of ignorance and deliberately.

In America's litigious society, the scientific enterprise is enmeshed in conflict. Science is used selectively by those seeking to influence legislation. The scientist-as-expert-witness is hired to persuade juries. Sometimes the conflict centers on whether a glass is half full or half empty: The same fact is looked at two different ways. Sometimes how well something is known is debated. It is hardly surprising that there is so much misunderstanding about both what science has learned and how science is conducted.

With a free press and unrestricted access to decision-makers, the open society is supposed to limit the adverse consequences of such legitimated distortions of science. To provide those checks and balances, the open society must be protected. The best way forward is to shore up our democracy -- no small task when the funding of politics is skewed by corporate personhood and the cogency of the media is undermined by the leveling effects of the internet.

Rejection. More threatening than the distortion of science, however, is its rejection. At issue is whether the scientific way of knowing is privileged relative to other ways of knowing that are rooted in myth. As scientists, we are poorly prepared to respond when science is called "just a theory," on a par with other theories. We are distressed when intelligent design and evolution are placed on the same footing. We consider it self-evident that better climate science will help in sorting out threats to human well-being from climate change. Then we learn that the answer is already known: Our vulnerability is minimal because God wouldn't let climate change injure us.

Think hard about Republican presidential candidate and Texas Gov. Rick Perry's mental model, which leads him to reject climate science and cast himself as Galileo and the current science establishment as the 17th century Catholic Church. Rather than writing him off, perhaps scientists should consider this stagecraft to be a warning. Perhaps an experienced politician knows something about the state of the electorate that scientists should not dismiss. What *are* the similarities between the current scientific enterprise and the 17th century papacy? We scientists are remote, we believe we deserve deference, and we extract considerable financial resources from the general population to run our affairs. Such parallels make us vulnerable.

We must not underestimate the threat now looming. Another age of darkness could lie ahead. In what may someday be called the Science Wars, our opponents present science as dogma and construct a symmetric conflict: their dogma vs. our dogma. We are carried back to the contest set up by Elijah to determine the stronger god, described in the Book of Kings. Firewood is piled on two altars on the peak of Mount Carmel, and each group pleads with its god to create a fire. "Baal, we cry to thee" is a poignant moment in Mendelssohn's rendition.

There is no such symmetry. Science is not just another point of view. Science is a process of searching, always incomplete. Its norms include strict evidentiary standards and transparency. Anyone working anywhere can overturn a prior consensus. Safeguards against human frailty take the form of countless processes that protect decision-making from being compromised by friendship, rivalry, and financial interest.

To counter the rejection of science, perhaps it will be productive for scientists to assure that these long-tested and distinctive norms are widely appreciated. Science is usually defended differently. One strategy is to justify science through its utility -- its role in bringing about the healthier and fuller lives that nearly all of us live. A second is to appeal to the elegance of the edifice of science and its capacity to make sense of both our past and our place in the universe. Arguing for science by explaining its governing rules is, in effect, opening a third front.

In summary, to refute distortion we must first understand that distortion is often animated by rejection. And to counter rejection, we must retain -- or perhaps regain -- the public's trust. We must earn the moral high ground: No longer can we assume that others will place us there.

The time on the *Bulletin*'s Doomsday Clock would need to be advanced at least two minutes toward midnight if the scientific method were to lose its primacy, even if, in the short run, nothing else changed.