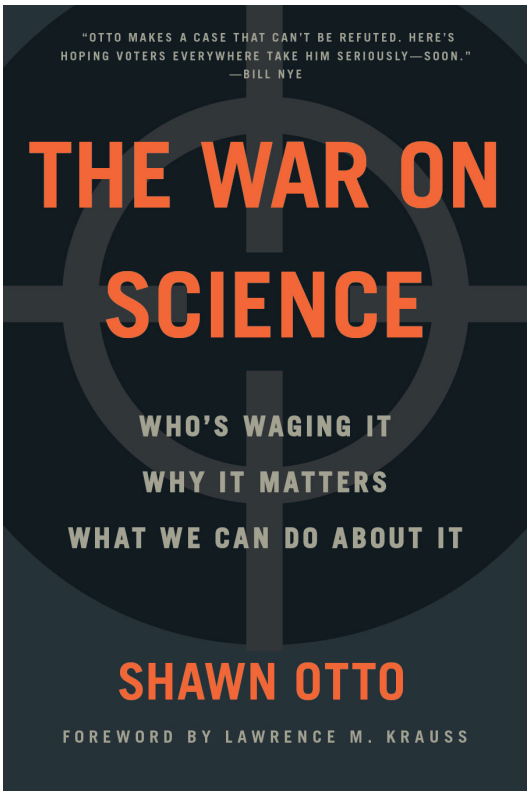
The War On Science



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"Otto makes a case that can't be refuted. Here's hoping all voters everywhere take him seriously—soon."

—Bill Nye

"There is a massive, organized, three-front war on science," asserts international science advocate Shawn Otto, in his breakthrough book, ***The War On Science: Who's Waging It, Why It Matters, and What We Can Do About It*** (Milkweed Editions, May 10, Trade Paperback, $18, 598 pages, 978-1-57131-353-9).

"It is coupled with a new rise in authoritarianism. There are things we can do to win the war and preserve our freedom, health, environment, and economy, but we must act."

Otto, whose writings have appeared in *Science, Salon, Scientific American*, and the National Academies' *Issues in Science & Technology*, is cofounder and producer of the US presidential Science Debates, the largest political initiative in the history of science. He is also an award-winning novelist and screenwriter, best known for writing and co-producing the Academy Award-nominated *House of Sand and Fog.*

"On every issue in modern society – from climate change and energy to public health and the environment, from the economy to defense to the Internet – we are in the midst of an unprecedented expansion of scientific progress and a simultaneous expansion of danger,' says Otto. "At the very time we need it most, science is being attacked in a vast, well-funded, three-front war: the identity politics war on science, the ideological war on science, and the industrial war on science. The result is an unprecedented erosion of thought in modern democracies as voters, policymakers, and justices ignore evidence and base policy decisions on the demands of the most strident voices."

Otto's compelling new book investigates the historical, social, philosophical, political, and emotional reasons why the evidence-based politics that gave birth to democracy are now in decline and authoritarian politics are once again on the rise on both left and right—and he provides some compelling solutions to bring us to our collective senses, before it's too late.

"Thomas Jefferson once wrote 'Wherever the people are well-informed, they can be trusted with their own government.' The world has changed. We now live in an age where every major policy issue is either caused by or informed by our knowledge from science," says Otto. "Candidates for public office are rarely generals or diplomats, but they readily opine on foreign policy. They are rarely economists, but they have no problem issuing sweeping economic proposals. Yet they rarely discuss the one other major subject that is truly affecting all voters' lives — science. They are intimidated by it. But in an age when science is so dramatically impacting everything, we simply have to make it a more central part of the discussion."

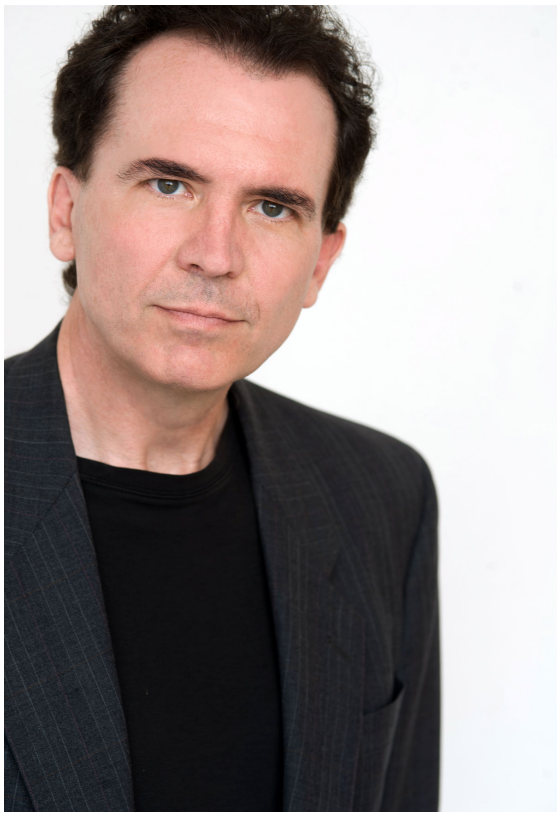
In *The War on Science*, Otto reopens the necessary public conversation on science and the common good.

Otto's book:

- Exposes the seven stages of an industrial attack on science.
- Explores why America—the winner of the science race—has since become either unaware, dismissive, or willfully blind to the problems and solutions science poses.
- Presents initiatives to reform the four major areas of our system that need to work better together: science, policy-making, the media, and the public.
- Suggests how the public can easily improve its understanding of science relative to policy issues and how the public can pressure lawmakers to use evidence over ideology and influence in their decision-making.
- Argues that science and tech issues influence our lives as much as economic and foreign policy issues, and calls for science debates (ScienceDebate.org) among the leading candidates for president and at all levels of government.
- Highlights more than a dozen areas that need to be addressed, including how our country and the world will handle climate change, energy, pandemics, science education, national security, space, genetic research, water and food safety, and health.
- Identifies the different ways the political left and political right go anti-science.
- Shows how the ideological war on science is being fought by religious fundamentalists, who object to the emerging scientific mastery of reproduction and the life cycle and seek to redefine scientific terms according to their own values — and to debate science as if it were an opinion.
- Illustrates how the political left in academia laid the philosophical groundwork for modern attacks on science, and how some professors still reject that the Earth goes around the sun.
- Explains how industry its and public-relations army, financed by corporations and conducted by PR experts, shills, and front groups, take advantage of journalists' naivety about objectivity and truth in order to manipulate the media, thereby shaping public opinion using uncertainties, deception, personal attacks, and outrage to move public policy toward an anti-science position.
- Refutes each of the top 10 climate-denial talking points.
- Offers a science pledge that citizens should demand their political representatives and candidates for office sign.
- Identifies scores of questions our Congressional and presidential candidates should answer covering areas of science, technology, medicine and bioengineering.

"In short, will we, the people, remain well enough informed to be trusted with our own government?" Otto asks in conclusion. "Winning the war on science is this generation's calling. The winners will chart the future of power, democracy, and freedom itself. This book is an account of that war, and what we — concerned citizens of all political persuasions, in all countries — can do to win it."

Shawn Lawrence Otto
Biography



Shawn Lawrence Otto is the organizer and producer of the last two U.S. presidential science debates, in 2008 and 2012, between President Barack Obama and his opponents John McCain and Mitt Romney. He is recipient of the National Distinguished Public Service Award from the IEEE-USA, the world's largest professional technology society, for "talking the lead in elevating science and technology in America's public dialogue."

Otto is also the award-winning screenwriter and co-producer of the Academy-Award-nominated HOUSE OF SAND AND FOG, starring Ben Kingsley and Jennifer Connelly.

In addition to his science advocacy and film work, Otto is the award-winning novelist of "SINS OF OUR FATHERS," finalist for the LA Times Book Prize and winner of the NE Minnesota Book Award, of the non-fiction book FOOL ME TWICE: FIGHTING THE ASSAULT ON SCIENCE IN AMERICA, winner of the 2012 Minnesota Book Award, and is editor of the collection WRITERS UNITED FOR ALL FAMILIES.

Otto is a frequent national and international public speaker and was the keynote speaker at the 2009 Nobel conference and a "warm-up act" in the run-up to the 2012 Denver US presidential debate. He is a frequent guest on NPR's *Talk of The Nation: Science Friday* and in other media.

Otto is also a frequent writer, panelist and public speaker on film, writing, politics, and science. He has appeared on NPR, PBS, CBS, FOX, NBC, ABC, MSNBC, BBC, and international media. His has written for and/or been featured in numerous publications, including Salon.com, Rolling Stone, Science, Huffington Post, Scientific American, New Scientist, Issues in Science and Technology, and MinnPost.com.

As an artist, Otto is winner of a Sloan Foundation Fellowship, a McKnight Foundation Fellowship, and is a PEN Center USA finalist. His film, House of Sand and Fog, was nominated for three Academy Awards.

Otto is a past board chair of the Loft Literary Center, America's leading independent literary center, and is the architect of their online learning program. He is married to Minnesota State Auditor Rebecca Otto, manager of her political campaigns, and lives in a wind- and solar-powered geothermal green home he designed and they built with their own hands.

For more information, please consult: http://www.shawnotto.com

Advance Praise

Evidence from science is one of the world's great equalizers, because it forms an objective basis for public policy. This book illustrates how central that notion is to the forming of modern democracy, and how current attacks on science endanger our freedom. Policymakers and voters everywhere would do well to read *The War on Science*.
—Walter Mondale, United States Vice President

Science is not a body of facts, but rather a structured approach to uncovering the fundamental laws that govern the natural world. As *The War on Science* shows, policymakers who choose to ignore those fundamental laws imperil us all, for the laws of nature will always trump the laws of man.
—Marcia McNutt, President of the United States National Academy of Sciences

We're seeing right now a titanic battle between the power of science and the power of money--and money is winning. *The War on Science* explains why, and offers some pointers that might get us back on the right track.
—Bill McKibben, Author and Co-Founder of 350.org

One of the most important books published in the last decade.
—Don Shelby, Peabody-Winning TV News Anchor

Otto makes a case that can't be refuted. Science is important to all of us, especially in a democracy. He backs it up with peer reviewed studies, carefully researched numbers, and his own extensive experience. He uses the process of science to prove that we need science in order to remain free. Here's hoping all voters everywhere take him seriously—soon.
—Bill Nye, The Science Guy

This insightful, heavily-researched book pulls back the curtain to show exactly where and how the rise of authoritarianism is being accomplished, via academic, fundamentalist, and public-relations attacks on scientists and the ideas of science that underlie modern democracy. *The War on Science* is must reading for anyone wanting to understand what's really going on in today's politics.
—Michael Mann, leading climate scientist and creator of the iconic "hockey stick" chart

Before you vote in the next election, read Shawn Otto's *The War on Science* .
— Ben Bova, Award-winning Author of the *Grand Tour* series and editor of *Omni* magazine

The War on Science dissects today's perfect storm of anti-intellectualism, one that has persuaded millions to agitate against their own interests. This book won't convert Limbaugh dancers. But it could help draw that smart engineer uncle of yours back toward the light. It might even encourage a newborn movement, to revive a science-loving version of conservatism out of the ashes.
—David Brin, Scientist and Award-Winning Author of *Earth* and *The Transparent Society*

In the struggle of people to be free, there has been one common denominator on which, like Sherlock Holmes, democracy depends—science, and the evidence it provides, as a guide to truth, fairness and justice. This insightful book explores how science became a necessary prerequisite for democracy, why it is under attack today, and what we can do to defend truth and freedom.
—Maria Konnikova, Bestselling author of *Mastermind: How to Think Like Sherlock Holmes*

How To Win The War On Science

If the messages coming from science are being ignored, misunderstood or opposed, science needs to fight back. *The War on Science* presents a 14-step battle plan to ensure that the world embraces the truths science has to offer.

1. **Do Something**
There are many things one can do, from personal actions like installing solar panels or buying into a community solar garden, to broader ones like trying to change public policy. One of the most important things a concerned citizen can do is organize, which means taking a public stand against the war on science, staging or participating in events that dramatize their concern, inviting local policy makers and media, and asking friends and family to join in.

2. **A National Center For Science and Self-Governance**
To be successful, self-governance relies upon Jefferson's edict of the well-informed voter. We cannot take that for granted; instead, we need to introduce certain safeguards to protect it. A well-endowed, university-based Center for Science and Self-Governance could work to bridge that gap. Such a center could focus academic resources on developing the scientific knowledge and legal strategies necessary to address this growing threat to democracy in a nonpartisan way.

3. **Push For Science Debates**
In an age when science drives well over half of all economic activity, what is each candidate's vision for maintaining a competitive edge? Politicians for high office should debate how they'd tackle climate disruption, how to manage biosecurity in an age of rapid international travel, and how they'd balance privacy and freedom on the Internet, or manage public health and the environment.

4. **Politicians Should Have Science Advisors**
Every legislator and executive at every level of government, from international to national to state to large municipalities, needs science advisors to navigate today's policy issues—the majority of which are science-driven—intelligently and effectively.

5. **Preaching In the Age of Science**
The magnitude of the current issues suggest that this would be a very good time for church leaders to reach out to scientists. Religious leaders need to speak out in defense of science and use houses of worship as centers for moral and ethical reflection on the new, more detailed knowledge being created by science.

6. **Teachers Should Teach Science Civics**
Schools should hold student science debates, establish cross-disciplinary science literacy classes and requirements, and seek to inform parents in the scientific process of exploration so they can serve as good role models to their children.

7. **Granting Bodies Should Require and Fund More Outreach**
Most of the public cannot name a living scientist, yet there are millions in the United States. The kind of public outreach that is needed includes reaching out to and speaking in churches, rotary clubs, and local chambers of commerce. By making scientists and science communicators known and more accessible to the public, there will be substantially more opportunities for informal exchanges and education on the key science topics of the day, increasing the role of evidence in the public dialogue—which can go a long way to countering antiscience disinformation campaigns.

8. Scientists Should Adopt A Scientific Code of Ethics

The code should lay out the moral and ethical principles under which science should and should not be conducted. It would have some means of enforcement and exposure of scientists who did not meet this standard, so the public could evaluate their claims in that context. It would have guidelines for best practices in research, peer review, independence, and disclosure.

9. Business Leaders Should Form A Chamber of Progressive Commerce

It is in the best interests of ethical companies and new-economy companies to form a new Chamber of Progressive Commerce, to work toward advancing their business interests and their ethical concerns in a common forum. Such an alliance could have the resources to counter disinformation campaigns and leverage its power to create meaningful social change, synergistically creating new markets for their superior products and services (because they don't need to employ antiscience and obstructionist tactics to prosper).

10. Diplomats and Elected Leaders Should Use Transformative Foreign Policy

If free trade is established between countries so too should a shared regulatory framework, to prevent a race-to-the-bottom exhibition of human and environmental resources simply to provide cheap short-term economic gain. Countries that exploit labor or environmental resources should be treated similarly to countries that dump currency or commodities into international markets, i.e. subject to sanctions and exclusion from key markets.

11. Candidates Should Sign Science Pledges

In order to reflect candidates' commitments to basing public policy decisions on evidence, versus opinion or belief, we need a vehicle. The Contract From America, the Taxpayer Protection Pledge, and the No Climate Tax Pledge have all sought to restrict reasoned debate. We need a pledge that seeks to expand it. Citizens can print out the Science Pledge and challenge their elected leaders to sign it. The Science Pledge asks candidates to commit to the kind of civic-minded leadership citizens are owed in a democratic republic, where decisions are based on evidence when such evidence exists. It seeks to separate freedom lovers from authoritarians, data-based decision makers from those governed by "but faith, or opinion" and independent thinkers from ideologues.

12. Editors Should Insist on Pro-Evidence Journalism

Investigative journalists should target the fraud of science denial. Science is as foundational to a functioning democracy as journalism. The first gathers evidence on which policies should be based, and the second disseminates that evidence and reports on those policies to the public. There needs to be more reporting based on that evidence and not on subjective perspectives on politics, and a lot more reporting on what is happening to democracy's instruments of self-governance: evidence gathering, evidence-based reporting, and evidence-based policymaking. Is this value-slanted? You bet it is, in favor of democracy.

13. Scientists Need to Fight Back

Scientists must call out antiscience activities.

14. Voters Should Support Candidates Who Support Science

Reject political candidates who ignore the problems and solutions presented by science

Shawn Otto Q&A
The War on Science

1. **Shawn, why, as your book states, is there a war on science?** Science creates knowledge about reality, that knowledge creates power, and that power is political, because it either confirms or disrupts vested interests. Right now the vested interests in academia, religion, and industry are all being threatened in various ways by what science is telling us about the world, and they are fighting back by attacking science.

2. **Exactly who is waging this war?** Left-wing academic authoritarians, right-wing ideological authoritarians, and industrial capitalist authoritarians.

3. **What can be done to counter those who dismiss, ignore, argue against, and selectively deny science?** We need to fix our broken media and education systems, renew our value of science being important to freedom and democracy, call authoritarianism what it is, and create a stigma and penalties for those who use public relations campaigns to defraud investors, their followers and the public into supporting policies that run counter to the evidence.

4. **On the other hand, scientists throughout history have made mistakes, faked results, or postured theories that didn't hold up. What's wrong with a friendly debate about what scientists present to us?** Scientists debate all the time, that's part of the whole process of science, but they base their arguments on evidence. There's a big difference between that and the authoritarian approach of cherry-picking only the evidence that supports your foregone conclusion. That's not critical thinking, that's ideological thinking with a pre-determined agenda, or its public relations designed to manipulate. In either case it's authoritarian.

5. **What role is politics playing with science?** Science creates knowledge, knowledge is power, and that power is political. There will always be people with power, status, and money who are threatened by contradictory science, and who will be tempted to deny, quash, or destroy it. At the same time, they will often begin to ramp up their political giving in at attempt to sway policy.

6. **What role is religion playing, too?** Religious fundamentalists oppose what science suggests about our origins and control of the human reproductive process. They provide the foot soldiers for industrial interests opposed to what science suggests about environmental and health regulations. We see a similar drive in fundamentalist Islam, with the rise of groups like *Boko Haram*, whose name roughly means "Western knowledge is forbidden." What religion could do to have a more constructive relationship with science is to help guide moral and ethical discussion about the real issues the new, increasingly detailed knowledge from science is uncovering, instead of denial. This would help followers navigate an increasingly complex moral world.

7. **What do you mean when you say there's been a rise in anti-science news media?** Over the last two generations, journalists have been taught that there is no such thing as objectivity. This is repeated by major journalists and in reporter guidelines. Its intent is to make journalists own their biases, but it has created a more pernicious problem: false balance. Journalists, many of whom hated their high school science class, ran into the humanities in college and wound up in journalism. There they were taught there's no such thing as objectivity. But there are more and more policy issues are in fact deeply influenced by the objective knowledge science is creating, and these journalists are poorly equipped to inform the public, because they are biased against the

idea of objective knowledge in the first place. So you'll see stories or split screens on TV where one half has a somewhat boring scientist speaking in paragraphs about the objective knowledge we've been able to establish based on tens of thousands of experiments, and the other half has a charismatic person articulately and passionately arguing an opinion that runs counter to the science, and the journalists think they've done their job, when in fact they've elevated extremist views, fueled partisanship, and created a false balance between knowledge and opinion.

8. **How can we sustain a world when there's an ideological war on science?** The ideological war on science is coming from religious conservatives uncomfortable with what science is saying about origins and human reproduction, and in some cases about dominion and thus regulation. They deny science in order to impose their religious caliphate ideas, whether it's a Muslim caliphate or a Christian evangelical state, through taking over the government so they can "make disciples of all nations." It's a moral issue for them. They can be defeated in a democratic society when people who care about the ideal of secular democracy based on evidence take a stand against this kind of religious authoritarianism and discredit it in society.

9. **How will we get truth to win out? What are some steps that need to be taken?** We need to set a higher bar in journalism and education, and we need to find ways to inject science and reason back into our political dialogue, and to hold vested interests who deny science, through major PR campaigns seeking to influence policy, accountable for defrauding the public. This is why several countries now are looking at science debates as one option. By bringing politicians together with scientists, journalists, and the public, we can help ground the discussion in what we actually know from evidence instead of what sounds good as a sound bite, and in this way hold politicians and journalists to a higher standard. I go into many others in the book.

10. **Do you believe we've entered a new Dark Age? Why**? No. Science and technology are growing so advanced that most average people can no longer connect with them on a know-how level, so they're becoming effectively indistinguishable from magic. In that way, it is not unlike the disparity that existed during the dark ages between the educated few at the top of the ruling class and everyone else. Ignorance and fear make us vulnerable to manipulation by vested interests with political agendas. Are we in a new dark age? No. Science has never been more advanced. But are we in danger of entering a new dark age? Absolutely.

11. **In 2008, you formed an organization called ScienceDebate.org, to push for debates of science issues in the presidential election. We're now in the 2016 race. How do things look?** Not great. The leading republicans deny climate change and other science, such as vaccinations, and the media do little to hold them accountable. I spent hours negotiating with the democratic campaigns, trying to get them to attend a primary debate dedicated to the science issues that are impacting everyone's lives, to no avail. I had a network producer, but the campaigns said they would do it if the DNC pushed it, and the DNC said they would do it if the campaigns wanted, and it was the chicken and the egg. There's something wrong when you have Leonardo DiCaprio using his Oscar speech to talk about climate change but journalists and presidential candidates are largely ignoring science. There were two debates following the Paris accord, one republican and one democrat. This was a massive international accord involving nearly 200 countries to start to remake the world's economy and get us off carbon, and not one of the journalists in either debate asked a single question about climate change. And that's just one example.

12. **President Obama seemed to support science and the global climate meltdown movement, but was he able to get any meaningful legislation passed in 7 ½ years on these issues?** In his first state of the union speech, Obama asked Congress to send him a climate bill that put a cap on carbon. The House complied, with 8 Republicans votes. But he underestimated the opposition and

didn't come out fighting aggressively on it, and that left a lot of room for folks like CEI and Americans for Prosperity to wedge an opening and eventually kill it in a Democratically-controlled senate, which was remarkable. It was a brilliant campaign on their part. After that, he really seemed to step away from the scientists he'd put into his cabinet. He banned the words climate change, everyone had to talk about the new energy economy instead. He then attempted to address it on his own via the Clean Power Plan, but the courts are still involved in that.

13. **It seems with the advances of genetics, robotics, astronomy, bioengineering and all areas of science – coupled with our improved ability to locate and share information via the Internet – shouldn't this be a golden era for the scientific advancement of humanity?** It is, and that's part of the problem. It's the very speed and complexity of the advances that is causing much of the issue. As power is placed in the hands if the individual, so is disinformation, and the arguments over what is real and what isn't that once happened on a societal level are being disaggregated down to the individual level, and individuals are picking and choosing what to believe based on political and emotional factors. We need a new model for the age of science.

14. **Is the world looking to science and technology to address the very problems that it doesn't even fully acknowledge to exist? What happened to common sense, strong political will, and fact-based policy making?** Well that's certainly true in the case of climate change and the talk of geoengineering: just let the smart people handle it for us. We'll outsource that. But as Rush Holt once said when we copresented together in Missouri, if the science shows that it's our collective individual actions that are causing the problem, then it's reasonable to look at changing our collective individual actions as the way to solve the problem, and that's as much a policy approach as it is a science one. It's also the crux of the political argument we're having right now on a wide variety of topics from guns to climate: where to draw the line between individual rights and responsibilities, or in other words between my fist and your face. That government exists to prevent the "wild west" seems lost to a generation where psychology-based marketing is largely geared toward self-fulfillment and lifestyle.

15. **If science offers a remedy to a problem, why are policy makers increasingly unwilling to pursue such a solution?** Because policymakers are increasingly influenced by the spending of vested interests. Most of them don't have science advisors and in America they have closed their science advisory body, the Office of Technology Assessment, and so they largely rely on lobbyists and the Internet for their science information, neither of which are very reliable sources. They sometimes have scientists in to present in committee, but in the end it's about getting re-elected for many of them. It's hard to say "I'm going to do what the evidence suggests even if it's not popular with the people that could run ads and PR campaigns against me." And on the other hand, they also want to please the squeakiest wheel, and so they seek to find a compromise.

16. **You say the debate over science now extends to engineering as well. How so?** The growing sophistication of science and engineering is causing a split between the science-literate and those who are not. People often think of political attacks against scientists. But now we see engineers being, for example, arrested by science-illiterate law enforcement officers who fear that they are making bombs or compromising national security. This happened last year to the chair of Temple University's physics department, Xi Xiaoxing, when the FBI arrested him for passing the design for a pocket heater to China. Except it turned out that the FBI agents didn't know what the design was, and it wasn't for a pocket heater at all. Then there was the case of Ahmed Mohamed, who likes robotics and electronics. He brought a clock he'd made to school and was arrested by Texas authorities who thought it might be a bomb. When we are ignorant, our fears (and things that go along with fear, like racism and nationalism) become the fallback, as they appear to have been in these two cases.

17. **Is science outpacing the ability of governments or citizens to fully grasp its findings?** No. People are smart, and even those who haven't studied science can understand it when the process is broken down and explained to them so they can see it with their own eyes and reason through it. The problem is that we rarely do that, and because science is now so complex, with new science standing on a foundation of older science, there's more and more explanation that has to be done, and we have a generation of elected officials who were taught with postmodern methods that presume objectivity is false to begin with, so we've literally got the impassioned blind leading the slightly less impassioned blind in many cases. So the Idiocracy is spreading.

18. **You state the George W. Bush presidency was profoundly anti-science. How has that distorted current debates about science?** He took an authoritarian approach. By denying access to journalists that challenged him, he cowed them on coverage of the Iraq War rationale and other areas. He appointed ideologues that replaced science with ideological views on the NASA and CDC websites and banned scientists like James Hansen from talking directly to the media. He elevated faith-based initiatives that were contradicted by science, and did the same thing in reproductive medicine and environmental regulations. He made loving science and being politically conservative almost mutually exclusive as a political strategy, and they really are not.

19. **Your book details how historically scientists have always been opposed, initially, by the politicians or clergy leaders of the day. But you also showed how science was right and eventually won out. Why are we still repeating the same mistakes today?** I wouldn't say they've always been opposed, but it's happened often because science is a creatively disruptive process. New knowledge is commercialized and vested interests are built up on it. Then even newer science comes along and shows aspects of the knowledge underpinning the old vested interests to be flawed, and that poses a threat. Pesticides in the environment, oil and climate change, etc. What's important is to realize this will happen, and to develop policies to protect the science and the less powerful and to allow for change to happen in an orderly way.

20. **When did scientific truth become subjective**? It's not, but a lot of academics became confused with the rise of postmodernism and the claims by people like Thomas Kuhn that science only progresses in sudden mystical paradigm shifts after resistance to new knowledge is overcome. This is nonsense. A friend of mine recently voted to deny the tenure of a fellow professor who taught that we can't know for certain that Earth goes around the sun. He was overruled by other humanities professors on the tenure committee who thought she was right, and told him to read Kuhn. We can't really know anything since all knowledge can be overturned, they argued. Kuhn and other postmodernists confused the process of science with its politics. But in fact, knowledge progresses much more like a pack of dogs after a fox, sniffing in all sorts of holes and bushes, than a revolution. What "revolutions" there have been were anticipated by other scientists, and included and expanded the prior knowledge rather than overturning it. Scientists are generally both cautious and open-minded, and they love embracing the cutting edge because that's where progress is happening and careers are made and remade. Kuhn got it all wrong. Science is not about subjective beliefs that are clung to by a curmudgeonly power elite until a new subjective belief overturns them. It's about how we slowly cull what is provisionally objectively true from all the perceptual, psychological, social, identity, spiritual, gender, emotional and other biases that cloud our judgment and confuse us, until we are left with knowledge that we can confirm no matter who does the measuring. We call this sort of knowledge objective, and it is our primary tool for making progress and for fighting authoritarianism alike.

Selected Excerpts

Can We Manage The Scientific Revolution?

Over the course of the next forty years, science is poised to create more knowledge than humans created in all of recorded history, completely redefining our concepts about – and power over – life and the physical and mental worlds as we assume editing control over the genetic code and mastery in our understanding of the brain. One only has to recall the political battles fought over past scientific advances to see that we are in for a rocky ride. How that rush of new knowledge will impact life, how it will be applied through technology and law, and whether our societies and government will be able to withstand the immense social and economic upheavals it will bring depends upon whether we can update our political process to accommodate it. Can we manage the next phase of the scientific revolution to our advantage, or will we become its unwilling victims?

We Are Now 100% Dependent On Science To Solve Our Problems

As we are being overwhelmed by new scientific and technological developments, we also are facing a host of legacy challenges caused by commercialization of the incomplete scientific knowledge of the past. Thanks to early science, humans have prospered, but at a cost: significant climate disruption, unprecedented environmental degradation, massive extinction of other species, vast economic and power inequities, and a world armed to the teeth with the products of a military-industrial complex, including weapons that could destroy nearly all life on the planet.

Without a better way of incorporating science into our policy-making, democracy may ultimately fail its promise. We now have a population that we cannot support without destroying our environment – and the developing world is advancing by using the same model of unsustainable development. We are 100 percent dependent on science and technology to find a solution.

The Battle For The Future

Science and engineering are providing us with increasingly clear pictures of how to solve many of our challenges, but policymakers are increasingly unwilling to pursue the remedies that scientific evidence suggests. Instead, they take one of two routes: deny the science, or pretend the problems don't exist. Vast areas of scientific knowledge and the people that work in them are under daily attack in a fierce war on science. Scientific advances in public health, biology and the environment and being resisted or rolled back. Political and religious institutions the world over are pushing back against much of science and reason in a way that is threatening social and economic stability.

Are People Making Responsible Decisions?

Can it be that science has simply advanced too far? That the problems are too big or too complex, or that knowledge is now too inaccessible to normal citizens to make good decisions – decisions in their own best interest? In a world dominated by science that requires extensive education to fully grasp, can democracy still prosper, or will the invisible hand finally fall idle? Are the people still sufficiently well informed to be trusted with their own government?

The Media, Scientists & Politicians Don't Use The Same Math

Another part of the problem may be that journalists, scientists, and politicians each approach questions of fact from differing perspectives. Journalists look for conflict to find an angle, so there are always two sides to every story. Bob says 2+2=4. Mary says it is 6. It sounds surprising, but Mary may have legitimate reasons for her perspective. The media outlet gets a good headline and an interesting story, the controversy rages, and newspapers or web clicks are sold. A scientist would say that, based on the knowledge built up from observation, one of these claims can be sown to be objectively false and it's

poor reporting to paint this as a controversy, because it's not. Using four apples, the scientist can quickly and objectively demonstrate that Bob is right. Not so fast, a politician might answer. How about a compromise? Soon we see a new law affirming that 2+2=5. This is democracy's problem, in a nutshell, in the age of science.

The modern journalistic approach does not work when applied to scientific questions, and it tends to skew public policy in counterfactual directions, as the above example shows. This is a bit ironic because journalistic techniques were originally developed as a means of fact-checking, akin to replication and peer review in scientific research.

When Facts Don't Matter

Scientists will tell us this is just plain wrong. Facts are facts. They're not fungible, and these people are just poorly educated. The problem is that the public doesn't view science as a collection of facts that can't be argued with. In fact, some studies suggest that the brain processes facts and beliefs in essentially the same way. Thus, when a fundamentalist Christian say she believes as a fact that God created people literally as described in the Bible, she means it, in the same way that a scientist believes a factual statement about evolution or geology. This underscores how critical the distinction is between knowledge and opinion, and how hopelessly entangled the conflict between science and politics sometimes seems.

Opponents of evolution, climate disruption, vaccines, birth control, stem-cell research, HPV vaccination, sex education, and other science issues are all using the same methods. Motivated by the sense of identity, belonging, and purpose they receive from these well-funded causes, thousands of laypeople are delving into geology, biology, immunology, paleontology, statistics, climatology, meteorology, geophysics, and oceanography, with the support of churches and industry-funded front groups who, like the Cornwall Alliance, preach a gospel of biblical fundamentalism mixed with a heavy dose of Ayn Rand free-market economics, science denial, and anti-tax ideology. This anti-science militia is aided and abetted by trained scientists and professors like Fred Singer, Willie Soon, David Legates, and Michael Behe, who supply a steady stream of pseudoscience that can be used by foot soldiers to sway the public debate.

Science-Driven Market Economics At Play

Science-driven market economics began to change the planet. Today, the majority of the policy challenges facing the leading governments revolve around science as either the dominant cause or the best hope for solution or both. But the solutions science suggests are often at odds with massive industrial investments and distribution systems. In order to protect their business models from regulatory disruption, several industries have begun to develop business strategies to coopt or create uncertainties about science that does not support their business models. For ideas on how to do this, they turned to the arguments first developed by the postmodernist and religious wars on science, and merged them with new insights from the burgeoning field of public relations.

The Crisis Point

Clearly we have reached a crisis point. Science already affects every aspect of life, yet voters are increasingly unable to make decisions grounded in it. Our quality of life, our economy, the existence of the middle class, and the ongoing viability of the planet hang in the balance. The breakdown in our policymaking apparatus presents perhaps the greatest moral and political dilemma in human history. How are these factors likely to lay out in the near term? Understanding this is the first step in winning the war.