Chapter 12
Battle Plans

> Scientists would see no reason why, just because the individual condition is tragic, so must the social condition be. Each of us is solitary: each of us dies alone: all right, that's a fate against which we can't struggle—but there is plenty in our condition which is not fate, and against which we are less than human unless we *do* struggle.
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> Most of our fellow human beings, for instance, are underfed and die before their time. In the crudest terms, that is the social condition. There is a moral trap which comes through the insight into man's loneliness: it tempts one to sit back, complacent in one's unique tragedy, and let the others go without a meal.
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> As a group, the scientists fall into that trap less than others. They are inclined to be impatient to see if something can be done; and inclined to think that it can be done, until it's proved otherwise. That is their real optimism, and it's an optimism that the rest of us badly need.
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> —C. P. Snow, 1959

What Must Be Done

We've now had the briefest of tours of the vast intellectual, ideological, and economic war on science. We know who's waging it, we know why, we've seen some of the political changes in Western society that have allowed it to spread and that it has caused, and we know what the stakes are if it is not won. We've examined some of the generals on either side of this war, and we've explored what it is in our own minds that makes us such easy targets for conscription on one side or the other.

We've also looked at the issues that form the conditions—the intellectual soil, if you will—of the whole debate: that science has succeeded beyond our wildest dreams, and that, in so doing, it has torn away some of the spiritual

mysteries of life and disrupted our sense of our place in the cosmos. But more importantly, it has enabled us to increase our population and our environmental impact beyond the capacity of our one small planet to support us. This, above all else, is breaking apart the foundation on which modern society has been built—that individuals, acting in their own self-interest in a free marketplace, can deliver the highest and most efficient good to society, and that such economic activity can expand without limit. Population plus individualism plus technology may be our ultimate undoing.

But the operative word of course is *may*. As we've heard Jane Lubchenco and Simon Levin argue, science has been able to resolve such dilemmas before. Life is not a zero-sum game; the pasture's bounds can be increased. The tool for that increase is the human imagination and its capacity for problem solving and innovation. And while taking a square look at the challenges is daunting and may make it seem as if all hope is lost, all hope is not lost. The human capacity to innovate can always be unleashed, given the right support and circumstances. We know what it takes—a marriage of science and engineering with creativity, artistic design, a vibrant exchange of ideas, freedom of inquiry, investment in and support of basic research, ambition, and cultural support. Those are the elements that have always produced giant leaps forward, and they certainly can again.

But we are running out of time. When policymakers could be encouraging innovation, far too many are fighting against it. When the media could be reporting on the true state of affairs, far too many are making facts up, using false balance, shying away as if they are intimidated, and abdicating their role as democracy's feedback mechanism. And when religious leaders could be parsing great human questions, they are too often flailing in an intellectual quagmire of fundamentalism and free-market libertarianism.

We need to beat back the war on science in order to provide the space, resources, money, and motivation to research, to learn—and, finally, to bring our many fragmented cultures together in common cause. That means drawing some moral lines in the sand. Attacks on science are attacks on democracy and freedom, and we need to start treating them with that level of seriousness and sanction in our public discourse and legal system. As tobacco companies were found liable for misleading the public, which led to increased deaths from cancer, so too should we look at sanctioning other companies and privately funded networks of think tanks who engage in disinformation campaigns to spread "uncertainties" about science they know there is no real uncertainty about.

Because of this quality—that attacking science is attacking the foundation of democracy—democratic forms of government need to take such attacks extremely seriously, and to enact legislation that fights them back. Additionally, the other institutions of civil society should and can do their part to battle back the war on science.

There is no one strategy by which the war may be won, no nuclear option, no shock and awe. But there are many individual battle plans. Some of them can come from government, some of them from within academia, some from business or religious institutions, and some of them from concerned individuals who have had enough and want to do something. Each of these plans deals with different factors that allow antiscience to thrive, and each can contribute in important ways to a new future. In aggregate, they may help to bridge the gaps between science and society, and to push the forces of antiscience back. The list is by no means intended to be complete or inclusive; it is merely offered as a starting point.

Battle Plan 1: Do Something

The summer of 2014 was the hottest that had ever been recorded up until then. By September, a critical mass was being reached. More than three hundred thousand people demonstrated in the People's Climate March in Manhattan as the United Nations gathered for a summit. The march brought together a coalition of more than 1,500 groups and was organized by 350.org, the climate action group founded by environmental writer Bill McKibben. The group Avaaz, another organizer of the march, presented a petition with more than 2.1 million signatures demanding action on climate change. "It's a testament to how powerful this movement is," said Ricken Patel, the executive director of Avaaz. "People are coming in amazing numbers."

What made the march so successful was the size of its coalition, its multipronged approach to communication, and the passionate involvement of individuals and their social networks, according to a study of the event by sociologists Dana Fisher and Anya Galli of the University of Maryland's Program for Society and the Environment. Thirty-three percent of survey respondents found out about the march from an organization or group, 22 percent found out from flyers or posters, 21 percent found out from social media, and 18 percent found out from websites. The findings show that, although the Internet was an important channel for publicizing the event, traditional media were equally important. However, personal networks ruled above all: when

asked about how they found out about the event, 42 percent of participants mentioned family or friends. Social networks also played a central role in bringing people out to the streets. Most people (60 percent) came to the march with friends or family, whereas just under 20 percent came with organizations. Personal connections and personal actions by concerned individuals made all the difference.

Fed up by lack of policy action on climate, more and more individual citizens are getting involved in a wide variety of creative ways. In the process, they are becoming one of the major anti-establishment social movements of the twenty-first century. Taking personal action in the face of policy paralysis is both gratifying and gives life meaning, and it takes only a small amount of initiative to take personal, committed action to begin to turn the war on science around.

In June of 2015, by far the hottest June ever recorded to that point, a loose-knit group of "kayaktivists"—led by local Greenpeace activists, but also involving unaffiliated individuals—paddled out to block Royal Dutch Shell's offshore drilling rig, the Polar Pioneer, from departing Seattle for the Chukchi Sea. The protest made international headlines. After weighing the mounting bad press against the price of oil and the costs of exploration, in September Shell announced it would abandon its controversial plans to drill in the Arctic "for the foreseeable future"—a decision climate activists hailed as a victory.

Environmental activism isn't the same thing as science activism, but the two are often related because science creates power and scientists are therefore inevitably political actors. These stories can provide useful models in an age when massive disinformation campaigns are heavily influencing public policy and drowning out scientific knowledge.

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 policymakers and media, and asking friends and family to join in. You don't need to hop in a kayak or march in New York City. You can start wherever you are. Identify a need and do something about it. Use your life as a tool to live your values, and you may find you are coming alive for the very first time. Create a narrative. Invite the press. Use the Internet and social media to reach out. It will give you a chance to give your life new focus and integrity. That's what the six cofounders of ScienceDebate.org found. We began to change the national conversation around science in public policy and influenced the president's selection of

top scientists to cabinet-level positions. I have advised similar efforts in other countries. By changing the conversation, we can change the politics.

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. Consider one of the most successful legacy organizations now tackling the antiscience crisis, the Union of Concerned Scientists. Originally formed by scientists concerned about nuclear proliferation, since the beginning of the twenty-first century the organization has broadened its focus to target antiscience efforts such as the climate battle, to take on the US federal government over lapses in scientific integrity, and to form a new Center for Science and Democracy that focuses on many of the questions discussed in this book. Its then–policy directors Francesca Grifo and Michael Halpern were early and ardent supporters of the first US Science Debate effort, and Halpern kept fighting against the war on science over those years, helping reinvigorate the venerable UCS organization.

Another successful group is the League of Conservation Voters, which, while on the environment rather than science, has nevertheless provided an inspirational model for generating useful metrics and data to shape public opinion about issues related to environmental science.

Taking more militant action to draw attention to many science and environmental issues such as climate disruption, over-logging, and overfishing, Greenpeace has set an international model for combining civic action with creative communication to draw attention to critical issues and cast them in terms of justice. But the group also supports scientists in their work, particularly in politically contentious areas, and tracks and exposes how much money antiscience campaigns funnel into front groups to spread disinformation. Unfortunately, the group also occasionally gets involved in antiscience, such as its work in China against the adoption of GM crops, and must guard against this.

Then there's the National Center for Science Education, which is on the front lines of the battle to prevent efforts to change school textbooks to include intelligent design and climate-change denial, and to stop such efforts within schools. The group provides legal, strategic, media, and scientific resources to parents, students, teachers, and other individuals concerned about the erosion of science for political purposes in classrooms and textbooks, empowering them to do something about it and surrounding them with the support to be successful.

Students are getting fed up and acting on their own as well. Zack Kopplin,

then a high-school senior, brought together seventy-eight Nobel laureates in his 2010 campaign against the Louisiana Science Education Act, which allowed science teachers to use supplemental materials that call into question evolution and climate change. While Kopplin's effort did not get the law changed, he was so impassioned and articulate that he became a television spokesperson on these issues, triggering an ongoing national discussion, an outcome not unlike that of Clarence Darrow's. Young people can often have an outsize impact by reinspiring an older generation.

Americans United for the Separation of Church and State was founded in 1947 to work on similar issues in education and other areas where evangelical Christians have tried to insert religion into public policy. The organization increased these efforts with the rise of the religious right, fighting important battles against teaching creationism in science classes, funding religious schools through vouchers, and funding various "faith-based" initiatives, such as abstinence-only sex education, using public tax dollars.

CREDO uses an innovative model to funnel profits from its mobile phone service to fund progressive issues, many of which focus on battling the war on science. They have led the curve of a new trend in business: for-profit companies that serve social good motivations.

If one truly considers the role of business in society, it's not simply to maximize shareholder value. In fact, the *Hobby Lobby* decision expressly states the law does not require such a strict view. The role of business is rather to make life better by addressing a need—i.e., to maximize stakeholder value. That's why a business is started and how it survives in the long run. A good business makes life better for its customers. But it also makes life better for employees by organizing the market and protecting employees from risk. It makes life better for shareholders by providing a return on investment and creating real value. It makes life better for society by being a good citizen in the community. It pays for the public resources it uses with taxes. But it can't do any of these things well if it is unsustainably mining resources from the environment, dumping pollution back in, or externalizing costs that should be rightly borne in the price of the product. Such companies become combative and duplicitous, seeking to battle back all regulation so it is unfettered, when instead they should advocate for fair regulation to level the playing field so all parties can compete sustainably. The opportunities to engage constructively in the business cycle abound. Consider ways your for-profit business could rethink the old model.

A new wave of climate-focused nonprofit organizations has also recently arisen, providing excellent models to tackle issue-specific battles in the war on science. 350.org was one of the first. It focuses on climate activism through local chapters, and has led massive marches and successful efforts to get large investment funds to divest from fossil-fuel corporations. This is an argument that was not taken seriously at first by the financial industry, which is particularly limited in how it defines fiduciary duty and often conscribes its meaning to rule out anything beyond the immediate investment performance. However, with the successful association of climate risk to the risk of fossil-fuel business performance, 350's divestment movement now has a fiduciary argument that even investment advisors are beginning to take seriously: fossil-fuel companies must change or die, and there is significant market risk based on environmental issues, political issues, economic competition from renewables, and the companies' own histories of climate denial, that suggests they have looked at this and are unable to change—and so may no longer be the wise investment they once were. In fact, they are increasingly risky, and when the market moves away from them, it may move very quickly, leaving fiduciaries without enough foresight to bear significant losses.

Climate Progress, an arm of the progressive think tank the Center for American Progress, founded by ScienceDebate supporter and former Bill Clinton chief of staff John Podesta, is edited by science blogger, author, and physicist Joe Romm, who has become one of the most influential thought leaders on climate change.

Climate Nexus works to localize stories of climate change and make the issue personal, concrete, and accessible for journalists and others. ClimateDesk works in similar ways to create broadly accessible mainstream content on climate-science issues.

InsideClimate News is a small nonprofit that has hired excellent science journalists out of the mainstream media and put them to work addressing the opportunities for coverage of climate that mainstream journalism was mostly failing on. The organization won the 2013 Pulitzer Prize for its work.

The relatively new Super PAC Climate Hawks Vote, led by R. L. Miller, Hunter Cutting, and Brad Johnson, has had a powerful influence in focusing public attention on key issues, including Exxon's climate-denial funding, and on supporting candidates who are proscience.

Media Matters for America is dedicated to a similar mission of exposing and correcting (largely conservative, industry) disinformation in the mainstream

media on a variety of science- and climate-oriented topics, as well as on progressive policy issues. Its focus is to provide journalists and supporters with resources to debunk false claims in the media.

The Climate Disobedience Center is an example of a new startup dedicated to building a larger movement of civil disobedience to draw attention to climate disruption and its moral, ethical, and legal implications.

The Sallan Foundation works to disseminate information that can produce greener cities, and that exposes the climate-change disinformation battle in the war on science.

NextGen Climate has done some important work debunking the assumption, often argued but unsupported, that tackling climate change will be a hit to the economy. It funded an economic study that shows that, in fact, it will be an economic stimulus. Its associated PAC supports candidates who commit to tackling climate change. Its founder Tom Steyer knows that the best way to leverage change is by intervening in the political process in some form.

Global online networks of concerned scientists, climate bloggers, environmental groups, and energy transition experts are springing up, helping provide resources to journalists and others concerned about attacks on science and about getting the science and engineering right around politically contentious issues.

Indigenous peoples are finding themselves on the moral and environmental front lines of many climate and environmental efforts. Several First Nations in Canada are working to block fracking and the exploitation of the tar sands. American Indian tribes are using hunting, fishing, and ricing treaty rights and civil disobedience to block proposed oil pipelines. Tribes are holding powwows, press conferences, and protests, forging new alliances within the broader environmental movement and hiring legal experts to block pipeline expansion through ecologically sensitive areas.

There are other examples of activists who started where they lived. In Pennsylvania, Darlene Cavalier was a cheerleader for the Philadelphia 76ers basketball team and a Republican, but was alarmed by the erosion of science in the public dialogue. She formed ScienceCheerleader.com, an organization that grew to more than three hundred current and former NFL and NBA cheerleaders, many of them also professional scientists and engineers, who work nationally to promote science and engineering. Cavalier also ran into scientists along the way who needed research assistants, and at the same time noticed how isolated science was becoming from the public, so she helped form a

national movement to reinvigorate citizen science, connecting avid nonscientist citizens with researchers.

State-based nonprofits such as Fresh Energy and the Center for Environmental Advocacy in Minnesota and Clean Energy Action in Colorado work on moving policy at the state and local levels, which is a critical strategic approach, since battling antiscientific and anticlimate forces at the federal level has resulted in gridlock. These organizations are representative of hundreds of similar nonprofit startups. Usually involving the marriage of scientists, attorneys, activists, and lobbyists, they do original science to develop sound policy prescriptions and then lobby for legislative solutions. They provide excellent, nonpartisan, evidence-based models for citizen-led groups that focus on the intersection of science, politics, the media, and the public.

Environmental caucuses organized within political parties attempt to exert political pressure on a variety of issues. Joining or forming such a caucus gives one the opportunity to endorse like-minded candidates and recruit volunteers for their campaigns. Examples in the United States include environmental caucuses in the Democratic Party in California, Florida, Minnesota, and Oregon, as well as the National Democratic Party. Each of these was started by concerned citizens obtaining a caucus charter, gathering like-minded people, and starting to organize.

Nationally, in the United States, the National Caucus of Environmental Legislators works to provide legislators with accurate science information, resources, and policy frameworks to enact environmental legislation that is based on knowledge and evidence instead of politics and ideology.

The groups and individuals listed above are just the tip of the iceberg. The takeaway: see a need, take a stand, seek out others, and do something about it. It doesn't matter if you're a CEO or a waitress. You can indeed change the world.

Battle Plan 2: A National Center for Science and Self-Governance

To be successful, self-governance relies upon the well-informed voter. We cannot take that for granted; instead, we need to introduce certain safeguards to protect it.

The accelerating quantity and complexity of science is producing a depth and breadth of knowledge no longer possible for any one voter to attain. This has opened up an opportunity for antiscience campaigns to gain an

unprecedented foothold in the democratic process, undermining the role of science and data in decision making.

At the same time, scientific knowledge now plays a major role in most public policy challenges, and is the main arbiter and protector of individual freedom and social justice. A question arises: how best to bridge the gap between the voter and science so that democracy can be preserved?

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 problem in a nonpartisan way. An interdisciplinary approach to the study and defeat of antiscience, antidemocratic forces would be a rich, multifaceted effort with profound positive impacts for society, and would be well within the charter of most institutions of higher learning.

What would such a center look like, and how would it be guided? Efforts would naturally fall along eight lines of inquiry where the greatest vulnerabilities exist: process, journalism, outreach, education and research, electoral and public policy, foreign policy, religious, and legal.

Process Initiatives

Since we cannot know every issue of import in advance, attempting to bridge the gap must begin with corrections to the process itself. Generally, these efforts should fall along the four paths where the problems arise most often:

1. Improving the quantity and quality of media coverage of science policy issues
2. Improving the quantity and quality of scientist interactions with the public on policy issues
3. Improving the public's engagement with, and understanding of, the scientific process, critical thinking, and high-quality scientific information relative to policy issues
4. Improving lawmakers' use and mastery of science in decision making

The overall strategic approach is to consistently work at the intersection where the four quadrants of science, policymaking, the media, and the public come together. This is true even if the quadrants are only representative; i.e., the intersection is within the mind of an individual student, say, in an education initiative, or voter, in an electoral or public-policy initiative. The important

guiding principle as that to be most effective, a strategy should incorporate all four of these elements. Additionally, the approach should always take a pro-science perspective, which means a nonpartisan perspective but never a bipartisan perspective or a multipartisan "stakeholder" perspective, instead letting the chips of partisan interests fall where they may and going with what the knowledge from science suggests.

Journalism Initiatives

1. Create, host, and manage a seal of approval to certify the accuracy of online science information on contentious political issues. The *Tampa Bay Times* did something like this with Politifact.com, which became a national fact-checking site of politicians' claims that won the Pulitzer Prize. There is a need for similar fact checking of public claims about science, not just by politicians but also others who influence public policy.
2. Develop and run an interdisciplinary science-civics-journalism program to train and certify journalists to understand how to work with knowledge from science.
3. Develop a prestigious continuing-education program or fellowship for journalists that teaches them how to incorporate objective scientific knowledge into their reporting and educates them about the core roles of science and journalism in a democracy. Fellows could be certified to report on policymaking.
4. Work with journalism schools to develop curricula that refute the false notion that there is no such thing as objectivity, and to identify where objective and subjective reporting are each appropriate and where each is not.
5. At the same time, show how journalists' own biases, like those of individual scientists, can influence a story, which is why the knowledge gained from replicable science should be given higher authority, and framing a story should take that into account.
6. Create and endow a prestigious international award similar to the Nobel Prize for journalists who consistently incorporate high-quality, science-based, objective knowledge and avoid false balance and antiscience framing in their reporting on public policy and electoral politics.
7. Create a low-cost access point to full-text scientific papers for independent journalists and bloggers, as well as links to related coverage

and papers, so that knowledge is more readily accessible and easily disseminated.
8. Work with public-relations firms to create a Public Relations Code of Ethics governing the use of public deception, the third-party technique, and disinformation campaigns that challenge, skew, or cast "uncertainties" on established science. Work to create a policing mechanism.
9. Develop a method of exposing public-relations firms who act unethically in their handling of scientific knowledge.

Public-Outreach Initiatives

1. Provide and work to require mass-communication training for graduate students in the sciences, so that scientists are able to communicate as successfully as the media-trained shills.
2. Develop tools and models to reform the tenure system to encourage, honor, and reward public outreach and interdisciplinary teaching.
3. Research and develop models to refute postmodernist, fundamentalist, and public-relations ideas about science and objectivity.
4. Create a means for identifying, encouraging, educating, and venerating generalists (scientist-statesmen) who do public outreach and can help the public and scientists themselves put it all together in a big-picture sense, and research ways to develop career paths for generalists.
5. Work to reform granting organizations' public-outreach guidelines and investment to require and fund principal investigators to hire science communicators to do public outreach about their research.
6. Build a CAD-like media modeling toolbox to help scientists and science communicators to quickly integrate advanced visualization technology to illustrate complex concepts and physical interactions in concrete visual terms for the public and decision makers.

Education, Research, and University-Related Initiatives

1. Develop model curricula and provide training for science-civics classes at the secondary and postsecondary level so that non-science students develop an understanding of how science works in decision making and public policy, and how it relates to their daily lives.

2. Create and promote a standard for reproducing science-paper abstracts in plain English and suggesting how conclusions may apply across disciplines.
3. Proselytize the new reality that we are in an era of silo-breaking computational power in which generalists and aggregators are as important as specialists.
4. Work to establish viable, well-paid, and prestigious career paths for science generalists and science communicators (bloggers, journalists, and media creators).
5. Establish multidisciplinary university programs to study science denialism.

Electoral and Public-Policy Initiatives

1. Engage the public in combination with national and international science partners, news outlets, and media networks to develop and host federal and state science debates among candidates for public office, then have scientists recap and rate their answers based on what the best current science indicates, and publicize the ratings.
2. Develop a guide to making good decisions about science-related issues.
3. Using a nonpartisan team of scientists and public-policy experts, develop model bills on contentious public-policy issues based solely on the best science, and make them freely available, along with abstracts and commentary.
4. Using the model bills as a benchmark, rate current and proposed laws by how close they are to what the current science suggests, then use this to highlight differences and create public discussion.
5. Build a database of research into current and past antiscience initiatives.
6. Develop forums for the proactive discussion of the ethical and public-policy issues at hand, assuming the science is not a point of attack or contention. Too often, public-policy discussions become sidetracked by special interests into debates over the science itself. But what if the science was considered settled? Then what would the debate look like? Focusing on ethics and public policy with the science as a given can potentially provide useful models for what productive public policymaking

looks like in a science-dominated age, and may lead to leapfrogged solutions—giant insights that would not be possible to apprehend if the base of knowledge is not already a given.

7. Develop and support model policies and legislation that make it more difficult for antiscience forces to influence the public debate.
8. Develop and test model legislation limiting public-relations efforts that seek to misinform the public or cast "uncertainties" about established science.
9. Develop and test model legislation requiring full disclosure of donors and other financial supporters of front groups, astroturf organizations, and other third-party techniques of propaganda campaigns.
10. Work to restore the Fairness Doctrine in the United States and to codify it in federal law.

Foreign-Policy Initiatives

1. Develop model foreign policies at the SEEP juncture of science, economics, environment, and population control.
2. Hold and promote major foreign-policy dialogues about solving SEEP challenges.

Religious Community Initiatives

1. Initiate a religious-community-outreach program to build collaboration with the faith community to promote the use of science in decision making and policymaking, and to hold faith-oriented community discussions about the moral and ethical issues new knowledge presents, in order to help smooth the process of the social, ethical, and legal integration of new knowledge.
2. Work with faith community leaders to develop guidelines regarding when denial of science is and is not moral and ethical, and how people of faith with strongly held convictions can morally and ethically respond to knowledge from science that offends their beliefs.

Legal Initiatives

1. Develop models for working with the legal community in knowledge transfer: i.e., help formulate models for future public policy about

emerging issues to get ahead of the debate, and strategies for framing the issues in advance to avoid common political pitfalls. For example, as our understanding of the human brain and the various brain systems that can affect perception and free will continues to explode over the next 25 years, how will our legal system need to be adjusted to accommodate this new knowledge and the finer understanding of when we may or may not be able to exercise free will and how free will may be interfered with by drugs, devices or biological processes? What strategies can be developed now to facilitate that knowledge transfer and avoid lengthy public-policy battles and costly legal battles over personal responsibility?

2. Work with the legal community to develop models for legal sanctions against organizations and individuals who engage in science-denial public-relations campaigns. Misrepresentation of known facts is regulated by several federal and state laws.
3. Work with Native constitutional and indigenous law experts to develop models for defense of certain evidence-based environmental-science claims, such as danger from pollution caused by copper-nickel mining or oil pipelines, under assertion of Native treaty rights or sovereignty.
4. Continue to develop legal strategies based on extant law to force regulatory responses, such as the many cases brought by the Center for Biological Diversity on various environmental-science issues.
5. Develop a network of proscience think tanks that explore and promote the relationship between regulation and freedom: when is regulation restrictive and when does it increase freedom? Develop legal theory through these think tanks to clarify this.

Battle Plan 3: Push for Science Debates

Beyond personal activism and the development of policy responses, there is also a need to work at the level of public sentiment. "Public sentiment," Lincoln said, "is everything. With public sentiment, nothing can fail; without it nothing can succeed. Consequently he who moulds public sentiment, goes deeper than he who enacts statutes or pronounces decisions. He makes statutes and decisions possible or impossible to be executed." This is, of course, the description of a politician seeking to mold sentiment in the national dialogue of a democracy. And a key way those who care about the role of evidence in public policy can work to influence public sentiment and counter antiscience efforts is to hold science debates.

Scientific advances now influence every aspect of life on the planet, and play a major role in our most pressing policy challenges. With climate disruption, genetically modified foods, vaccines, the dangers of artificial intelligence and scores of other science-related issues in the public discourse, it is not too much to ask candidates running for national office to address scientific topics during election season.

Most Americans (87 percent) say that candidates should have a basic understanding of the science informing public policy, according to a 2015 US public opinion poll I instigated that was commissioned by Research!America and ScienceDebate.org. This finding holds true across the political spectrum, with a very large majority of Democrats, Republicans, and independents agreeing that candidates should debate key science-based challenges facing the United States, including health care, climate disruption, energy, education, and innovation and the economy. In addition, more than three-quarters of Americans agreed that public policies should be based on the best available science.

While it may be no surprise that a majority of Americans (87 percent) said scientific innovations are improving their standard of living, what is remarkable is that the presidential candidates had up to that point been mostly silent on scientific topics, with the result that less than half of voters (45 percent) said they were well informed about the candidates' views on policies and public funding for science and innovation.

Seemingly, unless the issue is mired in political ideology, such as whether girls should be given HPV vaccinations, science tends to be an afterthought in debates, town-hall meetings, and other campaign activities. This is a missed opportunity, not only for candidates, but also for voters eager to learn their positions. Evidence from science is the great equalizer in a democracy, an objective source of knowledge that can draw us together and create new opportunity. Much of the quashing of science and the passage of antiscience policies occur long after an election and sometimes with little scrutiny. Science debates can bring policy prescription into the light of day, where the public has the greatest leverage in the discussion.

In an age when science drives well over half of all economic activity, what is each candidate's vision for maintaining a competitive edge? How will the candidates tackle climate disruption? What are their thoughts on balancing energy and the environment? How should we manage biosecurity in an age of rapid international travel? Nuclear weapons? Stem-cell research? Freshwater resources? Ocean fisheries? Health care? Science education? The sixth mass

extinction? The teaching of evolution? Balancing privacy and freedom on the Internet? Is it acceptable for a president to implement policies that are contradicted by science?

Many candidates do not have science advisors on tap, and the advent of a science debate offers an excellent opportunity to correct this, and one that also provides an opportunity for scientists to be involved in helping inform public policy with objective evidence.

As it stands, it's far too easy for politicians, who largely ran away from science classes after high school and haven't looked back since, to ignore these issues, and that leaves them—and by extension, the rest of us—vulnerable to disinformation campaigns.

Science debates reunite the four fractured elements of society—politicians, scientists, the media, and the public—and bring them back together under scrutiny to discuss important science issues in a way that, if done well, is informed by knowledge instead of disinformation or uneducated opinion. The way it works is quite simple. The debate topics are the big issues of political import of the day, some of which were touched on above. The possible questions could go on for pages. In fact, when ScienceDebate.org develops its questions, they generally come from thousands that have been submitted by supporters and the public.

Beginning with these big policy questions, candidates debate in the regular format, with a skilled journalist as a moderator, accompanied by skilled science communicators to signal to the audience that this is something different, science-based, more serious.

Candidates are incentivized to base their responses on knowledge in the same way Thomas Jefferson did, instead of pandering to antiscientific political forces, because their answers are graded by a nonpartisan panel of scientists who are recognized in their fields, based on how well their policy responses were supported by knowledge from science.

In this way, the public gets a chance to assess not just the policy positions that a candidate espouses, but also their quality of thought and how realistic their responses are from a scientific, evidenciary perspective. Thus, science is re-injected into the discussion and rhetoric is tethered back to objective reality, "till the mind is brought to the source on which it bottoms," as Locke advised—advice Jefferson bore in mind when contemplating his new form of government.

If this sounds like pie in the sky, consider what happened in online forums that ran below the print stories on the candidates' responses to the early

ScienceDebate initiatives. At the time, news directors and newspaper editors told me that the idea of a science debate was a niche topic and the public just wasn't interested. But once we posted the candidates' responses online, their answers—through two presidential cycles—made close to two billion media impressions, and sparked terrific online discussions. The public was hugely interested. Science reporters wrote great stories. The information grabbed the public's attention because science was finally being presented in the form it was first born in, and in which adults are most used to taking in complex information—the ongoing national and international political and policy dialogue. The stories generated more stories, which in turn generated even more. The public, as it turns out, was hungry for this sort of information, for candidates to respect their intelligence and capture their imagination about what we can do to solve our problems.

But science debates have a much larger effect—they capture the imaginations and transform the thinking of the participants, and in so doing they transform the world. When he first ran for office, Barack Obama was not science-friendly. He was an attorney and a community organizer, with little to no interest in the idea of a science debate until we hounded him into it. But as a result of that effort, of becoming convinced of its value, and then forming a team to help him understand and answer the questions, Obama became science-literate, and he eventually came to see science as a central aspect of his administration. He appointed prominent science debate supporters who were scientists to his cabinet, more than any other president in history, and he became the first president to go into office with a science team and a science policy already in place. Just asking these questions has value because it forces the conversation.

But beyond transforming the thinking of politicians, science debates begin to break down the wall between the science community and the public. Today, science is still somewhat walled off from the general population, a subject left to experts, something noted science philosopher Karl Popper frequently warned against. Science has become commoditized. The public is merely presented with the conclusions and not exposed to the process. But watching candidates who know they will be held accountable for the scientific integrity of their remarks and positions, and watching scientists deliver that accountability by grading them and discussing where science and policy do and don't meet, helps the public become familiar with science and knowledge-based argumentation as opposed to rhetoric, to learn or relearn how to distinguish between

the two, and to use this process not only in making electoral decisions but also in discussing issues with their kids or over the water cooler at the office. By creating a means to inject the rigorous honesty of science into our political discussions, we have the opportunity to transform our public dialogue for the age in which we currently live—an age dominated by science.

Finally, science debates should not be limited to presidential or prime ministerial races. They should be held at every level of government, especially the congressional and parliamentary levels, but also in state and provincial legislatures and in mayoral and city-council races. If we want to transform the quality of the political leadership, we have to transform the quality of the debate, and science debates are the way to do that.

The fact that science debates are supported by leading figures on the political right and left provides an important means of breaking down identity politics and partisanship. Science is political in that it is a top-wing activity—i.e., it grounds arguments in facts, not in the authority claims of vested interests—but it is not partisan. There are scientists who are progressive and scientists who are conservative, but science itself is both and neither.

Battle Plan 4: Using Science Advisors More Effectively

One of the keys to winning the policy battle is winning the intellectual battle in the mind of the policymaker. The only way a policymaker can make well-informed votes on critical issues in the age of science is to have an independent, nonpartisan science advisor. Otherwise, too many policymakers are left science-blind, and key policy issues sail over their heads. The role of the science advisor is to bridge the world of science and values-based policymaking. That's not to say there are no values in science—there are values in what scientists choose to study, and in how they apply or use the results. There are values implicit in the process, including integrity, honesty, humility, self-examination, and doubt. But the process of science is values-free on the questions under study, as it was designed to be, and that is how it can claim to create objective knowledge that is independent of our values systems.

The president of the United States has a science advisor, as does the US secretary of state, as do prime ministers of several Western countries. But 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 science-driven policy issues intelligently and effectively.

If you are a scientist, reach out. You can help. Contact your mayor, city councilor, governor, or member of Congress or Parliament. Ask them if they have a science advisor. Chances are they will say no, which means they are flying blind when it comes to the complex science information that informs their policymaking, and are probably relying on lobbyists and the Internet, neither of which is a very reliable source of objective knowledge. If they do say no, volunteer for the position, and assemble a network of advisors you can go to to provide them with objective summaries of what the science says on given topics. This is an important and immediate way you can effect better policy outcomes for everyone.

One of the problems with the way the US presidential science advisor's role is structured is that the advisor is appointed by the president. This introduces partisanship in the perceptions of the advice the person provides. It doesn't mean the advice is partisan, just that the other side won't be as willing to trust the advisor and will be more likely to use the fact that she or he is part of the administration as a political excuse for ignoring advice it finds inconvenient. It is additionally problematic in countries like the United States, where Congress has no nonpartisan science advisory body of its own.

In Canada, where the Harper government first sidelined and then abolished its national science advisor position in 2008, the group Evidence for Democracy worked to build support for a number of different approaches to restore and improve scientific integrity in Canadian government offices. "We're making two recommendations," says Katie Gibbs, executive director of the group. "A parliamentary science officer and a chief scientist position. The parliamentary science officer would be an independent overseer of science in government and function somewhat like the parliamentary budget officer, auditing government science policies and reporting to the people. But there's also a role for someone who answers to the government and provides them with science advice."

New Zealand recently created a science advisor position and took a slightly different path toward the same goal. Like Australia, the country has its share of anti-fluoridation and anti-GM activists. But it generally has much less antiscience than the United States, and the hardcore religious science denial around human reproduction—stem-cell research, the morning-after pill, abortion, gay rights, etc.—never really got traction in New Zealand.

That makes it an interesting place to look at how science advice can work in government. In fact, New Zealand recently developed a solution to this problem that can serve as a model for how a successful science-advisor position could be

structured. Sir Peter Gluckman, the first science advisor to the prime minister, provides us with a case study of how his role has been structured to provide independence, and the effect that independent approach can have on politics and public policy.

> A science advisor is not just a scientist but also must have a set of skills in understanding the policy process and what we call political intelligence. One of the reasons why science academies haven't usually been effective in advising government is they haven't appreciated those nuances.
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> If the person is seen as a lobbyist for the science community, for example, the chance of failure is high. Being a lobbyist for the science community or being the public face of science is not the job; then you are simply representing a vested interest.
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> Another one is that scientists think they know a lot, and therefore when they recommend something government must act on it. The reality is scientists may know a lot but there's also a lot they don't know, and their input into the policy process may be limited. We live in a democracy, and there's more than logic that enters into political decision making. Most areas that cause contention are where the science is not complete and there are considerable values involved and the values are really what's in dispute, and the attacks on science are a proxy for the value discussion.
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> In my opinion, the science advisor has to be independent from the politics of the day. If I became a political tool of one political party or the other, the trust in what I would say to policymakers or the public would be diminished. And so the prime minister and I agreed that the post had to be independent. I was also available to and could talk to the opposition leader and to the opposition spokesman on science. As a result, I now have a good relationship and a nonpartisan relationship with both major political parties.

So how does this all play out in practice? Consider New Zealand's high teen-pregnancy rate—the same as that of Texas. New Zealanders wanted to do something about it. Looking at how New Zealand's science-advice process helped develop policy to address this issue is instructive of the independence Gluckman was working to achieve.