Merchants of Doubt

INTRODUCTION

BRIEF BIOGRAPHY OF NAOMI ORESKES AND ERIK M. CONWAY

Naomi Oreskes and Erik M. Conway are both prominent historians of science. Beyond their well-known joint work on the relationship between corporate power, media, and policymaking in the contemporary U.S., their research also focuses on the history of geology (Oreskes) and the history of aviation and spaceflight (Conway). Naomi Oreskes studied geology at London's Imperial College and briefly worked for a mining company in Australia before earning a PhD in Geological Research and History of Science at Stanford University. She has taught at Dartmouth College, New York University, the University of California, San Diego, and Harvard University, where she is currently the Henry Charles Lea Professor of the History of Science. Most of her work has focused on the history of plate tectonics and climate science. She writes frequently for the popular press and has given hundreds of public lectures, interviews, and seminars (including a popular TED Talk) about her work. Erik M. Conway has been the resident historian at the NASA Jet Propulsion Laboratory in Pasadena, California since 2004. After working as an engineer in the U.S. Navy for several years, Conway earned a PhD in the History and Philosophy of Science and Technology at the University of Minnesota for a dissertation about the history of aircraft landing gear technology. Ever since, his work has focused on the political priorities, research institutions, and scientific discoveries that have driven modern technological innovation in American spaceflight and aviation. Oreskes and Conway's most recent project, *The Magic of the Marketplace: The True History of a False Idea*, is supported by a Guggenheim Fellowship, and they are also working on a project called *The Big Myth*.

HISTORICAL CONTEXT

Merchants of Doubt focuses on the history of scientific research, public policy, and corporate marketing and public relations practices in the tobacco, chemicals, and fossil fuel industries. Oreskes and Conway show how corporations in these industries have undermined needed government regulation by paying well-connected scientists like Fred Singer and Fred Seitz to create think tanks, pose as experts, and convince the public that settled scientific research about dangerous products isn't actually conclusive. This began with tobacco companies like Philip Morris and R. J. Reynolds, which publicly denied the clear link between cigarettes and cancer starting in the 1950s. Other corporations and scientists have followed the same playbook ever since. Oreskes and Conway argue that the Cold War made this system possible by bringing atomic scientists into high-level government roles and convincing the public that any government regulation would set the U.S. on a path towards brutal authoritarianism. Virtually all of the "merchants of doubt" were physicists who first rose to prominence and made high-level political connections through Cold War military research. After the Cold War ended, Oreskes and Conway argue, these physicists remained committed to "free market fundamentalism"—or the idea that a totally unregulated free market is the only economic system compatible with democracy and progress. Based on this ideology, the merchants of doubt turned from fighting communism to fighting environmentalism (which remains their principal target today). Over time, the merchants of doubt have entrenched their power by establishing a vast network of corporate-funded think tanks and publications, as well as by weakening government regulatory agencies and broadly convincing the public that there are always multiple sides to any scientific debate. However, Oreskes and Conway also emphasize how researchers and journalists are learning to identify and circumvent doubt-spreading tactics in the 21st century by fact-checking contrarian scientists and reporting on their funding sources.

RELATED LITERARY WORKS

Since collaborating on *Merchants of Doubt*, Naomi Oreskes and Erik M. Conway have written two more books, *The Collapse of Western Civilization: A View from the Future* (2014) and *The Magic of the Marketplace: The True History of a False Idea* (forthcoming as of 2022). Oreskes's other work focuses on the history of plate tectonics (*The Rejection of Continental Drift: Theory and Method in American Earth Science*, 1999) and oceanography (*Science on a Mission: How Military Funding Shaped What We Do and Don't Know about the Ocean*, 2021). Conway's work focuses on the history of aviation and spaceflight, and his most significant book is *Exploration and Engineering: The Jet Propulsion Laboratory and the Quest for Mars* (2015). The titular "merchants of doubt" have publicized their claims through dozens of books, including Fred Singer's frequently republished *Hot Talk, Cold Science: Global Warming's Unfinished Debate* (1997) and Dixy Lee Ray and Lou Guzzo's 1990 *Trashing the Planet: How Science Can Help Us Deal with Acid Rain, Depletion of the Ozone, and Nuclear Waste (among Other Things)*. Oreskes and Conway also cite political scientist Bjørn Lomborg as part of a new generation of doubt-mongers. Lomborg is best known for his popular 2001 book *The Skeptical Environmentalist: Measuring the Real State of the World*. Oreskes and Conway's seventh chapter focuses on the controversy surrounding Rachel

Carson's *Silent Spring* (1962), which alerted the public to the dangers associated with widespread pesticide use. The epidemiologist David Michaels looks at the manufacture of doubt in other industries like food science, pharmaceuticals, and sports in *The Triumph of Doubt: Dark Money and the Science of Deception* (2020). Gale Sinatra and Barbara Hofer explore the psychological roots of doubt in *Science Denial: Why It Happens and What to Do About It* (2021). Finally, the issue of science denialism became even more prominent in global public life during the COVID-19 pandemic. Books like medical anthropologist Emily Mendenhall's *Unmasked: COVID, Community and the Case of Okoboji* (2022) and Canadian activist Nora Loreto's *Spin Doctors: How Media and Politicians Misdiagnosed the COVID-19 Pandemic* (2021) show how the same trends Oreskes and Conway explore in *Merchants of Doubt* have continued to threaten good science policy since the pandemic began.

KEY FACTS

- **Full Title:** Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming
- **When Written:** Mainly Cambridge, Massachusetts and Pasadena, California
- **Where Written:** Mainly 2005–2010
- **When Published:** May 2010
- **Literary Period:** Contemporary
- **Genre:** Nonfiction, History, Science, Investigative Journalism
- **Setting:** U.S. science, politics, and media communities from the 1960s to early 2000s
- **Antagonist:** The merchants of doubt (especially Fred Singer, Fred Seitz, Robert Jastrow, and William Nierenberg); the massive multinational corporations that use doubt as a public relations strategy (including Philip Morris and ExxonMobil); disinformation
- **Point of View:** Third Person, First Person

EXTRA CREDIT

Tricks of the Trade. The filmmaker Robert Kenner (best known for *Food, Inc.*) adapted *Merchants of Doubt* into a 2014 documentary of the same name. The documentary uses a magician as an extended metaphor for the tactics used by the merchants of doubt. Fred Singer threatened to sue Kenner over the documentary but never did.

A Legacy of Doubt. Oreskes and Conway's work shaped public opinion about S. Fred Singer so deeply that *The New York Times* interviewed Naomi Oreskes for his obituary and called him a "Merchant of Doubt" in the sub-headline.

PLOT SUMMARY

In *Merchants of Doubt*, the historians of science Naomi Oreskes and Erik M. Conway show how a small group of Cold War physicists have repeatedly undermined the push for environmental policy in the U.S. since the 1970s. Funded primarily by corporations in the tobacco, fossil fuel, and chemical industries, these physicists—most importantly Fred Singer and Fred Seitz—have argued that smoking doesn't cause cancer, the climate isn't changing, and deadly pesticides like DDT do more good than harm. While the scientific community has long reached a consensus about these issues, the "merchants of doubt"—retired lobbyists who have done no original research of their own—continue to convince much of the public and government that these dangers don't exist at all.

The authors introduce their book by recounting how Fred Seitz and Fred Singer accused the leading atmospheric scientist Ben Santer of doctoring a prominent 1995 report for the Intergovernmental Panel on Climate Change. All that Santer did was edit the report in response to peer review comments—exactly like scientists are supposed to. But this didn't matter: Seitz and Singer were media savvy and politically connected enough to ruin Santer's reputation and make the public question his research.

In the first chapter, Oreskes and Conway explain Fred Seitz got his start in the tobacco industry. In the 1950s, cigarette companies started fighting new research on the dangers of smoking by hiring scientists to publicly testify that cigarettes were safe. For two decades, the industry bombarded doctors, journalists, and politicians with misleading pamphlets and insisted that the media cover "both sides" of the research. In 1979, as part of this effort, the R.J. Reynolds tobacco company hired Seitz to manage a new biomedical research program. The program would fund research that explored other causes of lung cancer, besides cigarettes. Seitz was already a well-known physicist: he helped develop the atomic bomb and even served as president of the National Academy of Sciences (NAS). He was also a firm anti-communist who believed that private industry, not the government, should fund science.

In the next chapter, Oreskes and Conway explain how Seitz took the lessons he learned in the tobacco industry to the George C. Marshall Institute, a think tank that physicists Edward Teller and Robert Jastrow created to promote nuclear weapons proliferation and President Reagan's Strategic Defense Initiative (SDI) anti-missile system. Most astronomers agreed that the SDI would be ineffective, while a nuclear war would destroy most life on Earth. In response, the Marshall Institute publicly insisted that the Soviet Union had a superior missile defense system (it didn't) and was planning to launch a world war (it wasn't). It accused leading astronomer Carl Sagan of working for the USSR and called the NAS a corrupt, communist conspiracy group. Oreskes and Conway argue that,

with the formation of the Marshall Institute, "the right-wing turn against science had begun."

The next chapter is about acid rain. In the 1970s, meteorologists like Bert Bolin and Gene Likens discovered that industrial pollution was causing acid rain, which was destroying forests and devastating fish populations. But in the 1980s, the Reagan administration was reluctant to place regulations on polluting companies. After a joint U.S.-Canada study concluded that acid rain was a serious problem, Reagan created an independent nine-member panel to review the study and put the Cold War physicist William Nierenberg in charge. All the scientists on the panel agreed that the study was correct—except the satellite physicist Fred Singer, who accused the others of exaggeration and repeated unscientific claims from the energy industry. After the panel finished its interim report, the White House let Singer add a new introduction, in which he argued that fixing acid rain would be too expensive. Later, Nierenberg rewrote the final report's executive summary to the same effect, without the other scientists' knowledge. Based on this report, the Reagan administration declared that the research on acid rain was unsettled and decided not to regulate the emissions that cause it.

In Chapter 4, Oreskes and Conway describe how Fred Singer worked with aerosol companies to spread doubt about the growing ozone hole that scientists discovered in the 1980s. After researchers showed proved that chemicals like chlorofluorocarbons (CFCs) were destroying atmospheric ozone, Singer began publicly stating that climate change would fix the ozone hole and that CFC substitutes would be toxic (even though they hadn't been invented yet). After the UN agreed to ban CFCs, Singer continued attacking the scientific consensus. He never got the CFC ban overturned, but his personal think tank did make millions of dollars. He also influenced other contrarians like the zoologist and governor Dixy Lee Ray, who cited his writings to argue that environmentalists were trying to destroy capitalism.

In Chapter 5, Oreskes and Conway follow Singer to his work on secondhand smoke. In 1981, researchers found that even being *around* smokers could cause cancer, and in 1986, the Surgeon General released a public report confirming these findings. As the government acted to ban smoking in public places and offices, the tobacco industry started spending millions of dollars "to maintain the controversy." It hired Fred Seitz and Fred Singer, called studies it didn't like "junk science," and baselessly accused the EPA of distorting evidence. Of course, the EPA's conclusions were based on aggregating dozens of peer-reviewed studies, while the tobacco industry had no valid evidence of its own. Eventually, it just started claiming that laws against smoking would destroy people's liberty.

In Chapter 6, Oreskes and Conway explain how the merchants of doubt began working on climate change. After research in the 1960s and 1970s found that CO2 emissions could dramatically warm Earth, the White House asked leading scholars to review the evidence. Earth scientists found that climate change could be catastrophic, but economists like Thomas Schelling argued that global warming would be too expensive to stop. In a crucial seven-chapter NAS report compiled by William Nierenberg, five chapters by scientists who emphasized the grave dangers of climate change were wedged between an introduction and conclusion by economists who promoted a "wait and see" approach. Ultimately, the economists got the upper hand: the report's executive summary echoed their talking points. Even though scientists viewed the final report as "garbage," it still became the foundation for the U.S. government's climate policy. After retirement, William Nierenberg joined the George C. Marshall Institute. Along with Robert Jastrow and Fred Seitz, he started pushing the idea that the sun was causing global warming all on its own. Their work was full of serious distortions and not peer reviewed, but the White House listened to them.

Later, Fred Singer published a paper in collaboration with Roger Revelle, the scientist who first discovered that CO2 emissions could cause climate change. But Revelle suffered a near-fatal heart attack, and Singer wrote the paper all on his own. When Revelle objected to Singer's claim that global warming would probably be insignificant, Singer published the paper anyway—and kept Revelle's name on it. Reveille died shortly after. Singer started claiming that Revelle had changed his mind and stopped believing in climate change. In fact, he has made this claim for decades, and he has even sued Justin Lancaster, Revelle's former graduate student, who tried to correct the record. Finally, Singer and Seitz went after Ben Santer, the climate modeler whose case Oreskes and Conway described in their introduction. *The Wall Street Journal* published Seitz and Singer's attacks on Santer in full, but the paper heavily edited Santer's replies to make them appear unreasonable.

In Chapter 7, Oreskes and Conway explain how the merchants of doubt attacked the famed biologist and science writer Rachel Carson years after her death. Carson had discovered that the widely used pesticide DDT was extremely toxic to wildlife and published her findings in the 1962 book **Silent Spring**. Her work convinced the government to ban DDT. But in the early 2000s, contrarians like Dixy Lee Ray and Steven Milloy started accusing Carson of mass murder, based on the flawed assumption that DDT would have eradicated malaria. (But most mosquitos had already evolved immunity to DDT by the time it was banned.) While the science about DDT was long settled, Oreskes and Conway argue that the campaign to discredit Carson demonstrates why right-wing Cold War scientists turned against science itself: science had started to demonstrate "the limits of free-market capitalism."

In their conclusion, Oreskes and Conway summarize how scientists like Singer and Seitz undermine effective policy by

spreading doubt. By claiming that real scientific evidence doesn't exist and insisting that their own made-up evidence is the truth, the merchants of doubt turn science into a political game. The media continues to give them airtime they don't deserve in the name of "balance," and the public often takes them seriously because they appear to be legitimate. They work for think tanks (which are funded by polluting corporations), publish in journals (which aren't peer-reviewed), and appear to be experts (but mostly just criticize other scientists' work). Even when there's a clear scientific consensus, the merchants of doubt insist that more research needs to be done, which stops the government from taking action.

The merchants of doubt aren't just in it for money: they are also motivated by a belief in "free market fundamentalism," or the idea that the only way to preserve democracy, freedom, and technological progress is by rejecting all government regulation. Since they believe that regulation will lead to tyranny and technological progress will automatically solve all of the problems that the free markets create, they fight all regulation, no matter what the cost. As historians of science, Oreskes and Conway argue that free market fundamentalism is empirically inaccurate, but ever since the Cold War, this mindset has been deeply entrenched in many Americans.

CHARACTERS

MAJOR CHARACTERS

S. Fred Singer – Along with Fred Seitz, S. Fred Singer is one of the two central "merchants of doubt" that Oreskes and Conway focus on in their book. He was an atmospheric physicist who worked on weapons technology during World War II and helped develop key American satellites in the early years of the Cold War. Like Seitz, Singer was a free market fundamentalist who believed in fighting communism and government regulation at any cost—even if it meant brazenly lying to the public. After retiring from research, he held a number of significant government jobs and then began spreading doubt about key environmental hazards for the tobacco, chemical, and fossil fuel industries. Singer helped the Reagan administration derail an important advisory panel on acid rain: even though researchers had already reached a consensus about acid rain's sources, prevalence, and dangers, Singer argued that not enough was known about it to justify government action. He also claimed that the costs of stopping acid rain would not be worth the benefits, because he reasoned that the environment has no inherent value worth preserving. Singer used similar tactics to try to stop the U.S. government from regulating ozone-damaging CFCs, secondhand smoke, and the greenhouse gas emissions that cause climate change. Notably, Singer led a coordinated attack on the atmospheric scientist Ben Santer and persuaded the pioneering climate researcher Roger Revelle to coauthor a paper with him. But Singer wrote nearly the whole paper—he argued that global warming would probably be insignificant, and that the research was still "too uncertain to justify drastic action." Revelle disagreed with these claims, but Singer publicly said otherwise for more than a decade—and even sued Revelle's former graduate student, Justin Lancaster, who dared to tell the truth. Singer's constant deception and extreme demotion to anti-regulation, free market ideology demonstrates why Oreskes and Conway consider the merchants of doubt to pose such a severe threat to honest science and effective public policy.

Frederick Seitz – Along with S. Fred Singer, the physicist Frederick Seitz is one of the two main "merchants of doubt" whose stories stand at the center of Oreskes and Conway's book. After working on the atomic bomb during World War II, Seitz became a renowned textbook author, then president of the National Academy of Sciences throughout the 1960s and Rockefeller University for most of the 1970s. However, his strong support for free market fundamentalism, nuclear weapons development, and the Vietnam War made him controversial among fellow scientists. After retirement, he founded the George C. Marshall Institute along with William Nierenberg and Robert Jastrow, and he became a full-time merchant of doubt. Seitz worked for the tobacco industry, managing a research program designed to create "friendly witnesses" for the industry and show that factors besides smoking were the true causes of conditions like lung cancer. Seitz also played a role in starting the Marshall Institute and publicly defending Reagan's Strategic Defense Initiative against fellow scientists. Finally, he spread doubt about secondhand smoke's health effects and played a role in the campaign to discredit climate change research. In particular, Seitz fueled Fred Singer's attacks on the climate scientist Ben Santer. Seitz's success at delaying policy action on a wide range of issues showed Oreskes and Conway that the U.S.'s current political, economic, and media systems tend to reward disinformation and undervalue scientific consensus.

Benjamin Santer – Benjamin Santer is a leading climate scientist who specializes in using advanced statistical methods to analyze atmospheric data. He served as the primary author on a key chapter of the second official IPCC report, and his group was the first to definitively show that human activities are the main driver of climate change. This made him a primary target for the "merchants of doubt" (politically influential scientists who sought to downplay environmental and public health issues). They accused him of using faulty climate models, but this charge was based on a fundamental misunderstanding about his model. They also accused him of "secretly altering the IPCC report," but all he did was make ordinary changes to his work in response to peer review comments, which is standard practice for all scientists. While Fred Singer and Fred Seitz's public complaints about Santer were widely published and

repeated in the popular media, Santer's responses—and those of the dozens of other scientists who defended his research—barely found an audience. As a result, even though the charges against Santer were baseless, they destroyed his reputation and career for many years. Santer's fate shows how the merchants of doubt undermined the public's faith in legitimate science by exploiting media bias through clever public relations strategies.

William Nierenberg – William Nierenberg was a successful oceanographer and nuclear physicist who helped develop the atomic bomb during World War II and later founded the George C. Marshall Institute with his friends and colleagues Fred Seitz and Robert Jastrow. Nierenberg also led important panels on acid rain and climate change for the U.S. government. Based on their research, Oreskes and Conway conclude that Nierenberg likely edited the executive summary of the acid rain panel's report in order to make it less supportive of government regulation and therefore more favorable to polluting industry. Similarly, the report he organized on global warming emphasized economists' doubts about the cost of taking regulatory action, while minimizing climate scientists' serious concerns about the effects of global warming. A few years later, he retired and began popularizing absurd, contrarian hypotheses about climate change on behalf of the Marshall Institute. But thanks largely to Nierenberg's political connections, the government took the Marshall Institute's distorted statistics and baseless assertions more seriously than the broad consensus of peer reviewed scientific research when setting policy. Ultimately, like the other "merchants of doubt," he became a pariah win the scientific community because of his dishonest tactics.

Rachel Carson – Rachel Carson was a science writer and marine biologist who rose to international prominence for exposing the environmental dangers of pesticides like DDT in her 1962 book **Silent Spring**. Oreskes and Conway call her "an American hero" because her work contributed to the U.S. government's decision to ban DDT. But decades after her death, the "merchants of doubt" (politically influential scientists who downplayed environmental issues) began calling her a mass murderer, all based on the scientifically dubious assumption that DDT would have eradicated malaria. Her work represents an important pivot in the environmentalist movement from mostly aesthetic concerns—like preserving natural land—to policy concerns like regulating toxic industrial substances to prevent ecological damage. And the campaign against her demonstrates how contrarians reject all regulation, despite its scientific effectiveness, based on the ideology of free market fundamentalism.

Roger Revelle – Roger Revelle was a distinguished oceanographer and climate scientist who is best known for being among the first to argue that humankind's industrial CO2 emissions could cause global climate change. He advised the government extensively on climate policy, including by serving on key NAS panels, and strongly advocated taking action to reduce emissions. But at the very end of his life, Revelle agreed to coauthor a paper with Fred Singer—and then suffered a near-fatal heart attack. Singer wrote most of the paper, including several passages arguing that climate change was an overblown threat and too poorly understood to justify government action. After Revelle's death, Singer began insisting that Revelle shared his contrarian views about climate change. However, Revelle's family and his graduate student Justin Lancaster claim that Revelle regretted working with Singer and consistently viewed global warming as a serious problem up until his death. Singer sued Lancaster over his claims, but Oreskes and Conway argue that the relevant facts strongly support Lancaster's view. Singer's attack on Revelle shows how "merchants of doubt" frequently go to extreme lengths—including blatant dishonesty and baseless lawsuits—to undermine scientific evidence and prevent the public from distinguishing between legitimate and sham research.

Carl Sagan – Carl Sagan was the most famous and influential astronomer of the 20th century. He is best known for popularizing science and researching the conditions that could produce extraterrestrial life. However, he also did significant research on nuclear weapons and global warming. Specifically, he demonstrated that a nuclear war would dangerously cool Earth's climate, plunging it into a state of "nuclear winter" that would probably kill all human beings. However, he spoke publicly about his theory before formally publishing his findings. Later, he led a large cohort of professional astronomers who strongly opposed the Reagan administration's Strategic Defense Initiative on the grounds that it would be ineffective and only increase the chances of a nuclear conflict. In response, Fred and Russell Seitz attacked his research on behalf of the George C. Marshall Institute.

I. L. Baldwin – I. L. Baldwin was a bacteriologist and biological weapons researcher who wrote a critical review of **Silent Spring** in Science in 1962. While he agreed with all of Rachel Carson's conclusions, he thought that she was too "impassioned" and pessimistic about technology. In the 21st century, contrarians began citing Baldwin's review as evidence as part of a media campaign to defend DDT and promote free market fundamentalism.

Bert Bolin – Bert Bolin was a respected Swedish meteorologist who wrote an important early report on acid rain in 1971. He later helped found the IPCC and served as its first chair from 1988–1997. He was also one of the few scientists who publicly defended climate research against the "merchants of doubt" and their George C. Marshall Institute.

Martin J. Cline – Martin J. Cline is a prominent geneticist at UCLA who conducted groundbreaking biomedical research but also seriously violated scientific ethics rules in a 1980 experiment and worked extensively for the tobacco industry.

He studied the lungs' defense against cancer as part of Fred Seitz's tobacco industry research program, and he testified in court on behalf of tobacco companies, arguing that it's impossible to link any individual case of lung cancer to cigarette smoking.

James E. Hansen – James E. Hansen is a leading climate scientist and global warming activist. He is well-known for his widely broadcasted 1988 testimony to Congress, which helped make global warming a matter of widespread public concern. Robert Jastrow, Fred Seitz, and William Nierenberg seriously misrepresented Hansen's data in their lobbying work at the George C. Marshall Institute.

Robert Jastrow – Robert Jastrow was a prominent NASA physicist who became a prominent "merchant of doubt" after retirement. A strong believer in free market capitalism, U.S. global power, and nuclear proliferation, he founded the George C. Marshall Institute along with Fred Seitz and William Nierenberg to promote his views and defend Reagan's Strategic Defense Initiative plan. He published articles warning the public about an imaginary high-tech Soviet missile defense system and baselessly accused scientists like Carl Sagan of working for the enemy. He later helped steer the Marshall Institute toward climate change denialism.

Harold Johnston – Harold Johnston was the leading atmospheric chemist who first discovered that nitrogen oxide emissions from SSTs could deplete the atmosphere's ozone layer. His finding led to more important work on ozone, including the studies that discovered the dangers of CFCs. When an official government report misrepresented his research, he publicly responded with a letter in Science. While this corrected the record, it didn't reach as wide of an audience as the misleading report.

Gene E. Likens – Gene E. Likens is the pioneering biologist and forest ecologist who led the Hubbard Brook Ecosystem Study in New Hampshire and first identified acid rain as a serious problem in North America through his research there. He also served on William Nierenberg's Reagan administration panel on acid rain, where he clashed with Fred Singer and spoke out against Nierenberg for making unauthorized changes to the final summary report. After the government decided not to act to stop acid rain, Likens continued monitoring its evolution over time in the Northeast.

Steven J. Milloy – Steven J. Milloy is a tobacco and fossil fuel lobbyist who has frequently appeared in the media to spread doubt about the dangers of DDT, ozone destruction, secondhand smoke, climate change, and more. He pioneered the popular media strategy of calling research favorable to polluting industries as "sound science" and research hostile to it as "junk science." He also helped organize the doubt-spreading industry, most notably by setting up a lobbying group called The Advancement of Sound Science Coalition for the Philip Morris tobacco company.

Dixy Lee Ray – Dixy Lee Ray was a zoologist who served as the chair of the Atomic Energy Commission during the Nixon administration and later became the governor of Washington from 1977 to 1981. She was a firm anti-communist and free market fundamentalist and, after retirement, dedicated her time to fighting environmentalism. Most notably, she spread doubt about the dangers of ozone depletion and DDT in her 1990 book *Trashing the Planet*. While her writings were completely at odds with working scientists' actual research findings, they gave an air of legitimacy to the contrarian positions of people like Steven Milloy and Fred Singer.

Sherwood Rowland – Sherwood Rowland was an atmospheric chemist who won the 1995 Nobel Prize for Chemistry for his research proving that CFCs destroy Earth's ozone layer. He also served on William Nierenberg's panel to study acid rain. When Fred Singer and Dixy Lee Ray tried to undermine Rowland's research by distorting his evidence, he derided their tactics and defended himself in a major public speech to the American Association for the Advancement of Science (of which he was president).

Thomas Schelling – Thomas Schelling was the Nobel Prize-winning economist who chaired the NAS's second review panel on global warming. Based on the dubious assumption that future environmental destruction has little significant economic cost, Schelling concluded that it's best to do nothing about climate change and simply deal with its negative consequences when they arrive. The "merchants of doubt" largely imitated Schelling's "wait and see" attitude.

Edward Teller – Edward Teller was a prominent but controversial nuclear physicist who played an important role in the development of the atomic bomb. Along with other physicists like Robert Jastrow and Fred Singer, Teller worked to defend the Strategic Defense Initiative, discredit Carl Sagan's scientifically valid nuclear winter theory, and convince the U.S. government to develop and stockpile more nuclear weapons.

Ronald Reagan – Reagan was the president of the United States from 1981 to 1989. He proposed the Strategic Defense Initiative system and consistently promoted corporate interests over environmental protection concerns. To this end, his administration helped suppress its own panel report on acid rain and fought against regulation to ban ozone-killing CFCs. The "merchants of doubt" and their George C. Marshall Institute strongly supported his agenda in both areas.

MINOR CHARACTERS

Russell Seitz – Russell Seitz, Fred Seitz's cousin, is a lobbyist with links to conservative think tanks who helped spread doubt about Carl Sagan's research on nuclear winter and the damaging health effects of secondhand smoke.

Naomi Oreskes and Erik M. Conway – The authors of *Merchants of Doubt* are prominent historians of science whose

work focuses on how corporations, politics, and media influence science research and policy in the modern U.S.

Richard Nixon – Nixon was the president of the United States from 1969 to 1974. He took environmental policy concerns relatively seriously and even established the Environmental Protection Agency, but he also dissolved the President's Science Advisory Committee.

TERMS

Chlorofluorocarbons (CFCs) – Chlorofluorocarbons (commonly called CFCs or Freon) are a class of industrial chemicals, once frequently used in aerosols but now banned in the U.S., that severely damage Earth's ozone when released into the atmosphere.

DDT – DDT is a powerful insecticide that was widely used around the world for agricultural and pest control purposes from World War II through the 1980s. It made food production more efficient and helped eliminate malaria in many parts of the world, but mosquitos developed resistance to it within a few years. It also proved extremely toxic to wildlife, as **Rachel Carson** detailed in her classic 1962 book Silent Spring. Carson's work contributed to the EPA's decision to ban DDT in 1972.

Environmental Protection Agency (EPA) – The Environmental Protection Agency is the U.S. executive branch agency, established during the **Nixon** administration, that is responsible for assessing and addressing environmental threats. It has been a primary target for the "merchants of doubt."

Fairness Doctrine – The Fairness Doctrine was a U.S. federal policy that required broadcast journalists to give comparable attention to multiple competing opinions when covering controversial public interest issues. While the Fairness Doctrine was revoked in 1987, its underlying principle—that journalists should provide "balance" by portraying multiple sides of an issue—has become a norm in American journalism. **Oreskes and Conway** suggest that this has contributed to systematic media bias ever since, because covering multiple "sides" of a scientific controversy once work scientists have already reached a consensus really just means giving unearned coverage to fringe contrarians.

Free Market Fundamentalism – Free market fundamentalism is the devout belief that unregulated capitalism is the only economic system under which democratic freedoms can survive. Mainly a holdover from the Cold War, it amounts to a more extreme version of the belief that unregulated markets will always allocate resources in the most efficient possible way.

George C. Marshall Institute – The George C. Marshall Institute was the conservative think tank started by **Fred Seitz**, **Robert Jastrow**, and **William Nierenberg** in 1984 and disbanded in 2015.

Intergovernmental Panel on Climate Change (IPCC) – The UN's Intergovernmental Panel on Climate Change is a committee of thousands of scientists who advise the international community on the current state of climate research. It is widely considered the leading global authority on climate science.

Merchants of Doubt – "Merchants of doubt" is **Oreskes and Conway**'s titular term for scientists who use their political influence to undermine scientific consensus about environmental and public health issues like climate change, pollution, and the dangers of secondhand smoke.

National Academy of Sciences (NAS) – The National Academy of Sciences is the leading organization of professional scientists in the United States. It is responsible for formally advising the U.S government on the state of current science and medicine.

Nuclear Winter – Nuclear winter is the global climate-cooling effect that scientists hypothesize could result from a nuclear war.

Peer Review – Peer review is the standard process by which scientists carefully evaluate and correct one another's work before publication. It is the main benchmark that distinguishes legitimate scientific research from unproven assertion.

President's Science Advisory Committee (PSAC) – The President's Science Advisory Committee (later called the Office of Science and Technology) was a group of leading scientists who formally advised the president on science-related policy issues during the Cold War, from 1957 to 1973.

Science (Journal) – *Science* is the one of the two most prestigious and influential academic journals in the natural sciences. (The other is *Nature*.)

Secondhand Smoke – Secondhand smoke (also known by its tobacco industry name "environmental tobacco smoke") is the smoke that non-cigarette smokers accidentally inhale when near people who are smoking. It is highly toxic and causes many of the same damaging health effects as smoking itself.

Strategic Defense Initiative (SDI) – The Strategic Defense Initiative, often called "Star Wars," was an outer space-based missile defense system that the **Reagan** administration planned to build (but later cancelled) during the Cold War.

Supersonic Transport (SST) – Supersonic transport are aircraft that travel faster than the speed of sound. The U.S. government once planned to develop SSTs for civilian transport, but it cancelled these plans in the early 1970s. Concern about SSTs' impact on the atmosphere led to initial research into ozone depletion.

Tobacco Industry Research Committee – The Tobacco Industry Research Committee (later renamed the Council for Tobacco Research) was a research group that tobacco companies created to spread doubt about the health impacts of cigarette smoking from the late 1950s until the 1990s.

THEMES

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SCIENCE, TRUST, AND PUBLIC POLICY

In *Merchants of Doubt*, historians of science Naomi Oreskes and Erik M. Conway show how a small group of politically influential Cold War physicists (the titular "merchants of doubt") have tried to systematically undermine the scientific consensus on a host of environmental and health issues, ranging from the dangers of secondhand smoke to the reality of climate change. Their genuine goal is not to correct bad science or get closer to the truth—in fact, it's just the opposite. The merchants of doubt want to make truth indistinguishable from falsehood and legitimate, peer-reviewed science indistinguishable from baseless speculation. And polluting companies pay them millions of dollars to do this. They have no expertise in the fields they talk about, do no research of their own, and consistently misrepresent the legitimate research that they call "junk science." Yet, time and time again, they have successfully obstructed the U.S. government's efforts to resolve environmental crises.

The merchants of doubt succeed because they destroy the trust that effective science-related policy depends on. Specifically, Oreskes and Conway argue that policymakers, the scientific community, and the public must all view one another as honest and intent on doing the right thing if they are to work together to address serious environmental threats. But the merchants of doubt destroy this trust by undermining people's shared sense of reality. They accuse legitimate scientists of imaginary misconduct and always insist that policymakers should wait for more research to act—even when the people doing the research have already reached a consensus. This turns science policy into what Oreskes and Conway call a game of "he said/she said/who knows?" The U.S. government has since put appropriate regulations on most of the environmental hazards that the merchants of doubt defended, like secondhand smoke, ozone-depleting CFCs, and the toxic pesticide DDT. In these cases, the merchants of doubt significantly *delayed* policy action—often by a decade or more—but they did not stop it altogether. Yet there is one crucial, ongoing exception: climate change. The merchants of doubt have recycled the same strategies for half a century, and Oreskes and Conway hope that their research can help policymakers overcome them and achieve the effective climate policies that humanity needs to thrive in the 21st century.

CAPITALISM AND THE ENVIRONMENT

The "merchants of doubt" (politically influential scientists who try to cover up environmental and public health issues) are motivated primarily by an ideology that Oreskes and Conway call free market fundamentalism. They believe that a totally unregulated capitalist free market is the only way to preserve liberty and democracy. By extension, they worry that any government regulation at all—including simple laws to limit toxic pollution—will risk turning the United States into an authoritarian dictatorship. Oreskes and Conway view free market fundamentalism as a relic from the Cold War, during which scientists really *were* working to save democracy from tyranny. But today, they argue, this ideology is simply incorrect: environmental regulations, like bans on toxic chemicals, haven't destroyed American democracy in the past and won't destroy it in the future. In contrast, when governments fail to impose basic environmental regulations, they *do* seriously harm the public. They allow private corporations to poison public air, water, and ecosystems without paying for the true cost of their actions. As a result, Oreskes and Conway argue, fully unregulated capitalist markets are incompatible with human flourishing in the long term. Instead, the authors conclude that the only way for a society to achieve sustainable growth is for its government to impose regulations that force polluters to pay for the environmental cost of their actions.

MEDIA BIAS

Oreskes and Conway argue that the "merchants of doubt"—scientists who undermine the scientific consensus about environmental and public health issues—have made an outsized impact on U.S. public policy largely because they know how to take advantage of the media. Self-interested corporations pay them millions of dollars to defend dangerous products by any means necessary, including through outright disinformation. But they present themselves as legitimate, independent experts who are merely raising serious questions about other scientists' research. And the public often believes them. Oreskes and Conway attribute this pattern to a mismatch between how science works and how the media works. When many different scientists start researching a new question, they frequently disagree and formulate numerous different hypotheses. But once they do enough research and reach a consensus, there is only one "side" remaining in the scientific debate. For instance, in the 1960s, scientists weren't yet sure whether humanity was emitting enough CO_2 to permanently change the earth's climate. But after researching the subject for several years, nearly every climate scientist reached the same answer: *yes*.

Nevertheless, no matter how far along this research process is, the U.S. media generally tries to present two different "sides" of the story. The U.S. government first established this norm

through a law called the Fairness Doctrine, but now Oreskes and Conway suggest that it's just an unwritten rule. Yet, when the media looks for multiple "sides" to a settled scientific question, it often ends up giving one person's unproven opinion the same weight as a consensus that hundreds of scientists have reached after gathering and analyzing evidence for several years. This approach can give viewers the false impression that the science is not yet settled, and that each "side"—the scientists and the fringe contrarians—is making an equally legitimate point. And when corporate public relations departments back such fringe opinions, they often receive far *more* attention than the actual science. Thus, Oreskes and Conway conclude that to communicate effectively to the public, the popular media must learn to cover science in a new way. This entails taking peer review seriously, investigating the funding sources behind contrarian spokespeople, and most importantly, treating consensus as consensus.

CERTAINTY, DOUBT, AND THE SCIENTIFIC METHOD

Oreskes and Conway call the contrarian physicists at the center of this book "merchants of doubt" because their strategy depends on paralyzing serious science through uncertainty, and not disproving it through evidence. Ever since tobacco companies invented this tactic in the 1950s, contrarians have assumed—often rightly—that the government won't pass environmental regulations so long as they can "keep the controversy alive." For instance, researchers fully understood acid rain by 1981. But when William Nierenberg and Fred Singer contributed to an official U.S. government report on the subject in 1984, they argued that the existing research wasn't yet sufficient to justify government action. Proposed regulations were struck down, and a comparable law wasn't passed until 1990. As late as 2007, Nierenberg's George C. Marshall Institute still claimed that researchers haven't studied acid rain enough to truly understand it. This case shows how contrarians demand scientific *certainty* and then manufacture *doubts* to stop political leaders from ever taking action.

But when there's already substantial research on a topic, Oreskes and Conway argue, it's unreasonable to wait until everyone is totally certain about it. In the past, before the merchants of doubt arrived on the scene, the U.S. government did this right. For example, the EPA banned the toxic pesticide DDT in 1972. When evaluating the chemical, the EPA didn't ask if its dangers were "'proven,' 'demonstrated,' 'certain,' or even well understood." Instead, it wanted to know whether DDT was *safe beyond a reasonable doubt*. The burden of proof fell on the chemical company, not the government. And it called for the same standard of evidence used in criminal trials. While it's important for scientists to be absolutely sure about the claims they make—and doubly so when those claims go on to influence policy—Oreskes and Conway believe that third parties shouldn't be able to shut down environmental regulation just by voicing *any* kind of doubts about the science behind it. Instead, they argue that policymakers should learn to demand from scientists what scientists demand from themselves: not perfect certainty, but rather strong evidence that proves a conclusion beyond a reasonable doubt and passes the bar of peer review.

SYMBOLS

Symbols appear in **teal text** throughout the Summary and Analysis sections of this LitChart.

SILENT SPRING

Rachel Carson's book *Silent Spring* represents the origins of both contemporary environmentalism and the contrarian backlash to it. In *Silent Spring*, Carson showed that commonly used pesticides like DDT can severely damage wildlife and crucial ecosystems across the globe. This showed the public that, beyond simply preserving natural areas for aesthetic purposes, society also needs to regulate which toxic substances its members can release into the environment. In other words, *Silent Spring* convinced environmentalists to stop focusing on *aesthetics* and start fighting for *regulation*.

Yet *Silent Spring* also carried a troubling implication for Americans during the Cold War: it showed them that an unregulated free market is environmentally unsustainable. This is why free market fundamentalists, who believe that all regulation brings society a step closer to tyranny, have made Rachel Carson one of their primary targets even several decades after her death. After all, discrediting her would be a way for the "merchants of doubt" (politically influential scientists) to undermine the entire modern environmentalist movement.

QUOTES

Note: all page numbers for the quotes below refer to the Bloomsbury edition of *Merchants of Doubt* published in 2011.

Introduction Quotes

❝ Every scientific paper and report has to go through the critical scrutiny of other experts: peer review. Scientific authors are required to take reviewers' comments and criticisms seriously, and to fix any mistakes that may have been found. It's a foundational ethic of scientific work: no claim can be considered valid—not even potentially valid—until it has passed peer review.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Benjamin Santer

Related Themes:

Page Number: 3

Explanation and Analysis

Naomi Oreskes and Erik M. Conway introduce their book by describing how the merchants of doubt, a group of contrarian scientists, publicly attacked the leading climate researcher Ben Santer. The contrarians accused Santer of maliciously tampering with a prominent report he wrote for the Intergovernmental Panel on Climate Change—when, in reality, all that Santer did was make ordinary edits in response to peer review comments.

Here, Oreskes and Conway briefly describe the peer review process and explain why it's so important to modern science. In short, peer review is the basic litmus test that determines what counts as legitimate science at all. Whereas anyone can publish their own baseless opinions in a blog, a newspaper, or even a book, publishing a paper in a reputable scientific journal requires showing other scientists that one's work is logically coherent, consistent with other findings in one's field, and based on legitimate data.

Thus, it's extraordinarily strange that scientists would attack one of their own for participating in peer review. But this is why Oreskes and Conway begin with this example: the attacks on Ben Santer show how outlandishly the merchants of doubt distort the scientific community's norms. As the rest of the book will show, the merchants of doubt did no original research of their own, and they consistently published in mock academic journals and the popular media, where they didn't have to withstand peer review. This is because their work simply wouldn't have stood up to it: it involved so many lies, distortions, and willful misrepresentations of other scientists' work that legitimate working scientists would have never let it get through peer review. In a way, the attack on peer review is an effective metaphor for the merchants of doubt's overall campaign to undermine science, and the people who do it, on behalf of powerful polluting corporations.

> Millions of pages of documents released during tobacco litigation demonstrate these links. They show the crucial role that scientists played in sowing doubt about the links between smoking and health risks. These documents—which have scarcely been studied except by lawyers and a handful of academics—also show that the same strategy was applied not only to global warming, but to a laundry list of environmental and health concerns, including asbestos, secondhand smoke, acid rain, and the ozone hole.
>
> Call it the "Tobacco Strategy." Its target was science, and so it relied heavily on scientists—with guidance from industry lawyers and public relations experts—willing to hold the rifle and pull the trigger.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Frederick Seitz, S. Fred Singer

Related Themes:

Page Number: 6

Explanation and Analysis

The two principal "merchants of doubt" that Oreskes and Conway profile in this book are the contrarian physicists Fred Seitz and Fred Singer. Both men worked extensively to defend the tobacco industry, which first invented the doubt-mongering strategies that they later perfected. Now, decades later, the industry's internal documents have finally been released to the public, and Oreskes and Conway have combed through them as part of their research for this book. (Their work with this archive forms the backbone of the book's first and fifth chapters.)

Oreskes and Conway introduce this history in order to present their book's overall historical thesis: that the merchants of doubt consistently undermined environmental regulations by applying the "Tobacco Strategy" to other fields. This strategy is simple: corporations hire credentialed scientists to publicly criticize mainstream science. When the strategy works, corporations whose products harm people or the environment get to avoid government regulations and continue business as usual. This strategy scarcely changed over the decades when the merchants of doubt were at work, and mostly because it didn't have to. It tended to succeed because government and the media struggle to distinguish between true and imitation science—or, in some cases, fail to make this distinction on purpose, because it benefits them to side with the imitators.

Chapter 1 Quotes

Over the next half century, the industry did what Hill and Knowlton advised. They created the "Tobacco Industry Research Committee" to challenge the mounting scientific evidence of the harms of tobacco. They funded alternative research to cast doubt on the tobacco-cancer link. They conducted polls to gauge public opinion and used the results to guide campaigns to sway it. They distributed pamphlets and booklets to doctors, the media, policy makers, and the general public insisting there was no cause for alarm.

The industry's position was that there was "no proof" that tobacco was bad, and they fostered that position by manufacturing a "debate," convincing the mass media that responsible journalists had an obligation to present "both sides" of it.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Frederick Seitz, S. Fred Singer

Related Themes:

Page Number: 16

Explanation and Analysis

Oreskes and Conway's first chapter focuses on the "Tobacco Strategy" that cigarette companies used to defend their products starting in the 1950s. In particular, they emphasize Fred Seitz's involvement with big tobacco, which set the stage for his and Fred Singer's later work marketing doubt for industries ranging from aerosols to fossil fuels.

The "Tobacco Strategy" included the various components that Oreskes and Conway outline here, ranging from funding alternative scientific research to securing positive coverage in the media. But the strategy's core principle was that no amount of evidence would ever be enough to conclusively link cigarettes to health problems like cancer. In other words, no matter what researchers and the government found, the industry's private scientists and public relations spokespeople would continue to claim that the link wasn't yet proven. This is why they became merchants of *doubt*: they knew that, so long as the research on cigarettes appeared inconclusive, regulating cigarettes would appear unjustified, and tobacco companies could continue with business as usual. These tobacco spokespeople were the first merchants of doubt, but as Oreskes and Conway show in the rest of the book, they were far from the last.

Balance was interpreted, it seems, as giving equal weight to both sides, rather than giving accurate weight to both sides.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 19

Explanation and Analysis

One of the tobacco industry's key doubt-mongering strategies was convincing the public that cigarettes' link to cancer was still the subject of an ongoing scientific debate. But in reality, any debate had been definitively settled years before: scientists had long reached a consensus that cigarettes cause cancer. In order to create the impression of a lively debate, the tobacco industry convinced major news outlets to cover "both sides" of the issue—meaning both scientists' legitimate work on the link between cigarettes and cancer *and* the cigarette companies' unscientific insistence that this link didn't exist.

Oreskes and Conway point out that the tobacco companies pushed a fundamentally distorted concept of journalistic "balance" on the American media: they demanded "equal weight" for the truth and lies, as opposed to "accurate weight"—which would have meant fully exploring the data and reasoning behind each position. The legitimate scientists had years of studies to prove their points, while the doubt-mongers had nothing but baseless speculation. Ultimately, science is about finding and proving facts, and once the facts are proven, there is only one "side" to the debate. As a result, the only way to provide true "balance" in scientific debates is to listen to professional researchers and ignore the merchants of doubt who unfairly attack them.

Did they deserve equal time?

The simple answer is no. While the idea of equal time for opposing opinions makes sense in a two-party political system, it does not work for science, because science is not about opinion. It is about evidence. It is about claims that can be, and have been, tested through scientific research—experiments, experience, and observation—research that is then subject to critical review by a jury of scientific peers. Claims that have not gone through that process—or have gone through it and failed—are not scientific, and do not deserve equal time in a scientific debate.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 31-2

Explanation and Analysis

After explaining how industry leaders convinced the U.S. popular media to give equal time to "both sides" of the tobacco controversy—meaning both the scientists who proved that cigarettes cause cancer and the industry lobbyists who denied these results without any evidence—Oreskes and Conway ask if there was any reasonable justification for this imbalance. They conclude that there wasn't.

Legitimate political debates can have multiple equal sides because they're ultimately about *values*: different sides can disagree about what kind of policies to enact even though they agree on a shared set of facts. However, *scientific* debates don't necessarily have multiple valid sides because they're about the *facts themselves*. Once the facts are proven, rejecting them isn't a legitimate position in a debate—it's just denying reality. Two ways of interpreting the truth may be equally legitimate, but the truth itself is not just as legitimate as falsehoods. Of course, scientists can debate whether other scientists have collected data correctly, or whether their data are significant enough to prove a certain conclusion. Often, different sets of data will point scientists toward different conclusions. But baseless claims that don't even pass the most basic test of scientific legitimacy—peer review—don't belong in a scientific debate at all. Therefore, tobacco companies' doubt-mongering wasn't a legitimate "side" in the scientific debate about whether cigarettes cause cancer. If they had any evidence, then it would have been, but the very fact that they never found any evidence shows that it wasn't.

❝ Doubt is crucial to science—in the version we call curiosity or healthy skepticism, it drives science forward—but it also makes science vulnerable to misrepresentation, because it is easy to take uncertainties out of context and create the impression that everything is unresolved. This was the tobacco industry's key insight: that you could use normal scientific uncertainty to undermine the status of actual scientific knowledge. As in jujitsu, you could use science against itself.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 34

Explanation and Analysis

The merchants of doubt have been so effective because *all* science depends on the kind of "healthy skepticism" that Oreskes and Conway describe in this passage. *All* scientists approach the world with doubt: they don't take claims for granted unless there's evidence behind them, they try to assess every possible explanation for the evidence they do gather, and they don't accept any explanation as certain until they've ruled out all the others. Put differently, healthy doubt is key to science because it's the *only way to arrive at certainty*. For instance, nobody can truly prove that cigarettes cause cancer, or that greenhouse gas emissions cause global warming, until they rule out all the alternative explanations.

As Oreskes and Conway explain here, the merchants of doubt exploit doubt's central role in science in order to undermine science itself. There's a fine line between using doubt to establish certainty about scientific claims and using constant doubt as an excuse for saying that nothing is ever certain. For instance, proving that cigarettes cause cancer doesn't require eliminating all the other possible explanations for the correlation between smoking and cancer. But the merchants of doubt take this a step further and pretend that proving that cigarettes cause cancer requires proving that *nothing else* causes cancer. On the other hand, proving that human activities are the primary cause of global warming *does* require ruling out all the other possible primary causes. But once this is done, scientists *can* be relatively certain that humans are responsible. In this case, the merchants of doubt simply insist that closed lines of inquiry are still open: when scientists have already proven that other factors aren't responsible for global warming, the merchants of doubt ignore this research and pretend that the other factors still haven't been studied. In short, the scientists at the center of this book will gladly fight *any* scientific conclusion by taking doubt a step too far.

Chapter 2 Quotes

❝ On one level, then, the scientific process worked. Scientists took the nuclear winter hypothesis seriously, and worked through it, evaluating and improving the assumptions, data, and models supporting it. Along the way, they narrowed the range of potential cooling and the uncertainties involved, and came to a general consensus. Without actually experiencing nuclear war, there would always be quite a lot of "irreducible uncertainty" in the concept—no one denied that—but overall, the first-order effects were resolved. A major nuclear exchange would produce lasting atmospheric effects that would cool the Earth significantly for a period of weeks to months, and perhaps longer. It would not be a good thing.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Frederick Seitz, Carl Sagan

Related Themes:

Page Number: 52

Explanation and Analysis

In the 1980s, Fred Seitz applied the skills he learned in the tobacco industry to defend the Reagan administration's Strategic Defense Initiative (SDI). Led by the world-famous astronomer Carl Sagan, the SDI's detractors suggested that it would never work perfectly, which means that, in any nuclear exchange between the U.S. and the Soviet Union, at least some missiles would hit the earth. Sagan and his allies conducted significant theoretical research showing that, if even a few significant nuclear weapons hit the planet's surface, they would alter the atmosphere and cool the planet so much that it could threaten all life on earth. They called this situation "nuclear winter." Overall, they concluded that the SDI would actually make things far worse, because it would encourage more nuclear proliferation and fail to stop nuclear winter.

However, the nuclear winter hypothesis was also extremely difficult to prove, because it was impossible to empirically test. (Nobody wanted to send the world into a nuclear winter just to see if it would really happen.) This is why Oreskes and Conway argue that "there would always be quite a lot of 'irreducible uncertainty'" baked into the concept. This uncertainty made it easy for the merchants of doubt to argue that nobody really knew if there would be a nuclear winter. But, in what Oreskes and Conway view as a victory for the scientific community, other researchers refined Sagan's results until it became absolutely clear that a nuclear winter definitely *would* happen (even though nobody could predict exactly how severe it would be).

❝ Within the scientific community, then, the nuclear winter debate took place at two levels: over the details of the science and over the way it was being carried out in public. The latter created a fair bit of animosity, but the former led to resolution and closure. The TTAPS conclusions had been reexamined by others, and adjusted in the light of their research. Whether it was a freeze or a chill, scientists broadly agreed that nuclear war would lead to significant secondary climatic effects. Out of the claims and counterclaims, published and evaluated by relevant experts, a consensus had emerged. Despite the egos of individual scientists, the jealousies and the sour grapes, science had worked pretty much the way it was supposed to.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Carl Sagan

Related Themes:

Page Number: 54

Explanation and Analysis

Carl Sagan's team ("TTAPS") made a crucial contribution to Cold War-era science by demonstrating that even a small nuclear exchange would likely plunge the planet into a serious nuclear winter and threaten human survival. But in the process of doing this research, Sagan made a significant blunder: he began writing about his group's conclusions in the popular media before they published their peer-reviewed paper about it. Peer review is the basic measure of legitimate science, and other researchers still had plenty of important questions about the nuclear winter theory, so writing about it too soon was a serious *faux pas*. In doing so, Sagan seriously undermined his own credibility.

Still, in this passage, Oreskes and Conway characterize this nuclear winter research as an important victory for science overall. This is because, even if Sagan spoke too soon, the scientific community as a whole still managed to examine and refine his claims. At first, Sagan made the same error as the merchants of doubt: he asserted certain claims as scientific truths before the scientific community as a whole agreed on them. But the community did its job, tested his ideas, and reached a consensus. Once it did, these ideas became legitimate scientific claims—and very good reasons to oppose the SDI.

"Does all this matter?" he asked rhetorically. Indeed it did. Seitz was painting a canvas of politically motivated exclusion—conservative victimhood, as it were. If all this were true—or even if any of it were true—it meant that science, even mainstream science, was just politics by other means. Therefore if you disagreed with it politically, you could dismiss it as political.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Russell Seitz, Carl Sagan

Related Themes:

Page Number: 63

Explanation and Analysis

Russell Seitz, Frederick Seitz's cousin, played an important role in the merchants of doubt's effort to defend the Reagan administration's Strategic Defense Initiative and undermine Carl Sagan's research about the dangers of a nuclear winter. Seitz mixed the tobacco industry's science-oriented public relations strategies with the brazen political attacks that would later characterize the doubt-mongers' work on issues like global warming. Seitz accused Sagan's research group of several invented offenses, like using models to oversimplify the issue (even though all scientists use models). But more troublingly, he also declared that Sagan and his allies—even including the National Academy of Sciences—were part of a left-wing conspiracy to twist science to their own political ends. In other words, Seitz insisted that Sagan was inventing evidence and using it to justify a political agenda.

Of course, the irony should not be lost on Oreskes and Conway's readers: the ones who *actually* invented evidence for political reasons were Seitz and his allies. But, as the authors explain here, Seitz's ideas weren't just troubling because they were so hypocritical. They were also troubling because they undermined the very notion of objective science and a shared set of facts. According to Oreskes and Conway, Seitz told his audience that they could dismiss facts that didn't agree with their politics. This is all the more frightening because, in contrast to the tobacco controversy, there were far more than a few million smokers' lives hanging in the balance. Instead, the nuclear war debate implicated the survival of most life on earth.

Chapter 3 Quotes

So now there were two different versions of the problem. One, written by the panel, acknowledged the uncertainties but insisted that the weight of evidence justified significant action. The other, written by Singer (perhaps with help from the White House), suggested that the problem was not so grave, and that the best thing was to make only small adjustments and see if they helped before considering anything more serious. These were not the same view at all. Which one would prevail?

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), S. Fred Singer

Related Themes:

Page Number: 88

Explanation and Analysis

When the White House's official panel on acid rain published an interim report on its findings in 1983, many of the scientists who contributed to it were baffled to notice two major changes. First, the White House removed two key paragraphs about acid rain's long-term dangers, and second, Fred Singer added an alternative introduction that also played down the problem. To make matters even more unusual, the White House had appointed Singer directly to the panel, even though he had no experience researching acid rain. This strongly suggested that political influence was at play. As Oreskes and Conway explain it here, it seemed that Singer and the administration were working together to try and undermine the report. This demonstrates what happens when political leaders invite the merchants of doubt into the halls of power: evidence becomes irrelevant, science stops guiding official policy, and the people who do it start to realize that they're primarily being used for show. Unfortunately, the administration's tactics succeeded in the short term, as it successfully delayed regulations that would have limited acid rain. This example underlines why Oreskes and Conway believe it's so important for evidence, sound logic, and adherence to the scientific consensus to form the basis for official policy.

Whether or not the House Committee chairman believed Singer's claims, his letter certainly would have had at least one effect: to make it appear that the committee was divided and there was real and serious scientific disagreement. The committee was divided, but it was divided 8–1, with the dissenter appointed by the Reagan White House.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Ronald Reagan, S. Fred Singer, William Nierenberg

Related Themes:

Page Number: 91

Explanation and Analysis

While serving on the Nierenberg acid rain panel, Fred Singer challenged the rest of the committee's consensus by making a series of increasingly outlandish arguments that dismissed the significance of the problem. Most memorably, he insisted that leaders shouldn't consider natural ecosystems at all when they make policy decisions because it's impossible to quantify how much they're worth in terms of money. In other words, because nature is priceless, he assigned it a worth of zero—and then he concluded that all policy should be about weighing monetary costs and benefits. These bizarre assumptions led Singer to precisely the conclusion that the administration wanted him to reach: there was no need to take action to stop acid rain, even though it was clearly causing severe damage to fragile ecosystems.

In this passage, Oreskes and Conway succinctly explain how Singer's involvement in the acid rain panel gave the administration the cover it needed for inaction. Just like corporations create the image of public controversy by paying off a few experts to make unfounded, fringe claims in the media, the administration used Singer to create the appearance of controversy, and then used the appearance of controversy to justify rejecting regulations. This shows why spreading doubt and "keeping the controversy alive" are such effective strategies for the merchants of doubt: even if they belong to a tiny minority, the fact that they speak at all means that there are now two sides to the conflict, which makes choosing the unscientific side seem more legitimate.

Likens tried to set the record straight with an article in *Environmental Science and Technology* entitled "Red Herrings in Acid Rain Research." But in a pattern that was becoming familiar, the scientific facts were published in a place where few ordinary people would see them, whereas the unscientific claims—that acid rain was not a problem, that it would cost hundreds of billions to fix—were published in mass circulation outlets. It was not a level playing field.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Gene E. Likens, S. Fred Singer

Related Themes:

Page Number: 101

Explanation and Analysis

After the Reagan administration officially decided to do nothing about acid rain, valiant scientists like the ecologist Gene Likens continued publishing their research on the severe problems that it was causing in North America. The article that Oreskes and Conway describe here was Likens and his collaborators' attempt to reaffirm the legitimacy of their previous research and combat the misinformation spread by contrarians like Fred Singer.

However, as Oreskes and Conway note here, the merchants of doubt often spread their misconceptions much faster and farther than actual research scientists could spread their legitimate results. This was mainly because of a basic structural problem in the media: nobody but scholars read academic journals, while mass circulation newspapers often seek out controversy, treat all opinions equally regardless of merit, and fail to adequately capture the difference between a broad scientific consensus and a few contrarian voices. Thus, while Likens and his collaborators' article might have reached their colleagues—who were no doubt already on their side—it did little to correct the public record.

Necessity is the mother of invention, and regulatory compliance is a powerful form of necessity.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 106

Explanation and Analysis

At the end of their chapter on acid rain, Oreskes and Conway point out a fundamental irony in the argument that corporate polluters and merchants of doubt frequently make to justify fighting regulations. They argue that regulation reduces pollution at a great cost, because it forces companies to shut down economic activities, while market-based solutions like cap-and-trade programs are more efficient at reducing pollution and helping cleaner alternatives take hold. But actually, Oreskes and Conway argue, it's the opposite: historically, market-based solutions

have enabled regulators to keep polluting for a nominal price, while strict government regulations have forced them to innovate. The resulting innovations generate less pollution, and they also often yield better products in the long term. In other words, regulation can actually be better for the market than market-based solutions.

Chapter 4 Quotes

Singer alleged that scientists had rushed to judgment. There was a bit of serious illogic here, for if scientists wanted above all to keep their own research programs going, then they would have had no reason to rush to judgment. They would have been better off continuing to insist that more research was needed, rather than saying that there was now sufficient evidence to warrant regulations.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), S. Fred Singer

Related Themes:

Page Number: 128

Explanation and Analysis

When prominent scientists started warning governments about the growing ozone hole over the Antarctic, Fred Singer joined the debate, on behalf of polluters, to spread doubt about these findings. He published polemic editorials in the *Wall Street Journal* and *National Review*, but peer-reviewed academic journals like *Science* rejected his work because it was neither logically coherent nor based on legitimate research. Singer responded with a series of publicly accusations against the scientific community. He alleged that his fellow scientists were conspiring against conservatives, jumping to conclusions, and overstating their evidence in order to get more evidence.

In this passage, Oreskes and Conway analyze Singer's accusations—and point out the obvious contradictions within them. First and foremost, they note that selfish scientists who greedily want research funding wouldn't boldly state their conclusions and call for immediate government action. But secondly, there's also an important subtext to Oreskes and Conway's explanation: the merchants of doubt, like Singer, were the ones who *really* asked for more research. In fact, their entire strategy depends on constantly demanding more research, so that the existing work always seems insufficient to justify serious government action. While Oreskes and Conway stop short of claiming that Singer and his allies are the truly selfish ones, and that they're merely accusing other scientists of the same mistake to throw off the public, their claims do logically imply it.

In short, Singer's story had three major themes: the science is incomplete and uncertain; replacing CFCs will be difficult, dangerous, and expensive; and the scientific community is corrupt and motivated by self-interest and political ideology. The first was true, but the adaptive structure of the Montreal Protocol had accounted for it. The second was baseless. As for the third, considering Singer's ties to the Reagan administration and the Heritage Foundation, and considering the venues in which he published, this was surely the pot calling the kettle black. And we now know what happened when CFCs were banned. Non-CFC refrigerants are now available that are more energy efficient—due to excellent engineering and stricter efficiency standards—than the materials they replaced, and they aren't toxic, flammable, or corrosive.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Ronald Reagan, S. Fred Singer

Related Themes:

Page Number: 129

Explanation and Analysis

In this passage, Oreskes and Conway summarize Fred Singer's case against ozone regulation and point out why each of its elements was demonstrably wrong. Even though the science about CFCs was incomplete, there *was* enough evidence to show that they were clearly dangerous and justify immediately reducing emissions, and the international agreement on CFCs regulation (the Montreal Protocol) was specifically designed to adapt to new science. Singer's predictions about future CFC replacements were purely speculative (and turned out to be wrong). And his accusations against other scientists couldn't have been further from the truth.

While Oreskes and Conway went through the effort of refuting Singer's accusations, in the actual CFCs debate, it scarcely mattered whether they were true or not. Instead, they merely needed to give CFC producers plausible deniability in their attempts to undermine regulations. Put differently, Singer's ideas didn't need to hold up to scrutiny; they just needed to seem coherent at first, so that his allies could claim to have legitimate reasons for opposing new regulations.

Did all of Singer's efforts to discredit mainstream science matter? When asked in 1995 where he got his assessments of ozone depletion, House Majority Leader Tom DeLay, probably the most powerful man in Congress at the time, said, "my assessment is from reading people like Fred Singer."

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), S. Fred Singer

Related Themes:  

Page Number: 133

Explanation and Analysis

Tom DeLay's comment demonstrates how the merchants of doubt's strategy largely succeeded, even though virtually nothing they said was scientific—and most of the actual scientists in their orbit knew it. They didn't have to convince legitimate scientists, the majority of Congress, or even any significant portion of the U.S. public to reject mainstream science. Instead, men like Fred Singer just had to come up with an explanation that seemed reasonable enough to a small number of conservatives who held the right positions of power. In fact, even *they* didn't have to believe him—although many certainly did. Pro-business congresspeople like DeLay simply needed to be able to cite a legitimate-seeming scientific voice as a reason to avoid regulating polluters, and Singer and his colleagues were willing to say whatever they needed.

Chapter 5 Quotes

The tobacco industry was worried, very worried. It was one thing to say that smokers accepted uncertain risks in exchange for certain pleasures, but quite another to say that they were killing their friends, neighbors, and even their own children. Philip Morris vice president Ellen Merlo put it this way: "All of us whose livelihoods depend upon tobacco sales—directly or indirectly—must band together into a unified force … it's not a question of 'are we going to do well or badly … this year?' It's a question of: 'Are we going to be able to survive and continue to make a living in this industry in the years to come?'" The bottom line, she explained, was this: "If smokers can't smoke on the way to work, at work, in stores, banks, restaurants, malls and other public places, they are going to smoke less," and the industry was going to shrink.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:  

Page Number: 139

Explanation and Analysis

When new studies began alerting the public about the health risks of secondhand smoke in the 1980s, tobacco companies returned to the doubt-mongering strategies they pioneered in the 1950s, '60s, and '70s. As Ellen Merlo's quote demonstrates, the companies knew what they stood to lose from regulation: a lot of money, and possibly even their survival. Because capitalism required them to continue growing and finding new ways to stay profitable, doubt-mongering started to look like an essential business expense. From the outside, it's easy to declare that tobacco companies just should have failed, but from the inside, company leaders felt that they quite literally had no choice but to fight regulations, as Merlo's comments show.

But Oreskes and Conway don't repeat Merlo's comments in order to make their readers feel sympathy for her or even conclude that her actions were anything less than evil. On the contrary, they merely want their readers to understand *why* executives like Merlo acted this way: their company's economic survival depended on it. This shows that corporations don't turn to doubt-mongering simply because of a few malicious executives, but rather because of incentives deeply rooted in the capitalist system. Changing corporate behavior requires changing corporate incentives—and, as Oreskes and Conway will later conclude, the best way to do so is through regulations that force corporations to pay for the costs they impose on society.

Bad Science was a virtual self-help book for regulated industries, and it began with a set of emphatic sound-bite-sized "MESSAGES":

1. Too often science is manipulated to fulfill a political agenda.
2. Government agencies … betray the public trust by violating principles of good science in a desire to achieve a political goal.
3. No agency is more guilty of adjusting science to support preconceived public policy prescriptions than the Environmental Protection Agency.
4. Public policy decisions that are based on bad science impose enormous economic costs on all aspects of society.
5. Like many studies before it, EPA's recent report concerning environmental tobacco smoke allows political objectives to guide scientific research.
6. Proposals that seek to improve indoor air quality by singling out tobacco smoke only enable bad science to become a poor excuse for enacting new laws and jeopardizing individual liberties.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 144-5

Explanation and Analysis

During the secondhand smoke controversy, the tobacco industry published an extensive public relations handbook called *Bad Science*, which the authors describe and quote in this passage. In fact, Oreskes and Conway note that *Bad Science* was among the most valuable documents that they encountered during their research, because it was so open about its purpose and so frank in listing the merchants of doubt's signature strategies.

The tobacco industry offers no data about secondhand smoke in its communications on the topic simply because there isn't any that favors it—instead, its only option is to spread doubt. By this point in the book, readers should be able to easily pick out the obvious distortions in *Bad Science*. For instance, the people who "*manipulat[e science] to fulfill a political agenda*" are corporations and the merchants of doubt, not scientists, and science-based policy decisions impose costs on corporations whose products hurt society, not society itself. Of course, these corporations encourage the public to identify with them and conflate their own interests with society's, precisely so that they can keep privately profiting at the public's expense. Unless preventing premature deaths and childhood disease are untenable "*political objectives*," the proposed secondhand smoke ban was, in the authors' opinion, actually a fine example of science-based policy.

> This was the *Bad Science* strategy in a nutshell: plant complaints in op-ed pieces, in letters to the editor, and in articles in mainstream journals to whom you'd supplied the "facts," and then quote them as if they really were facts. Quote, in fact, yourself. A perfect rhetorical circle. A mass media echo chamber of your own construction.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 147

Explanation and Analysis

To substantiate its third main point, "No agency is more guilty of adjusting science to support preconceived public policy prescriptions than the Environmental Protection Agency," the handbook *Bad Science* declares that "The EPA report [on secondhand smoke] has been widely criticized within the scientific community." This argument captured Oreskes and Conway's attention, and they present their response in the passage above.

The only members of "the scientific community" who criticized the EPA's report were scientists working for the tobacco industry. In effect, the industry was characterizing its own doubts about secondhand smoke as scientific, then treating this so-called scientific doubt as legitimate evidence in the fight against regulation. This tactic is so brazen and manipulative that it arguably captures the doubt-mongering strategy better than any other example in the whole book. Once listeners fall into the "mass media echo chamber" and stop looking for the data behind the industry's claims, evidence-based discussions become all but impossible.

> Scientists are confident they know bad science when they see it. It's science that is obviously fraudulent—when data have been invented, fudged, or manipulated. Bad science is where data have been cherry-picked—when some data have been deliberately left out—or it's impossible for the reader to understand the steps that were taken to produce or analyze the data. It is a set of claims that can't be tested, claims that are based on samples that are too small, and claims that don't follow from the evidence provided. And science is bad—or at least weak—when proponents of a position jump to conclusions on insufficient or inconsistent data.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Dixy Lee Ray, Sherwood Rowland, Frederick Seitz, S. Fred Singer

Related Themes:

Page Number: 153-4

Explanation and Analysis

Despite the tobacco industry's claims in its handbook *Bad Science*, true "bad science" isn't just any data that harms a corporation's bottom line. Instead, as Oreskes and Conway explain here, there are many forms of bad science, and working scientists know it when they see it. The hallmarks of bad science range from irregular data and illogical ways of interpreting it to impossible hypotheses and deliberate

misrepresentation of other scientists' work. And while it's difficult to systematically identify, the scientific community does have a foolproof tool for identifying and stopping it: peer review. Needless to say, the merchants of doubt's work is full of bad science, but they get away with it because they don't submit their work to peer review.

Thus, Oreskes and Conway's reminder about true bad science serves two purposes. First, it highlights yet another way in which the merchants of doubt turn the truth on its head in order to make it indistinguishable from lies. And second, it strengthens their argument that peer review should be the gold standard for taking any piece of scientific work seriously, whether within the scientific community or outside it.

> Anti-Communism had launched the weapons and rocketry programs that launched the careers of Singer, Seitz, and Nierenberg, and anti-Communism had underlain their politics since the days of Sputnik. Their defense of freedom was a defense against Soviet Communism. But somehow, somewhere, defending America against the Soviet threat had transmogrified into defending the tobacco industry against the U.S. Environmental Protection Agency.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), William Nierenberg, Ronald Reagan, Frederick Seitz, S. Fred Singer

Related Themes:

Page Number: 164

Explanation and Analysis

At the end of their chapter on secondhand smoke, Oreskes and Conway start to situate the merchants of doubt within the broader historical and ideological movement that they call "free market fundamentalism." They have already pointed out that the merchants of doubt primarily forged their careers during the Cold War, when the U.S. government and public viewed science largely as a bulwark against Soviet aggression and communist tyranny. Now, they point out how the merchants of doubt carried this militaristic, pro-capitalist worldview directly into their work defending polluters.

Like veterans who never truly get over battle psychologically, the merchants of doubt continued to fight an imaginary enemy after the Cold War: they redefined environmental protection as the new communist threat and unregulated capitalism as the new essence of liberty. Of course, this perspective was perfectly amenable to the major corporations they worked with, because it offered a clear reason to reject regulations. Oreskes and Conway emphasize this historical dimension of the merchants of doubt's campaign, in addition to the financial, scientific, and political aspects of their work, because they want readers to understand why they rose to power in the first place—and why people who share their views will likely continue to find an outsized voice in U.S. politics in the years to come.

> Russell Seitz and the defenders of tobacco invoked liberty, too. But as the philosopher Isaiah Berlin sagely pointed out, liberty for wolves means death to lambs. Our society has always understood that freedoms are never absolute. This is what we mean by the rule of law.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Russell Seitz

Related Themes:

Page Number: 165-6

Explanation and Analysis

Even if the merchants of doubt spent most of their time undermining actual scientific research, they also frequently made ideological arguments about why deregulating major polluting corporations was necessary for the survival of capitalism, democracy, and above all, *liberty*. Oreskes and Conway recognize that this is a powerful line of thinking, above all in the U.S., a nation that defines itself above all by a commitment to personal liberty. But they also argue that it's useless to talk about liberty in a vacuum, as though giving more of it to one group of people will never affect any other group. Concretely, giving corporations the liberty to pollute (whether through fossil fuels, acid rain emissions, or secondhand smoke) also means taking certain liberties away from the people who are affected by that pollution. Often, it also means literally killing people.

This is why Oreskes and Conway quote Isaiah Berlin: the question is not whether new policies give someone more liberty, but rather whose liberty they promote and whose liberty they take away. In plainer terms, liberty is, in the authors' view, too loaded of a term to be the centerpiece of policy discussions. Instead, scientists, policymakers, and journalists should think in terms of a policy's overall contribution to the *public good*.

Chapter 6 Quotes

❝ One Jason recalls being asked by colleagues, "When you go to Washington and tell them that the CO2 will double in 50 years and will have major impacts on the planet, what do they say?" His reply? "They … ask me to come back in forty-nine years." But in forty-nine years it would be too late. We would be, as scientists would later say, "committed" to the warming—although "sentenced" might have been a better word.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 173-4

Explanation and Analysis

In the late 1970s, the Carter administration asked a group of elite physicists called the Jasons to examine the emerging evidence on global warming. In their study, the Jasons reported that the problem was clearly serious and warranted significant attention from policymakers. But, as Oreskes and Conway explain in this passage, the administration responded with apathy. The government had no interest in addressing global warming until it became a tangible problem—even if that took several decades.

This attitude reflects two key problems that Oreskes and Conway have identified throughout their book. The first is a specific issue pertaining to climate policy: global warming's effects occur so long after the emissions that cause it that, once they are obvious, it's already too late to reverse them. In other words, governments have to act especially early in order to stop climate change—and they're particularly bad at acting early on all policy issues, especially those related to science. The second issue is a broader problem pertaining to science policy in general: policymakers often wrongly approach scientific facts as if they are negotiable, in the same way that people's political interests and agendas are. This is very similar to how the media approaches scientific debates as though they were actually political debates, by covering "both sides" of an issue.

❝ Schelling's attempt to ignore the cause of global warming was pretty peculiar. It was equivalent to arguing that medical researchers shouldn't try to cure cancer, because that would be too expensive, and in any case people in the future might decide that dying from cancer is not so bad. But it was based on an ordinary economic principle—the same principle invoked by Fred Singer when discussing acid rain—namely, discounting. A dollar today is worth more to us than a dollar tomorrow and a lot more than a dollar a century from now, so we can "discount" faraway costs. This is what Schelling was doing, presuming that the changes under consideration were "beyond the lifetimes of contemporary decision-makers."

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Thomas Schelling, S. Fred Singer

Related Themes:

Page Number: 179-80

Explanation and Analysis

In one of its numerous early reports on climate change, the U.S. government asked the leading economist Tom Schelling to write a conclusion assessing the costs and benefits of taking action. Even though the majority of the report was written by climate scientists who emphasized the dire nature of the problem, the government largely overlooked their work. Instead, it prioritized Schelling's chapter—and the introduction, which was also written by a group of economists.

In his conclusion, Schelling argued that taxing fossil fuels would cost too much money, so policymakers should simply wait until climate change starts causing problems for humanity, and then deal with those problems. In other words, he proposed addressing the symptoms and ignoring the cause—even though researchers weren't yet sure how severe the problem would be and knew that it would only get worse the more CO2 humans emitted. Schelling's technical justification for this conclusion was the discounting approach that Oreskes and Conway describe here: since climate change's effects would happen in the distant future, they should be "discount[ed]," or ignored. Perhaps future people would even *want* the climate to change, Schelling suggested.

But Oreskes and Conway bring up Schelling's discounting approach in order to ask a crucial question: is discounting an appropriate method for evaluating *environmental* threats? Paying a dollar to avoid problems today is scarcely different from paying a dollar to avoid problems tomorrow. But climate change isn't like this. There is a fixed window for taking climate action—once the impacts arrive, it is too late

to prevent them. In other words, failing to act on climate change means locking in the costs now, but not experiencing them until much later. These costs affect other people—not the decision-makers themselves, but their descendants—and they have impacts all around the world. But Schelling ignored all of these factors and tried to calculate a dollar-value answer to the problem instead. Indeed, the debate over discounting again shows how dangerous it is to view health and environmental policy solely through the lens of economics—a discipline which ignores most health and environmental costs by design.

He concluded emphatically, "The scientific base for a greenhouse warming is too uncertain to justify drastic action at this time." This, of course, was precisely what he had said about acid rain. And ozone depletion. It was easy to see why many working scientists didn't like Fred Singer. He routinely rejected their conclusions, suggesting that he knew better than they did.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), S. Fred Singer, Roger Revelle

Related Themes:

Page Number: 192-3

Explanation and Analysis

Fred Singer spent many years spreading doubt about climate science—and indeed, this is the work he's best remembered for today. Long after actual researchers reached a consensus on the issue—global warming is real, humans have caused it, and it poses a serious threat to most life on earth—Singer continued insisting that the science was "too uncertain to justify drastic action." In other words, he kept coming up with unfounded sources of doubt because he knew this would help delay policy action. He even roped the leading climate scientist Roger Revelle into putting his name on one of his papers as a co-author, and then spent years claiming that Revelle changed his mind.

But even if Singer took his doubt-mongering to another level with climate change, none of his basic tactics were any different. He used the same underhanded, manipulative lies to undermine government action on every other issue he worked with—and other scientists caught on. As Oreskes and Conway point out in this passage, Singer already had a strong reputation in the scientific community, but unfortunately, that wasn't enough to prevent him from forming a strong positive following among some conservatives and wealthy businesspeople.

Imagine providing "balance" to the issue of whether the Earth orbits the Sun, whether continents move, or whether DNA carries genetic information. These matters were long ago settled in scientists' minds. Nobody can publish an article in a scientific journal claiming the Sun orbits the Earth, and for the same reason, you can't publish an article in a peer-reviewed journal claiming there's no global warming. Probably well-informed professional science journalists wouldn't publish it either. But ordinary journalists repeatedly did.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 214

Explanation and Analysis

The effort to undermine climate science has probably been the merchants of doubt's most successful campaign so far. Oreskes and Conway attribute their success to a few factors. For instance, corporations were becoming more powerful, oversight weaker, and politics more hostile to the truth. But most of all, the merchants of doubt were perfecting their strategies—especially when dealing with the media. Just like during the ozone and acid rain debates, in the global warming controversy, the merchants of doubt loudly protested that the popular media must cover "both sides"—even though one side was science and the other was pure speculation. Oreskes and Conway use this series of examples to point out how absurd it is to provide "balanced" coverage of scientific facts. Journalists didn't intend to help erode the truth, but extraordinarily enough, they did it anyway. And they will continue to do so for as long as mainstream journalists continue to overlook peer review and listen to the merchants of doubt instead of the scientists who actually did the research.

Chapter 7 Quotes

Sometimes reopening an old debate can serve present purposes. […] In the demonizing of Rachel Carson, free marketeers realized that if you could convince people that an example of successful government regulation wasn't, in fact, successful—that it was actually a mistake—you could strengthen the argument against regulation in general.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Rachel Carson

Related Themes:

Page Number: 217

Explanation and Analysis

By 2007, the toxic pesticide DDT had been banned in the U.S. for more than 30 years, and the science writer who brought its dangers to the public's attention, Rachel Carson, had been dead for even longer. But it was in 2007, puzzlingly enough, that conservative writers and media personalities started accusing her of atrocities. (DDT would have eradicated malaria and saved countless lies, the logic goes—even though scientists already disproved this assertion long *before* the DDT ban.) This new DDT doubt movement was clearly tied to the merchants of doubt's other campaigns, but it was different in one important way.

Oreskes and Conway emphasize that this contrarian movement didn't necessarily want to legalize DDT or challenge the details of Carson's research. In fact, it wasn't really about DDT at all. Their attacks were squarely for show: Carson was such an influential environmental activist that tainting her memory would allow the merchants of doubt to taint environmentalism as a whole. The DDT ban was among the most successful environmental laws ever, so if the contrarians could undermine it, then they could make an even more convincing case "against regulation in general."

> The Kennedy PSAC report, *Use of Pesticides: A Report of the President's Science Advisory Committee*, is notable in hindsight as much for what it did not do as for what it did. The scientists did not claim that the hazards of persistent pesticides were "proven," "demonstrated," "certain," or even well understood; they simply concluded that the weight of evidence was sufficient to warrant policy action to control DDT.
>
> [...]
>
> Both science and democracy worked as they were supposed to.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Rachel Carson

Related Themes:

Related Symbols:

Page Number: 221-2

Explanation and Analysis

After Rachel Carson published *Silent Spring*, her book about DDT, the government quickly jumped into action. The President's Science Advisory Committee (PSAC) issued a report on DDT's dangers, and Congress and the EPA acted to ban it within a few years.

But this kind of timely action is unthinkable in U.S. environmental policy today, largely because the merchants of doubt have inserted themselves into every stage of the policymaking process. Oreskes and Conway analyze the PSAC report's language to show that, at the time, the committee was still viewing science through the lens of the public good: the government wanted to know if DDT was doing more harm or good, and if it was harm, then it would ban it. To Oreskes and Conway, this is refreshing compared to the government's doubt-centric approach to science today, in which conservatives presume that pollutants are safe until scientists can prove with absolute certainty that they are really dangerous.

In addition to serving as a guide for how policymakers should look at science, then, the PSAC report also offers a useful reminder that there's no such thing as an automatic march of progress, even in science. As Oreskes and Conway have shown throughout the book, conditions for science in public life have markedly deteriorated since the 1970s. And saving science-based policy from the merchants of doubt will depend on the effort that scientists, journalists, policymakers, and citizens put into improving these conditions today.

> So Sri Lanka didn't stop using DDT because of what the United States did, or for any other reason. DDT stopped working, but they kept using it anyway. We can surmise why: since DDT had appeared to work at first, officials were reluctant to give it up, even as malaria became resurgent. It took a long time for people to admit defeat—to accept that tiny mosquitoes were in their own way stronger than us. As a WHO committee concluded in 1976, "It is finally becoming acknowledged that resistance is probably the biggest single obstacle in the struggle against vector-borne disease and is mainly responsible for preventing successful malaria eradication in many countries."

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Dixy Lee Ray, Rachel Carson

Related Themes:

Related Symbols:

Page Number: 231

Explanation and Analysis

More than a decade after the U.S. banned DDT, the former governor of Washington, Dixy Lee Ray, became the first major contrarian to attack Rachel Carson based on a serious distortion of the historical record. Ray correctly pointed out that Sri Lanka was using DDT to kill mosquitos before it was banned, and malaria cases were falling fast—but then, after the ban, cases started increasing again. Based on this turn of events, she concluded that DDT would have eradicated malaria in Sri Lanka, and that Rachel Carson and the regulators who listened to her were responsible for countless deaths there.

Yet the important detail that Dixy Lee Ray omitted was that Sri Lanka stopped using DDT, years before the U.S. banned it, because mosquitos had evolved to become completely resistant to it. Malaria cases were already going up and Sri Lanka was already looking for other ways to fight it, with or without the DDT ban.

Nevertheless, other contrarians began picking up Ray's version of the story, publishing it in the popular media, and using it against environmentalists who were calling for more regulations. Thus, even though the campaign against Rachel Carson never got DDT itself deregulated, it still achieved its real aims: to change public perception about one of the most successful environmental regulations of all time, so that Americans would oppose new regulations that could make just as much of an impact.

❝ Scientists have faced an ongoing misrepresentation of scientific evidence and historical facts that brands them as public enemies—even mass murderers—on the basis of phony facts.

There is a deep irony here. One of the great heroes of the anti-Communist political right wing—indeed one of the clearest, most reasoned voices against the risks of oppressive government, in general—was George Orwell, whose famous *1984* portrayed a government that manufactured fake histories to support its political program. Orwell coined the term "memory hole" to denote a system that destroyed inconvenient facts, and "Newspeak" for a language designed to constrain thought within politically acceptable bounds.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 236

Explanation and Analysis

At the end of their chapter on Rachel Carson and DDT, Oreskes and Conway point out the disturbing contradiction between American conservatives' characteristic fear of propaganda and the world that their anti-science tendencies are creating. George Orwell clearly understood how authoritarian governments could rule with virtually no opposition once they broke down the population's sense of reality and truth. If "inconvenient facts" aren't viewed as facts at all, while speech that acknowledges them becomes politically unacceptable, then there is no way for people to oppose the state's tyranny. And yet the merchants of doubt are doing exactly the same thing—just with corporate power, instead of state power. They try to shut down scientists who report "inconvenient facts" and insist on adapting reality to "politically acceptable bounds"—or whatever fits with their free market fundamentalist point of view. In trying so hard to escape government regulation, Oreskes and Conway suggest, conservatives have embraced a tyranny of the private sector instead.

❝ Accepting that by-products of industrial civilization were irreparably damaging the global environment was to accept the reality of market failure. It was to acknowledge the limits of free market capitalism.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Rachel Carson

Related Themes:

Related Symbols:

Page Number: 238

Explanation and Analysis

At the end of their final chapter, Oreskes and Conway summarize their overarching theory of why the merchants of doubt continue to reject science. Ever since Rachel Carson wrote *Silent Spring* and showed the public that industrial chemicals could irreparably harm the planet, U.S. environmentalism has focused on regulating industrial capitalism's negative externalities—or the harmful effects

that it produces, but does not pay for. For the merchants of doubt, who believe so strongly in the unregulated free market, environmentalism feels like both a dangerous constraint on capitalism and a warning that capitalism can't actually solve all of humankind's problems on its own. In other words, as Oreskes and Conway put it here, regulating pollutants means "acknowledg[ing] the limits of free market capitalism." And surviving in the 21st century will require appropriately regulating capitalism in order to fend off ecological disaster. But for people like the merchants of doubt, it's often easier to just deny that capitalism has limits at all—mostly, by refusing to accept that major corporations and toxic pollution are destroying the environment in the first place.

Conclusion Quotes

Free market fundamentalists can perhaps hold to their views because often they have very little direct experience in commerce or industry. The men in our story all made their careers in programs and institutions that were either directly created by the federal government or largely funded by it. Robert Jastrow spent the lion's share of his career at the Goddard Institute for Space Studies—part of NASA. Frederick Seitz and Bill Nierenberg launched their careers in the atomic weapons programs, and expanded them at universities whose research activities were almost entirely funded by the federal government at taxpayer expense. Fred Singer worked directly for the government, first at the National Weather Satellite Service, later in the Department of Transportation. If government is bad and free markets are good, why did they not reject government support for their own research and professional positions and work in the private sector?

Related Characters: Naomi Oreskes and Erik M. Conway (speaker), Robert Jastrow, William Nierenberg, Frederick Seitz, S. Fred Singer

Related Themes:

Page Number: 250

Explanation and Analysis

In their conclusion, Oreskes and Conway ask how a group of eminent, highly-educated scientists became such loyal adherents to the bogus, empirically inaccurate ideology of free market fundamentalism. They propose a logical but unconventional explanation: men like Fred Seitz, Fred Singer, Bill Nierenberg, and Robert Jastrow were free market fundamentalists because they actually *knew next to nothing about the free market*. They never actually worked in private industry, so they never had any experiences that would challenge their blind faith in it. In a way, the grass was always greener on the other side for them. Underwhelmed by their government and university jobs, they thought the private sector seemed like a more promising alternative. And when they finally started working with the private sector—as science consultants, or merchants of doubt—they were lavished with money, attention, and power. Of course, this doesn't fully explain how they reconciled working for the government for most of their careers with believing that the government should have almost no role in science at all, but it does explain how they could continue to hold such wildly unrealistic ideas about the great promise of private industry all the way until the end of their lives.

Cornucopians hold to a blind faith in technology that isn't borne out by the historical evidence. We call it "technofideism."

Why do they hold this belief when history shows it to be untrue? Again we turn to Milton Friedman's *Capitalism and Freedom*, where he claimed that "the great advances of civilization, in industry or agriculture, have never come from centralized government." To historians of technology, this would be laughable had it not been written (five years after Sputnik) by one of the most influential economists of the second half of the twentieth century.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 261

Explanation and Analysis

The key principle behind free market fundamentalism in the 21st century is Cornucopianism, or the belief that technological innovation will solve ecological problems on its own—if only the government doesn't interfere with the free market. In turn, Cornucopianism depends on technofideism—or the "blind faith in technology" that Oreskes and Conway describe here. These three ideas then work together: a blind faith in technology (technofideism) suggests that the best public response to ecological crisis is to do nothing and wait for innovation to fix everything (Cornucopianism). In turn, this Cornucopianism supports the idea that, the less regulated a state's markets, the freer

and better off it always is (free market fundamentalism).

The only problem with technofideism, Cornucopianism, and free market fundamentalism is that they're all terribly wrong. As Oreskes and Conway point out here, there is plenty of clear evidence that the crucial factor in nearly all major innovation throughout history has been massive *government* investment, and not efficient *private* investment. Thus, technofideism, Cornucopianism, and free market fundamentalism have it backwards. More likely than not, the authors argue, the merchants of doubt believe in these ideologies for the same reason as their audiences believe in their doubt-mongering: because they're very convenient excuses for doing nothing, and the leaders of major corporations are perfectly happy with the status quo.

> What this all adds up to—to return to our story—is that the doubt-mongering campaigns we have followed were not about science. They were about the proper role of government, particularly in redressing market failures. Because the results of scientific investigation seem to suggest that government really did need to intervene in the marketplace if pollution and public health were to be effectively addressed, the defenders of the free market refused to accept those results. The enemies of government regulation of the marketplace became the enemies of science.

Related Characters: Naomi Oreskes and Erik M. Conway (speaker)

Related Themes:

Page Number: 262

Explanation and Analysis

Over the course of this book, Oreskes and Conway have shown how the merchants of doubt involved themselves in a wide range of different scientific debates—on subjects they knew very little about—in order to defend major corporations against regulations that would hold them accountable for the harms they caused people and the environment. From the start, it was clear that they had no real scientific evidence on their side, but it *wasn't* clear what (besides sheer self-interest) motivated them to take up such an absurd uphill battle. Then, in their last two chapters, Oreskes and Conway introduced the ideology of free market fundamentalism, which linked government regulation to authoritarianism and unbridled democracy to freedom.

In this passage from their conclusion, Oreskes and Conway summarize their overall story about who the merchants of doubt were and why they did what they did. According to the authors, the merchants of doubt were free market fundamentalists who believed that preventing government regulation was far more important than preserving the integrity of scientific research. So they sacrificed science to politics: they lied, manipulated others, and violate basic professional ethics in order to do so. And in many ways, they succeeded. Their legacy heavily influences public policy and political debates about science in the U.S. today, and the conflict between evidence-based policy and free market fundamentalism has only grown more pronounced and consequential since their deaths.

SUMMARY AND ANALYSIS

The color-coded icons under each analysis entry make it easy to track where the themes occur most prominently throughout the work. Each icon corresponds to one of the themes explained in the Themes section of this LitChart.

INTRODUCTION

Unassuming, soft-spoken Ben Santer is one of the world's leading climate scientists. He works at the Lawrence Livermore National Laboratory, where he collects, shares, and analyzes atmospheric data. He has shown that the lowest layer of the atmosphere, the troposphere, is getting warmer, but the next-lowest, the stratosphere, is getting cooler. This proves that human activity on Earth's surface—and not the sun—is causing global warming. But Santer has been brutally attacked for making this discovery.

Oreskes and Conway begin with Ben Santer's story because it clearly represents the pattern that lies at the heart of their book: the "merchants of doubt" work to publicly undermine legitimate science in order to advance their own political agenda. Santer's story shows how high the stakes of this conflict are today. Doubt-mongering threatens to undermine action on climate change, the greatest threat to humankind's survival in the 21st century.

In 1988, the United Nations and World Meteorological Organization founded the Intergovernmental Panel on Climate Change (IPCC). Scientists had long known that burning fossil fuels could warm the planet, and by the 1980s, they had evidence that it was happening. In 1995, the IPCC's hundreds of distinguished climate scientists publicly reported that greenhouse gases were warming the planet. Their report's lead author was Ben Santer.

The merchants of doubt attacked Santer precisely because he was so highly trusted and respected: he was the scientific community's most authoritative voice on climate change. Thus, undermining Santer was a way for the merchants of doubt to undermine public trust in the scientific community as a whole—and prevent lawmakers from implementing science-based policies to limit climate change.

After the IPCC published its report, a group of physicists at a Washington, D.C. think tank started publicly attacking it. They called the report doctored and deceptive, and they accused Ben Santer of tampering with it before publication. (He did make changes to it, but only as part of the peer review process that all reputable scientific work undergoes.) Santer and his colleagues publicly rebutted these baseless accusations—which still spread widely. Santer's reputation and personal life fell apart. He tried to defend himself with facts, but this didn't work. His accusers didn't want to discover the truth—they wanted to *fight* it.

The physicists who attacked Santer are the merchants of doubt. They succeeded by exploiting the gap between how science actually works and how the rest of society understands it. Specifically, they recognized that, to get attention from policymakers and the media, their accusations didn't need to be true*—they just needed to be* plausible*. They knew that honest researchers like Santer have a professional obligation to tell the truth, so their strongest weapon was their ability to blur the line between truth and falsehood.*

Years later, Ben Santer read a newspaper article about how the tobacco industry paid scientists to publicly attack the evidence linking smoking to cancer. By "keep[ing] the controversy alive," these scientists helped tobacco companies avoid legal challenges. Santer realized that the exact same thing happened to his climate change research—and exactly the same physicists did it: Fred Seitz and Fred Singer.

Seitz and Singer developed a tried-and-true strategy for undermining policy action on important health and environmental issues: they loudly and publicly denied that established scientific facts were truly established at all. Politicians and corporate elites could then use Seitz and Singer's claims as a basis for refusing to solve problems they profited from.

Seitz and Singer both worked closely with the U.S. defense industry during the Cold War: Seitz helped design the atomic bomb, Singer led the nation's satellite program, and both publicly supported Reagan's Strategic Defense Initiative on behalf of a conservative think tank called the George C. Marshall Institute. Both Seitz and Singer also worked for the tobacco industry: Seitz led the R.J. Reynolds Tobacco Company's $45 million program to fund pro-tobacco research from 1979–1985, and the tobacco industry paid Singer to publicly question the EPA's findings on the dangers of secondhand smoke in 1990.

Seitz and Singer built their careers in an era when science was closely wedded to public policy. They used the power and connections that they gained to shape national policy for decades afterward. Yet their career trajectories show that their motivations were primarily financial and political, not scientific. Put differently, after retiring as legitimate scientists, they started exploiting their credentials and reputations to imitate legitimate scientists for a living.

Court documents show that Seitz and Singer used this "Tobacco Strategy" on issues ranging from global warming to the hole in the ozone layer. They worked with public relations professionals, industry lawyers, and think tanks to undermine scientific consensus and attack other researchers' motivations. They even ruined some of these other researchers' careers through public attacks and lawsuits. Seitz, Singer, and their collaborators (like William Nierenberg and Robert Jastrow) had no background in health or environmental science. But they *did* have close connections to the government and significant experience dealing with the media. Thus, even though they never actually researched the issues they spoke about, journalists frequently presented them as scientific authorities and politicians consistently justified inaction by pointing to their claims. This book explains how they did it—and how others continue to use their strategies today.

Oreskes and Conway summarize the chapters to follow, in which they will look in depth at Seitz, Singer, and their collaborators' strategies and effects on government policy over almost four decades. They point out that the merchants of doubt are really one branch of a vast corporate marketing strategy. Moreover, the merchants of doubt largely succeeded because the media and government are often not scientifically literate enough to distinguish legitimate research from confidently-asserted nonsense. In this way, the authors emphasize that many different actors and institutions are all partially responsible for the way the merchants of doubt have undermined good health and economic policy—and all of them must be reformed, in different ways, in order for science to take back its rightful place in public life.

CHAPTER 1

In May 1979, just after his retirement, distinguished atomic scientist Frederick Seitz met with a group of R.J. Reynolds tobacco executives to learn about their new biomedical research program. The companies would be funding dozens of labs to study degenerative diseases like cancer and diabetes. The executives asked Seitz to help them choose which researchers to fund. Seitz hired two advisors: James A. Shannon, a prominent physician and former director of the National Institutes of Health, and Maclyn McCarty, a distinguished bacteriologist who helped discover the function of DNA. Seitz, Shannon, and McCarty decided to fund promising but underappreciated young scientists, like the lung researcher Martin J. Cline and the protein researcher Stanley B. Prusiner.

Oreskes and Conway begin with Fred Seitz's work for the tobacco industry because this is where he first perfected the doubt-mongering techniques that he later brought to other fields. However, he didn't invent these techniques: instead, he learned them from the industry's existing anti-science marketing strategy. In fact, his research campaign exemplifies how destructive corporations use science to fight science: they create an air of scientific legitimacy around their bogus claims by paying highly-respected researchers to join their side.

Seitz's program funded legitimate, groundbreaking research. But its true purpose was to defend the tobacco industry by challenging the scientific consensus about tobacco's health effects, linking degenerative disease to other causes to distract the public, and funding scientists who could later testify in court on behalf of tobacco companies. This strategy was already tried-and-true: even though scientists proved the link between cigarettes and cancer in the 1950s, for more than two decades afterward, every single lawsuit against tobacco companies failed thanks to scientists' testimony.

Tobacco companies couldn't directly refute the conclusive evidence that cigarettes cause cancer. Instead, they distracted *from it by presenting alternate explanations for the health problems they caused, as well as by paying scientists to make unscientific claims on their behalf. The corporations consistently evaded responsibility because scientific proof doesn't necessarily translate cleanly into legal evidence. They depend on two different kinds of causality. Research can establish that smoking causes cancer in the population as a whole, but not that any individual gets cancer specifically because of their smoking.*

In 1953, the American press began reporting on urgent new research showing that cigarette tar gave mice fatal cancer. (In fact, this line of research wasn't new—the Nazis proved that cigarettes caused cancer in the 1930s.) Executives from several major tobacco companies met with a major public relations firm and agreed on a strategy: they would publicly deny the new scientific findings, spread positive messages about cigarettes, and fund their own research. They founded the Tobacco Industry Research Committee, which declared that the evidence linking cigarettes to cancer wasn't yet conclusive. They also met with the nation's top publishing executives to explain their "research program" and request more "balanced" coverage of the issue.

Oreskes and Conway turn to the very beginning of the tobacco controversy in order to understand the origins of the doubt-mongering strategy that corporations still use today. This strategy is public relations disguised as science: its purpose is not to discover new facts or advance the state of scientific knowledge, but rather to defend deadly (but highly profitable) products against the truth. In other words, they were fighting to preserve their business model: killing people by selling them poison. Tobacco executives specifically used their wealth, power, and connections to manipulate the media: they insisted that "balance" required giving their lies the same level of consideration as proven scientific facts. Needless to say, throughout the book, Oreskes and Conway will show how Fred Seitz, Fred Singer, and their associates recycled this same playbook for decades.

Researchers had definitively proven the link between cigarettes and cancer—and the tobacco executives knew it. But the Committee confused the media by flooding it with information and funding research into questions that were still unanswered (like why not *all* smokers get cancer). To lead the Committee, industry leaders chose Dr. Clarence Cook Little, a respected geneticist who believed that "genetic weakness" caused cancer. They promoted the work of Wilhelm C. Hueper, a prominent researcher at the National Cancer Institute, who often testified in court to help plaintiffs prove that the toxic building material asbestos (and *not* cigarettes) caused their cancer.

The Tobacco Industry Research Committee started by pursuing two key priorities: recruiting contrarian scientists and overwhelming the public with so much information that it would struggle to distinguish the truth from lies. Researchers like Little and Hueper couldn't legitimately claim that cigarettes were safe, but they could *convincingly blame cancer on other factors. Together, these tactics made the tobacco corporations' misinformation appear just as legitimate as scientists' actual peer-reviewed consensus.*

The Committee also sent out thousands of pamphlets full of loaded questions about cancer. For instance, the pamphlets asked why, if cigarettes caused lung cancer, different cities could have similar smoking rates but vastly different lung cancer rates. Of course, scientists already knew the answer (which is that many factors besides smoking cause lung cancer). But most journalists, politicians, and doctors *didn't*. Thus, the pamphlets made settled science look like a lively, ongoing controversy. Moreover, the federal Fairness Doctrine required journalists to take balanced approaches to controversial issues, and when it came to cigarettes and cancer, they decided to "giv[e] equal weight to both sides, rather than giving *accurate* weight to both sides."

The Committee's loaded questions appeared to raise doubts about the link between cigarettes and cancer, but only because they seriously mischaracterized the existing research and distorted basic logical principles. The claim that cigarettes are safe because they don't give every *smoker cancer is illogical: common sense dictates that something can be harmful without harming* everyone *who comes into contact with it. So is the claim that, if cigarettes cause cancer, then different cities can't have the same smoking rate but different lung cancer rates. No scientist seriously thought that cigarettes were the* only *cause of lung cancer. Ultimately, Oreskes and Conway argue that the media wrongly applied a* political *concept of "balance" (covering two legitimate, competing sides) to* science *(in which scientific consensus is legitimate, and baseless claims that go contrary to it are not).*

Next, the Tobacco Industry Research Committee started funding researchers, medical students, and national medical associations. It got so close to the medical establishment that in 1962, the U.S. Surgeon General even gave it veto power over appointments for the Advisory Committee on Smoking and Health. Yet, after examining the scientific evidence, the panel unanimously concluded that tobacco smoking is the primary cause of lung cancer. (In fact, tobacco industry scientists had already reached the same conclusion years before.) In 1964, when the surgeon general revealed these findings at a press conference, he shocked the nation.

The tobacco industry's primary goal was to prevent political leaders from building policy around the emerging research on cigarettes. Therefore, securing power in official public health committees was one of its foremost priorities. It succeeded, but it couldn't stop officials from implementing effective policies. This is because, in the 1960s, public health committees were still bound by basic scientific principles—like valuing truth and evidence. Oreskes and Conway will later show that this is no longer the case today, thanks largely to the merchants of doubt.

In response to the growing controversy, rather than admitting the dangers of cigarettes, the Tobacco Industry Research Committee simply rebranded itself as the "Council for Tobacco Research" and started funding even more research. The more the evidence mounted, the harder the Council fought it. The U.S. government banned tobacco advertising and mandated warning labels on cigarette packaging, and smoking rates started to fall drastically. But tobacco companies were still extremely profitable—and very concerned about fighting off lawsuits. In fact, from 1954 to 1979, the industry won 125 lawsuits and lost zero. Its secret was to keep hiring renowned scientists and keep selling doubt.

The Committee's tactics show that the tobacco industry wasn't trying to legitimately challenge research about cigarettes on scientific grounds, but rather fighting to undermine it at any cost. Fortunately, the government chose to base its policy on the scientific evidence—as it should—and not on the industry's distortions. However, the legal system didn't yet catch up, because the standard of evidence necessary to regulate dangerous products is very different from the standard of evidence needed to win a legal case against the people who produce them. To regulate cigarettes, the government merely needed to show that they cause significant harm to the public in general, but to win a specific legal case, a plaintiff would have to show that cigarette companies specifically harmed particular individuals.

This is how the tobacco industry ended up hiring Frederick Seitz. His career helps explain why he agreed to join. After playing a major role in the Manhattan Project to build the atomic bomb and publishing leading textbooks in the 1940s, Seitz became president of the National Academy of Sciences, then Rockefeller University—which he left in 1979 to work for the R.J. Reynolds tobacco company, one of the university's most generous donors. By this point, Seitz had fallen out with most of his colleagues over his support for the Vietnam War and nuclear proliferation. He also hated communism and viewed private industry as a better source of scientific funding than government grants. Ironically, he viewed the public's animosity toward tobacco companies as part of a dangerous anti-science trend in American life. Finally, he believed that genetic defects cause disease, not the environment.

Fred Seitz began working at the intersection of science and policy very early in his career. This experience gave him the credibility and connections that enabled him to effectively defend the tobacco industry later on. In fact, World War II efforts like the Manhattan Project, and the similar programs that followed during the Cold War, ensured that the most conservative and pro-war physicists became the most prominent in public life. Seitz's political leanings led him to turn against most of his scientific colleagues well before he began outright denying the validity of their research. In other words, his work for the tobacco industry was politically motivated: he saw it as part of a push for private industry to overtake the government as the primary patron of American science. He didn't seem to care which companies were doing the funding, or what their underlying motives were.

After joining R.J. Reynolds, Frederick Seitz started giving out millions of dollars in research funding. But before each grant, he consulted with lawyers to ensure that the research would create useful "friendly witnesses" for tobacco industry lawsuits, like Martin J. Cline. As late as 1997, Cline testified at a trial that it's impossible to link any individual's smoking habit to their lung cancer—and admitted that he received $3 million in "gift[s]" from the tobacco industry. Because of friendly scientists like Cline, the tobacco industry avoided legal liability for decades.

Cline's testimony shows that Seitz's program succeeded: by supporting important research by legitimate scientists, it gave an air of credibility to completely illegitimate lies about cigarettes. The bottom line was money: tobacco companies paid respected scientists astronomical sums of money to lie in court. Even if the vast majority of scientists would refuse this kind of unethical conduct, the companies only needed a select few to embrace it in order to achieve their goals.

In 2006, courts finally recognized the tobacco industry's research strategy as "part of a criminal conspiracy to commit fraud." Industry scientists like Cline didn't deserve a fair hearing in the media or court, Oreskes and Conway argue, because they didn't make truly scientific claims. They never collected evidence, reached any conclusions, or went through peer review. They simply spread doubt. But it worked for more than 50 years. Since not all smokers die of smoking, the tobacco industry insisted that smoking doesn't truly cause disease with certainty. And since scientists are always uncertain about *something*—like whatever research question they are investigating—the industry wrongly insisted that scientists aren't sure about *anything*. Frederick Seitz kept using these same strategies for decades, starting with the George C. Marshall Institute.

The tobacco industry long fought off lawsuits related to its products because courts require a kind of certainty that even science often fails to provide—researchers had no way to link smoking to individual cases of cancer. However, lawsuits about the industry's public relations practices succeeded because courts could *prove with certainty that tobacco companies deliberately misled the public about their products. Still, the merchants of doubt largely succeeded: even though they didn't altogether prevent the government from regulating tobacco products or holding tobacco companies accountable, they delayed both by decades. This meant decades of extra profit for tobacco companies—and decades of serious health consequences for the people who used their products. Ultimately, Oreskes and Conway have begun with the story of the tobacco industry in order to show how the "merchants of doubt" at the center of their book learned to replicate its strategies in other industries, even today.*

CHAPTER 2

In the 1980s, Fred Seitz began associating with fringe scientists, including a group of anti-communist Cold War physicists who defended Reagan's Strategic Defense Initiative (SDI). After conservative think tanks helped defeat Nixon's plans to de-escalate tensions with the Soviet Union, physicists Edward Teller and Robert Jastrow decided to start a think tank to defend the SDI. Prominent astronomer Carl Sagan had shown that any nuclear war would create a nuclear winter and destroy much of the planet. In contrast, Teller and Jastrow believed that the U.S. should keep stockpiling weapons so that it could defeat the Soviet Union in a nuclear war. To promote such ideas, Jastrow and several other physicists founded the George C. Marshall Institute. They appointed Fred Seitz as its founding chairman.

Fred Seitz's work on the SDI was even more directly connected to his past in politics than his earlier work with the tobacco industry. The vast majority of scientists believed in avoiding nuclear war at all costs, but men like Seitz, Teller, and Jastrow embraced the idea—and ignored the evidence of how devastating it would be—because they believed the U.S. should dominate global politics. Just like cigarette companies founded a formal research institute to make their unproven assertions sound credible and scientific, Seitz and his colleagues started a think tank to disguise their political opinions as legitimate, independent research. And because their political opinions agreed with the administration's official stance, their unscientific assertions about nuclear war gained just as much of an audience as Carl Sagan's legitimate research on it.

The Birth of Team B. In 1976, Edward Teller convinced the CIA to conduct an independent assessment of the Soviet Union's military strength. The CIA's 1975 report involved collaboration from other intelligence agencies, and Teller believed that it underestimated the Soviet threat and should have focused on worst-case scenarios. When another agency accused the CIA of *overestimating* Soviet defense spending, it agreed to Teller's request. It created "Team B"—three panels of extremist foreign policy experts.

Teller's relationship with the CIA again shows that, just because scientists *advise the administration on policy, this doesn't make their advice* scientific. *Just like his stance on nuclear winter, Teller's stance on the Soviet military plainly contradicted the established facts—so he ignored those facts and continued pushing his beliefs anyway. He succeeded because he was influential and political leaders agreed with him, and not because his ideas had any merit.*

"Team B" concluded that the Soviet Union was planning a third world war, and that the U.S. needed to invest more in weapons to remain globally dominant. Even though they had no evidence for their claims, they leaked a draft of their report to the press, then spent four years on a massive publicity campaign. Many "Team B" experts also worked on Ronald Reagan's campaign, and once he was elected, they took charge of his foreign policy.

With Edward Teller's help, "Team B" successfully did what the tobacco companies could not: it convinced the administration to ignore the facts and build policy around its own bald-faced lies instead. Its motivations were more political than financial, but it's easy to see how corporations (and scientists paid off by them) could use the same strategies to promote destructive policies that benefit them, too.

Star Wars: The Strategic Defense Initiative. The authors describe President Reagan's plan to set up a satellite-based ballistic missile defense system in outer space. The SDI was designed to both give the U.S. an advantage in the Cold War and undermine the growing anti-nuclear proliferation movement. But thousands of scientists publicly refused to work on it. Prominent astronomer Carl Sagan served as their spokesperson. They pointed out that the SDI could never stop all Soviet missiles, but certainly *would* encourage the Soviets to develop new, better nuclear weapons—or even launch a preemptory nuclear strike against the U.S. Worse still, the only way for the U.S. to test the SDI would be by launching several nuclear missiles at *itself*.

In theory, an anti-nuclear missile defense system sounds like an excellent way to prevent nuclear war. But in reality, the SDI program was far more likely to set off *such a war, because it probably wouldn't have worked in the first place. Yet the public controversy surrounding the SDI yet again shows why it can be so dangerous to mix science and politics: even when the vast majority of scientists reach a consensus, this doesn't guarantee that political leaders will listen to them. Instead, politicians can easily choose to dismiss them and listen to a small group of contrarians who have no solid evidence to support their claims.*

Robert Jastrow, a prominent retired astronomer who founded NASA's Goddard Institute for Space Studies and frequently appeared in popular media, couldn't stand the scientific establishment's opposition to the SDI. In 1981, he published a prominent magazine article declaring that, without massive investment, the U.S. would lose the Cold War due to the Soviets' superior missile defense system. Even though this Soviet defense system didn't really exist, the article whipped up a furor, and Congress approved the SDI.

Jastrow proved to be a natural ally for Seitz and Teller: like them, he believed so strongly that the U.S. must win the Cold War that he was willing to publicly lie to Congress in order to justify massive new defense spending. His plan worked: after the fact, it didn't matter that the Soviets never had a missile defense system, because the U.S. was already investing in one of its own.

From Strategic Defense to Nuclear Winter. A group of NASA scientists discovered that, just like the massive asteroid impact that drove the dinosaurs to extinction 65 million years ago, nuclear detonations could block out the sun and doom humanity to "death by deep freeze." This group was nicknamed TTAPS, for its authors' surnames—the last was Carl Sagan, who wrote about the nuclear winter theory in *Parade* and *Foreign Affairs* magazines just before the group formally published its results in the prestigious journal Science. Over the next few years, as other scientists added their own findings to the model, a consensus emerged: nuclear war would cool the planet dangerously, although less than the TTAPS model originally predicted. Many scientists were angry that Sagan spoke publicly before this consensus emerged.

Oreskes and Conway emphasize that Carl Sagan did *make a serious mistake by writing about his results for the popular media before formally publishing them in a peer-reviewed journal. His colleagues' indignation shows why peer review is the cornerstone of successful science: it ensures that scientists can rely on one another's results, and that the public can trust them. By speaking out too soon, Sagan undermined this norm—his conclusions could have turned out to be wrong, or he could give contrarians a basis for rejecting good science. Still, Sagan's results turned out to be mostly right. As in all reliable science, Sagan's peers checked and updated his results, until the community reached a consensus about them. Consensus means that scientists were as certain as they could possibly be about the dangers of nuclear winter.*

The George C. Marshall Institute. Robert Jastrow decided to start a new think tank. He wanted to undermine the nuclear winter research and the Union of Concerned Scientists, a powerful antiwar group that had long opposed nuclear missile defense systems by pointing out their serious technological flaws. So he called on two close, prominent physicist friends, Fred Seitz and William Nierenberg, and they started the George C. Marshall Institute with funding from conservative foundations.

Just like the tobacco industry, Jastrow, Seitz, and Nierenberg were interested in undermining the existing scientific consensus and not in doing legitimate research of their own. They were primarily motivated by politics, not profit, but they still made plenty of money because their stance closely aligned with that of powerful conservative donors.

The Marshall Institute started publishing contrarian articles and demanding that journalists include their views in the name of "balance." They even prevented a major documentary about the SDI from airing on most public TV stations. Jastrow sincerely believed that SDI opponents were doing the Soviet Union's bidding—he accused the TTAPS scientists of working for the Soviets and deceiving the public by deliberately inflating the risk of nuclear winter, while ignoring the way that rain and the oceans would mitigate it. But he was wrong: the TTAPS group *did* mention these effects from the beginning.

The Marshall Institute closely copied the tobacco industry's playbook by promoting their views through a robust public relations campaign disguised as scientific debate. They never found any evidence to support these views—instead, they simply misrepresented the work of the TTAPS scientists, who actually were *studying nuclear winter. Next, based on these misrepresentations, they accused the TTAPS researchers of fraud. Finally, they claimed that this supposed fraud disqualified not only the TTAPS team's research, but the whole nuclear winter theory.*

A Wholesale Attack on Science. Oreskes and Conway explain that Frederick Seitz's cousin Russell Seitz published a harsh attack on nuclear winter research in 1986. He declared that the TTAPS model was unrealistic and simplified—but the authors point out that every model is a simplification, TTAPS's used the most advanced research available, and Seitz offered no alternate model of his own. Still, Seitz insisted that the TTAPS authors were primarily motivated by left-wing politics. In fact, he presented the whole U.S. scientific establishment—including the Union of Concerned Scientists and even the National Academy of Sciences—as politically corrupt. By presenting science as nothing more than politics, the authors argue, Seitz hinted to his fellow conservatives that they could simply reject any science they found politically inconvenient.

*Russell Seitz also followed the tobacco industry playbook. By claiming that the TTAPS research was illegitimate because it was based on simplification, he preyed on the public's ignorance about how science is done—*all *science depends on simplified models. Similarly, he exploited people's misunderstanding about how scientific proof works: discrediting the TTAPS researchers' method wouldn't mean that their conclusion* must be false, *but only that they* failed to prove it. *For instance, if someone uses terrible reasoning to argue that the earth is round, disproving their reasoning doesn't mean that the earth flat—instead, it just means that they have found the wrong explanation for the right conclusion. Finally, Seitz accused legitimate scientists of exactly what he was doing: lying to promote a political agenda. Since both sides were accusing the other of the same thing, it became extremely difficult for the public to decide who was telling the truth. This is why Oreskes and Conway say that Seitz reduced science to politics: with the science so muddled, it became easier for the public and policymakers to just choose the conclusion that fit with their political views.*

Russell Seitz's accusations were far from the truth. Conservative scientists still worked freely—in fact, Edward Teller and Fred Singer even published rebuttals to the nuclear winter theory in Science, the journal that originally presented it. Most scientists were liberals, but the conservative minority had outside influence—particularly under Reagan. Moreover, the National Academy of Sciences is a famously conservative agency, and hundreds of other scientists had checked and verified the TTAPS group's results. Oreskes and Conway conclude that "the right-wing turn against science had begun." It centered on two issues: the arms race and environmental protection, which most scientists were increasingly seeing as incompatible with unregulated free-market capitalism.

"The right-wing turn against science" started when scientists began arguing that conservative political stances were based on misconceptions and could be destructive. Rather than modifying their beliefs to accommodate the facts, right-wing scientists and politicians started modifying the facts to accommodate their beliefs. The scientific community allowed conservative scientists to publish their ideas, and then it evaluated those ideas on merit. In response, the conservatives kept turning science into politics: when their ideas were disproven, they blamed a political conspiracy. Eventually, they began claiming that their right to free speech required their audience to take their lies just as seriously as their counterparts' facts.

CHAPTER 3

In 1963, a group of U.S. Department of Agriculture scientists found highly acidic rain in New Hampshire's remote Hubbard Brook woods. They were surprised and worried. Environmentalism was becoming a hot political issue at the time. For decades, both parties agreed on basic environmental policies, like preserving national parks. But in the 1960s and 1970s, policies like the Clean Air Act and Clean Water Act started generating controversy, because they called for the government to regulate environmentally harmful economic activity.

Environmental pollution issues like acid rain were perfect targets for the merchants of doubt because they took all the key characteristics of the tobacco debate to the next level. First, environmental policy pits a few corporations' private self-interest against society's overall public interest. Secondly, it raises the question of how extensively the government should be able to regulate the economy. And finally, pollution issues like acid rain are difficult for people to understand intuitively or see with the naked eye, which means that how seriously they take them depends entirely on how much they trust scientists.

By the 1970s, scientists knew that nitrogen and sulfur emissions from burning oil and coal were causing acid rain in remote places like Hubbard Brook. In 1971, Swedish meteorologist Bert Bolin published the first comprehensive report on acid rain's significant environmental dangers, and over the next few years, governments and scientists began studying it in much more depth. The evidence was clear: acid rain devastates fish populations, damages plants, corrodes buildings, and harms human health.

Acid rain's effects are felt far from the places that cause it, which means that most of the people, animals, and ecosystems that it harms bear no responsibility for it. This makes it a useful model for thinking about the other environmental dangers that take center stage in the rest of the book. In all these cases, science illuminates the inherent conflict between corporate interests and the greater good.

In 1976, when Hubbard Brook researcher Gene Likens described the link between acid rain and mass fish die-offs in the American Chemical Society's official magazine, it still wasn't clear *which* human activities were causing it. Yet, within a few years, scientists learned to link acid rain back to specific sources through isotope studies and explain why it affects soils more than streams. By 1981, scientists had a complete and accurate model of it.

It took scientists many years to fully understand acid rain. But this is the case for all reliable scientific research, which always requires a massive, communal undertaking. Scientists must study every aspect of the problem in depth, then check one another's work for accuracy and coherence. This fact underlines how radical and absurd the merchants of doubt are when they claim to disprove the whole scientific community's consensus on their own.

Political Action and the U.S.-Canadian Rift. Oreskes and Conway explain how, in 1979, European countries agreed to collectively limit air pollution (especially sulfur). Shortly thereafter, the U.S. and Canada came to a similar agreement and began cooperating on a 10-year study on acid rain. After all, most acid rain in Canada actually came from pollution originating in the U.S.

These early agreements on acid rain pollution show how effective public policy can and should follow the scientific consensus. It also points to the way that science can unify people and governments across borders. Scientists everywhere work together on issues of shared concern, and they follow the same fundamental code of ethics. Thus, when their work becomes the basis for policy, they tend to promote international cooperation (especially on issues that literally cross borders, like acid rain).

Skepticism in the Reagan White House. Oreskes and Conway explain how Reagan's pro-business, small-government ideology derailed the 10-year acid rain study. The study found a clear link between human emissions and worsening acid rain. Yet, in its official summary of the study, the U.S. government falsely called this link uncertain. One reason for this difference is certainly that Canada's economy relies largely on forestry and fish, while the U.S. produces far more pollution. But the main reason for this difference is actually that the Reagan administration pressured scientists to alter the summary.

Reagan shared many of the same principles as the merchants of doubt. Most importantly, he strongly believed in unregulated capitalism, and according to the authors, he was willing to accept nearly any cost to defend it—including imposing acid rain on ecosystems throughout the U.S. and Canada. If Edward Teller's influence during the SDI controversy shows how scientists can distort politics, then Reagan's presidency shows how politics can distort science.

Getting a Third Opinion. Oreskes and Conway explain how, after the National Academy of Sciences reviewed the U.S.-Canada study and concluded that acid rain posed serious dangers, Reagan created his own independent panel to review these conclusions. As its chair, he chose William Nierenberg—the cofounder of the Marshall Institute, who had never studied acid rain but already served in several prominent positions under Reagan. Like Seitz and Jastrow, Nierenberg was a successful Cold War nuclear physicist who despised environmentalism and strongly supported the Vietnam War. He was opinionated and arrogant but also brilliant. For the panel, he selected men like the ozone researcher Sherwood Rowland, the fallout expert Lester Machta, and Gene Likens. At first, most of them agreed that acid rain was dangerous.

Just like Teller convinced the CIA to hire "Team B," Reagan tried to supplement the official panel of independent scientific experts with his own panel of loyal conservatives. He and his administration weren't interested in finding out the truth, but merely in finding experts who would tell them what they wanted to hear. Thus, he gave the merchants of doubt a prominent voice in the highest levels of his government. It's no surprise that Nierenberg's background looks very similar to Seitz, Singer, Jastrow, and Teller's: he also rose to prominence because of his conservative views and connections with the military.

The Nierenberg Acid Rain Peer Review Panel. Oreskes and Conway summarize this panel's review of the joint U.S.-Canada study. The panel concluded that acid rain is a serious problem and the government should take steps to reduce emissions. But a separate appendix suggested that there *wasn't* yet enough data to justify government action. The author of this appendix was Fred Singer—the only member of the panel appointed directly by the White House, rather than by Nierenberg.

While the panel's assessment faithfully represented the existing research, Fred Singer's appendix cleverly reinterpreted this science in order to reach a conclusion that fit the Reagan administration's policy goals. Singer's strategy was the same one used by tobacco companies and Fred Seitz during the nuclear winter debate. First, he denied the existing evidence about acid rain. Then, he used this denial as a basis for claiming that there wasn't enough evidence on the subject. And finally, he assumed that, if there wasn't enough evidence, acid rain must not be dangerous at all.

Another conservative, politically well-connected Cold War physicist, Fred Singer worked on major satellite programs (and frequently fought with other scientists) in the 1950s before moving to work primarily in policy. In the 1960s and early 70s, he was an environmentalist: he spoke out about the dangers of overconsumption and ecosystem collapse. But by 1978, he began questioning whether preserving clean air and water is a worthwhile economic decision, and three years later, he was publicly calling for total deregulation of the U.S. oil industry.

Singer's switch from environmentalist to free market crusader is crucial, because it speaks to the underlying ideology that has motivated the merchants of doubt to undermine science. According to the authors, Singer simply decided that the environment is less valuable than economics—specifically, preserving major corporations' profit margins and, even more importantly, their right to pollute. Oreskes and Conway will later call this way of thinking "free market fundamentalism."

In 1982, the White House appointed Singer to Nierenberg's panel, choosing him over candidates with far more relevant research experience. On the panel, he repeated the same argument he had made in a letter to Nierenberg earlier that year: the problem of acid rain was too complex to justify emissions reduction laws.

Oreskes and Conway heavily suggest that the White House appointed Singer to the panel because it knew that he would use invented doubts as a justification to defend polluters. In other words, the administration seems to have deliberately courted the merchants of doubt and promoted their tactics in an effort to undermine needed regulations.

In June of 1983, the Nierenberg panel published a five-page interim report explaining that sulfur dioxide emissions were acidifying lakes, killing fish, and harming forests. But the White House Office of Science and Technology Policy struck out two paragraphs noting how these effects could cascade throughout the food chain and take decades to reverse. It also reordered paragraphs in the report, so that it would start by emphasizing the limits of existing research, rather than acid rain's clear dangers and the need to stop it. In a related document, it added a new introduction by Fred Singer, who claimed that acid rain is not "life-threatening" and too costly to fix. Contrary to the panel's conclusions, he proposed only limited, cost-effective emissions reductions.

The White House modified the Nierenberg report in order to undermine it—and ensure that the conclusive existing research on acid rain would not lead to new regulations. Of course, in the process, it willfully misrepresented this research. Singer's perspective perfectly fit with the administration's: both viewed environmental problems exclusively in terms of economic costs and benefits. In turn, both assumed that the economic costs of acid rain would be limited and predictable. Ironically, then, they claimed with relative certainty that acid rain would only cause minor damage, even as they argued that more research was needed to truly understand the phenomenon.

In fact, during the panel's discussions, Fred Singer repeated unproven claims from the energy industry and accused other scientists of exaggerating acid rain's effects. He gave the eight other panelists documents explaining the Reagan administration's policy objective: promoting the free market and finding technological solutions to environmental problems. Throughout the process, he insisted that resources like lakes shouldn't be considered at all in government policy because scientists can't prove that they have inherent monetary value. In a public rebuttal to the panel's interim report, Singer wrongly insisted that there still wasn't enough evidence on acid rain (which, he said, may even be beneficial).

Singer's behavior during the panel discussions shows that he was working to promote a specific ideology, when he was really supposed to be evaluating the existing research on acid rain from a disinterested scientific perspective. Instead of updating his ideas to fit the evidence, he discarded evidence that didn't fit with his ideas. For instance, he blindly assumed that innovation in the market would resolve acid rain, even though all the available evidence suggested that the problem would be nearly impossible to reverse once it advanced beyond a particular stage.

Singer was also tasked with writing the report's chapter about the costs and benefits of reducing acid rain. But he concluded that ecological damage has no measurable cost, so the benefits of stopping acid rain are *zero*. The rest of the panel refused to accept this conclusion and published Singer's chapter as a separate appendix instead. Singer concluded that since analyzing the costs and benefits of emissions reduction is too difficult, the government should leave it to the free market by allowing companies to trade pollution rights and find the cheapest emissions reduction strategies on their own. Of course, this view reflected the administration's official stance.

Singer's argument that acid rain imposes zero costs on society shows why it's so dangerous to approach environmental issues purely through the realm of economics. If policymakers can simply ignore anything that they can't put a monetary value on, then even human life and well-being are largely irrelevant unless they produce profit. Singer's cap-and-trade proposal assumes that companies will figure out the most economically efficient level of pollution, but he never asks what level of pollution is best for the environment. Ironically, the economically efficient level of pollution depends on what price the government puts on pollution—which, in turn, depends on how seriously policymakers take environmental damage. This all makes it even more clear that Singer's goal wasn't to make a coherent, honest argument about how to deal with the acid rain problem, but rather to say anything it took to undermine potential new regulations.

Based on the panel report, a congressional panel rejected acid rain legislation by a 10-9 vote. Business publications celebrated the decision and falsely claimed that scientists had barely studied acid rain.

The alliance between the merchants of doubt and the administration succeeded. It allowed acid rain to continue, and Fred Singer's distortions spread much farther in the public record than the real, conclusive research on it.

Manipulating Peer Review. Oreskes and Conway explore why, even though Congress and the White House received the Nierenberg panel report in April 1984, it wasn't released to the public until August. Two congressmen accused the Reagan administration of suppressing the report, but the White House Office of Science and Technology Policy replied that it wasn't even finished until July. In fact, between April and July, the Office was editing the report's executive summary to significantly weaken its conclusions. It never informed most of the panelists, who raised an outcry when they learned what had happened. Nierenberg publicly claimed not to know about the changes, but panelists' testimony and documentation suggests that he actually *made* these changes, at the behest of the president's chief science advisor.

Legitimate science is peer-reviewed: researchers check each other's work, then make whatever improvements are needed to ensure that it's accurate and reliable. But the Reagan administration did the opposite: it secretly modified the Nierenberg report in order to replace its scientific conclusions with ideological ones. In fact, the evidence suggests that the administration may have put Nierenberg in charge of the panel for this very purpose. Nierenberg wasn't as blatantly ideological or hostile to mainstream science as Singer, but he shared the same underlying faith in the free market and was just as willing to put politics before science when asked.

For the rest of Reagan's term, his administration refused all action to stop acid rain, and his science advisors kept claiming not to know what causes it. As with tobacco, the science actually *was* settled, but a few doubt-makers convinced the public otherwise. While honest scientists like Gene Likens continued publishing conclusive research about acid rain in academic journals, the popular business media kept claiming that the science was unsettled. It enthusiastically cited dissenting scientists like soil researcher Edward Krug, who repeated the widely debunked claim that natural processes were causing soil acidification, and Laurence Kulp, a Columbia geochemist who believed in using science to prove Christian principles.

With acid rain, as with the SDI, doubt-mongering became the Reagan administration's official position. Oreskes and Conway point out how journalists unwittingly amplified the administration's lies by primarily covering the political debate over acid rain, rather than the scientific evidence about it. And when they did cover the scientific debate, newspapers spoke to the sources with the most powerful backing—who were generally paid to undermine legitimate scientific research. Ultimately, newspapers simply have a far greater impact on public life and policy than academic journals. Thus, in science-based policy, lies often travel much further than facts.

In 1990, the George H.W. Bush administration finally started regulating sulfur dioxide emissions through a "cap and trade" program. In 2003, the Environmental Protection Agency (EPA) concluded that this program had cost $8-9 billion, but saved $101-119 billion, over the previous decade. Contrary to the energy industry's warnings, "protecting the environment didn't produce economic devastation."

While the merchants of doubt significantly delayed policy action on acid rain—and ensured several more years of environmental destruction—they weren't able to stop regulation completely. The EPA's assessment shows that Fred Singer and his allies were wrong from the start: stopping acid rain wasn't *actually costlier than letting it continue. Oreskes and Conway suggest that Singer's primary worry may not have truly been the overall economic costs of regulation, but rather the specific costs to the few polluting companies who would have to modify their practices under new regulations.*

Yet this market-based program didn't go far enough. In 1999, Gene Likens and his colleagues found that acidification was still worsening at the Hubbard Brook forest, which was shrinking fast. And as of 2007, the George C. Marshall Institute is still calling acid rain a "largely hypothetical" threat that requires more research. Research by technology historians Margaret Taylor and David Hounshell suggests that strict regulation would control pollution far better than cap-and-trade, as it would give companies a true economic incentive to innovate in the field. But instead, "doubt-mongering" delayed the regulation process for years, and the scientists who did it began branching out into other fields.

It seems that no amount of research will ever make the merchants of doubt see acid rain as a real threat: no matter how much conclusive evidence comes out about it, the Institute continues to insist that it's not enough. Meanwhile, Likens's research points to Oreskes and Conway's broader conclusion about environmental policy: regulation cannot succeed if it's limited to market-friendly solutions. Finally, Taylor and Hounshell's work suggests that these seemingly market-friendly solutions are actually harmful to markets in the long run. In other words, avoiding regulation really just means putting the short-term self-interest of a few polluting companies above the long-term self-interest of society as a whole—including the broader economy.

CHAPTER 4

In 1970, scientists found that new supersonic planes (SSTs) would emit so much water vapor that they could deplete Earth's ozone layer and substantially increase skin cancer rates. At a major conference, the atmospheric chemist Harold Johnston showed that the nitrogen oxide compounds SSTs released would damage the ozone layer even more. A draft of Johnston's passionate paper on the subject leaked to the press and caused a public uproar.

Just like acid rain, ozone depletion presents a serious, potentially irreversible risk to a large portion of the population and environment. In both cases, it's possible to stop the emissions responsible for the danger, and the only people who stand to suffer from these emissions restrictions are the wealthy executives who run polluting companies. As a result, it's little surprise that the merchants of doubt got involved in both issues—on behalf of the polluters.

After cancelling the SST program due to its cost, the U.S. government still funded a climate assessment report on it. The report found that SSTs would significantly deplete the ozone layer, but oddly, its executive summary simply argued that better SSTs in the future *wouldn't* pose any ozone-related risks. Major newspapers started attacking scientists like Harold Johnston, but they refused to publish letters defending their research and correcting the executive summary. Johnston published his rebuttal in the journal Science, but it never received public attention. SST airplanes never became common, but Johnston's research led to a wave of studies about how industrial chemicals like chlorofluorocarbons (CFCs) destroy ozone. Congress recognized the danger and immediately started holding hearings about CFCs.

Years before the acid rain debate, government officials were already manipulating scientific reports to play down the dangers of pollution. This approach was the same as Fred Singer's appendix to the Nierenberg report: the SST report placed blind faith in future technology, which it claimed would solve environmental problems on its own. And the media repeated the same troubling pattern: leading publications treated pollution as a political issue, not a scientific one. They sidelined legitimate scientific research, while amplifying doubt-mongers' voices instead. Yet despite all these obstacles, the government still worked as intended: it began investigating how to build policies around the best available science for the sake of the public interest.

The Ozone War. Oreskes and Conway describe how aerosol manufacturers conducted their own research on CFCs and funded public relations campaigns to defend them. A U.S. government task force recommended banning CFCs, and it assigned the National Academy of Sciences to review the evidence. In response, the aerosol industry paid a British professor to tour the U.S., denouncing this research. Reporters publicly discredited him. So, the industry changed tactics: it started blaming volcanos for high atmospheric CFC levels. However, a major eruption quickly disproved this hypothesis.

Aerosol companies defended their dangerous products using many of the same dishonest public relations strategies as tobacco companies. Yet journalists effectively exposed their lies and the government didn't fall for them. Again, this shows how environmental regulation should *work in a functional democracy. But the following chapters will show how the merchants of doubt have distorted this system more and more in the decades since the debate over CFCs.*

Next, a young researcher proved that CFCs were breaking down the ozone layer by discovering chlorine monoxide in the stratosphere. Chlorine monoxide is a "fingerprint" for ozone depletion: it is only produced when chlorine breaks down ozone. However, when the NAS delayed its final report on ozone to make revisions—new data suggested that ozone breakdown could be slower than previously thought—the aerosol lobby triumphantly told the public that CFCs were totally safe. Yet the final NAS report indicated that CFCs were quickly destroying the ozone later. The NAS suggested completely banning CFCs within two years. Regulators started formulating new rules, and the public started dramatically reducing CFC use on its own.

The National Academy of Sciences did its job: it assessed the state of research on ozone depletion and made rational policy recommendations based on its findings. The industry's doubt-mongering was neither sophisticated nor persuasive enough to challenge the NAS's findings. And perhaps most importantly, the public's immediate move to reduce CFC use shows that there was a broad sense of trust in the government and scientific community: the population willingly followed government scientists' advice because it believed that they had its best interests at heart.

Holes in the Ozone Layer. Oreskes and Conway explain how, in the 1980s, British researchers discovered a massive hole in the ozone layer above Antarctica. This shocked the scientific establishment, which couldn't explain the hole and wondered why NASA satellites failed to detect it. They realized that the satellites had mistakenly processed low ozone concentrations as measurement errors. Soon, researchers had clear images of the vast Antarctic ozone hole. Some meteorologists questioned the evidence, but the U.S. sent two groups to Antarctica to investigate further. They discovered that CFCs specifically accelerated ozone breakdown in the Antarctic because of Antarctica's distinctive strong winds and icy clouds.

Depending on one's interpretation, the discovery of the Antarctic ozone hole is either a story of serious scientific failure or one of profound scientific success. On the one hand, researchers initially missed the hole because they programmed satellites incorrectly. This shows that the merchants of doubt are right to say that scientists sometimes do make serious mistakes, which can undermine the validity of their research. But, on the other hand, the researchers also caught and fixed their error. This shows how scientists' shared commitment to discovering and speaking the truth leads the whole scientific community to form a consensus around this truth, over time.

Creating an Adaptive Regulatory Regime. In 1987, at a UN conference in Montreal, nations agreed to reduce global CFC emissions by half and reconvene every few years to adapt their plans as needed. New satellite data soon proved that ozone depletion was worse than predicted—including in the Northern Hemisphere. But scientists also knew that satellite measurements could be very unreliable, so they established the Ozone Trends Panel to review the evidence. The panel concluded that ozone depletion was very severe, even if satellites were overestimating it. A DuPont chemical company scientist who served on the panel even convinced the company's executives to stop making CFCs.

The international community's collective agreement to address the ozone problem again shows how science-based policy should *work. Of course, this depends on a generalized sense of trust between policymakers and the scientific community. Indeed, as DuPont's agreement to stop producing CFCs shows, even polluting corporations seemed to share this fundamental trust in science. DuPont's decision also underlines how easy it can be for such corporations to stop polluting—especially when governments give them clear incentives to do so.*

An Arctic Ozone Hole? Next, researchers began asking whether there might also be an ozone hole over the Arctic. In 1989, stratospheric scientists made several flights into the Arctic and found even higher levels of chlorine monoxide than in the Antarctic. Yet there was no ozone hole, because the Arctic isn't as cold or windy as the Antarctic. Still, based on this new research, nations agreed to completely ban CFC production in 1990.

The Arctic research suggested that CFCs would only cause more and more damage over time, as their atmospheric concentration continued increasing. Meanwhile, the differences between the Arctic and Antarctic speak to how difficult it can be to generalize about scientific problems—which is another reason that the government should prefer empirical research over vague, speculative promises from people like the merchants of doubt.

Constructing a Counternarrative. Oreskes and Conway call the CFC ban "a success story" for science-based environmental regulation. Yet they note that industry, Reagan appointees, and conservative think tanks also consistently tried to derail the regulations through doubt-mongering. One of the leading voices was the Heritage Foundation, a new right-wing think tank funded by banks and large corporations. It gave Fred Singer a prominent platform in the 1980s. By the time of the ozone debate a few years later, Singer was working for the U.S. government instead. But he publicly questioned the research on ozone anyway.

The CFC ban was "a success story" because the government's interest in human well-being proved stronger than the merchants of doubt's campaign to undermine science. However, this all happened around the same time that Fred Singer and his allies did *successfully undermine acid rain regulations. This all shows that each environmental debate is separate, and the winner will always depend on conditions specific to each—like who has more power, resources, and allies in the government. If nothing else, Oreskes and Conway's book could serve as a resource to help scientists and their allies to fight this battle more effectively.*

In an article on the front page of the *Wall Street Journal*, Fred Singer claimed that ozone wasn't being depleted, just moving around. He blamed many factors besides ozone depletion for causing more skin cancer, and he seriously mischaracterized the research about SSTs. He suggested that researchers overreacted by panicking about SSTs and were repeating the same mistake. In a paper the following year, Singer argued that natural climate change caused the ozone hole by cooling the stratosphere. He cited researchers like V. Ramanathan and James E. Hansen, who agreed that climate change was cooling the stratosphere—but attributed this to human greenhouse gas emissions, not natural processes. Of course, Singer concluded that no new regulations were necessary.

Singer followed the same tried-and-true doubt-mongering playbook: he distorted the existing peer-reviewed research to justify rejecting it, and then presented his own absurd, unproven ideas as unquestionable facts. If emissions weren't destroying ozone, then there would be no need for companies to stop them. It's also telling that Singer blamed the ozone hole on supposedly natural *global warming, while failing to mention Ramanathan and Hansen's work on greenhouse gas emissions. This suggests that he already knew that human-caused climate change would also become a controversial—and profitable—political issue.*

When Science rejected Fred Singer's paper for its lack of rigor, Singer publicly complained in the conservative *National Review*. He accused the scientific community of selfishness, alarmism, and jumping to conclusions. He falsely claimed that the ozone hole was first discovered in the 1950s, and he warned that CFC substitutes would be ineffective and dangerous—even though they didn't exist yet. In fact, after CFCs were banned, scientists *did* develop far safer and more effective alternatives.

Singer even used his signature move to deal with his detractors: when his work was rejected for being unscientific, he turned the charge on its head and called his accusers *unscientific instead. Oreskes and Conway point out that this accusation is deeply ironic, because if mainstream scientists were really so selfish, they would have simply demanded more funding so that they could keep conducting more research (instead of declaring the ozone issue settled).*

After the final CFC ban, most policymakers and scientists moved on to other pressing issues, but Fred Singer stayed focused on ozone. He founded a think tank called the SEPP (Science and Environmental Policy Project), secured funding from a powerful conservative church, and started publishing articles claiming that the consensus on ozone was wrong because it used ground-based measurements instead of satellite data. (Actually, the satellite data showed *even more* ozone depletion.)

Singer's persistence serves as an important warning to scientists and their allies: the merchants of doubt continue trying to undermine science long after it is settled. Oreskes and Conway will explore the dangers of this phenomenon further in their seventh chapter, which explores how the merchants of doubt attacked Rachel Carson's groundbreaking work on DDT.

In 1990, the zoologist and former Washington governor Dixy Lee Ray lent credibility to Singer's work by citing it in her book, which was an attack on the environmentalist movement. But Singer's data wasn't based on original research—instead, it came from a fringe political magazine. It confused stratospheric chlorine, which destroys ozone, with chlorine emissions from sources like volcanos, which never reach the stratosphere. Sherwood Rowland publicly refuted this evidence in a major 1993 speech, but Singer kept repeating it—including at congressional hearings. When Rowland won a Nobel Prize for his work on ozone, Singer accused the committee and the public of "environmental hysteria." Yet Republican leaders continued listening to Singer, not Rowland.

Dixy Lee Ray's writing shows how misinformation about science can spread, especially when it's repeated by public figures with elite credentials and a wide following. Singer and Ray's distortions are difficult to fight because they are based on extremely obscure sources and highly technical misinterpretations of the data. As a result, when repeated in the press, their ideas often sounded just as legitimate as the real scientific truth. In contrast, the scientists doing legitimate work on ozone (like Rowland) struggled to correct the public record because they weren't as well-connected or powerful.

What Was This Really About? Oreskes and Conway explore Singer's true motives for spreading doubt about ozone depletion. Even as he accused other scientists of seeking money and fame, his organization, the SEPP, made millions of dollars, and he became one of the most popular scientists in the country. But it wasn't just about money. In 1989, he argued that socialists were trying to overthrow free-market capitalism by spreading lies about environmental threats. Thus, it's clear why the Marshall Institute began repeating Singer's claims and pro-business newspapers eagerly published them.

Once again, the paper trail shows that undermining legitimate science was extremely profitable for the merchants of doubt. But Oreskes and Conway also emphasize that financial incentives alone can't explain Singer's behavior. Instead, his actions were part of a broader political mission to defend unregulated capitalism against what he viewed as an environmentalist conspiracy. In the following chapters, Oreskes and Conway will further explore how the Cold War and its aftermath shaped this mission.

CHAPTER 5

In 1986, the link between smoking and cancer was already common knowledge. But that year, a major Surgeon General's report concluded that even non-smokers could get cancer from "secondhand" cigarette smoke. The EPA started to limit smoking indoors, so the tobacco industry hired Fred Singer to challenge the evidence and discredit the EPA.

With the acid rain and ozone debates all but settled, Fred Singer moved on to a new policy area, secondhand smoke. It's clear why the tobacco industry hired him: he was already an established merchant of doubt, with strong connections to people in power and impeccable pro-business connections.

A Brief History of Secondhand Smoke. Tobacco industry scientists already knew about secondhand smoke's dangers in the 1970s. In 1980, other researchers found that working in a smoky office could cause cancer, and in 1981, a landmark Japanese study showed that nonsmoking women were more likely to get lung cancer the more their husbands smoked. Tobacco companies challenged the findings by hiring contrarian scientists, buying advertisements, and funding independent studies. But they privately admitted that the Japanese study was right.

The debate about secondhand smoke was all but a repeat of the earlier controversy about cigarettes and cancer. Indeed, early findings on secondhand smoke were totally consistent with what researchers already knew: if smokers' spouses were experiencing the same negative health effects as smokers themselves, then cigarettes were the obvious culprit. Nonetheless, tobacco companies repeated the same dishonest playbook in the hopes of undermining (or at least slowing down) legislation.

State governments started banning public smoking, and in 1986, the Surgeon General released his report describing secondhand smoke as a serious danger. Tobacco companies responded with every tactic imaginable: they paid off scientists through secretive law firms, called smoking bans discrimination against smokers, and blamed construction materials for the effects of secondhand smoke. Just one company, Philip Morris, spent $16 million trying "to maintain the controversy." The industry started calling secondhand smoke "environmental tobacco smoke." But this backfired: the word "environmental" invited regulation from the Environmental Protection Agency. In 1992, an EPA report concluded that "environmental" smoke caused 3,000 lung cancer deaths and hundreds of thousands of asthma, bronchitis, and pneumonia cases per year.

Tobacco companies had already fooled the public about cigarette smoke once, so governments acted much faster to restrict it the second time around. By this point in the book, readers likely won't be surprised by the tobacco companies' response: they invested massively in a deceptive public relations campaign. They hoped to fend off policy change by insisting that scientific results were actually still up for debate, when in reality, they were totally conclusive. As the EPA report shows, they were really fighting for the right to continue killing innocent people for profit.

The scientific evidence on secondhand smoke was very strong—the best studies showed that smokers' spouses had much higher risks of lung cancer. Eight studies showed this with 95 percent certainty and nine more with 90 percent certainty. These studies could never be perfect, because scientists can't expose test subjects to toxic materials like secondhand smoke, but the EPA considered the evidence on secondhand smoke as "conclusive." So, the tobacco industry hired Fred Seitz and Fred Singer to deny it.

Oreskes and Conway point out the very real limits of scientific research—especially when it comes to substances that scientists can't ethically test through experiments. Of course, regulators have to realistically understand these limits if they are to create effective science-based policies. While it may be reasonable to demand 100% certainty in some experiments—above all in physics—this simply isn't feasible in most research dealing with health and environmental toxins.

Fred Seitz proposed that the tobacco industry reject the EPA's "balance of the evidence" approach and only consider perfect studies based on "ideal research designs." But no such studies could ever exist, so the industry rejected Seitz's proposal. Instead, it adopted Fred Singer's proposal to call favorable studies "sound science" and unfavorable ones "junk science." In articles for the industry, Singer claimed that the EPA was ignoring other risk factors for lung cancer (which was false) and "rig[ging] the numbers" by accepting studies with 90 percent certainty. Of course, his true goal was to undermine potential regulations.

Seitz's "ideal research designs" idea was impractical, but at least it had a plausible scientific principle behind it. This principle was the same one that doubt-mongers had already been citing for decades: science isn't valid unless it's absolutely certain. In contrast, Fred Singer's distinction between "sound science" and "junk science" was pure rhetoric, with no coherent principle behind it at all. Whereas Seitz's strategy would have forced the tobacco industry to reject virtually all science, Singer's benefited it by allowing it to label studies it funded or favored as "sound."

Next, tobacco companies published a communications handbook, *Bad Science*, based on Fred Singer's work. It was full of unproven statistics, quotable lines, and articles from industry consultants. But it also included many articles about real scientific misconduct, ranging from researchers inventing data to, ironically enough, corporate money distorting research. This was all designed to give readers "a means to challenge science on any topic." Of course, the handbook focused on the EPA. It declared that the EPA report on secondhand smoke was "widely criticized within the scientific community"—even though the only scientists criticizing it were the ones paid off by the tobacco industry. *Bad Science*'s goal wasn't really to correct bad science: it was to protect secondhand smoke by attacking science altogether.

Bad Science *offers the clearest available evidence about how the merchants of doubt approached their work. The handbook all but explicitly advised that corporations should undermine science that harms them by lying about it. Of course, it was primarily a guide for speaking to and writing in the media—and specifically for tricking the public into taking corporate lies seriously, while questioning legitimate science. This again highlights the fact that the merchants of doubt could not have possibly succeeded without a corporate media environment that favored them. Above all,* Bad Science *took advantage of the public's inability to identify* truly *"bad science."*

Blaming the Messenger: The Industry Attack on the EPA. Oreskes and Conway explain how the Philip Morris tobacco company began secretly funding the George C. Marshall Institute in exchange for press coverage defending secondhand smoke. Through the lobbyist Steven Milloy, Philip Morris founded a group called The Advancement of Sound Science Coalition (TASSC), which embarked on a national media tour and began recruiting "third party allies"—favorable scientists and journalists.

Oreskes and Conway frequently point out that companies like Philip Morris hide their public relations funding by routing it through law firms, lobbyists like Milloy, and legitimate-seeming institutes like TASSC. Of course, these companies' goal is to make positive media coverage sound independent and objective, when they've really been paying for it.

Next, the industry hired the Alexis de Tocqueville Institution, a pro-business think tank, to produce a report defending secondhand smoke. Its authors, Fred Singer and the conservative lawyer Kent Jeffreys, accused the EPA of trying to ban smoking entirely (which wasn't true). They argued that secondhand smoke is probably harmless in small doses, and that the EPA was doing bad science by assuming otherwise.

Like all other press coverage by the merchants of doubt, Singer and Jeffreys' report was effective because it was plausible*—it sounded like it could be true, even though it simply wasn't. If the EPA truly* were *trying to ban all smoking and secondhand smoke truly* were *harmless in small doses, then conservatives' indignation would be justified. The problem wasn't Singer and Jeffreys' reasoning—it was that their reasoning wasn't based in any underlying truth.*

The true test of good and bad science is peer review. A board of nine qualified doctors and research scientists peer reviewed the EPA study, and they *did* recommend significant changes: they thought that the EPA was *understating* the risks of secondhand smoke, especially on children. Since scientists already knew that cigarette smoking severely harms people's health, peer reviewers concluded that studies at the 90 percent confidence level were sufficient to link secondhand smoke to cancer. And two dozen of these studies consistently found the same risks, bringing the overall confidence level for the report's conclusions to above 999 in 1,000. Finally, the peer reviewers had no reason to consider the threshold effect idea—that secondhand smoke is harmless below a certain level—because there was no evidence for it, and it is simply not true of most toxic substances.

Peer review is the end-all-be-all of legitimate research because it's how the scientific community distinguishes between work that does and doesn't meet its professional standards. Since the scientific community is the best judge of whether a given piece of research is legitimate, Oreskes and Conway suggest that policymakers, the media, and the public should decide which science to believe in primarily by placing their trust in the peer review process. In the case of secondhand smoke, peer reviewers rejected both of Fred Singer's objections as unfounded. For instance, many studies came out at a lower confidence interval than scientists usually demand, but these studies simply didn't need *a higher confidence interval because of their sheer quantity and consistency—coupled with the robust existing research about tobacco's direct harms to smokers.*

The EPA built a website to respond to the tobacco industry's attacks and explain its findings about secondhand smoke, including why it accepted 90 percent confidence levels and rejected the threshold effect theory. But the website received far less attention than the tobacco companies' marketing campaign. This campaign was based on recycled ideas. In particular, the threshold theory became popular after researchers learned that Japanese atomic bomb survivors experienced few health effects if they received low levels of radiation. This makes sense: humans have constantly encountered low levels of radiation every day for thousands of years. But the same isn't true of toxins like industrial pesticides and cigarette smoke. Still, industry advocates tried to defend both using the threshold theory.

The EPA's website shows that scientists do *take defending their work and responding to corporate lies very seriously. However, since the EPA's public relations budget is much lower than the tobacco industry's, it struggled to combat disinformation at the necessary scale. Ultimately, Oreskes and Conway suggest that the underlying problem is that the U.S. media tends to spread the best-funded ideas, regardless of their truth or falsity. The threshold effect idea was attractive to the tobacco industry: it had been proven true in another context, which made it seem scientifically legitimate. What the industry conveniently failed to mention is that, when it comes to cigarettes, the threshold effect hypothesis is simply false.*

Fred Singer and Fred Seitz worked for the tobacco industry as part of a broader campaign for "free market fundamentalism" and against government regulation. *Using Tobacco to Defend Free Enterprise*. Oreskes and Conway explain how the British tobacco industry fought antismoking regulation by creating an advocacy group called FOREST (Freedom Organisation for the Right to Enjoy Smoking Tobacco). In a 1994 report introduced by a prominent anti-regulation economist, FOREST argued that antismoking advocates were suppressing true science in order to justify taking away smokers' freedom.

Oreskes and Conway use the term "free market fundamentalism" to refer to Singer, Seitz, and their allies' strong conviction that society cannot protect democracy and personal freedom unless it also protects corporations' absolute freedom to do whatever they wish, without regulation. FOREST shows that this worldview was not a uniquely American phenomenon. FOREST manipulates the concept of freedom to protect corporations by framing the debate around smokers' freedom to smoke, rather than nonsmokers' health and safety.

In the U.S., Russell Seitz—who worked for a pro-free market foundation's institute at Harvard—made a similar argument. He even proposed that the government should fund research "to remove the smoke from cigarettes," in order to make smoking safer without violating smokers' freedoms. Of course, all societies recognize that citizens' freedom to kill each other must be restricted. Still, Seitz and FOREST turned the debate over smoking restrictions into a proxy for the fight between capitalism and socialism. After all, at the end of its report, FOREST argued that many other scientific issues—from global warming to concern over "allegedly disappearing species"—were all inventions designed to limit capitalism.

Russell Seitz's arguments, like FOREST's, show how the merchants of doubt fought regulation by strategically making policy debates about freedom instead of the common good. But Oreskes and Conway point out that it never makes sense to talk about freedom in the abstract. Instead, freedom always really means the freedom to do specific things in specific contexts, and some people's freedoms inevitably affect others. The absurd idea of "remov[ing] smoke from cigarettes" demonstrates how untenable this argument is: while claiming to be protecting freedom in general, it really elevates smokers' freedom above nonsmokers' freedom. And its fundamental motivation isn't smokers' freedom at all, but rather corporations' freedom to harm people for profit.

CHAPTER 6

In 1995, the Intergovernmental Panel on Climate Change (IPCC) concluded that humans were significantly warming the planet. Ten years later, even though virtually all climate scientists had reached a consensus on the issue, most Americans still thought that the science was uncertain. In fact, scientists have known about the greenhouse effect for over 150 years, and even in the 1960s, they were already warning the government that fossil fuel emissions could permanently change Earth's climate. Yet the U.S. government did nothing. "The confusion raised by Bill Nierenberg, Fred Seitz, and Fred Singer" is one of many reasons for this inaction.

In many ways, this is the book's most significant chapter. Global warming is by far the most significant political problem that the merchants of doubt have fought to undermine. Their campaign against climate change science has been by far their most effective, and it's the only one that is still ongoing. In fact, their stance has become a mainstream political opinion and heavily influenced policy. Oreskes and Conway show this by starting with the clear discrepancy between the state of climate science and the state of public opinion about it.

1979: A Seminal Year for Climate. In 1965, the prominent oceanographer Roger Revelle wrote a report for the government about the risk of CO2 emissions causing global warming. Presidents Johnson and Nixon took the report seriously, but they mostly focused on more urgent policy challenges. In the 1970s, droughts caused severe famines across the Soviet Union and sub-Saharan Africa. In response, the U.S. government asked the Jasons, a group of elite physicists, to study CO2 emissions and the climate. Their conclusion echoed earlier studies by climate scientists: if atmospheric CO2 levels reach 540 ppm (double what they were before the industrial revolution), the atmosphere will warm 2.4 degrees Celsius—and the poles more than 10 degrees.

Oreskes and Conway note that the science on global warming is even older than that on acid rain or ozone, and yet there's still less of a political consensus on it today—as well as less definite policy action. This shows how successful the merchants of doubt have been in undermining public support for climate science. Roger Revelle is among the scientists who can most legitimately claim to have discovered global warming. This fact becomes particularly important at the end of this chapter, when Revelle has a fateful series of encounters with Fred Singer. Finally, the government's extensive research on climate change shows that it did take the problem very seriously at first. This was largely possible because the public still strongly trusted scientists in the 1970s, and fossil fuel corporations hadn't yet begun their influence campaign to undermine climate change research.

The Carter administration asked the NAS to peer review the Jasons' study. Leading climate modeler Jule Charney led a nine-member panel who used more sophisticated models but reached a similar conclusion: doubling CO2 levels would increase global temperatures by about 3°C, plus or minus 1.5°C. The panel carefully studied "negative feedback mechanisms," or natural processes that could slow down global warming, and concluded that they would have a minimal effect on the overall temperature change. The panelists also concluded that warming wouldn't seriously begin for several decades, because it takes oceans a very long time to heat up. Thus, people wouldn't feel or measure global warming until it was already far too late to stop it.

The NAS report is a clear example of how effective science works: over time, researchers review, refine, and reevaluate one another's work, until the community as a whole reaches a consensus about an issue. Charney's work helped confirm the Jasons study's overall predictions, while refining its specific conclusions. Slowly but steadily, scientists were forming a better understanding of global warming. The discovery that global warming wouldn't start for decades meant that the planet wouldn't start to suffer yet and governments would have plenty of time to act before experiencing its worst effects. But it also had a more sinister effect: it made inaction easier and its consequences much harder to see. It also made climate science easier to undermine, as Oreskes and Conway will show in the rest of this chapter.

Organizing Delay: The Second and Third Academy Assessments. The NAS commissioned a new study to follow up on the previous report. The economist Thomas Schelling led the new panel, which also included Roger Revelle and Bill Nierenberg. It concluded that global warming's social and economic impacts were very difficult to predict, but that humans could probably manage them by migrating and adapting their ways of life. While the panel agreed that humans should stop fossil fuel use as soon as possible, it also argued that the free market would naturally make fossil fuels more expensive and less popular. Thus, it proposed that the government conduct more research instead of limiting emissions.

The next assessment contributed to the overall scientific understanding of climate change by weighing in on its implications for human life and society. However, it assessed these implications through the logic of free market fundamentalism. Just like Fred Singer's appendix to the Nierenberg acid rain report, the Schelling panel report assumed that the problem would not be very costly just because its costs were difficult to measure. It also illogically assumed that an unregulated free market would naturally solve all of the same problems it created. It was correct to say that the government needed to do more research into global warming, Oreskes and Conway suggest, but it was too confident about humanity's ability to solve the problem later on.

Yet other prominent scientists firmly disagreed with the panel's conclusion. The NAS's top climate researcher, John Perry, wrote an article calling climate change "Today's Problem, Not Tomorrow's." He pointed out that increasing CO2 levels by far less than double would still cause significant climate change, so global warming was definitely already underway. Perry was right, but most politicians found it more convenient to side with Thomas Schelling instead.

Schelling's report assumed that global warming would not significantly harm humans, but only because it didn't look at the problem very closely. In contrast, Perry and his colleagues tried to correct the record by examining the problem's severity and likely timeline. When politicians chose Schelling's explanation, Oreskes and Conway suggest, they were choosing uninformed overconfidence over realistic caution.

In 1980, Congress created *another* committee to study CO2, then put Bill Nierenberg in charge. Rather than publishing a collectively-authored report, like NAS committees usually do, Nierenberg's group instead released a report with several individually-authored chapters. Five chapters by scientists described climate change's likelihood and effects, while two chapters by economists disagreed. In the first chapter, three economists argued that CO2 levels were likely to double by 2065, but taxing fossil fuels would be more expensive than just adapting to the problem when it arrives. In the final chapter, Schelling argued that it's better to deal with climate change's symptoms than its causes because we know little about how future people will live or what they will want.

In the Nierenberg climate change report, like in the Nierenberg acid rain report, unfounded and overly optimistic predictions from non-specialists ended up drowning out dire warnings from scientists who actually examined the problem. Yet again, the economists' introduction and conclusion applied free market fundamentalist principles to the environment. The introduction argued that environmental destruction only matters to the extent that its value can be quantified through money, so a significant (but highly uncertain and potentially catastrophic) level of it should be acceptable. The conclusion simply rejected government action based on the economic principle that decision-makers should care more about their present than their future, because circumstances can change and people can take action later. But this principle ignored many key facts—like the fact that humans will probably never collectively prefer for the environment to be destroyed and the fact that emissions rules always take many years to make a significant impact on the climate.

The report's executive summary agreed with the economists, not the scientists. It argued that the government should "wait and see," and people will migrate and adapt to new environments. Peer reviewers like physicist Alvin Weinberg critiqued the report's unsupported claims about climate adaptation, but the NAS ignored their comments. One researcher later told Oreskes that scientists "knew [the report] was garbage so we just ignored it."

The scientist's comment to Oreskes succinctly captures one of the main reasons that lies often outperform truth in the media: whereas doubt-mongers spend nearly all of their time and resources manipulating the media, legitimate scientists actually have research to do. Their job is to actually do *science, not explain it to the public, and their voices don't carry nearly as far as the doubt-mongers' when they do. As a result, the media is systematically biased towards people like the merchants of doubt—and the lies they tell.*

However, the administration took the report very seriously, using it to discredit the EPA's efforts to regulate coal. In fact, officials guided the report from the start: they asked the panel to avoid "speculative, alarmist, 'wolf-crying' scenarios" and instead argue that technology would solve humanity's environmental problems. While the panel didn't reject science altogether, it *did* ignore climate scientists and any economists who disagreed with free market fundamentalism.

The administration's response further suggests that it deliberately planned the report in order to get the answer it wanted to hear. It's telling that the administration called predictions about catastrophic climate change "speculative," but clearly didn't apply the same label to its own free-market fundamentalist prediction that everything would be okay because capitalism would innovate the problem away. In reality, there was much less scientific evidence for this second train of thought, which made it far more "speculative" than the scientists' approach.


Meeting the "Greenhouse Effect" with the "White House Effect." In 1988, a severe drought ravished the globe, and climate scientist James E. Hansen publicly testified that human-caused global warming was already observable. Global temperatures had already increased by at least half a degree, and Hansen presented models showing that, within two decades, they would likely be higher than at any time in the last 120,000 years. Hansen's testimony was widely covered across the U.S. Meanwhile, atmospheric scientists agreed to work together and assess the evidence on climate change, just as they had done for ozone a few years before. They formed the IPCC and named Bert Bolin as its first chair. The administration also began investing in climate change research.

It's significant that Hansen's testimony is generally remembered as the moment when global warming became a serious scientific problem, even though there had already been research into it for decades. This reaffirms that the public and political leaders' perceptions of science depend far more on the way scientists are covered in the media than the way they actually do research. Meanwhile, Hansen's testimony is the merchants of doubt's worst nightmare: a rare example of legitimate, peer-reviewed science reaching a broad audience and seriously influencing political leaders' priorities. The IPCC is still the leading global climate advisory group today.


Blaming the Sun. After his retirement, Bill Nierenberg joined the George C. Marshall Institute. In 1989, the Cold War was ending, so the Institute was pivoting from supporting the SDI to attacking environmentalists. It began circulating a report by Jastrow, Seitz, and Nierenberg blaming global warming on the sun. These scientists called the White House and arranged a meeting with several key cabinet members, who took their work very seriously.

Nierenberg's path from government to the Marshall Institute again shows how close the links between political leaders and doubt-mongers really are. In a way, the merchants of doubt are far better connected to political power than they are to the rest of the scientific community. In turn, this is what won them such an immediate and attentive audience with the White House—even though they had no real expertise on climate science.

But Jastrow, Seitz, and Nierenberg's argument was based on a serious distortion of James Hansen's data. Hansen showed that three factors explain most historic temperature change: CO2 emissions, volcanic eruptions, and radiation from the sun. Jastrow, Seitz, and Nierenberg republished Hansen's solar radiation graph, while ignoring his graphs of CO2 and volcanic eruptions. Moreover, if they *were* right about the sun, this would actually mean that Earth is extremely sensitive to temperature change, and greenhouse gases are even *more* dangerous than previously thought.

One of the most basic principles of scientific research is that scientists must fairly analyze all the data they collect, rather than simply cherry-picking the results that will help them reach their preferred conclusion. Thus, in any serious scientific circle, Jastrow, Seitz, and Nierenberg's work would be viewed as dishonest and legitimate. Yet this somehow didn't stop them from advising the president. The core problem, Oreskes and Conway suggest, is that the government chooses not to apply the basic criteria for legitimate science when choosing its advisors.

In 1990, the IPCC's first report confirmed that greenhouse gases were the main cause of global warming and explained that solar radiation levels would only have a minor effect, at most, on global temperatures. Yet the George C. Marshall Institute continued blaming the sun and publishing erroneous graphs, even after Bert Bolin and other climate scientists publicly corrected them, and the White House continued listening to the Marshall Institute over the IPCC.

The first IPCC report's conclusions represent a scientific consensus about greenhouse gas emissions causing global warming. Even though research has continued to improve ever since, this consensus was already established in 1990. But decades later, public opinion still has not caught up. This is because, just like Republican administrations, most of the public has chosen to believe a convenient (but false) version of science instead of the actual experts.

The Attack on Roger Revelle. Oreskes and Conway explain how Fred Singer started publicly accusing Roger Revelle of "chang[ing] his mind about global warming." Revelle was studying how humans could switch to alternative energy sources and how forest growth could help remove carbon dioxide from the atmosphere. Fred Singer contacted Revelle to propose working on an article together, and Revelle agreed.

Singer's attack on Revelle is significant for two reasons. First, it underlines that the merchants of doubt are willing to go to extreme lengths to get their way. And secondly, Revelle was the scientist who first proposed that the greenhouse effect could warm the planet, so his voice had significant sway in the scientific community. Oreskes and Conway suggest that, judging by Revelle's career trajectory, Singer's accusations were designed to undermine Revelle's life work.

Then, Revelle had a serious heart attack, which nearly killed him. During Revelle's six-week hospital stay, Singer sent him three drafts of a joint paper. But Revelle's secretary reports that he ignored the drafts and considered Fred Singer a poor scientist. Oreskes and Conway suggest that Revelle may have regretted agreeing to work with Singer, who was a pariah, and tried to prevent their paper from getting published by simply ignoring it.

Oreskes and Conway emphasize that it's impossible to know exactly what Revelle wanted or thought after his heart attack. However, they argue that it's important to try and fairly interpret the existing evidence about the end of Revelle's life, in order to test Fred Singer's unlikely claims about him. This evidence strongly suggests that Revelle did not support Singer's skeptical claims about climate change. After all, Singer's track record, as the authors have presented it, suggests that he would be willing to lie about Revelle's ideas and intentions in order to undermine legitimate science.

Meanwhile, Fred Singer was independently publishing articles making the same point about global warming that he once made about ozone and acid rain: [the science is still "too uncertain to justify drastic action."](#) When Singer and Revelle finally met to discuss their joint paper, Revelle rejected Singer's claim that the climate would warm by "less than one degree Celsius, well below the normal year to year variation." Revelle knew that there would be at least one to three degrees of warming, which is far *more* than natural variation. Yet, while Singer removed the reference to "one degree Celsius," he left the rest of the sentence unchanged. The paper was published in the obscure, non-peer-reviewed magazine *Cosmos*. Revelle voiced his embarrassment at the paper's publication, then died shortly thereafter.

Singer effectively wrote the whole paper that he claimed to co-author with Revelle. This suggests that his primary goal may have simply been to get Revelle's name on a climate-skeptical article, so that he could later claim that Revelle changed his mind. Yet Singer and Revelle's disagreement over the magnitude of likely global warming offers even clearer evidence that Revelle never truly did change his views. Revelle's predictions were in line with the overall scientific consensus about climate change, and he specifically went out of his way to challenge Singer's ideas. Of course, it's also significant that Singer published this paper in a non-peer-reviewed journal, because this ensured that his work would not be subject to scrutiny or fact-checking.

Then, Revelle's former student Al Gore ran for vice president. Popular media sources like the *New Republic* started associating Revelle with Singer's claim that climate science was still uncertain, and soon, Ross Perot's running mate was quoting Singer and Revelle's paper in a vice-presidential debate. Revelle's daughter and colleagues wrote public letters explaining that Singer misrepresented Revelle's views. One of Revelle's graduate students, Justin Lancaster, insisted in the *New Republic* and at a Harvard symposium on Revelle's life and work that Revelle never actually wrote the article. In response, Singer sued Lancaster for libel, and Lancaster agreed to a decade-long gag order to settle the suit. But Revelle's papers clearly demonstrate that he never changed his mind about global warming.

The media fallout surrounding Singer and Revelle's paper further suggests that Singer pushed for the collaboration as part of a calculated public relations strategy. Clearly, it worked: Singer's claims about Revelle spread more widely and proved more influential than the actual truth. Singer's lawsuit against Lancaster again shows that, while the truth generally wins out in scientific circles, people like Singer often use their power and influence to ensure that it doesn't in politics. Oreskes and Conway's research represents an important step toward correcting the record—although they also faced similar kinds of harassment from Fred Singer for doing so.

In the 1992 UN Framework Convention on Climate Change, 192 countries (including the U.S.) agreed to fight global warming. *Doubling Down on Denial*. Oreskes and Conway explain how the merchants of doubt stepped up their campaign in response. They began attacking the climate modeler Benjamin Santer, who used advanced statistical methods to evaluate climate models and try to show that human activities were specifically responsible for global warming. He was also the convening lead author for a chapter in the second IPCC report, which means he was responsible for coordinating with 35 other climate scientists. After an extensive process including multiple rounds of drafting and review, it became clear that Santer's group had clearly found the "fingerprint" necessary to prove that climate change was human-caused. However, his comments for the last round of review were delayed.

As evidence about climate change mounted, the international community began taking major, much-needed steps to address the problem. Oreskes and Conway return to the example they used in the book's introduction: the attacks on Ben Santer. Like Revelle's work in the 1960s, Santer's work was clearly at the cutting edge of climate research. The "fingerprint" that he discovered showed that human activity was driving climate change, which means that stopping it would become a major concern for public policy. Santer's position at the IPCC and the extensive peer review process that his report underwent both suggest that there was no serious reason to doubt his results.

A copy of the IPCC report was leaked before its official meeting, and Republican leaders began attacking Santer's findings. At a congressional hearing, the contrarian climatologist and fossil fuel lobbyist Patrick J. Michaels testified that the IPCC was using incorrect models and unfairly ignoring his review comments. (In response, the meteorologist Jerry Mahlman explained to Congress that Michaels's review comments were based on a mix-up between different kinds of models.)

There's little question that the merchants of doubt publicly attacked Santer in the hopes of undermining the IPCC as a whole. If Santer's report was right and human greenhouse gas emissions were the primary cause of climate change, then major polluting companies would have to fundamentally transform their business models—and possibly even lose money—in order to save the planet. This was not acceptable to Republican leaders.

At the IPCC meeting, delegates from fossil fuel companies and oil-producing states questioned Santer's work. The IPCC reached a compromise by describing the human impact on climate as "discernible" (rather than Santer's preferred term, "appreciable"). Still, Fred Singer attacked Santer's work with a series of baseless claims, ranging from the accusation that it was never peer reviewed (it was) to an insistence that the climate was actually cooling (it wasn't). At a government briefing, two enraged petroleum industry lobbyists screamed at Santer for "secretly altering the IPCC report," and William Nierenberg repeated the same claim in an interview, even though Santer's chapter hadn't even been published yet.

Oreskes and Conway discuss the controversy over "discernible" versus "appreciable" warming in order to emphasize that the IPCC report was already very conservative in its wording and conclusions. In other words, if anything, it underplayed *the threat of climate change, because many powerful people with the same political interests as Fred Singer contributed to it. Singer's previous actions already made it clear that he had little interest in the truth, and his attacks on Santer fit this pattern. They were obviously, verifiably false—but they made a significant dent in Santer's credibility anyway.*

Fred Seitz publicly accused Santer of fraud in the *Wall Street Journal*. Santer and 40 other IPCC scientists wrote the *Journal* to explain that the changes were part of peer review, but the *Journal* significantly edited their letter, including by deleting the forty other scientists' names. The *Journal* also heavily edited a similar letter from Bert Bolin and the IPCC chairman John Houghton. The American Meteorological Society independently republished the letters to show how the *Journal* edited them. Singer came to Seitz's defense. Singer and Santer continued going back and forth with open letters in the *Journal*, then switched over to email. Singer falsely accused Santer of relying on unpublished results and changing his chapter as part of a political conspiracy with John Houghton. Of course, the reality is that these changes were merely part of peer review.

The Wall Street Journal*'s biased editorial practices further show how the popular media amplifies the voices of the merchants of doubt by depicting their baseless claims as equally legitimate to (or even more reasonable than) peer-reviewed science. In particular, publications that are closely aligned with major corporations—like the* Journal*—stand to benefit financially from spreading pro-corporate misinformation, which creates a clear conflict of interest. Yet because these publications have a far wider circulation and much more political influence than legitimate scientific journals, their editorial decisions make an outsized impact on the way policymakers understand science and set science-related policy.*

Clearly, right-wing groups and scientists were *really* the ones meddling with science for political purposes. Some scientists cut their ties with William Nierenberg after realizing that he was spreading disinformation. Yet millions of people, including many in Congress and the White House, still read Seitz, Jastrow, Nierenberg, and Singer's ideas in the *Wall Street Journal*—and took them seriously. These men continued disguising their true motivations, like they had done during the Cold War, and the media continued covering their ideas in an ill-fated attempt to provide balanced coverage. By 1997, even though scientists had reached a consensus about climate change, "politically, global warming was dead."

The merchants of doubt continue to use the tobacco industry's tried-and-true playbook. This strategy delayed, but did not stop, government regulation relating to cigarettes, acid rain, and ozone. But unfortunately, it seems to have been even more successful when it comes to climate change—which is by far the largest of any of these issues. There's little doubt that Oreskes and Conway wrote this book primarily because they understood that scientists, climate activists, and their allies must understand doubt-mongering tactics in order to successfully fend them off.

CHAPTER 7

Oreskes and Conway begin by calling the biologist Rachel Carson "an American hero" for alerting the public to the dangers of pesticides in her book **Silent Spring**. Her work convinced the government to ban the dangerous pesticide DDT in the 1970s. But 30 years later, conservatives on the internet started accusing Carson of mass murder and praising DDT as a lifesaving chemical. It was all part of their campaign "against regulation in general."

Younger readers may or may not be familiar with Rachel Carson, who was arguably the most influential environmental activist of the 20th century. Regardless, this chapter can serve as a useful introduction to her work and its impact. Oreskes and Conway explore the merchants of doubt's comments about Carson not because they worry that the U.S. will roll back DDT regulations, but rather because they believe these comments speak volumes about the doubt-mongers' worldview, underlying goals, and long-term strategy in the 21st century.

Silent Spring and the President's Science Advisory Committee. DDT use became widespread during World War II, when other pesticides were scarce. Experiments showed that DDT effectively killed disease-carrying insects, and it was very inexpensive and easy to spray from airplanes. It was also widely believed to be safe—until Rachel Carson and other biologists at the U.S. Fish and Wildlife Service discovered that it was harming crucial species.

In many ways, DDT was a miracle of modern science, and Oreskes and Conway don't mean to underplay its significance. Like CFCs and fossil fuels, it provided great benefits to modern societies and great profit to the corporations that created it—but it also came at a great environmental cost. Carson showed the public for the first time that effective policy requires balancing the social, economic, and environmental costs and benefits of new technologies and products.

In 1962, Carson published **Silent Spring** in *The New Yorker*. She showed how DDT killed fish, people's pets, and key pollinating insects. Since DDT didn't naturally break down, it accumulated up the food chain: small animals like rodents ate plants covered in DDT, and then the predators who ate those small animals got very sick. This led whole ecosystems to the brink of collapse. Animal experiments suggested that DDT could also seriously harm human fertility.

Carson's research wasn't necessarily rigorous or quantitative, but it still made a clear, definitive case about the dangers of DDT. Of course, it helped her case that DDT's effects were more visible and direct than those of acid rain or ozone-killing pollution: poisoned animals can more easily tug at the public's heartstrings than eroding ecosystems or a changing atmospheric chemistry.

After Rachel Carson published **Silent Spring**, the pesticide industry—and even some fellow scientists—started attacking her. Then, the official President's Science Advisory Committee (PSAC) studied DDT and concluded that the government should regulate pesticides immediately, because they pose such great risks to wildlife and humans. In the following years, Congress passed bipartisan legislation and created institutions like the EPA, which banned DDT altogether in 1972.

The pesticide industry's attacks show that corporations were already using doubt-mongering tactics long before Seitz and Singer came on the scene. However, in the 1960s, corporate lobbyists weren't yet strong enough to significantly influence the national political agenda, so science prevailed. Meanwhile, the history of Congress establishing the EPA is an important reminder that the government's power to regulate toxic pollutants shouldn't be taken for granted—instead, it was the result of deliberate political decisions, and other deliberate political decisions could always take it away.

Oreskes and Conway point out that the PSAC report focused on the overall evidence, not on whether "the hazards of persistent pesticides were 'proven,' 'demonstrated,' 'certain,' or even well understood." The PSAC didn't endlessly demand more research or make baseless political accusations against Rachel Carson. Instead, it asked pesticide companies to prove, beyond a reasonable doubt, that their products were safe. In other words, "science and democracy worked as they were supposed to."

Oreskes and Conway closely examine the language used in the PSAC report because it shows how "science and democracy" should *work. The government should adopt a common-sense standard for banning dangerous substances, and the burden of proof to show that a product is safe should fall on the company that sells it (and not on independent or government researchers).*

Years later, in the early 2000s, conservatives started calling Rachel Carson a mass murderer. They asserted (without evidence) that DDT is safe and would have completely eradicated malaria if it weren't banned. Mainstream newspapers like the *Wall Street Journal* and even the *New York Times Magazine* ran articles questioning Carson's research and citing the work of bacteriologist I. L. Baldwin.

This campaign against Carson began several decades after her 1964 death. Like Fred Singer's campaign against Roger Revelle, it took advantage of the fact that Carson was dead (and unable to defend herself) in order to make unfounded claims about her life and work. By the early 2000s, doubt-mongering tactics were far more widespread in U.S. culture and media, and so it proved easy for the people who used them to get their claims into the popular media.

In fact, world health authorities gave up on fighting malaria through DDT four years *before* DDT was banned. They had successfully eradicated malaria in most countries, but in sub-Saharan Africa, it wouldn't go away unless healthcare and nutrition improved significantly. Moreover, after people's homes get treated with DDT, they can never clean their walls, which is impractical. And most importantly, mosquitos were evolving to become DDT-resistant, largely due to DDT's widespread use in the U.S. agriculture industry. Ultimately, DDT was never even necessary—for instance, the U.S. and Panama eradicated malaria in the early 1900s by draining the pools of stagnant water where mosquitos breed.

Just like their attacks on the science about acid rain, ozone, and climate change, the doubt-mongers' attacks on Rachel Carson were simply factually incorrect. DDT just wasn't *the miracle pesticide they claimed it was—rather, it was remarkably effective until it stopped working. In fact, DDT's fate speaks to an important truth about technology and capitalism: today's miracle cure often proves obsolete tomorrow. As Oreskes and Conway pointed out in their chapter about acid rain, environmental regulation can actually play an important role in spurring regulation because it forces researchers and corporations to come up with new, better products that don't threaten health and safety. This is deeply ironic because the merchants of doubt consistently present deregulation as a way to promote and preserve innovation. But according to the authors' perspective, it's just the opposite: removing regulation just allows the leading players in the market to entrench their power.*

I. L. Baldwin, the bacteriologist cited by Rachel Carson's 21st-century detractors, never even researched DDT. Instead, he just wrote a mildly critical book review about **Silent Spring**. He called the book "superbly written" and scientifically flawless, but he criticized Carson's passion and focus on pesticides' downsides, rather than their benefits. Carson's argument was always based on DDT's effects on the *environment*, not its direct effects on humans. And medical researchers have since found that pesticides like DDT *do* cause significant increases in cancer and serious birth defects. Meanwhile, there is no evidence for the contrarians' claim that DDT saved millions of lives. Instead, like with tobacco, acid rain, ozone, and climate change, the contrarians were spreading doubt about DDT "to defend an extreme free market ideology."

While Baldwin may have believed in free-market fundamentalist ideology, he wasn't necessarily operating as a merchant of doubt because he admitted that Carson's science was correct. He was accusing Carson of being too pessimistic and caring too much about environmental preservation, but not *of lying, distorting evidence, or participating in a dark conspiracy to destroy capitalism. It was only later that the true merchants of doubt began making these unfounded suggestions and portraying Baldwin as one of their own. As Oreskes and Conway point out, their real goal wasn't to bring back DDT, but rather to attack the environmentalist movement at its root.*

Denial as Political Strategy. Oreskes and Conway note that the campaign to defend DDT was also unique because, when it started, the science was long settled and Rachel Carson was long dead. DDT contrarians weren't trying to stop *new* regulations: they were attacking regulations *in general* by trying to discredit one of the central figures in modern environmentalism. The first person to use this strategy was Dixy Lee Ray, who argued that DDT all but ended malaria in Sri Lanka—until the nation stopped using it, and malaria cases shot back up. But Ray never mentioned *why* Sri Lanka stopped using DDT: malaria-carrying mosquitos became totally resistant to it, and it stopped working.

Rachel Carson was an important target for the merchants of doubt because, perhaps more than anyone else, she was responsible for launching the contemporary environmentalist movement. In other words, if the merchants of doubt could implicate Carson in their conspiracy theory, then they could suggest that all environmentalism was rotten at its core. This promised to help the merchants of doubt win their other 21st-century battles (including, most importantly, their fight against climate change policy).

Eventually, the former tobacco lobbyist and "junk science" alarmist Steven Milloy worked with entomologist J. Gordon Edwards to repeat Dixy Lee Ray's claims—again, without mentioning pesticide resistance. The radio personality Rush Limbaugh, the novelist Michael Crichton, and especially the Heartland Institute continue using the same talking points. While the nonprofit Heartland Institute is now best known for its brazen climate denialism, it also worked extensively with tobacco and chemical companies in the 1990s. It spread doubt about their products' harmful effects in exchange for millions of dollars in tax-deductible donations.

Just like Fred Seitz's claims about the SDI and Fred Singer's claims about climate change, Ray and Milloy's assertions are difficult to refute because they depend on ignoring *the available evidence. On their own terms, these ideas seem legitimate—they can only be disproven when other voices enter the conversation and direct the audience's attention to other pieces of evidence. Meanwhile, Limbaugh and Crichton show how anti-science ideas have spread by winning allies in popular conservative media. Needless to say, readers will know that this phenomenon has only become more pronounced in the years since Orestes and Conway published this book.*

The Orwellian Problem. Oreskes and Conway conclude that a web of corporations, journalists, and right-wing foundations has created a crisis of disinformation in American science. This is the same right wing that heeded George Orwell's warnings about propaganda and denounced Soviet lies during the Cold War. Now, these contrarians conveniently forget scientific evidence or label it as "junk," while presenting utter fictions as the truth. In the process, they undermine science, which is about "studying the world as it actually is—rather than as we wish it to be."

Oreskes and Conway use the term "The Orwellian Problem" because they suggest that capitalism's assault on science has created the same kind of unaccountable propaganda machine that conservatives viewed with so much scorn during the Cold War (although on a much smaller scale). This critique also has an important implication: if propaganda means presenting lies as facts and repeating them until the public believes them, then the opposite of propaganda—presenting the truth as such and helping the public believe in it on its own merits—is science itself.

Science has shown that unregulated capitalism is not sustainable: humans have to transform their economy if they want to hold onto the same standard of living without destroying the planet. Under the current system, companies generate profound environmental costs (or "negative externalities") but do not have to pay for them unless the government steps in to make them through regulation. Thus, people like Fred Seitz, Fred Singer, Robert Jastrow, Bill Nierenberg, and Dixy Lee Ray spread lies about science in order to avoid accepting "the limits of free market capitalism." These scientists turned against their own profession in the name of the free market.

Oreskes and Conway summarize their primary conclusion about why the merchants of doubt do what they do. In short, doubt-mongering is an ill-fated attempt to defend unregulated capitalism against the externalities it produces. In the authors' minds, this really amounts to a fundamental flaw in the system: corporations are not legally required to account for environmental damage in the same way as the other costs they incur, so they have a strong incentive to destroy the environment in the name of profit. While the merchants of doubt defend this system—on behalf of the corporations who most benefit from it—Oreskes and Conway merely suggest that the law should change in order to take environmental costs into account.

CONCLUSION

Oreskes and Conway argue that democracy is impossible without a free press to inform citizens. Even though the Fairness Doctrine is no longer law, U.S. media still tries to give equal coverage to every "side" of an issue—even when some "sides" are based on ignorance, confusion, or even brazen deception. The internet has made disinformation even worse by "creat[ing] an information hall of mirrors" where lies can easily multiply. As a result, many Americans don't believe in basic facts, like the dangers of smoking and the reality of climate change. Politics turns into a game of "he said/she said/who knows?"

In their conclusion, Oreskes and Conway summarize the broad political takeaways from their book and outline how researchers, citizens, and policymakers can help build a healthier role for science in public life. They begin by emphasizing how U.S. media's structure and incentives feed disinformation and help undermine legitimate science. The core issue is that the media applies political standards (like covering all "sides" of an issue equally) to scientific debates (in which, once researchers reach a consensus, only one "side" is legitimate). By characterizing contemporary U.S. media as a "information hall of mirrors," they show how its organizing principle—repeating the ideas that grab the most discussion—also prevents fact-based discussion. Of course, with the rise of social media, this problem has only grown in the years since Oreskes and Conway published this book in 2010.

This disinformation is particularly threatening to science, which depends on anchoring our beliefs in evidence. This book has shown how, for over 40 years, a few ideologically-motivated scientists have prevented politicians from acting on solid scientific evidence by spreading doubt. These contrarian scientists' arguments are difficult to combat because they're "based on *ignoring* evidence." When mainstream scientists reach a consensus, contrarians repeat disproven ideas and insist that the consensus doesn't exist.

The merchants of doubt manage to overpower the scientific consensus because they take advantage of structural weaknesses in the U.S. media and political systems. Science only works when everyone involved acts in good faith, by respecting data and truth. But when some people cheat the system by inventing, distorting, or ignoring evidence, then truth becomes indistinguishable from lies, and the system falls apart.

Journalists then report the contrarians' claims without revealing that they're being paid by the corporations that stand to lose most from new government regulations. Several of the journalists who Oreskes and Conway interviewed for this book reported that they never even knew about their sources' industry ties. Moreover, industry executives have frequently met with newspaper publishers to ask for "equal consideration" alongside scientists, and wishful thinking has also certainly led some journalists to minimize threats like smoking and global warming.

Journalists unwittingly do the merchants of doubt's bidding because doubt-mongers have the right credentials and know how to make their lies seem newsworthy. Meanwhile, journalism is driven by speed and profit, so journalists often fail to fully investigate their sources' backgrounds and motives. Reforming the system to promote legitimate science would require, first and foremost, ensuring that journalists and politicians hold scientists to the same standards that scientists apply to themselves.

This all helps explain why the media portrayed the research into smoking, acid rain, and the ozone layer as unsettled well into the 1990s, long after scientists reached agreement. In the case of global warming, the media lagged 25 years behind the scientific consensus. Rather than reporting the facts, the media has used "balance" to justify systematically privileging unscientific minority views. Fortunately, some recent examples suggest that this could be changing. For instance, in 2008, *The New York Times* reported on how military contractors and Pentagon officials were grooming retired generals to defend the Iraq War. (This is a disturbing parallel to how corporations paid the retired physicists Jastrow, Seitz, Nierenberg, and Singer to defend their products.)

Oreskes and Conway present this media bias as the primary reason for the disconnect between science and policy. Their example from The New York Times *shows that this trend may be slowly changing, and this book promises to help speed up the process. However, they also make it clear that broader changes in the structure of U.S. journalism will be necessary in order to ensure that media companies actually start putting facts over process. Moreover, the example from* The New York Times *also suggests that doubt-mongering techniques are spreading to other realms of life and society in the U.S.*

A Scientific Potemkin Village. Oreskes and Conway note that the corporate doubt campaigns succeeded in part because they created a veneer of scientific legitimacy. They established institutes, organized conferences, and published papers, journals, and newsletters. Their work looked like science, but it wasn't really scientific at all. And this strategy worked: the White House took the George C. Marshall Institute's reports seriously, even though they were never peer-reviewed and full of serious misrepresentations.

In this next section, Oreskes and Conway focus on the specific techniques that the doubt-mongers used to appeal to politicians and the media. They copied all of the outward structures and practices associated with science, but without actually doing any research. And they rightly assumed that policymakers either wouldn't be able to tell or wouldn't care if they were actually doing real peer-reviewed science.

Similarly, Fred Seitz took the unusual step of leading a petition challenging the evidence on global warming. He carefully emphasized his former connection to the National Academy of Sciences in the document, and he even formatted it so that it appeared to be from the NAS. He reported receiving 15,000 signatures from scientists, but they're unverifiable. The NAS held a special press conference to denounce Seitz's petition, but much of the mainstream media still treated it as legitimate, and it's still circulating today. Finally, the merchants of doubt publish their work in sources like the *Journal of American Physicians and Surgeons*, which sounds legitimate but is actually published by a right-wing think tank. All in all, their tactics are designed to fool journalists—and they often succeed.

Seitz's credentials were legitimate, but he used them in a deceptive way: he manipulated them in order to insinuate that his fringe positions were actually part of the scientific mainstream. The NAS's press conference on the subject was an extremely unusual but powerful move intended to defend the scientific community's integrity. Yet the controversy received deeply unbalanced press coverage, which again shows that the merchants of doubt will continue to get their way until journalism and politics' relationships to science fundamentally change.

Free Speech and Free Markets. In 1973, former government regulator and University of California chancellor Emil Mrak gave a speech about the intricacies of the regulatory process to the tobacco company Philip Morris. Shortly thereafter, President Nixon disbanded the President's Science Advisory Committee (PSAC), which had made the regulation process for DDT so efficient. Meanwhile, corporations and conservative donors realized that they could undermine science by channeling millions of dollars to fake experts, like Steve Milloy, and think tanks, like the Heartland Institute and the Ludwig von Mises Institute. All these donors, institutes, experts, and corporations had one thing in common: they believed in free market capitalism at all costs.

In the second half of their conclusion, Oreskes and Conway explore the political ideology and financial interests that motivate the merchants of doubt. They begin with three stories—none is particularly important in itself, but each represents an important trend that allowed the doubt-mongering industry to take off in the early 1970s. Mrak's speech represents the growing alliance between researchers and private industry, Nixon dissolving the PSAC represents the government's push for deregulation, and the rise of fake experts like Steve Milloy exemplifies the sudden flow of money into conservative pseudo-scientific institutions. Oreskes and Conway see these as the three key trends that allowed contrarians to overtake genuine scientists in the realm of policy.

Market Fundamentalism and the Cold War Legacy. Anti-communism was absolutely central to 20th-century American politics. The main merchants of doubt (Seitz, Singer, Nierenberg, and Jastrow) built careers around using science to fight communism during the Cold War, and then turned against environmentalism instead. Men like Fred Singer believed that, if the government steps in to limit people's economic rights (by, for instance, preventing them from releasing toxic pollution into the atmosphere), then it will inevitably take away their civil rights, too.

As historians of science, Oreskes and Conway pay close attention to the social and political trends that made doubt-mongering into such a lucrative profession. World War II and the Cold War brought several crucial groups together: physicists, high-level military and government officials, corporate leaders, and conservative ideologues. The merchants of doubt were born out of this specific alliance. During the Cold War, the government gave pro-military, pro-corporate physicists significant power, while systematically disempowering scientists who didn't share these attitudes. It should not be surprising that the scientists who emerged from the Cold War with the most power were these same militaristic, pro-market ideologues.

In other words, the merchants of doubt believe in "free market fundamentalism"—they think that society will *only* be free if the economy is left completely unregulated. But this belief is based on blind faith, not science. Even the most extreme free-market economists, like Milton Friedman, have argued that the government must use regulation to control externalities like pollution. And by lying to the public, the merchants of doubt ensured that the best ideas *wouldn't* prevail. Oreskes and Conway suggest that, ironically, Seitz, Nierenberg, Jastrow, and Singer believed in the unlimited power of private industry mostly because they never actually experienced its failures firsthand. They spent their whole careers working for universities and the government.

Free market fundamentalism is not just a specific worldview: it's also a broad political movement that seeks to transform society in line with that worldview. Like the merchants of doubt themselves, free market fundamentalism has its origins in the Cold War, when much of the public saw free-market capitalism as inextricably linked to American democracy and global power. Yet today, this ideology doesn't come from free-market economists, but rather from wealthy corporate leaders, who use it as an excuse to demand even more power from elected leaders and the public. So even while fooling others, the merchants of doubt were also themselves being fooled. Unfortunately, free market fundamentalism has spread widely: much of the U.S. public and political class now believe that the nation's prosperity depends on giving polluting corporations license to do whatever they wish.

The main problem with free market fundamentalism is that, empirically, it's false. Free markets often *aren't* the best way to allocate resources, and they frequently collapse, like in the Great Depression (which the U.S. only survived due to massive government spending). But thanks to the Cold War, many leading scientists viewed their jobs as defending liberty and progress, no matter the cost to the environment. At the extreme, Dixy Lee Ray and Fred Singer accused environmentalists of trying to create a single, global socialist government.

Free market fundamentalism was the ideology that held together the alliance of military, political, corporate, and scientific leaders who spearheaded the U.S.'s effort in the Cold War. Scientists like Lee and Singer, who came to prominence as part of this alliance, naturally carried their worldview with them into the next phase of their lives after the Cold War ended. Yet, without the threat of brutal, authoritarian communism on the horizon, free market fundamentalism was no longer a useful political strategy. Instead, it gave way to serious misconceptions about history and paranoid conspiracy theories about the government—and, eventually, science itself.

In the 1990s, this line of thought persuaded the Republican Party to turn entirely against global climate accords. In fact, far more books challenged climate science in the 1990s than ever before, even though the science was also more certain than ever before. Ironically, the longer that contrarians manage to delay action on climate change by associating it with socialism, the more far-reaching—and potentially authoritarian—that action will have to be to solve the problem.

Oreskes and Conway warn their readers against assuming that society will naturally make progress and learn to listen to science on its own. Instead, they emphasize that free market fundamentalism's reach as an ideology is only growing. *Now, it's central to one of the two mainstream parties' platforms, and it's threatening to entirely undermine government action on climate change—the most serious environmental problem that humanity has ever faced. Thus, the authors believe that fighting back against free-market fundamentalism is of the utmost importance. It may even be the key to saving the planet.*


Can't Technology Save Us? Experts of all political leanings agree that new energy technology will be the key to stopping global warming, but they disagree about how fast that technology will spread without government support. Some thinkers, who call themselves Cornucopians, believe that technology will always improve enough to solve humanity's problems—*if* free markets allow them to keep innovating.

Oreskes and Conway carefully distinguish between two approaches to technology. On the one hand, mainstream scholars view transitioning to renewable energy technology as crucial to stopping climate change. On the other, the Cornucopians think that technology will advance so far in the future that humanity doesn't need to take any action at all *to stop climate change now. But the Cornucopian perspective is ultimately based on faith, not legitimate research. Humanity has made incredible scientific advances before, but this doesn't mean that technology will solve all of our problems on its own.*

Although he had doubts about this approach at first, Fred Singer eventually became an avowed Cornucopian. Today, political scientist Bjørn Lomberg is probably the most prominent Cornucopian. But most of his talking points are unscientific and based on dubious statistics. Lomberg argues that humans should focus on issues like hunger instead of climate change (even though it's clearly possible to do both), and he freely admits that nature has no value at all in his calculations. Right-wing think tanks ardently defend Lomberg's work, as Cornucopian thinking strongly supports free market fundamentalism. But it's also wrong: climate change will likely accelerate, so future technology may not be enough to stop it, and it's simply not true that innovation relies on the free market.

Cornucopianism props up free market fundamentalism because it suggests that the free market, and not collective political action, is the best solution to environmental problems. Like the merchants of doubt, Lomberg tells people what they want to hear and knows how to appear scientific—even though he doesn't actually do any legitimate science. His arguments are based on logical fallacies, and their true purpose is simply to justify inaction and defend the profits of major polluting corporations. His rise to prominence shows that doubt-mongering is still alive and well today—in fact, it only seems to be getting more sophisticated over time.

Technofideism. "Technofideism" is Oreskes and Conway's term for "a blind faith in technology that isn't borne out by the historical evidence." The most transformative technologies have almost always come from massive *government* investment. For instance, the U.S. Army invented a way for machines to build identical, interchangeable parts for other machines. This technology is the foundation of all modern industrial manufacturing. U.S. government investment also created the Internet, made airplanes and transistors commercially viable, and electrified the nation, built the national highway system, and invented the atomic bomb.

If Cornucopianism is the leading justification for free market fundamentalism today, then in turn, technofideism is the primary justification for Cornucopianism. Thus, to empirically disprove the merchants of doubt, historians like Oreskes and Conway primarily have to disprove technofideism—or show that the free market doesn't just magically come up with technological solutions to all of the problems it creates. As they explain here, the historical record on this issue is clear: if anything, technofideism is the opposite *of the real historical truth.*

Why Didn't Scientists Stand Up? Scientists know that contrarians are lying to do "politics camouflaged as science." But only a few scientists (like Gene Likens and Sherwood Rowland) have publicly spoken out against these contrarians. One explanation is that contemporary science always depends on joint contributions from dozens of scientists, so individual researchers are usually reluctant to try to speak for the group. When organizations *do* publish collective statements (like the IPCC's lengthy reports), almost nobody reads them.

So far in their conclusion, Oreskes and Conway have summarized the underlying ideology that motivated the merchants of doubt and the specific political history, corporate interests, and media biases that have allowed their lies to spread. Now, they ask why the merchants of doubt have met so little resistance from the mainstream scientists they have so long undermined. First, Oreskes and Conway point out that single contrarians are often more persuasive and charismatic than the dry consensus reports that science relies on.

Another reason scientists avoid speaking publicly is that they generally care more about conducting research than "populariz[ing]" it, and they worry that they will compromise their scientific objectivity if they take any kind of political stance. Worst of all, scientists who speak the truth on politically controversial issues often get personally attacked. This has even happened to Oreskes and Conway, and Ben Santer still receives constant harassment, many years after Seitz, Singer, and Nierenberg first attacked him. Finally, many scientists ignore disinformation because their job is to find the truth, not deal with other people's lies. But if society is going to solve critical problems like global warming, then *someone* has to deal with these lies. Oreskes and Conway propose that everyone should do their part.

Oreskes and Conway also explain mainstream research's failure to influence policy by pointing to systematic biases within the scientific community. Mainstream scientists' job is to do science, so they generally communicate in a way intended for other scientists—and not the media, public, or government. In contrast, the merchants of doubt's only job is to speak to the media, public, and government, which gives them an unfair advantage. To overcome this doubt-mongering, the scientific community and society at large have to learn to communicate differently. Just like the media and government should take scientists' standards of evidence into account when reporting on their work, the authors suggest, researchers and their allies must start to take science communication far more seriously. The fate of the planet may depend on it.

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