

## CHAPTER 1

# Doubt Is Our Product

**O**N MAY 9, 1979, A GROUP OF tobacco industry executives gathered to hear about an important new program. They had been invited by Colin H. Stokes, the former chairman of R. J. Reynolds, a company famous for pioneering marketing, including the first cigarette advertisements on radio and television (“I’d walk a mile for a Camel”). In later years, Reynolds would be found guilty of violating federal law by appealing to children with the character Joe Camel (which the Federal Trade Commission compared to Mickey Mouse), but the executives had not come to hear about products or marketing. They had come to hear about science. The star of the evening was not Stokes, but an elderly, balding, bespectacled physicist named Frederick Seitz.

Seitz was one of America’s most distinguished scientists. A wunderkind who had helped to build the atomic bomb, Seitz had spent his career at the highest levels of American science: a science advisor to NATO in the 1950s, president of the National Academy of Sciences in the 1960s, president of the Rockefeller University—America’s leading biomedical research institution—in the 1970s. In 1979, Seitz had just retired, and he was there to talk about one last job: a new program, which he would run on behalf of R. J. Reynolds, to fund biomedical research at major universities, hospitals, and research institutes across the country.

The focus of the new program was degenerative diseases—cancer, heart disease, emphysema, diabetes—the leading causes of death in the United States. And the project was huge: \$45 million would be spent over the next six years. The money would fund research at Harvard, the universities of

Connecticut, California, Colorado, Pennsylvania, and Washington, the Sloan-Kettering Institute, and, not surprisingly, the Rockefeller University.<sup>1</sup> A typical grant was \$500,000 per year for six years—a very large amount of money for scientific research in those days.<sup>2</sup> The program would support twenty-six different research programs, plus six young investigators on “RJR research scholarships,” in the areas of chronic degenerative disease, basic immunology, the effect of “lifestyle modes” on disease.<sup>3</sup>

Seitz’s role was to choose which projects to fund, to supervise and monitor the research, and to report progress to R. J. Reynolds. To determine the project criteria—what types of projects to fund—he enlisted the help of two other prominent colleagues: James A. Shannon and Maclyn McCarty.

Shannon was a physician who pioneered the use of the antimalaria drug Atabrine during World War II. Atabrine was effective, but had lousy side effects; Shannon figured out how to deliver the drug without the sickening side effects, and then administered the program that delivered it to millions of troops throughout the South Pacific, saving thousands from sickness and death.<sup>4</sup> Later, as director of the National Institutes of Health from 1955 to 1968, he transformed the NIH by convincing Congress to allow them to offer grants to university and hospital researchers. Before that, NIH funds were spent internally; very little money was available to American hospitals and universities for biomedical research. Shannon’s external grant program was wildly popular and successful, and so it grew—and grew. Eventually it produced the gargantuan granting system that is the core of the NIH today, propelling the United States to leadership in biomedical research. Yet, for all this, Shannon never won a Nobel Prize, a National Medal of Science, or even a Lasker Award—often said to be biology’s next best thing to the Nobel Prize.

Maclyn McCarty similarly had a fabulously successful career without being fabulously recognized. Many people have heard of James Watson and Francis Crick, who won the Nobel Prize for deciphering the double helix structure of DNA, but Watson and Crick did not prove that DNA carried the genetic information in cells. That crucial first step had been done a decade earlier, in 1944, by three bacteriologists at the Rockefeller University—Oswald Avery, Maclyn McCarty, and Colin MacLeod. In an experiment with pneumonia bacteria, they showed that benign bacteria could be made virulent by injecting them with DNA from virulent strands. You could change the nature of an organism by altering its DNA—something we take for granted now, but a revolutionary idea in the 1940s.

Perhaps because Avery was a quiet man who didn’t trumpet his discovery,

or perhaps because World War II made it difficult to get attention for any discovery without immediate military relevance, Avery, McCarty, and McLeod got relatively little notice for their experiment. Still, all three had distinguished scientific careers and in 1994 McCarty won the Lasker Award. But in 1979, McCarty was definitely underappreciated.

So it is perhaps not surprising that when Shannon and McCarty helped Seitz to develop their criteria for judging proposals, they sought projects that took a different perspective from the mainstream, individuals with unusual or offbeat ideas, and young investigators in their “formative stages” who lacked federal support.<sup>5</sup> One funded study examined the impact of stress, therapeutic drugs, and food additives (like saccharin) on the immune system. Another explored the relation between “the emotional framework and the state of . . . the immune system . . . in a family of depressed patients.” A third asked whether the “psychological attitude of a patient can play a significant role in determining the course of a disease.”<sup>6</sup> Projects explored the genetic and dietary causes of atherosclerosis, possible viral causes of cancer, and details of drug metabolism and interactions.

Two scientists in particular caught Seitz’s personal attention. One was Martin J. Cline, a professor at UCLA who was studying the lung’s natural defense mechanisms and was on the verge of creating the first transgenic organism.<sup>7</sup> Another was Stanley B. Prusiner, the discoverer of prions—the folded proteins that cause mad cow disease—for which he later won the Nobel Prize in Physiology or Medicine.<sup>8</sup>

All of the chosen studies addressed legitimate scientific questions, some that mainstream medicine had neglected—like the role of emotions and stress in somatic disease. All the investigators were credentialed researchers at respected institutions.<sup>9</sup> Some of the work they were doing was pathbreaking. But was the purpose simply to advance science? Not exactly.

Various R. J. Reynolds documents discuss the purpose of Seitz’s program. Some suggest that supporting research was an “obligation of corporate citizenship.” Others note the company’s desire to “contribute to the prevention and cure of diseases for which tobacco products have been blamed.” Still others suggest that by using science to refute the case against tobacco, the industry could “remove the government’s excuse” for imposing punitive taxes.<sup>10</sup> (In 1978, smokers paid over a billion and a half dollars in cigarette excise taxes in the United States and abroad—taxes that had been raised in part in response to the scientific evidence of its harms.)

But the principal goal, stressed by Stokes to his advisory board that day

in May and repeated in scores of industry documents, was to develop “an extensive body of scientifically, well-grounded data useful in defending the industry against attacks.”<sup>11</sup> No doubt some scientists declined the offer of industry funding, but others accepted it, presumably feeling that so long as they were able to do science, it didn’t really matter who paid for it. If any shareholders were to ask why company funds were being used to support basic (as opposed to applied) science, they could be told that the expenditure was “fully justified on the basis of the support it provides for defending the tobacco industry against fundamental attacks on its business.”<sup>12</sup> The goal was to fight science with science—or at least with the gaps and uncertainties in existing science, and with scientific research that could be used to deflect attention from the main event. Like the magician who waves his right hand to distract attention from what he is doing with his left, the tobacco industry would fund distracting research.

In a presentation to R. J. Reynolds’ International Advisory Board, and reviewed by RJR’s in-house legal counsel, Stokes explained it this way: The charges that tobacco was linked to lung cancer, hardening of the arteries, and carbon monoxide poisoning were unfounded. “Reynolds and other cigarette makers have reacted to these scientifically unproven claims by intensifying our funding of objective research into these matters.”<sup>13</sup> This research was needed because the case against tobacco was far from proven.

“Science really knows little about the causes or development mechanisms of chronic degenerative diseases imputed to cigarettes,” Stokes went on, “including lung cancer, emphysema, and cardiovascular disorders.” Many of the attacks against smoking were based on studies that were either “incomplete or . . . relied on dubious methods or hypotheses and faulty interpretations.” The new program would supply new data, new hypotheses, and new interpretations to develop “a strong body of scientific data or opinion in defense of the product.”<sup>14</sup> Above all, it would supply witnesses.

By the late 1970s, scores of lawsuits had been filed claiming personal injury from smoking cigarettes, but the industry had successfully defended itself by using scientists as expert witnesses to testify that the smoking-cancer link was not unequivocal. They could do this by discussing research that focused on other “causes or development mechanisms of chronic degenerative diseases imputed to cigarettes.”<sup>15</sup> The testimony would be particularly convincing if it were their *own* research. Experts could supply reasonable doubt, and who better to serve as an expert than an actual scientist?

The strategy had worked in the past, so there was no reason to think it would not continue to work in the future. “Due to favorable scientific

testimony,” Stokes boasted, “no plaintiff has ever collected a penny from any tobacco company in lawsuits claiming that smoking causes lung cancer or cardiovascular illness—even though one hundred and seventeen such cases have been brought since 1954.”<sup>16</sup>

In later years, this would change, but in 1979 it was still true. No one had collected a penny from the tobacco industry, even though scientists had been certain of the tobacco-cancer link since the 1950s (and many had been convinced before that).<sup>17</sup> Every project Reynolds funded could potentially produce such a witness who could testify to causes of illness other than smoking. Prusiner’s work, for example, suggested a disease mechanism that had nothing to do with external causes. A prion, Seitz explained, could “take over in such a way that it over-produces its own species of protein and . . . destroys the cell,” in “the manner in which certain genes . . . can be stimulated to over-produce cell division and lead to cancer.”<sup>18</sup> Cancer might just be cells gone wild.

Cline’s research suggested the possibility of preventing cancer by strengthening the cell’s natural defenses, which in turn suggested that cancer might just be a (natural) failure of those defenses. Many of the studies explored other causes of disease—stress, genetic inheritance, and the like—an entirely legitimate topic, but one that could also help distract attention from the industry’s central problem: the overwhelming evidence that tobacco killed people. Tobacco caused cancer: that was a fact, and the industry knew it. So they looked for some way to deflect attention from it. Indeed, they had known it since the early 1950s, when the industry first began to use science to fight science, when the modern era of fighting facts began. Let us return, for a moment, to 1953.

DECEMBER 15, 1953, was a fateful day. A few months earlier, researchers at the Sloan-Kettering Institute in New York City had demonstrated that cigarette tar painted on the skin of mice caused fatal cancers.<sup>19</sup> This work had attracted an enormous amount of press attention: the *New York Times* and *Life* magazine had both covered it, and *Reader’s Digest*—the most widely read publication in the world—ran a piece entitled “Cancer by the Carton.”<sup>20</sup> Perhaps the journalists and editors were impressed by the scientific paper’s dramatic concluding sentences: “Such studies, in view of the corollary clinical data relating smoking to various types of cancer, appear urgent. They may not only result in furthering our knowledge of carcinogens, but in promoting some practical aspects of cancer prevention.”

These findings shouldn't have been a surprise. German scientists had shown in the 1930s that cigarette smoking caused lung cancer, and the Nazi government had run major antismoking campaigns; Adolf Hitler forbade smoking in his presence. However, the German scientific work was tainted by its Nazi associations, and to some extent ignored, if not actually suppressed, after the war; it had taken some time to be rediscovered and independently confirmed.<sup>21</sup> Now, however, American researchers—not Nazis—were calling the matter “urgent,” and the news media were reporting it.<sup>22</sup> “Cancer by the carton” was not a slogan the tobacco industry would embrace.

The tobacco industry was thrown into panic. One industry memo noted that their salesmen were “frantically alarmed.”<sup>23</sup> So industry executives made a fateful decision, one that would later become the basis on which a federal judge would find the industry guilty of conspiracy to commit fraud—a massive and ongoing fraud to deceive the American public about the health effects of smoking.<sup>24</sup> The decision was to hire a public relations firm to challenge the scientific evidence that smoking could kill you.

On that December morning, the presidents of four of America’s largest tobacco companies—American Tobacco, Benson and Hedges, Philip Morris, and U.S. Tobacco—met at the venerable Plaza Hotel in New York City. The French Renaissance chateau-style building—in which unaccompanied ladies were not permitted in its famous Oak Room bar—was a fitting place for the task at hand: the protection of one of America’s oldest and most powerful industries. The man they had come to meet was equally powerful: John Hill, founder and CEO of one of America’s largest and most effective public relations firms, Hill and Knowlton.

The four company presidents—as well as the CEOs of R. J. Reynolds and Brown and Williamson—had agreed to cooperate on a public relations program to defend their product.<sup>25</sup> They would work together to convince the public that there was “no sound scientific basis for the charges,” and that the recent reports were simply “sensational accusations” made by publicity-seeking scientists hoping to attract more funds for their research.<sup>26</sup> They would not sit idly by while their product was vilified; instead, they would create a Tobacco Industry Committee for Public Information to supply a “positive” and “entirely ‘pro-cigarette’” message to counter the anti-cigarette scientific one. As the U.S. Department of Justice would later put it, they decided “to deceive the American public about the health effects of smoking.”<sup>27</sup>

At first, the companies didn’t think they needed to fund new scientific research, thinking it would be sufficient to “disseminate information on hand.” John Hill disagreed, “emphatically warn[ing] . . . that they should . . .

sponsor additional research," and that this would be a long-term project.<sup>28</sup> He also suggested including the word "research" in the title of their new committee, because a pro-cigarette message would need science to back it up.<sup>29</sup> At the end of the day, Hill concluded, "scientific doubts must remain."<sup>30</sup> It would be his job to ensure it.

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.<sup>31</sup> 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. Representatives of the Tobacco Industry Research Committee met with staff at *Time*, *Newsweek*, *U.S. News and World Report*, *Business Week*, *Life*, and *Reader's Digest*, including men and women at the very top of the American media industry. In the summer of 1954, industry spokesmen met with Arthur Hays Sulzberger, publisher of the *New York Times*; Helen Rogers Reid, chairwoman of the *New York Herald Tribune*; Jack Howard, president of Scripps Howard Newspapers; Roy Larsen, president of Luce Publications (owners of *Time* and *Life*); and William Randolph Hearst Jr. Their purpose was to "explain" the industry's commitment to "a long-range . . . research program devoted primarily to the public interest"—which was needed since the science was so unsettled—and to stress to the media their responsibility to provide a "balanced presentation of all the facts" to ensure the public was not needlessly frightened.<sup>32</sup>

The industry did not leave it to journalists to seek out "all the facts." They made sure they got them. The so-called balance campaign involved aggressive dissemination and promotion to editors and publishers of "information" that supported the industry's position. But if the science was firm, how could they do that? *Was the science firm?*

The answer is yes, but. A scientific discovery is not an event; it's a process, and often it takes time for the full picture to come into clear focus. By the late 1950s, mounting experimental and epidemiological data linked tobacco with cancer—which is why the industry took action to oppose it. In private, executives acknowledged this evidence.<sup>33</sup> In hindsight it is fair

to say—and science historians *have* said—that the link was already established beyond a reasonable doubt. Certainly no one could honestly say that science showed that smoking was safe.

But science involves many details, many of which remained unclear, such as why some smokers get lung cancer and others do not (a question that remains incompletely answered today). So some scientists remained skeptical. One of them was Dr. Clarence Cook Little.

C. C. Little was a renowned geneticist, a member of the U.S. National Academy of Sciences and former president of the University of Michigan.<sup>34</sup> But he was also well outside the mainstream of scientific thinking. In the 1930s, Little had been a strong supporter of eugenics—the idea that society should actively improve its gene pool by encouraging breeding by the “fit” and discouraging or preventing breeding by the “unfit.” His views were not particularly unusual in the 1920s—they were shared by many scientists and politicians including President Theodore Roosevelt—but nearly everyone abandoned eugenics in the ’40s when the Nazis made manifest where that sort of thinking could lead. Little, however, remained convinced that essentially all human traits were genetically based, including vulnerability to cancer. For him, the cause of cancer was genetic weakness, not smoking.

In 1954, the tobacco industry hired Little to head the Tobacco Industry Research Committee and spearhead the effort to foster the impression of debate, primarily by promoting the work of scientists whose views might be useful to the industry. One of these scientists was Wilhelm C. Hueper, chief of the Environmental Cancer Section at the National Cancer Institute. Hueper had been a frequent expert witness in asbestos litigation where he sometimes had to respond to accusations that a plaintiff’s illnesses were caused not by asbestos, but by smoking. Perhaps for this reason, Hueper prepared a talk questioning the tobacco-cancer link for a meeting in São Paulo, Brazil. When the Tobacco Industry Research Committee learned about it, they contacted Hueper, who agreed to allow them to promote his work. Hill and Knowlton prepared and delivered a press release, with copies of Hueper’s talk, to newspapers offices, wire services, and science and editorial writers around the country. They later reported that “as a result of the distribution [of the press release] in the U.S.A., stories questioning a link between smoking and cancer were given wide attention, both in headlines and stories.”<sup>35</sup> *U.S. News and World Report* practically gushed, “Cigarettes are now gaining support from new studies at the National Cancer Institute.”<sup>36</sup>

Little's committee prepared a booklet, *A Scientific Perspective on the Cigarette Controversy*, which was sent to 176,800 American doctors.<sup>37</sup> Fifteen thousand additional copies were sent to editors, reporters, columnists, and members of Congress. A poll conducted two years later showed that "neither the press nor the public seems to be reacting with any noticeable fear or alarm to the recent attacks."<sup>38</sup>

The industry made its case in part by cherry-picking data and focusing on unexplained or anomalous details. No one in 1954 would have claimed that everything that needed to be known about smoking and cancer was known, and the industry exploited this normal scientific honesty to spin unreasonable doubt. One Hill and Knowlton document, for example, prepared shortly after John Hill's meeting with the executives, enumerated fifteen scientific questions related to the hazards of tobacco.<sup>39</sup> Experiments showed that laboratory mice got skin cancer when painted with tobacco tar, but not when left in smoke-filled chambers. Why? Why do cancer rates vary greatly between cities even when smoking rates are similar? Do other environmental changes, such as increased air pollution, correlate with lung cancer? Why is the recent rise in lung cancer greatest in men, even though the rise in cigarette use was greatest in women? If smoking causes lung cancer, why aren't cancers of the lips, tongue, or throat on the rise? Why does Britain have a lung cancer rate four times higher than the United States? Does climate affect cancer? Do the casings placed on American cigarettes (but not British ones) somehow serve as an antidote to the deleterious effect of tobacco? How much is the increase in cancer simply due to longer life expectancy and improved accuracy in diagnosis?<sup>40</sup>

None of the questions was illegitimate, but they were all disingenuous, because the answers were known: Cancer rates vary between cities and countries because smoking is not the only cause of cancer. The greater rise in cancer in men is the result of latency—lung cancer appears ten, twenty, or thirty years after a person begins to smoke—so women, who had only recently begun to smoke heavily, would get cancer in due course (which they did). Improved diagnosis explained some of the observed increase, but not all: lung cancer was an exceptionally rare disease before the invention of the mass-marketed cigarette. And so on.

When posed to journalists, however, the loaded questions did the trick: they convinced people who didn't know otherwise that there was still a lot of doubt about the whole matter. The industry had realized that you could create the impression of controversy simply by asking questions, even if you actually knew the answers and they didn't help your case.<sup>41</sup> And so the

industry began to transmogrify emerging scientific consensus into raging scientific "debate."<sup>42</sup>

The appeal to journalistic balance (as well as perhaps the industry's large advertising budget) evidently resonated with writers and editors, perhaps because of the influence of the Fairness Doctrine. Under this doctrine, established in 1949 (in conjunction with the rise of television), broadcast journalists were required to dedicate airtime to controversial issues of public concern in a balanced manner.<sup>43</sup> (The logic was that broadcasts licenses were a scarce resource, and therefore a public trust.) While the doctrine did not formally apply to print journalism, many writers and editors seem to have applied it to the tobacco question, because throughout the 1950s and well into the 1960s, newspapers and magazines presented the smoking issue as a great debate rather than as a scientific problem in which evidence was rapidly accumulating, a clear picture was coming into focus, and the trajectory of knowledge was clearly against tobacco's safety.<sup>44</sup> Balance was interpreted, it seems, as giving equal weight to both sides, rather than giving *accurate* weight to both sides.

Even the great Edward R. Murrow fell victim to these tactics. In 1956, Hill and Knowlton reported on a conference held with Murrow, his staff, and their producer, Fred Friendly:

The Murrow staff emphasized the intention to present a coldly objective program with every effort made to tell the story as it stands today, with *special effort toward a balanced perspective and concrete steps to show that the facts still are not established and must be sought by scientific means such as the research activities the Tobacco Industry Research Committee will support.*<sup>45</sup>

Balance. Cold objectivity. These were Murrow's trademarks—along with his dangling cigarette—and the tobacco industry exploited them both. Murrow's later death from lung cancer was both tragic and ironic, for during World War II Murrow had been an articulate opponent of meretricious balance in reporting. As David Halberstam has put it, Murrow was not ashamed to take the side of democracy, and felt no need to try to get the Nazi perspective or consider how isolationists felt. There was no need to "balance Hitler against Churchill."<sup>46</sup>

Yet Murrow fell prey to the tobacco industry's insistence that their self-interested views should be balanced against independent science. Perhaps, being a smoker, he was reluctant to admit that his daily habit was

deadly and reassured to hear that the allegations were unproven. Roger Ferger, publisher of the *Cincinnati Enquirer*, evidently felt that way, as he wrote a bread-and-butter note for his copy of the *Scientific Perspective* pamphlet: "I have been a smoker for some forty-five years and I am still a pretty healthy specimen."<sup>47</sup> It was certainly comforting to be told that the jury was still out.

Editors, however, might eventually be expected to notice if the only support for industry claims came from obscure conferences in Brazil. No doubt realizing this, the industry sought links with mainstream medicine, funding research projects at leading medical schools related to cancer pathology, diagnosis, and distribution, and potentially related diseases such as coronary heart disease. In 1955, the industry established a fellowship program to support research by medical degree candidates: seventy-seven of seventy-nine medical schools agreed to participate.<sup>48</sup> (Industry documents don't tell which two declined; perhaps they were affiliated with religious denominations that eschewed smoking.) The industry also sought to develop good relations with members of the National Cancer Institute and American Heart Association by inviting their representatives to board meetings.<sup>49</sup> Building on his success, in 1957 the Tobacco Industry Research Committee published 350,000 copies of a new pamphlet, *Smoking and Health*, mostly sent to doctors and dentists.<sup>50</sup>

By the end of the 1950s, the tobacco industry had successfully developed ties with doctors, medical school faculty, and public health authorities across the country. In 1962, when U.S. Surgeon General Luther L. Terry established an Advisory Committee on Smoking and Health, the tobacco industry made nominations, submitted information, and ensured that Dr. Little "established lines of communication" with the committee.<sup>51</sup> To ensure that the panel was "democratically" constituted, the surgeon general invited nominations from the tobacco industry, as well as from the Federal Trade Commission (who would become involved if restrictions were placed on tobacco advertising). To ensure that the panel was unbiased, he excluded anyone who had publicly expressed a prior opinion. One hundred and fifty names were put forward, and the tobacco industry was permitted to veto anyone they considered unsuitable.<sup>52</sup>

Despite these concessions, the 1964 report was not favorable to the tobacco industry.<sup>53</sup> Historian Allan Brandt recounts how half the members of the panel were smokers, and by the time their report was ready, most of them had quit.<sup>54</sup> For those close to the science, this was no surprise, be-

cause the evidence against smoking had been steadily mounting. In 1957, the U.S. Public Health Service had concluded that smoking was “the principal etiological factor in the increased incidence of lung cancer.”<sup>55</sup> In 1959, leading researchers had declared in the peer-reviewed scientific literature that the evidence linking cigarettes and cancer was “beyond dispute.”<sup>56</sup> That same year, the American Cancer Society had issued a formal statement declaring that “cigarette smoking is the major causative factor in lung cancer.”<sup>57</sup> In 1962, the Royal College of Physicians of London had declared that “cigarette smoking is a cause of cancer and bronchitis and probably contributes to . . . coronary heart disease,” a finding that was prominently reported in *Reader’s Digest* and *Scientific American*. Perhaps most revealingly, the tobacco industry’s own scientists had come to the same conclusion.

As University of California professor Stanton Glantz and his colleagues have shown in their exhaustive reading of tobacco industry documents, by the early 1960s the industry’s own scientists had concluded not only that smoking caused cancer, but also that nicotine was addictive (a conclusion that mainstream scientists came to only in the 1980s, and the industry would continue to deny well into the 1990s).<sup>58</sup> In the 1950s, manufacturers had advertised some brands as “better for your health,” implicitly acknowledging health concerns.<sup>59</sup> In the early 1960s, Brown and Williamson’s in-house scientists conducted their own experiments demonstrating that tobacco smoke caused cancer in laboratory animals, as well as experiments showing the addictive properties of nicotine. In 1963, the vice president of Brown and Williamson concluded, presumably with reluctance, “We are, then, in the business of selling nicotine, an addictive drug.” Two years later, the head of research and development for Brown and Williamson noted that industry scientists were “unanimous in their opinion that smoke is . . . carcinogenic.”<sup>60</sup> Some companies began secretly working on a “safe” cigarette, even while the industry as a whole was publicly denying that one was needed.

It’s one thing for scientists to report something in peer-reviewed journals, however, and another for the country’s doctor in chief to announce it publicly, loud and clear. The 1964 surgeon general’s report, *Smoking and Health*, did just that. Based on review of more than seven thousand scientific studies and testimony of over one hundred and fifty consultants, the landmark report was written by a committee—in this case selected from nominations provided by the U.S. Food and Drug Administration, the Federal Trade Commission, the American Medical Association, and the Tobacco

Institute—but its conclusions were unanimous.<sup>61</sup> Lung cancer in the twentieth century had reached epidemic proportions, and the principal cause was not air pollution, radioactivity, or exposure to asbestos. It was tobacco smoking. Smokers were ten to twenty times more likely to get lung cancer than nonsmokers. They were also more likely to suffer from emphysema, bronchitis, and heart disease. The more a person smoked, the worse the effects.

Terry realized that the report's release would be explosive, so when he gathered two hundred reporters into the State Department for a two-hour briefing, the auditorium doors were locked for security.<sup>62</sup> The report was released on a Saturday to minimize impact on the stock market, but it was still a bombshell. Nearly half of all adult Americans smoked—many men had picked up the habit while serving their country during World War II or in Korea—and the surgeon general was telling them that this pleasurable habit, at worst a mild vice, was killing them. The government not only allowed this killing, but promoted and profited from it: the federal government subsidized tobacco farming, and tobacco sales were an enormous source of both federal and state tax revenues. To argue that tobacco killed people was to suggest that our own government both sanctioned and profited from the sale of a deadly product. In hindsight, calling it the biggest news story of 1964 seems insufficient; it was one of the biggest news stories of the era.<sup>63</sup> One tobacco industry PR director concluded that the cigarette business was now in a “grave crisis.”<sup>64</sup> They did not sit idly by.

Immediately, they redoubled their effort to challenge the science. They changed the name of the Tobacco Industry Research Council to the Council for Tobacco Research (losing the word “industry” entirely), and severed their relations with Hill and Knowlton. They resolved that the new organization would be wholly dedicated to health research, and not to “industry technical or commercial studies.”<sup>65</sup> They “refined” the approval and review process for grants, intensifying their search for “experts” who would affirm their views.

Given the evidence produced in their own laboratories, the industry might have concluded that the “debate” game was up. The PR director for Brown and Williamson suggested that perhaps the time had come to back off “assurances, denial of harm, and similar claims.”<sup>66</sup> Others suggested identifying the hazardous components in cigarette smoke and trying to remove them, or adopting voluntary warning labels.<sup>67</sup> In 1978, the Liggitt Group—makers of L&Ms, Larks, and Chesterfields—filed a patent application for a technique to reduce the “tumorigenicity” of tobacco. (Tumori-

genicity is the tendency of something to generate tumors, so this was an implicit acknowledgement that tobacco did indeed cause tumors, as one newspaper realized.)<sup>68</sup>

The cigarette manufacturers did not give up. Rather, they resolved to fight harder. "A steady expansion in our program of scientific research into tobacco use and health has convinced us of the need for more permanent organizational machinery," one press release concluded. The industry had already given more than \$7 million in research funds to 155 scientists at more than one hundred American medical schools, hospitals, and laboratories; now it would give even more.<sup>69</sup> When Congress held hearings in 1965 on bills to require health warnings on tobacco packages and advertisements, the tobacco industry responded with "a parade of dissenting doctors," and a "cancer specialist [who warned] against going off 'half cocked' in the controversy."<sup>70</sup>

Sometimes further research muddies scientific waters, as additional complications are uncovered or previously unrecognized factors are acknowledged. Not so with smoking. When a new surgeon general reviewed the evidence in 1967, the conclusions were even starker.<sup>71</sup> Two thousand more scientific studies pointed emphatically to three results, enumerated on the report's first page: One, smokers lived sicker and died sooner than their nonsmoking counterparts. Two, a substantial portion of these early deaths would not have occurred if these people had never smoked. Three, were it not for smoking "practically none" of the early deaths from lung cancer would have occurred. Smoking killed people. It was as simple as that. Nothing had been learned since 1964 that brought into question the conclusions of the earlier report.<sup>72</sup>

How did the industry respond to this? More denial. "There is no scientific evidence that cigarette smoking causes lung cancer and other disease," Brown and Williamson insisted.<sup>73</sup>

In 1969, when the Federal Communications Commission voted to ban cigarette advertising from television and radio, Clarence Little insisted that there was "no demonstrated causal relationship between smoking or [sic] any disease."<sup>74</sup> Publicly, the industry supported the advertising ban, because under the Fairness Doctrine health groups were getting free anti-smoking advertisements on television, and these were having an effect.<sup>75</sup> Privately, however, the Tobacco Research Council sent materials to the liquor industry suggesting that it would be the next target.<sup>76</sup> In fact, the FCC had disavowed any such intentions, declaring in their own press release, "Our action is limited to the unique situation and product; we . . . expressly

disclaim any intention to so proceed against other product[s].”<sup>77</sup> But the tobacco industry sought to foster the anxiety that controlling tobacco advertising was the first step down a slippery slope to controlling advertising of all sensitive products.

Despite industry fears, the U.S. Congress did not ban or even limit sales of tobacco, but it did require warning labels. The American people now knew that smoking was dangerous. And the danger wasn’t just cancer. A host of ailments had been clearly linked to smoking: bronchitis, emphysema, coronary heart disease, hardening of the arteries, low birth weight in infants, and many more. As the 1960s came to a close, the numbers of Americans who smoked had declined significantly. By 1969, the number of adult Americans who smoked was down to 37 percent. By 1979 it would fall to 33 percent—among doctors it would fall to 21 percent—and the *New York Times* would finally stop quoting tobacco industry spokesmen to provide “balance.”<sup>78</sup>

While smoking had declined, industry profits had not. In 1969, R. J. Reynolds reported net revenues of \$2.25 billion. Despite the mounting political pressure to control tobacco sales and discourage tobacco use, Reynolds’s directors reported records for sales, revenues, and earnings, and the continuation of its seventy-year record of uninterrupted dividends to its stockholders. “Tobacco,” they concluded, “remains a good business.”<sup>79</sup> Protecting that business—against regulation, punitive taxes, FDA control, and, especially, lawsuits—became a growing concern.<sup>80</sup>

Although 125 lawsuits related to health impairment were filed against the tobacco industry between 1954 and 1979, only nine went to trial, and none were settled in favor of the plaintiffs.<sup>81</sup> Still, industry lawyers were increasingly concerned, in part because their insistence that the debate was still open was contradicted not just by academic science, but by their own internal company documents. To cite just one example: in 1978, the minutes from a British American Tobacco Company research conference concluded that the tobacco-cancer link “has long ceased to be an area for scientific controversy.”<sup>82</sup> (Brown and Williamson lawyers recommended the destruction or removal of documents that spoke to this point.)<sup>83</sup>

How could the industry possibly defend itself when the vast majority of independent experts agreed that tobacco was harmful, and their own documents showed that they knew this? The answer was to continue to market doubt, and to do so by recruiting ever more prominent scientists to help.

Collectively the industry had already spent over \$50 million on biomedical research. Individual tobacco companies had invested millions more—

bringing the total to over \$70 million. By the mid-1980s, that figure had exceeded \$100 million. One industry document happily reported that “this expenditure exceeds that given for research by any other source except the federal government.”<sup>84</sup> Another noted that grants had been distributed to 640 investigators in 250 hospitals, medical schools, and research institutions.<sup>85</sup> The American Cancer Society and American Lung Association in 1981 devoted just under \$300,000 to research; that same year, the tobacco industry gave \$6.3 million.<sup>86</sup> It was time to do even more.

In the 1950s, the tobacco industry had enlisted geneticist C. C. Little—a member of the U.S. National Academy of Sciences—to lend credibility to their position. This time they went one step better: they enlisted Dr. Frederick Seitz—the balding man introduced to Reynolds executives in 1979—a former *president of the Academy*.<sup>87</sup>

Seitz was part of the generation of bright young men whose lives were transformed by the Manhattan Project, catapulted into positions of power and influence on the basis of brainpower. Before World War II, physics was a fairly obscure discipline; nobody expected to become rich, famous, or powerful through a career in physics. But the atomic bomb changed all that, as hundreds of physicists were recruited by the U.S. government to build the most powerful weapon ever known. After the war, many of these physicists were recruited to build major academic departments at elite universities, where they frequently also served as consultants to the U.S. government on all kinds of issues—not just weapons.

Seitz’s link to the atomic bomb was even closer than most. A solid-state physicist, he had trained under Eugene Wigner at Princeton, the man who, along with colleague Leo Szilard, convinced Albert Einstein to send his famous letter to Franklin Roosevelt urging him to build the atomic bomb. Later, Wigner won the Nobel Prize for work in nuclear physics; Seitz was Wigner’s best and most famous student.

From 1939 to 1945, Seitz had worked on a variety of projects related to the war effort, including ballistics, armor penetration, metal corrosion, radar, and the atomic bomb. He also managed to complete a textbook published in 1940, *The Modern Theory of Solids*—widely acknowledged as the definitive textbook of its day on solid-state physics—and a second volume, *The Physics of Metals*, in 1943. He also found time to consult for the DuPont Corporation.

In 1959, Seitz became science advisor to NATO and from there moved into the highest echelons of American science and policy. From 1962 to 1969, he served as president of the National Academy of Sciences and as ex

officio member of the U.S. President's Science Advisory Committee. In 1973, he received the National Medal of Science from President Richard Nixon. As Academy president, he developed an interest in biology, and in 1968 became president of the Rockefeller University—American's preeminent biomedical research center. In 1979 he went to work for R. J. Reynolds.

It's obvious why R. J. Reynolds would have wanted a man of Seitz's credentials on their team, but why would Seitz want to work for R. J. Reynolds?<sup>88</sup> Speaking to the industry executives in 1979, Seitz stressed the debt of gratitude he felt to Reynolds for the funding they had supplied his institution. Rockefeller was one of the universities that the tobacco industry had long funded, and Seitz put it this way:

About a year ago, when my period as President of the Rockefeller University was nearing its end, [I was] asked if I would be willing to serve as advisor to the Board of Directors of R. J. Reynolds Industries, as it developed its program on the support of biomedical research related to degenerative diseases in man—a program which would enlarge upon the work supported through the consortium of tobacco industries. Since . . . R. J. Reynolds had provided very generous support for the biomedical work at The Rockefeller University, I was more than glad to accept.<sup>89</sup>

Reynolds *had* been generous to Rockefeller. In 1975 they had established the R. J. Reynolds Fund for the Biomedical Sciences and Clinical Research, with a grant of \$500,000 per year for five years, with an additional \$300,000 in year one to endow the R. J. Reynolds Industries Post-doctoral Fellowship “to make possible permanent recognition of RJR's assistance.”<sup>90</sup>

There was a bit more to it than gratitude. Seitz also harbored an enormous grudge against the scientific community that he once led. Over the years, Seitz had come to view the scientific community as fickle, even irrational. As president of the National Academy, he had become “keenly aware how quickly, and irrationally, the mood of the membership of an organization can change. I could become highly unpopular almost overnight because of some seemingly trivial issue.”<sup>91</sup>

Seitz was particularly unpopular for his support of the Vietnam War, which increasingly isolated him from colleagues on the President's Science Advisory Committee, who by the early 1970s had concluded not only that the war was a morass, but that they, like the rest of America, had been

lied to about its progress.<sup>92</sup> As the 1970s drew to a close, Seitz also parted company with scientific colleagues on questions of nuclear preparedness. The scientific community generally supported arms limitations talks and treaties, and rejected as impossible the idea of achieving permanent technology superiority. Seitz, on the other hand, was committed to a muscular military strengthened by the most technologically advanced weaponry. He never rejected the idea of achieving American political superiority through superior weaponry, an idea that most colleagues had abandoned, but which would continue to crop up and cause conflict in the 1980s.

Above all, Seitz, like his mentor Eugene Wigner (a Hungarian refugee), was ardently anti-Communist. (Wigner in later years lent his support to Reverend Sun Myung Moon's Unification Church, evidently feeling that any enemy of Communism was his friend.)<sup>93</sup> Seitz's support for aggressive weapons programs was a reflection of this anti-Communism, but the feeling went further. As president of the Academy, Seitz had been a strong supporter of Taiwan, developing exchange programs with Taiwanese scientists as a counterbalance to the influence of "red" China. Exchange programs with Taiwanese scientists was an idea that most colleagues found reasonable enough, but in later years Seitz's anti-Communism would seem to lose a sense of proportion, as he increasingly defended anything that private enterprise did, and attacked anything with the scent of Socialism.<sup>94</sup>

Seitz justified his increasing social and intellectual isolation by blaming others. American science had become "rigid," he insisted, his colleagues dogmatic and closed-minded. The growing competition for federal funds stifled creativity, and discouraged work that didn't fall into clean disciplinary categories. This, perhaps, was the most important basis for his connection with the tobacco industry, as he explained in a presentation to Reynolds's International Advisory Board: "From time to time, [there are] exceptional cases where the ever-growing rigidity of the support provided by the federal government excludes the support of an important program in the hands of a distinguished and imaginative investigator."<sup>95</sup> Seitz would welcome the role of being the arbiter of who these distinguished and imaginative investigators were, and his judgment was not necessarily bad. Witness his support for Stanley Prusiner.

Seitz, however, did not simply want to support creative science. He was also angry at what he saw as an increasingly antiscience and antitechnology attitude in American life. He accepted the industry argument that attacks on the use of tobacco were "irrational," and that "independent" science was

needed to “sift truth from fiction” (although independent from whom was never made clear).<sup>96</sup> Seitz saw irrationality everywhere, from the attack on tobacco to the “attempt to lay much of the blame for cancer upon industrialization.”<sup>97</sup> After all, the natural environment was hardly carcinogen-free, he noted, and even “the oxygen in the air we breathe . . . plays a role in radiation-induced cancer.”<sup>98</sup> (Oxygen, like most elements, has a radioactive version—oxygen-15—although it is not naturally occurring.)<sup>99</sup>

Seitz believed passionately in science and technology, both as the cause of modern health and wealth and the only means for future improvements, and it infuriated him that others didn’t see it his way. In his memoir, he confidently proclaimed his faith in technology, insisting that “technology is continuously devising procedures to protect our health and safety and the natural beauty and resources of our world.”<sup>100</sup>

While in his own mind a staunch defender of democracy, Seitz had an uneasy time with the masses. Environmentalists, he felt, were Luddites who wanted to reverse progress. His academic colleagues were ingrates who failed to appreciate what science and technology had done for them. Democracy as a whole had an uncertain relation to science, Seitz noted, and higher culture in general. Popular culture was a morass—Seitz despised Hollywood—and he wondered with more than a trace of bitterness whether the “culminating struggle to create free and open societies” would culminate in the “triumph of the ordinary.” Seitz did not help build the atomic bomb to make the world safe for action-adventure films.<sup>101</sup>

These attitudes all help to explain how and why Seitz would have been willing to work for the tobacco industry. And there is one more important piece of the puzzle. Like C. C. Little before him, Seitz was something of a genetic determinist (perhaps because he was loath to admit that environmental hazards related to technology might cause serious health harms, or perhaps because he just saw the science that way). In his memoir, he attributed the early death of his friend William Webster Hansen, co-inventor of the klystron (important in the development of radar) to “a genetic defect leading to emphysema,” but this interpretation is highly unlikely.<sup>102</sup>

Medical experts believe that emphysema is almost invariably caused by environmental assaults. The Aetna insurance company concludes that up to 90 percent of cases are caused by smoking and most of the rest to other airborne toxins; only 1 percent of cases are attributable to a rare genetic defect.<sup>103</sup> Hansen’s case was strange, because he died so young—only thirty-nine—so perhaps he did have a genetic defect, but his disease could also have been caused by inhaling the beryllium he used in his research.<sup>104</sup>

Beryllium is well-known to be extraordinarily toxic; in later years the U.S. federal government would compensate workers exposed to beryllium in the nation's nuclear weapons programs.<sup>105</sup> Seitz clearly had trouble accepting that Hansen's exposure to beryllium could have been the cause of his early death.<sup>106</sup>

Given these various views—hawkish, superior, technophilic, and communophobic—Seitz may well have felt more comfortable in the company of conservative men from the tobacco industry (who perhaps shared his political views) than with his mostly liberal academic colleagues (who generally did not). Over the years, he had spent a good deal of time in corporate America, first as a physicist at General Electric in the 1930s, and then, for thirty-five years during his academic career, as a consultant to DuPont. He was also a member of the Bohemian Grove, an exclusive men's club in San Francisco, which in those days counted among its members Secretary of Defense Caspar Weinberger, as well as many executives of California banks, oil companies, and military-industrial contractors. (One former president of Caltech recalls that he joined Bohemian Grove because the trustees of his institution insisted it was important, but as a liberal and a Jew he never felt comfortable there.)<sup>107</sup>

Seitz no doubt also enjoyed the perks he received while working for the tobacco industry, such as flying to Bermuda with his wife when the Reynolds Advisory Committee met there in November 1979, as well as the heady feeling of distributing money to researchers that he had handpicked.<sup>108</sup> Given his views that genetic weakness was the crux of disease susceptibility, and that modern science had become narrow-minded, Seitz may well have honestly believed that tobacco was being unfairly attacked, and that Reynolds money could do some real good. But we know from tobacco industry documents that the criteria by which he chose projects for funding were not purely scientific.

By May 1979, Seitz had made commitments for over \$43.4 million in research grants. During this time, he corresponded frequently with H. C. Roemer—R. J. Reynolds's legal counsel—discussing with him which particular projects they planned to fund and why; all press releases regarding the research program had to be cleared by the legal department.<sup>109</sup> It's not normal for granting agencies to consult legal counsel on each and every grant they make, so this connection alone might suggest a criterion related to legal liability. But we don't have to speculate, because industry documents tell us so: "Support [for scientific research] over the years has produced a number of authorities upon whom the industry could draw for

expert testimony in court suits and hearings by governmental bodies.”<sup>110</sup> The industry wasn’t just generating reasonable doubt; it was creating friendly witnesses—witnesses that could be called on in the future.

One of these witnesses was Martin J. Cline, who had earlier caught Seitz’s attention. Cline was one of the most famous biomedical researchers in the United States. Chief of the Division of Hematology-Oncology at UCLA’s medical school, he had created the world’s first transgenic organism: a genetically modified mouse. In 1980, however, he was censured by UCLA and the National Institutes of Health for an unapproved human experiment injecting bone marrow cells that had been altered with recombinant DNA into two patients with a hereditary blood disorder.<sup>111</sup> Cline was found to have misrepresented the nature of the experiment to hospital authorities, telling them that the experiment did not involve recombinant DNA.<sup>112</sup> He later admitted that he had performed the experiments, but claimed that he did it because he believed it would work. Cline lost nearly \$200,000 in research grants and was forced to resign his position as division chief, although he was permitted to stay on as a professor of medicine.<sup>113</sup>

Many years later—in 1997—Cline was deposed in the case of *Norma R. Broin et al. v. Philip Morris*.<sup>114</sup> (Broin was a nonsmoking flight attendant who contracted lung cancer at the age of thirty-two, and sued—along with her husband and twenty-five other flight attendants—charging that their illnesses were caused by secondhand smoke in airline cabins, and the tobacco industry had suppressed information about its hazards.)<sup>115</sup> In the deposition Cline acknowledged that he had been a witness in two previous trials, one in which he testified that a plaintiff’s cancer was not caused by exposure to toxic fumes, and another in which he testified that a plaintiff’s leukemia was not caused by exposure to radiation. He had also served as a paid consultant in a previous tobacco litigation case, had given seminars to a law firm representing the tobacco industry, and had served on a so-called Scientific Advisory Board for R. J. Reynolds. (The scientists that Seitz supported were also sometimes called upon as an advisory group, attending periodic meetings to offer “advice and criticism.” One letter suggested that they might also act as an advocacy group—although this was later struck out.)<sup>116</sup>

When asked point blank in the Norma Broin case, “Does cigarette smoking cause lung cancer?” attorneys for Philip Morris objected to the “form of the question.”<sup>117</sup> When asked, “Does direct cigarette smoking cause lung cancer?” the attorneys objected on the grounds that the question was

"irrelevant and immaterial." When finally instructed to answer, Cline was evasive.

Cline: Well, if by "cause" you mean a population base or epidemiologic risk factor, then cigarette smoking is related to certain types of lung cancer. If you mean: In a particular individual is the cigarette smoking the cause of his or her cancer? Then . . . it is difficult to say "yes" or "no." There is no evidence.<sup>118</sup>

When asked if a three-pack-a-day habit might be a *contributory* factor to the lung cancer of someone who'd smoked for twenty years, Cline again answered no, you "could not say [that] with certainty . . . I can envision many scenarios where it [smoking] had nothing to do with it." When asked if he was paid for the research he did on behalf of the tobacco industry, he acknowledged that the tobacco industry had supplied \$300,000 per year over ten years—\$3 million—but it wasn't "pay," it was a "gift."<sup>119</sup>

What Cline said about cancer was technically true: current science does not allow us to say with certainty that any one particular person's lung cancer—no matter how much she smoked—was caused by smoking. There are always other possibilities. The science *does* tell us that a person with a twenty-year, three-pack-a-day habit who has lung cancer most probably got that cancer from smoking, because other causes of lung cancer are very rare. If there's no evidence that the woman in question was ever exposed to asbestos or radon, or smoked cigars or pipes, or had prolonged occupational exposure to arsenic, chromium, or nickel, then we could say that her lung cancer was almost certainly caused by her heavy smoking. But we couldn't say it for sure. In scientific research, there is always doubt. In a lawsuit we ask, Is it *reasonable* doubt? Ultimately, juries began to say no, but it took a long time, in large part because of witnesses like Martin Cline, witnesses that the industry had cultivated by supporting their research. Reynolds supported scientists, and when the need arose they were available to support Reynolds.

Stanley Prusiner would have been an even better witness for the industry—his work on prions was groundbreaking and his reputation untarnished—and his name did appear on a list of potential witnesses in the 2004 landmark federal case against the tobacco industry: *U.S. vs. Philip Morris et al.*<sup>120</sup> (He evidently did not testify; available documents do not indicate why.) The industry was finally found guilty under the RICO Act (Racketeer Influenced and Corrupt Organizations).<sup>121</sup> In 2006, U.S.

district judge Gladys Kessler found that the tobacco industry had “devised and executed a scheme to defraud consumers and potential consumers” about the hazards of cigarettes, hazards that their own internal company documents proved they had known about since the 1950s.<sup>122</sup>

But it took a long time—just about half a century—to get to that point. Along the way the tobacco industry won many of the suits that were brought against it. Juries, of course, were much more likely to believe scientific experts than industry executives—especially scientists who appeared to be independent—and neither Cline nor Prusiner ever worked “directly” for the tobacco industry; many of the funds were channelled through law firms.<sup>123</sup> External research could also help bolster the industry’s position that the public should decide for themselves. “We believe any proof developed should be presented fully and objectively to the public and that the public should then be allowed to make its own decisions based on the evidence,” they had argued, seemingly reasonably.<sup>124</sup> The problem was that public had no way to know that this “evidence” was part of an industry campaign designed to confuse. It was, in fact, part of a criminal conspiracy to commit fraud.

Cline and Prusiner were reputable scientists, so one might ask, Didn’t they have a right to be heard? In later years Seitz and his colleagues would often make this claim, insisting that they deserved equal time, and their ability to invoke the Fairness Doctrine to obtain time and space for their views in the mainstream media was crucial to the impact of their efforts. 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.

A scientific hypothesis is like a prosecutor’s indictment; it’s just the beginning of a long process. The jury must decide not on the elegance of the indictment, but on the volume, strength, and coherence of the evidence to support it. We rightly demand that a prosecutor provide evidence—abundant, good, solid, consistent evidence—and that the evidence stands up to the scrutiny of a jury of peers, who can take as much time as they need.

Science is pretty much the same. A conclusion becomes established not when a clever person proposes it, or even a group of people begin to discuss it, but when the jury of peers—the community of researchers—reviews the evidence and concludes that it is sufficient to accept the claim. By the 1960s, the scientific community had done that with respect to tobacco. In contrast, the tobacco industry was never able to support its claims with evidence, which is why they had to resort to obfuscation. Even after decades and tens of millions of dollars spent, the research they funded failed to supply evidence that smoking was really OK. But then, that was never really the point of it anyway.

THE TOBACCO INDUSTRY was found guilty under the RICO statute in part because of what the Hill and Knowlton documents showed: that the tobacco industry knew the dangers of smoking as early as 1953 and conspired to suppress this knowledge. They conspired to fight the facts, and to merchandise doubt.

But it took a long time for those facts to emerge, and the doubt to be dispelled. For many years, the American people did continue to think that there was reasonable doubt about the harms of smoking (and some still do). While hazard labels were strengthened, it was not until the 1990s that the industry began to lose cases in courts. And although the FDA sought to regulate tobacco as an addictive drug in the early 1990s, it was not until 2009 that the U.S. Congress finally gave them the authority to do so.<sup>125</sup>

One reason the industry's campaigns were successful is that not everyone who smokes gets cancer. In fact, most people who smoke will not get lung cancer. They may suffer chronic bronchitis, emphysema, heart disease, or stroke, and they may suffer cancer of the mouth, uterus, cervix, liver, kidney, bladder, or stomach. They may develop leukemia, suffer a miscarriage, or go blind. The children of women who smoke are much more likely to be low birth weight babies than the children of women who don't, and to suffer high rates of sudden infant death syndrome. Today, the World Health Organization finds that smoking is the known or probable cause of twenty-five different diseases, that it is responsible for five million deaths worldwide every year, and that half of these deaths occur in middle age.<sup>126</sup> By the 1990s, most Americans knew that smoking was generally harmful, but as many as 30 percent could not tie that harm to specific disease. Even many doctors do not know the full extent of tobacco harms, and nearly a quarter of poll respondents still doubt that smoking is harmful at all.<sup>127</sup>

Industry doubt-mongering worked in part because most of us don't really understand what it means to say something is a cause. We think it means that if A causes B, then if you do A, you will get B. If smoking causes cancer, then if you smoke, you will get cancer. But life is more complicated than that. In science, something can be a *statistical* cause, in the sense that if you smoke, you are much more *likely* to get cancer. Something can also be a cause in the everyday sense of being an occasion for something—as in “the cause of the quarrel was jealousy.”<sup>128</sup> Jealousy does not always cause quarrels, but it very often does. Smoking does not kill everyone who smokes, but it does kill about half of them.

Doubt-mongering also works because we think science is about facts—cold, hard, definite facts. If someone tells us that things are uncertain, we think that means that the science is muddled. This is a mistake. There are always uncertainties in any live science, because science is a process of discovery. Scientists do not sit still once a question is answered; they immediately formulate the next one. If you ask them what they are doing, they won't tell you about the work they finished last week or last year, and certainly not what they did last decade. They will tell you about the new and uncertain things they are working on *now*. Yes, we know that smoking causes cancer, but we still don't fully understand the mechanism by which that happens. Yes, we know that smokers die early, but if a particular smoker dies early, we may not be able to say with certainty how much smoking contributed to that early death. And so on.

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. “Doubt is our product,” ran the infamous memo written by one tobacco industry executive in 1969, “since it is the best means of competing with the ‘body of fact’ that exists in the minds of the general public.”<sup>129</sup> The industry defended its primary product—tobacco—by manufacturing something else: doubt about its harm. “No proof” became a mantra that they would use again in the 1990s when attention turned to secondhand smoke. It also became the mantra of nearly every campaign in the last quarter of the century to fight facts.

For tobacco is not the end of our story. It is just the beginning. In the years to come various groups and individuals began to challenge scientific

evidence that threatened their commercial interests or ideological beliefs. Many of these campaigns involved the strategies developed by the tobacco industry, and some of them involved the same people. One of these people was Frederick Seitz.

As the industry campaign to defend tobacco was reaching the end of its course—and the claim that smoking's harms were unproven became harder to say with a straight face—Seitz moved on to other things. One of these was to found the George C. Marshall Institute, created to challenge scientists' conclusions in a whole new arena—strategic defense. When that debate was over, they would turn to the environment. Seitz had railed about scientific colleagues who made “simplified, dramatic statements” to capture public attention, rather than remaining “sober,” yet in the later years of his life, he would do exactly that when discussing the ozone hole, global warming, and other environmental threats.<sup>130</sup>

The tobacco road would lead through Star Wars, nuclear winter, acid rain, and the ozone hole, all the way to global warming. Seitz and his colleagues would fight the facts and merchandise doubt all the way.