

The Atomic Secret in Red Hands? American Suspicions of Theoretical Physicists During the Early Cold War

Visions of Science and Scientists in Postwar America

THE EARLY YEARS OF THE COLD WAR were not a pleasant time to be an intellectual in the United States, especially if he or she happened to have a past or present interest in the political left. Following pathbreaking work by historians such as Ellen Schrecker on academics' ill treatment, scholars have begun to examine the toll of McCarthyism—which began earlier and lasted longer than Joseph McCarthy's fevered tenure in the Senate—on American scientists. Through special scrutiny, unfair treatment, blacklists, and quiet removals from classrooms and laboratories, American scientists bore the brunt of “loyalty-security” investigations during the Cold War era. Thanks to the efforts of many historians, we now know a great deal about how scientists fared from the late 1940s through the mid-1950s.¹

Paradoxically, by talking generally about “scientists,” most of these previous studies have been at once too general and not far-reaching enough. There is a finer-grained story to be told about *which types* of scientists received the most attention at the time, and about the shifting assumptions about science that undergirded this scrutiny. In short, theoretical physicists emerged as the most consistently named whipping-boys of McCarthyism: repeatedly subjected to illegal surveillance by the Federal Bureau of Investigation (FBI), paraded in front of the House Un-American Activities Committee (HUAC), charged time and again in the media as well as in federal courts with being the “weakest links” in national security, and widely considered to be more inherently susceptible to Communist propaganda than any other group of scientists or academics. Focusing more squarely on allegations

ABSTRACT During the early years of the Cold War, a formulaic depiction emerged in the United States linking one group of scientists—theoretical physicists—with “atomic secrets,” whose possession would supposedly allow other nations to build their own nuclear weapons. Scrutiny narrowed quickly around theoretical physicists, as reporters, senators, and federal judges alike asserted that theorists were inherently a breed apart, more susceptible than any other group of people to Communist influence. / REPRESENTATIONS 90, Spring 2005 © The Regents of the University of California. ISSN 0734–6018, electronic ISSN 1533–855X, pages 28–60. All rights reserved. Direct requests for permission to photocopy or reproduce article content to the University of California Press at www.ucpress.edu/journals/rights.htm.

against this subgroup of American scientists, and the representations repeatedly made of them in congressional committees and broad-market media outlets, I will attempt to illuminate broader changes in assumptions both about scientists and about the nature of science after World War II.

More than a dozen theoretical physicists suffered publicly—and often over long durations—in the vise-grip of postwar anticommunism: Edward Condon, Joseph Weinberg, Giovanni Rossi Lomanitz, David Bohm, Max Friedman, I. David Fox, Byron Darling, Bruce Dayton, Philip Morrison, Bernard Peters, Wendell Furry, Albert Einstein, and J. Robert Oppenheimer. Their cases often remained in the news for months at a time, resurfacing as a result of surreptitious leaks by their political enemies.² Thousands of scientists and engineers were affected by McCarthyism; only a few became headlines in the newspapers or suffered repeated hounding by congressional committees. More theoretical physicists were called by HUAC, for example, as (“unfriendly”) witnesses between 1948 and 1953 than members of any other academic specialty: more than twice the number of chemists or historians; almost three times the number of biologists; nearly four times the number of economists or philosophers, and so on. The committee devoted no fewer than twenty-seven hearings to investigations of theorists and their “Communist infiltration” of weapons projects and educational institutions during this period—an average of nearly five per year, twice as many as those involving any other academic field.³ Nor was HUAC alone. When *Life* magazine ran a two-page spread in April 1949 on a “red rumpus” of “dupes and fellow travelers” who purportedly gave aid to Communist-front organizations—featuring photographs of fifty individuals—twice as many theoretical physicists as members of any other academic field were included.⁴ The only other scientists to receive comparable sustained scrutiny from the likes of HUAC and the national media included astronomer Harlow Shapley and physical chemist Linus Pauling—both politically outspoken senior scientists—and experimental physicist Frank Oppenheimer, Robert’s younger brother. Chemists and engineers were certainly implicated at times during the early Cold War. Yet theorists became cultural stand-ins for postwar intellectuals, their portrayals fitting a common pattern with remarkable consistency.

These dozen or so theoretical physicists surely came under fire for many reasons; with hindsight their troubles appear almost overdetermined. Most were Jewish; several had been active in labor organizing before or during the war; a few had flirted with the Communist Party in their youth; many were active in other left-wing political organizations after the war. Perhaps most important, however, they had close and long-standing ties with Robert Oppenheimer, all but Darling and Einstein having been trained by him as graduate students or postdoctoral fellows. (When he became director of the Institute for Advanced Study in Princeton in 1947, Oppenheimer even became Einstein’s “boss,” although Einstein had been under intense FBI surveillance long before then.) As previously classified documents make clear, Oppenheimer had enemies within the military and intelligence

branches of the government from his earliest days in the wartime Manhattan Project; he was under surveillance even before most of his students and colleagues were. Debate continues to this day over the extent of Oppenheimer's sympathies—and possible affiliation—with the Communist Party.⁵ It is certainly plausible that this circle of theorists garnered undue attention as “collateral damage,” caught in the escalating cross fire between Oppenheimer's growing list of enemies and the central figure himself, whose personnel security hearing in spring 1954 marked the climax of McCarthyist attacks on scientists and public intellectuals. Yet even if connections to Oppenheimer explain why these particular people were singled out, the pedagogical links alone do not explain the types of representations formed about theory and theorists as a whole. Petty politics might have fixed the victims, but not the charge.

The portrait of theoretical physicists that eventually solidified into a recognizable (and oft-repeated) ideal type relied on three separate elements. None was beyond question; some were openly challenged in their day. Changing political exigencies, however, eventually snuffed out the dissenting voices, and by 1948–49 the formula had been set. The first piece of the Cold War equation was that theorists had single-handedly built the atomic bomb. The wartime Los Alamos laboratory had been headed by the theorist Oppenheimer, and soon after the war lack of information due to government secrecy led to a skewed picture of how the bombs had been built. Second, a widespread presumption emerged that “atomic secrets” existed whose possession would allow other countries immediately to build their own bombs. By the late 1940s, if not immediately in the wake of the bombings of Hiroshima and Nagasaki, many came to believe that these “secrets” consisted of purely theoretical information, perhaps even single equations that only theorists understood and that could be smuggled out of the country on tiny scraps of paper. As soon as journalists and politicians concurred that text-based atomic secrets existed and that theorists were their special keepers, it seemed to follow that theorists required special scrutiny. The anticommunist backlash struck theorists particularly hard, coalescing in the third and final element of the Cold War formula: reporters, senators, and federal judges alike began to assert that theoretical physicists were inherently a breed apart, more susceptible to Communist influence than any other group of people. By the late 1940s, theorists routinely were cast as doubly dangerous proto-spies: of all scientists, theorists held the most important information, and they were most likely to give it away.

Lurking behind this formulaic depiction of the postwar theorist lay a specific idea of how science works, not just how various scientists behave. By tracing discussions of purported “atomic secrets” and their “red” keepers—as these unfolded in such varied venues as the *New York Times*, *Newsweek*, *Time*, *Life*, *Fortune*, the *Saturday Evening Post*, *Reader's Digest*, and the *Bulletin of the Atomic Scientists*, as well as in congressional hearings, government reports, and oratory reprinted in *Vital Speeches of the Day*—we learn about the shifting cultural and political valence of “tacit knowl-

edge” within postwar America.⁶ Historians and sociologists of science have long been interested in tacit knowledge: craftlike skill and artisanal “know-how” crucial to the practice of science, yet incapable of being transmitted by texts alone. Earlier figures such as Thomas Edison had been publicly valorized precisely on the strength of their storehouses of tacit knowledge rather than formal book-learning. Recent innovative studies by sociologists and anthropologists, meanwhile, have emphasized how critical tacit knowledge has been and remains for designing and building nuclear weapons.⁷

As I argue here, such evaluations of tacit knowledge have a history—a history closely intertwined with changing ideas about theory and theorists in Cold War America. Naturally, certain kinds of textual information could aid other groups in their efforts to build atomic bombs, mainly by helping them avoid “blind alleys” and focus their replication efforts on techniques that had been shown to work. What I find fascinating is the way in which congressional, judicial, and journalistic discussions collapsed all these issues, beginning in the late 1940s, to focus narrowly around “secret formulas” that somehow held the key to the entire bomb. During the early Cold War years, the importance of tacit knowledge fell out of discussions, leaving only text-based information as the seeming “secret” of the bomb—with deleterious effects for many theoretical physicists.

The Work of Many People

Nuclear weapons have always been “the work of many people.” Edward Teller introduced the phrase in 1955 when recalling the range of efforts and contributions—from specialists in many different fields—to the American hydrogen-bomb effort.⁸ (Many of Teller’s critics found the maneuver a disingenuous effort to deflect criticism after his withering performance at Oppenheimer’s personnel security hearing mere months before, and his less-than-generous sharing of credit throughout the early 1950s.)⁹ Whether made in good faith or not, Teller’s remark was accurate and applies equally to the wartime efforts to build atomic bombs. At its peak, the wartime Manhattan Project employed more than 125,000 people at more than thirty sites, ultimately spending more than \$2 billion. Huge factory towns sprung up at Oak Ridge, Tennessee, and Hanford, Washington; university facilities were converted to top-secret laboratories at Berkeley, Columbia, the University of Chicago, and elsewhere; and a new laboratory was created at Los Alamos, New Mexico.

In all these facilities, scientists, engineers, and technicians of many stripes contributed their expertise to turn nuclear weapons into a reality. The overall scientific directors of the wartime project were Vannevar Bush and James B. Conant, an electrical engineer and a chemist, respectively. The theorist Oppenheimer served as scientific director of the Los Alamos laboratory, where he was joined by a nine-

person governing board that included one fellow theorist alongside four experimental physicists, two chemists, and two experts in ordnance. Several divisions were created at Los Alamos, focusing on metallurgy, chemistry, ballistics, ordnance, electrical engineering, experimental physics, and theoretical physics. The laboratory's wartime organization chart shows the groups arranged in a circle and connected by spindly links; no group appeared on top directing the others.¹⁰ A few months after the war, the War Department awarded eleven "Medals for Merit" to scientific staff of the Manhattan Project for their contributions to the atomic bomb project; a little more than one-quarter went to theoretical physicists, while half went to chemists and engineers.¹¹

Of all the work done at wartime Los Alamos, the challenge of implosion—detonating a sphere of conventional explosives to compress fissionable material into a superdense critical mass—best exemplified the melding of many groups' efforts and the central place of tacit knowledge in making bombs.¹² From the metallurgy of plutonium, to the design and fabrication of sufficiently homogenous shaped-charge lenses, to the chemistry of radioactive "initiators," to the physical measurements of spontaneous fission rates and reaction cross sections, to the challenges of wiring the detonation circuits to fire simultaneously, to the mathematical studies of in-going shock waves and the hydrodynamics of matter under extreme conditions, the implosion device was a product of varied—and harried—contributions. The Theoretical Physics division or "T-division" remained the smallest of all divisions at Los Alamos, soon dwarfed by such groups as the Engineering Ordnance division.¹³ The T-division played some important roles throughout the project, estimating critical masses, trying to calculate optimal shapes for the conventional-explosive lenses, and so on; in some instances, their contributions proved critical, while in others the T-division struggled to play catch-up to the other groups.¹⁴ Throughout the war, theorists remained hamstrung, having no self-consistent theory of nuclear forces and no reliable way to calculate properties of nuclear matter in bulk, even under idealized conditions—problems that would haunt theoretical physicists for the next decade and a half.¹⁵ Members of Los Alamos's T-division developed some "good enough" approximation methods, learning clever ways to "get the numbers out," in Sam Schweber's telling phrase. But even these approximations rarely drove design or manufacturing efforts; most calculations relied upon tedious hand-cranked or punched-card mechanical calculators, and the nonlinear nature of the equations made extrapolation from one curve to another treacherous. At no time could the T-division *calculate* the properties of the bomb from first principles; atomic bombs have never resulted from the mere "application" of explicit formulas, let alone full-blown theories.¹⁶

News of the surprise bombings of Hiroshima and Nagasaki in August 1945 was the first most people in the United States and abroad had heard of atomic bombs. The only information released about technical aspects of the bombs came from a specially prepared government report, released to the press on the evening of

11 August. The two-hundred-page document with the long-winded title—*A General Account of the Development of Methods of Using Atomic Energy for Military Purposes Under the Auspices of the United States Government, 1940–1945*—quickly became known as the “Smyth Report,” named for its author, the Princeton physicist and Manhattan Project consultant Henry DeWolf Smyth. As Rebecca Press Schwartz comments in her stunning analysis of the Smyth Report’s composition, “What it included, and what it omitted, had a great impact on what the Manhattan Project meant to the American people.” Security concerns dominated what Smyth could and could not include within his report. Early on, Smyth, General Groves, and advisors agreed that only information that had already been published in the open literature, that was widely known to working scientists, or that had “no real bearing on the production of atomic bombs” was fit for release. Little of the messy combination of chemistry, metallurgy, engineering, and industrial-scale manufacturing met these criteria; these aspects of the sprawling project, crucial to the actual design and production of atomic bombs, remained closely guarded. Instead, Smyth focused narrowly on ideas from physics, pushing theoretical physics in particular to the forefront—only such material was deemed safe enough to publicize. Ironically, most people read in Smyth’s Report the lesson that theorists had built the bomb (and by implication, had won the war).¹⁷ A supplemental document released a few months later by the Senate’s new Special Committee on Atomic Energy, entitled *Essential Information on Atomic Energy*, reinforced the lesson, depicting atomic bombs as the natural outcome of continuous developments in atomic theory. A “chronological table” at the end of the report extended the narrative as far back as 400 BC to the ancient Greek atomists!¹⁸ Official reports on the Manhattan Project painted a consistent—if consistently inaccurate—picture: theoretical physicists had built the bomb. True or false, the first part of the Cold War formula was in place.

The Making of a “Secret”

The notion that there existed a single “secret” to the atomic bomb was not hatched all at once with the bombings in August 1945 or the release of the Smyth Report. It emerged over time, unfolding in lockstep with changing political tides. In the weeks after news of the bombs broke, rumors of legislative efforts (in the form of the May-Johnson bill) that would have extended the wartime military regime into peacetime spurred groups of scientists and engineers at Los Alamos, the University of Chicago, Oak Ridge, and elsewhere to speak out about the nature of atomic weapons. The new bill would have kept all aspects of atomic energy under strict military control, perpetuating the wartime secrecy protocols. In response, the fledgling “atomic scientists’ movement” launched a vigorous public-relations campaign, putting mimeograph machines into motion to counter the proposal.¹⁹ Their pamphlets made it into the hands of editors at the *New Republic*, who quoted from

them approvingly in the 8 October 1945 issue, adding italics for their own emphasis: “‘*There is no secret to be kept.*’” The “principles” required for the explosive release of atomic energy, the editors continued (still quoting from the scientists’ memoranda), “‘have been the common property of scientists throughout the world for the last five years.’” President Truman sounded a similar note that same week when he delivered his first speech to Congress on atomic policy matters. Like the atomic scientists, Truman insisted that “the essential theoretical knowledge upon which the discovery [of the atomic bomb] is based is already widely known. There is also substantial agreement that foreign research can come abreast of our present theoretical knowledge in time.”²⁰ That autumn, scientists and journalists developed a second, related response: the only secret about the bomb was whether or not it would work—not how to design or produce one—and that “secret” had disappeared with the destruction of Hiroshima and Nagasaki.²¹ No secrets, no need for military control.

Beyond these immediate denials that there were any secrets, speculation continued as to whether “atomic secrets” existed and what they might be. Scientists, journalists, and politicians proposed at least eight distinct candidates, each put forward as *the* “atomic secret” between 1945 and 1955. The candidates hardly emerged at random; two distinct phases marked the “secrets” discussions.²² Between 1945 and 1948, most coverage focused on raw materials and industrial infrastructure as the keys to producing atomic weapons, emphasizing nontextual “know-how” rather than textual “knowledge” or “information.” Beginning late in 1948 and accelerating through the mid-1950s, the weight of discussion among politicians and journalists shifted, focusing instead on textual and theoretical “information” as the essential “secret” of the atomic bomb, rather than experimental skill or industrial capacity. Many now claimed that specific, esoteric formulas—the x ’s and y ’s of theoretical physics—contained the true secrets of the atomic bomb.²³

Three main contenders for the “secret” received the most attention between 1945 and 1948: (1) raw materials and their handling, (2) production plants and industrial methods, and (3) technical details of design and manufacture. Editors at *Newsweek* entered the fray first, proclaiming “A New Era: The Secrets of Science” in their 20 August 1945 issue. No doubt drawing on the just-released Smyth Report, *Newsweek* heralded uranium isotope separation as “the No. 1 secret of the war, known to only a few men in the ‘Manhattan Project.’” President Truman similarly called for the need “to establish control of the basic raw materials essential to this power” in his speech to Congress on 3 October 1945.²⁴ One month earlier, a vice president at the University of Chicago emphasized industrial contributions, “working on a gigantic scale,” as the essential ingredients in the bomb’s development. *Time* magazine reassured its readers in mid-September 1945 that there were “no immediate dangers” that other nations could threaten the United States with their own atomic bombs, “because at this stage of the bomb’s development huge production plants (which exist in the U.S. alone) are necessary.” Throughout the remainder

of 1945 and much of 1946, conservative members of Congress—alarmed to learn the extent of foreign-born scientists’ contributions to the Manhattan Project—repeatedly heralded “American industrial and technological superiority” as the real secret to the project’s success. One representative went so far as to declare, “I am not giving the principal credit for the production of the bomb to the scientists,” who (he continued) would have been unable to do anything useful had it not been for “the trained fingers of the technician. . . . —in other words, American know-how produced the atomic bomb.”²⁵ As late as October 1948, a reporter for the *New York Times* emphasized that “engineering and technical know-how”—embodied in teams working in “gigantic facilities”—was “of equal or greater importance” than any “theoretical scientific knowledge” that was by then widely shared. The only “secrets” to be kept, urged veterans of the wartime weapons projects when testifying before Congress, were technical details and manufacturing processes.²⁶

Throughout this first phase of discussions—much of it elicited by overt political debate regarding the proper role and scope of the new Atomic Energy Commission (AEC)—the emphasis remained on controlling matériel and industrial capacity. Driving the message home, several scientists, politicians, and journalists during this period spoke of a basic category error: bombs are not formulas. One week before the three-nation accord on atomic energy, signed on 15 November 1945 by President Truman and Prime Ministers Clement Attlee of the United Kingdom and MacKenzie King of Canada, former Prime Minister Winston Churchill delivered to the British Parliament a lesson on the sociology of knowledge. What the Americans sought not to disclose after the war, Churchill explained,

is the practical production methods, which they have developed at enormous expense and on a gigantic scale. This would not be an affair of scientists or diplomats sending over formulas. To be effective, any such disclosure would have to take the form of a considerable number of Soviet specialists, engineers and scientists visiting the United States arsenals, for that is what the manufacturing centers of the atomic bomb really are.

They would have to visit them and would have to dwell there so they could have it all explained to them and the officials would then return to their own country with all the information they had obtained and with any further improvements which might have occurred to them.²⁷

No mere written exchanges here. Churchill evoked a notion of tacit knowledge to explain how working knowledge of atomic bombs could be transported from one country to another. His successor, Attlee, continued the lesson later that month, explaining that the ability to construct atomic bombs “cannot be given in a formula or a handbook or a blueprint. It can only be done by scientists and technicians being taken to the plant, everything being shown and explained to them in great detail.”²⁸

Back in the states, scientists tried to deliver a similar message to Congress and the public, testifying that atomic bombs “are not matters that can be stolen and transmitted in the form of information.”²⁹ Smyth told reporters from *Life* magazine that “There is no ‘secret’ of the atomic bomb in the sense of a mysterious formula

that can be written on a slip of paper and carried in the sole of a shoe or the handle of a hunting knife.” The message got through to some mainstream journalists. Responding to allegations in July 1947 that some servicemen at wartime Los Alamos had stolen classified information about the bomb project (by pilfering a few documents to keep as souvenirs), the *New York Times* replied that “we do not believe that the atomic ‘secret’ is something that can be written down in a page or two, like a recipe for corn bread. We suspect that some tons of blueprints might convey it, and that it will never be carried overseas in the heel of a shoe.”³⁰ It would take much more than such pencil-and-paper information to design and manufacture nuclear weapons; the “secrets” were not textual in nature but based on artisanal know-how and industrial production. Such was the dominant message during 1945–48.

The “bombs are not formulas” campaign was not without its detractors during this early period. Competing visions of atomic secrets emerged in the course of (often quite bitter) political debate over domestic and international proposals for the control of atomic energy. Allegations of atomic espionage—along with the assumption that various “secrets” existed that could be stolen, with great benefit to foreign nations—were used as political instruments as early as 1946. As Gregg Herken has shown, for example, news of a Canadian spy ring that had operated during the war was leaked by General Groves to certain hand-picked journalists who were friendly to the general’s goal of erecting military rather than civilian control over the postwar atom.³¹ Nor did Groves only enlist journalists while pursuing this tactic. In March 1946, in the midst of debate over competing domestic atomic energy bills, Senator Bourke Hickenlooper read into the *Congressional Record* a letter from Groves claiming that British physicist Alan Nunn May (who had worked in Canada during the war and later confessed to sharing material with the Soviets) “has a general knowledge of the construction of the atomic bomb.” Groves’s letter continued, suggesting that May “understands the principles of design and construction” of nuclear reactors (which could be used to produce fissionable materials such as plutonium). The *New York Times* reported that Hickenlooper’s sudden introduction of Groves’s letter caught rival Senator Brien McMahon, backing a bill for civilian control of atomic energy, by surprise, coming as it did at a crucial juncture of the debate. Groves’s and Hickenlooper’s allegations were seen as adding great weight—at just the right moment—to Senator Arthur Vandenberg’s proposed amendment to McMahon’s bill, calling for a military advisory board to the civilian Atomic Energy Commission.³² Claims about “general knowledge of the construction of the atomic bomb”—knowledge of “principles” that could be written down and given to Soviet agents—helped tip the balance, ensuring passage of Vandenberg’s promilitary amendment. Never mind that the official report on the alleged Canadian spy ring concluded three months later that “no one in Canada could have revealed how to make an atomic bomb. There was no one in Canada who had that information”—as Groves, overseer of the entire wartime project, had well

known all along.³³ Innuendo about secrets in the form of “general knowledge” and “principles” that could be stolen had come in handy.

If such political jockeying around matters atomic began in the Senate’s Special Committee on Atomic Energy, it soon became the basic operating procedure for the HUAC. As Jessica Wang has demonstrated, HUAC’s forays followed a predictable political timetable. After orchestrating a series of press leaks throughout spring 1947, HUAC delivered its first explicit salvo on the “atomic secrets” front on 1 March 1948 when it announced that theoretical physicist Edward Condon, then director of the National Bureau of Standards, constituted “one of the weakest links in our atomic security”—an official report delivered just days before debate over appropriations for HUAC was set to begin in Congress.³⁴ The first attack by HUAC on theorists involved few details of the nature of their work; Condon *qua* theorist was not really under discussion. The theorist’s outspoken support for the McMahon bill throughout 1946, combined with the fact that he had been hired to direct the bureau by then Secretary of Commerce Henry Wallace—and hence offered the Republican-dominated HUAC an opportunity to strike at Truman and his most left-leaning cabinet member—were probably sufficient to single Condon out as a target.³⁵

The list of HUAC’s “weak links” was quickly expanded and the committee conducted highly publicized hearings later that year into supposed Communist activities and atomic espionage during the wartime Manhattan Project. This time the nature of theoretical physics and the trustworthiness of theorists played a larger role. Releasing their new report in September 1948, in time for maximum election-year impact (the *New York Times* reported Truman’s “no comment” on the report while campaigning in Texas), HUAC claimed that several Manhattan Project scientists had passed along “vital information” on the bomb to the Soviets.³⁶ Following charges against the chemists Clarence Hiskey, John Chapin, and Martin Kamen, HUAC included a titillating accusation against a person identified only as “Scientist X,” who had worked at the University of California’s Radiation Laboratory during the war, one of the contracting laboratories of the Manhattan Project. This person, HUAC charged, had visited the house of Steve Nelson, a Bay Area Communist Party member, at 1:30 a.m. one morning in March 1943. Once there, Scientist X allegedly

read to Nelson a complicated formula, which Nelson copied down. Scientist X gave as his reason for asking Nelson to copy it down that the formula was in the handwriting of some other person, and that he, Scientist X, had to return the formula to the University of California radiation laboratories in the morning.³⁷

HUAC’s charge displayed a remarkable fetish for the written word—a medieval worship of the manuscript page and the authorial power of an individual’s penmanship. Atomic bombs were not children of the Industrial Revolution after all, cried

HUAC; bombs' "vital" innards were the stuff of manuscript culture, captured in symbols on a page.

The committee's sensational charges take on a still more bizarre cast when compared to the declassified transcript of the conversation, as captured by officers of the Military Intelligence Division. The speaker identified as "Steve" had actually asked his interlocutor for copies of an article that had "already been published." "I could certainly get reprints of it," the other person replied, although he added quickly that "the leaflet itself will give them [the Soviets] no knowledge" with which they could actually build anything. The conversation turned to whether or not the Soviet Union had "the means and raw materials" to construct atomic bombs, over and above any explicit information that might be conveyed to them. Near the end of the transcript, the officers noted that Steve's conversation partner "dictated and STEVE wrote down at this point approximately 150 to 200 words, largely indistinguishable, but believed to be from the conversation a basic formula of some type"; "the word 'spectograph' [*sic*] was mentioned." What was *not* mentioned anywhere in the transcript—nearly every page of which includes several interruptions because the speakers' words were "unintelligible," and thus "a few words were missed"—was anything about other peoples' handwriting or top-secret manuscripts that had to be returned to the laboratory. What HUAC later construed as "a complicated formula" was, in the first instance, only *assumed* to be "a basic formula" based on a conversation that had been largely "unintelligible." All the while, Steve's interlocutor consistently expressed doubts that textual materials (let alone formulas) would be of any use at all.³⁸

Of course, nothing beyond HUAC's version was available to the public at the time, and HUAC's florid (and largely manufactured) account received immediate, feverish attention. *Time* magazine covered HUAC's report under the boldface sub-heading, "Hot Formula."³⁹ "Atomic secrets" were back, cast now as explicit, textual information rather than tacit "know-how" or industrial capacity. HUAC milked the story relentlessly over the next year, sending out nearly identical press releases (dressed as "fresh news") and garnering at least eight front-page headlines in the *New York Times* for what remained essentially the same story. The "trial by newspaper" began to work: many soon proclaimed that bombs might be formulas after all.⁴⁰

The secrets-as-formula formula thus emerged a full year before Truman announced the Soviets' detonation of their own atomic bomb, and seventeen months before the theorist Klaus Fuchs confessed to spying for the Soviets during the war. These later events solidified the "hot formula" message, but did not create it. One week after Truman's announcement about the Soviet "Joe I" bomb, HUAC identified the mysterious "Scientist X" as theoretical physicist Joseph Weinberg. Their voluminous, three-volume follow-up report on "Communist Infiltration of the Radiation Laboratory" implicated Weinberg along with four other young theorists, all of whom had worked at the Manhattan Project site during the war, and all of whom were now accused of having been Communists. Politicians and the public

grasped at this “explanation” for the Soviet bomb: theorists had stolen secret formulas during the war and shepherded them to the Soviets; only because of theorists’ treachery did Stalin now possess nuclear weapons.⁴¹ The association between theorists and atomic secrets grew stronger still following the revelation, in early February 1950, that theoretical physicist Klaus Fuchs, who had worked at Oak Ridge and Los Alamos during the war as a member of the British team, had confessed to spying for the Soviet Union. Fuchs’s announcement set off a domino effect of accusations and confessions during spring and summer 1950, ultimately implicating Harry Gold, David Greenglass, Julius and Ethel Rosenberg, and Morton Sobell as members of an American “spy ring” working during the war to ferret “atomic secrets”—in the form of reports, formulas, blueprints, and graphs—to the Soviets.⁴² The swirl of comment by politicians and journalists surrounding each of these events cemented the shift in assumptions about what constituted “atomic secrets” and what types of people were most likely to hold and transmit such secrets. The secrets now became solidly theoretical, and the secret-keepers seemed more than ever to be theoretical physicists.

During 1948–55, the formula linking textual secrets with theorist-keepers calcified into a robust cultural artifact. Five distinct but related candidates for “the atomic secret” were proposed during this later phase, all centered around textual information rather than tacit knowledge: (1) “complicated formulas,” akin to HUAC’s charge against “Scientist X”; (2) information about the nation’s nuclear stockpile—the types and numbers of nuclear weapons being made; (3) the size and shape of the bomb; (4) the implosion mechanism; and (5) more general “principles” and “theories” of bomb design. All of these types of information could be written down on paper and smuggled out of the country; each “secret” candidate gained force from unfolding political events.

The charge by HUAC about “complicated formulas” soon received many echoes; two days after Truman’s announcement about the Soviet atomic bomb, science journalist Waldemar Kaempffert declared, “No doubt Soviet agents in this country pieced together scraps of information” from American physicists, from which the bomb had been built. A year and a half later, the Joint Committee on Atomic Energy alleged that David Greenglass—an Army machinist at Los Alamos during World War II and the government’s chief witness against his sister and brother-in-law, Ethel and Julius Rosenberg—had “met with a Russian official in New York and was asked to supply a mathematical formula concerning high-explosive lenses used in the Nagasaki-type weapon.” Greenglass was not the only person charged with peddling secret formulas; J. Edgar Hoover, imperious director of the FBI, explained in *Reader’s Digest* in May 1951 how the “crime of the century” had unfolded: the chemist-turned-courier Harry Gold “received formulas and various other technical data about atomic research” from Klaus Fuchs, and then passed them on to Russian agents. Indeed, Hoover charged, between Gold and Fuchs, “the basic secrets of nuclear fission had been stolen”—as if there remained any “basic secrets

of nuclear fission” to be stolen from wartime Los Alamos! (It was precisely the lack of such “secrets” that had allowed Smyth to focus so squarely on basic nuclear physics in his report.) In October 1952 a new film entitled *The Thief* depicted a nuclear physicist-turned-traitor who surreptitiously photographed his colleagues’ “top secret scientific papers” to pass them along to foreign agents.⁴³ Even the medium of film began to profess the power of texts.

Beyond “hot formulas,” other kinds of textual information came under scrutiny. On the day that President Truman delivered his controversial decision for “crash course” development of a hydrogen bomb, Senator Brien McMahon delivered a speech in Detroit urging that the most important atomic secrets concerned the nation’s nuclear stockpile. How could democracy function, McMahon asked, if neither the Joint Committee on Atomic Energy (of which he was chair) nor the public at large had access to basic information about “how many bombs and atomic weapons we possess and how fast we are producing them”? Several years later, the editors of *U.S. News & World Report* concurred with McMahon that the real “secrets” had to do with stockpiles and strike capabilities—even if they disagreed with McMahon on whether or not such “secrets” should be released.⁴⁴ Others claimed that the real secrets concerned the outward appearance and basic dimensions of atomic bombs, likewise textual information that could easily fall into the wrong hands. Soon after being elevated to chair of the Atomic Energy Commission, for example, Gordon Dean told the editors of *U.S. News & World Report* that the real secrets of the bomb concerned “the size, the weight, the shape and general characteristics of the gadget,” while journalist Alan Moorehead explained part of Klaus Fuchs’s treachery: “He gave the size of the bomb—a vital point. . . . He gave his own calculations of the actual dimensions of the parts.” Two of McMahon’s fellow senators on the joint committee argued more generally that “one of the strong points about the atomic weapon is the fact that it creates mystery.”⁴⁵ To Senators Tydings and Connally, “mystery”—engendered by textual “secrets” regarding stockpile and bomb-size—was deemed *politically* vital to the entire atomic weapons program, all replication and proliferation issues aside.

During and after the Rosenbergs’ trial in spring 1951, most discussion of “atomic secrets” turned on information supposedly gleaned by the machinist Greenglass concerning the implosion mechanism for detonating plutonium bombs. At the start of the trial, *Life* magazine described the nature of Greenglass’s thievery: he had stolen “this nation’s most closely guarded and worst kept secret: the mechanism of the atomic bomb.” “Having wangled information out of loquacious scientists,” *Life*’s coverage continued, Greenglass “was able to show Julius [Rosenberg] a rough design of the ultrasecret detonating lens producing the implosion that triggers the bomb into action.” Fuchs, too, was accused of giving away “a description of an implosion lens” as part of the sheaf of papers he passed off to Harry Gold. Ironically, the Atomic Energy Commission had allowed David Greenglass to testify

about the implosion lenses (even showing diagrams) during the Rosenbergs' trial—to a partially open court whose gallery had been cleared of all listeners *except* journalists!—precisely because it had deemed this information safe enough for release. Gordon Dean, AEC chief, conferring nearly every day with members of the prosecution team, had actually approved releasing this information as a kind of *de facto* declassification.⁴⁶ So much for “this nation’s most closely guarded and worst kept secret.”

More generally, in the wake of these allegations and court proceedings, journalists and politicians spoke of general “principles” and “theories” of bomb design that had been “stolen,” all by means of textual transfer. The Joint Committee on Atomic Energy, for example, explained in its April 1951 report on *Soviet Atomic Espionage* that “it is little appreciated that Fuchs” was “the great betrayer of the theory” underlying uranium isotope separation at Oak Ridge. Based on “Fuchs’s grasp of the theoretical principles involved,” they reported, “he would be able to reconstitute our whole program [at Oak Ridge] from only scattered pieces of information”—rebuilding an entire city of industrial production from a few scraps of paper. (In contrast, the Chrysler Corporation in 1947 had tried to popularize how critical various large-scale industrial processes had been to the operation at Oak Ridge, such as certain metal-plating techniques to keep equipment from corroding in the presence of the highly noxious uranium hexafluoride gas—all techniques that built on Chrysler’s in-house stock of tacit knowledge and large-scale capacity.)⁴⁷ Alan Moorehead, in his four-part series on Fuchs that ran in the *Saturday Evening Post* in late spring 1952, closed his report by arguing that Fuchs “thought the worst thing he had done was to give information about the principle of the design of the plutonium bomb.”⁴⁸ Now when physicists protested that such claims relied on a category mistake, confusing equations with the tacit knowledge and industrial infrastructure required to design and produce nuclear weapons, their tone had become defensive. No longer educating congressional leaders, they were merely offering “heretical afterthoughts.”⁴⁹

Two sets of HUAC hearings frame most starkly the shift in discussions about “the atomic secret” from raw materials and industrial capacity to text-based information. In June and July 1948—a few months before releasing their “Scientist X” and “hot formula” report—the committee heard testimony about shipments of uranium metal that had gone to the Soviet Union under wartime lend-lease arrangements. A year and a half later, deep into the second phase of “secrets” discussions, HUAC held new hearings, this time on the allegation that suitcases of Manhattan Project *documents* had been shipped to the Soviets under lend-lease.⁵⁰ The “atomic secret” had come a long way since 1945. The second part of the Cold War formula—a notion of atomic secrets as “principles,” “theories,” and “hot formulas” that could be scribbled down on scraps of paper and passed off to foreign agents—thus emerged late in 1948 and solidified during the early 1950s.

Egghead Revolutionaries

The final portion of the Cold War equation—casting theorists as inherently left-leaning, indeed, as especially susceptible to Communist influence—likewise took shape during 1948–49, rather than immediately after the bombings of August 1945. Only in this later period did many come to assume that theorists as a whole were different from other groups of scientists (let alone academics or federal employees). Generalizations about theorists eventually came to be found among working scientists, journalists, politicians, and even federal judges. Some began to argue that theorists' special mental states or patterns of thought marked them as different (indeed, some claimed, as dangerous). Others pointed to theorists' unbalanced educations, their ethnic backgrounds, and even their physiognomies as signs of their untrustworthiness. Theorists became the new “eggheads”—that term used increasingly to disparage intellectuals—and many feared they needed to be watched.⁵¹ As discussion of “atomic secrets” centered more and more narrowly around theoretical formulas and information, the purported keepers of such secrets were seen in a more ominous light.

Theorists were not singled out at first. In the eighteen months after Truman enacted his immense loyalty-security program in spring 1947, for example, Congress appropriated nearly \$18 million to pay the FBI to screen *all* federal employees and applicants for federal jobs, from the Agriculture Department through the State Department. Nearly two and a half million people were examined by the end of 1948, triggering fewer than eight thousand full field investigations, at the end of which only 200 or so “disloyal employees” had been found (although no evidence of espionage surfaced). By the end of 1951, the number of federal employees and applicants screened for loyalty had risen to more than four million (nearly 17,000 of whom had been subjected to full FBI investigations), yielding a grand total of 343 individuals who were denied employment as a result. The early loyalty net had been thrown wide.⁵²

The employees and applicants to the newly established Atomic Energy Commission—and all individuals working with the fast-growing list of AEC contractors and subcontractors—fell under the new loyalty-security surveillance. Most required formal security clearance (whether or not they worked with classified data) in addition to loyalty screening; by one estimate, the AEC investigated four hundred thousand individuals between 1947 and 1952. The average cost of these FBI investigations ran between one hundred and two hundred dollars each, and in the early days averaged two full months per screening. During 1947 and 1948, the AEC commissioners devoted fully one-third of their formal meeting time to personnel security matters; soon the number of AEC employees working full time on secrecy and security rivaled the entire population of Los Alamos.⁵³ From the start, all kinds of scientists, engineers, and technicians were affected. During 1947 and 1948, the

Federation of American Scientists reported early cases of security-clearance problems among chemists, biologists, physiologists, electrical engineers, and both experimental and theoretical physicists; no specialist group seemed to have been singled out for special scrutiny. The following year, the *New York Times* reported that somewhere between twenty thousand and fifty thousand scientists, engineers, and technicians were still waiting for their security clearances, working at reduced capacity, if at all, in the meantime.⁵⁴

An important shift occurred between April 1948 and early 1949 in the AEC's official regulations, however; the change in rules unfolded just as HUAC made repeated headlines with its allegations of atomic espionage against various theorists. Now the AEC made an explicit distinction between two types of case. "Category A" referred to specific disloyal acts committed or strongly suspected of an individual; "category B" referred to the more nebulous region of *thought* rather than action. "Sympathetic interest" in various "political ideologies"—rather than party membership or actual activities—now qualified as sufficient grounds for denying clearance and triggering dismissal.⁵⁵ Once the criterion for dismissal became curiosity and thinking in certain ways rather than proclivities for action, the balance of suspicion—at least in congressional committees and the popular press—fell more narrowly upon that group most easily cast as professional thinkers: theoretical physicists. HUAC's "trial by newspaper" had pressured the Atomic Energy Commission to change its rules; the new regulations reflected broader changes in assumptions about what and who constituted the ultimate security risks.⁵⁶

Sometimes scientists themselves began to assume that theorists as a whole shared more leftist political affiliations than any comparable group of scientists or academics. The University of California enacted a new "loyalty oath" in spring 1949, for example, and over the next two years Berkeley's physics department lost *all* of its theorists, either through resignation or firing for refusal to sign the anticommunist oath. Although the department also lost two of its most esteemed and successful experimentalists, department chair Raymond Birge linked specific political proclivities only to the category of theorists. With the disagreeable oath in place, lamented Birge, the department would never be able to "induce a single first-class theoretical physicist in this country to accept a position at Berkeley"; he displayed no such concerns about finding "first-class" replacements for his lost experimentalists.⁵⁷ The former executive secretary of the Federation of American Scientists presented a similar taxonomy of scientific specialties and political dispositions in June 1951. Unlike chemists, biologists, or engineers, explained Richard Meier, "the physicist by nature is politically radical":

His mind is schooled in the proposition that progress is made by discarding various assumptions and premises and thereby making it possible to create a more powerful theory upon a simpler underpinning. The physicist, more than any scientist, deals with abstractions which make nonsense out of observations based on the commonplace; he is educated in doubt and

can disregard evidence which to the ordinary observer is both convincing and conclusive. Thus many physicists chose a vague leftist political philosophy, partly as the only relatively rational set of value premises which was offered at the time ('36 to '40) in the world of ideas.⁵⁸

Though he attributed these political leanings to physicists as a whole, he did so on the basis of their *theoretical* methods, emphasizing “abstractions” and styles of thinking rather than, say, skills in manipulating apparatus or designing experiments.

More and more the associations between scientists and political leanings became a topic of general fascination and comment. Psychologist Anne Roe and science journalist Waldemar Kaempffert offered contrasting views to readers of the *New York Times Magazine* as to whether or not a unique “scientific mind” existed, and whether or not that “mind” had special affinities for particular political philosophies. Their debate played out between 1949 and 1954. Although Kaempffert denied that any special “scientific mind” existed (whereas Roe argued for it), he did argue that scientists’ mode of thought encouraged them to “turn a Marxian proposal this way and that, so view it in all its aspects, and sometimes accept it. The communistic argument appeals to younger scientists.” Five years later, Kaempffert elaborated on this thesis, narrowing its application to “thinkers” in biology or physics—theorists—who sometimes became enamoured of Communist arguments. These theorists ultimately failed to realize, asserted Kaempffert, that “it is much easier to establish the physical and chemical constitution of a star than it is to invent a social system that will bring happiness to mankind, abolish poverty and end war.”⁵⁹ To such commentators, scientific “thinkers” were more inclined toward leftist political philosophies, and Communism in particular, because they mistakenly tried to tackle social and political problems the same way they tackled theoretical physics.

The assumption that theorists as a whole were the most susceptible of all scientists to Communist influence received repeated tellings, often in less benign reports than Kaempffert’s and Roe’s musings. Self-proclaimed experts held forth on a new and dangerous threat to the nation: “ideological espionage.” According to a lengthy *New York Times Magazine* article in May 1949, it was the number of “‘idealists’ or ideological traitors, the educated, sophisticated thinkers” who were inclined to act against the country on principle rather than for money or fame, that increased so alarmingly in the postwar period—not the number of mercenaries or other opportunistic traitors. The latest psychoanalytic theories, the article explained, held that intellectuals committed espionage in part because they unconsciously likened the nation to their parents (who else?), against whom they sought revenge. One psychiatrist went so far as to write down a special equation for the new phenomenon:

$$C = T + S - R.$$

Crime equals the criminal Tendencies (“which we all have to some degree”) plus the given Situation—but minus the mental Resistance which normal people develop over the years.⁶⁰

Be on guard, the experts now warned: mentally unbalanced intellectuals were poised to wreak havoc.

Several people began to apply the notion of “ideological espionage,” fashioned for critiques of intellectuals in general, to theoretical physicists in particular. Journalist Rebecca West argued that Klaus Fuchs’s “mental processes”—including what Fuchs himself called his “controlled schizophrenia,” compartmentalizing his thinking so he could continue his espionage even as he worked closely with American and British colleagues—pointed far beyond Fuchs himself. Fuchs stood in, West argued, for a new ideal type, “the traitor scientist.” This new breed tried—with disastrous results—to apply their “rare and exalted gifts” at mathematical and theoretical abstraction to political thinking. Although the results of their political philosophizing might read “like the ramblings of an exceptionally silly boy of 16,” the theorists’ new relation to atomic secrets, and their peculiar thought processes, made them the most serious threat of the nuclear age. Fuchs’s own attorney reasoned along virtually identical lines when arguing for leniency in sentencing, explaining that (all) theorists’ overly rationalized and insufficiently “flexible” minds often arrived at poor political judgments.⁶¹ Manhattan Project veteran and *Bulletin of the Atomic Scientists* editor Eugene Rabinowitch complained in exasperation at the new tendency to generalize from the single case of Fuchs to all theorists everywhere: why hadn’t journalists like West made similar leaps to the in-built mental processes and political proclivities of all lawyers in the wake of the Alger Hiss case? Yet West’s purple prose soon found many imitators, including the Joint Committee on Atomic Energy. Its April 1951 report on *Soviet Atomic Espionage* argued in precisely the same way that the “warped mentalities” of theorist-spies created “an almost diseased yearning to remold the world after the image of their own work in physical science.” Theorists were disproportionately driven to Communism, this official government report concluded, because they tried to force sociopolitical ideas into the hyper-rationalist straightjacket of their beloved nuclear theory.⁶²

More than just mental states and thought processes were at issue. Part of the problem, West and the Joint Committee concluded, derived from theorists’ unbalanced education: too much theoretical physics and mathematics had come at the expense of the liberal arts.⁶³ As late as December 1956 an influential federal judge took up the same issue. Judge Alexander Holtzoff of the United States District Court for Washington, D.C., reinstated a physics graduate student’s contempt of Congress conviction for failing to name names during a HUAC investigation back in 1954. Although the physics student’s conviction had been overturned on a technicality in November 1955, the Federal Court of Appeals reinstated the charge in July 1956, which is how Bernhard Deutch wound up in Judge Holtzoff’s courtroom that December. Not content simply to sentence Deutch to a ninety-day prison term (which he did), Holtzoff seized the opportunity to deliver a broader sermon about young physicists and Communism. “The younger generation of pure scientists”

had become a “fertile field for Communist propaganda,” he declared; the *New York Times* carried his decision under the headline, “Pure Scientists Called Red Prey.” Holtzoff made it clear that he did not mean just any scientists; he “was not referring to scientists in engineering, chemistry, and similar fields.” Rather, he explained that “from evidence admitted in other cases that have come before the court”—Holtzoff had presided over the cases of all five of the theorists whom HUAC had accused of being Communists and of “infiltrating” Berkeley’s Radiation Laboratory—“the court has gleaned the inference that the younger generation of pure scientists specifically engaged in research in physics has succumbed to Communistic propaganda.” Like Rebecca West and the Joint Committee, Holtzoff attributed the problem to recent educational changes, which deprived young physics students of “a proper cultural background”; the new generation displayed “an abysmal ignorance” of such fields as history and economics.⁶⁴

Judge Holtzoff’s accusation that “pure physicists” lacked a “proper cultural background” signaled still another layer in the unfolding image of the theorist. Nine of the thirteen theorists who fell afoul of protracted anticommunist scrutiny were of Jewish background. Indeed, it had become common even among physicists to note the high proportion of Jews working in theoretical physics (rather than in other branches of the discipline); some physicists in the early 1950s still made note of job candidates’ “Jewish features.” Overt examples of anti-Semitism riddle the secret FBI and Military Intelligence Division reports on physicists during World War II.⁶⁵ Several conservative members of Congress repeatedly emphasized during 1945–46 the foreign- and Jewish-sounding names of theoretical physicists who had worked on the Manhattan Project.⁶⁶ After the war, however, as the magnitude of the Holocaust became better known, blatant and explicit anti-Semitism became less common, at least in popular discourse. Bigotry hardly disappeared; rather, it often reemerged in the guise of virulent anticommunism. Many sociologists, historians, and social critics—people like Arthur Schlesinger Jr., Edward Shils, David Riesman, and Richard Hofstadter—observed during the early years of the Cold War that much anticommunist sentiment drew its force from sublimated anti-Semitism. Older claims about Jews’ supposed “cosmopolitan” leanings (not to mention “internationalist conspiracies”) fit the new stereotype of the urban Communist equally well.⁶⁷ Indeed, as late as 1957 the retired intelligence chief for General Douglas MacArthur could denounce Soviet espionage undertaken by “East European immigrants, an ethnic group that has furnished the largest percentage of agitators and Communists who can combine the benefits of American citizenship with the betrayal of their refuge and their neighbors.”⁶⁸ Major General Charles Willoughby’s listeners at the 27th Annual Convention of the American Coalition of Patriotic Societies would have had little difficulty parsing just who this “ethnic group” of “East European immigrants” was. Theorists were Jews; Jews were Communists—still one more reason to treat this group as a special threat.

Beyond the basic bigotry often associated with McCarthyism, the theorists’

case was tied even more broadly to longer-standing American anxieties over intellectuals. At times the charges and counter-charges of anti-intellectualism were made explicitly.⁶⁹ More often, however, anti-intellectualism surfaced in more subtle ways. Even physiognomy could invite suspicion: during this period, intellectuals were routinely cast as “effeminate” in appearance, their overdeveloped brains paired with emasculated bodies.⁷⁰ The trope worked to the detriment of theoretical physicists. In story after story during the early 1950s, theorists appeared as tall, thin (even lanky), with delicate features and retiring manners, whereas all other scientists, engineers, and technicians were described as short, overweight, even “burly,” but certainly not effeminate. Reporting Julius Rosenberg’s arrest in July 1950, for example, *Time* magazine called the engineer “a puffy, spectacled native New Yorker”; his wife Ethel, explained the *New York Times*, was a “plump, plain-faced girl.” Rosenberg’s alleged coconspirator, the electrical engineer Morton Sobell, was “short” and “chunky” with “unruly hair,” reported *Newsweek* upon Sobell’s arrest. During the Rosenberg-Sobell trial, the *New York Times* described Sobell as “swarthy-faced, with a receding shock of heavy black hair,” while the machinist-turned-government witness, David Greenglass, was “a burly young man,” reported *Life* magazine. The chemist-courier Harry Gold was “a little man, insignificant, average-looking,” with “broad build [and] round face”; in short, he was “stocky,” explained FBI director J. Edgar Hoover in *Reader’s Digest*. The *New York Times* agreed, describing Gold as “pudgy-faced.” The chemist Alfred Dean Slack, convicted on charges of wartime espionage for ferreting out information about new chemical explosives via Gold to the Soviets, was likewise “of medium height [and] a little too heavy,” reported *U.S. News & World Report*.⁷¹ Chemists, engineers, technicians: they might be disloyal, but they were certainly not intellectuals; they simply didn’t have the body for it.

How did the theorists compare? Klaus Fuchs was “of feeble physique,” explained Rebecca West; Hoover agreed, describing Fuchs as “thin, sallow-complexioned, with stooping shoulders, balding head and weak brown eyes behind thick lenses.” He was a “frail scientist” with “delicate fingers,” Hoover continued. Indeed, physiognomy should have revealed ignominy all along, declared journalist Alan Moorehead in the *Saturday Evening Post*:

Even in 1946, before anyone knew about Fuchs’ real character, it was possible to notice superficial similarities between him and [Alan Nunn] May. Both were serious and shy and self-effacing. Both had the same bulging forehead, the receding hair, the horn-rimmed glasses, the set mouth and the slightly weak chin.⁷²

How could the British mission or Groves’s security forces have missed Fuchs, since he had all the facial features of a devious, calculating spy? Nor was this body description limited to Fuchs. Other nuclear physicists at the time were described in the press as “lanky” and “scholarly-looking,” or tall and “loose-jointed.”⁷³ None seemed to have struck journalists as “burly,” “stocky,” “plump,” “chunky,” or

“swarthy-faced”; intellectuals never were. By the early 1950s, the final element in the Cold War formula was thus complete: theorists were special, different from other types of scientists, engineers, or academics. They were especially prone to Communism, the worst type of intellectual in an anti-intellectual age.

Proof in the Pudding?

In his study *Anti-Intellectualism in American Life* (1964), Richard Hofstadter noted that intellectualism in this country has often been “pitted against practicality, since theory is held to be opposed to practice, and the ‘purely’ theoretical mind is so much disesteemed.” Trouble brews especially during those periods when “ordinary folk”—including politicians—develop *ambivalence* about formal knowledge and those who possess it: ambivalence driven by a mixture of “respect and awe with suspicion and resentment.”⁷⁴ After World War II theoretical physicists, as supposed keepers of the “atomic secret,” seemed to have acquired awe-inspiring power, and they became all the more suspicious for it.

Yet it didn’t have to be that way. No portion of the Cold War formula—theorists built the bomb; bombs were made from formulas; and theorists were Communist dupes—was beyond doubt. Some of these elements were demonstrably false, even if the demonstrations were hampered by postwar security gag-orders. Whatever the origins of this train of assumptions (likely some admixture of the Smyth Report and Oppenheimer’s escalating troubles, fired by debates over atomic energy legislation and cemented by news of the Soviets’ bomb and Klaus Fuchs’s confession), these allegations and representations marked an important shift in broader assumptions about science and scientists. Before the war, theoretical physicists—when garnering media attention at all—had usually been dismissed as ultimately amusing at best, and certainly not worth troubling over. The *New York Times* declared in 1923, for example, on the topic of “Einsteinism” and the new physics, that one should “just ignore it . . . as of no concern to us”; a few years later the newspaper advised its readers to file relativity and quantum mechanics under “things you needn’t worry about just yet.” By the mid-1930s, casual dismissals of theorists in the national media had become common: they were likened to medieval theologians debating how many angels fit on the head of a pin; theorists’ equations, readers of the *New York Times* were told, gave no answers to life’s truly important questions.⁷⁵ Yet within a few years after the war, the stuff of pencil and paper began to trump depictions of American technical ingenuity; the Thomas Edison types, hands-on tinkerers who had self-consciously projected an antitheoretical image, no longer claimed center stage.⁷⁶ Struggling to make sense of these fast-moving events, journalists and politicians poured the new Cold War wine into older anti-intellectual bottles, grasping at ready-to-hand descriptions of “effeminate” and devious intellectuals and quickly pressing them into action. If some of the characterizations were

stale, however, their target was new. The scientists requiring closest scrutiny were not the builders but the thinkers. “Science” now meant formulas, not know-how.

Some might claim that in the light of what we know now, many of these Cold War precautions about theorists and atomic secrets were ultimately justified. After all, Alan Nunn May and Klaus Fuchs admitted to supplying the Soviets with written information about the atomic bomb project, and theorist Ted Hall all but admitted his own wartime espionage more recently. Even the assistant director of the Soviet nuclear weapons project, Yuli Khariton, admitted repeatedly in the mid-1990s that his group received clandestine atomic information from the American project, and that these stolen reports helped to determine the form of “Joe I.”⁷⁷ A few cautions are in order. First, many of the claims about the effectiveness of wartime espionage for the Soviet nuclear project were made by retired KGB agents looking to share the honor for having made the Soviet Union’s first bomb. Espionage certainly occurred, but even with the purloined texts the Soviet group still had to redo most experiments, adapting stolen blueprints to the availability of different types of materials, and in general improvising at least as much as following explicit, text-based procedures.⁷⁸ The stolen information could have helped the Soviet group avoid certain blind alleys, and thus save time and resources (although in fact the Soviet leadership decided, much as General Groves had done, to march forward along several competing directions at once—even though the Soviets knew which of these processes had worked best for the American project). The major limiting factor of the Soviet effort, it is now clear, was its dire shortage of uranium—raw materials trumped textual information for several years.⁷⁹ Moreover, even with designs, reports, and data—whether received surreptitiously by the Soviets or legitimately by the British—*every single country* that has succeeded in making its own nuclear weapon has taken *longer* than the wartime Manhattan Project. Each attempted replication has had to build up both the industrial capacity and the tacit knowledge for its use from scratch. Texts simply can’t deliver these. To this day, bombs have never been reified equations.⁸⁰

Obviously, security measures are essential; even the postwar atomic scientists’ movement argued that certain technical details, materials, and processes needed to be tightly controlled. What I find fascinating about the early Cold War period is the image of theory—and of theorists—that drove know-how and tacit knowledge from view, especially since these had long been staples of a triumphalist American self-image. Nor was the postwar valorization of theory (with attendant demonization of theorists) a temporary phenomenon. In the mid-1970s, the Princeton undergraduate physics major who drew up his own plutonium bomb design from publicly available sources was repeatedly asked where he was keeping his bomb and what he planned to do with it—the distinction between blueprint and arsenal consistently evaded people.⁸¹

More troubling is the recent case of Wen Ho Lee, the Chinese-American scientist at Los Alamos who was accused of nuclear espionage in the late 1990s. Lee

worked with computer codes in part of the lab's X-division (an outgrowth of the wartime Theoretical Physics or T-division). The Departments of Energy and Justice, along with the FBI, alleged that Lee had committed the single gravest case of nuclear espionage since the Rosenbergs, likening the text-based codes that Lee handled to the "crown jewels" of bomb making—"the nation's most prized nuclear secrets," as a Justice Department panel wrote.⁸² As Hugh Gusterson has remarked recently, government officials and the national media acted as if Lee had "emailed the U.S. nuclear arsenal to a foreign power," betraying the familiar slippage from text to artifact.⁸³ Several lab experts had to explain that bombs are no more made from million-line computer codes than they are from secret formulas. The material that Lee downloaded had not even been marked as "Top Secret Restricted Data"; in fact, it had never even been classified at all. Racial profiling, meanwhile, marred the case from the beginning, as counterintelligence officials consistently asserted that a Taiwanese-born American citizen was more likely than anyone else to aid Communist China. Lee spent close to one year in solitary confinement before fifty-eight of the fifty-nine felony charges against him were finally dismissed.⁸⁴

Even today, as news of Pakistani nuclear scientist A. Q. Khan's illegal activities come to light, Cold War assumptions shine through. Khan has been accused of selling equipment, including specialized, high-precision centrifuge parts that can be used to enrich fissionable uranium, as well as having sent his own trained personnel to various places to set up and use the equipment. So it seems that Khan trafficked in matériel and the tacit knowledge to use it, precisely the most dangerous ingredients feeding nuclear proliferation. And yet at least some press reports have dismissed Khan as "merely" a metallurgist; after all, he's no theorist.⁸⁵ All these lesson-filled years later, we still live with the legacy of the early Cold War.

Notes

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The following abbreviations are used: AEC, Atomic Energy Commission; *BAS*, *Bulletin of the Atomic Scientists*; FAS, Federation of American Scientists; HUAC, United States Congress, House Committee on Un-American Activities; JCAE, United States Congress, Joint Committee on Atomic Energy; *NYT*, *New York Times*; *VSD*, *Vital Speeches of the Day*.

1. On McCarthyism and American higher education see esp. Ellen Schrecker, *No Ivory Tower: McCarthyism and the Universities* (New York, 1986); Sigmund Diamond, *Compro-*

- mised Campus: The Collaboration of Universities with the Intelligence Community, 1945–1955* (New York, 1992); James Hershberg, *James B. Conant: Harvard to Hiroshima and the Making of the Nuclear Age* (New York, 1993); and John McCumber, *Time in the Ditch: American Philosophy and the McCarthy Era* (Evanston, Ill., 2001). On American scientists in particular, see esp. Jessica Wang, “Science, Security, and the Cold War: The case of E. U. Condon,” *Isis* 83 (1992): 238–69; Jessica Wang, *American Science in an Age of Anxiety: Scientists, Anticommunism, and the Cold War* (Chapel Hill, N.C., 1999); Silvan S. Schweber, *In the Shadow of the Bomb: Oppenheimer, Bethe, and the Moral Responsibility of the Scientist* (Princeton, 2000); Lawrence Badash, “Science and McCarthyism,” *Minerva* 38 (2000): 53–80; Naomi Oreskes and Ronald Rainger, “Science and Security Before the Atomic Bomb: The Loyalty Case of Harald U. Sverdrup,” *Studies in History and Philosophy of Modern Physics* 31 (2000): 309–69; David Kaiser, “Nuclear Democracy: Political Engagement, Pedagogical Reform, and Particle Physics in Postwar America,” *Isis* 93 (2002): 229–68; Fred Jerome, *The Einstein File: J. Edgar Hoover’s Secret War Against the World’s Most Famous Scientist* (New York, 2002); and Gregg Herken, *Brotherhood of the Bomb: The Tangled Lives and Loyalties of Robert Oppenheimer, Ernest Lawrence, and Edward Teller* (New York, 2002).
2. On Condon, see Schrecker, *No Ivory Tower*, 274–75; Wang, “Science, Security, and the Cold War”; and Wang, *American Science*, chap. 4. On Weinberg, Lomanitz, Bohm, Friedman, and Fox, see Schrecker, *No Ivory Tower*, 130–48; Russell Olwell, “Physical Isolation and Marginalization in Physics: David Bohm’s Cold War Exile,” *Isis* 90 (1999): 738–56; and Shawn Mullet, “Intelligence Files and the Unlearning of Atomic Espionage: Joseph Weinberg and Giovanni Rossi Lomanitz” (unpublished manuscript 2003). On Darling and Dayton, see Schrecker, *No Ivory Tower*, 207–9, 277–79. On Philip Morrison and Bernard Peters, see Schrecker, *No Ivory Tower*, 148–60; and Schweber, *In the Shadow of the Bomb*. On Furry, see Schrecker, *No Ivory Tower*, 197–204; and Catharine M. Hornby, *Harvard Astronomy in the Age of McCarthyism* (A. B. thesis, Harvard University, 1997), chap. 2. On Einstein, see Jerome, *Einstein File*. The literature on Oppenheimer’s case is vast; see esp. Philip Stern, *The Oppenheimer Case: Security on Trial* (New York, 1969); Barton Bernstein, “‘In the matter of J. Robert Oppenheimer,’” *Historical Studies in the Physical Sciences* 12 (1982): 195–252; and Charles Thorpe, *Oppenheimer: The Tragic Intellect* (Chicago, forthcoming) chap. 7. Many additional theorists were subject to behind-the-scenes harassment, including FBI wiretaps and mail covers, although their cases did not erupt into the media spotlight: Barton Bernstein, “Interpreting the Elusive Robert Serber: What Serber Says and What Serber Does Not Explicitly Say,” *Studies in History and Philosophy of Modern Physics* 32 (2001): 443–86.
 3. In addition, eight mathematicians and five experimental physicists were called as witnesses before HUAC between 1948 and 1953, totaling less than three-quarters and one-half the number of theoretical physicists, respectively. Information on witnesses before HUAC hearings (in both public and executive sessions) is most conveniently available via the “Congressional universe” search engine: <http://web.lexis-nexis.com/congcomp>. Similarly, Schrecker’s meticulous account in *No Ivory Tower* (which ranges beyond HUAC to include several other congressional, state, and university committees) includes twelve physicists who were adversely affected (eleven of whom were theoretical physicists), whose number was greater than that in any other academic specialty.
 4. “Red, Rumpus: Dupes and Fellow Travelers Dress up Communist Fronts,” *Life*, 5 April 1949, 42–43.
 5. On the early and sustained surveillance of Oppenheimer, see Bernstein, “‘In the Mat-

- ter of J. Robert Oppenheimer’”; and Herken, *Brotherhood of the Bomb*. Recent exchanges in the ongoing debate over Oppenheimer and Communism include Daniel J. Kevles, “The Strange Case of Robert Oppenheimer,” review of Herken, *Brotherhood of the Bomb*, *New York Review of Books* 50 (4 Dec. 2003): 37–40; and Gregg Herken, “The Oppenheimer Case: An Exchange,” with a reply by Kevles, in *New York Review of Books* 51 (25 Mar 2004).
6. Relevant articles were found by examining all entries for 1945–55 in the *Reader’s Guide to Periodical Literature* indexed under the following keywords: “atomic bomb,” “atomic secret,” “atomic espionage,” and “physicists.”
 7. Donald MacKenzie and Graham Spinardi, “Tacit Knowledge, Weapons Design, and the Uninvention of Nuclear Weapons,” *American Journal of Sociology* 101 (July 1995): 44–99; Laura McNamara, *Ways of Knowing About Weapons: The Cold War’s End at the Los Alamos National Laboratory* (Ph.D. diss., University of New Mexico, 2001), esp. chap. 4; and Hugh Gusterson, “A Pedagogy of Diminishing Returns: Scientific Involvement Across Three Generations of Nuclear Weapons Science,” in *Pedagogy and the Practice of Science: Historical and Contemporary Perspectives*, ed. David Kaiser (Cambridge, Mass., 2005), 75–107. On “tacit knowledge” in science studies more broadly, see esp. Harry Collins, *Changing Order: Replication and Induction in Scientific Practice*, 2nd ed. (Chicago, 1992); Harry Collins, “Tacit Knowledge, Trust and the Q of Sapphire,” *Social Studies of Science* 31 (2001): 71–85; Trevor Pinch, H. M. Collins, and Larry Carbone, “Inside Knowledge: Second Order Measures of Skill,” *Sociological Review* 44 (1996): 163–86; H. M. Collins, G. H. de Vries, and W. E. Bijker, “Ways of Going On: An Analysis of Skill Applied to Medical Practice,” *Science, Technology, and Human Values* 22 (1997): 267–85; Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, 1985); Myles Jackson, *Spectrum of Belief: Joseph von Fraunhofer and the Craft of Precision Optics* (Cambridge, Mass, 2000); and David Kaiser, *Drawing Theories Apart: The Dispersion of Feynman Diagrams in Postwar Physics* (Chicago, 2005).
 8. Edward Teller, “The Work of Many People,” *Science* 121 (25 Feb. 1955): 267–75.
 9. See, e.g., Herbert York, *The Advisors: Oppenheimer, Teller, and the Superbomb*, 2nd ed. (Stanford, 1989), 133–34; and Hugh Gusterson, “The Death of the Authors of Death: Prestige and Creativity Among Nuclear Weapons Scientists,” in *Scientific Authorship: Credit and Intellectual Property in Science*, ed. Mario Biagioli and Peter Galison (New York, 2003), 281–307, on 283–84.
 10. See esp. Richard Hewlett and Oscar Anderson Jr., *The New World, 1939–46*, vol. 1 of *A History of the United States Atomic Energy Commission* (University Park, Pa., 1962); David Hawkins with Edith Truslow and Ralph C. Smith, *Project Y: The Los Alamos Story* (New York, 1983), esp. 30, on the Governing Board; Lillian Hoddeson et al., *Critical Assembly: A Technical History of Los Alamos During the Oppenheimer Years, 1943–1945* (New York, 1993); Andrew Pickering, “Cyborg History and the World War II Regime,” *Perspectives on Science* 3 (Spring 1995): 1–48; Peter Hales, *Atomic Spaces: Living on the Manhattan Project* (Urbana, Ill., 1997); Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago, 1997), esp. chap. 4; and Rebecca Press Schwartz, “Manhattan Beyond the Mesa” (unpublished manuscript 2004). The Los Alamos wartime organization chart appears on the cover of Galison, *Image and Logic*.
 11. See the following War Department press releases: “Medal for Merit Presented to Eight Scientists for Work on Atomic Bomb” (4 March 1946); “Atomic Bomb Scientists Awarded Medal for Merit” (13 March 1946); and “Harvard Scientist Awarded Medal for Merit for Atom Bomb Work” (9 April 1946), all available in Paul Kesaris, ed., *Man-*

- hattan Project: *Official History and Documents* (Washington, D.C., 1977), 12 microfilm reels, on reel 1, part 6.
12. The implosion device was first tested at the so-called Trinity test near Alamogordo, New Mexico, on 16 July 1945, and a comparable bomb destroyed Nagasaki on 9 August 1945; the bomb that destroyed Hiroshima on 6 August 1945 used a different technique to trigger the explosive chain reaction.
 13. Hoddeson et al., *Critical Assembly*, 93.
 14. See esp. Hawkins, Truslow, and Smith, *Project Y*; Hoddeson et al., *Critical Assembly*; and Anne Fitzpatrick, *Igniting the Light Elements: The Los Alamos Thermonuclear Weapon Project, 1942–1952* (Ph.D. diss., Virginia Institute of Technology, 1999), available as report LA-13577-T from Los Alamos National Laboratory.
 15. Kaiser, *Drawing Theories Apart*, chaps. 5–9.
 16. On theorists' wartime efforts to "get the numbers out," see Silvan S. Schweber, *QED and the Men Who Made It: Dyson, Feynman, Schwinger, and Tomonaga* (Princeton, 1994), esp. chap. 3. On the nontheoretical elements involved in nuclear weapons design and manufacture, see also Hawkins, Truslow, and Smith, *Project Y*; Hoddeson et al., *Critical Assembly*; Fitzpatrick, *Igniting the Light Elements*, chap. 2; MacKenzie and Spinardi, "Tacit Knowledge"; Hugh Gusterson, *Nuclear Rites: A Weapons Laboratory at the End of the Cold War* (Berkeley, 1996); and McNamara, *Ways of Knowing*.
 17. Rebecca Press Schwartz, *The Making of the History of the Atomic Bomb: The Smyth Report and the Historiography of the Manhattan Project* (Ph.D. diss., Princeton University, in preparation), quotations from chap. 2. The security regulations governing what could and could not be included in the Smyth Report are also quoted in Arvin Quist, *Security Classification of Information*, vol. 1, *Introduction, History, and Adverse Impacts*, 2nd ed. (Oak Ridge, Tenn., 2002), chap. 5, p. 2 (available at <http://www.fas.org/sgp/library/quist>). In 1946 Princeton University Press took over the printing of the Smyth Report (the Government Printing Office had become overwhelmed by all the requests for copies), releasing it with a slightly more manageable title: Henry DeWolf Smyth, *Atomic Energy for Military Purposes* (Princeton, 1946). Not all of its readers agreed that the Smyth Report overplayed theoretical physics at the expense of engineering and industrial contributions. Early in 1947, one Manhattan Project veteran complained that the report gave too much attention to the industrial contractors, and that the report had been cavalier in revealing "technological aspects of the production of fissionable materials and manufacture of bombs"; E. R. [Eugene Rabinowitch], "Editorial: The Atomic Secrets," *BAS* 3 (Feb. 1947): 33, 68, on 33; see also "Smyth Disclosure Amazed Savants: Chicago Atomic Scientists Say They Were 'Dumfounded' [*sic*] at Report; Writer Defends it," *NYT*, 18 Feb. 1947, 17.
 18. United States Senate, Special Committee on Atomic Energy, *Essential Information on Atomic Energy* (Washington, D.C., 1946), esp. 21–31, 41–44.
 19. See esp. Alice Kimball Smith, *A Peril and a Hope: The Scientists' Movement in America, 1945–47* (Chicago, 1965); and Wang, *American Science*, chaps. 1–2.
 20. "The Bomb Is No Secret," *New Republic*, 8 Oct. 1945, 451–53, on 451; Harry S. Truman, "Atomic Energy: Domestic and International Control," *VSD* 12 (15 Oct. 1945): 8–10, on 9–10.
 21. Reuben G. Gustavson, "Story Behind the Atomic Bomb: Teamwork Among Scientists," *VSD* 11 (1 Oct. 1945): 762–67, on 766; "The Bomb is No Secret," 451; A. K. Solomon, "Physics of the Bomb," *Fortune*, 1 May 1946, 114–22, 173–76, on 174. Later commentators sometimes returned to this theme: E. R. [Eugene Rabinowitch], "Editorial: The Atomic Secrets," 33, 68, on 33; and "The Russians Knew," *Time*, 2 Jan.

- 1950, 54. See also the congressional testimony from Oct. 1945 by Manhattan Project scientific veterans Leo Szilard and Harold Urey, as quoted in Quist, *Security Classification*, chap. 5, p. 30.
22. Cf. William A. Reuben, *The Atom Spy Hoax* (New York, 1955). Reuben did not focus on the implications of the “secrets” discussions for theory or theorists, and he periodized the debate slightly differently than I do here (Reuben saw the Soviets’ detonation of Joe I as the main pivot between two phases of discussion), but his book nonetheless remains a prescient study worthy of renewed attention.
 23. Looking back at the troubled decade in October 1954, for example, physicist Ralph Lapp lamented that in August 1945 “public attitudes had not congealed into their present state of rigidity. Then the notion of ‘the secret of the atomic bomb’ was only a notion and not a fixation. And it had not become a plank in a political platform”; Ralph E. Lapp, “Atomic Candor,” *BAS* 10 (Oct. 1954): 312–14, 226, on 312.
 24. “A New Era: The Secrets of Science,” *Newsweek*, 20 Aug. 1945, 34–42, on 37; Truman, “Atomic Energy,” 9. Historian Gregg Herken argued in 1980 that the only real “atomic secret” was General Groves’s secret negotiations during the war to secure a monopoly on the world’s supply of uranium ore; Gregg Herken, *The Winning Weapon: The Atomic Bomb in the Cold War, 1945–1950* (New York, 1980), chap. 5. Groves similarly testified in Nov. 1945 before the Senate Special Committee on Atomic Energy that the greatest challenge had been garnering sufficient fissionable material: Quist, *Security Classification*, chap. 4, p. 28.
 25. Quoted in Harry Hall, *Congressional Attitudes Toward Science and Scientists: A Study of Legislative Reactions to Atomic Energy and the Political Participation of Scientists* (Ph.D. diss., University of Chicago, 1961), on 96; see also 26, 33. A facsimile edition of Hall’s dissertation was published by Arno Press in 1979.
 26. Gustavson, “Story Behind the Atomic Bomb,” 765; “The secret,” *Time*, 17 Sept. 1945: 30; Hanson W. Baldwin, “Has Russia the Atomic Bomb? Probably Not,” *NYT*, 9 Nov. 1947, E3; Winifred Mallon, “Leaders Condemn Secrecy in Science,” *NYT*, 26 Oct. 1945, 4; E. R. [Eugene Rabinowitch], “Editorial: Freedom of Scientific Publication,” *BAS* 2 (Dec. 1946): 1, 32; Russell Porter, “Dr. Conant in Plea for U.S. Leadership,” *NYT*, 20 Oct. 1948, 1, 12. Truman similarly erected a division between “scientific information” on the one hand, and “manufacturing processes leading to the production of the atomic bomb itself”: Truman, “Atomic Energy,” 8–10. This basic division appeared throughout Truman’s other early statements about the bomb: cf. White House press release, “Statement by the President of the United States” (6 Aug. 1945), in Kesaris, *Manhattan Project*, reel 1 part 6; the three-nation accord signed on 15 Nov. 1945 with Britain and Canada, reprinted in Special Committee on Atomic Energy, *Essential Information on Atomic Energy*, 3–4; and Henry Wallace’s recollections of the 21 Sept. 1945 cabinet meeting: Wallace, “The Maginot Line of Secrecy,” *BAS* 8 (Feb. 1952): 36–37.
 27. Churchill’s 7 Nov. 1945 address to Parliament as quoted in Reuben, *Atom Spy Hoax*, 10–11.
 28. Attlee quoted in Reuben, *Atom Spy Hoax*, 12.
 29. Lloyd Berkner quoted “sworn testimony before Congress in 1945 by [unnamed] authorities on the matter,” in Berkner, “Is Secrecy Effective?” *BAS* 11 (Feb. 1955): 62–63, 68, on 63.
 30. Smyth quoted in Press Schwartz, *Making of the History of the Atomic Bomb*, chap. 2, 12 n. 33; “Mystery of the Stolen Atom,” *NYT*, 11 July 1947, 14; see also E. R. [Eugene Rabinowitch], “Editorial: The atomic secrets,” 33, 68; and Baldwin, “Has Russia the Atomic Bomb?” E3.

31. Herken, *The Winning Weapon*, chap. 6. See also Reuben, *Atom Spy Hoax*, 16–110, on the Canadian spy ring.
32. Indeed, Vandenberg had begun the Senate discussion that led to Hickenlooper's disclosure only after McMahon had made a passionate radio address the night before arguing against such military incursions into the civilian agency: Anthony Leviero, "Groves Bares Leak in U.S. Atom Plant," *NYT*, 20 March 1946, 1, 11; Groves's complete letter to Hickenlooper, dated 12 March 1946, is reprinted in JCAE, *Soviet Atomic Espionage* (Washington, D.C., 1951), 51–53. See also Hall, *Congressional Attitudes*, 230–31.
33. In his confession, May claimed that the report he wrote for the Soviets was brief and general, containing no more information than was soon released in the Smyth Report. The Report of the (Canadian) Royal Commission, appointed to investigate the spying allegations, was published in June 1946, and was quoted in JCAE, *Soviet Atomic Espionage*, 53. House member J. Parnell Thomas (R, N.J.) likewise invoked fear over losing (unspecified) "atomic secrets" in his efforts to block the McMahon bill: see Wang, *American Science*, 45–46.
34. Wang, "Science, Security, and the Cold War," 246, 252–53; see also Robert Carr, *The House Committee on Un-American Activities, 1945–50* (Ithaca, N.Y., 1952), 134.
35. Several scientists at the time attributed HUAC's attacks on Condon to their differing political views on domestic atomic energy legislation; see, e.g., "Scientists Defend Themselves on Loyalty Charges," *BAS* 9 (Feb. 1953): 2–3; and Carr, *House Committee*, 131–53.
36. "Atomic Spy Report Will Shock Public, Official Declares," *NYT*, 26 Sept. 1948, 1, 23; William White, "Indictment of Five Is Urged in Report on Atomic Spying," *NYT*, 28 Sept. 1948, 1, 23 (quotations about "vital information" on 23); HUAC, *Excerpts from Hearings Regarding Investigation of Communist Activities in Connection with the Atom Bomb* (Washington, D.C., 1948); and "Text of Report by House Committee on Un-American Activities Relating to Atomic Espionage," *NYT*, 28 Sept. 1948, 22–23. See also "The Atom Spy Report," *NYT*, 29 Sept. 1948, 28, criticizing HUAC for unsubstantiated charges drummed up for political gain.
37. The *NYT* reprinted HUAC's entire twenty-thousand-word report in "Text of Report by House Committee," quotation on 23.
38. The transcript may be found in Record Group 77, Entry 8, Box 100, in the National Archives in Washington, D.C. My thanks to Shawn Mullet for bringing the transcript to my attention.
39. "The Atomic Spy Hunt," *Time*, 4 Oct. 1948, 22–23.
40. On HUAC's repetition of their press releases about "Scientist X" and his clandestine formula, and the *NYT*'s front-page coverage, see Walter Gellhorn, *Security, Loyalty, and Science* (Ithaca, N.Y., 1950), 118–20. On HUAC's "trial by newspaper" (referring to their similar treatment of the theorist Condon), see J. T. Klapper and C. Y. Glock, "Trial by Newspaper," *Scientific American* 180 (Feb. 1949): 16; and Carr, *House Committee*, chap. 10.
41. "Named 'Scientist X,' He Denies Charge," *NYT*, 1 Oct. 1949, 1; "Soviet Atom Gains Laid to U.S. Laxity," *NYT*, 26 Sept. 1949, 4. The charge that scientists' espionage had single-handedly delivered Stalin the bomb received repeated tellings throughout the mid-1950s, subsiding only after the surprise launch of Sputnik in 1957—a scientific and technical achievement that the Soviets could not possibly have "stolen" from the Americans. Cf. "Vast Aid to Soviet Laid to Atom Spies," *NYT*, 9 April 1951, 1, 18; Edward Shils, "Conspiratorial Hallucinations," *BAS* 10 (Feb. 1954): 51–54; and Harry Schwartz, "The Real Threat of Moscow's Missile," *NYT Magazine*, 15 Sept. 1957, 11,

- 78–80. On the case against the five Rad Lab theorists, see also HUAC, *Hearings Regarding Communist Infiltration of Radiation Laboratory and Atomic Bomb Project at the University of California, Berkeley, Calif.* (Washington, D.C., 1949), 3 vols.; Carl Beck, *Contempt of Congress* (New Orleans, 1959), 65–70; Schrecker, *No Ivory Tower*, 126–48; Olwell, “Physical Isolation and Marginalization in Physics”; and Mullet, “Intelligence Files and the Unlearning of Atomic Espionage.”
42. See esp. JCAE, *Soviet Atomic Espionage*; Robert C. Williams, *Klaus Fuchs: Atom Spy* (Cambridge, Mass., 1987); and Ronald Radosh and Joyce Milton, *The Rosenberg File*, 2nd ed. (New Haven, 1997).
43. Waldemar Kaempffert, “Soviet Bomb Speeds Up Battle of Scientists,” *NYT*, 25 Sept. 1949, E5; JCAE, *Soviet Atomic Espionage*, 7; J. Edgar Hoover, “The Crime of the Century: The Case of the A-bomb Spies,” *Reader’s Digest* 58 (May 1951): 149–68, on 155 and 158; “Spy Melodrama at the Roxy,” *NYT*, 16 Oct. 1952, 1. The idea of “hot formulas” spread still further. For example, J. Edgar Hoover alleged in a follow-up article that Russian “undercover agents . . . stole formulas for petroleum products, lacquers, textiles, industrial chemicals”; Hoover, “Red Spy Masters in America,” *Reader’s Digest* 61 (Aug. 1952): 83–87, on 83. Similarly, a chemist was accused of being part of the Canadian spy ring of 1946; his alleged crime (of which he was exonerated) was passing along the “secret” formula for a new chemical explosive, RDX—even though the chemical formula for the material had been published in the open chemical literature in 1904. The same charge was later made against the American chemist Alfred Dean Slack; even though he likewise protested that the chemical formula for RDX had been published for decades, he was sentenced to ten years in prison, and all of his requests for appeal were denied. See Reuben, *Atom Spy Hoax*, 53, 300–312. Thus even in indictments of chemists during this period, their main crime was seen as *textual*, trading in illicit formulas.
44. Brien McMahon, “Atomic Energy Policy: Paradoxes Which Secrecy Creates,” *VSD* 15 (15 Feb. 1949): 263–65, on 263 (also published as McMahon, “Should We Reveal the Size of Our Atomic Stockpile?” *BAS* 5 [March 1949]: 66–68); “The Strange Case of Dr. Oppenheimer,” *US News & World Report*, 23 April 1954, 20–22, 24, on 24.
45. “Can Atom Secrets Be Kept?” *U.S. News & World Report*, 24 Nov. 1950, 36–40, on 36; Alan Moorehead, “Traitor Klaus Fuchs: He Gave Stalin the A-bomb, Part Two,” *Saturday Evening Post*, 31 May 1952, 32–33, 70–74, on 72; Senators Tydings and Connally quoted in “Secrecy Debated in Joint Congressional Committee,” *BAS* 5 (March 1949): 95. See also Waldemar Kaempffert, “Science in Review,” *NYT*, 6 March 1955, E11.
46. “Spy’s Version of the A-bomb,” *Life*, 26 March 1951, 51–52, on 51; “The Case of the World’s Greatest Secret,” *Life*, 16 April 1951, 53–56, on 53. On Gordon Dean’s behind-the-scenes work with the prosecutors, see Roger Anders, “The Rosenberg Case Revisited: The Greenglass Testimony and the Protection of Atomic Secrets,” *American Historical Review* 83 (April 1978): 388–400; and Roger Anders, ed., *Forging the Atomic Shield: Excerpts from the Office Diary of Gordon E. Dean* (Chapel Hill, N.C., 1987), chap. 3. Dean seems to have assumed that the testimony about implosion lenses was safe to release because the Soviets’ “Joe I” bomb had used a similar design, and hence was no “secret” to them. But even if the Soviets knew, presumably the AEC would not have wanted such “secrets”—if they really were significant and dangerous—to fall into other countries’ hands. The implication thus remains that such text-based information really was not as dangerous as the prosecution and Judge Irving Kaufman alleged during the Rosenberg-Sobell trial and sentencing.

47. Wesley Stout, *Secret* (Detroit, 1947).
48. JCAE, *Soviet Atomic Espionage*, 1, 22; Alan Moorehead, "Traitor Klaus Fuchs: He Gave Stalin the A-bomb, Part Four," *Saturday Evening Post*, 14 June 1952, 34, 170–74, on 170.
49. See, e.g., Eugene Rabinowitch, "Atomic Spy Trials: Heretical Afterthoughts," *BAS* 7 (May 1951): 139–42, 157; "Atomic Secrecy Deemed Overdone," *NYT*, 17 March 1954, 5 (quoting James Beckerly, director of the AEC Classification Office); Ralph Lapp, "We Meet the Soviet Scientists: Many Misconceptions About Soviet Science," *VSD* 22 (15 Dec. 1955): 156–60, esp. 157.
50. HUAC, *Investigation of Uranium Purchases by the Soviet Union* (Washington, D.C., 1948); HUAC, *Hearings Regarding Shipment of Atomic Material to the Soviet Union During World War II* (Washington, D.C., 1949–50). See also JCAE, *Soviet Atomic Espionage*, 184–92; and Carr, *House Committee*, 186–93.
51. On the rise of "egghead" as a term of derision against intellectuals, see Arthur Schlesinger Jr., "The Highbrow in American Politics," *Partisan Review* 20 (1953): 156–65; and Richard Hofstadter, *Anti-Intellectualism in American Life* (New York, 1964), 4.
52. Robert Cushman, "Freedom Versus Security," *BAS* 5 (March 1949): 69–72, on 71; Leonard White, "The Loyalty Program of the United States Government," *BAS* 7 (Dec. 1951): 363–66, 382, on 366. On Truman's loyalty-security program more generally, see also Gellhorn, *Security, Loyalty, and Science*, chaps. 4–7; Schrecker, *No Ivory Tower*, chap. 4; Wang, *American Science*, chap. 3; and Schrecker, *Many Are the Crimes: McCarthyism in America* (New York, 1998), chap. 6.
53. Wang, "Science, Security, and the Cold War," 257; "Can Atom Secrets Be Kept?" *U.S. News & World Report* (24 Nov. 1950): 36–40, on 38; "Joint Committee's Reports on AEC Investigations," *BAS* 5 (Dec. 1949): 330–36, on 335. See also Peter Westwick, "Secret Science: A Classified Community in the National Laboratories," *Minerva* 38 (2000): 363–91.
54. Byron Miller and Harrison Brown, "Loyalty Procedures of the A. E. C.: A Report and Recommendations," *BAS* 4 (Feb. 1948): 45–48; FAS Committee on Secrecy and Clearance, "Loyalty Clearance Procedures in Research Laboratories," *BAS* 4 (April 1948): 111–14; FAS Committee on Secrecy and Clearance, "Some Individual Cases of Clearance Procedures," *BAS* 4 (Sept. 1948): 281–85; see also the special issue of *BAS* 4 (July 1948); *NYT* report as quoted in Gellhorn, *Security, Loyalty, and Science*, 193–94. See also Wang, *American Science*, chaps. 2–3, 5.
55. "AEC Criteria for Security Clearance," *BAS* 5 (Feb. 1949): 62–63 (quotations on 63), which reprinted the newly released AEC "official policy statement." This superseded the AEC's "Interim Procedure" of April 1948.
56. On HUAC's pressure, see Wang, *American Science*, chap. 5. The AEC's relationship with the JCAE was also fraying at this point, in part because the JCAE sought to fend off HUAC's incursions into its atomic-energy territory; Hall, *Congressional Attitudes*, 403–4.
57. Raymond Birge to Baldwin M. Woods, Chairman, Committee on Academic Freedom (Berkeley), 12 Sept. 1950, in Raymond Thayer Birge, *Correspondence and Papers*, call number 73/79c, Bancroft Library, Berkeley, California. On the loyalty oath at the University of California, see David Gardner, *The California Oath Controversy* (Berkeley, 1967); and Schrecker, *No Ivory Tower*, 126–31; on its effects on Berkeley's physics department, see Kaiser, "Nuclear Democracy," esp. 245–47.
58. Richard Meier, "The Origins of the Scientific Species," *BAS* 7 (June 1951): 169–73, on 170.
59. Waldemar Kaempffert, "The Atom and the Scientific Mind," *NYT Magazine*, 9 Oct. 1949, 15, 28–35, on 30–32; Waldemar Kaempffert, "X-ray of the Scientific Mind,"

- NYT Magazine*, 25 April 1954, 7, 54–56, on 55; cf. Anne Roe, “What Makes the Scientific Mind Scientific,” *NYT Magazine*, 1 Feb. 1953, 10, 22.
60. Gertrude Samuels, “American Traitors: A Study in Motives,” *NYT Magazine*, 22 May 1949, 17, 63–66, on 17, 66. On “ideological espionage,” see also Schrecker, *Many Are the Crimes*, chap. 5; and Mullet, “Intelligence Files and the Unlearning of Atomic Espionage.”
 61. Rebecca West, “The Terrifying Import of the Fuchs Case,” *NYT Magazine*, 4 March 1951, 6, 29–34, on 31–32; the appeal from Fuchs’s attorney, Derek Curtis-Bennett, is quoted in Moorehead, “Traitor Klaus Fuchs, Part Four,” 173. The JCAE quoted extensively from West’s article in their April 1951 report, *Soviet Atomic Espionage*, 17–19, 21, 29–30, and reprinted the article in full on 200–204.
 62. Eugene Rabinowitch, “Editorial: Scientists and Loyalty,” *BAS* 7 (Dec. 1951): 354–55; JCAE, *Soviet Atomic Espionage*, 12. David Katcher, former editor of *Physics Today*, similarly wrote to the *NYT* to complain about West’s hasty generalization from Fuchs to all physicists: Katcher, “Science to Blame?” letter to the editor, *NYT*, 18 March 1951, SM2. The JCAE’s report in fact showed little coherence on the question of theorists’ inherent loyalty, arguing two pages earlier that “The fact that three of the four spies are physicists does not indicate that men of science, as a group, are more vulnerable to communism than other groups. It suggests, instead, that physicists alone fully understood many of the secrets which counted most and that physicists therefore attracted the concentrated attention of Soviet intelligence directors”; JCAE, *Soviet Atomic Espionage*, 10. Such government reports might have displayed this lack of coherence because they were written by several different staffers.
 63. West, “The Terrifying Import of the Fuchs Case,” 6, 31; JCAE, *Soviet Atomic Espionage*, 12.
 64. “Pure Scientists Called Red Prey,” *NYT*, 14 Dec. 1956, 15; “Judge Criticized on Physicist View,” *NYT*, 17 Dec. 1956, 19. The second article included more quotations from Holtzoff’s original decision, along with news of a formal letter of complaint from the president of the FAS to Holtzoff for his remarks. Soon physics graduate students at Columbia and Yale protested the judge’s unfair characterization as well; “Judge is Challenged: Students Reply to Charge of ‘Fertile Ground’ for Reds,” *NYT*, 18 Dec. 1956, 35; and Robert Gluckstern, McAllister Hull Jr., Joseph Shapiro, and James Turner, “Loyalty of Physicists,” letter to the editor, *NYT*, 29 Dec. 1956, 10. On the background of Deutch’s case, see “4 Held for Trial in House Inquiry,” *NYT*, 4 Dec. 1954, 8; [No title], *NYT*, (5 Nov. 1955), 12; “Court Reinstates Contempt Charge,” *NYT*, 27 July 1956, 12. Deutch appealed Holtzoff’s conviction, and his case eventually made it to the U.S. Supreme Court; “United States Supreme Court,” *NYT*, 23 March 1961, 46; although unfortunately no later article seems to report the outcome of Deutch’s appeal. Meanwhile, Holtzoff continued a controversial career, being formally reprimanded by the Federal Court of Appeals for “presiding over criminal trials as if he were prosecuting the case”; Holtzoff also had more of his decisions reversed by the U.S. Supreme Court than any other District Judge during the twenty-five years that he was on the bench. See “Judge Holtzoff, 81, will retire Dec. 30,” *NYT*, 25 Nov. 1967, 55; and “Judge Alexander Holtzoff, 82, of Washington District Court,” *NYT*, 7 Sept. 1969, 86.
 65. See, e.g., Raymond Birge to William Roth, 31 May 1955, in Department of Physics records, University of California at Berkeley, call number CU-68, Bancroft Library, Berkeley, Folder 5:143; Francis Jenkins’s notes on job candidates for the Berkeley physics department, winter 1950, in Folder 5:125; and David Kaiser, “The Postwar Suburbanization of American Physics,” *American Quarterly* 56 (Dec. 2004): 851–88, on 863–

65. On anti-Semitism within wartime intelligence files, see Rebecca Press Schwartz, "The Military-Industrial-Scientific Complex Meets the International Jewish Conspiracy: Antisemitism and Anticommunism on the Manhattan Project," paper presented at the 2002 annual meeting of the History of Science Society. Of course, many commentators at the time and since have blamed anti-Semitism for the severity of the Rosenbergs' death sentence; see, e.g., Marjorie Garber and Rebecca Walkowitz, eds., *Secret Agents: The Rosenberg Case, McCarthyism, and Fifties America* (New York, 1995).
66. Hall, *Congressional Attitudes*, 183–89, 193, 199–200.
67. Schlesinger, "Highbrow in American Politics," 164; Shils, "Conspiratorial Hallucinations," on 53; David Riesman and Nathan Glazer, "The Intellectuals and the Discontented Classes," *Partisan Review* 22 (1955): 47–72, on 57–58; Hofstadter, *Anti-Intellectualism*, 4, 42. See also David Hollinger, *Science, Jews, and Secular Culture: Studies in Mid-Twentieth-Century American Intellectual History* (Princeton, 1999).
68. Maj. Gen. Charles Willoughby, "Soviet Espionage: The American Communist Party," *VSD* 23 (15 March 1957): 344–47, on 346.
69. See, e.g., the letter of protest against Judge Holtzoff's "red prey" comments signed by eighty-nine graduate students at Columbia, as quoted in "Judge is Challenged."
70. See, e.g., Louis Bromfield as quoted in Schlesinger, "Highbrow in American Politics," 159. Also quoted in Hofstadter, *Anti-Intellectualism*, 9; on intellectuals as "effeminate," see also 19.
71. "Espionage: No. 4," *Time*, 31 July 1950, 12–13, on 12; Joseph Kraft, "Rosenberg Spy Case," *NYT*, 11 Jan. 1953, E4; "Atom Arrest No. 8," *Newsweek*, 28 Aug. 1950, 30; "Spy Defendants Classmates at C. C. N.Y.," *NYT*, 30 March 1951, 8; "The Case of the World's Greatest Secret," *Life*, 16 April 1951, 53–56, on 53; J. Edgar Hoover, "The Crime of the Century: The Case of the A-bomb Spies," *Reader's Digest* 58, May 1951, 149–68, on 158–60; A. H. Raskin, "Story of the Rosenbergs: Two Links in Atomic Conspiracy," *NYT*, 21 June 1953, E6; "Inside Story of a Native American Who Turned Spy," *U.S. News & World Report*, 24 Nov. 1950, as reprinted in JCAE, *Soviet Atomic Espionage*, 214–16, on 214. On Slack's case, see also Reuben, *Atom Spy Hoax*, chap. 15.
72. West, "The Terrifying Import of the Fuchs Case," 29; Hoover, "Crime of the Century," 150, 155, 161; Alan Moorehead, "Traitor Klaus Fuchs: He Gave Stalin the A-bomb," *Saturday Evening Post*, 24 May 1952, 22–23, 96–103, on 23.
73. "Smyth and Libby Men in Contrast," *NYT*, 16 Sept. 1954, 18; Sandra Littlewood and Skip Garretson, "Espionage in the Rad Lab—Naw!" *Daily Californian*, 11 Dec. 1953, 8. As late as 1959, an *NYT* reporter seemed stunned to find a nuclear physicist and veteran of the Manhattan Project who did not fit the prevailing image, explaining that "there is little of the so-called typical professor in his physical appearance"; "A Man's Man in Science: John Harry Williams," *NYT*, 17 July 1959, 2.
74. Hofstadter, *Anti-Intellectualism*, 46, 19, 21.
75. "Topics of the Times," *NYT*, 6 Feb. 1923, 18; Simeon Strunsky, "About Books, *More or Less*: Excessively Up to Date," *NYT*, 29 April 1928, BR3; "By-products: In the Matter of Einstein, Tea-Kettles, Destiny, &c.," *NYT*, 22 March 1931, E1; "New Forces for Atoms," *NYT*, 7 July 1936, 18; and "Improving on Relativity," *NYT*, 15 March 1939, 18.
76. On Edison's prewar persona, see Thomas Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870–1970* (New York, 1989).
77. On Ted Hall, see Joseph Albright and Marcia Kunstel, *Bombshell: The Secret Story of America's Unknown Atomic Spy Conspiracy* (New York, 1997); on Yuli Khariton's discussions of atomic espionage, see Yuli Khariton and Yuri Smirnov, "The Khariton version," *BAS* 49 (May 1993): 20–31; and Yuli Khariton, Viktor Adamskii, and Yuri Smir-

- nov, "The Way It Was," *BAS* 52 (Nov./Dec. 1996): 53–59. On the use of espionage in the Soviet nuclear weapons project, see also David Holloway, *Stalin and the Bomb* (New Haven, 1994), 90–97, 102–8, 296–97, 310–12; and Alexei Kojevnikov, *Stalin's Great Science: The Times and Adventures of Soviet Physicists* (London, 2004), chap. 6.
78. Roald Sagdeev, "Russian Scientists Save American Secrets," *BAS* 49 (May 1993): 32–36; Sergei Leskov, "Dividing the Glory of the Fathers," *BAS* 49 (May 1993): 37–39; Holloway, *Stalin and the Bomb*, 199; and Arkady Brish, "We Copied the Charge Design, not the Bomb Itself," *Literaturnaya Gazeta* 36 (7 Sept. 1994): 10, available in translation at <http://www.fas.org/news/russia/1994>.
 79. Kojevnikov, *Stalin's Great Science*, chap. 6.
 80. See esp. MacKenzie and Spinardi, "Tacit Knowledge"; McNamara, *Ways of Knowing*; and Gusterson, "Pedagogy of Diminishing Returns."
 81. John Aristotle Phillips and David Michaelis, *Mushroom: The Story of the A-Bomb Kid* (New York, 1978).
 82. See esp. Dan Stober and Ian Hoffman, *A Convenient Spy: Wen Ho Lee and the Politics of Nuclear Espionage* (New York, 2001). A redacted version of the classified May 2000 Justice Department review of the mishandling of the Lee case is available at <http://www.usdoj.gov/ag/readingroom/bellows.htm>, quotations from chap. 1.
 83. Gusterson, "Pedagogy of Diminishing Returns," 94.
 84. Stober and Hoffman, *Convenient Spy*. The material that Lee downloaded had been marked "Protect as Restricted Data" (PARAD), which was an informal measure devised to handle the large volumes of paper printouts from the early days of computing at the national weapons labs; it referred to material that had never been reviewed for classification, and was quite distinct from even low-level classifications such as "Restricted Data" (293–94).
 85. Bronwyn Curran, "A. Q. Khan, Godfather of the 'Islamic Bomb': Hero or Proliferator?" Agence France Presse report (25 Jan. 2004), available via LexisNexis; William Broad et al., "A Tale of Nuclear Proliferation: How Pakistani Built His Network," *NYT*, 12 Feb. 2004, A1.