The Postwar Suburbanization of American Physics

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> In class, status, and self-image, [the American intellectual] has become more solidly middle class, a man at a desk, married, with children, living in a respectable suburb.
>
> C. Wright Mills, *White Collar*, 1951[1]

The Cold War University as City or Suburb?

In his 1963 Godkin Lectures at Harvard on "The Uses of the University," Clark Kerr, then chancellor of the burgeoning University of California, observed that the faculty of the emergent cold war universities had become "affluent," and that their "salaries and status have risen considerably." Most telling of all, their roles and ways of life had changed palpably from the prewar days: "A professor's life has become, it is said, 'a rat race of business and activity, managing contracts and projects, guiding teams and assistants, bossing crews of technicians, making numerous trips, sitting on committees for government agencies, and engaging in other distractions necessary to keep the whole frenetic business from collapse.'" In short, Kerr concluded, the cold war university was neither a village nor a town, as older colleges and universities had been modeled, but rather a city—he called it a "City of Intellect" and a "city of infinite variety"—full of distinct subcultures, complex economies of operation, and vast managerial infrastructures. Kerr celebrated the modern, urbanized university, "rat race" and all.[2]

Other commentators read a different lesson into these structural changes in American higher education. The cold war university was not a grand and exciting city, they contended, but rather the ultimate suburb—and, as such, hardly deserving of praise. Irving Howe, for example, lambasted postwar literary intellectuals in a scathing 1954 *Partisan Review* article titled "This Age of Conformity." Intellectuals, Howe charged, had succumbed to the "temptations of an improved standard of living" and had sunk "into suburbs, country homes, and college towns." With this descent into suburbia came a "desire to retreat into the caves of bureaucratic caution" and "intellectual conformity."[3]

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Howe was hardly alone. Just a few years earlier, the iconoclastic sociologist C. Wright Mills had drawn similar conclusions about the new spate of suburban living, bureaucratization in government and the business world, and the fate of American intellectual life. Drawing on examples from his own field of sociology as well as from economics and political science, he castigated postwar academics as all too typical of the nation's new class of middle managers—bureaucratic in operation, bourgeois in outlook, and increasingly irrelevant intellectually.[4] More than three decades later, Russell Jacoby argued in *The Last Intellectuals* that American intellectuals' postwar migration to the suburbs—"from the cafés to the cafeterias"—had fostered the narrowly specialized, jargon-filled prose that passes for academic writing in everything from literary theory and history to sociology, economics, and political science.[5]

It is curious that Howe, Mills, and Jacoby restricted their scrutiny (not to mention their ire) to the humanities and social sciences, because many of the transitions within the cold war university that they loathed were felt first, and at their most extreme, by scientists and engineers, and often by physicists in particular. Wartime projects, such as the atomic bomb and radar, had thrust American physicists into new relationships with federal (mostly military) patrons.[6] In the afterglow of the atomic blasts over Hiroshima and Nagasaki—which most Americans credited with ending World War II—physicists moved to center stage in ways that no group of academics had ever done in this country. "Physical scientists are in vogue these days," announced a commentator in *Harper's* a few years after the war. "No dinner party is a success without at least one physicist." Physicists young and old—including those who had played no role in the wartime projects—found themselves "besieged with requests to speak before women's clubs" and "exhibited as lions at Washington tea-parties," reported a bemused senior physicist in 1950.[7] Physicists' mundane travels became draped with strange new fanfare. Police motorcades escorted twenty young physicists on their way to a private conference near Long Island in 1947, and a local booster sponsored a steak dinner en route for the startled guests of honor. B-25 bombers began to shuttle highly placed physicists-turned-government-advisors when civilian modes of transportation proved inconvenient. During the postwar years, military officials and heads of state sought out physicists for advice, often on topics far removed from the scientists' main areas of specialty. Long before President Kennedy began tapping Ivy League social scientists to be his advisors, physicists in the United States were already treated as "the best and the brightest."[8]

Physicists' status and role within American universities likewise quickly began to change after the war, as physicists and university administrators built upon

the scientists' wartime institutional relationships to establish the patterns that would eventually spread—with some modification, but rarely a wholesale departure—to several other areas within Kerr's beloved cold war university. By the late 1950s, more deans came from the physical sciences than from any other academic field.[9] More often than not, it was the newly elevated physicists who helped to create the very institutional structures that Howe, Mills, and Jacoby came to decry. Yet these social critics have hardly been the only ones to overlook physicists in their analyses of postwar American intellectual life. When historians have examined physicists' postwar experiences at all, they have usually restricted attention to physicists' new roles within a broadly political sphere, ranging from elite architects of atomic diplomacy to participants (on all sides) in low-brow domestic anticommunism.[10] Just as there is more to American history than political history, however, so too did the history of physics in America depend upon, reflect, and contribute to broader features of American life than the overtly political.[11] Tellingly, Kerr's quotation about the postwar professoriates' "rat race" came from an article by the physicist Merle Tuve. By the early 1960s, physicists' experiences could be taken as emblematic of the university as a whole.[12]

American physicists provide a particularly potent example for examining changes in postwar academics' vision of the proper role for the American intellectual.[13] Sweeping demographic shifts in the discipline after World War II elicited angst-ridden hand-wringing over values, norms, and identities in everything from department chairs' annual reports, to graduate student questionnaires, to junior faculty skits. Few topics evoked physicists' values-talk more readily than the training and socialization of new recruits. Training at the graduate-student and postdoctoral levels, together with the hiring and firing of junior faculty—like the initiation rites required to join any closed community—were never neutral or passive endeavors. Rather, these pedagogical activities provided postwar academics the means with which to mold their disciplines by carefully fashioning their disciples. Pedagogical issues assumed newfound significance for physicists after the war, as the number of graduate students pursuing higher degrees in physics grew like never before. More than two million veterans cashed in on the G. I. Bill, helping to drive a massive expansion at all levels of American higher education, across nearly all fields. Yet physicists encountered the vast demographic shift first and most acutely—they experienced the extremes of what would quickly become the norm. The growth of graduate-level enrollments in American physics departments outstripped those of every other field after the war: between 1945 and 1950, the rate at which U.S. institutions granted physics doctorates grew at nearly twice

the rate of all other fields combined. By the outbreak of fighting in the Korean War, American physics departments were producing three times as many new Ph.D.s in a given year as the prewar highs—a number that would only climb higher, by another factor of three, following the surprise launch of Sputnik in 1957.[14]

The physicists' postwar population explosion engendered reactions on many levels within a particular culturally mediated idiom. The stark and rapid transformation in their roles and university environment was invested with meaning—literally made sense of—with a specific vocabulary of faceless conformity and bureaucratization, a value system that pitted material comforts against higher callings, and promoted stereotypical gender roles for the home, office, and laboratory. The terms that physicists used to express discontent, and their tropes for describing goals and aspirations, were deeply resonant with the larger discussions then filling newspapers and magazines about the fate of postwar American society. In short, physicists appropriated the language of suburbanization and mass consumption to express deep-seated wishes as well as fears. These shifts in physicists' self-image—wider in scope than the particularities of military funding, and tied to broader transformations in contemporary American culture—provide a bellwether for similar changes throughout the cold war university, as the physicists' "rat race" and new way of life spread to more and more departments on campus.

The Suburbs as Symbol

There are at least two levels upon which one might consider the relationship between postwar American physicists and suburbanization. The first concerns literal suburbanization: where physicists chose to live. In fact, physicists were among the very first to experience suburban living as it would come to be known more broadly after the war: the U.S. Army erected tens of thousands of prefabricated houses during the war to billet the scientists and other workers at the various Manhattan Project sites in Oak Ridge, Tennessee; Hanford, Washington; and Los Alamos, New Mexico. Physicists and their families lived in nearly identical houses, stacked row upon row in orderly developments (fig. 1).[15] Several postwar commentators remarked on how "normal" these towns appeared.[16] The government continued the pattern after the war by constructing a series of new national laboratories away from urban areas, reducing their staffs to what physicist I. I. Rabi mocked as simply "carpools and cesspools." A new spate of industrial labs, usually headed by physicists, likewise began to spring up away from urban centers, as companies such as Gen-

Figure 1.
Employee housing at the Manhattan Project facilities in Oak Ridge, Tennesse, 1944. Reproduced with kind permission of the Chicago Historical Society.

eral Motors, IBM, and Bell Telephone erected huge "Industrial Versailles" in the suburbs of Michigan, Minnesota, and New Jersey.[17]

There is a second, symbolic level on which to consider the relationship between postwar physicists and suburbanization; it is the symbolic level that interests me here. This symbolic level affected physicists working at major universities in urban areas (such as Harvard, MIT, and Berkeley), as well as those further away from city centers (such as Princeton, Cornell, and the University of Illinois at Urbana). It likewise affected those physicists who chose—in fast-growing numbers after the war—to make their careers in industrial laboratories rather than in the nation's universities. Both within the academy and beyond it, physicists after the war found a vocabulary ready-made for expressing their aspirations and disappointments, stemming from broader discussions at the time about mass society, bureaucratized corporate culture, and suburbanization. Physicists drew upon these symbols of postwar American life to make sense of their changing discipline.[18]

During the late 1940s and throughout the 1950s, several indictments of suburbanization gained widespread currency. They became instant clichés, introduced in wide-circulation magazines and best-selling paperbacks and soon

invoked freely in everything from newspaper editorials to novels and films. Several key terms entered the nation's vernacular: David Riesman's *The Lonely Crowd* (1950), C. Wright Mills's *White Collar* (1951) and his writings on the "bureaucratic ethos," Sloan Wilson's *The Man in the Grey Flannel Suit* (1955), William Whyte's *The Organization Man* (1956), John Keats's *The Crack in the Picture Window* (1956), John Kenneth Galbraith's *The Affluent Society* (1958), and Vance Packard's *Status Seekers* (1959). All of these authors, and many others besides, cautioned that America was losing its vital edge. Gone were the earlier heroes of American can-do pragmatism, these self-appointed critics now declared. In their place were leisure-seeking yes-men, searching, in Riesman's telling phrase, more for morale than morality. Postwar America, each of these commentators agreed, had become a land of conspicuous consumption rather than self-sufficient production—in short, of keeping up with the Joneses in the rapidly expanding suburbs.[19]

The postwar social critics' complaints can be grouped into four broad categories. The first concerned suburbanites' personality traits and inner emotional lives: critics charged that the suburbs were filled with strangers whose superficial politeness masked deep feelings of loneliness, alienation, and isolation.[20] The second theme, related to the first, alleged that suburban social codes elevated group conformity and bland "neighboring" rituals (such as incessant "coffee klatching") at the expense of individual expression. There were similar worries about corporate life: were the faceless commuters who rode in every day from the suburbs getting lost in the anonymous bureaucracies of the business world?[21] Third, nearly all of the critics agreed that work had become merely a means to other ends. The manicured lawns, two-car garages, and other vestiges of the suburban lifestyle had been purchased at the expense of satisfaction in a job well done; such was the nature of conspicuous consumption, according to the social critics' diagnosis.[22] Lastly, many of the critics argued that gender roles had become constrained into mere stereotypes, with commuting husbands subject to domineering housewives.[23] Although we might desire more analytic clarity from these critiques—were there differences between the homogenization of mass society, individuals' alienation, corporate bureaucratization, domestic-sphere patterns in consumption, and gender-role stereotyping?—most of the critics at the time tended to blur these categories, using the symbol of the "suburbs" as the locus where all of these psychological, sociological, economic, and cultural transitions met.

As later commentators and historians have asserted, most of these critiques were of course overly simplistic. They often relied more on nostalgia for a nonexistent past than a realistic assessment of the present, generalizing hastily

from a handful of affluent suburbs to all suburbs everywhere; they constituted merely the "suburban myth."[24] Needless to say, we should by no means take the well-known suburban critiques at face value. At the same time, however, we can hardly ignore their immense circulation at the time: the formula, though flawed, was pervasive. The number of articles in wide-circulation magazines that dealt with aspects of suburbanization *quadrupled* between the successive five-year periods 1945–49 and 1950–54, and then doubled again during 1955–59. Typical were William Whyte's 1953 articles in *Fortune*, in which he made explicit the connections between the demographic swell in suburban home construction and the purported shifts in values and ways of life.[25] Without making claims about a homogenous zeitgeist, it is clear that certain expressions and assumptions regarding the suburban boom became commonplace during the postwar period. Indeed, much of the later debunkers' zeal stemmed from the extraordinary circulation and "naturalness" that the suburban myth had attained throughout the 1950s.[26]

The critics of suburbanization had been goaded by the tremendous demographic shift within American society after the war: with single-family home construction rising at a record pace, the suburban population grew by 43 percent between 1947 and 1953; by the end of the 1950s, more Americans lived in suburbs than in either cities or rural regions.[27] A parallel demographic shift took place at the same time within American physics departments, with graduate-student enrollments eclipsing any previous patterns. Not only were there vastly more graduate students than ever before, but—in a further break from the prewar pattern—most of them were married and had children, and growing proportions of them looked to industry rather than the academy in which to build their careers. Amid the changes, physicists across the country assessed themselves and their students through the idiom of suburbanization, using its terms and tropes as tools to interpret their new situation in the years after World War II.

The Lonely Crowd

Consider the contours of the population explosion. At Harvard, the number of physics graduate students had held steady at around 30 per year during the 1930s, falling to a low of just 14 during 1944–45—yet 116 graduate students crowded the halls during 1946–47. Both Princeton's and Cornell's graduate enrollments in physics, although smaller than Harvard's, likewise quickly grew to three times their prewar size, each crossing the 100 mark during the mid-1950s. Berkeley's physics department, already one of the nation's largest be-

fore the war, ballooned by the same factor of three: despite department chair Raymond Birge's continual hand-wringing, Berkeley's department housed between 204 and 276 graduate students at a time during the 1950s.[28] Predictably, this led to overcrowding within the graduate courses, in turn provoking alarm among department chairs across the country.[29] The sudden jump in numbers similarly affected departments' physical facilities. The pages of the *American Journal of Physics* reported on a spate of new buildings and building extensions, yet even the new facilities always seemed to come up short.[30] Complaints about lack of office and laboratory space punctuated nearly every one of the physics departments' annual reports at Berkeley, Harvard, Princeton, and Cornell between 1945 and the early 1960s. Princeton's department chair Allen Shenstone demanded new office space for the roomfuls of graduate students, so as to "prevent them from frequenting their professors' offices, a habit which is very aggravating though quite understandable under present circumstances." Berkeley's new department chair went one step further, dressing up a storage closet into makeshift office space.[31]

The graduate students who crowded into the nation's physics departments after the war provided the perfect portrait of the racial, ethnic, and class homogeneity that so many social critics charged had overtaken American suburbs. Surveys in 1948 and 1961 revealed that young physicists came from solidly middle-class stock: their parents were not as well-to-do as those of the nation's budding lawyers or medical doctors, but they were better off on average than the up-and-coming chemists and engineers.[32] Birge assured a correspondent in 1955 that Berkeley's physics department had "practically no minority group problems. So far as race is concerned, we have never yet had a negro graduate student in the department, hence that particular problem [*sic*] has never arisen." Only one in ten of the nation's physics graduate students during this period was foreign born, in part because only American citizens were allowed to work at Atomic Energy Commission (AEC)–funded laboratories, whether on classified or unclassified material, and whether paid or not.[33] Although nearly a hundred physicist refugees fleeing fascism arrived in the United States during the 1930s—and many played prominent roles in the wartime radar and atomic bomb projects upon their arrival—veterans of "the physicists' war" strove to put forward a thoroughly American face during the postwar years. Senior physicists took special care in the mid-1950s, for example, when selecting which of their members would appear in the film strips accompanying the new Physical Science Study Committee (PSSC) high-school curriculum. These films would convey an important lesson, as the main PSSC organizer and MIT physicist Jerrold R. Zacharias put it: the film strips were

"to show that a physicist was *not* a Hungarian with a briefcase talking broken English but the Ed Purcells [a Nobel-prize-winning Harvard physicist] of this world and the J. R. Zacharias's, somebody who spoke English with no accent, who was one of the boys."[34]

American accents or not, the real cost of the postwar population expansion, according to graduate students and department chairs alike, turned on personal relations. Many physicists, both young and old, reported that the postwar overcrowding produced a chilling effect on social ties. Harvard graduate students throughout the university filled out anonymous questionnaires at registration in the fall of 1948, answering questions about life in their respective departments. Harvard's young physicists complained almost uniformly about overcrowding and its effects. "The attitude in the department," wrote one student, "is one of complete iciness. I have not in a year been smiled at or recognized by a member of the physics department." Another noted that "Due to post-war conditions mainly—crowded classes—[there is] tremendous competition with a bit of ruthlessness on the part of both students & faculty." Only 2 percent of those surveyed reported that they felt "general solidarity among all students in the department"—the lowest response for any department in the university. Even larger problems, as far as these graduate students were concerned, loomed in student-faculty relations. "The classes are so large that there is little or no individual contact between student and teacher," came one typical response. Most students worried that few if any faculty members knew them well enough to write fair and informed letters of recommendation. "Decrease cold formality," pleaded one student; "Professors too distant socially," complained another. One student asked simply for "more friendliness in general."[35] Feelings of facelessness amid large crowds were hardly unique to Harvard's physics department. Throughout the 1950s, Princeton's physics department chair worried that the vastly increased enrollments had squelched the previous "intimacy" between graduate students and faculty, leaving only "decreasing familiarity" on both sides. Cornell's department chair similarly feared that the sudden jump in graduate-student enrollments would threaten the "individualistic" training for which Cornell's department had been known before the war.[36]

As crowding and waning intimacy affected daily life in small- and medium-sized departments, "decreasing familiarity" became the single most dominant feature within the behemoth of Berkeley's department. The changes at Berkeley are captured nicely by department chair Birge's annual "addresses of welcome" to the department, delivered at the start of each academic year. Birge served as department chair from 1933 until his retirement in 1955. His

early addresses, delivered in the midst of worsening economic conditions, always assured the graduate students that "every member of the department is interested in your education and in your struggle to become a real scientist."[37] The annual meetings, Birge announced year in and year out during the 1930s, were meant to allow all members of the department—graduate students, postdocs, visiting scholars, and faculty—to "get acquainted": "I hope before you leave," he intoned during his welcome in 1934, "each one of you will try to meet anyone here whom he has not met before." "It is quite unnecessary to wait for an introduction," he admonished in 1938. "Just get acquainted."[38] In 1946, however, upon welcoming his department mates back from their wartime service, Birge looked around the overflowing room and announced that there were "too many" just to get acquainted. His notes for the next year read simply, "*Size of Dept* (apologize for lack of personal contact!)." Further breaking custom, Birge no longer introduced the new teaching assistants one by one or read off the names of the previous year's Ph.D. recipients, noting simply "too many!" and giving statistics about relative increases instead.[39] Under Birge's chairmanship, Berkeley's department had weathered financial depression, a world war, and even political scandal. Yet the single most salient feature of his "addresses of welcome," written and filed dutifully over those twenty-two years, was the sudden disappearance, immediately after the war, of an older communal feeling. To Birge there had become, by 1951, a "deplorable lack of personal contact" within the department.[40]

"Friendliness," "intimacy," "personal contact"—physicists mourned the loss of these qualitative features from everyday life in the wake of the quantitative increases in enrollment. Such complaints highlight more general changes throughout postwar American university life, which became ever more common over the course of the 1950s.[41] Yet the physicists' complaints after the war show more than just an affinity with other (and slightly later) university-wide concerns. The physicists' expressions of loss provide ready comparison with broader critiques at the time about the quality of life within the booming postwar suburbs. Whether taken from David Riesman's diagnosis of the new "other-directed" way of life, which left one inwardly dislocated and unmoored, or from William Whyte's accusation that suburbanization robbed people of an older, tight-knit experience of community, a central feature of the social critics' position was that, as Herbert Gans summarized, "Suburbanites were incapable of real friendships; they were bored and lonely, alienated, atomized, and depersonalized."[42] Berkeley's Raymond Birge concurred, writing wistfully of the changes as "the sad result of relentless pressure of numbers."[43] This is the language of loss, a romantic yearning for an irretrievable past, articulated as clearly by Birge as it had been by Riesman and Whyte.

The Bureaucratic Ethos

Coupled with the social critics' concern for suburbanites' inner lives came the resounding lament that formal procedures governed everyday life now that facelessness held sway. Critics such as C. Wright Mills and William Whyte saw two evils lurking within the bureaucratic turn. First, it sapped individual creativity from the workplace, elevating mediocre teamwork over individual expression or accomplishment. Second, it removed spontaneity from suburban social life, reducing social interactions to routine rituals engineered to enforce conformity.[44] Driven by what Birge called the "relentless pressure of numbers," many physicists likewise saw bureaucratization seeping into the core of their work and discipline. The director of the American Institute of Physics (AIP) declared in 1952 that bureaucracy had become an "inevitable" feature of the discipline, just as it had for "any occupation" in "today's world."[45] Nor were such changes usually welcomed: the physics department chair of the University of Illinois complained in February 1950 that "three secretaries blossom where one did before," a complaint echoed a few years later by a Berkeley physicist, who griped to his department chair that now one had "to hire a girl to fill out forms" for every last thing. Cornell's department chair likewise reported the difficulties of retaining "competent girls" to handle the new bureaucratic load: by 1960, the department was processing eight hundred purchase orders and twelve hundred department invoices per year, drawing on more than fifty separate departmental accounts.[46] In 1954, nearly one in seven professional physicists listed "management and administration" as his or her primary job description, up 60 percent from 1951. Up-and-coming recruits learned the lesson quickly. On a survey of college graduates from the class of 1961, those who planned on graduate study in physics anticipated that administrative work would occupy a larger portion of their careers than those heading into any other field in the sciences or humanities.[47] That same year, the physicist Alvin Weinberg, director of the Oak Ridge National Laboratory, warned that "administratitis" had become a major threat to American science. Too many scientist-administrators, "with bellies to the mahogany desks," had moved in on the scientific enterprise.[48]

The new factory-sized machines of big science provided one obvious setting in which the bureaucratic ethos began to pervade. Arthur Roberts, the self-appointed poet laureate of postwar American physics, pleaded "Take Away Your Billion Dollars" in a song whose lyrics ran in one of the earliest issues of *Physics Today* in November 1948. Roberts's ballad told of the new era of military money and big machines, while longing for the simpler prewar days,

before "epidemic Berkel[ey]itis" and boosted budgets had brought their associated bureaucratization. Physicists delighted in quoting from the song at American Physical Society (APS) meetings over the course of the next year, often slipping in a line or two without needing to give any reference.[49]

More than laboratory protocols were at stake—the moral character of young physicists appeared to hang in the balance. As early as 1946, a senior physicist from Dartmouth College, noting the strong "emphasis on teamwork in contrast with the efforts of the individual" in the new laboratories, asked his fellow physicists: "What kind of people are you going to put into the large laboratories? What ideals are you going to place before them?" Would the new generation become mere "clock punchers," or would they learn that quality work could come only from "the scientific analogues of blood, sweat, and tears"? The next year, Harvard's Percy Bridgman, by then a Nobel laureate and former president of the APS, complained that the bureaucratic form of life, born of necessity during the war, had corrupted the profession's youth. Young physicists, Bridgman declared, had become merely anonymous teamworkers with no "individual initiative," who lacked any experience of "independent work," and hence "regard[ed] cooperative work in large teams as the normal thing"—fears that Raymond Birge repeated almost a decade later, quoting Bridgman extensively in his own presidential address to the APS in 1956.[50] Though we might contest the accuracy of these assessments, it would be foolish to conclude that such charges carried little weight in their day, issuing as they did from influential and outspoken elders of the profession.

Just as Whyte's *Organization Man* was hitting the nation's bookshelves and coffee tables, however, other senior physicists reached the opposite conclusion about teamwork and the appropriate values for young physicists. Samuel Goudsmit, then editor of the *Physical Review* and director of research at Brookhaven National Laboratory, circulated a memorandum within Brookhaven in May 1956. His memo practically defined the "organization man," holding him up as the only appropriate example for young physicists to follow, given the new scale of daily operations. "The old time research worker, who was an extreme individualist, cannot thrive in our atmosphere since he is almost doomed to anonymity," Goudsmit explained. The "operation and management of the machine itself" therefore demanded that "[j]ealousies be suppressed, ambitions should be focused on accomplishments of the Laboratory and not of the individual":

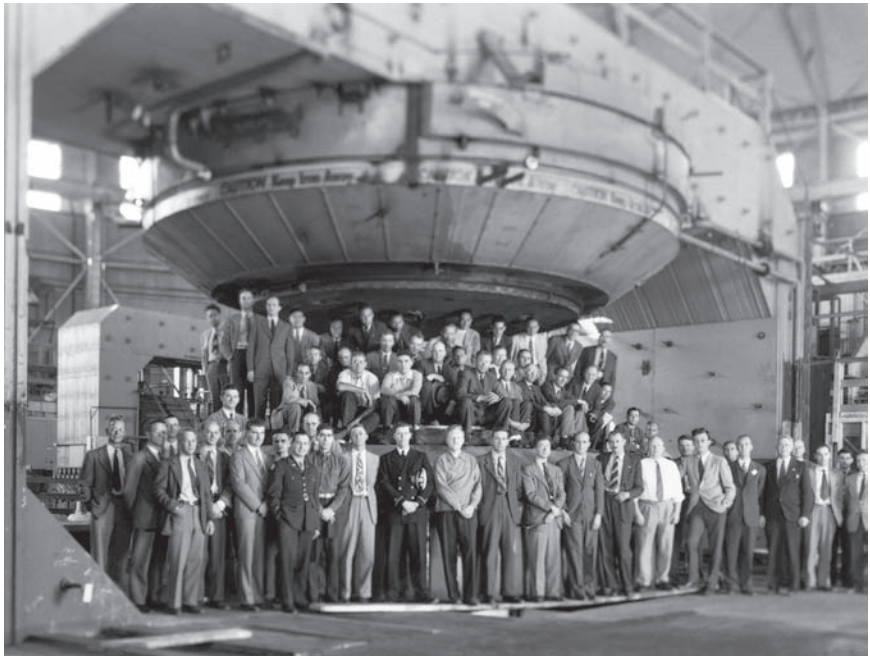
> [I]n this new type of work experimental skill must be supplemented by personality traits which enhance and encourage the much needed cooperative loyalty. Since it is a great privi-

> lege to work with the Cosmotron [Brookhaven's new particle accelerator], I feel that we now must deny its use to anyone whose emotional build-up might be detrimental to the cooperative spirit, no matter how good a physicist he is. . . . I shall reserve the right to refuse experimental work in high energy to any member of my staff whom I deem unfit for group collaboration.[51]

To Goudsmit, if not to Bridgman and Birge, only those young physicists who had internalized the ethic of teamwork and "cooperative loyalty" could fit within the new citadels of big science; being a "good physicist" was no longer enough.[52] (See fig. 2.)

If debate over the need for teamwork-minded workers versus brilliant individualists surfaced most obviously within the large-scale experimental work of big science, however, the issue was hardly restricted to bubble chambers, particle accelerators, and nuclear reactors. The task of training physics students throughout the country reflected the need to maintain high outputs of certified workers, if not individual thinkers with a heightened sense of initiative. At least some graduate students internalized the new ethos: young physicists were more likely than students in any other discipline to have their dissertation research topics selected for them by their advisor than to choose topics on their own—in fact, only 2 percent of the recipients of the physics doctorate in the late 1950s were said to have chosen their own topics.[53] In her interviews with graduate students in physics and chemistry during the late 1950s, sociologist Louise Merz asked them point-blank whether they would prefer to work on a research problem that was easy to solve but not scientifically novel or a problem that was more difficult but promised to make a genuine contribution to the field—and the great majority of her respondents chose the former option over the latter. Looking ahead, these same students told her that "young university professors do well to choose solvable problems even if they are not the most fascinating"—an observation echoed in physicists' interviews with several sociologists throughout the 1950s and 1960s.[54]

Beyond the selection of students' research topics, the exploded graduate-student enrollments forced changes in how American physics departments handled daily operations. Values and ways of life were at stake, and physicists wrangled with them in everything from the means of selecting faculty to the methods of admitting, advising, and examining graduate students. One last vestige of the older ways and means of running a physics department survived as late as February 1950—it provides the exception that proves the postwar rule. Francis Jenkins, a senior Berkeley physicist who would soon become a dean, made a "prospecting" trip back east for a few weeks. As he went, he kept notes on people who might make good additions to Berkeley's physics depart-



ment faculty. His notes reveal quite a bit about Jenkins's assumptions about how to assess such candidates and about how one should go about hiring junior faculty. After listing a potential candidate's name and marital status, Jenkins noted the places and years of the candidate's degrees. One line summed up previous employment, while an even briefer description summarized research interests and publication record, if any: "Interested in gas disch[ar]g[e]s, 2 abstracts at N.Y. Mtg.," for example. After these half-sentence descriptions, Jenkins expanded upon what he clearly saw as the most relevant information on each candidate. A typical entry read:

> Medium height, light build, wears horn-rimmed glasses, high forehead, slightly bald. Gave his paper loudly and clearly. Speaks with *slight* N.Y. accent. Friendly and intelligent in conversation. Teeth badly aligned, but not seriously. Gen. impression: *Fair to good*.

Figure 2.
E. O. Lawrence and his staff pose with the newly-renovated 184-inch sychrocyclotron at the Berkeley Radiation Laboratory, 1946. Reproduced with kind permission of the Lawrence Berkeley National Laboratory.

A recent Harvard graduate struck Jenkins as "Medium height, dark, rather handsome Jewish type. Seems to have good voice and confidence," while another prospect was "Tall, dark-haired, prominent nose, and reasonably good looking. Seems a very nice fellow." It did not pay to seem too pushy, however: a recent Chicago Ph.D. with "Jewish features" was "perhaps slightly forward in manner." And so on. Details of their research were secondary—the main question was whether or not the new recruits would fit in.[55] Very quickly, however, Jenkins's evaluation-by-physiognomy gave way to more formalized means of selecting faculty. Within three years, Jenkins's freewheeling note-taking had been transformed into the formalized procedures of policy-making special committees. The bureaucratic turn in admissions and hiring no doubt helped to quell some of the extreme abuses of "old-boy network" favoritism; as a tangible reminder of the shift, mimeographed memoranda replaced pencil-and-paper shorthand.[56]

The bureaucratic turn shaped how Berkeley's physics faculty interacted with its graduate students as well. During the 1930s, Birge had met personally with every graduate student in the department, checking over each student's schedule of courses every semester. Similarly, Berkeley's physics faculty before the war used to review every student's progress and make individual recommendations concerning appropriate fellowships and teaching assignments.[57] After the war, however, with upward of 250 graduate students at a time, the department could no longer coordinate all of the graduate students' trajectories based only on word-of-mouth and informal precedent. Instead, the department

quickly turned to committees and formal procedures. As early as 1951, Birge had to circulate a memo to all departmental faculty explaining how to sign students' study cards; three years later, there followed formal instructions for how to write standardized letters of recommendation. By the early 1960s, still dogged by "problems of assuring uniformity in advising quality," the department chair considered issuing formal handbooks on graduate-student policies.[58] Standardized testing became the norm for physics graduate admissions, and the two-stage doctoral examination fell subject to scrutiny and revision nearly every year during the 1950s. Similar concerns were felt keenly in other departments as well.[59]

If managing graduate student and faculty provisions at Berkeley and elsewhere had become a major undertaking, however, it was nothing compared with the Berkeley physics department's annual picnics. Like the department chair's annual "addresses of welcome," the picnics had begun well before World War II, when the department was still relatively small. In 1951, the annual event drew more than three hundred people (faculty, students, and their families). A few years later, the specially deputized "Master of the Picnic" circulated a memorandum to the other professors, looking to drum up student volunteers to help set up and run the event. With military-styled precision, the Master outlined the "four job classifications," together with the number of student hours needed to fulfill each job (loading and unloading food, cooking and serving the food, and so on). Faculty simply had to fill in the appropriate blanks on the standardized form and return it. The bureaucracy clearly worked: the 335 picnic-goers at the 1957 event consumed (as the Master dutifully reported) 115 pounds of roast beef, 2 gallons of barbecue sauce, 15 pounds of frankfurters, 10 dozen frankfurter buns, 15 gallons of lemonade punch, 12 gallons of coffee, 100 half-pints of milk, and on, and on.[60] During the 1950s, even the annual picnics had become logistically exhausting affairs. With the loss of "intimacy" had come the forced bureaucratization of social life itself.

Status Seekers

Young physicists after the war faced a rosy future. Even in the midst of booming enrollments, demand for physicists continued to outstrip supply well into the 1960s. Between 1950 and 1951, the federal government increased its demand for physicists by a factor of ten; there were likewise ten times more industrial jobs for physicists in 1952 than there had been in 1950. Dozens more employers looking to hire physicists registered each year with the American Institute of Physics's Placement Registry than did young physicists look-

ing for jobs; between 1960 and 1968, the federal government's demand for physicists rose on average 10 percent each year.[61] Efforts to recruit and protect physicists sometimes bordered on the absurd: in 1955 one New York City company began arranging for special medical examinations to be given to "difficult to replace" physicists who might miss work because of food allergies; although by the company's own estimate nearly 90 percent of the country's population suffered from food allergies, the proposed medical treatments would be doled out preferentially to physicists and other irreplaceable "scientific manpower" first.[62] More and more grade-school children, meanwhile, dreamed of becoming physicists. During the 1950s, Berkeley's department received so many inquiries from elementary, junior high, and high school students about opportunities in physics that the department had to print up a brochure to handle the mail load.[63] In a nationwide poll conducted in the early 1960s, Americans ranked "nuclear physicist" the third most prestigious occupation, behind only Supreme Court justice and physician.[64]

Amid the fanfare and hoopla, with such material and social rewards to be won, some physicists worried that graduate students' motivations for joining the profession were no longer what they once were, or should be. The value system no longer seemed to match the one articulated during the interwar period. A rather remarkable bit of doggerel, published in a Los Angeles–area newspaper just weeks after the bombings of Hiroshima and Nagasaki, captured the earlier stereotype of scientists' intense devotion to pure knowledge. The poem, titled "The Physics Professor," carried the following dedication: "Dedicated to Dr. Raymond T. Birge, chairman of the Department of Physics, University of California, whose scientific foresight made possible the researches of Lawrence and Oppenheimer into atomic structure." From thence to the ode to Birge:

> To one whose thoughts are pure as a star
> Unsullied by the dusts that are
> Of man's pragmatic passions,
> Who knows the purest forces of the universe,
> The mathematics of the squares inverse,
> In all its varied fashions,
> The Bessel functions and the oscillations
> Of molecular vibrations.
> A simple man, and one of modest mien
> With quiet speech—a patient Nazarene
> Within the halls of science,
> Teaching the world to know its inner strength
> And warning man to keep within the length

Of tested self-reliance.
He is a seer, a prophet and a sage—
A Zoroaster of this modern age.[65]

One wonders how many other department chairs in the history of American higher education have received such grand and public celebrations of their "unsullied purity" and "modest mien."

Such analyses—in prose form and verse—helped fuel a common image of scientific life as a "calling," an image that many American physicists invoked after World War II as part of their criticisms of postwar trends. Physicists who had come of age during the earlier period wondered what had happened to their beloved pursuit; several cast a suspicious eye after the war upon the hordes of graduate students who now clamored to become career physicists. Nary a book review could go by without inspiring some reflection on the value systems of postwar physicists. Berkeley's Raymond Birge complained in 1957, for example, that "young physicists . . . are growing up in these days of wide commercialism in science and intense competition."[66] Columbia University's outspoken Nobel Laureate, I. I. Rabi, hit on the same theme a few years later, when reporters from *Time* magazine interviewed him as one of the fifteen "Men of the Year" for 1960. Rabi told the reporters, in their paraphrase, that "all scientists ought to be 'oddballs.' Their lives, he says, leave no room for such bourgeois considerations as suburban homes or Madison Avenue clothes."[67]

The problem with the postwar graduate students, as some of these older physicists saw it, extended from social conformity to intellectual complacency; the former seemed to lead directly to the latter. In a mundane faculty meeting in 1958, Berkeley's Luis Alvarez interjected the complaint that the postwar graduate students were not intellectually curious—they seemed to be plodders, working contentedly as if physics were some 9-to-5 job.[68] A decade later John Slater, the former physics department chair at MIT, remarked in *Physics Today* as a self-proclaimed "old fogey" that the postwar physics graduate students had gotten spoiled by all of the money, and therefore had stopped being inventive; the postwar students seemed to Slater to wallow in "conformity and conservatism." Slater's own prewar generation, he contended, had been forced to be more creative, having to make do with less.[69] Philip Morse similarly commented in his autobiography that the MIT physics graduate students of the 1950s had become superficially courteous, intellectually as well as socially conformist, narrow-minded, and spoiled by the personal riches to be reaped upon entering physics as a career.[70] When each of these physicists had entered

physics in the 1920s and 1930s, they proclaimed with more than a tinge of self-righteousness after the war, they had entered it as an empassioned pursuit of pure knowledge, knowing full well that they could never become rich in the process.

Make no mistake: these older physicists' complaints should hardly be taken at face value. As department chairs, institution builders, and government consultants, each of these physicists worked hard to ensure that physicists would *not* have to return to the prewar patterns of research. The interest in their barbed jeremiads lies not in purported accuracy, but rather in the form with which they chose to express themselves. With charges of "wide commercialism," "suburban homes and Madison avenue clothes," "conformity and conservatism" and the like, it was as if these older physicists had taken a page from their favorite social critics and repeated it verbatim about their discipline.[71]

Nor was the suburban idiom restricted to older physicists' complaints. Many graduate students at the time spoke in similar terms—not to complain about the state of the discipline, but to express their own hopes and aspirations. Gone was all talk of a lifelong pursuit of knowledge with little care, or even disdain, for material rewards. Instead, Harvard's physics graduate students daydreamed about living the good life when filling out their questionnaires in 1948. Question 55 asked them, "If the best of your more realistic dreams came true, what kind of position do you think you might be holding 20 years after you have finished graduate study?" Certainly some responses read the way we might have expected, with students looking forward to academic or industrial careers. Yet most mentioned the *material* benefits to be gained from such professional security—hardly a point raised in any direct way by the form itself. "Salary—ca. $10,000 & some additional coin from consulting work" wrote one. Another anticipated "fat fees" from consulting with neighboring industries. "I would like enough money so that I could eat at a restaurant without pricing the entrees & have a nice home, car, & plenty of life insurance. Also enough time to live with my family," came one response. "I do not intend to burn the world up in my field—but rather seek to use my ability as a pleasant and satisfying means to my other desires," explained another. A classmate elaborated, "I would like a small house on a large plot of land—plenty of elbow room. I would like to spend my leisure with my wife and family (we hope to have two children). There is some fishing to be done."[72] Students mentioned salaries ranging from $8,000 to $20,000 per year, at a time when the national median income for professional physicists was $6,200, and the highest-paid physicists—senior researchers in private industry—averaged $12,000 per year.[73] So much for the material rewards anticipated from a

physics career. Out of all these responses, only six out of seventy-five mentioned the hope that some of their research would materially advance *physics*.

The Harvard students were not alone. Berkeley's physics graduate students replied to annual departmental surveys during the early and mid-1950s, routinely invoking their desire for a solid middle-class income with time for family and hobbies.[74] At Cornell, the physics department chair noted several years in a row—with obvious chagrin—that recent Ph.D.s from the department regularly received starting salaries at industrial laboratories that far outstripped their advisors' pay scales.[75] The lesson was not lost on the department's graduate students. Sociologist Louise Merz reported that more than half of the Cornell graduate students in physics and chemistry with whom she spoke during the late 1950s viewed their graduate training, and science itself, "not as ends in themselves but as means to other ends. . . . Such a value complex includes a desire for a stable, secure future, for social prestige, and for money." One physics graduate student summed up this orientation most explicitly, proclaiming to Merz:

> I don't know about all of this romanticizing of physics. As far as I'm concerned, physics is no different from any other occupation. It is work. Like every other kind of work, it's a job. I'm interested in it because it so happens you can get very good jobs in physics that pay a lot of money, as long as you have a Ph.D. So that's why I decided to come to graduate school.[76]

On a nationwide survey of college graduates in the class of 1961, those who planned careers in physics listed "making a lot of money" as a prime career objective more often than did those headed into any other academic field.[77]

Lurking behind these questionnaires loomed the new demographics of the American physics profession. Not only were thousands more graduate students in the pipeline than ever before, but the new recruits were older on average than during the interwar period (thanks largely to wartime service), and more of them were married than ever before—in fact, by the late 1950s three-quarters of the nation's physics graduate students were married. Of this married majority, two-thirds had at least one child, and fully 40 percent had two children or more.[78] Where these family-oriented students planned to work had also shifted from the prewar pattern, with more and more of them aiming for jobs in industry. Before the war, approximately one in three American physicists had worked in industrial laboratories. That proportion had held steady until as late as 1951. By 1954, however, the number of physicists working in industry caught up with the group employed by universities, each weighing in at just over 40 percent of the profession. Three years later, the industrial physicists had pulled ahead: nearly half now worked in industry, and only

one-third worked in educational institutions. In 1957, more than 85 percent of the nation's undergraduate physics majors listed industrial jobs as their top choice; tellingly, the minimum salaries they expected were fully 30 percent higher than those reported by their university-bound peers.[79]

Hundreds of advertisements in *Physics Today* and the *New York Times* gave further voice to these students' positive assessments of using a career in physics to pursue the comforts of a "normal," well-rounded, middle-class life.[80] The Hughes Research and Development Laboratories, for example, ran a series of full-page ads in *Physics Today* during the mid-1950s titled "Sidelights on the Scientists." Each featured a large, whimsical cartoon depicting different aspects of the lives of Hughes's staff scientists: they raised families even as they secured patents; they were well-rounded extracurricularly and athletically (a rather dubious claim)—*and*, as a boldface headline announced, they could easily "make $10,000 and up."[81] Waltham, Massachusetts–based Raytheon placed a similar series of advertisements in *Physics Today*, each with photographs of men "enjoy[ing] New England living as a Raytheon physicist" (fig. 3). One showed a family man pushing two children on a sled, while another caught a skier midflight; a third ad in the series featured a smiling man painting a landscape, while the fourth showed a Raytheon employee netting a fish. The fine print emphasized what the large photographs already portrayed: "Scientists and engineers at Raytheon lead lives they like." "At Raytheon," the advertisement continued, "you enjoy good living—an attractive home close to your work and the great outdoors."[82]

Many other firms prominently highlighted their laboratories' suburban locations when advertising jobs for physicists. A subsidiary of Westinghouse, for example, noted that "we are in a truly suburban atmosphere," where "housing is reasonable and plentiful. . . . Here you and your family can grow in an environment to match your professional growth." Often descriptions of the firm's pleasant location preceded any discussion of the type of work or the nature of the facilities. One firm emphasized the "bonus in better living for the whole family—Minutes from desk to restful suburbs . . . Famous New England coastal waters, lakes, mountains, ideal for year-round vacationing and play." Another enjoined young physicists to "enjoy life in the beautiful Connecticut countryside with its good schools, excellent housing, short commuting and convenient access to New York and Boston."[83] The Douglas Aircraft Company in Santa Monica, California, similarly encouraged readers of *Physics Today* to "Look Ten Years Ahead": "Will your income and location allow you to live in a home like this . . . spend your leisure time like this? They can . . . if you start your career now at Douglas!" Each ad featured a photo-

graph of an expansive suburban house, with the caption "A Douglas engineer lives here," paired with pictures of men fishing, golfing, sailing, horseback riding, or driving luxury automobiles.[84]

If the themes of material rewards and "normal" suburban living remained close to the surface in these ads, there was nothing tacit or subtle about a Westinghouse advertisement that ran in *Physics Today*. Westinghouse Electric placed a full-page ad, made to look like a newspaper report, in the November 1956 issue. A bold headline across the top read, "A Physicist and His Family Enjoy Life in Upstate New York." The wealth of detail in the faux story—a moral tale of honest, clean living lost and then regained—drew liberally upon well-known suburban ideals. The ad began with testimony from "Jim" the physicist, who explained, "Unless the wife and kids are happy, too, there's not much sense in sticking with a job . . . no matter how interesting the work is." He and his wife lacked "roots" at his previous job, and their children "were nervous and high-strung . . . with no good place to play." Happily, the Westinghouse Electronic Tube Division caught Jim's eye. A company representative gave Jim a tour of the lab *and* its surroundings in Elmira, New York: "I liked the looks of the clean little city, the attractive residential areas, and rolling wooded hills all around. About a mile from the plant, I spotted a super golf course!" There were also "wonderful fishing, boating, and swimming" in the nearby towns, from which "lots of Westinghouse folks . . . commute to work," Jim was promptly told. Next Marge, Jim's wife, took over the narration: "Well, like most physicists' wives, I'd be willing to live wherever Jim's work took him. But when Billy and Linda came along, it was different. I wanted them to grow up in a community where there were good schools, churches, and clean wholesome surroundings." Marge drew special attention to the "modern department stores, supermarkets, and everything" surrounding the Elmira facility. But most important was the restorative effect on the kids: "Both children have grown taller and huskier since we left the 'big city,' and they've lost their high-strung temperament." "This is real community living," Marge concluded, "and we are all growing 'roots' in the community thanks to Jim's decision to work at Westinghouse."[85] Join the "folks" at Westinghouse, put down "roots," and enjoy the "clean wholesome surroundings"—in short, get your Ph.D. in physics so you can become Ward (and June) Cleaver.

Figure 3.
Raytheon advertisement. Reproduced from *Physics Today* 9 (January 1956): 80.

One advertisement that ran in *Physics Today* a few months later further demonstrates how formulaic the suburbanization and mass-consumption themes had become within advertisements for physicists. Announcing that

the "Midwest Research Institute Isn't Exactly a Pleasure Resort," the ad began by asking, "Have you been reading the ads lately?"

> We mean the ads that people have been writing to entice scientific people like you into what they describe as "more rewarding" jobs. In many of these ads so much emphasis is placed upon the abundant recreational facilities at hand that we must confess we're having a little trouble in suppressing a disturbing mental picture . . . we see row upon row of muscular physicists poring over problems and formulae which serve to distract them only ever so slightly from Walter Mitty–like dreams of Christiana turns upon snow-capped peaks, tarpon lunging from deep blue water, or 300-yard drives down emerald fairways.

Yet even in the midst of its sly rebuff of the current advertising fashions, this ad nonetheless noted that its laboratory did indeed have "our own 'nearby recreational facilities' (of which there are quite a few)"—so tight was the perceived pairing between comfortable living and appropriate enticements for working physicists.[86] What appear to our eyes as well-worn clichés thus gave expression at the time to a host of widely shared cultural fears and aspirations: Jim the happy Westinghouse physicist had attained the same comforts and conformity that so many of the Harvard, Berkeley, and Cornell physics graduate students said they desired. These were the selfsame comforts and conformity that a few older physicists, such as Birge, Rabi, Alvarez, Slater, and Morse, worried were obscuring for the youth the purer reasons for building a scientific life rather than merely a physics career. Like any advertisements, the ads in *Physics Today* and the *New York Times* drew on themes and meanings that were already readily available, furthering and focusing some, to be sure, but hardly creating them ex nihilo.[87]

Gender Roles in the Suburbs

Intermixed with the celebration of suburban living, the Westinghouse advertisement highlighted a series of gender considerations that students and faculty alike faced during the decades after World War II. Marge had merrily acknowledged that like "most physicists' wives," she had been willing to put Jim's work in physics above all other concerns—at least until the children came along. Others worried about the relations between graduate students' family lives and their studies. In doing so, they articulated the same assumptions about gender roles as Wilson's and Keats's novels and Whyte's social commentary: women should remain "contained" in the home, supportive of their physicist-husbands without becoming "nags."[88]

One senior physicist reported in *Physics Today* in 1954 that the postwar boom in the funding for physics graduate education had been a good thing, allowing "graduate students . . . to have wives and children like normal people."[89] A few years later, a group of physicists engaged in a massive reform of high-school and undergraduate curricula sought to capitalize on the new "normalcy" to recruit more young students to consider careers in physics. "[L]ike other Americans," they explained in their new classroom materials, most physicists "marry, have children and belong to PTA's; some play golf and bridge and watch westerns on TV."[90] Others, however, saw less to celebrate in the new spate of "normalcy." Though Raymond Birge reported happily enough in 1938 on an outbreak of "marriagitis" among the Berkeley physics graduate students—eight physics students had gotten married during the summer of 1938 alone—he came to eye the postwar marriage rates of his graduate students with more suspicion, keeping careful statistics on the numbers of married fellowship and teaching-assistant applicants.[91] Francis Low, who pursued his graduate work at Columbia University, later recalled an exchange with his advisor, I. I. Rabi, which took place at the end of the summer of 1948. "What's new?" Rabi had asked. "I'm married," said Low. "Delusions of economic grandeur," came Rabi's quick reply. "What else is new?"[92]

A physicist who spoke with the psychologist Anne Roe during her interviews with scientists during the late 1940s and early 1950s put the matter even more explicitly. This physicist raised, as Roe reported, "a problem in graduate training which has developed in the last few years":

> This is the problem of the married student whose wife expects him home every evening at five or five-thirty. This is, after all, a reasonable expectation for most wives in our culture, as my subject admitted, but from his point of view it showed complete lack of understanding of the situation. (He also admitted that so far as he knew no one had explained the situation to the wives.) It is impossible, in his opinion, to turn out a properly trained and qualified Ph.D. in physics with only four years of graduate work if this is on a 40-hour week. It requires much more time and study than that. Formerly, he said, the students thought of practically nothing but their work and the lights were burning in the laboratories every night until late hours. Now the laboratories are dark at night.[93]

Graduate students at Harvard, MIT, and elsewhere organized "Physics Wives Clubs" in part "so that students' wives can grasp the significance" of their husbands' work, perhaps relieving some tensions at home (fig. 4).[94] Still, MIT's John Slater griped in *Physics Today* that "present students find it harder to settle down to work. Wives and babies take up a lot of time that my generation put into physics. The wives, it is true, help to type their husbands' theses,

Figure 4.
The first "Get Acquainted Tea" for wives of newcomers to the Lawrence Radiation Laboratory in Berkeley, 1961. The three women on the left are standing in their husbands' rank order at the lab. Reproduced with kind permission of the Lawrence Berkeley National Laboratory.

but in the older days the necessity of doing this ourselves made us learn typing." Secretarial assistance, Slater concluded, hardly compensated for domestic distractions.[95]

In a skit during the early 1960s, the junior faculty in Urbana-Champaign's physics department entertained the notion of extending graduate study to women, though this hardly signaled a progressive turn. Their 1963 skit suggested the need to "revise our requirements for admission": men should submit their credit rating, while "girls could submit photos in bathing suits, and give critical measurements." A series of advertisements could be placed in national magazines to improve the department's public relations, the skitsters mused: "for *Vogue*—I dreamed I found a K minus [subatomic particle] in my Maidenform bra!" while "for *Playboy*—some nice shots of the junior physics wives as playmate of the month." All the while they would plug their new song on the radio: "A smash record—folk song stuff—right to the guts!" titled "My Son the Physicist."[96]

At Harvard, the few women graduate students who did enter the fray—a number ranging from three to seven at any given time during the 1950s, when the total number of physics graduate students hovered around the one hundred mark—did not have an easy time of it. They were euphemistically registered through the "Radcliffe Graduate School," even though Radcliffe did not maintain a physics department of its own, nor did it offer any graduate courses in physics. Once these women were accepted and came to study at Harvard, their records were segregated into a "Radcliffe" pile—a division that the department's archival collections maintains to this day. This division could carry real bite: at least one woman who studied in the department during the late 1950s was late to a final examination because she had never been alerted as to where or when the exam would take place, her student record not having been filed with those of her classmates. Harvard's female physics graduate students likewise complained of discrimination when it came to teaching fellowships and research assistantships.[97]

Although a few calls did ring out to increase the number of women entering the profession—the cold war requirements for increased "manpower" in physics led some to suggest enrolling "womanpower"—most recommendations settled on encouraging the best women students to pursue part-time employment only. With part-time jobs, explained the author of the American Institute of Physics's 1962 pamphlet *Rewarding Careers for Women in Physics*, these few women might thereby "find a satisfactory combination of raising a family and working in physics at the same time." With physics cast more and more as a career rather than a calling after the war, young people of both sexes found it even more difficult to find a proper place for women in the field. As a result, the proportion of women receiving advanced degrees in physics fell by a factor of two between the prewar and postwar decades.[98]

Note the easy fit with larger discussions at the time about husbands' and wives' proper roles in the suburbs. Women could be cast as welcome dates to departmental picnics and "layman's" lectures, as long as they did not prove overly distracting or demanding.[99] They could be treated as sex objects sooner and more readily than as students or as professionals earning full-time employment. Women could both represent the new suburban ideals—drawing on centuries of associations between femininity and domesticity—as well as the dangers that effete suburbanization could pose to young male physicists. Some physicists feared that male graduate students, just like the "men in the grey flannel suits," were putting in mediocre efforts at the office and the laboratory because of domestic pressures and constraints. Meanwhile, most commentators agreed that women belonged in the home, raising families, rather than joining the ever-rising workforce of professional physicists.[100]

Suburban Physics: Beyond the Faustian Bargain

> A University is not outside, but inside the general social fabric of a given era. . . . [It is] an expression of the age.[101]

Dramatic structural changes in the daily operation of American physics departments after World War II provoked a range of reactions among faculty and graduate students. The largest change, and the one least easy to ignore, stemmed from the immediate overcrowding. In this, the physicists were slightly ahead of a curve that would quickly affect most other fields in American universities, as undergraduate and graduate enrollments grew exponentially across the board. Similarly, the new contract-administrative system, with its accompanying bureaucratization, spread rapidly through the physical to the biological and social sciences. Scholars in many fields besides physics became highly

valued elite consultants to government, the military, and industry—no doubt garnering the "fat fees" and "additional coin" that physics graduate students gleefully anticipated. Women, although better represented than in physics, still remained a small minority within the nation's graduate-student population, and the overall orientation of many fields, from biology to computer science, economics, political science, and psychology, remained tied to a masculinized cold war culture.[102] Physicists might have wrangled with these developments earlier than their colleagues, but not by much; their monopoly on "big science" was short-lived. Such structural changes, moreover, always underdetermine reactions and interpretations. Examining how the physicists responded to these changes and interpreted their new place and role can add to a more general understanding of intellectual life in the United States during the decades after World War II.

Related to academics' evolving self-image lay the question of research output in the changed university environment. Did graduate students daydream about suburban homes at one moment, only to return to doing "physics as usual" the next? Although a full consideration of this difficult question remains beyond the scope of this essay, some observations are in order. Physicists, historians, and sociologists have described the postwar generation of American physicists as more "pragmatic," "empiricist," and "utilitarian" than physicists in other times and places.[103] Gone was all talk of "philosophy" for these physicists—the famous puzzles and paradoxes that had so exercised the interwar generation of European physicists, including the architects of quantum mechanics, received nary a passing glance from the postwar Americans.[104] Some observers at the time were content to read these trends as little more than a general Tocquevillian "American spirit of pragmatism" in the air. More recently, several analysts have emphasized the cold war military patronage of American physics when looking to explain the hold that such "pragmatic" approaches had for so many American physicists.[105] Yet the ubiquity with which the militarism angle has been explored by historians and sociologists—usually cast as a one-dimensional Faustian bargain, with physicists trading intellectual autonomy for Defense Department largesse—obscures the wider transformations then under way in American culture and American physics.

Once we shift our vantage point from military dollars to the everyday exigencies of training students and pursuing research after the war, a broader series of changes in what it meant to be a physicist in the United States comes into focus. One concrete effect of the postwar demographic shift, filling American physics department classrooms to overflowing, was the sharpening of a prewar instrumentalism. The student overflows, and the concrete requirements

for teaching roomfuls of pupils rather than mentoring a handful of individual disciples, helped to solidify certain research traditions and approaches. Efficient, repeatable means of calculation could be taught and evaluated in ways that other styles of doing physics could not.[106] In the mid-1950s, a young Berkeley physicist learned especially clearly how the demographic shift solidified the discipline's pragmatic leanings. He was let go from Berkeley's department, not because he was unproductive in research or unconscientious in teaching, but rather because his overly abstract research area—Einsteinian unified field theories—was deemed unfit for spinning off sufficient numbers of appropriate assignments and dissertation topics for his many graduate students.[107] Only certain research topics could—or would—be tolerated under the new pedagogical conditions.

The topics that most American physicists did choose to pursue, and to teach to their students, rapidly narrowed after the war to two main poles: nuclear physics and solid-state physics.[108] These certainly included "basic" scientific endeavors, and American physicists often produced highly creative and original results, such as the successful quest to explain superconductivity—no mere mousetrap engineering or bottom-line chasing here. Yet this choice of topics was hardly a neutral one. Both nuclear physics and solid-state physics had newfound claims to "relevance" after the war: in weaponry, in civilian power generation, in electronics and communications technology, and so on. Both areas were pursued by growing numbers of researchers who moved easily between industry and the academy. As training exercises, these topics were especially pertinent for the new cadres who sought to make their careers in industry, as noted with evident pride by Cornell's department chair in the mid-1950s when reflecting on how well the department's revamped graduate curriculum fit the needs of the country and of the new students.[109] More generally, these research areas seemed to be appropriate material for a class of young researchers whose self-image tended more and more to the teamwork-oriented career physicist than to the isolated *Kulturträger*. The choice of topics, in other words, fit well with the evolving aspirations of the rising generation, as well as the expanded ranks of postwar employers. Only after the extreme contraction of employment possibilities for American physicists in the early 1970s—a product of détente, massive cuts in defense spending, and a similar decline in basic research within industrial laboratories—did a growing constituency again begin to dream of otherworldly branches of physics, such as black holes, the warping of space-time, and the shape and fate of the universe.[110] "Suburban" physics of the 1950s was often high quality and original—yet all the same, the horizon of "appropriate" topics for training and research bore the marks of time and place.

Notes

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The following abbreviations are used: *AIP-EMD*, American Institute of Physics, Employment and Manpower Division Records, in *NBL*; *AJP*, *American Journal of Physics*; *BDP*, University of California, Berkeley, Department of Physics Records, Bancroft Library, Berkeley, California; *CDP-AR*, Cornell University Department of Physics, Annual Reports, in departmental files; *HAB*, Hans A. Bethe correspondence and papers, Division of Rare and Manuscript Collections, Cornell University Library; *HDP*, Harvard University Department of Physics records, Pusey Library, Cambridge, Massachusetts; *NBL*, Niels Bohr Library, American Institute of Physics, College Park, Maryland; *NYT*, *New York Times*; *PDP-AR*, Princeton University Department of Physics, Annual Reports, Seeley G. Mudd Manuscript Library, Princeton, New Jersey; *PT*, *Physics Today*; *RTB*, Raymond T. Birge correspondence and papers, Bancroft Library, Berkeley, California.

1. C. Wright Mills, *White Collar: The American Middle Classes* (New York: Oxford University Press, 1951), 156.
2. Clark Kerr, *The Uses of the University*, 4th ed. (Cambridge: Harvard University Press, 1994 [1963]), 31–33, 71. Kerr's quotation about the "rat race" came from Merle Tuve, "Is Science Too Big for the Scientists?" *Saturday Review*, June 6, 1959, 49, as quoted in Kerr, *Uses*, 32.
3. Irving Howe, "This Age of Conformity," *Partisan Review* 20 (1954): 7–33, on 10, 17.
4. Mills, *White Collar*, esp. 129–36, and chap. 7.
5. Russell Jacoby, *The Last Intellectuals: American Culture in the Age of Academe*, 2d ed. (New York: Basic Books, 2000 [1987]), esp. chaps. 1, 6; quotation on 14.
6. See esp. Daniel Kevles, *The Physicists: The History of a Scientific Community in Modern America*, 3d ed. (Cambridge: Harvard University Press, 1995 [1978]), chaps. 21–23; Paul Forman, "Behind Quantum Electronics: National Security as Basis for Physical Research in the United States, 1940–1960," *Historical Studies in the Physical Sciences* 18 (1987): 149–229; Everett Mendelsohn, M. Roe Smith, and Peter Weingart, eds., *Science, Technology, and the Military* (Boston: Kluwer, 1988); Peter Galison and Bruce Hevly, eds., *Big Science: The Growth of Large-Scale Research* (Stanford: Stanford University Press, 1992); James Capshew and Karen Rader, "Big Science: Price to the Present," *Osiris* 7 (1992): 3–25; Stuart Leslie, *The Cold War and American Science* (New York: Columbia University Press, 1993); and Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press, 1997), chaps. 4, 5, and 9.
7. *Harper's* as quoted in Kevles, *The Physicists*, 375–76; Samuel Allison, "The State of Physics, or the Perils of Being Important," *Bulletin of the Atomic Scientists* 6 (January 1950): 2–4, 26–27, on 2–3.
8. Compare David Halberstam, *The Best and the Brightest* (Greenwich: Fawcett, 1972). On travel to the 1947 Shelter Island conference, see Silvan Schweber, *QED and the Men Who Made It: Dyson, Feynman, Schwinger, and Tomonaga* (Princeton: Princeton University Press, 1994), 172–74; on B-25 flights for civilian-physicist advisors, see Philip Morse, *In at the Beginnings: A Physicist's Life* (Cambridge: MIT Press, 1977), 247.
9. On deanships, see Bernard Berelson, *Graduate Education in the United States* (New York: McGraw-Hill, 1960), 123. See also Roger Geiger, *Research and Relevant Knowledge: American Research Universities since World War II* (New York: Oxford University Press, 1993); Rebecca Lowen, *Creating the Cold War University: The Transformation of Stanford* (Berkeley: University of California Press, 1997); Noam Chomsky et al., *The Cold War and the University* (New York: New Press, 1997); and Christopher Simpson, ed., *Universities and Empire: Money and Politics in the Social Sciences during the Cold War* (New York: New Press, 1998).
10. Alice Kimball Smith, *A Peril and a Hope: The Scientists' Movement in America, 1945–47* (Chicago: University of Chicago Press, 1965); Martin Sherwin, *A World Destroyed: Hiroshima and the Origins of the Arms Race*, rev. ed. (New York: Vintage, 1987 [1975]); Kevles, *The Physicists*; Paul Boyer, *By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age* (New York: Pantheon, 1985); Ellen Schrecker, *No Ivory Tower: McCarthyism and the Universities* (New York: Oxford University Press, 1986), esp. 126–60; Lawrence Badash, *Scientists and the Development of Nuclear Weapons* (Atlantic Highlands, N.J.: Humanities Press, 1995); Jessica Wang, *American Science in an Age of Anxi-*

ety: Scientists, Anticommunism, and the Cold War (Chapel Hill: University of North Carolina Press, 1999); and Silvan Schweber, *In the Shadow of the Bomb: Bethe, Oppenheimer, and the Moral Responsibility of the Scientist* (Princeton: Princeton University Press, 2000).

11. See also Lowen, *Cold War University*, 5–6; and Lizabeth Cohen, *A Consumers' Republic: The Politics of Mass Consumption in Postwar America* (New York: Knopf, 2003), 8.
12. Tuve, "Is Science Too Big," 49, as quoted in Kerr, *Uses of the University*, 32.
13. See also Paul Forman, "Social Niche and Self-Image of the American Physicist," in *The Restructuring of Physical Sciences in Europe and the United States, 1945–1960*, ed. Michelangelo de Maria, Mario Grilli, and Fabio Sebastiani (Singapore: World Scientific, 1989), 96–104; and Silvan Schweber, "Some Reflections on the History of Particle Physics in the 1950s," in *Pions to Quarks: Particle Physics in the 1950s*, ed. Laurie Brown, Max Dresden, and Lillian Hoddeson (New York: Cambridge University Press, 1989), 668–93.
14. David Kaiser, "Cold War Requisitions, Scientific Manpower, and the Production of American Physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33 (fall 2002): 131–59.
15. Edith Truslow and Kasha Thayer, *Manhattan District History: Nonscientific Aspects of Los Alamos Project Y, 1942 through 1946* (Los Alamos: Los Alamos Historical Society, 1997 [1946]); Bernice Brode, *Tales of Los Alamos: Life on the Mesa, 1943–1945* (Los Alamos: Los Alamos Historical Society, 1997); Craig Martin, *Quads, Shoeboxes, and Sunken Living Rooms: A History of Los Alamos Housing* (Los Alamos: Los Alamos Historical Society, 2000); and Peter Hales, *Atomic Spaces: Living on the Manhattan Project* (Urbana: University of Illinois Press, 1997).
16. Daniel Lang, *From Hiroshima to the Moon: Chronicles of Life in the Atomic Age* (New York: Simon and Schuster, 1959), esp. 23, 348. Photojournalist Bill Owens selected the town surrounding the Lawrence Livermore National Laboratory as the single best town to highlight for his photo-essay on suburbia: all 125 photographs were taken in Livermore. See Owens, *Suburbia* (San Francisco: Straight Arrow Books, 1973).
17. Rabi as quoted in Robert Crease, *Making Physics: A Biography of Brookhaven National Laboratory, 1946–72* (Chicago: University of Chicago Press, 1999), 58; see also chap. 2. On the new industrial laboratories, see Scott Knowles and Stuart Leslie, "'Industrial Versailles': Eero Saarinen's Corporate Campuses for GM, IBM, and AT&T," *Isis* 92 (2001): 1–33; see also Ann Markusen, "Cold War Workers, Cold War Communities," in *Rethinking Cold War Culture*, ed. Peter Kuznick and James Gilbert (Washington, D.C.: Smithsonian, 2001), 35–60; and Ann Markusen et al., *The Rise of the Gunbelt: The Military Remapping of Industrial America* (New York: Oxford University Press, 1991).
18. Paul Fussell makes a similar argument in his *The Great War and Modern Memory* (New York: Oxford University Press, 1975): soldiers' interpretations and reminiscences of their World War I experiences followed specific narrative and generic conventions, drawing (often unself-consciously and without direct attribution) on broadly circulating cultural artifacts such as songs, poems, and novels. My thanks to an anonymous reviewer for bringing the link with Fussell's work to my attention.
19. David Riesman with Reuel Denney and Nathan Glazer, *The Lonely Crowd: A Study of the Changing American Character* (New Haven: Yale University Press, 1950), esp. chap. 2 ("From Morality to Morale"); Mills, *White Collar*, and *The Sociological Imagination* (New York: Oxford University Press, 1959), chap. 5; Sloan Wilson, *The Man in the Grey Flannel Suit* (New York: Simon and Schuster, 1955); William Whyte, *The Organization Man* (New York: Doubleday, 1956); John Keats, *The Crack in the Picture Window* (Boston: Houghton Mifflin, 1956); John Kenneth Galbraith, *The Affluent Society* (Boston: Houghton Mifflin, 1958); Vance Packard, *Status Seekers* (New York: D. McKay, 1959). See also Lewis Mumford, *The City in History* (New York: Harcourt, Brace, 1961), 486–506; Kenneth Jackson, *Crabgrass Frontier: The Suburbanization of the United States* (New York: Oxford University Press, 1985); Daniel Horowitz, *Vance Packard and American Social Criticism* (Chapel Hill: University of North Carolina Press, 1994); J. John Palen, *The Suburbs* (New York: McGraw-Hill, 1995); Rosalyn Baxandall and Elizabeth Ewen, *Picture Windows: How the Suburbs Happened* (New York: Basic Books, 2000); and Cohen, *A Consumer's Republic*.
20. Riesman, *Lonely Crowd*, chaps. 6–7, 15–17; Whyte, *Organization Man*, chap. 6, 21–22; Wilson, *Grey Flannel Suit*; Keats, *Picture Window*; and Mills, *White Collar*, parts 2 and 3. Psychiatrists and social psychologists similarly argued that suburban living directly caused higher incidences of mental illness: John Seeley, R. Alexander Sim, and E. W. Loosley, *Crestwood Heights* (New York: Basic Books, 1956); R. E. Gordon, K. K. Gordon, and M. Gunther, *The Split-Level Trap* (New York: Dell, 1962).

21. Whyte, *Organization Man*, chaps. 4–5, 16, 25–26; Riesman, *Lonely Crowd*, chaps. 3, 7; and Mills, *White Collar*, chaps. 4–10.
22. Riesman, *Lonely Crowd*, chaps. 15–17; Mills, *White Collar*, chaps. 10–12; Whyte, *Organization Man*, chaps. 23–24; Galbraith, *Affluent Society*; Packard, *Status Seekers*, *passim*. See also an amusing "application" of Riesman's analysis by Gregory Stone, "Halloween and the Mass Child," *American Quarterly* 11 (Autumn 1959): 372–79.
23. Keats, *Picture Window*, esp. chap. 3; Wilson, *Grey Flannel Suit*. Also common was Philip Wylie's complaint of "momism": overbearing and overprotective suburban mothers were raising effete sons. Philip Wylie, *Generation of Vipers*, 20th ed. (New York: Pocket Books, 1959 [1942]), 184–206. Such charges were the inverse of the later charge that women in the suburbs were victims of "containment": bored, underappreciated, and stuck in dissatisfying life roles. See Betty Friedan, *The Feminine Mystique* (New York: Norton, 1963); Elaine Tyler May, *Homeward Bound: American Families in the Cold War Era* (New York: Basic Books, 1988); and Palen, *The Suburbs*, 163–66. This characterization has been challenged recently in Joanne Meyerowitz, ed., *Not June Cleaver: Women and Gender in Postwar America, 1945–1960* (Philadelphia: University of Pennsylvania Press, 1994); and Daniel Horowitz, *Betty Friedan and the Making of the Feminine Mystique: The American Left, the Cold War, and Modern Feminism* (Amherst: University of Massachusetts Press, 1998).
24. For recent, concise summaries of the "suburban myth" and its detractors, see Palen, *The Suburbs*, 68–100; Alan Brinkley, "The Illusion of Unity in Cold War Culture," in *Rethinking Cold War Culture*, ed. Kuznick and Gilbert, 61–73; and William Sharpe and Leonard Wallock, "Bold New City or Built Up 'Burb? Redefining Contemporary Suburbia," *American Quarterly* 46 (March 1994): 1–30.
25. William Whyte Jr., "The Transients," *Fortune* 47 (May 1953): 112–17, 221–26; *Fortune* 47 (June 1953): 126–31, 186–96; *Fortune* 48 (July 1953): 84–9, 160; *Fortune* 48 (Aug. 1953): 120–22, 186–90. These articles formed the basis for part 7 of Whyte's *Organization Man*. Data on publications about suburbs and suburbanization come from Louis Masotti and Deborah Dennis, "Suburbs, Suburbia, and Suburbanization: A Bibliography," *Council of Planning Librarians Exchange Bibliography* 524–25 (February 1974), 52–80. See also Joseph Zikmund III and Deborah Dennis, *Suburbia: A Guide to Information Sources* (Detroit: Gale Research Co., 1979); and Herbert Gans, *The Levittowners: Ways of Life and Politics in a New Suburban Community*, 2d ed. (New York: Columbia University Press, 1982 [1967]), xxxix–xli.
26. See esp. Bennett Berger, *Working-Class Suburb: A Study of Auto Workers in Suburbia* (Berkeley: University of California Press, 1960), chap. 1; Gans, *Levittowners*, xxvii–xxviii; and Scott Donaldson, *The Suburban Myth* (New York: Columbia University Press, 1969), chap. 1.
27. Cohen, *A Consumers' Republic*, 195–97.
28. Annual Report 1958–59, 3c-d, in *HDP*, "Correspondence, 1958–60," Box A-P; *PDP-AR*; *CDP-AR*; Raymond Birge to E. O. Lawrence, September 30, 1955, in *RTB*; Raymond Birge, *History of the Physics Department, University of California* (unpublished; copies in the Bancroft and Physics Department Libraries, University of California, Berkeley), 5 vols., esp. vol. 5. See also M. Lois Marckworth, *Dissertations in Physics: An Indexed Bibliography of All Doctoral Theses Accepted by American Universities, 1861–1959* (Stanford: Stanford University Press, 1961), x–xi.
29. Raymond Birge to E. W. Strong, August 30, 1950; see also Birge to Robert Sproul, April 15, 1950; Birge to B. H. Lehman, August 17, 1949; Birge to Sproul, May 10, 1950; and Birge to Sproul, April 15, 1952, all in *RTB*; Allen Shenstone, Annual Report, 1951–52, 1–3; similar remarks recur throughout the Princeton Annual Reports in 1953–54, 1955–56, 1956–57, and 1957–58, in *PDP-AR*; and Dale Corson, Annual Report for 1956–57, IV.1, in *CDP-AR*; see also L. G. Parratt, Annual Report for 1960–61, 8–10, in *CDP-AR*; and Hans Bethe, "30 Years of Physics at Cornell," ca. 1965, *HAB*, Folder 3:21. Compare Hans Rosenhaupt with Thomas Chinlund, *Graduate Students Experience at Columbia University, 1940–1956* (New York: Columbia University Press, 1958), 60.
30. For example, the article by Robert Oetjen and John Cooper, "The New Physics Building at the Ohio State University," *AJP* 21 (1953): 221–27, included citations to six similar reports published within that journal between 1942 and 1950 (221n1).
31. Birge to Dean A. R. Davis, April 20, 1951, in *RTB*; see also Birge to Sproul, April 15, 1950, in *RTB*; Allen Shenstone, Annual Reports for 1956–57 (p. 9), 1957–58 (p. 13), and 1959–60 (p. 14), in *PDP-AR*; *CDP-AR*; William Preston, Annual Report for 1959–60, in *HDP*, "Correspondence, 1958–60," Box A-P; and A. Carl Helmholz, budget information and request for 1957–58, in *BDP*, Folder 1:23.

32. "The Scientists," *Fortune* 38 (October 1948): 106–12, 166–76; James Davis, *Great Aspirations: The Graduate School Plans of America's College Seniors* (Chicago: Aldine, 1964), 164. See also Richard Meier, "The Origins of the Scientific Species," *Bulletin of the Atomic Scientists* 7 (June 1951): 169–73, on 169–70; Anne Roe, *The Making of a Scientist* (New York: Dodd, Mead, 1952), 67–69; R. H. Knapp and H. B. Goodrich, *Origins of American Scientists* (Chicago: University of Chicago Press, 1952); Donald Super and Paul Bachrach, *Scientific Careers and Vocational Development Theory* (New York: Columbia University Press, 1957), 3, 35–37; and Spencer Klaw, *The New Brahmins: Scientific Life in America* (New York: Morrow, 1968), 16–17.
33. Birge to William Roth, May 31, 1955, in *BDP*, Folder 5:143; Henry Barton, R. Bruce Lindsay, and Leonard Olsen, "Survey of Graduate Students in Physics," *PT* 15 (July 1962): 42–56, on 50. On the restriction of AEC facilities to U.S. citizens, see Birge to Walter Thirring, January 8, 1952, in *BDP*, Folder 5:117. See also Glenn Craig to Robert Sproul, May 25, 1955, and Helmholz to A. R. Davis, August 3, 1955, in *BDP*, Folder 2:30.
34. Jerrold Zacharias interview, as quoted in John Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002), 126–47, emphasis in original. On the 1930s emigration of European physicists to the United States, see esp. Charles Weiner, "A New Site for the Seminar: The Refugees and American Physics in the Thirties," in *The Intellectual Migration: Europe and America, 1930–1960*, ed. Donald Fleming and Bernard Bailyn (Cambridge: Harvard University Press, 1969), 190–234; and Robin Rider, "Alarm and Opportunity: Emigration of Mathematicians and Physicists to Britain and the United States, 1933–1945," *Historical Studies in the Physical Sciences* 15 (1984): 107–76. See also Cohen, *A Consumer's Republic*, chap. 5, on managing racial and class diversity in postwar suburbs.
35. "Opinions of Returning Graduate Students in Physics," eighty-six-page report, 1948, on 4, 6–13, 15, 52–55, 64, 83–86. Harvard University Archives, Pusey Library, Cambridge, Massachusetts (hereafter *HDP*-"Opinions").
36. Shenstone's Annual Report, 1955–56, 2; Annual Report, 1956–57, 2–3, in *PDP-AR*; Lloyd Smith's Annual Report, 1947–48, 6; Annual Report, 1948–49, 5; Annual Report, 1950–51, 6, in *CDP-AR*.
37. Typed manuscript, "Address of Welcome by Chairman. First Department Meeting, August 23, 1933, Room 222, LeConte Hall, by Raymond T. Birge," 6, in *BDP*, Folder 2:4.
38. Birge's notes for his annual addresses may be found in *BDP*, Folder 2:4. Emphasis in original.
39. Birge, addresses of welcome from October 2, 1946, October 1, 1947, and October 8, 1952, in *BDP*, Folder 2:4.
40. Raymond Birge to Douglas Higgins, December 3, 1951, in *RTB*. See also Birge, *History*, vol. 5.
41. See, e.g., Edgar Friedenberg and Julius Roth, *Self-Perception in the University: A Study of Successful and Unsuccessful Graduate Students* (Chicago: University of Chicago Press, 1954), chap. 3; Lowen, *Cold War University*, 3–4, 226–27; and Kerr, *Uses of the University*, 31. Lowen highlights Dana Farnsworth, *Mental Health in College and University* (Cambridge: Harvard University Press, 1957), as indicative of the late-1950s trend.
42. Gans, *Levittowners*, xxvii–xxviii. See also Riesman, *Lonely Crowd*, 19–26; Whyte, *Organization Man*, chap. 22.
43. Raymond Birge to Henry Crew, May 4, 1949, in *RTB*.
44. Mills, *White Collar*, esp. ix–xx and chap. 5; Mills, "The Bureaucratic Ethos," in *The Sociological Imagination*, 100–18; Whyte, *Organization Man*, chaps. 4–6, 21–22; see also Keats, *Picture Window*, chap. 3.
45. Henry Barton, "AIP 1952 annual report," *PT* 6 (May 1953): 4–9, on 4.
46. F. Wheeler Loomis, "Can Physics Serve Two Masters?" *Bulletin of the Atomic Scientists* 6 (April 1950): 115–20, on 119; Birge reported Charles Kittel's frustration in a May 13, 1955, letter to Frederick Seitz, in *RTB*; Dale Corson, Annual Report for 1956–57, VII.1, in *CDP-AR*; L. G. Parratt, Annual Report for 1960–61, 18, in *CDP-AR*. Whyte dedicated three chapters of his *Organization Man* to "the organization scientist" (chaps. 16–18). See especially "The Bureaucratization of the Scientist," 217–29.
47. Marsh White, "American Physicists in the Current Quarter Century," *PT* 9 (January 1956): 32–36, on 35; Davis, *Great Aspirations*, 224, 227. Davis's study was based on a survey of nearly 34,000 June 1961 college graduates.
48. Alvin Weinberg, "Impact of Large-Scale Science," *Science* 134 (1961): 161–64, on 161. See also Weinberg, *Reflections on Big Science* (Cambridge: MIT Press, 1967).

49. Arthur Roberts, "Take Away Your Billion Dollars," *PT* 1 (November 1948): 17–21. Both Lee DuBridge and Edward Condon quoted some of Roberts's lyrics in their talks at APS meetings, published as DuBridge, "The Effects of World War II on the Science of Physics," *AJP* 17 (1949): 273–81, on 279; and Condon, "The Development of American Physics," *AJP* 17 (1949): 404–8, on 404. See also Eugene Wigner with Andrew Szanton, *The Recollections of Eugene P. Wigner, as told to Andrew Szanton* (New York: Plenum, 1992), 255.
50. Gordon Hull, "Fifty Years of Physics: A Study in Contrasts," *Science* 104 (September 13, 1946): 238–44, on 243–44; Percy Bridgman, "Science and Freedom—Reflections of a Physicist (1947)," as quoted in Raymond Birge, "Physics and Physicists of the Past Fifty Years," *PT* 9 (May 1956): 20–28, on 24–25. See also Maila Walter, *Science and Cultural Crisis: An Intellectual Biography of Percy Williams Bridgman (1882–1961)* (Stanford: Stanford University Press, 1990), 270–72.
51. Samuel Goudsmit, unpublished Brookhaven memorandum (May 1956), as quoted in Crease, *Making Physics*, 227–28. On the immediate context within the laboratory to which Goudsmit was responding, see ibid., chap. 9. See also the profile of Goudsmit from 1953, reprinted in Lang, *Hiroshima*, 215–46.
52. See also Norman Hilberry, unpublished 1958 Argonne memorandum, as quoted in Robert Seidel, "A Home for Big Science: The Atomic Energy Commission's Laboratory System," *Historical Studies in the Physical Sciences* 16 (1986): 135–75, on 164–65; Lew Kowarski, "Team Work and Individual Research," *CERN Courier* 2 (May 1962): 7; and Kowarski, "New Forms of Organization in Physical Research after 1945," in *History of Twentieth Century Physics*, ed. C. Weiner (New York: Academic Press, 1977), 370–401.
53. Berelson, *Graduate Education*, 178; see also Warren Hagstrom, "Traditional and Modern Forms of Scientific Teamwork," *Administrative Science Quarterly* 9 (December 1964): 241–63, on 247.
54. Louise Merz, *The Graduate School as a Socializing Agency: A Pilot Study of Sociological Aspects of Graduate Training in the Physical Sciences* (Ph.D. dissertation, Cornell University, 1961), 126, 144. See also Hagstrom, "Scientific Teamwork," 246; Lawrence Kubie, "Some Unsolved Problems of the Scientific Career, II," *American Scientist* 42 (January 1954): 104–12, on 109; Meier, "Scientific Species," 173; and H. B. G. Casimir, "Anticipations: A Continental View of Physics and Its Future," *PT* 9 (April 1956): 13–16, on 16.
55. Handwritten notes by Francis A. Jenkins, undated, ca. January–February 1950, in "Prospective staff members" folders, within *BDP*, Folders 5:9, 5:14, 5:16, and 5:125; emphases in originals.
56. The special committee records, ca. 1953–54, may be found in *BDP*, Folders 5:2–3.
57. Typed lecture for Birge's 1938 annual address of welcome, 3, in *BDP*, Folder 2:4; Birge memo, "Graduate Fellowships in Physics, 1954–55, Covering Letter," n.d., ca. spring 1954, in *BDP*, Folder 2:25.
58. Memo from Birge to the department faculty, "Instructions to Graduate Student Advisers," September 19, 1951, in *BDP*, Folder 3:4; Memo to all department chairs from Lloyd D. Bernard, "Suggestions on Preparation of Letters of Reference," dated October 28, 1954, in *BDP*, Folder 7:6; B. J. Moyer, comments in agenda for physics department meeting dated December 7, 1962, in *BDP*, Folder 1:31.
59. Unsigned physics department faculty meeting minutes, dated April 16, 1958; A. Carl Helmholz, minutes from the physics department faculty meeting of May 7, 1958; Helmholz's agenda for physics department faculty meeting of November 5, 1958; Helmholz's minutes of physics department faculty meeting of December 16, 1959, all in *BDP*, Folder 2:2; David Kaiser, *Making Theory: Producing Physics and Physicists in Postwar America* (Ph.D. dissertation, Harvard University, 2000), 124–30; Morse, *Beginnings*, 126–27, 287; W. C. Kelly, "Survey of Education in Physics in Universities of the United States," unpublished report dated December 1, 1962, in *AIP-EMD*, Box 9.
60. J. H. Reynolds memorandum, May 11, 1954; Robert Karplus memorandum, April 22, 1957; Karplus to A. C. Helmholz, May 16, 1957; all in *BDP*, Folder 4:25.
61. Kaiser, "Cold War Requisitions," 142–43, 151; "Placement register, statistical comparison, APS-AAPT Annual Joint Meeting, 1963 to 1969" (n.d., ca. 1970), in *AIP-EMD*, Box 13, Folder "Placement literature."
62. "Extending Longevity in Scientists," as reported in "Scientific Manpower," *PT* 8 (June 1955), 23–24; see also Kaiser, "Cold War Requisitions," 147.
63. Several thick folders of these letters have been preserved in *BDP*, Folders 3:19–21.
64. Kevles, *The Physicists*, 391.
65. Joseph Kaplan, a UCLA physics professor, forwarded the newspaper clipping with this poem to Birge, saying only that the poem, by one Carlton Kendall, had appeared recently in "a local paper." Kaplan

to Birge, October 1, 1945, in *RTB*, Box 16, Folder "Kaplan, Joseph." See also Richard Hamer, "The Romantic and Idealistic Appeal of Physics," *Science* 61 (1925): 109–10, as quoted in Spencer Weart, "The Physics Business in America, 1919–1940: A Statistical Reconnaissance," in *The Sciences in the American Context: New Perspectives*, ed. Nathan Reingold (Washington, D.C.: Smithsonian, 1979), 295–358, on 303. Similar themes appeared in Sinclair Lewis's best-selling novel *Arrowsmith* (London: Cape, 1925).

66. Raymond Birge to Graham DuShane (editor of *Science*), May 22, 1957, in *RTB*. Birge's review was of John Rowland, *Ernest Rutherford, Atom Pioneer* (New York: Philosophical Library, 1957).
67. "Men of the Year," *Time*, January 2, 1961, 40–46, on 43.
68. Minutes from the December 10, 1958, physics department faculty meeting, dated December 16, 1958, in *BDP*, Folder 2:2; Helmholz's agenda for physics department faculty meeting, prepared on December 8, 1958, in *BDP*, Folder 2:2. Alvarez characterized his own life in physics as a series of "adventures," hardly the stuff of dull suburbanites: Luis Alvarez, *Alvarez: Adventures of a Physicist* (New York: Basic Books, 1987), esp. chaps. 2–3 on his interwar training.
69. John Slater, "The Graduate Student: Why Has He Changed?" *PT* 22 (March 1969): 35–37.
70. Morse, *Beginnings*, 267–69. See also Lang, *Hiroshima*, 215–46; and Roe, *Making of a Scientist*, 49.
71. During an earlier era, self-appointed academic critics such as William James, Thorstein Veblen, and G. Stanley Hall had castigated their students in what was then an equally potent cultural idiom, dismissing the younger generation for having the same values as the "captains of industry" and "robber barons": Robert Kohler, "The Ph.D. Machine: Building on the Collegiate Base," *Isis* 81 (1990): 638–62, on 655–57. See also Christopher Jencks and David Riesman, *The Academic Revolution* (Garden City: Doubleday, 1968), chap. 2 ("The War Between the Generations").
72. *HDP*-"Opinions," 66–71; emphasis in original.
73. Laure Sharp and Helen Wood, "Earnings of Physicists, 1951," *PT* 5 (November 1952): 4–7. College seniors in 1949, most of whom planned a business career rather than an academic one, actually anticipated lower salaries than those quoted by the Harvard physics graduate students. Whyte, *Organization Man*, 71.
74. See the department's lists of "Students Advanced to Candidacy" from 1951 to 1954 in *BDP*, Folders 7:8–12. Each of these lists included students' names, thesis topics, and advisors, as well as the students' responses for "Type of Position Wanted."
75. Lloyd Smith, Annual Report for 1950–51, 1, 8; Lloyd Smith, Annual Report for 1951–52, 11; Dale Corson, Annual Report for 1956–57, V.1; and L. G. Parratt, Annual Report for 1960–61, in *CDP-AR*.
76. Merz, *Graduate School*, 34–37. Merz interviewed thirty-three graduate students in chemistry and thirty-five graduate students in physics for her study. Although she referred to the location only as a "large eastern university," several clues point to Cornell as the school in question: she was enrolled in Cornell's Sociology Department at the time; she referred to the "Special Committees" (p. 106) that each student had to set up upon entering graduate school (an idiosyncratic feature of Cornell's graduate programs at the time; see *CDP-AR*); and one of her interviewees in experimental nuclear physics referred to "the big machine downstairs (the synchrotron)" (p. 120), most likely a reference to Cornell's Laboratory of Nuclear Studies facilities.
77. Davis, *Great Aspirations*, 177–78. Once enrolled in graduate school, physics students easily found this objective reinforced: stipends for graduate students in the physical sciences routinely exceeded those paid in other fields, sometimes by as much as a factor of two. National Science Foundation, *Graduate Student Enrollment and Support in American Universities and Colleges, 1954* (Washington, D.C.: Government Printing Office, 1957); Rosenhaupt, *Graduate Students*, 57–59; James Davis, *Stipends and Spouses: The Finances of American Arts and Sciences Graduate Students* (Chicago: University of Chicago Press, 1962). None of the social sciences graduate students interviewed at the University of Chicago in the early 1950s, on the other hand, endorsed making money as a principal reason for entering graduate school: Friedenberg and Roth, *Self-Perception in the University*, chap. 3.
78. L. R. Harmon, "Physics Ph.D.'s: Whence, Wither, When?" *PT* 15 (October 1962): 21–28, on 26–27; see also Barton, Lindsay, and Olsen, "Survey of Graduate Students in Physics," 43. On physicists' ages, see John Cooper, "American Physicists and Their Graduate Degrees," *AJP* 20 (1952): 484–47; R. T. Birge to Charles Townes, May 12, 1953, in *RTB*; and Berelson, *Graduate Education*, 134–35.
79. White, "American Physicists," 35; J. N. Gadel and G. A. Peters, "Employment Preferences of Physicists," *PT* 10 (October 1957): 14–16, on 15; Henry Barton, "Education and Employment of Physi-

cists," *PT* 13 (January 1960): 20–22, on 21; Sylvia Barisch, "Some Results of the 1962 Physics Roster," *PT* 17 (April 1964): 48–53, on 49. See also Merz, *Graduate School*, 172–73.

80. In fact, the number of advertisements for industrial scientists in the *New York Times* grew exponentially in the decade and a half after the war, doubling every 2.7 years to a peak in 1962. See figure 12.17 in Physics Survey Committee, *Physics in Perspective* (Washington, D.C.: National Academy of Sciences, 1972), vol. 1, 852.
81. The Hughes advertisements ran as follows: "Scientists and Their Children," *PT* 8 (November 1955): 5; "How Many Patents per Ph.D.?" *PT* 8 (December 1955), inside front cover; "Brain *and* Brawn," *PT* 9 (February 1956); "Education and Job Change," *PT* 9 (April 1956): 49; "How to Make $10,000 (and Up)," *PT* 9 (July 1956), inside front cover; and "Drums to Dramatics," *PT* 9 (September 1956): 33.
82. "Physicist Makes New Tracks," *PT* 10 (January 1957): 29; see also "Enjoy Wonderful New England Living as a Raytheon Physicist," *PT* 9 (January 1956): 80; "Physicist Creates a Fresh Perspective," *PT* 10 (March 1957): 57; and "Physicist Makes a Prize Catch," *PT* 10 (July 1957): 37.
83. The Melpar, Inc., advertisements ("truly suburban atmosphere") appeared in *PT* 9 (February 1956): 31; *PT* 9 (March 1956): 41; *PT* 9 (August 1956): 42; and *PT* 10 (January 1957): 57; Employer's Services of New England ("bonus in better living"), *NYT*, June 26, 1960, F21; Hamilton Standard division of United Aircraft Corporation ("beautiful Connecticut countryside"), *NYT*, September 25, 1960, F13. For a small sample of the hundreds of similar ads in the *New York Times* from this period, see: Radio Receptor Company, *NYT*, March 20, 1955, F18; Westinghouse, *NYT*, November 27, 1955, 204; Avco, *NYT*, August 26, 1956, F9; Radio Corporation of America, *NYT*, April 13, 1958, F11; Perkin-Elmer, *NYT*, January 24, 1960, F16; Bendix Aviation, *NYT*, March 23, 1959, 49; Geophysics Corporation of America, *NYT*, August 28, 1960, F19; Schlumberger Well Surveying Corp., *NYT*, October 9, 1960, F19; Tung-Sol Electronic, *NYT*, October 16, 1960, F16; Vitro Electronics Laboratories, *NYT*, March 22, 1961, 50; NASA, *NYT*, October 8, 1961, M20; and Scope, Inc., *NYT*, March 25, 1962, 170.
84. The Douglas Aircraft advertisement series appeared in *PT* 9 (April 56): 5; *PT* 9 (May 1956): 31; *PT* 9 (July 1956): 4; *PT* 9 (August 1956): 8; and *PT* 10 (April 1957): 9; ellipsis in original.
85. "A Physicist and His Family Enjoy Life in Upstate New York," *PT* 9 (November 1956): 14; ellipsis in original.
86. "Midwest Research Institute Isn't Exactly a Pleasure Resort," *PT* 10 (February 1957): 8; ellipsis in original. See also David Riesman, "The Suburban Sadness," in *The Suburban Community*, ed. William Dobriner (New York: Putnam, 1958), 375–408, on 381.
87. On this point, see esp. T. J. Jackson Lears, *Fables of Abundance: A Cultural History of Advertising in America* (New York: Basic Books, 1994).
88. Wilson, *Grey Flannel Suit*; Keats, *Picture Window*; Whyte, *Organization Man*, part 7; Riesman, "The Suburban Sadness." Compare May, *Homeward Bound*; and Cohen, *A Consumers' Republic*, chap. 3.
89. Merle Tuve, "Technology and National Research Policy," *PT* 7 (January 1954): 6–9, on 7. See also Nathan Nichols, "Stipend: $1000," *PT* 1 (July 1948): 16–17, 28; and Davis, *Stipends and Spouses*.
90. *PSSC Physics: Teacher's Resource Book and Guide* (Boston: D. C. Heath, 1960), sec. 1–3, as quoted in Rudolph, *Scientists in the Classroom*, 126–27.
91. Birge, "Department meeting, August 24, 1938," 6, in *BDP*, Folder 2:4; Birge, memos on "Fellowships 1952–53," and "Applicants for Teaching Assistantships, 1955–56," in *BDP*, Folder 2:3. Birge's successor, Carl Helmholz, kept similar marriage statistics: "Fellowships, 1956–1957" and "Fellowships, 1957–58," in *BDP*, Folders 2:27–28. Many others reported increased marriage rates among graduate students during the 1950s: Rosenhaupt, *Graduate Students*, 55; Hayward Keniston, *Graduate Study and Research in the Arts and Sciences at the University of Pennsylvania* (Philadelphia: University of Pennsylvania Press, 1959), 23–24, 45; Berelson, *Graduate Education*, 134–35.
92. Francis Low, "Autobiography, ca. 1965," unpublished typescript, on 7, in *NBL*.
93. Roe, *Making of a Scientist*, 48.
94. Quotation from *HDP*-"Opinions," 64. See also the form letters by David Adler, dated July 30, 1958, in *HDP*, "Correspondence: 1958–60," Box A-P, Folder "1959–60 Graduate Students Club"; and Morse, *Beginnings*, 68.
95. Slater, "The Graduate Student," 35. Slater's view shows ready contrast with the prevailing assumptions among American physicists during the 1970s and 1980s, when it was assumed that young (male) physicists *should* be married, since marriage was thought to provide much-needed stability. See Sharon

Traweek, *Beamtimes and Lifetimes: The World of High Energy Physicists* (Cambridge: Harvard University Press, 1988), 83–84.

96. "Faculty Skit 1963," in "Faculty Skits, 1963–73," Department of Physics, University of Illinois at Urbana-Champaign, deposited in *NBL*. Compare Traweek, *Beamtimes*, chap. 3.
97. Evelyn Fox Keller discussed the examination episode with me; see also Evelyn Fox Keller, "The Anomaly of a Woman in Physics," in *Working It Out*, ed. Sara Ruddick and Pamela Daniels (New York: Pantheon, 1977), 78–91; and Evelyn Fox Keller, *Secrets of Life, Secrets of Death: Essays on Language, Gender, and Science* (London: Routledge, 1992), 1–12. On complaints about fellowships and assistantships, see *HDP*-"Opinions," 16–17. Ten years later, the lists of graders, substitute teachers, and faculty aides for Harvard's physics department included only male students; these lists were appended to the 1958–59 Annual Report, in *HDP*, "Correspondence, 1958–60," Box A-P.
98. Quotation from Elizabeth Wood, *Rewarding Careers for Women in Physics*, rev. ed. (New York: American Institute of Physics, 1967 [1962]), 15, a copy of which is in *AIP-EMD*, box 9. On "womanpower," see Mary Therese, "Scientific Womanpower—Our Country's Need and What Women's Colleges Are Doing to Supply Physicists," *AJP* 21 (October 1953): 569–70; Walter Michels, "Women in Physics," *PT* 1 (December 1948): 16–19; and Margaret Rossiter, *Women Scientists in America: Before Affirmative Action, 1940–1972* (Baltimore: Johns Hopkins University Press, 1995), chap. 3. On the number of women receiving advanced degrees in physics, see the data in Douglas Adkins, *The Great American Degree Machine* (Berkeley: Carnegie Commission on Higher Education 1975), 278–81.
99. J. H. Reynolds, memo of May 11, 1954, in *BDP*, Folder 4:25; *HDP*-"Opinions," 64.
100. See Keller, "Anomaly"; Rossiter, *Women Scientists in America*; Margaret Murray, *Women Becoming Mathematicians: Creating a Professional Identity in Post–World War II America* (Cambridge: MIT Press, 2000); and Ruth Oldenziel, "Multiple-Entry Visas: Gender and Engineering in the U.S., 1870–1945," in *Crossing Boundaries, Building Bridges: Comparing the History of Women Engineers, 1870s–1990s*, ed. Annie Canel, Ruth Oldenziel, and Karin Zachmann (Amsterdam: Harwood, 2000), 11–49.
101. Abraham Flexner, *Universities: American, English, German* (New York: Oxford University Press, 1930), 3–4, as quoted in Kerr, *Uses of the University*, 3.
102. Geiger, *Research and Relevant Knowledge*, 43–44; Lowen, *Cold War University*, chaps. 6–7; Keller, *Secrets of Life*; Nicholas Rasmussen, "The Midcentury Biophysics Bubble: Hiroshima and the Biological Revolution in America, Revisited," *History of Science* 35 (1997): 245–93; Ellen Herman, *The Romance of American Psychology: Political Culture in the Age of Experts* (Berkeley: University of California Press, 1995), chaps. 5–6; Paul Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge: MIT Press, 1996); Chomsky et al., *Cold War and the Universities*; Simpson, ed., *Universities and Empire*; and Mark Solovey, "Project Camelot and the 1960s Epistemological Revolution: Rethinking the Politics–Patronage–Social Science Nexus," *Social Studies of Science* 31 (April 2001): 171–206.
103. Marcello Cini, "The History and Ideology of Dispersion Relations: The Pattern of Internal and External Factors in a Paradigm Shift," *Fundamenta Scientiae* 1 (1980): 157–72; Silvan Schweber, "The Empiricist Temper Regnant: Theoretical Physics in the United States, 1920–1950," *Historical Studies in the Physical Sciences* 17 (1986): 55–98; Forman, "Behind Quantum Electronics"; Andrew Pickering, "From Field Theory to Phenomenology: The History of Dispersion Relations," in Brown et al., eds., *Pions to Quarks*, 579–99; Schweber, "Some Reflections"; and Galison, *Image and Logic*, esp. chap. 4.
104. American physicists had underplayed the philosophical puzzles of quantum mechanics during the interwar period, and shunned them with particular force after the war: Schweber, "Empiricist Temper"; Nancy Cartwright, "Philosophical Problems of Quantum Theory: The Response of American Physicists," in *The Probabilistic Revolution*, ed. Lorenz Krüger et al. (Cambridge: MIT Press, 1987), vol. 2, 417–35; Alexi Assmus, "The Americanization of Molecular Physics," *Historical Studies in the Physical Sciences* 23 (1993): 1–34; Russell Olwell, "Physical Isolation and Marginalization in Physics: David Bohm's Cold War Exile," *Isis* 90 (1999): 738–56; Shawn Mullet, *Political Science: The Red Scare as the Hidden Variable in the Bohmian Interpretation of Quantum Theory* (B.A. thesis, University of Texas, Austin, 1999); and Olival Freire, "A Story without an Ending: The Quantum Physics Controversy, 1950–1970," *Science and Education* 12 (2003): 573–86.
105. André Guinier, "The Spirit of Research in the United States," *PT* 3 (May 1950): 22–29; Forman, "Behind Quantum Electronics"; Robert Seidel, "The Postwar Political Economy of High-Energy Physics," in *Pions to Quarks*, ed. Brown et al., 497–507; and Leslie, *The Cold War and American Science*.

106. See esp. Rudolph, *Scientists in the Classroom*; and David Kaiser, *Drawing Theories Apart: The Dispersion of Feynman Diagrams in Postwar Physics* (Chicago: University of Chicago Press, in press).
107. This case is described further in Kaiser, "Cold War Requisitions," 154–56.
108. So stark was the condensation of the field that in 1955 the editor of the *Physical Review* proposed splitting the journal into two separate installments, one each to cover nuclear physics and solid-state physics: Birge to Samuel Goudsmit, April 5, 1955, in *RTB*; see also Harmon, "Physics Ph.D.'s," 22; and Physics Survey Committee, *Physics in Perspective*, vol. 1, 87–94.
109. Lloyd Smith, Annual Report for 1950–51, 9; Smith, Annual Report for 1951–52, 12–15, in *CDP-AR*; see also Saul Dushman, "Postwar Training of Physicists for Industry," *AJP* 12 (August 1944): 219–24; and J. T. Littleton, "Educational Training for Physicists," *AJP* 15 (July–August 1947): 339–40.
110. On the job crunch, see Kaiser, "Cold War Requisitions," 149–53. On the neglect of general relativity and cosmology during this period, see Jean Eisenstaedt, "The Low Water Mark of General Relativity, 1925–55," in *Einstein and the History of General Relativity*, ed. Don Howard and John Stachel (Boston: Birkhäuser, 1989), 277–92; and David Kaiser, "A *Psi* Is Just a *Psi*? Pedagogy, Practice, and the Reconstitution of General Relativity, 1942–1975," *Studies in History and Philosophy of Modern Physics* 29 (1998): 320–38.