

A New National Defense:
Feminism, Education, and the Quest for “Scientific Brainpower,” 1940-1965

Laura Micheletti Puaca

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in
partial fulfillment of the requirements for the degree of Doctor of Philosophy in the
Department of History.

Chapel Hill
2007

Approved by:

Jacquelyn Dowd Hall

James Leloudis

Peter Filene

Jerma Jackson

Catherine Marshall

©2007
Laura Micheletti Puaca
ALL RIGHTS RESERVED

To my parents, Richard and Ann Micheletti,
for their unconditional love and encouragement.

ACKNOWLEDGEMENTS

While working on this dissertation, I enjoyed the support and assistance of numerous individuals and organizations. First, I would like to acknowledge those institutions that generously funded my work. A Mowry Research Award from the University of North Carolina's Department of History and an Off-Campus Research Fellowship from the University of North Carolina's Graduate School supported this project's early stages. A Schlesinger Library Dissertation Grant from the Radcliffe Institute for Advanced Study at Harvard University, as well as a Woodrow Wilson Dissertation Fellowship in Women's Studies, allowed me to carry out the final phases of research. Likewise, I benefited enormously from a Spencer Foundation Dissertation Fellowship for Research Related to Education, which made possible an uninterrupted year of writing.

I am also grateful to the archivists and librarians who assisted me as I made my way through countless documents. The staff at the American Association of University Women Archives, the Columbia University Archives, the Columbia University Rare Book and Manuscript Library, the Massachusetts Institute of Technology Archives, the National Federation of Business and Professional Women's Clubs Archives, the National Archives at College Park, and the Rare and Manuscript Collection at Cornell University provided invaluable guidance. In particular, I would like to thank Donald Glassman at the Barnard College Archives, Sarah Hutcheon and Jane Knowles at the Radcliffe Institute's Schlesinger

Library, Tom Frusciano at Rutgers University's Special Collections and University Archives, Deborah Rice at Wayne State University's Walter P. Reuther Library, and Tanya Zanish-Belcher at Iowa State University's Women in Science and Engineering Archives. Friends and family members who opened their homes to me include Fran and George Anderson, Sandra VanBurkleo, Jan and Neal Butler, Katya Varlamova, and Melissa Skwira Morencey. Their hospitality and generosity thoroughly enriched my research travels.

My Spencer Dissertation cohort—especially Rene Luis Alvarez, Anna Bailey, David L. Davis, and Anne-Lise Halvorsen—pushed me toward new approaches and ideas, while providing much encouragement and wonderful company. In Chapel Hill, writing group members Katie Otis, Nancy Schoonmaker, and Tomoko Yagyu offered many thoughtful comments and constructive critiques, all while working on their own dissertations. Pam Lach read numerous copies of chapter drafts and has been a continual source of support since our days at Douglass College. Hilary Marcus also read each chapter and helped enormously, especially in the final stages of writing, to help me rethink and refine some of my core ideas and assumptions. Kurt Piehler, Linda Eisenmann, and Chris Ogren, who commented on early chapter segments as they appeared in conference paper form, provided wonderful feedback. Sylvia Hoffert and Michael H. Hunt also helped to direct the early phases of this project and I am thankful for their insights.

Members of my committee—Jim Leloudis, Peter Filene, Jerma Jackson, and Catherine Marshall—have contributed significantly to this project over the years, both in informal conversations and through directed comments on drafts. I am grateful to them for sharing their expertise and for their guidance. My greatest intellectual debt is to Jacquelyn

Hall. Her close reading of every page, as well as her broader theoretical and conceptual suggestions, have enriched this project immensely. She challenged me at every step and taught me much about the craft of historical writing. Moreover, she has been a constant source of support, guidance, and encouragement, and always believed in me even when my own confidence faltered.

Finally, I want to thank my closest friends and family for their unending support. My husband, Brian Puaca, not only encouraged me at every turn, but also read countless drafts. Likewise, Audrey Statelman, Janel Modoski, Deborah Puaca, Michael and Sally Puaca, and David and Elizabeth Micheletti, and Richard and Ann Micheletti, have continually bolstered me throughout this long process. Without their love, humor, and patience, the completion of this project would not have been possible.

ABSTRACT

LAURA MICHELETTI PUACA: A New National Defense: Feminism, Education, and the
Quest for “Scientific Brainpower,” 1940-1965
(Under the direction of Jacquelyn Dowd Hall)

Focusing on the Second World War and early Cold War Era, this study uncovers how female activists promoted women’s scientific participation as a shared solution to national security concerns. By appropriating the language and the cause of national defense, they presented powerful, sophisticated, and surprisingly familiar critiques of the pervasive cultural attitudes and discriminatory practices that discouraged women’s scientific interests and aspirations. Although these activists lacked the analytical tools to comprehend the deep-rootedness of women’s scientific subordination, they still conceived of it as the product of social forces. They realized fully that women’s exclusion stemmed from a series of cultural attitudes and deliberate choices regarding who could “do” science and who could not. But, in the context of the Second World War and early Cold War years when “scientific brainpower” was supposedly at a premium, they argued that this artificial and inaccurate distinction, along with all of its ramifications, was ultimately wasteful and unpatriotic.

In an era that discouraged and even punished dissent, the language and cause of national defense provided activists with a culturally legitimated means for critiquing gender conventions and discrimination. The invocation of defense rhetoric, however, not only camouflaged but also compromised their agenda. Activists’ own implorations to “utilize”

female intellect and stem the “waste” of scientific talent elided their interest in sexual equality. The militaristic and technocratic language in which they couched their demands, moreover, subordinated women’s rights to national needs and circumscribed their liberatory potential. Nevertheless, these efforts at expanding women’s scientific participation are significant because they set the groundwork for later feminist reform. In effect, this study reveals that contemporary feminist interest in science did not spring full-blown from the so-called “second wave” of American feminism but rather, had been percolating for some time. Reclaiming this early history complicates our picture of the mid-twentieth century as an era of domestic complacency, illuminates continuities between earlier efforts and contemporary feminist critiques, and calls into question the “waves of feminism” paradigm.

TABLE OF CONTENTS

Introduction	1
Chapter 1: An Overview of the Early History of Women in Science	15
Chapter 2: “Let Science Help to Win the War”	40
Chapter 3: After War, What?	100
Chapter 4: The Dawn of the Defense Decade	156
Chapter 5: “Scientific Womanpower” Enters the Sputnik Era	195
Epilogue	249
Bibliography	261

INTRODUCTION

Audience members at the annual meeting of the American Association for the Advancement of Science watched intently as plastics engineer Betty Lou Raskin took the podium and began to address the crowd. The under-representation of women in scientific fields, Raskin insisted, “is not due to any intellectual incompetence or lack of creative ability on the part of women. It is the fault of our cultural conditioning and our poor vocational guidance.” Citing outmoded sexual stereotypes and social conventions as the most persistent barriers to women’s scientific success, Raskin then proposed a number of tactics, such as providing college bound “girls” with booklets about scientific careers, casting a popular actress as an aeronautical engineer in a romantic comedy, and showcasing a female scientist each month in a women’s magazine. “The longer we continue to ignore the scientific potentialities and skills of the women in this country,” she concluded, “the more we are hurting our chances for survival.”¹

What is significant about Raskin’s remarks is that she delivered them in 1958, at the height of what some scholars have termed “Cold War domesticity.”² Of even greater importance is the fact that Raskin was not alone in her efforts to encourage and assist women

¹ Betty Lou Raskin, “American Women: Unclaimed Treasures of Science,” paper presented at the American Association for the Advancement of Science Annual Meeting, Washington D.C., December 1958., reprinted in *Goucher College Bulletin*, 25, no. 4 (January 1959): no page numbers given, folder EC, carton 12, records of the American Council on Education’s Commission on the Education of Women (hereafter cited as CEW), Schlesinger Library, Radcliffe Institute for Advanced Study, Harvard University (hereafter cited as Schlesinger).

² See Elaine Tyler May, *Homeward Bound: American Families in the Cold War Era* (New York: Basic Books, Inc., 1988).

in scientific and technical fields. Indeed, throughout the Second World War and the early Cold War years, a number of individuals and organizations dedicated themselves to this mission. In 1942, for example, Barnard College Dean Virginia Gildersleeve finally convinced Columbia University's School of Engineering to admit female students. During the early 1950s, the newly-established Society of Women Engineers embarked on a campaign to educate parents, teachers, and teenage girls about engineering as a career for women. And at the close of the decade, Dean Polly Bunting of Douglass College secured a Ford Foundation grant to retrain college-educated housewives in the field of mathematics. These activities were guided by an overarching interest in women's scientific participation. They were publicly justified, however, through a strategic appeal to national defense.

By appropriating the language and the cause of national defense, female activists presented powerful, sophisticated, and surprisingly familiar critiques of the pervasive cultural attitudes and discriminatory practices that discouraged women's scientific interests and aspirations. The continued under-representation of women in scientific and technical fields today, however, both belies and obscures these earlier efforts. It also conceals the determination and prescience of earlier activists whose identification and critiques of the obstacles to women's scientific participation would be extended and adapted by feminists in the 1960s and 1970s.

In the conservative climate of the mid-twentieth century, and in the absence of open support for women's rights, female activists found it most expedient to tether their cause to national defense. Their efforts, as we will see, were simultaneously contextualized, legitimized, and circumscribed by the mobilization and militarization of American science

throughout this period. While science and technology had long contributed to the outcome of armed conflicts, key scientific discoveries of the 1930s and 1940s had ushered in a new phase of science and combat.³ The early 1930s witnessed the development of the first operational “radio detection and ranging,” or “radar,” system that could be employed to detect enemy aircraft and confuse enemy signals.⁴ V-2 long-range rockets, designed by the Germans in 1936 and first used in 1944, also highlighted the importance of science in war as Allied scientists raced to develop countermeasures.⁵ But perhaps the most remarkable scientific discovery was the splitting of the uranium nucleus by two German scientists in 1938. The achievement of atomic fission struck both awe and fear in the heart of the international scientific community. Scientists around the world turned their attention to generating and harnessing atomic energy. In the United States, these efforts resulted in the uranium bombs that would speed the end of World War II and permanently transform the relationship between science and warfare.⁶

A number of innovative mechanisms institutionalized defense research and wartime science. New government agencies, such as the National Defense Research Committee (1940) and its successor, the Office of Scientific Research and Development (1941),

³ For comparison with earlier periods, see Charles E. Rosenberg, *No Other Gods: On Science and American Social Thought* (Baltimore: The Johns Hopkins University Press, 1976).

⁴ Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (New York: Knopf, 1977; reprint, with new preface, Cambridge: Harvard University Press, 1995), 290-291; James Phinney Baxter III, *Scientists Against Time* (Boston: Little, Brown and Company, 1946), 5.

⁵ Baxter, *Scientists Against Time*, 36.

⁶ Baxter, *Scientists Against Time*, 419-447; Kevles, *The Physicists*, 289, 224-234; Alex Roland, “Science and War,” *Osiris* 2, vol. 1 (1985): 265. Roland distinguishes between ending the war and causing the end, and argues that the bomb “can hardly be credited with winning the war in the Pacific.”

launched an ambitious weapons design program that oversaw all stages of production. “Research and development,” as historian of science and technology A. Hunter Dupree argues, “were here coupled in a union that was to become standard in government terminology.”⁷ Academic institutions and industrial firms, which received the bulk of “R&D” defense contracts, quickly redirected their research priorities to accommodate military needs.⁸ The subsequent expansion of wartime science was further facilitated by a change in financial policy. Instead of relying on the President’s emergency funds, the Office of Scientific Research and Development received direct congressional appropriations. Consequently, its budget dwarfed that of its predecessor: in comparison with the \$100 million that had been allocated to scientific research in 1940, scientific expenditures totaled more than \$1.5 billion by the end of World War II.⁹ This level of government spending for

⁷ The NDRC continued to operate as a branch of the OSRD. A. Hunter Dupree, *Science in the Federal Government: A History of Policies and Activities to 1940* (Cambridge: The Belknap Press of Harvard University Press, 1957), 371; Roger L. Geiger, *Research and Relevant Knowledge* (New York: Oxford University Press, 1993; reprint with new introduction, New Brunswick: Transaction Publishers, 2004), 6. For the official history of the OSRD, see Irvin Stewart, *Organizing Scientific Research for War: The Administrative History of the Office of Scientific Research and Development* (Boston: Little, Brown, and Company, 1948).

⁸ In contrast to the First World War, when two-third of wartime contracts had gone to corporations, the NDRC and OSRD allocated more than half of World War II contracts to educational institutions, thereby drawing research universities into war work at an unprecedented rate. Dupree, *Science in the Federal Government*, 369-371; Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial: The Military-Industrial-Academic Complex at M.I.T. and Stanford* (New York: Columbia University Press, 1993), 6.

⁹ Kevles, *The Physicists*, 299-300; Geiger, *Research and Relevant Knowledge*, 6; Dupree, *Science in the Federal Government*, 373; Baxter, *Scientists Against Time*, 125. Federal interest in science, however, has a long history. President Lincoln, for example, created the National Academy of Sciences to advise the government on scientific matters. During the 1920s, the federal government provided approximately one-third of the \$200,000,000 spent annually on scientific research (the other two-thirds came from industry). See also Karl T. Compton, Robert W. Trullinger, and Vannevar Bush, *Scientists Face the World of 1942* (New Brunswick: Rutgers University Press, 1942), 12 and Kevles, *The Physicists*, 173.

defense-related scientific endeavors was unprecedented and accelerated the rise of what has come to be known as “big science.”¹⁰

Following the cessation of hostilities in 1945 and the resumption of peace, defense spending dipped moderately even though it remained above its prewar levels. With the onset of the Cold War in the late 1940s, however, federal funding for defense research quickly resumed its upward climb, especially after allied-turned-enemy Soviet scientists detonated their own nuclear bomb and ended America’s monopoly on atomic energy. Meanwhile, the Cold War arms race spurred the creation of more powerful and more deadly weapons, as did the race to space. New federally funded organizations such as the National Science Foundation and NASA facilitated these efforts, despite escalating concerns about the nature of government control. Although the proportion of federal monies devoted to defense research and development declined amidst enlarged allocations for technologies with both civilian and military uses, actual spending soared. Between 1958 and 1961, the Defense Department’s “R&D” budget nearly doubled, while NASA’s increased tenfold.¹¹

America’s rapidly proliferating technological commitments required a continuous supply of scientists, mathematicians, and engineers. To increase the production of scientific and technical personnel, the federal government and American industry not only collaborated

¹⁰ A more complete treatment of the term “big science” and its manifestations can be found in Peter Galison and Bruce Hevly, eds., *Big Science: The Growth of Large-Scale Research* (Stanford: Stanford University Press, 1992). The term “big science” was first used in a 1961 article by physicist and Oak Ridge National Laboratory director Alvin Weinberg. See Alvin Weinberg, “Impact of Large-Scale Science on the United States,” *Science* 134 (July 21, 1961): 161-64.

¹¹ Michael S. Sherry, *In the Shadow of War: The United States Since the 1930s* (New Haven: Yale University Press, 1995), 203, 219-220. For insightful analyses of Cold War science see Leslie, *The Cold War and American Science*; Rebecca S. Lowen, *Creating the Cold War University: The Transformation of Stanford* (Berkeley: University of California Press, 1997); and Jessica Wang, *American Science in an Age of Anxiety* (Chapel Hill: University of North Carolina Press, 1999).

with the nation's colleges and universities but in doing so, often financed their joint efforts. During the Second World War, more than two hundred participating schools received federal funding to offer intensive, short-term, courses of college grade through the newly established Engineering, Science, and Management Defense Program, which Congress had approved in October 1940. (After Pearl Harbor, it was renamed Engineering, Science, and Management War Training, or ESMWT). Several individual industries followed with their own training programs, many of which were also located on college campuses but indirectly subsidized by the federal government through defense contracts.¹² Likewise, the Cold War saw a precipitous rise in federal aid for science education, as evidenced by the new National Science Foundation fellowships established in the early 1950s and the monumental National Defense Education Acts passed in the wake of the Soviet Sputniks.

Underlying these various initiatives was a general anxiety regarding America's supply of "scientific brainpower." Throughout the 1940s and 1950s, government bureaucrats, industry representatives, university educators, and assorted individuals continually assessed the state of this national commodity. The wartime draft of male students and professionals had visibly depleted the pool of available talent, they concurred. Although returning veterans quickly resumed their studies with assistance from the G.I. Bill, the four-year lag in the production of Ph.D.s continued to take its toll. More speculation about shortages and supply arose after the United States entered the conflict in Korea and defense industries geared up for production. The launching of the Soviet satellite Sputnik in 1957 confirmed these fears:

¹² Henry H. Armsby, "Engineering, Science, and Management War Training Final Report," Bulletin 1946, No. 9 (Washington, D.C.: U.S. Office of Education, 1946), viii-xi; V.R. Cardozier, *Colleges and University in World War II* (Westport: Praeger, 1993), 176.

the United States, it seemed, had been outpaced and outperformed in the field of space age science.

Both academic journals and popular publications covered these topics at length with varying degrees of sensationalism. Meanwhile, “manpower” experts compiled statistics on college enrollments, graduation rates, employment trends, and general labor force patterns. Ad-hoc committees, government agencies, philanthropic organizations, and professional societies convened conferences to discuss these findings and to identify new sources of scientific talent. In general, interested parties agreed on the paramount importance of highly trained technical personnel to national defense. They also agreed—albeit reluctantly and when national emergencies seemed particularly acute—on the need to enlist all of America’s intellectual resources, regardless of gender. In these times of crisis, government, industry, and education officials alike publicly identified female intellect as the nation’s largest supply of untapped “scientific brainpower.”

These proclamations lent support, legitimacy, and urgency to the work of individuals and organizations concerned with women’s scientific participation. Most of these female activists were themselves scientists and engineers; the few who were not were academics or professionals in other fields. They were generally white, middle class, and college educated, and their concerns very much reflected their social position and backgrounds. Yet these women were both privileged and marginalized, especially those who made their living in the male-dominated world of science and engineering.

As Margaret W. Rossiter has shown in her encyclopedic two-volume account, *Women Scientists in America*, the professionalization of American science in the late nineteenth

century was accompanied by, and in many ways dependent upon, its masculinization. The designation of scientific authority as the province of university-educated men precipitated and legitimated women's exclusion.¹³ Meanwhile, according to Londa Schiebinger, the folkways and customs of modern science "took form in the absence of women and...also in opposition to their participation." These included styles of dress, modes of interaction, hierarchies of practices and values, and "rituals of day-to-day conformity" that visibly marked women as outsiders.¹⁴ Women who did break into science programs and professions often felt unwelcome, as their abilities were regularly questioned and their aspirations rarely encouraged. Likewise, the professional culture of science itself was structured on a male model that failed to account for the realities and responsibilities of women's lives.

The female activists who comprise the core of this study recognized and sought to remedy many of these dilemmas. Their own experiences and observations had revealed to them the pervasiveness of cultural attitudes and discriminatory practices that barred, discouraged, or otherwise marginalized women with scientific interests and aspirations. Although these activists lacked the analytical tools to comprehend the deep-rootedness of women's scientific subordination, they still conceived of it as the product of social forces.¹⁵

¹³ Margaret W. Rossiter, *Women Scientists in America*, vol. 1, *Struggles and Strategies to 1940* (Baltimore: Johns Hopkins University Press, 1982) and *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995). For an earlier treatment in the European context, see Londa Schiebinger, *The Mind Has No Sex? Women and the Origins of Modern Science* (Cambridge: Harvard University Press, 1989).

¹⁴ Londa Schiebinger, *Has Feminism Changed Science?* (Cambridge: Harvard University Press, 1999), 68.

¹⁵For contemporary critiques of how the practice and content of science is gendered, see Sandra Harding, *The Science Question in Feminism* (Ithaca: Cornell University Press, 1986); Harding, *Whose Science? Whose Knowledge? Thinking from Women's Lives* (Ithaca: Cornell University Press, 1991); Evelyn Fox Keller, *Reflections on Gender and Science* (New Haven: Yale University Press, 1985); and Donna J. Haraway, *Simians, Cyborgs, and Women* (New York: Routledge, 1991).

They realized fully that women's exclusion stemmed from a series of cultural attitudes and deliberate choices regarding who could "do" science and who could not. But, in the context of the Second World War and early Cold War years when "scientific brainpower" was supposedly at a premium, they argued that this artificial and inaccurate distinction, along with all of its ramifications, was ultimately wasteful and unpatriotic.

The identification of women as an unused or underutilized resource legitimized activists' efforts to expand women's scientific participation. Under the guise of national defense, extending engineering education to women became a mechanism for increasing the production of experts. Likewise, providing young women with female role models in the field promised to attract new sources of scientific talent. Innovative programs enabling women to combine scientific work with domestic endeavors ensured the fuller "utilization" of female intellect. And denouncing gender stereotypes and sex-role socialization became part of a more noble effort to mobilize the vast reserve of untapped "scientific brainpower."

Thus, in an era that discouraged and even punished dissent, the language and cause of national defense provided female activists with a culturally legitimated way of challenging traditional gender roles and conventions. The invocation of defense rhetoric, however, not only camouflaged but also compromised their agenda. Activists' own entreaties to "utilize" female intellect and stem the "waste" of scientific talent elided their interest in sexual equality. The militaristic and technocratic language in which they couched their demands, moreover, subordinated women's rights to national needs and circumscribed their liberatory

potential.¹⁶ Nevertheless, these efforts at expanding women's scientific participation are significant because they laid the groundwork for later feminist reform, both in science and more generally.

Throughout the mid-twentieth century, and especially the immediate postwar years, which are popularly remembered as the depths of domestic complacency, I argue that there existed the rumblings of a burgeoning feminist movement.¹⁷ Although most of these female activists eschewed the feminist label for themselves, associating it narrowly with suffrage or the National Woman's Party, they nevertheless espoused many of feminism's core ideals. As this study shows, they firmly believed that women and men should enjoy the same opportunities for school and for work; that outmoded cultural conventions and stereotypes stymied women's intellectual and professional development; and, perhaps most importantly, that change was needed and possible.

By the time that Betty Friedan's *The Feminine Mystique* hit stands in 1963, these activists had already identified and proposed remedies for many of the dissatisfactions expressed on its pages. One of these activists, Polly Bunting of Douglass College and later of

¹⁶ See also Cynthia Enloe, *Maneuvers: The International Politics of Militarizing Women's Lives* (Berkeley: University of California Press, 2000) and Miriam Cooke and Angela Woollacott, eds. *Gendering War Talk* (Princeton: Princeton University Press, 1993). Laura McEnaney weaves many of these theoretical insights in her study of Cold War civil defense. See McEnaney, *Civil Defense Begins at Home: Militarization Meets Everyday Life in the Fifties* (Princeton: Princeton University Press, 2000).

¹⁷ The growing body of literature that examines female activism in the postwar period includes Joanne Meyerowitz, ed., *Not June Cleaver: Women and Gender in Postwar America, 1945-1960* (Philadelphia: Temple University Press, 1994); Susan Lynn, *Progressive Women in Conservative Times: Racial Justice, Peace, and Feminism, 1945 to the 1960s* (New Brunswick: Rutgers University Press, 1992); Cynthia Harrison, *On Account of Sex: The Politics of Women's Issues, 1945-1968* (Berkeley: University of California Press, 1988); Susan M. Hartmann, *The Other Feminists: Activists in the Liberal Establishment* (New Haven: Yale University Press, 1998); and Linda M. Eisenmann, *Higher Education for Women in Postwar America, 1945-1965* (Baltimore: Johns Hopkins University Press, 2006). See also William Chafe, *The Paradox of Change: American Women in the Twentieth Century* (New York: Oxford University Press, 1991).

Radcliffe, had even considered collaborating with Friedan on the book project. Bunting had made the acquaintance of Friedan during the late 1950s through her cousin (and Friedan's Smith College classmate), Marion Ingersoll. The two women found that they had much to discuss and had even exchanged chapter drafts before ultimately parting ways. Although Bunting described their separation as amiable and Friedan acknowledged Bunting as one of the "educators valiantly fighting the feminine mystique, who gave me helpful insights," Bunting later expressed frustration with the book's notoriety. She seemed to resent that the expose had been credited with the rebirth of organized feminism and she suggested that the kind of critiques and initiatives that she had already launched had actually cultivated the climate for the book's success. Thus Bunting, who regarded *The Feminine Mystique* as more of a capstone than a catalyst, believed that Friedan "caught that tide beautifully" but did not create it.¹⁸

This study traces that tide from World War II through the early 1960s by situating it within broader histories of American education, modern science, feminist activism, and national defense policy. The mobilization and militarization of American science have been fairly well-documented, as has the emergence of what President Dwight D. Eisenhower first termed the "military-industrial" complex.¹⁹ Conspicuously absent from most accounts,

¹⁸ Kimberly Dolphin Wheaton, "Challenging the 'Climate of Unexpectation:' Mary Ingraham Bunting and American Women's Higher Education in the 1950s and 1960s" (Ed.D. dissertation, Harvard University, 2001), 99-101; Betty Friedan, *The Feminine Mystique* (New York: W.W. Norton & Company, 1963; reprint, with new preface and introduction, New York: Laurel, 1983), 13; Mary Ingraham Bunting, "Oral Memoir," interview by Jeannette Bailey Cheek, September-October 1978, transcript, 87-88, Schlesinger. For insights into Friedan's radical past, see 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, 1988).

¹⁹ Some useful histories of higher education during World War II and the Cold War include: V.R. Cardozier, *Colleges and Universities in World War II* (Westport and London: Praeger, 1993); Noam Chomsky, et. al. *The*

however, are their gendered effects. Likewise, the responses of female activists to these phenomena receive scant attention, although scholars such as Margaret Rossiter, Ruth Oldenziel, and Amy Sue Bix have studied them to some degree.²⁰ In general though, most histories of women's education, professional women, and American feminism ignore these mid-twentieth century individuals and organizations, as well as their influence on the modern feminist movement.²¹

While my study is informed by these accounts, it principally draws on a vast collection of published and unpublished letters, oral histories, meeting minutes, conference proceedings, government documents, newspaper clippings, organizational records, and personal correspondence. These include the records of the U.S. Office of Education, the

Cold War and the University: Toward and Intellectual History of the Postwar Years (New York: The New Press, 1997); Ellen W. Schrecker, *No Ivory Tower: McCarthyism and the Universities* (New York and Oxford: Oxford University Press, 1986); and Barbara Barksdale Clowse, *Brainpower for the Cold War: The Sputnik Crisis and the National Defense Education Act of 1958* (Westport, CT: Greenwood Press, 1981). For studies addressing the relationship between science and national defense see Leslie, *The Cold War and American Science*; Lowen, *Creating the Cold War University*; and Wang, *American Science in an Age of Anxiety*.

²⁰ See Rossiter, *Women Scientists in America*, vol. 2; 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 (Australia: Harwood Academic Publishers, 2000), 11-49; Amy Sue Bix, "Feminism Where Men Predominate: The History of Women's Science and Engineering Education at M.I.T." *Women's Studies Quarterly* XXVIII (1 and 2): 24-45 and Bix, "Engineering National Defense: Technical Education at Land-Grant Institutions During World War II," in *Engineering in a Land-Grant Context: The Past, Present and Future of an Idea* ed. Alan I. Marcus (West Lafayette: Purdue University Press, 2005): 105-133. Other histories of women's experiences as scientists and mathematicians during the mid-twentieth century include Margaret A.M. Murray, *Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America* (Cambridge: MIT Press, 2000) and Kathleen Broome Williams, *Improbable Warriors: Women Scientists and the U.S. Navy in World War II* (Annapolis, MD: Naval Institute Press, 2001).

²¹ For general histories of women's higher education, see: Mabel Newcomer, *A Century of Higher Education for American Women* (New York: Harper & Brothers, 1959); Barbara Miller Solomon, *In the Company of Educated Women: A History of Women and Higher Education in America* (New Haven: Yale University Press, 1985); Amy Thompson McCandless, *The Past in the Present: Women's Higher Education in the Twentieth-Century American South* (Tuscaloosa: University of Alabama Press, 1999); Paula S. Fass, *Outside In: Minorities and the Transformation of American Education* (New York and Oxford: Oxford University Press, 1989); and Helen Lefkowitz Horowitz, *Campus Life: Undergraduate Cultures from the End of the Eighteenth Century to the Present* (Chicago: The University of Chicago Press, 1987).

National Science Foundation, the U.S. Women's Bureau, the War Manpower Commission, the American Council on Education, the Commission on the Education of Women, and the National Manpower Council. I have also examined the records of various colleges and universities, such as the Massachusetts Institute of Technology, New Jersey College for Women, and Iowa State University. But the most revealing accounts came from the records of individual women and women's organizations, such as Virginia Gildersleeve, Polly Bunting, and various scientific societies such as the Society of Women Engineers and Sigma Delta Epsilon. Their letters, oral histories, and publications constitute an invaluable resource which, ironically, has been woefully "underutilized" by most scholars.

The organization of this dissertation proceeds chronologically. Chapter 1 provides a brief overview of women's participation in science up until the dawn of the Second World War. The second chapter examines the process through which female activists collaborated with educators, bureaucrats, and industry officials during World War II in a joint effort to create new opportunities for women in scientific and technical fields. It also investigates women's wartime experiences as scientists, engineers, and technical aides, paying particular attention to continued resistance against women in these areas. Chapter 3 focuses on the problems and the possibilities of the postwar period as male veterans reclaimed their places at school and at work. While certainly disadvantageous, the postwar backlash also fueled new efforts to organize and agitate. The fourth chapter highlights how the early Cold War and the conflict in Korea infused female activists' efforts with a new sense of urgency and legitimacy. This chapter takes as its focus the newly-formed Society of Women Engineers and members' efforts to improve vocational guidance for women and girls. The fifth chapter

investigates the national security anxieties arising from the Soviet Sputniks and the specter of Soviet womanpower. By examining organizations such as Sigma Delta Epsilon and individuals such as Polly Bunting, it also uncovers innovative efforts to enable married women to combine scientific and domestic work. The epilogue connects these earlier initiatives to later activities, arguing that despite their limitations, the efforts of mid-twentieth century activists laid the groundwork for more explicitly feminist reforms.

CHAPTER 1

An Overview of the Early History of Women in Science

Women's participation in the sciences and related fields, of course, predated the Second World War, as did female scientists' efforts to improve their status. In her study of secondary school curricula in the United States between 1794 and 1850, however, Kim Tolley refutes the popular perception that science classes have always been dominated by men.¹ By 1840, she argues, girls were taking courses in chemistry, astronomy, and natural philosophy (the early equivalent of physics). More importantly, girls' representation in science classes surpassed that of boys. Even though males made up sixty-two percent of the student body at New York's Genesee Wesleyan Seminary in 1834, for example, they comprised the minority of science students.² At this school and more generally, girls were more likely than boys to study the sciences. Male students, on the other hand, concentrated on the classics, which comprised the core of their secondary school curriculum, especially in the South. According to Tolley, in Virginia and North Carolina, ninety-one percent of boys' schools offered Latin and eighty-five percent advertised Greek. By contrast, only eighteen

¹ What Tolley refers to as "secondary schools" vary enormously and include day schools, finishing schools, seminaries, and academies. She defines secondary schools as "precollege institutions providing instruction beyond learning to read and write." See Kim Tolley, "Science for Ladies, Classics for Gentlemen: A Comparative Analysis of Scientific Subjects in the Curricula of Boys' and Girls' Secondary Schools in the United States, 1794-1850," *History of Education Quarterly* 36, no. 2 (Summer 1996): 134. For a full-length treatment of the history of girls' scientific schooling that extends to the twentieth century, see Tolley, *The Science Education of American Girls: A Historical Perspective* (New York: RoutledgeFalmer, 2003).

²Tolley, "Science for Ladies, Classics for Gentlemen," 144-145. See also Nancy Beadie, "Emma Willard's Idea Put to the Test: The Consequences of State Support of Female Education in New York, 1819-67," *History of Education Quarterly* 33, no. 4 (Winter 1993): 543-562.

percent of girls' schools advertised Latin and even fewer—five percent—offered Greek among their course offerings. In the North, schools for girls advertised the classics more frequently, but usually as electives.³ The “traditional” curriculum for secondary school students in the early nineteenth century, then, is best captured by Tolley’s phrase “Science for Ladies, Classics for Gentlemen.”⁴

The tendency of boys to study the classics instead of the sciences can be attributed in part to college entrance requirements, which demanded mastery of these subjects. Colleges routinely required applicants to translate Caesar and Virgil from the original text or to translate English passages into Latin and Greek. The prestige of learning the classics, and the gentlemanly polish that it conferred, also helps to explain why so many boys studied Greek and Latin. Even for those without plans to attend college, a passing knowledge of the classics signified upper-class status, a valuable asset in the business world or in the plantation economy. Moreover, relatively few career opportunities in the sciences existed during the first half of the nineteenth century. Although the wonders of scientific discovery and exploration enjoyed popular appeal, American science was still in its infancy. Indeed, at the beginning of the nineteenth century, the sighting of a scientist in a small town was considered a novelty or an anomaly. Scientific training at the secondary school level had little vocational value and was often viewed by parents to as a frivolous “add-on” to their sons’ education.⁵

³ Tolley, “Science for Ladies, Classics for Gentlemen,”143; Tolley, *The Science Education of American Girls*, 44.

⁴ This phrase is borrowed from the title of Tolley’s article, “Science for Ladies, Classics for Gentlemen.”

⁵ Tolley, “Science for Ladies, Classics for Gentlemen,”149-151. Male students, once in college, were generally required to take some science courses as part of the classical curriculum, but this small smattering provided minimal professional preparation.

The sciences were more acceptable for girls, especially because they provided an alternative to the classics. Some educators insisted that women were incapable of learning Greek and Latin and these fields of study did not hold the same promise for girls that they did for boys, due to the scarcity of colleges and occupations available to young women. Late eighteenth and early nineteenth century debates over the purpose of educating females emphasized neither educational nor vocational advancement. Instead, reformers highlighted the benefits that a woman's education would bring to her family and to the fledgling country. Linking women's traditional parenting responsibilities with the creation of an educated citizenry, the ideology of "Republican motherhood" enjoyed particular cachet. In the post-Revolutionary world, historian Linda Kerber argues, "motherhood was discussed almost as if it were a fourth branch of government, a device that ensured social control in the gentlest possible way. If the Republic indeed rested on responsible motherhood, prospective mothers needed to be well informed and decently educated."⁶ As the mothers of the country's future political, religious, business, and professional leaders, women bore responsibility for inculcating in their (male) children the values of the new republic. These included civic virtue, morality, and what prominent patriot and physician Benjamin Rush referred to in 1786 as "the principles of liberty and government."⁷ In his *Thoughts Upon Female Education*, which he delivered at the opening of the Young Ladies' Academy in Philadelphia the following year, Rush elaborated on these and other female duties, such as instructing their

⁶ Linda K. Kerber, *Women of the Republic: Intellect and Ideology in Revolutionary America* (Chapel Hill: University of North Carolina Press, 1980), 11, 200.

⁷ Benjamin Rush, "Of the Mode of Education Proper in a Republic," (Philadelphia, 1787), quoted in Mabel Newcomer, *A Century of Higher Education for American Women* (New York: Harper and Brothers Publishers, 1959), 9, 32.

children in various subjects, serving their husbands as sympathetic companions, and overseeing household assets when their spouses were occupied with business matters.⁸ To equip females with the republican values, fiscal acumen, morality, and affability required to carry out their expanded domestic duties, Rush and others advocated substantial education for girls and women.

The kind of female education articulated by Rush and like-minded reformers precariously balanced women's expanded domestic roles with their subordinate position in society. While they argued that women must be educated beyond the fundamentals of reading, writing, and arithmetic, they sought to create a curriculum for girls and women that would enhance feminine influence but would not disrupt power relations within the family unit. Rush, for example, denounced "ornamental" subjects such as drawing, instrumental music, and French as a waste of time and argued that a woman's education would be better spent on geography or history—subjects that would "qualify her not only for a general intercourse with the world, but, to be an agreeable companion for a sensible man."⁹ He did not endorse Greek and Latin for women, but neither did he do so for men. (Rush viewed the classics as embodying all the pretensions of European aristocracy and as ill-suited for the new republic.)¹⁰ In addition to history and geography, Rush advocated "a general acquaintance with the first principles of astronomy, and natural philosophy," particularly the

⁸ Benjamin Rush, *Thoughts upon Female Education, Accommodated to the Present State of Society, Manners, and Government in the United States of America* (Philadelphia: Prichard and Hall, 1787), 6-7; Nancy F. Cott, *The Bonds of Womanhood: "Woman's Sphere" in New England, 1780-1835* (New Haven: Yale University Press, 1977; reprint, with new preface, 1997), 104.

⁹ Rush, *Thoughts upon Female Education*, 9.

¹⁰ Kerber, *Women of the Republic*, 218.

aspects of those fields “as are calculated to prevent superstition, by explaining the causes, or obviating the effects of natural evil.”¹¹ He also supported the inclusion of chemistry and even taught a course in the subject at the Young Ladies’ Academy. The application of chemistry to domestic tasks was a theme highlighted by Rush in his class lectures, forty percent of which were devoted to topics such as “the means of preserving female beauty,” “the means of preparing vegetables for food,” and “of rendering a house clean and wholesome.”¹² For Rush, these branches of science were perfectly compatible with women’s roles as wives and mothers.

Eminent English scientist, physician, and poet Erasmus Darwin expressed similar beliefs in his *Plan for the Conduct of Female Education*, which was issued in 1792 and republished in Philadelphia in 1798. Although “Republican motherhood,” did not play a part in his thinking, as it did with Rush, Darwin nevertheless advocated scientific study for girls on the basis that it would make them good companions for men. Among the subjects he endorsed were botany, chemistry, mineralogy, and astronomy. Darwin conceded that this range of study “may perhaps be thought to include more branches than necessary for female erudition,” but ultimately concluded that it would improve women’s conversational skills and make them more appealing to members of the male sex.¹³ Other individuals, such as Almira Phelps (Emma Willard’s sister), advocated the natural sciences for women on the grounds

¹¹Rush, *Thoughts upon Female Education*, 9-10.

¹² Rush, quoted in Tolley, *The Science Education of American Girls*, 57.

¹³ Thomas Woody, *A History of Women’s Education in the United States*, vol. 1 (New York: Science Press, 1929), 35-36; Erasmus Darwin, *A Plan for the Conduct of Female Education: In Boarding School, Private Families, and Public Seminaries*, quoted in Woody, 35.

that they were morally uplifting and theologically illuminating. Based on the premise that God could be known through the study of nature, she described geology as “afford[ing] important aid to religion by confirming the truth of revelation.”¹⁴ Similarly, popular textbook author J.L. Comstock depicted chemistry as a tool for moral instruction. “[T]his subject,” he wrote, “teaches, that nothing has been formed by the fortuitous concurrence of atoms, but that even the ‘stocks and stones’ bear the impress of creative agency and design.”¹⁵ The study of science also offered physical benefits for girls and women. The outdoor activities associated with botany, for example, were viewed by contemporaries as “conducive to health and cheerfulness.”¹⁶

The acceptance of science as a suitable subject for female students—as well as the notion that educated women made better mothers and wives—was reflected in the growth of “advanced” educational institutions for women during the first half of the nineteenth century. Although most operated as secondary schools, some were more rigorous than others and a few even achieved junior college status. Among the earliest and most notable were Emma Willard’s Troy Female Seminary (1821), Catherine Beecher’s Hartford Female Seminary (1823) and Mary Lyon’s Mount Holyoke Female Seminary (1837). Antebellum women’s schools, especially in the North, generally refrained from referring to themselves as “colleges” although their southern counterparts used the term more freely. While Georgia

¹⁴ Tolley, “Science for Ladies, Classics for Gentlemen,” 131-132; Almira Phelps quoted in Woody, *A History of Women’s Education in the United States*, vol. 1, 318-319.

¹⁵ Tolley, “Science for Ladies, Classics for Gentlemen,” 132; J.L. Comstock quoted in Tolley, “Science for Ladies, Classics for Gentlemen,” 132.

¹⁶ Phelps quoted in Tolley, “Science for Ladies, Classics for Gentlemen,” 131.

Female College (1836) is considered by some to be the first women's college, others have argued that the distinction belongs to Mary Sharp College (1850) in Tennessee. Historian Thomas Woody, in his classic study of women's education, supports the latter view on the grounds that Mary Sharp College's academic requirements (including some classes in Greek and Latin) and its four year course sequence culminating in an A.B. degree, more closely resembled a college for men. Although a handful of colleges such as Oberlin (1833) adopted coeducation early on, single-sex facilities remained the norm throughout the mid-nineteenth century.¹⁷

Following the Civil War, the number of colleges and universities open to women proliferated. In the Northeast, four-year women's colleges such as Vassar (1865), Wellesley (1875), and Smith (1875) modeled themselves after the most elite schools for men by adopting the classical curriculum and stringent degree requirements. Some women's colleges even instituted entrance exams in Greek and Latin, as was customary for many men's schools. New coeducational state universities—especially in the Midwest—also offered women the opportunity to study the classics, along with other subjects, that they could then teach to their own pupils. Ironically, as Kim Tolley points out, the inclusion of the classics as a core part of women's schooling occurred just as educators were beginning to deemphasize the classical curriculum for men in favor of agriculture, mechanic arts (engineering), and various branches of science.¹⁸

¹⁷ Newcomer, *A Century of Higher Education for American Women*, 11-12; Barbara Miller Solomon, *In the Company of Educated Women: A History of Women and Higher Education in America* (New Haven: Yale University Press, 1985), 23-24. See also Woody, *A History of Women's Education in the United States*, vol. 1.

¹⁸ Solomon, *In the Company of Educated Women*, 47-49; Tolley, *The Science Education of American Girls*, 153-158.

This transformation in American higher education can be attributed to several concurrent developments. As more became known about the natural world, educators increasingly insisted that a larger part of the college curriculum be devoted to scientific knowledge. Some colleges even established special divisions for the advancement of science, such as the Lawrence Scientific School at Harvard (1847) and the Sheffield Scientific School at Yale (1854). Other pedagogues believed that the expansion of scientific knowledge and its immediate applicability to American business rendered inadequate the traditional classical curriculum and its methods of rote learning. Instead of requiring the memorization and recitation of Latin, Greek, and mathematical formulas, these educators sought to engage students in lessons that would better prepare them for specific careers in industry and agriculture. Their goal was assisted by the Morrill Act of 1862, which provided federal funds to state land-grant colleges. Under the terms of the act, each state was authorized to endow and maintain “at least one college where the leading object shall be, without excluding other scientific and classical studies...to teach such branches of learning as are related to agriculture and the mechanic arts.”¹⁹ Likewise, philanthropic businessmen, such as Ezra Cornell, backed the growth of academic science and technology with institutions bearing their name. Transatlantic influences also played a role, as American educators returned from studying abroad. The German universities at which many studied emphasized original research, promoted academic specialization, and held the sciences in high esteem. Their

¹⁹ Morrill Land Grant Act of 1862 quoted in Roger L. Geiger, *To Advance Knowledge: The Growth of American Research Universities, 1900-1940* (New York: Oxford University Press, 1986), 5.

model would guide the creation of American graduate education and research universities, beginning in 1875.²⁰

The expansion of course offerings in undergraduate colleges, the training of professional scientists at newly-formed graduate institutions, the external endowment of scientific study, and the increasing need for technological expertise in agriculture and industry all helped to elevate the status of American science. The rising enrollment of men in these professionally promising fields of study further enhanced their prestige. While women increasingly entered the new positions open to them in teaching and social work, they maintained a strong foothold in the sciences—especially at women’s colleges. Women regularly joined scientific societies, attended lectures, and sought work in museums and observatories. And in the 1890s, they gained admittance to graduate programs.²¹

The growth of scientific and technical professions, however, had different consequences for women and men. The fact that more undergraduate women enrolled in “scientific departments” than in “collegiate departments” during the 1870s prompted educators and parents to reconsider the purpose of women’s scientific schooling. As a path to a rewarding career in industry or at one of the new agricultural stations, scientific study

²⁰ Geiger, *To Advance Knowledge*, 3-5; Laurence R. Veysey, *The Emergence of the American University* (Chicago: The University of Chicago Press, 1965), 11, 15; James L. Leloudis, *Schooling the New South: Pedagogy, Self, and Society in North Carolina, 1880-1920* (Chapel Hill: The University of North Carolina Press, 1996), 53; Helen Lefkowitz Horowitz, *Campus Life: Undergraduate Cultures from the End of the Eighteenth Century to the Present* (Chicago: The University of Chicago Press, 1987), 68-71; Robert V. Bruce, *The Launching of Modern American Science, 1846-1876* (New York: Alfred A. Knopf, 1987), 7-13, 329-330. The opening of Johns Hopkins University in 1876, under the presidency of German-educated Daniel Coit Gilman, is considered to mark the beginning of contemporary graduate education in the United States.

²¹ Margaret W. Rossiter, *Women Scientists in America*, vol. 1, *Struggles and Strategies to 1940* (Baltimore: Johns Hopkins University Press, 1982), xv-xvii, 30-31.

began to seem less suitable for female students.²² Two decades later, when women began pursuing master's degrees and Ph.D.s in steady numbers, they also found that graduate study did not open the same doors for them as it did for men. Many of the universities that reluctantly admitted women still reserved faculty positions for male candidates. When women did find jobs in academia, they usually did so in areas deemed particularly suitable for women, such as home economics or hygiene (both were considered "household science"). Women encountered similar discrimination when seeking jobs in industry and government, as most of the jobs open to them were as assistants to higher-ranking men. Furthermore, at the end of the nineteenth century, when there were more women "in science" than ever before, scientific societies instituted new membership requirements that restricted women to lower levels of members, or disproportionately excluded them by labeling them "amateurs." Anxious to establish their own careers and to improve the standing of science in society, male scientists worried that the presence of women would diminish the prestige of both. Taken together, men's fear of "feminization" and their push for "professionalization" served to limit women's scientific participation. By 1910, a new rigidity had set in, and "women's subsequent experience in science was more one of containment within previously demarcated limits than expansion into newer and greater opportunities beyond them."²³

Within the span of a century, the sciences had gone from being a woman's subject to a masculine enterprise. Although women continued to be active in certain areas of science,

²² Tolley, *The Science Education of American Girls*, 154-155.

²³ Rossiter, *Women Scientists in America*, vol. 1, 64, 73-74, 76, 313-314, xvi; Kim Tolley's account of secondary school education emphasizes more strongly the movement of women into other fields. See Tolley, *The Science Education of American Girls*.

especially botany, zoology, anthropology, and psychology, they were generally concentrated in lower level, lower paid, and less visible positions than men. Many desired to move beyond what had become scientific “women’s work” but encountered continued cultural and institutional obstacles at every turn. In response to their predicament, some female scientists increased their involvement in existing all-women science clubs or worked to create new ones. Local associations established in the late nineteenth century enabled townswomen interested in botany and natural history to gather on a regular basis. Other groups—such as the “Chemistry Fiends” established at the University of California at Berkeley in 1900—drew together female students for recreation and camaraderie. Berkeley’s “Chem Fiends,” for example, encouraged women’s scientific interests by hosting activities that would increase contact between female faculty and students. These included outdoor hikes, dinner parties, and candy pulls. By the end of its first decade, the Berkeley group had adopted a more academic focus and begun recommending that only students enrolled in chemistry courses beyond the first-year be eligible for membership. In 1912, members also chose a new name—Al Chemia, “as Chemistry Fiends was thought not to be dignified enough.”²⁴ In the meantime, similar organizations for women in chemistry were forming or had been formed at the University of Washington, the University of Nebraska, Stanford, and the University of Southern California. They merged with the Berkeley group in 1916 to become Iota Sigma Pi,

²⁴ Rossiter, *Women Scientists in America*, vol. 1, 73-75, 297-300; Agnes Fay Morgan, “History of Hydrogen Chapter of Iota Sigma Pi, 1900-1922,” [1949?], 1-3, folder 9, Box 18, Records of Iota Sigma Pi (hereafter cited as ISP), Women in Science and Engineering Archives, Iowa State University, Ames, Iowa (hereafter cited as WISE).

the national honor society for women chemists.²⁵ While the creation of Iota Sigma Pi reflected the broader trend of establishing honor societies to encourage academic excellence, it also represented a specific interest among women in calling attention to their presence and accomplishments in an otherwise male-dominated discipline. Over the next several decades, Iota Sigma Pi would be joined by other women's scientific societies in its quest to increase and reward women's participation in the sciences.

The expanding feminist and suffrage movements provided female scientists with additional outlets for voicing their concerns. Civil engineer Nora Stanton Blatch (granddaughter of Elizabeth Cady Stanton) even rode a horse across New York State campaigning for the vote.²⁶ But Blatch's activism was hardly limited to suffrage. In addition to writing numerous letters to the editor of the *New York Times* protesting women's plight, she also brought a lawsuit against the American Society of Civil Engineers for refusing to promote her past "junior member" (although she met the stated requirements) and dropping her from its rolls instead. She lost her case, unfortunately, and it would not be until 1927 that the society would elect Elsie Eaves as its first female associate member.²⁷

Other challenges to the status quo came from psychologists and suffragists Helen Thompson (later Woolley) and Leta Stetter Hollingworth, who used their research to

²⁵ Morgan, "History of Hydrogen Chapter of Iota Sigma Pi, 1900-1922," 1-3, folder 9, Box 18, ISP, WISE ; "Women's Honor Society Returns to Berkeley," *ChemiCAL Science and Engineering* 6, no. 1 (February 1998): 5.

²⁶ Rossiter, *Women Scientists in America*, vol. 1, 102-103, 116.

²⁷ Rossiter, *Women Scientists in America*, vol. 1, 91; Nora Blatch de Forest, letter to the editor, *New York Times* December 10, 1909, 10; "First Woman Made Member of Civil Engineers' Society," *New York Times*, March 17, 1927, 16.

disprove commonly-held assumptions about the biological limitations of women's intellectual capabilities. As a graduate student at the University of Chicago, Thompson mapped out and quantitatively tested supposedly "innate" sex differences between women and men. In her dissertation-turned-book, published in 1903, Thompson broke new ground by attributing what she viewed as relatively minor sex differences to social and environmental factors rather than immutable biological conditions. A decade later, Columbia University graduate student Leta Stetter Hollingworth reached similar conclusions when she took on the "variability" theory of male superiority. Dating back to Charles Darwin, variability theory held that greater variability within the male species signified greater adaptability and therefore, superiority. Even when tempered to acknowledge significant overlap between the abilities of both sexes, variability theory labeled women's intellect as average at best and was used to justify relegating women to certain jobs. Like Helen Thompson Woolley, Hollingworth found that the differences between men and women were minor and were largely the result of social forces. In a number of articles, she directed her findings at vocational guidance counselors, urging them not to channel women only toward "women's work." When Helen Thompson Woolley became director of the vocational bureau for Cincinnati's public school system, she advocated the same thing.²⁸

World War I posed yet another challenge to dominant ideas about women's scientific capabilities and women's work. Wartime demand for professional personnel expanded opportunities for women in psychology, home economics, and to a lesser degree, geography.

²⁸ Rossiter, *Women Scientists in America*, vol. 1, 99-102, 105-106, 114-116, 300; Rosalind Rosenberg, *Beyond Separate Spheres: Intellectual Roots of Modern Feminism* (New Haven: Yale University Press, 1982), 95-98, 103-107.

Several colleges sought to prepare their female students for defense work by offering special courses in these fields and others, such as bacteriology, mapmaking, nursing, and farming. Female chemists in particular enjoyed new positions in the male-dominated chemical industry. Generally heralded as a “chemists’ war,” the conflict required the rapid and voluminous manufacturing of chemical gasses and explosives. While chemical firms scrambled to meet wartime production quotas by recruiting available women, however, the federal government kept more closely with tradition by providing enlisted men with technical training and using “old boy” networks to staff its projects. Scientists recommended by friends, colleagues, and former teachers were inducted into the military and stationed in laboratories, where they carried out wartime research.²⁹

These government-sponsored scientific endeavors were coordinated by the newly established National Research Council, which had been proposed by George Ellery Hale and adopted by President Woodrow Wilson in 1916. Because they relied heavily on “soldier scientists,” however, most large-scale projects under its jurisdiction—such as the submarine detection task force at New London, Connecticut and the new Chemical Warfare Service at Maryland’s Edgewood Arsenal—virtually excluded women. The postponed and relatively short involvement of the United States in the war also served to limit the extent of women’s wartime participation, as no large scale preparations had been made to recruit and train

²⁹ Rossiter, *Women Scientists in America*, vol. 1, 99-102, 116-122; Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (New York: Knopf, 1977; reprint, with new preface, Cambridge: Harvard University Press, 1995), 111-113, 131-137.

civilian scientists. Efforts that did take place did so at the discretion of individual companies and schools and were often scattered and slipshod.³⁰

At the war's end, female scientists looked back on the past decade with mixed feelings and confusion over how to proceed. Some cited women's wartime contributions, feminist challenges to traditional gender roles, and increased support for suffrage as evidence that their work had been accomplished. In 1919, the Naples Table Association for Promoting Laboratory Research by Women, which had been established by Bryn Mawr President M. Carey Thomas in 1898, even recommended its own dissolution on the grounds that it had fulfilled its goal of encouraging women in science. (It would not actually disband, however, until 1932.)³¹

Other women were less quick to claim success and less certain that women's scientific societies had outlived their usefulness. Iota Sigma Pi, the honor society for female chemists, continued to expand and by 1921, had eleven chapters across the country.³²

Around the same time, new scientific societies for women sprouted, such as Sigma Delta Epsilon. This graduate "fraternity" for women in science, which had been founded by twelve Cornell students in May 1921, became a national organization and the only women's group to be affiliated with the prestigious American Association for the Advancement of Science.³³

³⁰ Rossiter, *Women Scientists in America*, vol. 1, 99-102, 116-122; Kevles, *The Physicists*, 111-113, 131-137.

³¹ Rossiter, *Women Scientists in America*, vol. 1, 48, 122, 307.

³² Agnes Fay Morgan, ed., *A History of Iota Sigma Pi*, 1953, reprint, (Berkeley: Iota Sigma Pi, 1963), no page number.

³³ Rossiter, *Women Scientists in America*, vol. 1, 48, 122, 300-301, 307; Kevles, *The Physicists*, 202-204; For a fuller treatment of the fraternity, see Mary Louise Robbins, ed. *A History of Sigma Delta Epsilon, 1921-1971* (S.I.: Graduate Women in Science, 1971).

Another organization—albeit a relatively short lived one—was Kappa Mu Sigma. Established at the University of Chicago in 1920, this association for female graduate students in chemistry had acquired a second chapter at Columbia University and 180 members by the time that it vanished around 1927. Little is known about its disappearance, other than that it occurred shortly after the Columbia chapter challenged the American Chemical Society's New York City Branch for excluding women from its dinners, which were held at the men-only Chemists Club.³⁴ Other associations, such as the women's engineering society that Elsie Eaves and Hilda Counts Edgecomb attempted to form in 1919 as undergraduates at the University of Colorado, never even got off the ground. Although they had conducted a national survey of engineering programs that accepted women, Eaves and Edgecomb were unable to locate enough female engineers to sustain their organization.³⁵

In 1921, amidst these debates, Madame Marie Curie embarked for the United States. Her visit, many later acknowledged, set the tone for women's scientific participation throughout the next two decades. Marie Meloney, editor of the woman's magazine the *Delineator*, spearheaded the trip, which she viewed as an opportunity to publicize Curie's accomplishments and raise money for Curie's research. Having learned that Curie possessed only a minute amount of radium for her own work, Meloney arranged to procure one gram of the precious substance, valued at \$100,000. The funds for the radium, one *New York Times*

³⁴ Rossiter, *Women Scientists in America*, vol. 1, 301-302; Aurum chapter (Iowa State) resolution proposed at 1924 Convention, Folder 3, Box 10, ISP, WISE. It might be significant that the same year that Kappa Mu Sigma disappeared (1927), a women's committee within the American Chemical Society formed. No evidence linking the two groups has been found, however. For more on the formation of the "Women's Service Committee" of the American Chemical Society, see Rossiter, *Women Scientists in America*, vol. 1, 303-304.

³⁵ Marta Navia Kindya, *Four Decades of the Society of Women Engineers* (New York: Society of Women Engineers, 1990), 9-10.

reporter explained, “will be the gift of America’s women to the foremost scientific leader of their sex.” Flanked by members of the Woman’s Committee of the Madame Curie Radium Fund, President Warren Harding awarded the present to Curie at a White House ceremony on May 20. In front of 600 congressmen, diplomats, scientists, philanthropists, and other individuals, Curie accepted the ribbon-draped box and key containing a model of the thimble-sized vial of radium, which was safely stored off-site.³⁶ Other events in Curie’s whirlwind tour included an opening reception at Carnegie Hall, where she was feted by 3,500 university women, the largest gathering of college women ever held in the United States, as well as commencement exercises at Smith, Wellesley, Northwestern, Pittsburgh, Columbia, Pennsylvania, and Yale, where she received honorary degrees. The Naples Table Association also made a special presentation to Curie and Iota Sigma Pi recognized her as its first honorary member.³⁷

The extensive publicity surrounding Curie’s visit reflected the country’s general fascination with science as well as a heightened awareness of women’s scientific capabilities. But her visit did less to open doors to female scientists than it did to raise the bar of scientific success. “Wasn’t it symptomatic,” inquires Margaret Rossiter, “of a kind of persistent and pernicious double standard that it took a Madame Curie with two Nobel Prizes to ‘prove’ that

³⁶ Rossiter, *Women Scientists in America*, vol. 1, 122-127; Kevles, *The Physicists*, 204; “Mme. Curie Likes Gift Plan: Women Propose Present of \$100,000 Gram of Radium,” *New York Times*, February 12, 1921, 13; “Radium Presented to Madame Curie: Vial Containing Gram, Given by American Women, Is Handed to Her by President,” *New York Times*, May 21, 1921, 12.

³⁷“Says Women Can and Must Stop War: M. Carey Thomas Calls on Sex to Force Action ‘Under Pain of Revolution,’” *New York Times*, May 19, 1921, 11; Kelves, *The Physicists*, 204; Agnes Fay Morgan, ed., *A History of Iota Sigma Pi* (Berkeley: Iota Sigma Pi, 1953), 23.

women could do work in science, when everyone had assumed that men could do so?”³⁸ In some cases, even Curie’s Nobel Laureate status was still not enough to achieve the recognition enjoyed by a similarly-credentialed man. Harvard, for example, held a reception for Curie, but resolutely refused to confer on her an honorary degree.³⁹ Media coverage, however, rarely mentioned continued obstacles such as these and instead focused on Curie’s predilection for hard work, her self-sacrificing nature, and her triumph over personal adversity.⁴⁰ The image of the successful woman scientist that Curie projected served as a model for many American women scientists during the 1920s and 1930s. Instead of outwardly protesting and calling attention to their situation (as their feminist predecessors had done), most women of this generation adopted the less confrontational approach of intentional overqualification and personal stoicism. They bowed to the expectation that before they would be regarded as even moderately successful in science, they would have to be far better than their male counterparts. It would take an exceptional woman to be considered the equal of a mediocre man.⁴¹

For the next two decades, many women scientists exercised what Rossiter refers to as the “Madame Curie strategy.” On both the baccalaureate and graduate levels, they persisted

³⁸ Rossiter, *Women Scientists in America*, vol. 1, 122.

³⁹ Interestingly, the 1921 ceremony marked the first time that Harvard awarded academic degrees to women: thirty-six received master of education degrees from Harvard’s Graduate School of Education. “Harvard Confers Degree on Angell,” *New York Times*, June 24, 1921, 15; “Mme. Curie in Boston—Will Receive Degree from Wellesley on Monday,” *New York Times*, June 19, 1921, 25; Rossiter, *Women Scientists in America*, vol. 1, 125-126.

⁴⁰ “Madame Curie’s Genius,” *New York Times*, May 1, 1921, 88; Rossiter, *Women Scientists in America*, vol. 1, 126-127.

⁴¹ Rossiter, *Women Scientists in America*, vol. 1, 129-130.

with their studies and, as the misleadingly labeled *American Men of Science* directory reveals, were often better educated than the men in their field. Through hard work and perseverance, they hoped to overcome sexual stereotypes and other obstacles to their advancement. They also avoided drawing negative attention to themselves and counseled other women to do the same.⁴² When advising another woman on her “chance in this so called man’s profession,” for example, Elsie Eaves of the *Engineering News-Record* wrote, “I think that women should enter the field of civil engineering and advance in it through their ability and without the benefit of ballyhoo.”⁴³ Eaves, who became first female member of the American Society of Civil Engineers in 1927, clearly embraced the “Curie strategy” of quiet diligence and dedication. Both she and other women in this era were painfully aware that the example they set would affect not only their own career paths, but also the experiences of women to come.

Even explicit attempts to organize reflected this environment of caution. In 1927, the same year that Kappa Mu Sigma mysteriously vanished after taking on the American Chemical Society, a women’s committee was formed within the ACS. Female members of the ACS had been holding informal luncheons since 1924 when their membership verged on 500. At one luncheon in 1926, the group chose Glenola Behling Rose to start a more formal women’s organization. Rose, who had worked as a chemist at the Du Pont Company since

⁴² Rossiter, *Women Scientists in America*, vol. 1, 130, 159, 25, 315. Although it included women since 1906, the *American Men of Science* did not change its name until 1971. See also Margaret W. Rossiter, *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995), 380.

⁴³ Elsie Eaves to Miss Swaty, March 2, 1936, Elsie Eaves Correspondence, Box 1, Records of the American Society of Women Engineers and Architects, Walter P. Reuther Library, Wayne State University.

1918, had been active in other women's organizations as well. She had, for instance, presented Marie Curie with a membership pin on behalf of Iota Sigma Pi in 1921.⁴⁴ But after some deliberation, she and a committee of five now decided against forming a separate association, for fear that its purpose might be misconstrued or interpreted negatively. Instead, they proposed to the all-male governing council of the American Chemical Society an innocuous-sounding "Women's Service Committee" that would help to increase women's membership in the general organization. Rose and her colleagues were glad to have their proposal accepted, but were uncertain about how to proceed. In 1928, Lois Woodford, who had been on the executive committee of the American Chemical Society's New York section during the Kappa Sigma Mu incident and who had been unsuccessful in swaying members to change the exclusion policy now recommended to Rose that their agenda be "not too aggressive—just enough to keep the ball rolling." Consequently, most of the Women's Service Committee's early activities would be devoted to arranging women's luncheons at the semiannual American Chemical Society meetings, although they would also poll ACS section leaders about women's involvement in local chapters.⁴⁵

In the shadow of the Great Depression, the Women's Service Committee (as well as women scientists more generally) found it increasingly necessary to address the economic conditions restricting women's employment. The growing sentiment that available jobs should be reserved for male breadwinners meant that many women scientists (including

⁴⁴ Rossiter, *Women Scientists in America*, vol. 1, 303-304; Morgan, *History of Iota Sigma Pi* (1953), 23.

⁴⁵ Rossiter, *Women Scientists in America*, vol. 1, 303-304, 395n13, 395n20; Lois Woodford quoted in Rossiter, *Women Scientists in America*, vol. 1, 304.

Glenola Behling Rose) found themselves being laid off or unable to obtain jobs.⁴⁶ Spurred by the crisis, which hit chemistry particularly hard, several older women fired off a new round of vocational advice that more fully addressed the circumstances faced by aspiring female chemists. In a series of symposia and articles, they delineated women's bleak prospects in the field and prescribed proper behavior for women still seeking to enter it. Although they continued to endorse patience and stoicism, they no longer advocated defying sexual stereotypes through overqualification. In light of the economic situation, direct competition with men for the few available jobs now seemed a less desirable strategy—no matter how qualified the woman might be. Versatility and a willingness to accept employment in scientific “women's work,” they argued, represented more realistic approaches.⁴⁷

In the depths of the Great Depression, the familiar fields of home economics, nutrition, and bacteriology offered alternatives to unemployment, as did new “hybrid” positions in the chemical industry. These jobs as chemical librarians, chemical secretaries, bibliographers, and abstractors had emerged in the aftermath of the First World War as the American chemical industry underwent enormous expansion, reorganization, and bureaucratization. The war had forced the embryonic industry to grow up quickly because it could no longer depend on German imports. In the postwar years, confiscated German patents made possible even greater growth, and many small companies consolidated into larger firms to produce new products. These conglomerates required new workers to run their offices and staff its libraries. Women—especially those with chemical training and advanced

⁴⁶ Ibid., 304.

⁴⁷ Ibid., 252-253, 315, 383n6.

degrees—seemed a perfect fit. The proliferation of chemical research during these years also made it necessary for chemistry publications to hire extra editorial help. Women chemists, again, fit the bill quite nicely. What these old and new forms of scientific “women’s work” had in common were their relatively low salaries and their diminished prestige, especially when compared to jobs held by male chemists with equivalent education.⁴⁸

Embracing feminine fields—instead of defying sexual stereotypes—served as a survival tactic for hard times but hardly promised lasting change or reform. Some women, such as chemist Florence Wall, treated these new hybrid positions with suspicion from early on and viewed them as dead-ends. In 1934, she warned that several years as a librarian would destroy a woman’s prospects for a career in chemical research. As an alternative, she proposed a different kind of women’s work in the booming field of cosmetic chemistry. In the post World War I era, make-up and cosmetics sales skyrocketed as technological innovations in photography and motion pictures, the popularity of movie stars, and an emerging consumer culture all influenced women’s attempts to fashion themselves and their appearances. Members of Iota Sigma Pi had tapped into this market since the early 1920s by manufacturing and selling batches of cold cream, hand lotion, and vanishing cream as fundraisers. On a much larger scale, the growing cosmetics industry seemed to offer a niche for women chemists in Hollywood and New York City. But during the Depression, even these jobs went to men and ultimately, the field of cosmetic chemistry never became as feminized as Wall had expected. By 1939, she had given up the hope that women chemists

⁴⁸ Ibid., 252-253, 315.

could carve out much room for themselves in the cosmetics industry. In its place, she began advocating secretarial work, which she now celebrated as an “opening wedge.”⁴⁹

Wall’s “wedge” theory reflected her realization that women needed to secure whatever foothold they could by taking the work available to them or risk being run out of the field altogether. Although this strategy was most common in chemistry, women in other fields advocated it as well. In 1936, for example, Elsie Eaves advised an engineering student to undertake secretarial training as a “practical means of getting [her] first job.” Eaves remarked that she found such preparation to be “an excellent wedge” and “would add that equipment to [her own] engineering training” if she were starting out again.⁵⁰ In reality, however, these secretarial positions offered less in the way of professional advancement than Eaves (and later Wall) had speculated. Most women found themselves promoted only when their bosses moved up the corporate ladder and few actually transitioned to meaningful positions in scientific research. Older forms of women’s scientific work in home economics and nutrition held more promise in terms of promotion and research opportunities. But these fields also suffered from diminished prestige and the women who worked in them—either purposely or reluctantly—found that their experience did little to help them springboard into other branches of science (even when the work was practically the same.)

⁴⁹ Ibid., 253-254; Florence Wall quoted in Rossiter, *Women Scientists in America*, vol. 1, 254; “History: Oxygen Chapter,” [1923?] and Marion Brimston to Miss Woodruff, March 3, 1928, Folder 3, Box 19, ISP, WISE; Kathy Peiss, *Hope in a Jar: The Making of America’s Beauty Culture* (New York: Metropolitan Books, 1998), 191-192.

⁵⁰ Elsie Eaves to Miss Swaty, March 2, 1936, Elsie Eaves Correspondence, Box 1, Records of the American Society of Women Engineers and Architects, Walter P. Reuther Library, Wayne State University.

Even established professionals such as engineer and scientific management expert Lillian Moller Gilbreth had a hard time breaking into industry. For twenty years, Gilbreth worked closely with her husband, Frank, to pioneer the field of time-and-motion studies. After his death in 1924, the widow and mother of twelve children carried on their family consulting business and experimented with other types of work, such as teaching. Whenever profitable, she used her situation as a single mother of a large family to generate interest in her ability and experience. But while this strategy (and her late husbands' professional contacts) propped doors open for her, she still faced discrimination as a woman and was rebuffed for industrial employment. Working on her own as a consultant, she focused instead on writing books on human management, designing efficient kitchens, and renovating homes for handicapped persons.⁵¹ No matter how qualified (Gilbreth had a Ph.D.), women found that industry's antipathy toward women scientists was widespread. As late as August 1939, Nellie Naylor of Iota Sigma Pi lamented, "We have to realize the fact that women are not as a rule wanted in industry."⁵²

Just weeks later, in September 1939, Hitler's troops invaded Poland. France and Great Britain retaliated by declaring war on Germany, though they would not engage in actual combat for another seven months. The "sitzkrieg," as it became known, ended abruptly in May 1940 when Germany overtook the low countries and forced France to surrender. The

⁵¹ Jane Lancaster, *Making Time: Lillian Moller Gilbreth—A Life Beyond "Cheaper by the Dozen"* (Boston: Northeastern University Press, 2004), 228-231; Rossiter, *Women Scientists in America*, vol. 1, 262. Mounting bills and erratic paychecks, however, finally led Gilbreth to a salaried professorship at Purdue University in 1936.

⁵² Nellie Naylor, quoted in "Report of the Eighth Triennial Convention of Iota Sigma Pi," held at the State University of Iowa, Iowa City, Iowa, August 30-31, 1939, Folder 8, Box 10, ISP, WISE.

United States—while still divided over its own role in the conflict—declared a national emergency and began defense preparations, thus precipitating a series of events that would generate both possibilities and problems for women scientists. Female activists would soon coalesce as national forces mobilized science for war. New national agencies, American industry, and institutions of higher education would all play a part in their efforts to include women as a source of scientific personnel. As we will see in the next chapter, the same forces that would facilitate women's increased involvement in scientific and technical fields—the recognition of science's role in wartime, increased federal support for science, and activists' own appeal to national defense—would simultaneously expand and constrict the possibilities for women's scientific participation.

CHAPTER 2

“Let Science Help to Win the War”¹

On a crisp fall day in October 1942, New Jersey College for Women (NJC) sophomore Doris Skillman strolled into the school chapel, took her seat, and waited for weekly assembly to begin. Moments later, academic dean Albert Meder approached the stage and announced that the war would be a long one and would certainly drain the much-needed pool of trained scientists and mathematicians. Skillman recalled that Meder then took a deep breath and “told us ladies that he was going to say something about choosing a major that he had never said to NJC students before.” Intrigued, she listened closely as “he said strongly, imploringly, that if we had any tendency to do math or sciences at all, we should major in those fields.”²

Doris Skillman abandoned her plan to pursue the dramatic arts and enrolled in the department of mathematics. Two years later, as she prepared to graduate from college, Skillman learned that Brown University’s graduate mathematics program had begun accepting women. She applied, was accepted, “and got a full scholarship there before there were ladies rooms on most of the Brown campus.” “Eventually I earned my Ph.D. at Brown in pure mathematics,” Skillman remembered, “and surely all those opportunities for me to

¹ Maude Slye, quoted in “Birth Party Celebration at the Annual Convention Luncheon,” *Sigma Delta Epsilon News* 8, no. 1 (February 1942), 6, Early Sigma Delta Epsilon Newsletters folder, Box 6, Sigma Delta Epsilon Records (hereafter cited as SDE, Rare and Manuscript Collection, Carl A. Kroch Library, Cornell University (hereafter cited as KLCU)).

² Doris Skillman Stockton, entry in *Douglass Class of 1945 50th Reunion*, ed. Jean Comeforo and Jay Comeforo (New Brunswick: Rutgers University, 1995), 23.

study math while the men were digging fox holes existed in large part because the Japanese had bombed Pearl Harbor.”³

Skillman’s experience is significant because it illustrates how escalating wartime anxieties helped to legitimize new opportunities for college women in scientific and technical fields. As the draft depleted the enrollment of college men and the general need for trained personnel soared, otherwise unwilling educators, industrialists, and government officials increasingly turned to female students.⁴ But this decision did not come about automatically or immediately. Although the importance of science and its practitioners to the war had been well established, the “utilization” of women had been left out of early discussions. Few women, for example, were initially included in the National Roster of Scientific and Specialized personnel, which the federal government had established in 1940 to facilitate identifying and locating individuals with relevant expertise.⁵ Nor were they well-represented in the early phases of what would become the Engineering, Science, and Management Defense Training (ESMDT) program. Although the federally-funded training program, which Congress approved in 1940, even included an anti-discrimination clause formally preventing any exclusion on the grounds of sex or race, it initially targeted (white) men.

³ Ibid.

⁴ By the fall of 1942, the demand for physicists alone had already surpassed the number of graduating physics majors by three or four times. Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (New York: Knopf, 1977; reprint, with new preface, Cambridge: Harvard University Press, 1995), 320.

⁵ Leonard Carmichael, “The National Roster of Scientific and Specialized Personnel,” *Science* 92, no. 2381 (August 16, 1940): 135-137.

Consequently, during the program's first year, women made up less than one percent of participants.⁶

The gradual decision to recruit, train, and employ women scientists was the product of numerous debates and discussions that took place between female activists, educators, industrialists, and bureaucrats throughout the war years. Many female activists found that they had to balance their desire to include women as a source of scientific expertise with their interest in women's education more generally. Not only did wartime conditions fuel debates about the purpose of women's schooling, but they also raised new questions about the relationships among education, industry, and the federal government as all three scrambled to maintain a continuous supply of technically trained personnel.

The Subcommittee on Women in College and National Defense⁷

Some of the earliest discussions regarding college women's wartime roles took place at the meetings of the Subcommittee on Women in College and National Defense, which had been established in October 1940 under the auspices of the National Committee on Education and Defense.⁸ Sweet Briar College President Meta Glass, one of the two women on the

⁶ Margaret W. Rossiter, *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995), 15.

⁷ Other variations of the committee's title were the "Sub-committee on Women in College and Defense," the "Subcommittee on Women in College and Defense," "Subcommittee on Women's Colleges and National Defense," and the "Committee on Women in College and National Defense"

⁸ The National Committee on Education and Defense had been established in August 1940 by the American Council on Education and the National Education Association. It initially consisted of representatives from fifty-five national educational organizations, including the American Association of University Women, the National Association of Deans of Women, the American Association for Advancement of Science, and the Society for the Promotion of Engineering Education. Five more organizations were later added, bring the total to sixty. Five more organizations were later added, bringing the total to sixty. George F. Zook, "Foreword," in *Organizing Higher Education for National Defense*, ed. Francis J. Brown, iii-v (Washington, D.C.: American Council on Education, 1941); Meta Glass to Virginia C. Gildersleeve, September 5, 1941 (list of organizations

national committee, had recommended the creation of a women's subcommittee. Having just returned from a recent gathering of women's college representatives, Glass reported to her colleagues that it was "clear that these institutions can have a fine...service to render." Although many women's schools had already formed organizations on their individual campuses to determine how they might contribute to national defense, a broader, coordinated effort now seemed necessary. In response, the executive board voted to authorize a Subcommittee on Women's Colleges and National Defense, which Glass would chair.⁹

Glass's national reputation, along with her educational, administrative, and wartime experience, made her an obvious candidate for the position. No stranger to politics, the sixty-year old Glass hailed from a prominent and well-connected Virginia family. Among her eleven siblings were U.S. Senator Carter Glass and Assistant Treasurer of the United States Marion Banister. Glass herself was also well-known, particularly in educational circles. After serving as national president of the American Association of University Women between 1933 and 1937, she became the second woman to preside over the Association of American Colleges in 1939. Her fifteen years as Sweet Briar president further bolstered her influence,

printed on back of National Committee on Education and Defense stationery), folder 85, Box 6, Dean's Office/Departmental Correspondence, 1940-1941, Barnard College Archives, Barnard College (hereafter cited as BCA).

⁹ Meeting minutes, National Committee on Education and Defense, Washington, D.C., October 9 and 10, 1940, folder 19, reel 143, American Association of University Women Archives, 1881-1976, microfilm edition (hereafter cited as AAUW). The other woman on the executive board was school superintendent and secondary school teacher Agnes Samuelson of the Iowa State Teachers Association. "Educators Meet for Defense Aid," *New York Times*, September 8, 1940, 25.

especially among women's college administrators who frequently consulted her on issues pertaining to women's higher education.¹⁰

Glass assumed the presidency of Sweet Briar College in 1925, following a five year stint at Columbia University as Assistant Professor of Latin and assistant to the Director of University Extension. The trip from New York City to Virginia must have seemed familiar, as she had made the same one thirteen years earlier (and many times in-between) after earning her Ph.D. from Columbia in 1912. With a newly-minted doctorate in Greek and Latin, Glass had returned to her family's home in Lynchburg and spent the next four years teaching at Randolph-Macon Women's College, where she had earned her bachelor's and master's degrees. In her leisure time, she made regular visits to her niece who was then a student at Sweet Briar College—only twelve miles from Lynchburg. Glass remained at Randolph-Macon until 1917, at which time she resigned in order to assist the YWCA in its war work overseas. Stationed in France, she directed the YWCA's hospital work and also headed the Training School for European Women. For her efforts, the French government awarded her the Reconnaissance Francaise in 1920. Glass then returned to the United States where she spent five years at Columbia University in both teaching and administrative positions before accepting the presidency of Sweet Briar College.¹¹

¹⁰ Ultimately, Glass presided over Sweet Briar College for a total of twenty-one years. "Dr. Meta Glass," AAUW National Boardmembers, Biographical Information [1946] and "Meta Glass," fellowship announcement, *Journal of the American Association of University Women* 56, no. 4 (May 1963): clipping, folder 29, roll 2, American Association of University Women Records, 1893-1976, AAUW; Martha Lou Lemmon Stohlman, *The Story of Sweet Briar College* (Sweet Briar, VA: Sweet Briar Alumnae Association, 1956), 157, 177-178; Susan Levine, *Degrees of Equality: The American Association of University Women and the Challenge of Twentieth-Century Feminism* (Philadelphia: Temple University Press, 1995), 28-29.

¹¹ "Dr. Meta Glass," AAUW National Boardmembers, Biographical Information [1946], Folder 29, Roll 2, AAUW; Stohlman, *The Story of Sweet Briar College*, 157-158; Levine, *Degrees of Equality*, 29.

Glass's experiences and interests meshed well with the aims of the new Subcommittee on Women in College and National Defense, which held its first meeting on November 23, 1940. Members included, in addition to Glass, Barnard College Dean Virginia Gildersleeve, American Council on Education President George Zook, and representatives from assorted educational institutions (including a teacher's college, a liberal arts college, a state university, and the National Catholic Educational Association.) Although the rapidly changing and uncertain nature of defense preparations precluded anything more than a preliminary report at the time, members agreed that "women, as well as men, all have a definite obligation to serve the nation."¹²

While Glass and her colleagues were eager to delineate women's wartime roles, they cautioned against becoming preoccupied with "the military aspects of defense."¹³ To safeguard higher learning from the dislocations of war (insofar as that was possible), the committee advised colleges to continue offering the liberal arts both as a four-year course and as professional program electives, and to encourage students to complete their studies before pursuing war work. These recommendations blended pragmatism and historical hindsight, as many educators still harbored resentment toward the federal government for what they believed had been an unlawful and unilateral raid on American colleges and universities during the First World War. Educational institutions had relatively little say in wartime planning, and many educators continued to resent the fact that when their schools

¹² "Subcommittee on Women in College and the National Defense," January 15, 1941, 2, folder 85, Box 6, Dean's Office/Departmental Correspondence, 1940-1941, BCA.

¹³ "Committee on Women in College and National Defense," [n.d.], 1, folder 85, Box 6, Dean's Office/Departmental Correspondence, 1940-1941, BCA.

were finally called upon, they were virtually taken over by the military. The debilitating wartime hysteria and violations of academic freedom that ensued further embittered many education officials. The federal government's lack of a comprehensive plan for training scientific and technical personnel only worsened the situation since it resulted in the indiscriminate drafting of (male) faculty members into the Army where they served in roles that underutilized their academic training and talents.¹⁴

Just one month before the subcommittee's first meeting, the American Association of University Women recalled these infractions in a widely circulated article on "The Colleges and National Defense." Published in the association's October 1940 journal, the article noted that "the war of 1914-1918 is still near enough to remember what happened to higher education at that time. College and university life was materially, psychologically, and spiritually disrupted, so that institutions, depleted in faculty and student body, became feeble adjuncts to military organization."¹⁵ Subcommittee members shared many of the author's sentiments, cautioning, "It is even more important in times of stress to retain in our institutions of higher learning these cultural values, as there is grave danger that cultural values will be submerged in the immediate defense needs."¹⁶ This concern with the subjugation of the liberal arts to military initiatives would become a recurring theme in

¹⁴ Samuel P. Capen, "The Effect of the World War, 1914-1918, on American Colleges and Universities," *Educational Record* XXI, no. 1 (January 1940): 40-48; Parke R. Kolbe, *The Colleges in War Time and After* (New York: D. Appleton and Company, 1919), 117-133; V. R. Cardozier, *Colleges and Universities in World War II* (Westport, CT: Praeger, 1993), 4-5. See also Carol S. Gruber, *Mars and Minerva: World War I and the Uses of the Higher Learning in America* (Baton Rouge: Louisiana State University Press, 1975).

¹⁵ "The Colleges and National Defense," *Journal of the American Association of University Women* 34, no. 1 (October 1940): 33.

¹⁶ "Subcommittee on Women in College and the National Defense," January 15, 1941, 3, folder 85, Box 6, Dean's Office/Departmental Correspondence, 1940-1941, BCA.

education circles, particularly in light of the increasing demand for technically trained personnel.

When the committee reconvened in the fall of 1941, its membership roster looked remarkably different. Returning members Meta Glass, Virginia Gildersleeve, and Irma Voigt were now joined by Purdue University Professor and esteemed engineer Lillian Moller Gilbreth, Kansas State College Dean and biochemist Margaret Justin, Bennett College President Willa Player, and Wellesley College President Mildred McAfee. With the exception of Francis J. Brown, who replaced Dr. Zook as the American Council on Education representative, the modified committee consisted entirely of female educators, including two scientists and one African American.¹⁷

At their September 1941 meeting, both new and old members turned their attention to how the demand for college women had changed over the past several months. They referred to a July 1941 conference of educators and military officers, the proceedings for which noted “There is a very great need for men—and an increasing need for women—with specialized training.”¹⁸ Although this demand “had developed less than had been expected” by the time that Glass and her colleagues gathered in September, committee members remained curious about projected future trends. Inquiries to the Civil Service Commission, the Office of Education, the National Roster of Scientific and Specialized Personnel, and the Women’s Bureau revealed that these government agencies also predicted an increasing reliance on

¹⁷ “Sub-Committee on Women in College and Defense,” September 3, 1941, 1, folder 85, Box 4, Dean’s Office/Departmental Correspondence, 1941-1942, BCA.

¹⁸ “Report of Conference of College and University Presidents and Representatives of National Defense Agencies of Government July 30-31, 1941,” *Higher Education and National Defense* no. 13 (August 13, 1941), 3.

college women's wartime participation.¹⁹ Although most of the fields mentioned by government representatives were those that were already dominated by women—such as nursing, nutrition, and social work—the realization that less traditional positions would open up as men left for the military prompted references to bacteriology and economics as well. Committee members remained concerned, however, about the impact of the war on the liberal arts. They acknowledged the responsibilities of colleges to train women “for definite professional and technical work,” but did so cautiously, as the demand for technically trained women was still not large enough to suggest that educational institutions should disrupt their regular courses of study.²⁰

The bombing of Pearl Harbor on December 7, 1941 quickly forced American institutions of higher education to reevaluate their purposes and policies as the country shifted from defense preparations to total war. In response to the attacks, members of the Subcommittee on Women in College and National Defense gathered once again, this time in Baltimore, where they participated in an emergency meeting of college and university presidents. Sponsored by the U.S. Office of Education and the National Committee on Education and Defense, the January 1942 meeting attracted more than 1,000 attendees. It was the largest gathering of leaders in higher education ever assembled to that date.²¹

¹⁹ “Sub-Committee on Women in College and Defense,” September 3, 1941, 1, folder 85, Box 4, Dean's Office/Departmental Correspondence, 1941-1942, BCA.

²⁰ *Ibid.*, 6.

²¹ “Facing the Future,” American Council on Education, *Higher Education and National Defense* no. 19 (December 20, 1941): 3-4; “Baltimore Conference,” American Council on Education, *Higher Education and National Defense* 20 (January 19, 1942): 1; Virginia C. Gildersleeve, “How Barnard Can Help Win the War,” (address, Barnard College, New York, January 13, 1942), addresses 1942, Box 2, personal papers of Virginia Crocheron Gildersleeve (hereafter cited as VCG), BCA.

Speakers at the two day “Baltimore Conference” covered an array of topics, ranging from accelerated coursework to occupational deferment to pre-induction training.²² Yet while the program was broad in scope, it was far from comprehensive. Most important from the viewpoint of Meta Glass and her colleagues, the presentations focused primarily on the schooling of young men. When women were mentioned, it was usually in the context of such traditionally feminine roles as teachers or U.S.O. hostesses. Only U.S. Civil Service Commissioner Arthur S. Flemming explicitly addressed the need for women engineers, chemists, and physicists.²³ Indeed, as New Jersey College for Women Dean Margaret T. Corwin noted, “To the representatives of the colleges for women it was especially baffling to discover how little woman-power had been considered as an element in the man-power which was clearly so urgently needed.”²⁴

For Meta Glass and the members of her subcommittee on Women in College and National Defense, the relative inattention paid to women must have been particularly frustrating. In the aftermath of Pearl Harbor, they viewed their work as more immediate and relevant than ever. But instead of integrating their efforts and insights into the general

²²“Baltimore Conference,” *Higher Education and National Defense* no. 20 (January 19, 1942): 1; Speakers included, but were not limited to, representatives from the armed forces, the National Roster of Scientific and Specialized Personnel, the U.S. Office of Education Wartime Commission, and the American Council on Education.

²³ Arthur S. Flemming, “Some Personnel Needs of the Government War Agencies,” in *Higher Education and the War: The Report of a National Conference of College and University Presidents, Held in Baltimore, Md., January 3-4, 1942*, ed. American Council on Education, 96-107 (Washington DC: American Council on Education, 1942). Flemming later goes on to be in charge of the Office of Defense Mobilization during the 1950s and is often quoted by the Society of Women Engineers and others.

²⁴ Margaret T. Corwin, “1941-1942 Annual Report,” June 30, 1942, 3, Folder 5, Box 11, Douglass College, Records of the Dean (hereafter cited as DCRD), Special Collections and University Archives, Rutgers University Libraries (hereafter cited as RUL).

program, conference organizers shunted them to the side, relegating the question of college women's wartime roles to one special "sectional meeting." The organizers acknowledged Glass's work only by appointing her to chair the session.²⁵

Still, the sectional meeting on "Women in College" held at the end of the conference's first day, did provide a forum for women's college presidents, deans of women, and other educators interested in women's schooling. For more than four hours, the group reflected on the day's events, focusing especially on the virtual exclusion of college women. They reviewed the resolutions circulated by the conference conveners and recommended modifications that would more fully incorporate female students. They also passed resolutions of their own, reiterating the growing need for trained personnel and designating chairwoman Glass "to call to the attention of such government offices and other agencies as may seem suitable, the fact that the 'manpower' of the nation includes also womanpower, and that the ignoring of this fact will result in wasting a large part of the resources of the nation." In doing so, the group resolved, Glass must also "urge upon the authorities the importance of using this woman power in an 'orderly, systematic and intelligent manner,' as they are endeavoring to use men."²⁶

By positing national defense, rather than equity or fairness, at the basis of their grievances, the sectional group achieved some moderate success insofar as the revised resolutions contained several references to women and "woman power." The Baltimore

²⁵ Brown, ed., *Organizing Higher Education for National Defense*, vi; "Report of Conference of College and University Presidents and Representatives of National Defense Agencies of Government July 30-31, 1941," *Higher Education and National Defense* no. 13 (August 13, 1941): 3.

²⁶ "Report of Discussion by Section on Women in College at the Baltimore Conference," January 3, 1942, 1-2, folder 85, Box 4, Dean's Office/Departmental Correspondence, 1941-1942, BCA.

assembly formally agreed, for example, that institutions of higher education and government agencies should cooperate in determining “the immediate needs of man power and woman power for the essential branches of national service—military, industrial, and civilian.” But most resolutions still focused on men while most references to women were subsumed in the grab bag section on “Allocation of Total Man Power,” thereby foreshadowing the limitations of folding women’s issues into national defense discourses that visibly excluded women.²⁷

Over the next several months, as the country became further embroiled in the international conflict, female activists became increasingly determined to situate the question of “womanpower” at the center of policy debates and recommendations. In March 1942, over 100 educators, industrialists, and government officials interested in the subject assembled in Washington D.C. for a special conference on “War Demands for Trained Personnel.” Members of Glass’s subcommittee were also in attendance, and several—such as Barnard College Dean Virginia Gildersleeve and Purdue University engineer Lillian Moller Gilbreth—had a long history of collaboration with the conference’s sponsor, the Institute of Women’s Professional Relations.²⁸

The Institute had been established in 1928 by Catherine Filene Dodd (later Shouse) to expand opportunities for women in non-traditional fields. Its founder, the daughter of Boston merchant and philanthropist Lincoln Filene, had served as Mary Anderson’s assistant at the

²⁷ “Resolutions and Recommendations,” in *Higher Education and the War*, ed. American Council on Education, 153-158.

²⁸ Nona Baldwin, “Agencies Seeking Scientific Women,” *New York Times*, March 15, 1942, 31; Nona Baldwin, “Asks Colleges Aid Women’s War Jobs,” *New York Times*, March 21, 1942, 12; “New Age Perplexes Women’s College,” *New York Times*, March 30, 1935, 17. Lillian Moller Gilbreth served on the Institute’s board of advisers, as noted in “Seek to Bridge Gap from Study to Job,” *New York Times*, October 29, 1939, 10.

new Women's Bureau in 1918. She had also edited the influential vocational handbook, *Careers for Women*, which was published in 1920 and contained more than fifteen entries on various branches of science and engineering.²⁹ Eight years later, with funding from the American Association of University Women, she established the Institute of Women's Professional Relations and named Dr. Chase Going Woodhouse as director. Both Shouse and Woodhouse faced an uphill battle—just one year after the Institute's founding, the Great Depression swept the country and decimated professional opportunities for women. As one survey reported, “with regard to that specially favored class of women, the trained personnel, the immediate outlook is not bright...For the trained workers are unemployed as truly as the untrained.”³⁰

In response to the economic crisis, the Institute sponsored a number of vocational forums and publications designed to help college women eke out whatever careers they could. Most emphasized positions in feminine fields such as home economics, fashion design, and department store retail, where women encountered less competition from men.³¹ Likewise, for female scientists, the Institute found that most opportunities existed as technical librarians and secretaries. These findings were confirmed at a special forum on women in chemistry held by the Institute in April 1939. As other women chemists had done throughout the 1930s, most attendees portrayed secretarial training as an “entering wedge.”

²⁹ Margaret W. Rossiter, *Women Scientists in America*, vol. 1, *Struggles and Strategies to 1940* (Baltimore: Johns Hopkins University Press, 1982), 263-264. See also Catherine Filene, *Careers for Women* (Boston: Houghton Mifflin, 1934).

³⁰ William Fielding Ogburn, “The Outlook for the Trained Woman: A Survey of Trends and Prospects,” *Journal of the American Association of University Women* XXVII, no. 3 (April 1934): 146.

³¹ Rossiter, *Women Scientists in America*, vol. 1, 263-264.

Not all participants agreed, however. The *New York Times* reported that chemistry Ph.D. Ruth O'Brien of the Federal Department of Agriculture "rose in something closely approximating wrath" upon hearing this characterization. According to O'Brien, "For a really able woman chemist bent on maintaining her professional dignity, it is definitely derogatory to permit herself to have anything to do with a typing job." "There is," she charged, "an octopus-tendency of the type-writer to wrap its arms around her and refuse to let her rise above it." But O'Brien held the minority view and most participants agreed that work as a chemical secretary represented an attractive alternative to unemployment. For the time being at least, as the *Times* headline announced, "Sidelines [Were] Stressed for Girl Chemists."³²

As overseas hostilities escalated and the United States mobilized its scientific resources for war, the outlook for technically trained women such as O'Brien appeared to brighten. Seizing this opportunity, the Institute for Women's Professional Relations called its March 1942 conference to clarify "what jobs need[ed] to be filled in the expanding industrial program."³³ This agenda bore the imprint of the Institute's director, Chase Going Woodhouse, who had been recently recruited as a consultant to the federal government's new National Roster of Scientific and Technical Personnel.³⁴ Pembroke College Dean Margaret S. Morriss observed that the conference "pointed up potential needs for women in paid jobs,

³² Kathleen M'Laughlin, "Sidelines Stressed for Girl Chemists," *New York Times*, April 16, 1939, 25; O'Brien quoted in M'Laughlin, "Sidelines Stressed for Girl Chemists."

³³ "To Discuss War Demands: Women's Professional Relations Institute Calls Conference," *New York Times*, March 19, 1942, p. 27.

³⁴ Rossiter, *Women Scientists in America*, vol. 1, 387n33.

conspicuously where a scientific or mathematic background was desired.” But, Morriss lamented:

[V]estigial remains of the old attitude toward women in science could still be found. I remember the distinguished elderly [male] chemist at that conference who brought up again the matter of women’s clothes catching fire in chemical laboratories, but who added reflectively, ‘I suppose that is not important now as they all wear slacks.’³⁵

Most participants, however, were less begrudging than the elderly chemist. Civil Service Commissioner Arthur Flemming, who had been the only presenter at the Baltimore Conference to address specifically the need for women scientists, spoke at this conference as well. His message—that “the largest untapped scientific resource in the country lies with the professionally trained women not now using their scientific knowledge”—was echoed by many others.³⁶ George Bailey of the Office of Scientific Research and Development promised immediate placement of any number of scientifically trained women. And various government branches including the military indicated a need for chemists, metallurgists, physicists, and “laboratory technicians for chemical warfare plants.”³⁷

Also present was Leonard Carmichael, the Director of the National Roster for Scientific and Specialized Personnel. Carmichael, too, had spoken at the Baltimore Conference, where he explained the function of the Roster as a mechanism for identifying and mobilizing “the great resource of America’s trained brains.”³⁸ Although much of his

³⁵ Margaret S. Morriss, “College Women Students and the War,” *The Educational Record* XXIV, no. 1 (January 1943): 36.

³⁶ Arthur S. Flemming quoted in Baldwin, “Agencies Seeking Scientific Women.”

³⁷ Baldwin, “Agencies Seeking Scientific Women,” *New York Times*, March 15, 1942, 31.

³⁸ Leonard Carmichael, “The National Roster of Scientific and Specialized Personnel,” in *Higher Education and the War*, American Council on Education, ed., 108.

Baltimore presentation focused on men, his talk at the conference held by the Institute for Women's Professional relations specifically addressed the demand for female scientists. It is not surprising that he would redirect his emphasis, given his audience at the March 1942 conference. Yet some audience members questioned his sincerity and doubted the amount of effort he claimed to have devoted to locating scientifically trained women for the Roster. Kathryn McHale, the Director of the American Association of University Women, for example, confronted Carmichael in front of the assembly. McHale charged, "I still am skeptical of your belief in the available resources. I don't think that you have really tapped them in a nation-wide sense. It is inconceivable, with the higher education of women having gone on nearly three periods of twenty-five years each, that you have tapped the supply available in my own Association alone."³⁹ As if to call his bluff, she demanded further action and offered the services of the A.A.U.W. to help him and his agency attain their "goal" of locating additional women. After all, she urged, "you have the alumnae publications, as well as the *Journal of the American Association of University Women* as one kind of common channel, but there would be other ways in which you could make this nation-wide appeal."⁴⁰

McHale's recommendations for enlisting female scientists were taken up by Meta Glass's committee the following month. At the April 1942 meeting of the Committee on College Women and Defense, which both Chase Going Woodhouse and Catherine Filene Shouse attended, members drafted a "Program for Full Utilization of Specialized Women

³⁹ Kathryn McHale, quoted in "Discussion," in *War Demands for Trained Personnel: Proceedings of the Conference Held at the Mayflower Hotel, Washington, D.C., March 20 and 21, 1942*, ed. Institute of Women's Professional Relations, 42 (New London: Institute of Women's Professional Relations, 1942).

⁴⁰ Ibid.

Power,” which focused on locating and recruiting scientifically trained women. In addition to identifying four distinct groups of college women with specialized training, the program called for a clearinghouse service to distribute information about government-sponsored courses in shortage fields. Other recommendations included establishing city-wide or regional placement committees, assisting with registration for the National Roster of Scientific and Technical Personnel, and distributing statistics on shortage occupations to colleges and universities enrolling women. The program reflected a growing realization among both committee members and other segments of society that the training of college women could help alleviate the wartime shortage of scientific personnel. Any woman interested or capable of scientific work should be not only encouraged, but “conserved for this training and, in the case of qualified women, at least, not diverted to other tasks.”⁴¹

By the summer of 1942, the training of women scientists had gone from a nominal concern to an issue of national significance openly acknowledged by university, industry, and government officials. On July 15 and 16, educators reassembled in Baltimore and drafted what would become “The Statement of Second Baltimore Conference on Higher Education and the War.” Sent to various high-ranking government and military officials, the “Statement” argued that the present plans for the training of college students were inadequate because “they fail to include women, who...have a vital part to play in the national effort.”⁴² Later that month, the U.S. Office of Education reiterated this sentiment when it

⁴¹ Robert Leigh, “Suggested Program for Full Utilization of Specialized Womanpower,” April 1942, 2 and meeting minutes, Committee on Women in College and Defense, Washington, D.C., April 22, 1942, 1-2, folder 85, Box 4, Dean’s Office/Departmental Correspondence, 1941-1942, BCA.

⁴²“Second Baltimore Conference,” *Higher Education and National Defense* no. 31 (July 24, 1942): 1-3.

recommended to the Chairman of the War Manpower Commission that “[t]he enlistment and training of college women for war service in scarcity fields is indispensable in meeting the total manpower problem, and women students should therefore be specifically included in the comprehensive, coordinated plan.”⁴³ But even while Meta Glass and her colleagues had seemingly succeeded in folding women into wartime planning, women’s concerns would, in many ways, remain peripheral to plans already underway as well as national defense concerns more generally. This dilemma would continually resurface as female activists struggled to create and extend meaningful opportunities to women in the sciences and technical fields.

Virginia Crocheron Gildersleeve and “The War of the Trained Brains”⁴⁴

For most female activists, the findings of the Second Baltimore Conference held in July 1942 nevertheless seemed encouraging. Just six months earlier, after all, many of these women had left the First Baltimore Conference disheartened by the parade of speakers touting the need for technically trained men. Despite their shared displeasure with this incident, however, female activists’ responses were hardly uniform. While Meta Glass explicitly pointed up the exclusion of women, for example, others, such as Virginia Gildersleeve pursued a less confrontational approach. Instead of lamenting the obvious omission, she simply and unapologetically applied the conference findings to female

⁴³“A Recommendation to the Chairman of the War Manpower Commission Concerning the Mobilization and Utilization of the Facilities of Higher Education for War Service Training,” as Revised and Approved by the Divisional Committee on Higher Education of the U.S. Office of Education Wartime Commission, July 30, 1942, 6, Confidential File, Proposals for Wartime College Training Programs; Division of Higher Education; Records of the Office of Education; Record Group 12, National Archives II, College Park, Maryland (hereafter cited as NACP).

⁴⁴ Virginia Crocheron Gildersleeve, *Many a Good Crusade* (New York: Macmillan Company, 1954), 249.

students. She even adopted Leonard Carmichael's phrase "trained brains" as the slogan for her own wartime campaign to expand opportunities for college women. But in uncritically doing so, she failed to interrogate the gendered unpinning of this term, particularly how and why scientific knowledge had come to mean male.

Gildersleeve's decision to exploit this arguably problematic phrase (and national defense rhetoric more generally) can best be understood in the context of her experiences as dean of Barnard College, the women's college at Columbia University. Appointed to the post in 1911, Gildersleeve had spent the previous thirty years negotiating the male-dominated university system. In addition to her regular duties at Barnard, Gildersleeve also served as the advisor to Columbia's female graduate students and as the only woman on numerous university-wide committees. While a staunch advocate of opportunities for women in education and professional life, she believed that "[a]s I was not battering at the doors from without, but working from within, it was important to avoid as far as possible creating antagonisms." In seeking women's admission to several of Columbia's professional schools during the 1910s and 1920s, for example, Gildersleeve had found that "it is best whenever possible just to get a first-rate woman slipped in as unobtrusively as may be and then let her show that she is not troublesome and that she can do work as sound as the men students and perhaps better."⁴⁵

Similarly, when conveying the wartime demand for "trained brains" she "slipped in" women with little indication that their scientific participation had been overlooked initially.

⁴⁵ Gildersleeve, *Many a Good Crusade*, 97-98. See also Rosalind Rosenberg, *Changing the Subject: How the Women of Columbia Shaped the Way We Think About Sex and Politics* (New York: Columbia University Press, 2004).

At a January 1942 assembly of Barnard students, she reported on the first Baltimore Conference, adding that it “was a very important occasion. It was also on the whole a cheering one.” As various Baltimore speakers had done, she delineated the serious shortage of physicists, chemists, engineers, and mathematicians. But instead of limiting her discussion to men, Gildersleeve expanded the shortage to include women when she said, “you, the students of Barnard College are already ‘trained personnel,’ ...[or]...are on the way to being trained for those jobs where the shortage is especially acute and serious.”⁴⁶ Later that month, she—along with Lillian Moller Gilbreth and others—put the finishing touches on a women’s engineering program that would begin in February at the Stevens Institute of Technology.⁴⁷ And in March, she took her message to the national level in a *New York Times* article entitled “We Need Trained Brains,” which featured a photograph of four female scientists.⁴⁸

Virginia Gildersleeve’s interest in science might seem surprising, given her background in history, English literature, and international relations. Born in 1877, the New York City native attended the Brearly School before entering Barnard College in 1895.⁴⁹ “Though Barnard was still small and poor,” Gildersleeve recalled, “it had the priceless advantage of membership in Columbia University,” where she studied with such luminaries as sociologist Franklin H. Giddings, historian James Harvey Robinson, and philosopher and

⁴⁶ Gildersleeve, “How Barnard Can Help Win the War.”

⁴⁷ “Stevens Offers Course for Women,” *New York Times*, January 5, 1942, 14.

⁴⁸ Gildersleeve, “We Need Trained Brains,” *New York Times Magazine*, March 29, 1942, 18, 37.

⁴⁹ The Brearly School was an all-girls school designed to help students pass Harvard entrance exam. See Gildersleeve, *Many a Good Crusade*, 35.

Columbia University President Nicholas Murray Butler.⁵⁰ After graduating in 1899, she remained at Columbia for an additional year to complete a master's degree in medieval history under the direction of Robinson, who had also directed her undergraduate thesis. For the next five years, she taught first-year composition at Barnard before enrolling in Columbia's Ph.D. program in English. Gildersleeve completed her dissertation on *Government Regulation of Elizabethan Drama* and earned her doctorate in 1908. Unwilling to leave New York, she turned down an associate professorship at the University of Wisconsin and spent the next several years cobbling together various teaching assignments at Columbia and Barnard. In 1910, she landed an assistant professorship in Barnard's English Department and the following year, Nicholas Murray Butler appointed her as Dean of Barnard College and Adviser of Women Graduate Students, a shared title at the time.⁵¹

Virginia Gildersleeve had barely unpacked her office when she encountered one of her first tests as dean. The mother of a senior approached Gildersleeve, begging her to forbid Barnard students from marching in the Fifth Avenue suffrage parade. The mother claimed that "to march in a parade would be a shocking and shameful thing for them to do and would injure the College greatly."⁵² But instead of interfering with the suffragists, Gildersleeve encouraged them. She believed that both students and faculty should freely participate in the era's political and social movements. Not surprisingly, Barnard claimed such various

⁵⁰ Gildersleeve, *Many a Good Crusade*, 47.

⁵¹ Gildersleeve, *Many a Good Crusade*, 47-65, 98. See also Rosenberg, *Changing the Subject*, 121-122.

⁵² Gildersleeve, *Many a Good Crusade*, 71; Rosenberg, *Changing the Subject*, 123.

organizations as a chapter of the New York State Woman Suffrage League and an openly acknowledged Socialist League.⁵³

Gildersleeve herself belonged to a variety of social and political organizations. Her position as Dean of Barnard College made her an automatic member of the Naples Table Association for Promoting Laboratory Research by Women. Founded by M. Carey Thomas in 1898, this group drew its support primarily from the leaders of women's colleges, whose institutions had a strong record of encouraging women's scientific participation, as well as female scientists. As her predecessors at Barnard had done, Gildersleeve served as a member of the general committee until the group's dissolution in 1932.⁵⁴ She was also something of a celebrity among educators, both in the United States and around the world. An indefatigable presence within the American Association of University Women, she chaired its first Committee on International Relations between 1918 and 1922. Through her work with that committee, she helped to found the International Federation of University Women in 1919 and served as its president on two separate occasions.⁵⁵ And in 1926, she became the first woman to chair the American Council on Education, the largest and most influential group of educators in the United States.⁵⁶

⁵³ Rosenberg, *Changing the Subject*, 123.

⁵⁴ Donald Glassman, Barnard College Archivist to author, 5 September 2006; photo of Gildersleeve with Naples Association appears in Rossiter, *Women Scientists in America*, vol. 1, 307.

⁵⁵ Gildersleeve attributes the IFUW's birth to moment in 1918 when she gathered with Rose Sidgwick and Caroline Spurgeon at their quarters in New York. Sidgwick died of influenza that year, and the IFUW was not founded until the following year. Gildersleeve drafted the constitution. The first conference was held in 1920. Gildersleeve, *Many a Good Crusade*, 129-135.

⁵⁶ Office of Public Relations, Barnard College, biography of Virginia Crocheron Gildersleeve, September 1962, 1-7, Gildersleeve Correspondence Folder, Box 1, President's Office, BCA; Levine, *Degrees of Equality*, 18.

Despite Gildersleeve's obvious interest in the education and advancement of women, she harbored ambivalent feelings toward organized feminism. As historian Rosalind Rosenberg notes in her study of women at Columbia, Gildersleeve assumed the deanship "just as the women's movement in New York was shifting into a new phase, one that spoke more forthrightly about claiming the rights and privileges of men, rather than being satisfied with expanding the traditional role of women."⁵⁷ Yet Gildersleeve distanced herself from those "militant feminists" known for their divisive tactics and flamboyant protests. She preferred instead her own strategy of what she called "boring from within." Her experiences at Columbia taught her that "Men dread the prospect of having a woman around...If she is to gain any influence, she must establish herself as a pleasant, amiable, but intelligent human being, no trouble but rather a help. The men can then turn to her in any puzzling questions involving women, perhaps enjoy her protection in warding off attacks by militant feminists from outside, and in time will lend an attentive ear to her own projects."⁵⁸

From the beginning of her deanship, Gildersleeve embraced this strategy for gaining the trust and respect of her male colleagues and it seemed to pay off. In 1915, the Columbia chapter of Phi Beta Kappa asked her to deliver the address at its annual convocation and to become the first woman in its history to do so. After accepting the invitation, she received from physics Professor Harold Webb a list of previously covered topics to guide her with her talk. They included "Competition in College," "New Humanities for Old," and "The College Man's Opportunity in Public Life." Gildersleeve reviewed and quickly cast aside these

⁵⁷ Rosenberg, *Changing the Subject*, 119, 123.

⁵⁸ Gildersleeve, *Many a Good Crusade*, 98.

subjects, settling instead on a theme of her own choosing: “Some Guidelines for Feminine Energy.” To justify her unconventional topic, Gildersleeve opened her address by noting that the present year marked the 25th anniversary of Barnard’s founding. “As a representative of a feminine college on a feminine anniversary,” therefore, “I feel committed to a feminine subject, and for this I crave your indulgence.”⁵⁹

The subject of “feminine energy” referred to a familiar justification for restricting women’s scholarly endeavors. It had been most notably espoused and medicalized by Harvard doctor Edward Clarke in his 1873 treatise on *Sex and Education*. Because women’s bodies possessed a finite supply of energy, Clarke argued, any energy devoted to academic pursuits necessarily depleted the amount available for reproduction and household work. Consequently, higher education for women held the threat of “monstrous brains and puny bodies” marred by infertility and domestic disability.⁶⁰

In her Phi Beta Kappa address, Gildersleeve took on Clarke’s theory, as well as male privilege more generally. She reassured her audience that women not only possessed ample energy to pursue academic and domestic activities, but that recent technological innovations had even improved women’s ability to combine the two. Electric lamps meant that women could spend their winter afternoons reading instead of making candles. And improved public health and declining infant mortality meant that women could produce fewer children with better chances of survival. The conveniences of the modern world, according to Gilderlseeve,

⁵⁹ Rosenberg, “Virginia Gildersleeve: Opening the Gates,” *Barnard Alumnae Magazine*, Summer 2001. <http://www.columbia.edu/cu/alumni/Magazine/Summer2001/Gildersleeve.html> (February 1, 2004); Gildersleeve quoted in Rosenberg, “Virginia Gildersleeve: Opening the Gates.”

⁶⁰ Rosenberg, “Virginia Gildersleeve: Opening the Gates;” Edward H. Clarke, “Sex in Education, or A Fair Chance for Girls,” (address, New England Women’s Club, Boston, [1873]).

allowed women to pursue the same educational and vocational opportunities as their male counterparts. In other words, women could have the same ambitions as men.⁶¹

Yet many of Columbia's traditions and policies excluded women, a practice that Gildersleeve sought to change. When Gildersleeve arrived at Barnard as dean, nearly all of Columbia's professional schools were closed to female students.⁶² Her iron determination, as well as a seat on the otherwise all-male University Council, equipped Gildersleeve in her crusade to pry open those doors. Her council position granted her regular access to the deans of all the schools making up the university, as well as the president. At their meetings, Gildersleeve rarely missed an opportunity to bring up the subject of women. Whenever President Butler mentioned new educational ventures, for example, she routinely followed with a question about female students.⁶³ But Gildersleeve quickly found that "most of [her] male colleagues outside Barnard had to be handled rather gently" and she suspected that "[m]en were opposed to letting women in some courses and professional schools largely because they thought the women would cause trouble, would probably weep and faint at inconvenient moments, expect special consideration and privileges, perhaps lower the standards, and in general be a nuisance."⁶⁴

⁶¹ Rosenberg, "Virginia Gildersleeve: Opening the Gates."

⁶² The School of Architecture had decided to admit women in 1910. Rosenberg, *Changing the Subject*, 124, 336n96.

⁶³ Rosenberg, *Changing the Subject*, 124; Rosenberg, "Virginia Gildersleeve: Opening the Gates,"; Office of Public Relations, Barnard College, biography of Virginia Crocheron Gildersleeve; Gildersleeve, *Many a Good Crusade*, 100.

⁶⁴ Gildersleeve, *Many a Good Crusade*, 97.

Not all of Columbia's professional schools were equally resistant to the admission of women, however, and Gildersleeve found that some battles were more easily won than others. With relative ease, she secured a place for women in the newly-established School of Business when it opened in 1916. Crucial to her victory was the fact that the business school had grown out of Columbia's Extension Teaching program, where women were already taking classes. The new School of Journalism had been a tougher battle, but it also agreed to admit women when it opened in 1912. The stiffest resistance came from the older and more established professional schools with a long history of rejecting female applicants. The medical school, for example, had been denying admission to women since 1873 when suffrage leader Lillie Devereaux Blake first petitioned the Columbia Trustees to enroll them. But Gildersleeve finally swayed the dean in 1917 to admit female medical school students under the condition that she would personally select the first candidates and guarantee their success. She employed a similar strategy in her crusade to enroll women in the law school. After a decade-long campaign, the Columbia Law School finally succumbed to "the Gildersleeve treatment" in 1928, when it agreed to admit several Barnard College graduates.⁶⁵

Only the School of Engineering continued to exclude women, a long-standing policy formalized by university trustees in the 1890s and reaffirmed in 1911, the same year that

⁶⁵ Rosalind Rosenberg, "'The Woman Question' at Columbia: From John W. Burgess to Judith Shapiro," (address, Columbia University Seminar on the History of the University, New York, February 17, 1999), http://beatl.barnard.columbia.edu/cuhistory/archives/Rosenberg/woman_question.htm (February 1, 2004); "Virginia Gildersleeve: Opening the Gates"; Rosenberg, *Changing the Subject*, 124-129; Gildersleeve, *Many a Good Crusade*, 99-104. With regard to the opening of the medical school, Gildersleeve had offered to help raise \$50,000 to cover the cost of new women's facilities, which she did with help of the American Women's Medical Association and "an old gentleman from Texas." See Rosenberg, *Changing the Subject*, 127-128.

Gildersleeve became Dean of Barnard College.⁶⁶ Gildersleeve later reflected that “For a good many years I felt that if a really tip-top candidate appeared, I might be able to insert her into the School, but no one did. Then the Second World War changed the situation drastically.”⁶⁷ Indeed, she found that despite its limitations, the wartime demand for scientific personnel provided an indispensable tool in her crusade to enroll women in the School of Engineering.

Gildersleeve’s strategy was a slow and steady one and meshed well with her more general preference for “boring from within.” She recognized early on the importance of science to the defense effort as well as growing opportunities for women in relevant fields. In her 1940-1941 annual report, she noted that Barnard’s Occupation Bureau had already experienced a significant increase in the number of calls for mathematicians, chemists, and physicists and predicted that there would soon be a shortage of physicians and bacteriologists. “It is true,” Gildersleeve argued, “that a reluctance to employ women, developed during the depression, still lingers. But we hope departments and employers will hasten to realize that it is better to appoint a first rate woman than a mediocre man. Soon even the mediocre man will not be available, and they will be forced to employ women, as at the time of the last war. A more speedy realization of the advantages of doing so will help our national efficiency.”⁶⁸

⁶⁶ Rosenberg, *Changing the Subject*, 167. It appears as though women had taken engineering classes before, but were barred by the trustees at the request of the School of Engineering in an effort to ameliorate the social problems posed when men and women geologists were sent into the field. Rosenberg indicates that this decision was essentially upheld in 1911 when professors in the applied sciences persuaded the trustees to amend university statutes “to permit them to exclude women from earning a degree in the School of Mines, Engineering, and Chemistry.” See Rosenberg, *Changing the Subject*, 347n3.

⁶⁷ Gildersleeve, *Many a Good Crusade*, 104.

⁶⁸ Gildersleeve, “Report of the Dean for the Academic Year Ending June 30, 1941,” 14-15, folder 17dd, Dean’s Office/Departmental Correspondence, 1940-1941, BCA.

Gildersleeve's stated interest in efficiency, rather than equity, justified the creation of a National Service Committee at Barnard in 1939. She worked closely with the committee's director, Professor Elizabeth Reynard, with whom she shared an interest in the roles of scientifically trained women (despite their own graduate training in English). Under the auspices of the committee, Reynard and Gildersleeve designed several extracurricular courses to help prepare Barnard students for scientific and technical defense work. In addition to conventional topics such as first aid and motor transport, "National Service" courses offered in 1940 and 1941 included engineering drafting, map reading, and aerial photographic interpretation. The drafting course, which was taught by two members of the Columbia's engineering faculty, helped to extend Columbia's resources to Barnard students although and would later be regarded by Gildersleeve as "the turn of the lock preliminary to the opening of the great [engineering] School to women."⁶⁹

Another of Elizabeth Reynard's early "National Service" projects involved investigating women's participation in the Engineering, Science, and Management Defense Training (ESMDT) program that had been established by Congress in 1940. Although the federally-funded program was only several months old when Reynard began her study—and initially targeted to train what Congress assumed would be male scientific and technical workers—Barnard's National Service Committee viewed women's contributions as equally important. After spending the 1940-1941 academic year surveying women's ESMDT enrollment, Reynard compiled and released the statistics. According to Gildersleeve, "These [figures] were valuable to us as showing in what fields a considerable number of women

⁶⁹ Gildersleeve, *Many a Good Crusade*, 104, 257.

were already equipped, where the gaps were, and how we at Barnard might fit in. Soon we found ourselves in the odd position of being the only agency in the country which knew these facts; not only corporations and organizations but even several government departments asked us for the statistics and said they were very helpful.”⁷⁰

Gildersleeve and Reynard’s interest in wartime science intensified even further once the United States formally entered the war. They realized that the contract system employed by the National Defense Research Committee and its successor, the Office of Scientific Research and Development, had significantly altered the nature of weapons research. As Reynard observed in a memorandum to Gildersleeve, “Notice the decentralization for much of the scientific contribution to the war. You do not have to go to Washington to work, as you do in the non-scientific services.”⁷¹ Gildersleeve was also aware of the Manhattan Project at Columbia, just across the street from Barnard’s gates, and she pressed to have women hired there. She would also house at Barnard one of the nation’s foremost code-breaking programs.⁷² Thus, both Gildersleeve and Reynard believed that Barnard occupied a unique position from which to train women scientists for the war. At a January 24, 1942 meeting of women’s college officials, Reynard asserted that Barnard is “in a key position and may perhaps become the center for training of our front line young war scientists. It will

⁷⁰ Gildersleeve, *Many a Good Crusade*, 258.

⁷¹ Elizabeth Reynard, “Educational Implications of this Use of Scientists,” sent to Virginia Gildersleeve, February 1942, Folder 153, Box 11, Elizabeth Reynard papers (hereafter cited as Reynard papers), Schlesinger Library, Radcliffe Institute for Advanced Study, Harvard University (hereafter cited as Schlesinger).

⁷² Rosenberg, *Changing the Subject*, 180; Gildersleeve, *Many a Good Crusade*, 265; For more on women and the Manhattan Project, see Ruth H. Howes and Caroline L. Herzenberg, *Their Day in the Sun* (Philadelphia: Temple University Press, 1999), 94.

undoubtedly be more closely integrated into the war effort than most colleges for women. Columbia facilities for physics, chemistry, and engineering are being made available to undergraduates and graduates as never before.” Herbert Davis, President of Smith College agreed that the relationship between Barnard and Columbia afforded Barnard a degree of leverage that many other women’s colleges lacked. He recommended to Reynard that Gildersleeve feature that angle and seek federal funding for recruiting and training women in physics, chemistry, mathematics, and electronics.⁷³

A few weeks later, in February 1942, Barnard officials received a telephone call from A. Dexter Hinckley, Columbia’s institutional representative to the Engineering, Science, and Management Defense Training program and the Assistant to the Dean of Columbia’s School of Engineering. Reflecting on his recent meeting with a member of the War Department, Hinckley suggested that ESMDT courses in drafting, laboratory techniques, statistical charting, and photographic interpretation be created for women students.⁷⁴ Several of these courses, particularly drafting and photogrammetry dovetailed nicely with Barnard’s National Service courses that had been set up under Reynard’s guidance nearly two years earlier. The ESMDT courses, however, would be federally funded (and occasionally cosponsored by defense industries, such as Grumman Aircraft Corporation), would enroll women from across

⁷³ “Notes After a Conference,” sent to Virginia Gildersleeve, January 24, 1942, miscellaneous re: Barnard folder, Virginia Gildersleeve Collection, Columbia University Rare Book and Manuscript Library.

⁷⁴ Elizabeth Reynard, “How Trained Brains Are Used in the War Effort,” February 1942, materials re: National Service Committee at Barnard, 1939-1942, Virginia Gildersleeve Collection, Columbia University Rare Book and Manuscript Library.

the country (not just Barnard students), and would reflect more broadly the growing national interest in scientifically trained women.⁷⁵

Columbia's ESMDT program advertised widely for college-educated women, giving preference to college seniors and graduates. By the end of 1942, several hundred women had enrolled, and by February 1943, 458 of the 584 participants in Columbia's program were women.⁷⁶ As had been the case with Barnard's National Service courses, the ability of female students impressed the instructors, most of whom were faculty members at Columbia's School of Engineering. This reaction, coupled with the general demand for scientifically trained women, bolstered Gildersleeve's plea that the School of Engineering finally admit undergraduate women. Gildersleeve's determination, however, met with continued resistance, even in the face of wartime changes.

Perhaps the most outspoken opponent of coeducational engineering education was the School of Engineering's own associate dean, James Kip Finch, for whom the admission of women seemed neither practical nor desirable. In October 1942, he issued a seven page memorandum to the engineering faculty imploring them to reject Gildersleeve's proposal for the admission of women to the School of Engineering. He warned, "We should not be stampeded into a mistaken and useless action under the impression that we are accomplishing something of value in winning the war." As an alternative to admitting female students, he proposed that Columbia expand its ESMDT program, "a suggestion which will meet

⁷⁵ "Columbia Training Women Engineers," *New York Times*, September 12, 1942, "Barnard Sends More Students Into War Jobs," *New York Herald Tribune*, November 8, 1942, and "Fifteen War Courses For Women on Columbia's List," *New York Herald Tribune*, December 22, 1942, clippings, folder 11, Box 21, World War II Collection, Columbia University Archives, Columbian Library.

⁷⁶ "Women Seek War Jobs," *New York Times*, February 16, 1943, 16.

emergency needs and involves no financial or other responsibilities for our School.”⁷⁷ By enlarging the scope of ESMDT offerings for women, Finch believed that the school could still contribute to the war but avoid admitting women as degree-earning students.

To justify the continued exclusion of women from the School of Engineering, Finch cited the small number of women in engineering and in engineering professional societies as evidence of women’s lack of interest in these fields. Yet by failing to interrogate the reasons for women’s relatively low enrollment and participation in engineering, Finch elided the larger question of discrimination against women in the field. Studies of women’s scientific societies, in fact, have revealed persistent discrimination against women in the traditionally male-dominated and more established scientific professional organizations, thus making necessary the existence of separate groups for women.⁷⁸ Finch gestured to this problem only once in his lengthy memorandum when he noted that the American Institute of Chemical Engineers had been “reported to ‘discourage’ applications for admission by women.” He made this concession almost incredulously, however, even using quotations to set apart the word “discourage” from the rest of the text.⁷⁹

Finch also objected to women’s admission on the grounds that the difficulties involved would grossly outweigh the benefits. He predicted that admitting women would not only “pose problems of adjustment and of finance” but would also “affect our alumni and,

⁷⁷ J.K. Finch to the Faculty of Engineering, October 6, 1942 and attached “Memorandum on the proposal to admit women to the undergraduate engineering course at Columbia,” Folder 13, Box 7, Dean’s Office/Departmental Correspondence, 1942-1943, BCA.

⁷⁸ Rossiter, *Women Scientists in America*, vol. 1, 73-99.

⁷⁹ Finch, “Memorandum on the proposal to admit women to the undergraduate engineering course at Columbia,” 2.

probably, our student organizations.” Although, he admitted, similar issues “have all been posed and, presumably, all been successfully met in other schools which have admitted women, as in law, medicine, etc.” he added that “there are, however, difficulties...peculiar to the Columbia engineering program., which are far more perplexing and uncertain of solution.”⁸⁰

The most significant (and legitimate) peculiarity stemmed from the School of Engineering’s requirement that the first and second year “pre-engineering” courses be taken at the all-male Columbia College. Since there was no indication that the College would open its pre-engineering curriculum to women, Finch explained, “[a]ny woman entering the Columbia Engineering School would, therefore, have to enter at the Junior level—get the first two years of her engineering course at some other school.” But, he added, “[t]hose who are familiar with the difficulties faced by men students who attempt to get their pre-engineering in any other institution than Columbia College know that no women’s college in the United States does, or probably can, offer an equivalent course of study.” Finch acknowledged that “it might be possible for Barnard to organize a pre-engineering course for women, but Barnard does not offer acceptable courses in such subjects as drafting, physics, power, or surveying required for admission to our school.” “It may thus be definitely stated,” Finch concluded, “that there are no women today prepared to enter our School of Engineering.”⁸¹

⁸⁰ Finch, “Memorandum on the proposal to admit women to the undergraduate engineering course at Columbia,” 1.

⁸¹ Finch, “Memorandum on the proposal to admit women to the undergraduate engineering course at Columbia,” 5-6.

With her usual alacrity, Gildersleeve responded by authorizing a two-year pre-engineering course at Barnard. “The need for trained engineers is so great at present,” she explained, “that it is hoped that a considerable number of able young women may be attracted to this important profession.”⁸² Heeding her call for “trained brains,” the School of Engineering voted to admit female students in December 1942. The engineering faculty stipulated, however, “Only those students who show definite ability during the first year will be permitted to go on with the second year’s work.”⁸³ Although they both left intact the masculinist underpinnings of science itself, Gildersleeve’s tried-and-true strategy of presenting extraordinary candidates, along with her careful maneuvering and strategic appeal to national defense, enabled her to open the last of Columbia’s professional schools to women.

Women Scientists and Engineers in a World at War

Although Virginia Gildersleeve encountered much resistance in her crusade to open Columbia’s School of Engineering to women, other institutions capitulated much more readily. Dwindling male enrollment, coupled with pressure to utilize “scientific womanpower,” resulted in women’s admission to 28 additional (and previously all-male) engineering schools across the United States.⁸⁴ A representative of Rensselaer Polytechnic Institute, for example, reported that “the need to train women scientists and technicians to replace men called into the armed services,” resulted in the Institute’s decision to accept

⁸² “Women Engineers,” December 7, 1942, Folder 13, Box 7, Dean’s Office/Departmental Correspondence, 1942-1943, BCA.

⁸³ Ibid.

⁸⁴ Rossiter, *Women Scientists in America*, vol. 2, 14.

women for the first time in the school's 116 years.⁸⁵ Another school, the Defense Training Institute in Brooklyn, even eliminated instruction for men and converted itself into a school for women.⁸⁶

At both coeducational universities and women's colleges, the war facilitated women's entrance into traditionally male-dominated fields of study. Ohio State University added to its curriculum several "women only" classes in physics, mathematics, and chemistry. The all-women's Wilson College, reported physics professor Dorothy Weeks, modified its science program to emphasize wartime needs (such as electronics). And another all-female institution, Smith College, provided its students with a variety of new technical courses from which to choose.⁸⁷

These changes did not go unnoticed female activists and other professional women who urged female students to take full advantage of wartime opportunities. In her address at a Careers Convocation for college women held at the University of Cincinnati, Margaret Hickey—who chaired the Women's Advisory Committee of the War Manpower Commission—reminded her female listeners that "[c]o-educational institutions [have] lost 73 percent of their men students, the men's colleges 95 percent." "So even if you don't want a

⁸⁵ Livingston W. Houston, quoted in "New R.P.I. Policy Will Admit Women," *New York Times*, September 13, 1942, 19.

⁸⁶ Summer Chick Bergen, "Women in Engineering, 1940-1970: Struggle Against the Gender System," (Master's Thesis, The University of Houston Clear Lake, 1998), 14.

⁸⁷ "New 'Women Only' Courses Are Started at Ohio State," *New York Times*, June 14, 1942, D5; Benjamin Fine, "Liberal Arts Eclipsed by Vocational Courses," *New York Times*, January 24, 1943, E7; Dorothy W. Weeks, "Wilson Modifies Science Courses," *New York Times*, July 12, 1942, D5.

degree in chemistry or medicine...to mention only a few professional fields greatly in need of students and graduates, the country wants it for you.”⁸⁸

Even as it obscured discussions of equality or equity, the war had openly enlarged and legitimized the scope of possibilities for college women. Female students responded to these new opportunities (and pleas for their participation) with considerable enthusiasm. By January 1943, Smith reported that enrollment in chemistry had increased sixty-eight percent. Physics had gained thirty-eight percent, while mathematics gained thirty-three percent. During the war, more than a quarter of all Vassar students declared majors in the sciences.⁸⁹ And at New Jersey College for Women, its 1944 yearbook editors observed, “science has had a war boom [here] as well as everywhere else. Freshman chem classes are swollen to an unbelievable size and the same interest holds in biology, physics, math, and the other sciences.”⁹⁰ Chemistry even surpassed home economics as the most popular major among “NJC” women.⁹¹

The biggest percentage increase in women’s enrollment was in the field of engineering, which jumped by seventy-five percent during the war. The admission of women to schools that had formerly been off-limits, as well as a growing awareness of the wartime

⁸⁸Margaret Hickey, “What’s Next for the College Trained Woman,” (address, Careers Convocation, University of Cincinnati, February 15, 1945), *Speeches and Broadcasts of Margaret A. Hickey, 1944-1945*, Records of the Women’s Advisory Committee, War Manpower Commission, Record Group 211, NACP.

⁸⁹ Benjamin Fine, “Liberal Arts Eclipsed by Vocational Courses,” *New York Times*, January 24, 1943, E7; Barbara Miller Solomon, *In the Company of Educated Women: A History of Higher Education in America* (New Haven: Yale University Press, 1985), 188.

⁹⁰ Evelyn Baumgartner and Nancy Petersen, eds., *Quair* (New Brunswick: Rutgers University, 1944), no page numbers.

⁹¹ “Freshman Questionnaire” results, 1943-1946, Statistics, 1938-1949, DCRD, RUL.

demand for engineers, helps account for this shift. Also, as Frances Tallmadge notes in her 1944 *Journal of Higher Education* article, larger numbers of female students entered schools where “[p]reviously, women were permitted, but certainly not encouraged, to participate in courses such as mechanical drawing, shop work, or the more advanced technical subjects.”⁹² In the fall of 1942, for example, the female enrollment of City College’s School of Technology increased by nearly half when five women enrolled. When asked by a *New York Times* reporter about their decision to become engineers, the women replied “that they realized that trained women engineers were needed, and they hoped they would be able to assume such positions in the near future.”⁹³

In absolute numbers, 181 women earned undergraduate engineering degrees between 1940 and 1945. This figure represents a significant increase over the previous five- year period, when only 50 degrees were awarded to female undergraduates. Yet it pales in comparison to the number of women “graduating” from the short-term, non-degree granting science and engineering training programs that the federal government and various industries instituted during the war.

The largest of these programs was the government-sponsored Engineering, Science, and Management War Training (ESMWT) program (previously ESMDT), which enrolled more than 280,000 women between 1940 and 1945. Administered by the U.S. Office of Education and funded by a special appropriation to its vocational education budget for

⁹² Cardozier, *Colleges and Universities in World War II*, 117; Frances M. Tallmadge, “Engineering Training for Women,” *The Journal of Higher Education* 15, no. 7 (Oct. 1944): 379.

⁹³ “Four Girls Engineers Enter City College,” *New York Times*, September 25, 1942, 16. Five women actually enrolled, but “the fifth girl freshman, Priscilla Jean, missed her first day’s classes.”

“defense training,” the ESMWT program provided tuition-free courses in skills deemed vital to national defense. At the end of their training, participants received a certificate recognized by the U.S. Civil Service Commission. The ESMWT program represented one of the first federal efforts to increase and train “scientific brainpower.”⁹⁴ It also represented a new level of federal interest in science education. The reach of the program was enormous. Originally limited to four-year technical schools, the program included 227 colleges and universities by the end of the war. Among these were numerous women’s colleges, such as Hunter, Smith, Wellesley, Vassar, Bryn Mawr, Simmons, Wilson, and New Jersey College for Women, which not only offered programs for current students, but also “refresher” classes for alumnae.⁹⁵

The participation of women’s colleges (and college women) in ESMWT belies the fact that the program initially targeted men. During the 1940-1941 academic year, when Barnard professor Elizabeth Reynard conducted her initial survey of participating women’s colleges, she found only three. Several more mentioned plans to begin instruction, but the majority reported either that they did not participate or that the programs offered at neighboring schools excluded women.⁹⁶ Likewise, when Columbia’s ESMWT (then ESMDT) representative phoned Reynard in February 1942 to discuss the possibility of establishing courses for women, Columbia’s program had already been operating for more

⁹⁴ Elsie Eaves, “Wanted: Women Engineers,” *Independent Woman* (May 1942), 132; Rossiter, *Women Scientists in America*, vol. 2, 15.

⁹⁵ Rossiter, *Women Scientists in America*, vol. 2, 15.

⁹⁶ Reynard, “ESMDT Courses” [1941?], Folder 127, Box 8, Reynard papers, Schlesinger. See also Nona Baldwin, “More Women Sign for War Courses,” *New York Times*, June 9, 1942, 20.

than a year. The deliberate recruitment of women for ESMDT—both at Columbia and nationally—reflected growing anxieties over a shortage of scientific and technical personnel. By 1943, Dr. George W. Case, the ESMWT Program Director, pointed out that the supply of male workers was dangerously low and that women were desperately needed for the war effort. Case argued that “The college woman will usually not make her greatest contribution to war production with a wrench or welding tools...At least 300,000 thousand women will be needed this year for jobs in engineering, chemistry, physics, and production supervision.”⁹⁷ In contrast to the program’s first year, when women made up less than one percent of participants, women’s enrollment leaped to 21.8 percent in 1943-1944.⁹⁸

Defense industries feeling the pinch for trained personnel developed similar programs, either in conjunction with ESMWT or on their own. Both kinds were located on college campuses and carried out with the assistance of the faculty, who taught most of the courses. Both kinds were also subsidized by the government, either directly through the U.S. Office of Education or indirectly through military contracts. Additionally, both carried with them the opportunity (and usually the obligation) to accept positions in defense industries after “graduation.” And as the war progressed, both types increasingly targeted women.⁹⁹ According to Frances Tallmadge, “The closer association between educational institutions

⁹⁷ George W. Case quoted in Evelyn Steele, *Careers for Girls in Science and Engineering*, (New York: E.P. Dutton & Company, Inc., 1943), 24.

⁹⁸ Rossiter, *Women Scientists in America*, vol. 2, 15.

⁹⁹ Ibid., Natalie Marie McIntire, “Curtiss-Wright Cadettes: A Case Study of the Effect of the World War II Labor Shortage on Women in Engineering,” (Master’s Thesis, University of Minnesota, 1993), 47.

and industrial concerns is in itself a significant change; the fact that it concerns women is of further consequence.”¹⁰⁰

Not only did defense industries include women, but many designed short-term programs specifically for female college students. One aircraft company sponsored a forty-eight week engineering course for women to be given at the Universities of Michigan, Connecticut, New Hampshire, Bucknell, and North Carolina State University (then College). At Purdue University, the Radio Corporation of America established a ten-month program to train women as “engineering aides.” The participants, who had completed at least one year of college work and had indicated some interest in engineering, received a small salary, lodging, and tuition. In Ohio, Goodyear teamed with the University of Cincinnati to teach engineering basics to women with various levels of college experience. They earned \$11 per week in addition to their living and educational expenses. And at New York University, Vought-Sikorsky Aircraft established a program to train college women (either seniors or recent graduates) in aeronautical engineering. In 1943, forty “Chance Vought Scholars” drawn from across the country received eight months of specialized training at NYU’s Daniel Guggenheim School of Aeronautics at the College of Engineering. In addition to tuition, room, and board, the scholars earned \$50.00 per month.¹⁰¹

¹⁰⁰ Tallmadge, “Engineering Training for Women,” 379.

¹⁰¹ Edna May Turner, “Education of Women for Engineering in the United States, 1885-1952,” (Ph.D. diss., New York University, 1954), 72; Rossiter, *Women Scientists in America*, vol. 2, 15; Tallmadge, “Engineering Training for Women,” 380; Rex B. Beisel, “Chance Vought Scholarships in Aeronautical Engineering at New York University,” [n.d.] folder 85, Box 6, Dean’s Office/Departmental Correspondence, 1943-1944, BCA, “Dormitory is Leased for N.Y.U. Students,” *New York Times*, February 21, 1943, 31. The Chance Vought Scholars were named after the late naval aircraft designer, Chance Vought. They were the first women to take courses at NYU’s College of Engineering. Their degrees, however, were granted from their home institutions.

The largest industrial program was sponsored by the Curtiss-Wright Corporation. In December 1942, the aircraft manufacturer announced that it would “pay for the training of 800 college women to be placed in eight of the country’s leading engineering schools.” Afterwards, it would employ the women in its plants. Much like the other engineering training programs, the Curtiss-Wright plan targeted women with some college experience in scientific and technical subjects. Likewise, the corporation assumed responsibility for the financial costs incurred and arranged to pay each participating school for the women’s room, board, and tuition. Cadettes would also be paid \$10 per week for the duration of the ten-month curriculum. Inquiries flooded in and, in less than one month, Curtiss-Wright had received 4,000 applications from women in forty-four states. The corporation whittled down the pool through a series of interviews and aptitude tests. More than 700 Cadettes began their training in February 1943, when they flocked to Cornell, Purdue, Iowa State, Texas, Penn State, Minnesota, and Rensselaer. (The eighth school, Northwestern, did not participate in the end).¹⁰²

Recruitment for Curtiss-Wright and wartime science more generally depended in large part on the assistance of various women and women’s organizations. As ESMWT field coordinator Henry H. Armsby acknowledged in the program’s final report, “Considerable special effort was expended to encourage women to enroll in ESMWT courses. The Nationwide cooperation of business and professional women’s clubs was secured in the effort to acquaint women with the opportunities for service to the war effort which were opened to

¹⁰² “Engineer Courses Draw Many Women,” *New York Times*, January 14, 1943, 16; “Curtiss-Wright to Pay 800 Girls to Attend Engineering Colleges,” *New York Times*, December 6, 1942, 1. See also McIntire, “Curtiss-Wright Cadettes,” especially page 29.

them.”¹⁰³ Leonard Carmichael of the National Roster of Scientific and Specialized Personnel emphasized the difficulties involved in trying to convince reluctant employers to hire women instead of men. “In the physical sciences and engineering, the area of greatest manpower shortage,” observed, “you have to use the art of salesmanship on the placement of women.” To carry out this strategy, he pleaded, “[p]rofessional women of the country must do all possible to cooperate with Federal authorities in opening jobs for women.”¹⁰⁴ Meanwhile, the Curtiss-Wright Corporation looked to deans of women in determining female students’ interest in its Engineering Cadettes program.¹⁰⁵

The women to whom government and industry officials turned with regard to wartime matters generally relished their new roles. They found that the current demand for scientific and technical womanpower meshed well with their own interests and agendas. Chase Going Woodhouse, for example, had directed the Institute of Women’s Professional Relations for more than a dozen years when Leonard Carmichael tapped her to assist with locating women for the National Roster. Her new position as “principal consultant in the field of women” enabled her to expand her influence and her commitment to professional women’s issues. Having lead her Institute through the depths of the Great Depression, she gladly announced in May 1942 that “There is no problem at all now in placing scientifically trained women.” “It is quite evident that the demands for women will exceed those recruited,” she added. “The

¹⁰³ Henry H. Armsby, *Engineering, Science, and Management War Training Final Report*, prepared for Federal Security Agency Bulletin, 1946, no. 9, 47.

¹⁰⁴ Nancy MacLennan, “Bids Women Push War Work Talents,” *New York Times*, December 14, 1942, 16.

¹⁰⁵ McIntire, “Curtiss-Wright Cadettes,” 33.

Roster wants a much fuller list of trained woman power.”¹⁰⁶ Kathryn McHale, director of the American Association of University Women, eagerly collaborated with Woodhouse in assembling names for the roster and encouraged AAUW members to make themselves available for scientific war work. This project clearly complimented the AAUW’s own objectives and proved a boon to its larger mission. As one member explained to Woodhouse, “Our national organization is particularly interested in scholarship and brilliant women and in getting jobs for brilliant women.”¹⁰⁷ As a wartime measure, assisting with the roster meant that the AAUW could carry out its larger goals of expanding opportunities for professionally trained women without the threat of suspicion or derision.

Another source of support for women’s participation in wartime science and engineering came from the American Council on Education’s Committee on College Women Students and the War, which succeeded Meta Glass’s subcommittee on college women in late 1942. Pembroke College Dean and outgoing AAUW President Margaret Shove Morriss chaired the committee which, like its previous incarnation, concerned itself with the roles of college women in wartime. The escalating demand for scientific and technically trained personnel both reaffirmed and refocused the committee’s work as new avenues opened to female students. Taking note of these developments, Morriss urged other educators to promote scientific fields for women:

¹⁰⁶ Chase Going Woodhouse, quoted in meeting minutes, National Roster of Scientific and Specialized Personnel, A.A.U.W. New York City Branch, May 15, 1942, 5-7, folder 70, Box 4, Dean’s Office/Departmental Correspondence, 1941-1942, BCA.

¹⁰⁷ Mrs. Thomas G. Evans, quoted in meeting minutes, National Roster of Scientific and Specialized Personnel, A.A.U.W. New York City Branch, May 15, 1942, 7, folder 70, Box 4, Dean’s Office/Departmental Correspondence, 1941-1942, BCA.

The study of mathematics, physics, chemistry, and so on, should be encouraged to the greatest possible extent; in fact, when I think of the urgency of the demand I am ready to say that all women students with even modest mathematical or scientific aptitude should be assigned to the study of those subjects...The colleges themselves are responsible for securing all the women scientists they can.¹⁰⁸

In addition to encouraging women to pursue formal study in degree-granting programs, Morriss and her colleagues generally endorsed the short-term scientific and technical courses offered in collaboration with industry and the federal government. As she noted in a 1943 report to the president of the American Council on Education, “[t]he members of the committee...have encouraged the setting up of one-year curricula by aeronautical and other industries for the training of selected women students as junior engineers.”¹⁰⁹

Some members even had a personal hand in creating these programs. Barnard College Dean Virginia Gilderlseeve and industrial engineer Lillian Moller Gilbreth, for example, worked closely with the Stevens Institute of Technology and ESMWT to arrange a course for women in engineering. They were assisted in this effort by other women and leaders in higher education, such as New Jersey College for Women Dean Margaret Corwin, Hunter College Dean Eleanor H. Grady and Sarah Lawrence President Constance Warren.¹¹⁰ Gildersleeve also advised officials at Columbia University and Grumman Aircraft, who established a similar program for women in New York City. Meanwhile, Gilbreth assisted

¹⁰⁸ Morriss, “College Women Students and the War,” 35, 42.

¹⁰⁹ Morriss, Report of Committee on College Women Students and the War, reprinted in George F. Zook, “The President’s Annual Report,” *The Educational Record* XXIV, no. 3 (July 1943): 211-212.

¹¹⁰ “Stevens Offers Course for Women,” *New York Times*, January 5, 1942, 14.

the Radio Corporation of America set up its program for women engineers at Purdue University.¹¹¹

Yet even as they worked to develop programs in fields where “short cuts do seem essential,” Morriss and her committee members acknowledged that “theoretically we may deprecate this development.”¹¹² Indeed, many individuals, including Gildersleeve and Gilbreth, harbored mixed feelings about these short-term programs. At the very least, they were reluctant to regard them as substitutes for regular coursework in engineering and the sciences and distrusted those who did. Both Gildersleeve and Gilbreth realized fully that these courses helped to illustrate, as one reporter observed, that “[e]ngineering talent is not, after all, the exclusive birthright of American men!,”¹¹³ And Gildersleeve in particular used this revelation to pry open Columbia’s school to women. But she also feared that these non-credit programs (and their financial incentives) might lure college women away from completing undergraduate degrees—an outcome that contradicted her own mission as well as the mission of Barnard College. Thus, when asked to comment on Curtiss-Wright’s Engineering Cadette program, Gildersleeve replied that while “the aircraft corporations realize acutely their immediate needs of trained personnel” and are “giving [women]

¹¹¹ “Columbia Training Women Engineers,” *New York Times*, September 12, 1942, clipping, folder 11, Box 21, World War II Collection, Columbia University Archives, Columbian Library; Amy Spear, “The History and Organizational Structure of SWE,” March 1992, 2, Series 11, The Society of Women Engineers Collection, Walter P. Reuther Library, Wayne State University (hereafter cited as SWEC). See also Gildersleeve, *Many a Good Crusade*.

¹¹² Morriss, “College Women Students and the War,” 39-40.

¹¹³ David Woodbury, “Capsule Courses Train Women for War,” Prepared for the War Manpower Commission through the Writers’ War Board, New York, June 16, 1943, p. 1; Classified General Records, 1940-1946; Records of the Historical Analysis Section; Records of the Reports and Analysis Service; Records of the War Manpower Commission; Record Group 211, NACP

elementary engineering training of a sort which will make them valuable in the aircraft factories...I think the good mathematicians, physicists, etc., would be more valuable to the nation if they completed their college training.”¹¹⁴

Gildersleeve also realized that some individuals—such as Columbia’s own James Kipper Finch—regarded these programs as an alternative to admitting women to engineering schools. Instead of enrolling women, Finch had proposed that Columbia simply expand its EMSWT offerings. Although Gildersleeve lauded women’s participation in Columbia’s program and cited it as evidence of their talents, she did not view short-term courses as a substitute for engineering degrees. Failure to distinguish between the two kinds of programs would have compromised her campaign to win women’s admission to Columbia’s School of Engineering.

Lillian Moller Gilbreth agreed with Gildersleeve that while “people are desperately needed in industry...[t]he college student’s job at this moment is to stay in college and finish her work.”¹¹⁵ Her reasoning, however, had less to do with education than with women’s position within the engineering profession. While she recognized the short-term engineering programs that she helped to create as a band-aid solution for the dire shortage of technically trained personnel, she also realized that women’s participation in these programs would not provide them with the credentials they needed to succeed in the profession. In the long-run, women would need professional degrees in engineering in order to be accepted by their male

¹¹⁴ Gildersleeve to Pearl Kazin, May 12, 1943, folder 17dd, Box 7, Dean’s Office/Departmental Correspondence, 1942-1943, BCA.

¹¹⁵ Lillian Moller Gilbreth, “You and Your Job,” speech given at New Jersey College for Women, [1941?]. DCRD, RUL.

colleagues. (Ironically, Gilbreth had earned her Ph.D. in industrial psychology but entered engineering through her husband's connections.)

At the heart of Gilbreth and Gildersleeve's concerns was the *type* of engineering work for which college women were being trained. Industrial and government-sponsored short-term programs generally prepared women as engineering aides, or assistants to higher-ranking men. By taking care of the more mundane engineering tasks such as drafting and machine testing, engineering aides released men for more challenging and prestigious assignments.¹¹⁶ The Curtiss-Wright corporation, for example, readily admitted that its Engineering Cadettes would "perform the lower category of engineering work and thus permit the up-grading of [male] graduate engineers."¹¹⁷ The General Electric Company's Turbine Department recruited female math majors "to relieve [male] engineers of as much calculating work as possible, and thus permit them to concentrate on the more involved problems for which their specialized training has fit them." Although women calculators took over much of the work carried out by male engineers, a GE representative carefully pointed out that they "are not engineers and do not supplant engineers."¹¹⁸ Colonel Alexander Heron of the War Department's Manpower Board elaborated on general policies regarding women

¹¹⁶ For an excellent analysis of sex-segregation in industry during World War II, see Ruth Milkman, *Gender at Work* (Urbana: University of Illinois Press, 1987). More general examinations of persistent discrimination and the tenacity of gender stereotypes during the war include Leila J. Rupp, *Mobilizing Women for War: German and American Propaganda, 1939-1945* (Princeton: Princeton University Press, 1978); D'Ann Campbell, *Women at War with America: Private Lives in a Patriotic Era* (Cambridge: Harvard University Press, 1984); Karen Anderson, *Wartime Women: Sex Roles, Family Relations, and the Status of Women During World War II* (Westport: Greenwood Press, 1981); and Maureen Honey, *Creating Rosie the Riveter: Class, Gender, and Propaganda During World War II* (Amherst: University of Massachusetts Press, 1984).

¹¹⁷ Warren Bruner, quoted in McIntire, "Curtiss-Wright Cadettes," 20.

¹¹⁸ Emily Hannan, talk given at meeting of the Schenectady Business and Professional Women's Clubs, November 1941, sent to Frances V. Seepk, December 5, 1941, Folder 712, Reel 122, AAUW.

and wartime science when he explained that “it is the policy of the War Department to *replace*, rather than *displace*, men in war work. Obviously, no male employee should ever be supplanted by a woman worker unless he is needed or wanted in some other essential activity, whether in the armed services or in a war industry.”¹¹⁹

Heron’s statement reveals much about broader attitudes surrounding scientific womanpower as well of the limits of advancing women’s status under the rubric of national defense. Most of the scientific and technical positions for which women were being recruited and trained were entry-level ones. They were also temporary in nature and subordinate to those higher-ranking positions generally reserved for men. Although some women did “replace” men for the duration, many more women occupied new “sub-professional” positions that did not exist before the war. The widespread utilization of women as “engineering aides,” for example, was made both possible and necessary by the rapid expansion of wartime science and defense research (The production of military aircraft alone increased by 4,500 percent between 1939 and 1944).¹²⁰ Consequently, as R.H. Baker and Mary L. Reimold of Stevens Institute of Technology acknowledged in their 1942 *Mechanical Engineering* article, “What Can be Done to Train Women for Jobs in Engineering,” “[t]he industrial openings for which these candidates were being trained did not exist at the time of

¹¹⁹ Alexander R. Heron, “Women War Workers in the Army Service Forces,” in *War and Post-War Demands for Trained Personnel*, Proceedings of the Conference held at the Mayflower Hotel, Washington D.C., April 9 and 10, 1943, ed. Institute of Women’s Professional Relations, 58 (New London: Institute of Women’s Professional Relations, 1943).

¹²⁰ Bergen, “Women in Engineering,” 16.

their enrollment.”¹²¹ Rather, many of the sub-professional positions that women eventually filled were created in order to meet wartime production quotas.

Elsie Eaves, an accomplished engineer with more than twenty years of professional experience, was quick to notice the discrepancy between the proclaimed shortage of engineering talent and the country’s reluctance to employ women in mid-level positions. In her “Wanted: Women Engineers” article that appeared in *Independent Woman*, the journal of the National Federation of Business and Professional Women’s Clubs, Eaves warned readers that recruiters used the term “engineer” to refer to two different jobs. For Elsie Eaves, as for Lillian Gilbreth, this distinction was critical to the engineering profession and to women’s place in it. As Eaves explained, the wartime demand for “womanpower” was two-fold: professional women engineers could expect beginning professional positions, but most of the demand would be for “sub-professional” work in drafting, tracing, engine testing, blueprint reading, and computing. Eaves expressed amazement at the amount of publicity given to the latter category. After all, she noted, “draftsmen and testing laboratory assistants occupy the bottom rungs on the professional ladder. Why should they make headline news?” But like Gilbreth and others, she also recognized that “engineers themselves are becoming scarce in relation to wartime demands for their trained minds...[and] those who graduate this year began four years ago. The need for a faster training program and a larger supply of trainees is obvious and the need is both urgent and immediate.”¹²²

¹²¹ R.H. Baker and Mary L. Reimold, “What Can Be Done to Train Women for Jobs in Engineering,” *Mechanical Engineering* 64, no. 12 (December 1942): 853.

¹²² Eaves, “Wanted: Women Engineers,” 132-133; Rossiter, *Women Scientists in America*, vol. 2, 14.

Although Eaves seemed suspicious of the publicity given to women in subprofessional engineering positions (as opposed to full-fledged women engineers), she viewed it as increasing acceptance of women in the field. She was also careful not to dismiss subprofessional engineering work or cast it as a blight on the profession. Instead, as she had done during the Great Depression with regard to technical secretarial and librarian work, Eaves depicted these positions as a solid entering wedge. A significant difference, however, was that during the Depression, technical secretaries and librarians had already been trained as professional engineers but found no other outlets for their talents. During the war, subprofessional engineering work was generally undertaken by women who had not yet completed engineering degrees. Thus, as Eaves explained, “girls who look at sub-professional work as a stepping stone to professional advancement, or girls with enough training in mathematics and science to qualify quickly for professional work, will want to know where the work on which they start will lead.” She concluded, “The overall framework of the engineering profession and the work that women engineers are now doing will help as a professional road map and guide posts.”¹²³

Eaves’ belief that wartime engineering work offered a “proving ground” for women eager to learn more about the future of engineering (and their own place within it) helps to explain why so many women enrolled in government and industry-sponsored training programs.¹²⁴ In a survey of her classmates’ motivations for enrolling in the Curtiss-Wright program, Engineering Cadette Mary Glover found that “the most prominent secondary

¹²³ Eaves, “Wanted: Women Engineers,” 133.

¹²⁴ Eaves, “Wanted: Women Engineers,” 159.

motive [next to contributing to the war effort] is the great opportunity for educational advancement.” Glover explained, “Here is a chance to become proficient in the various phases of engineering at absolutely no cost. Girls interested in mathematics and science can delve deeper into their mysteries; others who are just generally interested receive training that cannot help broadening their viewpoint and giving them valuable reference in the days to come.”¹²⁵ More than forty percent of Cadettes claimed a pre-existing interest in engineering or technology—an interest that had been discouraged in earlier years. For one Cadette, enrolling in the program meant finding “a group of other young women who were also interested in math, physics, and chemistry and I felt more accepted. Before, most of my acquaintances gave me the impression that my desires were a little odd for a woman.” Another noted that “I wanted to study engineering but my family insisted it was not a job for a girl...[The Cadette program] was a great opportunity to do what I’d always wanted to do.”¹²⁶

For women in these wartime programs, science and engineering became a way of life—as least for the duration. The programs were short but intense, and participants spent most of their time with each other. For ten consecutive months, for example, the Curtiss-Wright Engineering Cadettes roomed, ate, and studied together. They even formed a “Cadette Engineering Society” to learn more about engineering as a profession. Many

¹²⁵ Mary Glover, “With One Purpose—Victory!” *The Cadetter* March 1943, 1, Folder 4, Box 1, Records of the Curtiss-Wright Engineering Cadettes Program, Women in Science and Engineering Archives, Iowa State University, Ames, Iowa. (hereafter cited as WISE)

¹²⁶ McIntire, “Curtiss-Wright Cadettes,” 58-59; Cadette quoted in McIntire, “Curtiss-Wright Cadettes, 59.

recognized themselves as trailblazers in a “man’s” field, and realized the benefits of approaching it together.¹²⁷

The most highly regarded aspect of these training programs, however, was the coursework itself. Participants generally found the material interesting, exciting, and rewarding. They threw themselves into subjects such as aerodynamics, electrical currents, and applied mechanics. While many considered the classes challenging, they worked hard to do well and impressed their instructors. As Frances Tallmadge reported in a *Journal of Higher Education* article, “Faculty members, extremely skeptical, even a bit prejudiced about having women in the advanced engineering courses, have found to their delight and dismay that the women can do an excellent technical job and frequently exceed the men in interest and determination.”¹²⁸ Professors also reported to the Curtiss-Wright Corporation that the Cadettes were the “best group of students that had ever been on the campus, men or women.”¹²⁹

To substantiate these claims, Purdue University tested its Cadettes, along with eighteen male aeronautical engineering students who had completed three years of mathematics, applied mechanics, and aerodynamics. The Cadettes scored the highest. At Penn State, roughly one third of Cadettes made Dean’s list, compared with ten percent of regular students. Indeed, by most accounts, women enrolled in wartime science and

¹²⁷ McIntire, “Curtiss-Wright Cadettes,” 68; C. Wilson Cole, “Training of Women in Engineering,” paper presented at the 51st Annual Meeting, SPEE, Chicago Illinois, June 18-20, 1943, 11. War Training Programs—World War II, Curtiss-Wright Engineering Program, Volume AI, Iowa State College, Ames, Iowa.

¹²⁸ Margaret Perkins, “Sidelights at RPI,” *The Cadetter*, March 1943, 6, Folder 4, Box 1, Records of the Curtiss-Wright Engineering Cadettes Program, WISE; Tallmadge, “Engineering Training for Women,” 380.

¹²⁹ Bruner, quoted in McIntire, “Curtiss-Wright Cadettes,” 70.

engineering programs far surpassed all expectations. They were proud of their training and eager to put it to good use. As Engineering Cadette Mary Glover noted, “great excitement seems to rise from the fact that...[Cadettes] have picked up a course with a useful and rosy future.”¹³⁰

After completing their training, women were either placed with their sponsoring companies (such as Curtiss-Wright) or quickly snatched up by nearby defense industries (as was the case with ESMWT participants). Indeed, it was estimated that between six and nine employers called for each woman who finished university ESMWT courses.¹³¹ But despite the swiftness with which they were put to work, many of the women felt that their skills were underutilized, and few regarded their new jobs as interesting or engaging as their training had been. Although the Women’s Bureau found in one poll that approximately 93 percent of engineering aides liked their jobs most of the time and considered the pay to be good, most also regarded their duties as far beneath their level of training. Some Curtiss-Wright Engineering Cadettes even indicated that they were placed in positions that required no formal training whatsoever. Consequently, between January and September 1944, nearly forty percent of Engineering Cadettes left their positions with Curtiss-Wright. Many perceived their placement in repetitive, unchallenging jobs as evidence that they were not really needed by the corporation. Others indicated disappointment with opportunities for

¹³⁰ McIntire, “Curtiss-Wright Cadettes,” 70; Bergen, “Women in Engineering,” 21; Glover, “With One Purpose—Victory,” *The Cadetter*, March 1943, p. 2, Folder 4, Box 1, Records of the Curtiss-Wright Engineering Cadettes Program, WISE.

¹³¹ Committee on Educational and Vocational Guidance for Women, *UNC Women Train for War and Postwar Work* (Chapel Hill: University of North Carolina, 1943), 12; Esther W. Hawes, Faculty of New Jersey College for Women meeting minutes, February 9, 1942, Records of the Secretary of the Faculty, New Jersey College for Women (hereafter cited as DCSF), RUL.

promotion and many returned to college. Although Curtiss-Wright and other employers did acknowledge the fact that many women were overtrained for their particular assignments, they generally assumed little responsibility for the turnover. Instead, they placed the blame on the women themselves, charging them with being selfish, immature, and inexperienced, and lacking mechanical expertise.¹³²

Women who completed undergraduate or graduate degrees in “those strategically importance sciences” fared somewhat better in terms of their work assignments and they were certainly in high demand. In January and February 1942, recruiters from various chemical companies toured the women’s colleges to sign up June graduates before they had an opportunity to seek other work. In March 1942, New Jersey College for Women placement director Fredericka Belknap reported that the number of calls for majors in physics, mathematics, and chemistry to work in chemical plants and munitions factories was “enormous.” The largest request to date had come that very afternoon when the Raritan Arsenal phoned for fifty women with scientific or mathematical backgrounds to replace male “section leaders” who had been drafted. Similar requests poured in daily from various war plants not only in New Jersey, but also in Massachusetts, Delaware, Maryland, and Connecticut. According to Belknap, “Senior mathematics majors were considering anywhere from one to three jobs, wondering which to take” and “there were about ten possibilities for every chemistry major.”¹³³

¹³² Rossiter, *Women Scientists in America*, vol. 2, 15-16; McIntire, “Curtiss-Wright Cadettes,” 40.

¹³³ Rosamond Sawyer Moxon and Mabel Clark Peabody, *Twenty-five Years: Two Anniversary Sketches of New Jersey College for Women* (New Brunswick: Rutgers University Press, 1943), 24; Fredericka Belknap quoted in Esther W. Hawes, Faculty of New Jersey College for Women meeting minutes, March 9, 1942, DCRS.

Yet many of the positions offered to female college graduates still ranked below those offered to men with equivalent education and experience. Gloria Brooks Reinish, the first woman to graduate from Columbia's School of Engineering, finished second in her class. "But," she recalled in an interview, "I was quite annoyed by the fact that Bell Labs, which was a prestigious place to work, offered me a job as a TA, that's a technical assistant." She continued:

In those days, they only had two categories of employees, MTS, which was member of technical staff, and the TA, which was technical assistant. And engineers were normally hired as members of technical staff, but this was male engineers. They didn't have any female engineers. But they were hiring some mathematicians and physicists who were female, and they were giving them the status of technical assistant rather than member of technical staff. So this is what they offered me, technical assistant.¹³⁴

Although Reinish managed to negotiate a higher ranking position for herself as member of technical staff, most women in her situation were less successful.

Women with college degrees in mathematics, for example, found themselves being vigorously recruited for jobs as "computers," which often involved computing ballistic trajectories and solving complex mathematical equations.¹³⁵ Although ballistics computing had been dominated by men during World War I, it became feminized during World War II as male mathematicians and engineers were promoted to higher ranking positions in the expanding defense industry. In an April 1942 memorandum, the National Advisory

¹³⁴ Gloria Brooks Reinish, interview by Lauren Katya, May 22, 2003, transcript, 14-15, Box 3, Profiles of SWE Pioneers, SWEC.

¹³⁵ Until 1945, the term "computer" referred to a human being. After that date, the term referred to a machine, and the former human computers became operators. Jennifer Light, "Programming," in Nina E. Lerman, Ruth Oldenziel, and Arwen P. Mohun, eds., *Gender and Technology* (Baltimore: The Johns Hopkins University Press, 2003), 305. See also David Allen Grier, *When Computers Were Human* (Princeton: Princeton University Press, 2005).

Committee for Aeronautics (or NACA, the precursor to NASA), justified this policy: “It is felt that enough greater return is obtained by freeing the engineers from calculating detail to overcome any increased expenses in the computers’ salaries. The engineers admit themselves that the girl computers do the work more rapidly than they would. This is due in large measure to the feeling among the engineers that their college and industrial experience is being wasted and thwarted by mere repetitive calculation.”¹³⁶ Another division leader at Los Alamos admitted frankly that “We hire girls because they work better and they’re cheaper.”¹³⁷

One of the largest wartime computing projects was housed at the Army’s Ballistic Research Laboratory and resulted in the development of the country’s first electronic computer, the ENIAC. The Ballistic Research Laboratory hired female computers almost exclusively and during the war more than two hundred young women worked as “ENIAC girls,” including twenty-two year old Kathleen McNulty. The class of 1942 mathematics major was one of the first women hired onto the project, where she hand-calculated firing tables for rockets and artillery shells. Much of her work required numerical integration which, she explained, “is where you take, in this particular case...[the] path of a bullet from the time it leaves the muzzle of the gun until it reaches the ground.”

It is a very complex equation; it has about fifteen multiplications and a square root...You have to find out where the bullet is every tenth of a second...And when you finished the whole calculation, you interpolated the values to find out what was the very highest point and where it hit the ground.¹³⁸

¹³⁶ Computing Group Organization and Practices, National Advisory Committee for Aeronautics, April 27, 1942, quoted in Light, “Programming,” 299.

¹³⁷ Los Alamos division leader quoted in Howes and Herzenberg, *Their Day in the Sun*, 99.

¹³⁸ Kathleen McNulty, quoted in Light, “Programming,” 301.

Although ballistics computing required a high level of mathematical skill and calculating a single trajectory could take between twenty minutes and several days, it was labeled as subprofessional work.¹³⁹ Thus, even women with full-fledged degrees in mathematics (as well as other scientific and technical fields) were relegated to secondary and auxiliary roles with little real recognition.

Women with advanced graduate degrees encountered similar forms of discrimination. Marion Crenshall Monet, who earned her master's in chemical engineering from M.I.T. in 1943, was appointed as a "junior engineer" when she joined Du Pont after graduation. When chemist and Harvard University doctoral candidate Lilli Hornig arrived at Los Alamos, she was asked to take a typing test. And mathematics Ph.D. Mina Rees, who would become the only woman scientist at the Office of Scientific Research and Development to move into a major policy position after the war, was listed as a "technical aide" and "executive assistant" in 1943-1946.¹⁴⁰

This reluctance to employ women in positions commensurate with their talents and training also resulted in situations where female scientists were passed over entirely. In contrast to engineering, chemistry claimed a considerable supply of women at the beginning of the war. In 1941, for example, the National Roster of Scientific and Specialized Personnel included nearly 1,700 female chemists, 395 of whom held doctorates.¹⁴¹ But during the war,

¹³⁹ Light, "Programming," 301.

¹⁴⁰ Howes and Herzenberg, *Their Day in the Sun*, 80, 85; Rossiter, *Women Scientists in America*, vol. 2, 7. For more information on Mina Rees, see Kathleen Broome Williams, *Improbable Warriors: Women Scientists and the U.S. Navy in World War II* (Annapolis, MD: Naval Institute Press, 2001).

¹⁴¹ Rossiter, *Women Scientists in America*, vol. 2, 16.

both defense industries and government agencies expressed more interest in training college women for sub-professional chemical positions than employing experienced female chemists. As a result, many women with doctorates in chemistry remained at their teaching positions, probably expecting that, having enlisted with the National Roster or having taken other steps to seek war work, they would soon be called to an important wartime project. Relatively few female chemists, however, landed such prestigious or responsible positions. The only one to supervise an OSRD project was Iota Sigma Pi's Agnes Fay Morgan, who analyzed vitamin content in dehydrated foods. But she worked alone on her project and essentially managed herself.¹⁴²

Conclusion

By all accounts, the number of women in science and engineering skyrocketed between 1940 and 1945. Innovative programs for training scientific and technical personnel, the breaking down of formal barriers to women's education and employment, and the more general encouragement of girls and women to enter these fields all contributed to this shift. Various women and women's organizations, long interested in women's professional and educational advancement, viewed the wartime demand for scientists and engineers as a prime opportunity. They encouraged women to register with the National Roster for Scientific and Specialized Personnel, to participate in short-term training programs sponsored by government and industry, to pursue undergraduate and graduate degrees in "shortage" fields. And they were successful in these endeavors.

¹⁴² Ibid., 7-9.

Some women's representatives, such as those in Iota Sigma Pi, realized as early as March 1941 that "a call on women workers to handle jobs formerly held by men...is anticipated not because of the drainage of man-power for the army, but because of the expansion of defense preparations in industry necessitating an enormously increased labor force in the mass production industries."¹⁴³ But it is doubtful that they, or most other women's groups, realized fully the implications of this rapid expansion. The ESMWT program, which trained more than a quarter of a million women, trained nearly six times as many men. Likewise, the National Roster's attempts to locate scientifically trained women resulted in a doubling of women's representation during the war years. But because men's representation also doubled, women's overall representation increased only from 4.0 percent in 1941 to 4.1 percent in 1945.¹⁴⁴ While women enrolled in regular engineering and science degree programs often claimed a larger percentage of classroom seats than they had previously, they found that upon graduation, they did not fare nearly as well as the men whose places they took over. Whatever their levels of education and experience, women consistently found themselves relegated to the lower levels of scientific war work. They generally replaced men who had been promoted to higher positions, rather than being placed in those higher positions themselves. Thus even as women entered science and engineering in ever increasing numbers, the rapid expansion of wartime science made it impossible for them to outpace men. Instead, it reinforced their marginalization.

¹⁴³ "Women in the Defense Program," *Iota Sigma Pi News Letter* Vol. 1, No. 1, March 1941, p. 15.

¹⁴⁴ Armsby, *Engineering, Science and Management War Training*, 44-47; Rossiter, *Women Scientists in America*, vol. 2, 25.

Women scientists' continued marginalization was also shaped by the nature of their wartime education and employment. Both employers and government agencies openly characterized wartime training programs as "experiments" to see whether women could, in fact, carry out "men's work." Their surprise at women's success betrays their low expectations and regard for women's scientific capabilities. The effort to recruit and train as many women in as short a time as possible was also deemed an experiment by many women and women's organizations. They too viewed the training and employment of female scientists as an experiment, but one that aimed to "prove" women's capabilities and to pave the way for their greater acceptance. In both cases, scientifically trained women were characterized as vital to the war effort, even though their talents were remained "underutilized." In the larger experiment of wartime science, they were like hamsters, running hard but never getting anywhere, in the wheel of national defense. The end result was a stockpiling of female scientific talent, relegated to the margins of the profession.

CHAPTER 3

After War, What?

In January 1943, just thirteen months after the bombing of Pearl Harbor, Pearl Bernstein wrote a letter to the editor of the *New York Times* expressing concern over what would become of scientifically trained women at the end of the war. Bernstein, who ran New York City's Board of Higher Education, acknowledged that in wartime, "there is tremendous pressure from industry and from government for women draftsmen, engineering aides...and many other categories." But she also pointed out that many of the same organizations clamoring for women scientists and engineers had discouraged them in the not-so-distant past. What was needed, Bernstein argued, was "a definitive statement by the leaders of American industry that after the war is over women will not lose their jobs as engineers, chemists, physicists, etc., merely because they are women."¹

Although a definitive statement would be hard to come by, there was much posturing by industry officials, government bureaucrats, educators, female activists, and women scientists themselves about what to expect in the postwar period. Some predicted an expansion of educational and vocational opportunities for women. Others foresaw inevitable recoil, while still others were simply not sure what to expect. While their reactions and predictions varied widely, they touched on many of the same issues. Popular themes included assessments of women's wartime work, the war's impact on the production of scientific

¹ Pearl Bernstein, "Women Students Seek Light," *New York Times*, January 14, 1943, 20.

personnel, the role of science and technology in the postwar world, and the readjustment of education to peacetime. As the war wound down and victory grew closer, these discussions became increasingly divergent and divisive. The same forces that had coalesced to draw women into wartime science now splintered over their postwar fate.

Predictions and Prescriptions for the Post-War World

Postwar planning and prophesizing had begun almost as soon as the United States entered the war. Reconversion quickly became a popular subject, and everyone from the president to the populace weighed in. Most agreed that the future would be marked by peace and prosperity. The reuniting of families as veterans returned also promised a period of togetherness for most. There would be, of course, many women who lost husbands and fiancés in war. These women would certainly have to sustain themselves and their families, and their educations should prepare them for that task. But what about the others? What about those women students and professionals who served in the trenches of wartime science? Would they receive a heroes' welcome? Or would they be cast aside? Could they continue their scientific pursuits, or would they be pushed into more traditional work, either in the home or in feminized sectors of the economy?

Industrialists, bureaucrats, educators, and women's organizations all found that their efforts to recruit women scientists during the war required that they at least attempt to answer some of these questions. Those women considering changing careers or embarking on new ones wanted a glimpse of their own futures in science. They wanted, as Pearl Bernstein suggested, at least some indication of what to expect after the war, and preferably some guarantee.

Chase Going Woodhouse broached these issues early on. Woodhouse, who served as director of the Institute of Women's Professional Relations and consultant to the National Roster for Scientific and Technical Personnel, found herself so inundated with demands for scientific and technically trained women that she could barely update the Institute's newsletter.² But she remembered vividly that "after World War I, women chemists were dismissed" and "in the depression days, married women and then other women were the first to go." Woodhouse wondered how women scientists would fare after the current conflict ended and arranged a conference to address these questions. Under her direction, the Institute held a conference on "War and Post-War Demands for Trained Personnel" in the spring of 1943. In a precirculated memorandum outlining the conference objectives, Woodhouse reminded participants about the legacies of the past and argued that "we must face the question.—Will [women] be given consideration after the war, with equal opportunity to compete for jobs, or will the old rules of not employing women be revived? Will marriage be a bar to employment?" "In brief," she inquired, "is a chemist a chemist or do we have sex in chemistry, with one sex qualified to hold jobs in an emergency only?"³

Despite Woodhouse's prodding, most conference speakers sidestepped her hard-hitting questions by highlighting instead the current demand for specialized personnel and advocating the continued encouragement of women in scientific fields. Although much of

² Margaret W. Rossiter, *Women Scientists in America*, vol. 1, *Struggles and Strategies to 1940* (Baltimore: Johns Hopkins University Press, 1982), 387n33.

³ Chase Going Woodhouse, "Objectives of the Conference on War and Post-War Demands for Trained Personnel Called by the Institute of Women's Professional Relations," in *War and Post-War Demands for Trained Personnel, Proceedings of the Conference held at the Mayflower Hotel, Washington D.C., April 9 and 10, 1943*, ed. Institute of Women's Professional Relations, i-iii (New London: Institute of Women's Professional Relations, 1943).

women's scientific war work had been regarded as auxiliary and temporary, bureaucrats and industrialists alike chose to emphasize women's overall contribution to winning the war. Most likely, they realized that any unfavorable assessment of the postwar situation might derail their efforts to recruit women workers. Fowler Harper of the War Manpower Commission even observed in his presentation that "We hear of women who are reluctant to enter occupations in which they fear there will be retrenchment after the war as far as opportunities for women are concerned." Others painted a vague, but optimistic picture, of postwar employment and prosperity which presumably included women.⁴

Indeed, many postwar predictions shared this vague optimism. Evelyn Steele, who published several vocational guidance booklets for young women, observed in her 1943 *Careers for Girls in Science and Engineering* that "While it took a war to create the opportunities for training and experience which were not easily available to women before, there can be no doubt about the future. Women are being called upon to serve now; when the war is won those who have excelled will continue to serve."⁵ The chemist Walter Murphy claimed in 1944 that:

I am confident opportunities for women in chemistry in the postwar world will be bright. Their immediate status will be governed somewhat by what women have proved themselves capable of doing in the emergency period, particularly in jobs not heretofore open to women. The ever-widening horizons in chemistry are sure to bring with them new fields for women.⁶

⁴ Fowler Harper, "The Wartime Role of College-Trained Women," in *War and Post-War Demands for Trained Personnel* (New London: Institute of Women's Professional Relations, 1943), 45.

⁵ Evelyn Steele, *Careers for Girls in Science and Engineering* (New York: E.P. Dutton & Company, Inc., 1944), 25.

⁶ Walter J. Murphy, "Postwar Opportunities for Women in Chemical Engineering," in *War and Post-War Employment and Its Demands for Educational Adjustments, Proceedings of the Conference held at the*

And Margaret Hickey, who chaired the Women's Advisory Committee of the War Manpower Commission predicted that "the engineering field will continue to offer great numbers of job opportunities" to postwar women.⁷ These bright forecasts for the future were critical to wartime recruitment campaigns.

A significant number of women scientists and engineers seemed to share this positive outlook. Whether they internalized the general optimism surrounding wartime science, were emboldened by amount of publicity they attracted, or just indulged in wishful thinking, many projected a postwar world of expanding opportunity. Marjorie Crawford, the national secretary of Iota Sigma Pi, expected that "[w]ith so many men unable to continue their studies, women with advanced training will be more valuable than ever, both for the war effort and for the post-war period."⁸ Evelyn Laing McBain, Iota Sigma Pi's national president echoed Crawford's hopefulness when she predicted in the spring of 1945 that "We women Chemists will not yet have to face a job depression."⁹ Elsie Eaves, who had characterized wartime engineering training programs as a "stepping stone to professional advancement" set her sights on peacetime production and the application of new wartime technologies to everyday life. Developments in aeronautical engineering, for example, could

Mayflower Hotel, Washington, D.C., May 4 and 5, 1944, ed. Institute of Women's Professional Relations, 110-111 (New London: Institute of Women's Professional Relations, 1945).

⁷ Margaret A. Hickey, "Trends in the Labor Market," (radio address, January 26, 1944) Box 1, Speeches and Broadcasts of Margaret Hickey, 1943-1944, Records of the Women's Advisory Committee, War Manpower Commission, Record Group 211, National Archives II, College Park, Maryland (hereafter cited as NACP).

⁸ H. Marjorie Crawford, "Comments on Positions by National Secretary," *The Iotan* 4, no. 1. (March 1944), 9.

⁹ Evelyn Laing McBain, "Farewell from the National President," *The Iotan* 5, no. 1 (May 1945), p. 5-6.

improve commercial air travel.¹⁰ Even Lillian Moller Gilbreth publicly agreed that the wartime experiences of women engineers would be an asset in the postwar world.¹¹

On one level, it seems somewhat surprising that these older women scientists would voice such optimism. They had, after all, been the ones cast aside after the First World War and then further scorned during the Great Depression. On another level, perhaps, they saw in the war an opportunity to establish for themselves some stake in the postwar world. Even as they realized the limitations of the war work to which they were assigned, these women genuinely believed that their contributions were valuable and important. They maneuvered within the room that was available to them, and by asserting their own vision for the postwar period, they hoped they might avoid replicating their earlier experiences and mistakes.

The optimism expressed by younger women in school or in their first jobs seems less surprising. Born in the 1920s, most of these women began their college careers just as the wartime demand for scientific personnel surged. Although many had been discouraged from scientific and technical pursuits as children, and they themselves had grown up during the Great Depression, wartime changes provided unprecedented encouragement and opportunities. These women made their educational and career choices in a climate that publicly applauded women's scientific abilities and begged for more. Many of them later reflected on the war's broader impact on their own sense of what they could accomplish. Ruth Kimmelman Schochet, who entered college in 1942, recalls that the war, which "showed we could do whatever was needed," increased her "desire to go to graduate school

¹⁰ Elsie Eaves, "Wanted: Women Engineers," *Independent Woman* (May 1942), 133, 159.

¹¹ Lillian M. Gilbreth, "Women In Engineering," *Mechanical Engineering* 64, no. 12 (December 1942), 857, 859.

and become a chemist.”¹² A class of 1943 mathematics major recalls that the war “made me much more aware that I had a role to play.” After graduation, she worked in gun and radar development at Bell Telephone Labs. “It became more and more clear that women were capable of much more than previously credited.”¹³ Even Mary Glover, a Curtiss-Wright Engineering Cadette reported that many of her classmates “feel that there will be a need for their services in the post-war adjustment period.”¹⁴ Having proven themselves and their abilities, it was inconceivable to many that their talents would no longer be needed at the war’s end.

Other individuals, however, seemed less positive about what the future would hold. Virginia Gildersleeve, who had fought so zealously for women’s admission to Columbia’s School of Engineering, now pondered the fate of those first female students. In a series of exchanges with *Woman’s Home Companion* editor Esther Bien, she agreed with Bien’s assessment of the “manpower” shortage and the opportunities it had opened for women in scientific fields. But she questioned the accuracy of Bien’s prediction that the “huge expansion in certain of these fields promises to make many of the new jobs permanent and to offer lifetime careers to girls who equip themselves with special training in chemistry, physics, and mathematics.” In March 1943, Gildersleeve wrote to Bien, “I do not think you

¹² Ruth Kimmelman Schochet to author, New Jersey College for Women Questionnaire, no. 61, 4, in author’s possession.

¹³ Name withheld to author, New Jersey College for Women Questionnaire, no. 231, 4, 6, in author’s possession.

¹⁴ Mary Glover, “With One Purpose—Victory!” *The Cadetter* March 1943, 1, Folder 4, Box 1, Records of the Curtiss-Wright Engineering Cadettes Program, Women in Science and Engineering Archives, Iowa State University, Ames, Iowa. (hereafter cited as WISE).

are warranted in saying so positively that these times of work are going to offer life-time careers for women when the war is over.” “Possibly they will,” Gildersleeve conceded, and “I do not mean to imply that this doubt about the future should deter women from entering these jobs at the present time.” “But you cannot know definitely.”¹⁵

In spite of her uncertainty (and in an attempt to avoid undoing her own wartime work), Gildersleeve continued to stress publicly the immediate demand for “trained brains.” In 1944, she issued a revised version of her pamphlet “Educating Girls for the War and the Post-War World,” which read, “[S]o great and urgent is the need for mathematicians and scientists that any aptitude in these directions should certainly be encouraged.” Yet even as she predicted that “the scope of women’s professional activities will probably remain permanently enlarged,” she did concede that “it seems likely that the number of women physicists and mathematicians required will fall off rather sharply” in the postwar period.¹⁶

The central issue for Gildersleeve and others, then, was how best to counsel young women regarding these fields. As late as July 1944, Gildersleeve observed, the “tide” that carried many women into fields such as engineering, physics, and chemistry, “is still high. These workers are still needed for the waging of the war.” But “[w]hen the tide recedes, a few of them will be left in these fields of work.”¹⁷ Should they continue riding the wave of

¹⁵ Esther R. Bien to Dean of Women, March 19, 1943 and Virginia Gildersleeve to Esther Bien, March 23, 1943, Records of the Dean, Barnard College Archives. Folder 17d, Box 7, Dean’s Office/Departmental Correspondence, 1942-1943, Barnard College Archives (hereafter cited as BCA).

¹⁶ Virginia C. Gildersleeve, “Educating Girls for the War and Post-War World,” draft, January 4, 1943 and Postscript, October 10, 1943, addresses 1943, Box 2, personal papers of Virginia Crocheron Gildersleeve (hereafter cited as VCG), BCA.

¹⁷ Gildersleeve, “Professional Fields in Which New Jobs Are Developing,”(address, Business and Professional Women’s Clubs Conference July 17, 1944), Box 2, VCG, BCA.

national defense and just see where the tide takes them, or was a new direction needed? Justifying women's scientific participation in terms of national security needs, after all, would have limited resonance in times of peace.

Weighing in on the matter was Margaret Barnard Pickel, one of Gildersleeve's colleagues. Pickel had spent most of the past decade at Columbia, where she earned her Ph.D. in English in 1936. After graduation, she continued to teach courses at the university, and in 1940, she became the advisor to women graduate students at Columbia. In 1942, she established at Columbia a War Work Information Bureau for Women College Graduates, which operated in conjunction with the U.S. Civil Service Commission and the National Roster of Scientific and Specialized Personnel. It was in this capacity that she collaborated with such individuals as Chase Going Woodhouse and Virginia Gildersleeve in encouraging and recruiting technically trained women for the war effort.¹⁸ Like Woodhouse and Gildersleeve, Pickel embraced the popular claim that failing to place college-educated women in scientific and technical work for which they qualified was "wasteful." To this end, she not only directed college graduates to wartime openings in industry, but also endorsed short-term engineering programs as a tool for meeting immediate war needs. Her outlook for the postwar era even seemed hopeful. Although "there undoubtedly will be dislocations," she argued, "the woman who received good training and proved to be awfully good on the job is likely to remain in industry."¹⁹

¹⁸ "War-Job Roster for College Women," *New York Times*, July 12, 1942, D4; Obituary, "Margaret Pickel, Aide at Columbia," *New York Times*, January 8, 1955, 13.

¹⁹ Margaret B. Pickel quoted in "Use Skills in War, Graduates Urged," *New York Times*, February 8, 1943, 16.

But toward the end of the war, she changed her tone. In “A Warning to the Career Woman,” which the *New York Times* published in July 1944, Pickel argued that while it “is right that young women should feel a confidence in their future...that confidence should be founded on what is probable and feasible.” She criticized both older and younger generations of women for their unbridled optimism, which she likened to “the creeds of the excessive feminist.” “Perhaps it was the indomitable refusal of the early feminists to admit that anything was impossible for women that broadened the road women now travel.” But that optimism also has its limitations, she warned. She cautioned against overestimating the extent to which the war brought down barriers to women’s advancement. “It is too easy,” Pickel wrote, “for women who have borne the burden and the heat of the long day in which opportunities and rewards have increased, to think that all the odds are disappearing from a woman’s world.” “We should not take a temporary condition as a guarantee for the future, nor should we take an exception and make a rule from it.” Older women and educators, she urged, “must take the long view for their students to keep their heads.”²⁰

Curious and concerned about what would happen to female students at the war’s end, Pickel began looking for some warning signs. One came when a dean of women at a large college where over 100 women enrolled in pre-engineering courses told Pickel that she did not expect any considerable number of women engineers to be employed after the war.

Another early warning sign came from the director of Cooper Union, who publicly predicted that women drawn to wartime engineering positions would probably be dropped “like a hot

²⁰ Margaret Barnard Pickel, “A Warning to the Career Woman,” *New York Times Magazine*, July 16, 1944, 19.

potato” at the war’s end.²¹ Faced with these reports, Pickel inquired, “[A]re the educators of women justified in encouraging their students to start on the long, arduous, and expensive training for an engineering degree with the expectation of a professional career at the end of it?” She answered her own question with a resounding no, and advised that women “avoid those professions in which men are still pre-eminent.”²²

The questions raised by Pickel and Gildersleeve about how to educate women for the post-war world became increasingly contentious as victory loomed larger. They were tackled in some depth in 1944, when deans of women, industrialists, and bureaucrats gathered in Washington D.C. for another conference held under the auspices of the Institute of Women’s Professional Relations. Conference speakers once again offered a variety of predictions and prescriptions for scientifically trained women. These forecasts varied widely, and one speaker even managed to contradict himself in his own address. Just minutes after advocating that women abandon their wartime positions in “masculine” fields, Brigadier General Frank Hines of the Office of War Mobilization argued that “We can and should continue to utilize the services of scientifically trained women who desire to continue their careers in the postwar world.” He continued:

While the men’s colleges are empty, the women’s college are full. The country will need trained scientists and professionally trained people when the war is over....It would be poor social policy not to encourage these women to carry on.

²¹ Edwin S. Burdell, quoted in Summer Chick Bergen, “Women in Engineering, 1940-1970: Struggle Against the Gender System,” (Master’s Thesis, The University of Houston Clear Lake, 1998), 18.

²² Pickel, “A Warning to the Career Woman,” 19.

But his earlier point that no man “wants a woman with a stillson wrench in her hand or a cleaver” and that women should “do the light and artistic things, the things requiring finesse,” still lingered in the air.²³

Although some might have found his comments objectionable, educators and deans of women saw in Hines’ speech many of their own concerns and fears. As professional women themselves, many had encountered discrimination in their own lives and realized the importance of keeping doors propped open to women. They were wary about limiting women to “light and artistic things,” as Hines suggested, even if those were the areas in women would face the least resistance. But they also realized that other factors over which they had little or no control would severely limit many women’s options in the postwar period. The return of male veterans would undoubtedly exert pressure on employers and educators to once again favor college men. The end of the war also promised to disrupt the educational and career paths of those women who were married or engaged to returning veterans. A renewed emphasis on domesticity and home life, which many predicted, raised the age-old question, “For what are we educating women?”

Sarah Lawrence College President Constance Warren took up this subject in her address by the same title. She lauded those professional opportunities made available to women through war, but implored her colleagues to “remember that their students are going to be women and citizens, as well as...engineers.” The colleges, Warren argued, must adjust their offerings to equip students “for all these situations in which women will find

²³ Frank T. Hines, “The Problem of the Postwar Employment of Women,” in *War and Post-War Employment and Its Demands for Educational Adjustments*, ed. Institute of Women’s Professional Relations, 57-59.

themselves—marrying, earning their living, assuming community responsibilities.” She warned against courses “too narrowly vocational” and instead advocated an “elastic” curriculum that accommodated the complexities of women’s lives. The sciences made up one component of this curriculum but took a backseat to child psychology and economics, which now carried more immediacy. Warren was careful not to dismiss scientific careers for women, but instead advocated “a new approach to the study of science,” one that went beyond the accumulation of technical knowledge and examined in some detail “the impact of technical advance on our culture and upon others.”²⁴ A course introduced at Indiana University in 1944, called “Descriptive Survey of Physics” offers one example of this approach. This course and others like it, which were designed to provide a general knowledge of the physics and its social consequences helped to improve non-specialists’ understanding of the field.²⁵ But taken alone or as a substitute for laboratory work, these courses seemed less useful for women seeking careers in the field and more appropriate for women pursuing domestic and social endeavors.

Warren’s determination to deemphasize the technical aspects of science hints at many educators’ broader concern that the liberal arts had been both displaced and debased by war.²⁶ At the outset of the conflict, individuals such as Meta Glass had expressed reluctance

²⁴ Constance Warren, “For What Are We Educating Women,” in *War and Post-War Employment and Its Demands for Educational Adjustments*, ed. Institute of Women’s Professional Relations, 191-197.

²⁵ Alvin Johnson, “Education in Review: Our Need for Institutions Devoted Solely to the Schooling of the Adult,” *New York Times*, September 3, 1944, E9.

²⁶ Although it would have different consequences for male and female students, this move to reinstate the liberal arts curriculum at the war’s end was part of a more general interest in the future of liberal education. Deans, professors, and counselors at all types of colleges and universities took up the subject and innumerable books, conferences, committees, and articles proliferated. Many charged that the trend toward scientific and technical courses would produce a generation equipped to manage a technological society, but lacking the “vision and

to advocate unequivocally scientific and technical training for women. The liberal arts represented, after all, a ballast against militarism and promised to preserve those cultural values that might otherwise be lost. Strictly vocational training, designed to carry out scientific war work, threatened that base. Indeed, as Pembroke College Dean Margaret Morriss observed, “the whole program of liberal education is under fire....even in our women’s colleges we are being urged by Government officials and anxious industrialists to devote ourselves entirely to practical training.”²⁷ It was only as the general demand for scientific personnel escalated and new opportunities emerged that most educators and deans of women gradually embraced this sort of vocational education for college women. And in doing so, they found that the war offered an unprecedented occasion to expand women’s participation in fields from which they had previously been discouraged or excluded. But at what cost were these gains won? Had they gone too far?

In January 1943, the *New York Times* education correspondent and Columbia Ph.D. Benjamin Fine wrote the alarming story, “Liberal Arts Eclipsed by Vocational Courses.” Outlining the recent trend of high school and college students flocking to technical and science studies, Fine wrote:

ability” needed to promote the kind of social order for which the country went to war. Yet there was much disagreement over how to restore this vision or what “liberal education” should even look like in the post-war period. Some advocated a return to the “great books” of Western civilization while others advocated an expansion of the liberal curriculum to include those technical subjects with immediate relevancy to the post-war world. “The quarrel,” observed Columbia University philosophy professor Irwin Edman, “is between those who stress the fact that we inherit a great tradition and those who insist we face a great future.” “The controversy is in essence as old as education itself.” See V.R. Cardozier, *Colleges and Universities in World War II* (Westport, CT: Praeger, 1993), 122 and Irwin Edman, “Which Road for Education?” *New York Times Magazine*, July 2, 1944, 16.

²⁷ Margaret S. Morriss, “What’s Next in Women’s Education,” *Association of American Colleges Bulletin* XXX: 1 (March 1944): 116.

In all sections of the country...the emphasis now is upon technical training. As never before, young men and women are turning to mathematics, chemistry, physics, statistics, meteorology, and similar fields. Less attention is paid to philosophy, Latin, French, or the social sciences.

He noted with some surprise the record number of students enrolled in these subjects, as well as the rapid growth of short term training programs, such as ESMWT. The interest (and sponsorship) of government and industry in producing scientific and technical personnel clearly contributed to this shift. Women students had not escaped notice, and it was “the sharp trend toward technical courses...in the women’s colleges” that seemed most remarkable (it even warranted a special subsection in this article). And “with each passing month,” Fine observed, “a greater emphasis is placed on producing scientific and technical personnel.”²⁸

Some educators and deans of women, however, such as New Jersey College for Women Dean Margaret T. Corwin, believed that their institutions had been able to avoid some of the war’s more damaging effects through a “bifocal” approach to wartime planning. Women’s colleges in particular, she noted, have been “able to focus one set of lenses on our immediate program, in its war phase, and we can use the other lenses for the program of postwar planning.”²⁹ Hood College Dean Elizabeth May reported using a similar strategy at her institution:

We had the conflict that I think many of us have had, between those who were determined to preserve the liberal arts, dead or alive, and those who were determined to give girls vocational training. We have reached a very happy compromise by

²⁸ Benjamin Fine, “Liberal Arts Eclipsed by Vocational Courses,” *New York Times*, January 24, 1943, E7.

²⁹ Margaret T. Corwin, introduction to “Discussion,” in *War and Post-War Employment and Its Demands for Educational Adjustments*, ed. Institute of Women’s Professional Relations, 211.

calling it training for war and postwar service, and not a man will object to a phrase of that kind.³⁰

The careful phrasing employed by both May and Corwin enabled them to expand as wide as possible the scope of women's schooling during the war. And as May pointed out, the distinction between war and postwar service helped to guard against objections from male colleagues. But it also betrayed their assumption that scientific and technical training was a temporary measure. For both Corwin and May—as well as most other educators who had themselves been trained in the liberal arts—the wartime emphasis on science and technology represented a blip in women's education that would be smoothed over at the war's end. They did not completely discount continued training for women in scientific and technical fields, but they downplayed the vocational aspects of that training and generally agreed that most women would be best served by a traditional liberal arts curriculum.

Whatever their individual stance, most educators believed that post-war education required some kind of balance between the humanities and the more scientific fields of study. They recognized that their biggest task in the post-war period “will be to work out a program that will combine both vocational and liberal courses” and even the most ardent supporters of technical training advocated increased attention to humanistic fields. Indeed, some schools of engineering instituted new degree regulations requiring a certain number of credit hours in the liberal arts.³¹ But most educators also realized that the war's impact extended beyond a

³⁰ Elizabeth May, “Discussion,” in *War and Post-War Employment and Its Demands for Educational Adjustments*, ed. Institute of Women's Professional Relations, 224.

³¹ Benjamin Fine, “Education in Review: American Engineering Colleges Plan to Add Courses in Humanities and Liberal Arts,” *New York Times*, October 15, 1944, E9; Fine, “Education in Review: College Program to Combine Vocational and Liberal Courses Seen as Post-War Objective,” *New York Times*, August 13, 1944, E9.

rebalancing of the curriculum. The war had, after all, fundamentally altered the relationships among education, government and industry. Never before had institutions of higher education been so involved in the training of civilian scientists and the carrying out of defense research and development. Margaret Corwin voiced many educators' concern with the involvement of industry and government in university affairs when she wondered whether "the question of industry's being closer to the colleges...is incompatible with [our] hopes for the humanities, the liberal arts." Would it even be possible to resume "education as usual?"³² The answer to this question remained unclear, as the postwar role of the federal government and industry in university life had not yet been determined.

Science's Endless Frontier

As debates over post-war education waged on, so too did debates over post-war science. Educators, industrialists, bureaucrats, scientists, and the general public realized the importance of science to the war effort. The large-scale coordination and organization of weapons research through innovative mechanisms such as the National Defense Research Council and the Offices of Scientific Research and Development garnered much recognition and praise. Vannevar Bush, the architect and director of these agencies, took on heroic stature himself. Regularly chronicled and caricatured in national papers, the slender, kindly-looking, almost grandfatherly-like figure, usually depicted with a tobacco pipe in his hand, was lauded as the "mobilizer of America's scientific brain power" and the "chief of staff on the science front." Although, as one reporter remarked, "It seemed almost an anomaly for

³² Corwin, "Discussion," in *War and Post-War Employment and Its Demands for Educational Adjustments*, ed. Institute of Women's Professional Relations, 216.

this peaceful-looking man to be speaking about war,” Bush became the unmistakable face of wartime science.³³

A common theme found in many articles featuring Bush was the sheer enormity of the budgets he oversaw. One headline, for example, proclaimed, “Dr. Bush directs a research staff that spends almost \$3,000,000 a week to develop war weapons.”³⁴ This unprecedented level of spending became a source of awe (and occasionally suspicion) that ultimately elevated the status of American science in the eyes of many. Most policy makers and scientists believed that federal support for science was here to stay. Yet they were divided over what form federal support for science would take at the war’s end. Beginning in 1942, Democratic Senator Harley Kilgore of West Virginia introduced several bills to reorganize science and technology in the interest of the public good. The key piece of legislation, introduced in 1944, proposed a national science foundation that would be responsible to political authority and, what many constituents eventually feared, political control.³⁵

Vannevar Bush agreed with Kilgore that federal support of science should continue after the war, but he disagreed with the senator’s approach, especially regarding administrative control.³⁶ In an attempt to ensure that his own vision would prevail (and to

³³ S.J. Woolf, “Chief of Staff on the Science Front,” *New York Times Magazine*, January 23, 1944, 16.

³⁴ Woolf, “Chief of Staff on the Science Front,” 16.

³⁵ George T. Mazuzan, *The National Science Foundation: A Brief History* (Washington, D.C.: National Science Foundation, 1988), 1-6; Daniel J. Kevles, “The National Science Foundation and the Debate over Postwar Research Policy, 1942-1945,” *Isis* 68, no. 1 (March 1977): 16-18; J. Merton England, “Dr. Bush Writes a Report: ‘Science—The Endless Frontier,’” *Science* 191, no. 4222 (January 9, 1976): 41; Roger L. Geiger, *Research and Relevant Knowledge* (New York: Oxford University Press, 1993; reprint with new introduction, New Brunswick: Transaction Publishers, 2004), 14-15.

³⁶ Mazuzan. *The National Science Foundation*, 1-6.

counter growing interest in Kilgore's initiatives), Bush worked with members of the executive office to secure President Franklin Roosevelt's support. The result of this strategizing was a public letter from Roosevelt to Bush, in which the President formally requested Bush's recommendations for postwar science policy.³⁷

In this widely published November 1944 letter, President Roosevelt lauded the work of the Office of Scientific Research and Development and suggested that "there is...no reason why the lessons to be found in this experiment cannot be profitably employed in times of peace." The information, techniques, and research experience acquired during the war by thousands of scientists, the President argued, "should be used in the days ahead....for the improvement of national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living." With that objective in mind, Roosevelt asked Bush for recommendations on each of the following points: the prompt release of findings from secret wartime research; the creation of a medical research program; a plan for the government to "to aid research activities by public and private organizations"; and a program for developing scientific talent in American youth.³⁸ To carry out his charge, Bush quickly organized separate committees for each issue and began formulating his response.

³⁷ Kelly M. Greenhill, "Skirmishes on the 'Endless Frontier': Reexamining the Role of Vannevar Bush as Progenitor of U.S. Science and Technology Policy," *Polity* XXXII, no. 4 (Summer 2000), 633;

Kevles, "The National Science Foundation and the Debate over Postwar Research Policy, 1942-1945," 16-18; England, "Dr. Bush Writes a Report: 'Science—The Endless Frontier,'" 41.

³⁸ Franklin D. Roosevelt to Vannevar Bush, November 17, 1944, reprinted in Vannevar Bush, *Science, The Endless Frontier: A Report to the President on a Program for Postwar Scientific Research* (Washington D.C.: United States Government Printing Office, 1944), vii; analysis of letter in Geiger, *Research and Relevant Knowledge*, 14-15.

Eight months later, in July 1945, Vannevar Bush delivered his findings to President Harry Truman in the now famous report, *Science, The Endless Frontier*. Capitalizing on a popular American theme, Bush wrote that while “it has been basic United States policy that Government should foster the opening of new frontiers...the frontier of science remains.” Thus, he continued, “It is in keeping with the American tradition—one which has made the United States great—that new frontiers shall be made accessible for development by all American citizens.”³⁹ But making the frontiers of science accessible to all required continued federal support. Bush’s nearly two-hundred page treatise put forward a strong case for this argument, and delineated the importance of science to national security, the relationships between science and employment, and the importance of basic research. He also drew attention to the razor-thin lead that American scientists had achieved in the wartime race to develop new technologies and intimated that next time, they might not be so fortunate.⁴⁰

Another major component of Bush’s report called for a renewal of America’s scientific talent. By Bush’s calculations (which were informed by the 17-man committee he put on this task), the war had created a deficit of approximately 150,000 science and technology students who would have obtained bachelor’s degrees, had they remained at their colleges and universities. This loss had also affected the number of students continuing on to graduate school, and he estimated that the war cost science nearly 17,000 Ph.D.s. Because “the real ceiling on our productivity of new scientific knowledge...is the number of trained

³⁹ Bush, *Science, The Endless Frontier*, 6, 12.

⁴⁰ Ibid.; Mazuzan,, *The National Science Foundation*, 1-6.

scientists available,” this phenomenon promised to have far-reaching and potentially devastating effects.⁴¹

The threat of “scientific suicide” weighed heavily on Bush and his colleagues as they drafted a program for developing scientific talent in American youth.⁴² Such a program would need to offset the deficit created by war and would necessarily involve encouraging and enabling much larger numbers of students to pursue scientific careers. To carry out this goal, Bush’s committee proposed the creation of a federally-funded scholarship program for science education. Based solely on merit and “without regard to sex, color, race, creed or need,” the scholarships would support 6,000 undergraduates and 250 graduate students per year. Although committee members expressed particular interest in replenishing the (male) scientific talent lost to the armed forces, the program would include women as well. Thus, the national science scholarship program endorsed by Bush promised to attract and encourage America’s top scientific talent from all sectors of society. Indeed, he argued, “The future of our country in peace and war depends on [this] premium crop.”⁴³

Having established that the nation’s security and prosperity relied on continued federal support for science, Bush carefully built his case for a new federal agency devoted to this task. “[T]he national interest in scientific research and scientific education,” he explained, “can best be promoted by the creation of a National Research Foundation,” which served as the centerpiece of his proposal. As conceived by Bush, the organization would

⁴¹ Bush, *Science, The Endless Frontier*, 2-3, 129.

⁴² Charles Allen Thomas, quoted in Bush, *Science, The Endless Frontier*, 151.

⁴³ Bush, *Science, The Endless Frontier*, 144, 153.

develop and promote a national policy for scientific research and development, support basic research in nonprofit organizations, support long-range research on military matters, and “develop scientific talent in American youth by means of scholarships and fellowships.”⁴⁴ With Bush’s assistance, this model for a national science organization made its way into a bill sponsored by Democratic Senator Warren Magnuson of Washington. Magnuson proposed the bill on the same day that the White House released *Science, The Endless Frontier*. Harley Kilgore proposed a revised version of his own bill for a national science foundation (the title soon preferred) several days later. Yet more than five years (and one presidential veto) would pass before Congress and the administration arrived at a compromise bill and finally established the National Science Foundation.⁴⁵

Despite the heated disagreements and protracted debates, there existed extraordinary consensus about the need for a National Science Foundation. Most arguments had little to do with whether such an organization should be created, and much more to do with how it should function. Indeed, 99 out of 100 witnesses at Congressional hearings testified in favor of a National Science Foundation.⁴⁶ In the end, the model recommended in *Science, The Endless Frontier* would undergo significant revision. But the optimism and idealism surrounding science persisted, as did many of the report’s main points—particularly the centrality of science to national defense and the critical need for renewing America’s scientific talent.

⁴⁴ Bush, *Science, The Endless Frontier*, 28.

⁴⁵ Mazuzan, *The National Science Foundation*, 3-6; Geiger, *Research and Relevant Knowledge*, 14-15.

⁴⁶ Geiger, *Research and Relevant Knowledge*, 16-17.

The Postwar College

Even though the National Science Foundation would not award its first fellowships until 1952, there existed in the immediate postwar period other mechanisms for replenishing the country's scientific brainpower. The Serviceman's Readjustment Act of 1944, for example, enabled more than two million returning veterans to pursue higher education at government expense. While policy makers did not design the "G.I. Bill" with this purpose in mind, and veterans were not restricted to scientific subjects, the use of this legislation to renew scientific talent had been advocated by Vannevar Bush and his colleagues. They had even recommended an amendment to the bill that would "make that law an instrument for the amelioration of the deficits of scientists resulting from the war and Selective Service policy," which they deemed as "essential for the safety and continued prosperity of the nation."⁴⁷ And in practice, the G.I. Bill did help to renew America's scientific talent. Hundreds of thousands of veterans, many of whom would not have been able to afford college without federal assistance, flocked to the nation's science and engineering programs.⁴⁸

The GI Bill has been lauded for democratizing higher education. But it primarily benefited men. Women made up less than three percent of veterans and used G.I. benefits less frequently than their male counterparts.⁴⁹ Moreover, the rapid influx of male G.I.s

⁴⁷ Bush, *Science, The Endless Frontier*, 134.

⁴⁸ Cardozier, *Colleges and Universities in World War II*, 224; Davis R. B. Ross, *Preparing for Ulysses: Politics and Veterans During World War II*, (New York: Columbia University Press, 1969), 91-124. For other studies of the G.I. Bill, see Keith W. Olson, *The GI Bill, the Veterans, and the Colleges* (Lexington: The University Press of Kentucky, 1974); and Theodore R. Mosch, *The GI Bill: A Breakthrough in Educational and Social Policy in the United States* (Hicksville, New York: Exposition Press, 1975).

⁴⁹ Susan M. Hartmann, *The Home Front and Beyond* (Boston: Twayne Publishers, 1982), 106.

threatened the place of those college women who had been so vigorously recruited and encouraged during the war. The wartime demand for women gave way to a pronounced preference for returning veterans, whose arrival on college campuses overwhelmed enrollments and taxed school resources, such as housing, classrooms, teaching staff, and counseling services. Many universities, pressed for dormitory space, even converted women's residence halls into housing for male veterans. As University of Michigan Dean of Women Alice C. Lloyd observed, the G.I.s "have come in larger numbers and more quickly than anyone anticipated and their inevitable and unchallenged rights are threatening other college groups on many coeducational campuses. The group most often endangered is that group which has never been too secure in its rights and privileges in the educational world—the women." Although "[d]uring the war there has been a tremendous increase in the number of women seeking higher education and professional training," Lloyd continued, "there is grave danger that the women if not actually excluded, may be neglected and relegated very definitely to second place."⁵⁰

By 1946, as Lloyd suspected, educators across the country began curtailing women's admission. From Syracuse to Stanford, thousands of qualified women were turned away from higher education in an effort to accommodate veteran's needs. State universities such as Michigan and Wisconsin, where female students had made up 64 and 70 percent of wartime enrollments, respectively, now banned nearly all out-of-state women. Meanwhile, Cornell issued an announcement in January 1946 that unapologetically explained, "The dozen

⁵⁰Alice C. Lloyd, "Women in the Postwar College," *Journal of the American Association of University Women* 39, no. 3 (Spring 1946): 131.

fraternity houses under lease to the university as ‘cottages’ will not be available next fall, so the number of women students will inescapably have to be reduced.” Although women had constituted a majority of Cornell’s student body during the war years, the administration cut back women’s enrollment to the prewar norm of twenty percent. Undergraduate women’s colleges also felt pressure to accommodate veterans, and many—including Vassar, Finch, and Sarah Lawrence—admitted male students for the first time.⁵¹

Graduate programs suffered a similar fate. Between 1946 and 1951, female graduate enrollment at Johns Hopkins hovered between 21 and 25 percent each year. And the Radcliffe Graduate School (the female part of the Harvard Graduate School of Arts and Science), was forced to cut its enrollment from 400 in 1945 to less than 300 in 1946. Despite a significant increase in the number of applicants, Radcliffe’s female enrollment was not allowed to reach 400 again until 1957. Meanwhile, male graduate enrollment at Harvard soared from 1,088 in 1946 to 1,960 in 1947.⁵²

At the risk of sounding unpatriotic, many women’s advocates and educators such as Alice Lloyd denounced postwar policies limiting women’s enrollment. In her “Women in the Postwar College Article,” which appeared in the Spring 1946 *Journal of the AAUW*, Lloyd reminded readers about their own roles (and the roles of their colleges) in encouraging

⁵¹Lloyd, 131; Helen M. Hosp, “Doors Closing for Women Students,” *Journal of the American Association of University Women* 39, no. 3 (Spring 1946): 167; Hartmann, *The Home Front and Beyond*, 106; Margaret W. Rossiter, *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995), 31; Barbara Miller Solomon, *In the Company of Educated Women* (New Haven: Yale University Press, 1985), 189. While some women’s schools eventually reinstated their all-female policies, others permanently adopted coeducation. Due to excessive overcrowding at the all-male University of Florida at Gainesville, for example, the Florida State College for Women at Tallahassee not only admitted large numbers of male students, but also transformed itself into the coeducational Florida State University.

⁵² Rossiter, *Women Scientists in America*, vol. 2, 33.

women's wartime enrollment, adding that "It is not fair to forget this in the deliberations that are now taking place on college campuses as how to meet the present emergency." At the same time, she realized "that the threat to women in higher education...is clouded by the sentiment that is mixed up with society's feeling toward the veterans" and "by a certain masculine jealousy of their own professional prerogatives which the veterans feel were threatened while they were away at war." In an effort to reconcile the competing claims of civilian women and returning veterans, she proposed that colleges regard the record number of applications as an opportunity to raise standards. By taking the best students, and not necessarily every veteran who applied, institutions of higher education could improve their own performance. She urged AAUW members to advocate this solution as "the fairest and most intelligent way of limiting enrollment...without discrimination against any class or sex."⁵³

Lloyd's critique of postwar policies restricting women's admission was quickly echoed up by others, including 200 college administrators and educators who gathered in Lexington, Kentucky for the May 1946 American College Publicity Association Annual meeting. Delegates attacked the "men first" attitude of many colleges and universities as a "backward step" and one that served to bar "tens of thousands women from higher education." Like Lloyd, Alice Vosburgh of Smith College reminded the audience that "during the war women were welcomed to the campus" but were now being told that "we have no room." She urged colleges and universities across the country to revise this policy. Likewise, Dorothy Blair, Dean of Women at Ohio's Marietta College, called on institutions

⁵³ Lloyd, "Women in the Postwar College," 131-133.

to stop restricting women's admission. Veta Lee Smith of Marshall College called discrimination against women students "economically unsound and fundamentally wrong." She, too, urged institutions to provide equal educational opportunities for men and women. Even Adrien Minden of the Pratt Institute advocated that colleges "develop an equitable arrangement whereby both women and veterans are accepted."⁵⁴

The National Federation of Business and Professional Women's Clubs voiced similar concerns. At the group's biennial convention held in the summer of 1946, members passed a resolution opposing percentage restrictions on women's enrollments in colleges and universities "not only as discriminatory, but also as curtailing leadership where it is most needed in the years ahead."⁵⁵ Yet most of these protests fell on deaf ears. Even the larger organizations, such as the National Federation (with membership approaching 120,000) and the AAUW (which claimed more than 90,000 members) found that their influence was not weighty enough to offset the general public's eagerness to assist veterans. Nor could they contend with what the media portrayed as young women's own willingness to forfeit higher education in the service of returning soldiers. When a May 1946 *New York Times* radio forum posed the question "Should Women Stay Away from College to Give Veterans a Chance?," the two female students showcased by the *Times* answered yes. They agreed that "women who stayed away from college during the present emergency could utilize their time profitably to clarify their aims and plan their studies for later training."⁵⁶ Although it is

⁵⁴ Benjamin Fine, "Colleges Warned Not to Bar Women," *New York Times*, May 8, 1946, 41.

⁵⁵ National Federation of Business and Professional Women's Clubs, "Resolutions Adopted by the Convention," *Independent Woman* (August 1946), quoted in Rossiter, *Women Scientists in America*, vol. 2, 32.

⁵⁶ "Girls' Study Right Debated on Forum," *New York Times*, May 22, 1946, 19; Rossiter, *Women Scientists in*

unclear how many college women shared this sentiment, their response certainly reflected the widespread preference for rewarding and rehabilitating military men.

But gaining admission to the postwar college was only the first in a long line of obstacles encountered by women. Female students—both newly admitted ones and those who carried on from wartime days—often faced a hostile climate once on campus. Phyllis Pollock Magat, who enrolled in M.I.T.’s chemistry Ph.D. program in the fall of 1944, recalls the sharp contrast between the war years and the immediate postwar period:

[O]ur entering class in the chemistry grad school in 1944 was small (about eight) and were mostly women. The professors were amazed but soon got over any prejudice. The problems due to being a woman disappeared during the war, but reemerged with a vengeance after the war when veterans returned to schools.⁵⁷

One concrete example can be viewed in the distribution of financial aid, as many female students who had been both encouraged and funded during the war lost their scholarships to returning G.I.s. Other women daring to enter graduate programs also found that schools preferred to fund returning G.I.s and civilian men. As chemist Geraldine Lynch Krueger reported to Iota Sigma Pi’s national president, “The GI Bill has enabled huge numbers of men to go on in graduate study, but relatively few women. Competition for space to do research and for departmental assistantships has never been more keen.”⁵⁸ As returning

America, vol. 2, 32-33.

⁵⁷ Phyllis Pollock Magat to author, New Jersey College for Women Questionnaire, no. 50, 8, in author’s possession.

⁵⁸ Geraldine Lynch Krueger, President of Columbian Chapter ISP (Columbia University) to Dr. Essie White Cohn, University of Denver, November 12, 1949, Folder 6, Box 18, Records of Iota Sigma Pi (hereafter cited as ISP), WISE.

veterans reclaimed their places in scientific and engineering programs, women's presence in masculine fields became even more marginal.

The revival of traditional social attitudes was exacerbated by other postwar college trends effected by the G.I. Bill. The presence of married veterans, in particular, introduced “new patterns of college domesticity.”⁵⁹ At schools across the country, “Vetsvilles” sprouted up to house veterans and their families. There, a soldier and his wife might huddle over dinner in their Quonset hut, or bundle up the children for a stroll across campus. Images such as these proliferated in newspapers and yearbooks and, before long, became typical representations of college life.⁶⁰

Many college women recall the postwar surge in “collegiate domesticity” as a powerful force, and one that spread beyond the confines of “Vetsvilles.” Dorothy Lawrence Stephens, a class of 1946 women's college graduate, explained that “Marriage was in the air and everyone was doing it—it was hard to resist.”⁶¹ Although Stephens wed in the spring of the senior year, she still managed to complete her degree, thus benefiting from newer policies designed to accommodate married students. (In earlier years, married women might have been asked to leave school). In this regard, the G.I. Bill expanded the notion of who could benefit from college, and in doing so, eased the way for older, married students. But it also

⁵⁹ Solomon, *In the Company of Educated Women*, 190.

⁶⁰ Hartmann, *The Home Front and Beyond*, 106; and Linda M. Eisenmann, *Higher Education for Women in Postwar America, 1945-1965* (Baltimore: Johns Hopkins University Press, 2006), 54.

⁶¹ Dorothy Lawrence Stephens to author, New Jersey College for Women Questionnaire, no. 122, 4, in author's possession.

limited women's roles on campus, as most were regarded as wives or as future wives—whether they were or not.⁶²

The postwar emphasis on domesticity also emerged in new debates over women's schooling as the push to reinstate the liberal arts gave way to calls for a distinctly feminine curriculum. Emboldened by carefully selected psychological studies, educators highlighted sex differences and revived nineteenth century concerns that general education would unfit women for their domestic duties. One of the most vocal proponents of "feminine education" was Mills College President Lynn White, Jr., who denounced educating women "as if they were men." Instead, White advocated "feminine studies" that would include, among other topics, "the theory and preparation of a Basque paella, or a well-marinated shish-kabob."⁶³

The growing interest in the kind of feminine curriculum proposed by White was part of a broader backlash against women's wartime gains, both on campus and beyond. The movement of women into "masculine" fields was of particular concern to educators such as Simmons College President Bancroft Beatley, who now decried wartime efforts to increase the supply of scientifically-trained women. In a *Journal of Higher Education* article, he recalled, "Colleges which had never acknowledged a vocational objective... offered courses in map-making for the War Department, and undertook to educate women in a wide variety of technical subjects to help meet the shortage of trained personnel." Consequently, "women students, impatient with a program of exclusively liberal arts, sought increasingly to plan

⁶² Eisenmann, *Higher Education for Women in Postwar America*, 54-55.

⁶³ Lynn White, Jr., *Educating Our Daughters*, quoted in Solomon, *In the Company of Educated Women*, 192. See also White, "New Yardsticks for Women's Education," *Journal of the American Association of University Women* 41 (Fall 1947).

their courses so that they would be prepared to do something upon graduation.”⁶⁴ Enough is enough, he seemed to say: “The issue today is not whether women *can* pursue the same collegiate program as men, but whether they *ought* to do so in view of the different roles that men and women play in our common life.”⁶⁵ After blaming female activists for their failure to recognize this distinction, as well as for their “persistent and pernicious” influence on women’s education more generally, Beatley named an increased emphasis on homemaking as “one of the most obvious improvements needed.”⁶⁶

While both Beatley and White conceded that colleges must also prepare women to earn a living, they failed to recognize how a narrow emphasis on home-making, shish-kabob preparing, and flower arranging might impede this goal. Their critics, on the other hand, did not. Sarah Lawrence College President Harold Taylor, for example, saw little merit in the kind of “feminine education” advanced by Beatley and White. He believed that such a program restricted women to a fixed and subservient role “in terms of the needs and wishes of men, and not in terms of their own fulfillment.”⁶⁷ Rosemond Tuve, a professor at Connecticut College for Women, felt that feminine education heightened the dilemma of women who were “never taught by this society to see that being a success as a woman is inextricably connected with being a success as a human being.”⁶⁸ Barnard sociologist Mirra

⁶⁴Bancroft Beatley, “Another Look at Women’s Education, *Journal of Higher Education*, 22, Issue 1 (1951): 10.

⁶⁵ Beatley, “Another Look at Women’s Education,” 9-10. Emphasis added.

⁶⁶Beatley, “Another Look at Women’s Education,”14-15.

⁶⁷ Harold Taylor, quoted in Mabel Newcomer, *A Century of Higher Education for American Women* (New York: Harper & Brothers Publishers, 1959), 61. See also Solomon, *In the Company of Educated Women*, 193.

⁶⁸ Rosamond Tuve, quoted in Solomon, *In the Company of Educated Women*, 193.

Komarovsky not only denounced feminine education as shortsighted, but also urged that female students be prepared for “occupations which give full play to their abilities and ensure a comfortable standard of living.” In addition, she advocated that “good nursery schools [be made] available to all,” and that a “shift in men’s duties within the home” be encouraged.⁶⁹

Komarovsky, Tuve, and Taylor also recognized in proposals for feminine education the historic double bind that has always plagued female students and professionals. If women threw themselves into rigorous coursework and scholarly pursuits, they were regarded as ill-equipped for domestic life. But preoccupation with family matters left them open to doubts about their professionalism, seriousness of purpose, and career commitment. As Rosamond Tuve inquired, why could women not combine the two? Why should women be told that “they had to choose between marrying and caring intensely about scholarship?”⁷⁰ It must have smarted to know that these issues rarely affected college men, especially the new crop of married veterans who flooded the campuses. By most accounts, returning veterans—including those with children—made exceptional students. They were congratulated for their sense of purpose and the maturity they brought to their studies. Although they were generally older, hardened by war, and burdened by family responsibilities, none of these factors seemed to matter. To the contrary, these characteristics became assets that only fueled veterans’ desire to succeed and to build new lives for themselves and their families.⁷¹ But

⁶⁹ Mirra Komarovsky, quoted in Rosalind Rosenberg, *Changing the Subject: How the Women of Columbia Shaped the Way We Think About Sex and Politics* (New York: Columbia University Press, 2004), 205.

⁷⁰ Tuve, quoted in Solomon, *In the Company of Educated Women*, 193.

⁷¹ Olive Remington Goldman, “College Student, GI Style: Learning With a Difference,” *Journal of the American Association of University Women* 39:4 (Summer 1946): 205-207.

this kind of seriousness and ambition was attributed to women (especially older women or married women), for whom family obligations and personal issues were still regarded as distractions from academic and professional pursuits.

The postwar college teemed with such paradoxes. As educators debated and designed new curricula to prepare female students for their duties in the home, women worked outside the home in ever increasing numbers. Married women's workforce participation, in particular, rose steadily across race and class lines from 13.8 percent in 1940 to 21.6 percent in 1950 to 30.6 percent in 1960. This shift was particularly marked for middle-class wives (many of whom were college-educated), whose workforce participation reached nearly 40 percent by 1957.⁷² On college campuses, women's enrollment also grew, despite the implementation of restrictive quotas, which generally limited the percentage of seats allotted to female students, rather than their absolute numbers. Thus, even though women made up a smaller proportion of the student population than they had during the war, their overall enrollment doubled in the postwar period, jumping from 661,000 in 1946 to 1,339,337 in 1960.⁷³ Also significant was the postwar surge in women's attendance at the country's engineering schools and programs. Despite dwindling encouragement, women's enrollment rose precipitously as former "engineering aides," eager to continue their training and upgrade their status, pursued undergraduate degrees in record-breaking numbers. There, they joined those women who had begun their engineering degree programs during the war. As a result, more than 650 women earned undergraduate degrees in engineering between 1946 and 1950,

⁷² Linda Eisenmann, *Higher Education for Women in Postwar America*, 21-23, 29.

⁷³ Linda Eisenmann, *Higher Education for Women in Postwar America*, 44-45. Women's enrollment dropped temporarily in 1950 and 1951, but so did men's enrollment. In general, the overall upward trend persisted.

a significant increase from the war years when 181 undergraduate engineering degrees were awarded to women.⁷⁴ Meanwhile, the number of women earning doctorates in scientific fields rose slowly but steadily from about 120 per year in 1940 to about 290 per year in 1954.⁷⁵ The much larger increase of college men and returning veterans obscured women's increasingly avid participation in postwar science.

Science In and Out of Petticoats

Female scientists and engineers themselves, however, were keenly aware of these postwar paradoxes and developments. The disconnect between wartime rhetoric and postwar reality profoundly affected their education and employment experiences. Irene Peden recalled that when she enrolled in the University of Colorado's engineering program during the war, "the professors...were very welcoming to the small group of young women who entered the engineering college at that time."⁷⁶ But after the war ended and she prepared to graduate, she faced a very different situation when the chair of her department told her, "you're about to get your electrical engineering degree and you need to realize that you will have great value as a secretary to an engineer."⁷⁷ Undaunted, she began looking for electrical engineering jobs in 1947, only to encounter even more resistance. "I had a very difficult time

⁷⁴ Rossiter, *Women Scientists in America: Before Affirmative Action*, 32; Edna May Turner, "Education of Women for Engineering in the United States, 1885-1952," (Ph.D. diss., New York University, 1954), 188.

⁷⁵ Rossiter, *Women Scientists in America: Before Affirmative Action*, 33.

⁷⁶ Irene Peden, interview by Lauren Kata, March 2, 2002, transcript, 7, Box 3, Profiles of SWE Pioneers, The Society of Women Engineers Collection, Walter P. Reuther Library, Wayne State University (hereafter cited as SWEC).

⁷⁷ Irene Peden, interview by Brian Schoemaker, May 8, 2002, transcript, 8, Polar Oral History Project, Ohio State University.

getting my first job,” she later recalled.⁷⁸ “I simply pounded the pavement...I didn’t have a choice.” Peden remembered that employers “would simply tell me, ‘We’ve never hired a woman before, and we’re not going to talk to you,’ and shut the door.” “I had a lot of that to deal with,” she added.⁷⁹

The postwar emphasis on family and domesticity hampered her efforts. Like many women of her generation, she married a World War II veteran shortly after her own college graduation. And when her husband wanted to resume his college education using the G.I. Bill, she—also like many women—supported that decision and planned to help pay his way. But the cultural climate made that choice difficult:

It was a very family oriented time, when people had four children, baked their own bread. The only meaningful kind of leadership position that would have been socially acceptable was to run the P.T.A. And here I was, you know, trying to get a job as an engineer, to work as one.⁸⁰

After many failed attempts, Peden finally landed her first engineering job at the local power and light company. “Electric power had not been my thing at all,” she noted, but “it was the only job I could get.” The work itself was rather routine and she quickly grew bored. Not surprisingly, she later found out that the company had encountered much trouble filling her position before she applied. Although many men had interviewed for the job, they turned it down because of the low pay. Peden realized that “The only reason I got that job was because nobody else would take it.”⁸¹

⁷⁸ Ibid.

⁷⁹ Peden, interview by Kata, 12.

⁸⁰ Ibid., 14.

⁸¹ Peden, interview by Shoemaker, 10.

Chemist Juliette Moran encountered similar difficulties when trying to obtain a postwar position, despite her qualifications and experience. During the war, Moran juggled a number of job offers and was literally recruited by the federal government after having signed up with a local employment bureau. The class of 1939 chemistry major received an “enormous telegram” that read “you have been appointed a junior professional assistant option chemistry at the Signal Corps in Fort Monmouth, New Jersey and you are to report in ten days.” When she arrived, she found that “everybody who could possibly be a science major had been drafted for these jobs. There were half a dozen young ladies, all of whom...had some science.” After a year, she received another assignment from the Federal Employment Service and was placed as a junior chemist with the General Aniline & Film Corporation (GAF), a German chemical company that had been seized by United States and was used to produce dyestuffs for the war. The company desperately needed chemists since, as Moran explained, “the government had plucked away the entire top echelon of the company because they were all Germans.” While working at GAF, she began a part-time master’s program in chemistry at New York University, which she completed in 1948.⁸²

But after war production subsided and GAF made plans to transfer Moran’s division to Easton, Pennsylvania, she began looking for another position that would allow her to remain closer to New York City. Not fully realizing how slim her chances were, Moran sent letters to the top ten chemical companies in the Northeast inquiring about work and was disappointed by the response she received. “Seven of the companies did not reply at all,” she

⁸² Juliette M. Moran, interview by Laura Sweeney, December 20, 2001, transcript, 10, 12, 16, and Juliette M. Moran, c.v., Box 3, Women in Chemistry Oral History Project, WISE.

explained. “Two of them replied that they have no openings. And the last one, DuPont, replied that they may have an opening for a librarian.” In other words, Moran lamented, “There [was] not a single job for a female with my scanty credentials as the men have come back,” Moran explained.⁸³

Another chemist, Anne Briscoe, also faced much resistance when looking for work in the postwar period. Like many others, Briscoe had been encouraged during the war to pursue a career in science. She was completing her undergraduate degree in chemistry at Adelphi College when the Japanese bombed Pearl Harbor. Shortly thereafter, she recalled, one of her professors, “Dr. Lillian Ellis, who had graduated from Mount Holyoke College and [had] gotten a Ph.D. at Columbia University...told me that she had been pushed into graduate school and she was going to do that with me.” Ellis took Briscoe aside and showed her a posting in the *Chemical and Engineering News* advertising an instructor position at the University of Maine. “Although I would only have a Bachelor’s Degree,” Briscoe explained, “she thought I might have a chance because men were leaving the universities and going into the armed services. And that is exactly what happened.”⁸⁴

After a year, Maine’s dwindling student enrollment and Briscoe’s realization that “the University was collapsing [financially]” prompted her to look for another position. In 1943, she accepted an appointment in the chemistry department at Vassar College, where she completed her master’s degree two years later. The opportunity to pursue doctoral work came in the spring of 1945, just before Briscoe graduated. “About the time of VE day, a Yale

⁸³ Moran, interview by Sweeney, 22.

⁸⁴ Anne M. Briscoe, interview by Laura Sweeney, June 23, 2002, transcript, 6-7, Box 1, Women in Chemistry Oral History Project, WISE.

professor came to give...an endowed lecture at Vassar and he was head of what became the biochemistry department at Yale. And I talked to him about becoming a graduate student at Yale.” “It was a very good time to apply,” she added, “because the men were not demobilized.” Although victory loomed on the horizon, the war in the Pacific waged on. Briscoe realized that she entered Yale at what was still “a particularly convenient time for women.”⁸⁵

Despite being one of the few women in the biochemistry Ph.D. program at Yale, Briscoe regarded graduate school as a positive experience.⁸⁶ Once on the job market, however, she encountered fierce opposition. At the 1950 annual meeting of the Federation of American Societies for Experimental Biology, Briscoe registered with the on-site employment service in hopes of landing an interview. “Everyday I went to see if I had any messages,” but had little success.

My fellow students, young men who had gotten degrees when I did were getting a large number of interviews, something like 25 because in 1950 there were a lot of jobs if you had the right name. But I didn't. I had a female name and I got three interviews and they were not really good opportunities to develop myself as a research scientist.⁸⁷

She settled on a position with Cornell Medical School's New York Hospital in New York City. “But it was five years of learning nothing.”⁸⁸

⁸⁵ Briscoe, interview by Sweeney, 7-10.

⁸⁶ Briscoe technically earned her degree in from Yale's department of physiological chemistry, which became the department of biochemistry several years later.

⁸⁷ Briscoe interview, by Sweeney, 13-14.

⁸⁸ Briscoe interview, interview by Sweeney, 14.

During these “very difficult five years,” Briscoe also taught a night course in physiology at Hunter College, which was “only four long city blocks from Cornell.” She landed the position with help from the department chair, who was a woman and “liked the fact that I had degrees from Vassar and Yale.” But Briscoe had initially applied to the chemistry department, only to be told by the male chair, “I do not hire women.”⁸⁹ Briscoe was one of many qualified women who found themselves rebuffed by both academia and industry. Phyllis Pollock Magat, who earned her Ph.D. in chemistry from M.I.T. in 1947, “could not get interviewed for college teaching or industry due to being a woman.” This situation clashed sharply with her wartime expectations, when she felt “sure I could enter any field and be successful if I wanted to.” During the war, Magat had grown confident that women “had no ceilings, we could aspire to any role and be accepted.” But she realized quickly afterwards that this was not the case. After being flatly refused interviews “because I was a woman,” Magat ended up teaching public school instead.

Applied mathematician Hilda Geiringer von Mises also hit a number of dead ends when searching for an academic position after the war. Upon learning about a vacancy at Tufts University in the fall of 1947, she asked a friend with contacts there to inquire on her behalf about the opening. Her friend relayed to her a terse reply from a Tuft’s professor, who wrote, “I am quite sure that President Carmichael will not approve of a woman [to fill the vacancy.] We have Wm. Graustein’s widow on our staff, and Ralph Boas’ wife, so it is not merely prejudice against women, yet it is partly that, for we do not want to bring in more if

⁸⁹ Ibid.

we can get men.”⁹⁰ Ironically, the President Carmichael under discussion was Leonard Carmichael, who had directed the National Roster of Scientific and Technical Personnel during the war, and who would serve on nearly every scientific “manpower” commission in the 1950s and 1960s. Even though he headed major commissions urging the encouragement of scientifically-trained women, he evidently opposed encouraging women faculty at his own university. A third woman, after all, even one as esteemed and accomplished as Hilda von Mises, might diminish the reputation of Tuft’s mathematics department.⁹¹

Despite this renewed discrimination, some women did hold on to wartime gains. Class of 1942 mathematics major, Doris Clegg Larsen, for example, found that her training as a Curtiss-Wright Engineering Cadette gave her an “in” with the company. For more than a decade after the war had ended and the cadette program had been discontinued, she stayed on at “Wright’s” as a test engineer and a thermodynamic analyst.⁹² One of Larsen’s college classmates, and one of the first women to take courses at the Rutgers School of Engineering, also used her wartime education and experience well into the postwar period. After graduating in 1943, she accepted a position as a junior engineer at Turbo Engineering in Trenton, New Jersey, where she worked on several Navy contracts. The skills that she acquired on the job proved essential to her thirty-two year career as an aerospace engineer, first at Philadelphia Naval Base’s Aeronautical Engine Lab and later at the Bureau of

⁹⁰ Arnold Dresdent to Mrs. Von Misses, October 20, 1947, quoted in Rossiter, *Women Scientists in America*, vol. 2, 36, 399n22.

⁹¹ Rossiter, *Women Scientists in America*, vol. 2, 36.

⁹² Doris Clegg Larsen to author, New Jersey College for Women Questionnaire, no. 70, 4, 9-10, in author’s possession.

Aeronautics and Naval Air Systems Command in Washington, D.C.⁹³ Even Juliette Moran, who had been so discouraged by the postwar job market, made the most of her connections at the General Aniline & Film Corporation when she decided to move with the company to Easton, Pennsylvania. Although she had initially hoped to avoid transferring, she felt “very fortunate” because one of her former supervisors had been selected to run Easton’s Central Research Lab. “He remembered my work and I had a real break.” For more than thirty years, she worked her way up GAF’s corporate ladder. She retired in 1983 as director and as the highest ranking female officer in the company’s history.⁹⁴

Throughout her long and illustrious career, Moran never lost sight of the fact that “The only reason I originally got a job at GAF to begin with was because there was not a man to be had.”⁹⁵ She realized that the war had played a decisive role in her career trajectory, as did many other women who also got their big breaks during the war. Lois Graham, who would become the first woman in the United States to earn a Ph.D. in mechanical engineering, provides one example. She enrolled in her first engineering course in 1942, shortly after her high school graduation, when Rensselaer Polytechnic Institute began admitting women as a war measure. Because her father taught physical education there, Graham attended for free, a benefit that had previously been reserved for employees’ sons. Although she had always been interested in math and science, attending the all-male RPI was not an option before the war. Nor was attending other engineering schools, which limited

⁹³ Name withheld to author, New Jersey College for Women Questionnaire, no. 261, 4-6, in author’s possession; *ibid.*, telephone discussion with author, October 15, 1998.

⁹⁴ Moran, interview with Sweeney, 22 and Moran, c.v.

⁹⁵ Moran, interview with Sweeney, 22.

family finances ruled out. Although her parents supported her aspirations, “the finances weren’t there.” Reluctantly, she decided to study physics or math at the relatively inexpensive state teachers’ college in Albany, which her guidance counselor encouraged. From his point of view, she explained, “there was only one thing I could do [with an interest in math and science], and that was teach. But that was “the last thing I wanted to do.”⁹⁶

Fortunately for Graham, other plans were in the making. “The weekend before I was to start school at Albany,” she remembered, “we were at the dinner table, and my father got a phone call. And he came back and he said, ‘They’ve decided to accept women at RPI. Do you want to go?’” “So instead of going to the freshman tea at Albany, I went to the freshman tea at RPI.”⁹⁷ Less than three years later, she received her bachelor’s degree in mechanical engineering. She then worked for the Carrier Corporation for a year and a half before enrolling at the Illinois Institute of Technology for graduate study. She earned her master’s and doctoral degrees there, in 1949 and 1959, respectively.⁹⁸ Despite her long list of accolades and accomplishments, Graham always remained cognizant of the war’s impact on her career. “If there hadn’t been a war,” she observed, “I would not have been able to go to RPI, and I would have gone on to teachers college.”

I would have taught my year. Whether I would be able to get into industry such as I had wanted to after that year, I don’t know. I don’t know whether I’d have been able to go in the directions I was thinking of.

⁹⁶ Lois Graham, interview by Lauren Kata, June 6, 2003, transcript, 3, Box 1, Profiles of SWE Pioneers, SWEC.

⁹⁷ Graham, interview by Lauren Kata, 4.

⁹⁸ Lois Graham McDowell, “Now Is the Time for All Good Women,” *The International Altrusan* 30, no. 4 (January 1953): 5-6.

“But certainly,” Graham concluded, “the war gave me my opportunity.”⁹⁹

This recognition of the war’s transformative effects became a popular theme among women scientists and engineers in the immediate postwar period. Structural engineer Alice Goff explored this subject in her 1946 book, *Women Can Be Engineers*, and her fall 1947 *Journal of the AAUW* article by the same name. Both opened with Goff’s observation that “By an irony of fate, war, always bitterly denounced by women, has advanced them in the engineering profession.”¹⁰⁰ Goff lauded women’s wartime contributions and noted with pleasure that “World War II drew more women into the engineering field than ever before.”¹⁰¹ Another AAUW article, written by chemist Virginia Shapley in the spring 1946, also celebrated women’s contributions to wartime science. In “Science in Petticoats,” Shapley explained how new wartime mechanisms for coordinating weapons research helped to expand women’s scientific participation. “The Office of Scientific Research and Development,” she reminded her readers, “operated its research program by placing contracts with universities, colleges, and industrial organizations.” And because contractors were free to hire whomever they found to work on these projects, “many women who had not heretofore used their scientific training to the maximum were given the opportunity of doing so.” Consequently, women could be found in laboratories across the country where they worked on such major projects as the proximity fuse, radar, and the atomic bomb. Women’s

⁹⁹ Graham, interview by Kata, 33.

¹⁰⁰ Alice C. Goff, *Women Can Be Engineers* (Ann Arbor, Michigan: Edwards Brothers, Inc., 1946), iii; Goff, “Women CAN Be Engineers,” *Journal of the AAUW* 41, no. 1 (Fall 1947): 75.

¹⁰¹ Goff, “Women CAN Be Engineers,” 75.

contributions were indispensable, Shapley argued, and played a major part “in winning the war by means of scientific research and technological developments.”¹⁰²

Shapley relied on these notable examples in order to advocate for women’s continued scientific participation in the postwar period. She hoped that by highlighting women’s wartime contributions, many of which had gone unnoticed by the public because of their secret and classified nature, she might generate an appreciation for women’s scientific abilities more generally. But this tactic soon provoked a counter-reaction from other women scientists, who faulted Shapley for overestimating wartime changes in their status. In the fall of 1946, the *Journal of the AAUW* published “Science Out of Petticoats,” a direct reply to Shapley by chemists Eleanor Horsey and Donna Price. Horsey and Price contested the “glowing terms” in which Shapley described women’s wartime contributions and pointed out that “It is still a ‘man’s world.’” Despite a “noticeable decrease” in prejudice against women in the professions, they argued “the opposition to their existence in such positions is still very general and very large.” And while “there are, of course, well known cases of able women in very responsible positions, in general...the initial placement in such a job was an emergency measure and the retention of the position a mark of very exceptional ability.”¹⁰³

Horsey and Price also drew attention to some of the less noticeable barriers surrounding women’s scientific employment, such as being assigned to the most routine and

¹⁰² Virginia B. Shapley, “Science in Petticoats: In Wartime and in Peace,” *Journal of the AAUW* 39, no 3 (Spring 1946): 148-149.

¹⁰³ Eleanor F. Horsey and Donna Price, “Science Out of Petticoats,” *Journal of the AAUW* 40, no. 1 (Fall 1946): 13.

mundane tasks. “There is a much publicized belief that women will be more patient and conscientious in handling details than will men,” they explained.

That view has been so frequently stated that many women now accept it. However, patience and conscientiousness are not a matter of sex, but of self discipline and intelligence. Work requiring excessive amounts of patience and conscientiousness is apt to be tedious, and it is probably the general habit of relegating women to such less desirable work that has created the myth about their special qualifications for it.¹⁰⁴

Even when women were assigned the same type of work as their male counterparts, however, they rarely received the same salary. Horsey and Price believed that the lower pay scale for women, along with assumptions about married women’s workforce transience and the belief that women could not or should not supervise male workers, served as real obstacles to women’s scientific success. As long as these obstacles persisted, Horsey and Price believed, women would be continually treated as second class scientists.¹⁰⁵

Despite their differences, Horsey and Price shared with Shapley some core beliefs. Most importantly, all three advocated increasing and improving women’s scientific participation as a national defense measure. Their arguments drew strength from current debates surrounding science’s “endless frontier,” as well as broader interest in renewing America’s scientific talent. In “Science in Petticoats,” for example, Virginia Shapley pointed to the deficit of trained scientists that had been decried by Vannevar Bush and his colleagues. She even cited the same statistics used by Bush, which showed a wartime loss of 150,000 undergraduate science degrees and nearly 17,000 doctoral degrees, and noted that “a larger proportion of women students will have to be enrolled in the sciences in the future in order to

¹⁰⁴ Horsey and Price, “Science Out of Petticoats,” 13-14.

¹⁰⁵ *Ibid.*, 14-15.

balance the scientific budget.” Indeed, Shapley wrote, “The continuance of women in scientific work is essential to replenish our depleted scientific resources.”¹⁰⁶ Horsey and Price agreed, and argued that the obstacles faced by women in scientific fields “take on new importance in view of the current demand for increased scientific personnel.” Like Shapley, Horsey and Price also cited Vannevar Bush to support their claim that “scientific research must be vastly expanded for the purposes of national defense and welfare” and observed that “one practically untapped source of scientists is the women on this country.”¹⁰⁷ And in reference to the “frontiers” of science, Horsey and Price argued that “In view of the present untouched and undeveloped scientific realms, women are a source of explorers which should be encouraged rather than discouraged.”¹⁰⁸

This concern with renewing the country’s scientific talent also intrigued Marguerite Wycoff Zapoleon, who headed the Employment Opportunities Section of the United States Women’s Bureau. Born in 1907, Zapoleon attended college during the 1920s and earned an undergraduate degree in engineering. She pursued graduate study in economics and social work before becoming a vocational guidance counselor in the Cincinnati public schools. There, she worked with the influential psychologist Helen Thompson Woolley, whose early research attributed sex differences to social rather than biological factors. Although Woolley, who directed the city’s public school vocational bureau, no longer carried out psychological research, she still drew on her early findings when advising her counselors to avoid funneling

¹⁰⁶ Shapley, “Science In Petticoats,” 149.

¹⁰⁷ Horsey and Price, “Science Out of Petticoats,” 13.

¹⁰⁸ Horsey and Price, “Science Out of Petticoats,” 16.

women into “feminine” fields. And it is likely that Zapoleon, who had herself studied a non-traditional field, received her message warmly.¹⁰⁹

At the U.S. Women’s Bureau, Zapoleon continued her work in vocational guidance and in 1945, she initiated a study of recent changes and trends in women’s scientific employment. Although Zapoleon and her staff culled background information from more than 800 books, pamphlets, articles (including Horsey and Price’s “Science Out of Petticoats”), they regarded scientific organizations, personnel, employers, and educators as their best sources. They personally visited one hundred industrial firms where they interviewed both supervisors and women scientists themselves. They also consulted with federal agencies, research institutions, colleges and universities, and professional societies in order to compile numerical data and determine anticipated demands for scientifically trained women. The project, which took nearly four years to complete, resulted in a series of eight bulletins addressing opportunities for women in chemistry, biological sciences, mathematics and statistics, architecture and engineering, physics and astronomy, geology, geography, and meteorology, and the somewhat vague “occupations related to science.”¹¹⁰

In the 1949 introductory bulletin, entitled “The Outlook for Women in Science,” Zapoleon traced the impetus for her study to a broader recognition of “the importance of science to the individual and national welfare and the rarity of creative scientific talent.” More specifically, she inquired, “Is our Nation finding and developing all its potentially great scientists? Is it developing and utilizing without waste the services of other scientifically

¹⁰⁹ Rossiter, *Women Scientists in America*, vol. 1, 102, Rossiter, *Women Scientists in America*, vol. 1, 28.

¹¹⁰ Women’s Bureau of the United States Department of Labor, *The Outlook for Women in Science*, Bulletin 223 (Washington, D.C.: Government Printing Office, 1948-1949), ii, v-vii.

trained persons to whom the creative group supplies the inspiration and leadership?”

Zapoleon regarded the bulletin series as the Women’s Bureau “initial contribution both to the increasing number of women who want to train for scientific work and to those who are concerned with the present and potential use of a relatively unmined source of scientific talent.”¹¹¹

Marguerite Zapoleon was clearly familiar with the current debates surrounding postwar science. Not only had she read Vannevar Bush’s *Science: The Endless Frontier*, but she quoted it verbatim in her bulletin series. She also cited reports released by the President’s Scientific Research Board, which had been established by Harry Truman in October 1946 as a mechanism for ensuring the most effective use of scientific personnel, training, and research facilities.¹¹² Zapoleon noted with interest that two years after the war’s end, federal spending for scientific research had dropped only moderately below wartime levels and remained exponentially higher than prewar allocations. She also pointed to the Board’s specific recommendations that, by 1957, government expenditures for basic research be quadrupled, that those in health and medicine be tripled, and that those for nonmilitary development research be doubled. But increased spending would accomplish little in the way of national security and well-being if the supply of available scientific talent remained inadequate. She found that “the Federal demand for qualified scientific personnel continue[s]

¹¹¹ Women’s Bureau, *The Outlook for Women in Science*, 1.

¹¹² Bush quoted in Women’s Bureau, *The Outlook for Women in Science*, 44-45; Ruth Morrill, “Summary of Report of President’s Scientific Research Board for the AAUW,” [1947], Folder 712, Reel 122, Status of Women Committee Records, American Association of University Women Archives, 1881-1976, microfilm edition (hereafter cited as AAUW).

to be greater than the supply in some specialized fields.”¹¹³ And in 1947, she reported, the War and Navy Departments even had to abandon certain research projects because of the scientific shortage. Zapoleon regarded the shortage situation as a serious one and agreed with Vannevar Bush’s assertion that it imposed a “ceiling” on the nation’s scientific productivity and technological advancement.¹¹⁴

References to scientific shortages surfaced throughout Zapoleon’s bulletins, as she eagerly applied the findings of scientific advisory boards and “manpower” commissions to women. Although the President’s Scientific Research Board made little or no mention of gender in its proposals for the early identification of scientific talent, Zapoleon nevertheless appropriated its authority to substantiate her claim that “parents, counselors, teachers, employers and others whose advice may be sought by young women interested in science should be wary of discouraging the development of a talent that may be rare.”¹¹⁵ And like other individuals and organizations interested in reversing the scientific deficit, she pinpointed high school as a critical stage in young scientists’ career trajectories, noting that “the ground work in mathematics and science is usually laid in the secondary school.” But, she warned, “it is at this stage that so many girls are diverted from establishing a foundation upon which a scientific specialization can be built.”¹¹⁶ Zapoleon observed that boys were often urged by their parents and counselors to take science and three or four years of

¹¹³ Women’s Bureau, *The Outlook for Women in Science*, 41-42.

¹¹⁴ *Ibid.*, 45.

¹¹⁵ *Ibid.*, 34.

¹¹⁶ *Ibid.*, 31.

mathematics while girls were generally steered toward languages, history, or “other optional subjects.” As a result, relatively few girls enrolled in colleges having had four years of math or science. “While it is unlikely that the number of women preferring science and mathematics to other subjects will ever equal the number of men taking those subjects,” she conceded, “it is undoubtedly true that more qualified young women would take these subjects if they were not discouraged from doing so.”¹¹⁷

But encouraging women’s scientific talent went beyond the classroom. Zapoleon also advocated involvement in extracurricular activities, such as local science clubs and science fairs. National science competitions offered another outlet and were regarded by Zapoleon as particularly “interesting experiment[s] in the discovery and development of scientific ability among high-school girls.”¹¹⁸ The annual Science Talent Search, for example, which had been created by the Westinghouse Corporation during World War II, continued to provide opportunities for young women to involve and distinguish themselves in scientific fields. Each year, the talent search administered a science aptitude test and awarded forty contestants all-expense paid trips to Washington D.C., where they would compete for scholarships. Because the percentage of girls selected for the Washington trip corresponded with the percentage of girls entering the competition, women represented between a quarter to a third of Washington D.C. finalists. Women also made up half of grand-prize winners, since the talent search reserved one of its two \$2,400 scholarships for a girl. Zapoleon held

¹¹⁷ Ibid.

¹¹⁸ Ibid., 33.

up these policies as positive examples of what could be done to encourage women's scientific participation and to discover "unmined scientific talent" more generally.¹¹⁹

Zapoleon regarded financial support such as the Science Talent Search scholarships as another prerequisite for expanding the available supply of scientists. She noticed with interest that the vast majority of the talent search's female winners went on to study science, math, or engineering in college. But she also realized that the Science Talent Search was limited in its reach, funding only a handful of women each year. Many more aspiring female scientists still struggled to secure financial aid for undergraduate and graduate study and were often derailed in the process. The fact that numerous fellowship competitions remained altogether closed to women, Zapoleon noted, "undoubtedly results in the loss of some talented individuals who might otherwise prepare themselves for work in this field."¹²⁰ She eagerly eyed the National Science Foundation proposals currently being debated in Congress and suggested that a national program of undergraduate and graduate scholarships in science would vastly expand young women's opportunities. She lamented that presently, however, there was "no such Government-financed program under which future women scientists might be trained."¹²¹

Because women would have to rely on existing funding sources in the meantime, Zapoleon identified in her bulletins various fellowships and scholarships that young women might not be aware of. She reported that in 1946, more than 300 companies awarded 1,800

¹¹⁹ Ibid., 33.

¹²⁰ Ibid., 28-29.

¹²¹ Ibid., 31.

fellowships, scholarships, or grants for scientific research. At colleges and universities, she identified more than 600 awards given in science, mathematics, and engineering. She also discovered 300 additional awards that did not specify a field of study, and might be won by women scientists.¹²² Of course, the fact that schools, corporations, and agencies allowed women to compete for their scholarships did not ensure an equitable outcome. Preference for male students persisted, as did the assumption that women scientists, who might marry and leave the workforce after only a few years, were bad investments. Faced with this reality, women's organizations seemed to offer the most consistent and steady sources of funding. Zapeolon recognized two in particular, the AAUW and Sigma Delta Epsilon, for their outstanding support of women scientists.¹²³

Zapoleon's observation was not lost on these women's organizations, which were well aware that they had a special role to play in the postwar period. Sigma Delta Epsilon President Mary Willard fully realized that her organization's graduate fellowship, which had been awarded since 1941, would take on even greater significance as "the armed forces return and the competition is greater at our large universities for the doctorate and post doctorate fellowships." "Here is where our Fellowship comes in," she noted, "and where we are going to need more."¹²⁴ The AAUW, which had been awarding fellowships to female scientists since the 1890s, also recognized the importance of financial support for women

¹²² Ibid., 29-30.

¹²³ Ibid., 30.

¹²⁴ Mary L. Willard, "Look Ahead!," *Sigma Delta Epsilon News* 10, no. 2 (Dec. 1944): 3-4., Early Sigma Delta Epsilon Newsletters folder, Box 6, Sigma Delta Epsilon Records, Rare and Manuscript Collection, Carl A. Kroch Library, Cornell University (hereafter cited as SDE).

aspiring to “enter a man’s world.” Although AAUW fellowships were not limited to women in science, as Sigma Delta Epsilon’s were, female scientists were well-represented among its award winners, making up between one third to one half of recipients.¹²⁵ AAUW support served an important function in the postwar period, as other options for women scientists seemed to fade away. It is no coincidence that, in a survey of AAUW fellows, those from the late 1940s, reported encountering the most obstacles due to being a woman.¹²⁶ This heightened awareness is significant, and as AAUW member Ruth Tryon observed of these findings in her 1957 history of the fellowship program, “Perhaps the competition of returned service men in this period, reversing the wartime demand for women’s services, gave a sharp jolt to those who had not been conscious of discrimination.”¹²⁷

A “sharp jolt” appears to have struck other women scientists as well, who organized themselves in ever increasing numbers throughout the immediate postwar period. Membership in women’s scientific societies, such as Sigma Delta Epsilon and Iota Sigma Pi swelled considerably after the war. Both old members and new recruits viewed in sharp relief the contrast between wartime rhetoric and postwar reality. The discrimination and hostility they encountered, after having been lured and lauded just several years earlier, was undeniable. They recognized the unique resources and support that women’s organizations could provide and flocked to them in record numbers.

¹²⁵ Ruth Wilson Tryon, *Investment in Creative Scholarship: A History of the Fellowship Program of the American Association of University Women, 1890-1956* (Washington, D.C.: American Association of University Women, 1957), 12, 30-31.

¹²⁶ Tryon, *Investment in Creative Scholarship*, 33.

¹²⁷ *Ibid.*

In addition to the growth of existing women's scientific societies, the postwar period also saw the creation of new ones, especially in engineering. They were bolstered by women's record-breaking participation in engineering programs across the country, as former "engineering aides" joined those female students who had entered during the war, thereby swelling postwar enrollments. Indeed, women's engineering enrollment was even higher after the war than it had been during it, but so was the resistance that women encountered. Women engineers who gained entry to their first jobs during the war faced similar difficulties and eagerly sought ways to improve their condition. Consequently, women engineers banded together in Iowa, Indiana, Pennsylvania, New York, Massachusetts, and Washington D.C.¹²⁸ Although many of these groups formed independently and without knowledge of each other, their decision to organize when they did reflected broader phenomena particular to that historical moment.

In 1946, one of the earliest groups formed at the Drexel Institute of Technology in Philadelphia. Shortly thereafter, the "Women Engineers" of Drexel conducted a survey of universities across the country for information regarding women engineering students. The findings were "encouraging" and pointed to a need for organizing undergraduate women on a larger scale. In response, the organization arranged a conference, to be held at Drexel in April 1949, in order to "to more clearly define the problems of women in engineering," "to search for their solutions," and "to investigate the feasibility of joining forces" with other female

¹²⁸ Marta Navia Kindya, *Four Decades of the Society of Women Engineers* (New York: Society of Women Engineers, 1990), 11; Amy Spear, "The History and Organizational Structure of SWE," March 1992, 2, Series 11, SWEC; Amy Sue Bix, "Supporting Females in a Male Field: Philanthropy for Women's Engineering Education," in *Women and Philanthropy in Education*, ed. Andrea Walton (Bloomington: Indiana University Press, 2005), 320-345; Bix, "From 'Engineeresses' to 'Girl Engineers' to 'Good Engineers': A History of Women's U.S. Engineering Education," *NWSA Journal* 16, no. 1 (Spring 2004): 27-49.

students in the field.¹²⁹ More than seventy undergraduates representing nineteen institutions attended the Philadelphia meeting, where they formed a regional student organization that they named the “Society of Women Engineers.”¹³⁰

At approximately the same time, women engineers in New York City were organizing themselves as well. On March 27, 1949, one week before the Philadelphia gathering, a group of Metropolitan area women engineers assembled at the Hotel Edison to establish an organization for college graduates and professional women. Many of the attendees, who had come into contact with each other through various personal and professional networks, had been meeting informally for several years. As one member explained, “It might have been something as simple as having a cup of coffee, and seeing if we had something in common.” Others were recent graduates who had participated in women’s engineering societies while in college, such as the “Society of Women Engineers” that area students formed at the City College of New York in March 1948. Both the newly minted professionals and the more established engineers believed that by organizing themselves they could better facilitate women’s professional advancement. At the Hotel Edison meeting, the attendees emphasized the importance of educating the public on the need for women engineers, encouraging women who demonstrated interest in the field, and disseminating information about job openings for women in engineering. They established an

¹²⁹ Drexel Society of Women Engineers, registration form for “First Conference of Women Engineering Students,” held April 2 and 3, 1949, Series 11, SWEC.

¹³⁰ Doris McNulty, “History of SWE” (notes for speech given at the Society of Women Engineers birthday celebration, [1960?]), Series 11, SWEC; Phyllis Evans Miller, “History of the Society of Women Engineers,” [1952], Series 11, SWEC; “History of the Society of Women Engineers,” [1950], Series 11, SWEC; “Women Engineers Unite,” *New York Times*, April 4, 1949, 21.

employment committee, set up a constitution committee, resolved to issue a publication, and elected temporary officers. Finally, they selected a name for their new association: the “Society of Women Engineers.”¹³¹

The proliferation of women’s engineering societies in the postwar period was neither uncommon nor coincidental. Although many unknowingly chose the same name for themselves (limited most likely by the number of possible permutations for organizations with their aims and membership), these groups emerged from similar circumstances. The upsurge in women engineers or engineering students who had been recruited and trained by the federal government and industry during the war, created a relatively large population of technically trained women eager to use their training and talents. Lillian Murad, who earned her bachelor’s degree in chemical engineering in 1947, recalled of her college years, “At this time, there were sufficient numbers of undergraduates in college (women) to dream up a society which would embrace all the engineering professions, and help the women in the engineering schools in their work and later on in their jobs.”¹³² But this same population faced some harsh realities in the postwar period, as the returning veterans and the revival of traditional attitudes concerning women’s roles threatened their wartime gains and aspirations. They organized themselves in an effort to defend and create opportunities for women in their field, thus signaling a new wave of women’s activism that would continue throughout the postwar period.

¹³¹ “Women Engineers Meet at Hotel Edison to Form a Society,” *The Woman Engineer* 1, no. 1 (May 1949): 1; Mildred Paret, quoted in Kindya, *Four Decades*, 11; “Women Engineers Organize,” *New York Times*, March 8, 1948, 26; Mary Stokes, “Detailed Reply to the 8 Items of Letter 12-5-51,” Series 11, SWEC.

¹³² Lillian Murad to Katharine Stinson, June 8, 1952, Series 11, SWEC.

CHAPTER 4

The Dawn of the Defense Decade

In the spring of 1950, more than sixty women converged on Cooper Union's Green Engineering Camp with suitcases in tow. Among those who traveled to the woods of Ringwood, New Jersey that day were engineering students, aspiring professionals, and established engineers. After locating their sleeping quarters on the second floor of a converted barn, the women headed to the adjacent lodge in anticipation of the weekend's events. The purpose of the gathering was to create a national organization to support and promote women's participation in engineering. After two days of discussion and debate, the group had succeeded in its goal of establishing the national Society of Women Engineers.¹

The decision to form a national organization reflected attendees' determination to coordinate and extend the work they had been doing at the local and regional levels. Most of the "Camp Green" attendees represented the small women's engineering societies that had sprung up in various parts of the United States during the late 1940s. Members of the student organization formed at Drexel and the graduate organization formed at the Hotel Edison made up the nucleus of the Camp Green contingent. A handful of older women also attended, including Elsie Eaves and Hilda Counts Edgecomb, who as undergraduates had unsuccessfully attempted to form a women's engineering society at the University of

¹ Doris McNulty, "History of SWE" (notes for speech given at the Society of Women Engineers birthday celebration, [1960?]), Series 11, The Society of Women Engineers Collection, Walter P. Reuther Library, Wayne State University (hereafter cited as SWEC); Society of Women Engineers, guest list for Second Annual Convention, held May 27 and 28, 1950, Series 11, SWEC.

Colorado in 1919. While “[t]here was a sprinkling of ‘old timers’ with careers well established,” Eaves observed, “the spark and drive came from the graduates with brand new engineering degrees.”² Regardless of age, nearly all of the attendees had enjoyed expanded educational and professional opportunities during the Second World War and found it expedient to support each other in the postwar period.

At Camp Green, the new national Society of Women Engineers, or SWE, got to work immediately. Members instituted dues to sustain the organization, adopted temporary rules to govern its operation, and approved an emblem to signify its presence. They also held on-site elections and chose as their first president thirty-one year old Beatrice Hicks.³

Like the majority of SWE members, Hicks had gotten her first big break during the war. But her interest in engineering went back much further. The New Jersey native first encountered engineering through her father, a chemical engineer. She often told people that she decided to become an engineer at the age of thirteen, after admiring the Empire State Building and the George Washington Bridge with her father and learning that engineers designed those structures. Hicks attended high school during the early 1930s and found that her ambition met with resistance from both classmates and teachers who viewed engineering as an inappropriate field for women. Determined, she enrolled at the Newark College of

² Elsie Eaves, “The Society of Women Engineers, USA, at 25,” May 1976, 1, Series 11, SWEC; Miriam Gerla to Mary Stokes, January 3, 1952, Series 11, SWEC; Marta Navia Kindya, *Four Decades of the Society of Women Engineers* (New York: Society of Women Engineers, 1990), 9-10; BK Krenzer, “Our Greatest Achievement,” *U.S. Woman Engineer* (January/February 1989): 5-7; Harness, “SWE’s Golden Era: A ‘Do It Ourselves’ Spirit,” 9-10.

³ Gerla to Stokes, January 3, 1952, Series 11, SWEC; “Emblem Committee,” *Journal of the Society of Women Engineers* 2, no. 1 (September 1951): 9; “Convention Notes,” *The Woman Engineer* (Summer 1950): 1; Phyllis Evans and Phyllis Diamond, notes from Society of Women Engineers Council Meeting, May 27, 1950, Box 1, SWEC. The emblem had actually been designed and used by the Philadelphia group but was adopted as the national emblem at Camp Green.

Engineering (now the New Jersey Institute of Technology), where she would earn her bachelor's degree in Chemical Engineering in 1939. Following graduation, Hicks worked at the college as a research assistant until wartime labor shortages facilitated her employment in industry. In 1942, she joined Western Electric, a subsidiary of Bell Telephone, and later became its first female engineer. In addition to working on long-distance telephone technology, she developed a crystal oscillator (a device used in aircraft communications to generate radio frequencies) and enrolled in several graduate engineering courses. At the end of the war, Hicks worked as a consultant until her father died in 1946, at which point she became Vice President and Chief Engineer of her family's business, the Newark Controls Company. In the meantime, she continued her graduate work at the Stevens Institute of Technology, married fellow engineer Rodney Chipp in 1948, and received her master's degree in physics in 1949.⁴

After accepting the SWE presidency at the Camp Green meeting, Hicks outlined her plans for the new organization. She set up separate committees to deal with various logistical matters such as conventions and publicity and advocated that the Society pursue incorporation procedures as soon as possible. Other highlights of the convention included reports given by members on fostering congenial relationships among women in engineering, helping undergraduates find their place in industry, and creating laws favorable to women engineers. Before adjourning, the group voted to recognize Lillian Moller Gilbreth, one of

⁴ "Hicks, Beatrice A(lice)," in *Current Biography Yearbook*, ed. Marjorie Dent Candel (New York: H.W. Wilson, Co., 1957), 255-257; Amy Sue Bix, "Hicks, Beatrice Alice," in *Notable American Women: A Biographical Dictionary Completing the Twentieth Century*, ed. Susan Ware (Cambridge: Belknap Press, 2004), 295-297; "Beatrice Hicks, Society's first president, dies," *SWE Newsletter* (November/December 1979): 5.

the first female engineers to hold a Ph.D., as an honorary member.⁵ Like the local and regional organizations from which it sprung, the national SWE sought to improve conditions for women engineers by encouraging them in their studies, supporting them in their careers, and showcasing their accomplishments.

Although the postwar climate seemed formidable, it also offered new opportunities for activism. The onset of the Cold War in the late 1940s, followed by the conflict in Korea and the escalating arms race, stirred up new fears about a possible shortage of “scientific brainpower.” Individuals and groups such as the Society of Women Engineers tapped into these growing anxieties by calling attention to how the education and employment of women could expand the pool of scientific and technical personnel. They drew support from a recent flurry of commissions, publications, and studies highlighting the severity of the situation. Having benefited from engineering shortages themselves, many of these women recognized the transformative power of war—both hot and cold—and sought to capitalize on its effects.

In doing so, many realized that expanding female participation in scientific and technical fields would require more than breaking down formal barriers to women’s education and employment. Women like Virginia Gildersleeve had focused their energies on opening previously closed doors; the younger generation that walked through those doors now turned their attention to dismantling more subtle stereotypes and social conventions. As their own experiences had shown, women’s scientific success was hindered not only by discriminatory policies and lack of funding, but also by cultural attitudes surrounding science

⁵ Evans and Diamond, notes from Society of Women Engineers Council Meeting, May 27, 1950, Box 1, SWEC; “Second Annual Convention of the Society of Women Engineers,” *The Woman Engineer* 1, no. 6 (May 1950): 2.

itself. This younger generation regularly pointed out that stereotypes of scientists as men with thick plastic glasses, the convention of giving dolls to girls and chemistry sets to boys, and the assumed irreconcilability of being a wife and an engineer all served to discourage women from scientific careers. By linking these obstacles and attitudes to the much-decried shortage of “scientific brainpower,” they gave their cause a sense of immediacy and urgency. Cultural stereotypes surrounding women and science, then, became more than just unfair or psychologically damaging; they were also wasteful, unpatriotic, and a national security threat.

The Cold War Heats Up

In the summer of 1950, just weeks after the organizational meeting at Camp Green, the newly-elected Society of Women Engineers President Beatrice Hicks announced, “I am convinced we are going to grow into a large and powerful organization.”⁶ At the outset, her optimism might seem premature, given the infancy of the national organization. But it is important to note that her proclamation coincided with a critical moment in Cold War history: the beginning of the Korean War.

Since the late 1940s, as historian Michael Sherry observes, the Cold War had been escalating “in confusing fits and starts.”⁷ When the Soviet Union detonated an atomic bomb in the summer of 1949, it decisively ended the United States’ monopoly on nuclear energy and raised the Cold War stakes even higher. International tensions visibly escalated again when the Soviet-supported North Korean army invaded South Korea in June 1950. Anxious

⁶ Hicks quoted in “Spotlight,” *The Woman Engineer* (Summer 1950): 1.

⁷ Michael S. Sherry, *In the Shadow of War: The United States Since the 1930s* (New Haven: Yale University Press, 1995), 128.

to “contain” communism, the United States deployed its troops to assist the U.N. forces in South Korea. The intervention of communist China, whose army dealt a number of serious blows to the U.S./U.N. contingent, led Harry Truman to declare a national emergency in December of that year. This proclamation was accompanied by a vast increase in defense spending and, by 1953, national security expenditures reached fifty billion dollars, or two-thirds of the federal budget. While much of this money went to Korea, a significant portion was allocated to Europe, to new bases around the world, and to an expanded weapons program. And even after the war in Korea subsided, American scientists and engineers continued to race their Soviet enemies in the development of bigger and better jet fighters, bombers, missiles, and atomic weapons. Both the Korean conflict and the larger Cold War of which it was a part signaled a new kind of indefinite warfare.⁸

Against this backdrop, bureaucrats, industrialists, scientists, military personnel, and educators speculated widely and loudly about the impending shortage of scientific and technical personnel. They eagerly sought ways to expand the country’s “manpower” supply and by the fall of 1950, they had already begun recommending the use of women to alleviate the situation.⁹ In October, the academic vice-president of the University of Minnesota, Malcolm Wiley, made this suggestion at a meeting of midwestern college administrators. “If there are not enough males to provide us the necessary flow of trained engineers,” Wiley

⁸ Sherry, *In The Shadow of War*, 129, 177, 183.

⁹ Benjamin Fine, “Education in Review: Colleges Plan to Cooperate with Government and Among Themselves in an Emergency,” *New York Times*, July 30, 1950, E9.

stated, “then the only solution is the utilization of womanpower in that profession.”¹⁰ Later in the month, the Smith College newspaper ran the cover story “Market for Science Majors Up, Demand Outruns the Supply,” which outlined job opportunities for women in the field. And in November, the aeronautical division of the General Electric Company ran in the *Philadelphia Bulletin* an oversized classified ad for “Women Engineers.”¹¹

After the state of emergency was declared in December 1950, the call for “womanpower” became even more pronounced and enjoyed increasing public support. This growing interest came from a wide variety of organizations and individuals, such as University of Illinois biophysicist, Manhattan Project veteran, and *Bulletin of Atomic Scientists* editor, Eugene Rabinowitch. Rabinowitch’s February 1951 editorial, aptly entitled “Scientific Womanpower,” urged his colleagues to encourage women’s participation in science and engineering and advocated government funding for the training of women in those fields. The need to recruit women received additional publicity at the end of the month when *Newsweek* printed an article declaring, “Help Wanted: Women.” Meanwhile, *Scientific American* included in its special issue on “The Human Resources of the United States” a report by the Office of Defense Mobilization’s Arthur S. Flemming, who promoted the recruitment of women scientists and engineers. Perhaps the most comprehensive, up-to-date

¹⁰ Malcolm M. Wiley, quoted in “Women Engineers Urged,” *The Christian Science Monitor*, October 27, 1950, clipping in Series 11, SWEC.

¹¹ Nina Hodgson, “Market for Science Majors Up, Demand Outruns the Supply,” *Smith College Associated News*, October 31, 1950, 1, 6; Kindya, *Four Decades*, 47.

summary of current “manpower” thinking, the “Human Resources” issue sold out immediately and quickly went through three reprintings.¹²

Arthur Flemming’s advocacy of women in scientific and technical fields is important to note because of the consistency with which he supported women, as well as the degree to which he would collaborate with various women and women’s organizations throughout the Cold War. Although he was born to a prominent Republican family whose political identification he claimed for himself, Flemming’s passion for social justice reached across party lines. His government career began in 1939, when Democratic President Franklin Roosevelt appointed him as the Republican representative to the three-member Civil Service Commission. The thirty-four year old Flemming became the youngest Civil Service commissioner to serve since 1889, when Theodore Roosevelt took office at the age of thirty. During his tenure, which lasted until 1948, Flemming became increasingly interested in “manpower” issues, particularly as they related to national defense. He participated on various committees, such as the War Manpower Commission, and spoke at numerous conferences where he continually urged the “utilization” of women and minorities.¹³ Many times, he stood alone, as was the case at the January 1942 Baltimore Conference, when he

¹² Margaret Rossiter, *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995), 51-52.

¹³ Eric Pace, “Arthur S. Flemming, 91, Dies; Served in Eisenhower Cabinet,” *New York Times*, September 9, 1996, B10; Bernice Flemming, *Arthur Flemming: Crusader at Large* (Washington D.C.: Caring Publishing, 1991), 91-93, 100, 118. For information on Flemming’s later career, especially with programs related to aging, see Rosalie E. Green, “A Historical Study of Arthur S. Flemming: His Impact on Federal Education and Training Programs Relating to Aging During the Period 1958-1978,” (Ed.D. diss., Virginia Polytechnic Institute and State University, 1985).

was the only speaker to address explicitly the need for women engineers, chemists, and physicists.¹⁴

Although Flemming resigned from the Civil Service Commission in 1948, he found himself back in Washington, D.C. just a few years later when he joined the newly-established Office of Defense Mobilization in 1951. As assistant to the director of manpower, and later, as the director himself, Flemming held a special interest in the mobilization of scientific personnel. With Flemming on board, the Office of Defense Mobilization carried out numerous studies estimating the available supply of training scientists and engineers and decried what it perceived as an impending shortage. As he had during World War II, Flemming continually advocated that women's "brainpower" could and should be fully utilized in all defense preparations. Unlike other government officials who focused narrowly on the Korean conflict, Flemming believed that the United States' defense mobilization program would last for another two decades. "If people understood this," Flemming said, "more high school graduates, girls included, would study engineering, which sorely needs trained personnel."¹⁵ But he also believed that the need for women extended to other scientific fields as well. "Although the shortage is greatest and the demand most pressing in engineering," he noted, "all of the sciences are in need of womanpower."¹⁶

¹⁴ Arthur S. Flemming, "Some Personnel Needs of the Government War Agencies," in *Higher Education and the War: The Report of a National Conference of College and University Presidents, Held in Baltimore, Md., January 3-4, 1942*, ed. American Council on Education, 96-107 (Washington DC: American Council on Education, 1942).

¹⁵ Flemming quoted in Associated Press, "Flemming Predicts 10-20 Years of U.S. Defense Mobilization," *The Washington Post*, January 1, 1952, 7.

¹⁶ Flemming quoted in Glendy Culligan, "Rosie's Bright Kid Sister Comes On to Work Now," *The Washington Post*, November 6, 1951, B5.

In his speeches, policy recommendations, and personal correspondence, Flemming continually drove home this theme. In addition to its consistency, Flemming's interest in "scientific womanpower" is significant because it took into account the limitations of certain kinds of engineering work as well as the tendency to relegate women to positions beneath their education and experience. While serving on the Office of Defense Mobilization's Committee on Specialized Personnel in June 1952, for example, Flemming rejected a plan that women be trained as "engineering aides," as had been done during World War II. While he supported the entrance of women into engineering, and realized that something should be done to stem the shortage of engineers, he believed that such a plan "implies that women are suitable only for sub-professional work and does not encourage them to achieve full professional status."¹⁷ Thereafter, it was reported, other members of the committee and its consultants followed Flemming's lead by condemning management's appallingly low expectations for women engineers.¹⁸

Thus, Flemming established himself early on as someone with whom individuals and organizations such as the Society of Women Engineers would want to work. He shared many of their core convictions and took seriously the issue of "scientific womanpower." His ideas are firmly embedded in the Office of Defense Mobilization's policy recommendations, including its September 1952 Defense Manpower Policy, No. 8, which outlined the country's goals for utilizing scientific and technical personnel. The preface makes clear that "Throughout this document all references to scientists and engineers make no distinction

¹⁷ Flemming, quoted in Rossiter, *Women Scientists in America*, vol. 2, 53.

¹⁸ Rossiter, *Women Scientists in America*, vol. 2, 53. Rephrase, might be too close to Rossiter.

between the sexes or between racial groups; it being understood that equality of opportunity to make maximum effective use of intellect and ability is a basic concept of democracy.”¹⁹ Time and again, Flemming pointed to the seriousness of the scientific shortage and argued that the only way to alleviate it would be through the full utilization of womanpower.

Another source of admittedly more ambiguous support for “scientific womanpower” came from the newly formed National Science Foundation, which finally garnered presidential approval in 1950. Although it had undergone several transformations since it was first proposed more than five years earlier, the National Science Foundation still represented broad interest in government support of science, an awareness of science’s relationship to national defense, and a continued demand for renewing scientific talent. Its much-anticipated fellowship program, however, proved less advantageous to female science students than many individual women and women’s organizations had hoped. In 1952, when the first fellowships were awarded, women made up only 6.33 percent of winners. Although this might be considered a strong showing, considering that women made up only eight percent of applicants, it was still evident that women did not pursue or receive these awards in the same proportion as men.²⁰

The failure of women to pursue these fellowships and science more generally, however, also prompted additional investigations and proposals regarding women’s scientific participation. In 1954, the National Science Foundation commissioned two women to

¹⁹ Office of Defense Mobilization, Executive Office of the President, “Defense Manpower Policy No. 8: Training and Utilization of Scientific and Engineering Manpower, September 6, 1952” (Washington, D.C., 1952), quoted in Rossiter, *Women Scientists in America*, vol. 2, 53.

²⁰ Rossiter, *Women Scientists in America*, vol. 2, 75.

conduct preliminary research on this topic for its upcoming report on *Encouraging Scientific Talent*. Charles C. Cole, Jr. of Columbia University, who headed the project, reported that he had secured the services of MIT Ph.D. Jane Blizard and Yale-educated attorney Allaire Karzon “to write on ways in which effective scientific womanpower could be increased” and “to explore possible solutions which might make science careers more manageable and more attractive to more women of superior ability.”²¹ Cole incorporated their findings throughout his *Encouraging Scientific Talent*, which called attention to some of the cultural constraints faced by women seeking to enter the sciences and allied fields. He noted with interest that “Jane Blizard has suggested that the sex differences which exist in test scores are probably the result of socio-cultural influences” and he even included as an appendix Allaire Karzon’s “tax revision proposal to encourage women into careers.”²² Cole also drew on Karzon and Blizard’s recommendations regarding improved vocational guidance for girls and women, noting that “[v]ocational booklets outlining the advantages and attractions of scientific careers for women should be prepared and widely circulated.” After all, Cole acknowledged, “[I]t is particularly important that girls realize the need for their talents in scientific and engineering lines.”²³

²¹ National Science Foundation, Interim Report, *Encouraging Scientific Talent*, Sent to the Commission on the Education of Women, January 5, 1955, folder 100, Box 7, records of the American Council on Education’s Commission on the Education of Women (hereafter cited as CEW), Schlesinger Library, Radcliffe Institute for Advanced Study, Harvard University (hereafter cited as Schlesinger).

²² Charles C. Cole, Jr. *Encouraging Scientific Talent: A study of America’s able students who are lost to college and of ways of attracting them to college and science careers* (New York: College Entrance Examination Board, 1956), 24. Allaire Karzon’s tax proposal appears as Appendix A, pp. 198-208. Original drafts of Karzon’s and Blizard’s memoranda can be found in Folder 100, Box 7, CEW, Schlesinger.

²³ Cole, *Encouraging Scientific Talent*, 132.

Throughout the 1950s, the National Science Foundation continually revisited these themes and recommendations by sponsoring annual conferences aimed at identifying and improving the country's supply of scientific talent. Although the speakers and audience members varied each year, the overarching message remained the same: that scientific talent represented a critical national resource and no part of it could be spared.²⁴ Taken together, these on-going conferences and regular reports became part of a growing genre of Cold War "manpower studies," facilitated by a flood of new organizations dedicated to the subject.²⁵

Indeed, the early Cold War era witnessed an explosion of organizations, foundations, and councils interested in studying "manpower" issues and publicizing their findings. One early example is the Commission on Human Resources and Advanced Training, which was established in 1949 and directed by Dael Wolfle, noted psychologist, "manpower" expert, and future secretary of the influential American Association for the Advancement of Science. Its chief contribution was a three-hundred page long report on *America's Resources of Specialized Talent* that was published in 1954. Underwritten by the Rockefeller Foundation and principally prepared by Wolfle, the report received immediate acclaim and became the basis for many future manpower studies.²⁶ Another prominent example was the National Manpower Council, which was established in 1951 at Columbia University with funding from the Ford Foundation. The council, which brought together prominent educators, industrialists, and government officials, sought "to stimulate the improved utilization of the

²⁴ Findings were published in the National Science Foundation's publication, *Scientific Manpower*.

²⁵ National Manpower Council, *A Report on the National Manpower Council* (New York: Columbia University Graduate School of Business, 1954), 2-3.

²⁶ Dael Wolfle, *America's Resources of Specialized Talent* (New York: Harper & Brothers, 1954).

nation's manpower resources during this period of national crisis and increasing military and economic mobilization."²⁷ During the first decade of the Cold War, the council carried out this goal through a series of conferences, studies, and publications. Other major "manpower" initiatives included the National (later President's) Committee for the Development of Scientists and Engineers and the President's Committee on Education Beyond the High School, both of which were established by President Dwight Eisenhower in April 1956.²⁸

Even as they detailed and decried the shortage of scientific personnel, however, relatively few of these initiatives demonstrated any real interest in female talent. Of course, there were exceptions. Both Dael Wolfle and the National Science Foundation, after all, offered numerous recommendations for increasing women's scientific participation. But many more did not, or did so only reluctantly. The President's Committee on the Development of Scientists and Engineers, for example, initially included no female members—much to the chagrin of Arthur Flemming, who had urged Eisenhower to establish the commission in the first place. Although Marguerite Zapoleon of the United States Women's Bureau would be hired as a consultant, she did not share members' decision-making powers. Nor did the two female presidents of the National Education Association, who served as ex-officio members. Not only did their (unofficial) presence reinforce the

²⁷ National Manpower Council, *A Report on the National Manpower Council*, 7. See also Susan M. Hartmann, "Women's Employment and the Domestic Ideal in the Early Cold War Years," in *Not June Cleaver: Women and Gender in Postwar America, 1945-1960*, ed. Joanne Meyerowitz, 84-100, (Philadelphia: Temple University Press, 1994).

²⁸ National Science Foundation, *Scientific Manpower—1956: Significant Developments, Views, and Statistics* (Washington, D.C.: National Science Foundation, 1957), 3-4.

marginality of women's scientific participation, but it also reinforced the assumption that women could only succeed in science as school teachers.²⁹

The activities of the National Manpower Council also reveal much ambivalence regarding the "utilization" of women. From the outset, the council recognized "the crucial importance of skilled workers and scientific personnel."³⁰ But its initial study, which focused on military deferments for college men, necessarily excluded any discussion of women. The council's next undertaking, a four-part study of "scientific and professional manpower," nominally included women in its identification of potential engineers, physicians, and physicists. In line with traditional gender conventions, women received the fullest treatment in the fourth part, a chapter on teachers.³¹ Gradually, the council began to explore other aspects of "womanpower" and, at the urging of Columbia economist and business school professor, Eli Ginzberg, decided to carry out a full-fledged investigation of the subject.

Ginzberg, who headed the project, had a long-standing interest in "womanpower." In a later interview, he dated this interest to an experience in 1936, when he discovered that some of his best students were women. Concerned that their undergraduate training in French and art had prepared them poorly for the business world, Ginzberg began urging women's college administrators to steer their students toward math and science courses instead. He left the business school temporarily during World War II, when he headed to Washington, D.C. to work on wartime manpower problems. There, he learned of British women's participation

²⁹ Rossiter, *Women Scientists in America*, vol. 2, 58.

³⁰ National Manpower Council, *A Report on the National Manpower Council*, 10.

³¹ *Ibid.*, 13-17.

in the defense effort and urged that the United States register its women for the draft. Although he was “laughed out of the room,” he remained interested in womanpower issues and would continue to pursue them once back at Columbia. But bringing the National Manpower Council on board was not as easy as he might have hoped. Indeed, Ginzberg recalled, the decision to conduct the womanpower project was “the only time in the ten-year history of the Manpower Council that a theme had to be voted on.” In the end, the council adopted the “womanpower” theme by a single vote.³²

By 1955, the womanpower project was well underway and, over the next two years, the National Manpower Council sponsored sixteen conferences across the United States where representatives from industry, government, the armed forces, civilian agencies, labor unions, and women’s organizations met to discuss issues related to women’s employment. These conferences became the basis for the council’s three-hundred fifty page treatise, simply entitled *Womanpower*, which aimed “to contribute to a fuller understanding of the nation’s manpower resources by illuminating the present role of women in the working population.”³³ On March 13, 1957, several male members of the council presented the final *Womanpower* report to President Dwight Eisenhower at a White House ceremony. (Ironically, neither of the councils’ two female members were in attendance). Both the ceremony and the report, which was released to the public later that day, received immediate and widespread publicity. By the beginning of May, more than 552 newspapers in 47 states (as well as Hawaii and the District of Columbia) had covered the *Womanpower* study, and

³² Rosalind Rosenberg, *Changing the Subject: How the Women of Columbia Shaped the Way We Think About Sex and Politics* (New York: Columbia University Press, 2004), 211-213; Eli Ginzberg, quoted in *ibid.*, 213.

³³ National Manpower Council, *Womanpower* (New York: Columbia University Press, 1957), vii-viii.

sometimes more than once. Another 250 editorials had commented on the publication, as did numerous magazines and professional journals. Television and radio stations also devoted air time to the report and even featured interviews with some of its authors. Thus, in less than two months, *Womanpower* had already attracted more media attention than all of the council's previous projects combined.³⁴

Womanpower's overarching argument was that "women constitute not only an essential, but also a distinctive part of our manpower resources."³⁵ This compendium of both new and old studies recalled women's contributions during World War II, uncovered various forms of discrimination against women, and deplored the nation's failure to utilize female talent fully. It also identified a "revolution" in women's employment that had swelled the workforce participation of college-educated mothers and wives. In providing detailed evidence of this phenomenon, the report also retaliated against those who had advocated a distinctly feminine curriculum for female students.³⁶ Alongside these bold proclamations, however, ran remarkably conventional gender assumptions. Its treatment of current "manpower" shortages showcased women's expanded participation in teaching, nursing and social work and uncritically observed that "[p]roposals for expanding the supply of workers for occupations where shortages exist have generally assumed that there will be no change in the sex characteristics of occupational fields." "That is," the authors continued, "the

³⁴ National Manpower Council, Information Memorandum No. 114, "Report on Dissemination of *Womanpower*," June 13, 1957, folder 81, reel 145, American Association of University Women Archives, 1881-1976, microfilm edition (hereafter cited as AAUW).

³⁵ National Manpower Council, *Womanpower*, 9.

³⁶ *Ibid.*, 7-39; Rosenberg, *Changing the Subject*, 213-214.

shortages of nurses and engineers, for example, will be alleviated primarily by encouraging more young women, in the first instance, and more young men, in the second.”³⁷

Nevertheless, the *Womanpower* authors still suggested that women might be “utilized” in engineering and science. They regarded the recent increase in the number of women engineers as “striking” and as evidence that women could succeed in those fields. They also noted with interest that completing an undergraduate engineering degree takes approximately the same number of years as completing a degree in teaching or nursing. At the same time, however, they recognized “the strength of the tradition that engineering is a masculine field” and that increasing women’s scientific participation “involves changes in dominant ideas about suitable work for women, in employment practices, and in the way in which young women are guided in high school and college.”³⁸ To this end, they suggested that a “shift in emphasis in occupational guidance and counseling might encourage women to enter these fields” and hinted that the national shortage of scientists and engineers might relax occupational segregation. They did not embrace this idea wholeheartedly, however, noting that a large increase in the number of women scientists and engineers might seriously reduce the supply of teachers.³⁹

The *Womanpower* report and “manpower studies” more generally are significant because of the anxiety and ambivalence they revealed. They give us a window into Cold War politics and priorities, fueled by an obsession with technological prowess. The “waste,”

³⁷ National Manpower Council, *Womanpower*, 254.

³⁸ *Ibid.*, 218.

³⁹ *Ibid.*, 283, 256.

“shortage,” and “underutilization” of scientific talent became buzz words constantly repeated and recycled by politicians, educators, and industrialists eager to safeguard America’s position in the new Cold War world. But they also became tools employed by individual women and women’s organizations, such as the Society of Women Engineers, who were just as eager to dismantle cultural barriers to women’s scientific success.

Although the Society could not predict the extent of the Korean crisis, or the degree to which industry and government actually intended to recruit women engineers, it publicly embraced the prospect of an engineering shortage. At its 1951 convention in March, the Society even held a panel on “The Effect of the Current Emergency on Women in Engineering,” where participants forecasted expanding educational and vocational opportunities for women engineers.⁴⁰ At the convention’s much smaller and more private business meeting, however, SWE officers and committee chairs seemed reluctant to forfeit their mission to the laws of supply and demand and discussed concrete ways for the Society to improve women’s engineering participation. To recognize and publicize women’s contributions to engineering, the newly formed Awards Committee announced that it would confer the first SWE award on an established woman engineer in 1952. At this point, other SWE members advocated presenting awards to outstanding high school and college women with demonstrated aptitude for engineering as a way to encourage their participation in the field. Additionally, SWE President Beatrice Hicks suggested that the Board of Directors

⁴⁰ “Convention Notes: The Effect of the Current Emergency on Women in Engineering,” *Journal of the Society of Women Engineers* 1, no. 1 (Spring 1951): 9.

establish a committee to study the feasibility of sending members to high schools, colleges, and universities to talk to women students about engineering.⁴¹

Hicks realized that SWE could not rely on the predicted engineering shortage alone to forward its aims. But in justifying SWE activities, such as the annual achievement award, Hicks often invoked the specter of emergency. In the convention address in which she announced the award and its intention “to encourage women in their professional work and education,” Hicks related its importance to “the present desperate shortage of trained people” and the reality that “the needed personnel will be drawn from those having engineering aptitudes, whether men or women.”⁴² This connection between promoting women engineers and securing the national defense would remain a prominent theme in SWE activities throughout the 1950s. Like Hicks, many early SWE members had benefited from engineering shortages caused by war almost a decade earlier and appreciated the possibilities generated by the contemporary situation. As one SWE member remarked in a statement encapsulating this strategy, “The present shortage of engineers affords us a wonderful opportunity to bring to the attention of the public the possibility of alleviating the shortage by encouraging girls to become engineers.”⁴³

Promoting Professional Guidance

⁴¹ Kay Broughton, notes from SWE business meeting, March 10, 1951, Series 2, SWEC.

⁴²“Women Engineers See Field Widening,” *New York Times*, March 11, 1951, 47; no title, *Journal of the Society of Women Engineers* 1, no. 1 (Spring 1951): 13.

⁴³Katharine Stinson, “President’s Message,” *Journal of the Society of Women Engineers* 4, no. 1 (September 1953): 2.

As stated in its certificate of incorporation, the Society of Women Engineers aimed “to foster a favorable attitude in industry toward women engineers,” “to contribute to their professional advancement,” “to encourage young women with suitable aptitudes and interests to enter the engineering profession,” and “to guide them in their educational programs.”⁴⁴ Throughout the early 1950s, SWE carried out this mission by educating both female students and the general public about engineering as a career for women. Recognizing the cultural barriers to women’s engineering achievement, SWE sought to improve women’s engineering participation by offering scholarship programs, designing guidance pamphlets, organizing vocational forums, collaborating with industry representatives and government bureaucrats in the recruitment of women, and providing young women with established female role-models in the field.

By appropriating the language and the cause of national defense, SWE broadened its base of support and extended its network of potential allies. This approach also brought new urgency to SWE’s agenda, which required confronting and contesting deep-rooted social conventions and stereotypes. Engineering had traditionally been considered a field for men only and the continued marginality of women engineers seemed to validate this claim. Women engineers, if not altogether invisible, conjured images of lonely, unattractive career women wearing thick spectacles and “sturdy brown shoes.”⁴⁵ The perceived incompatibility of engineering and womanhood (particularly femininity, marriage, and motherhood)

⁴⁴ Society of Women Engineers, Certificate of Incorporation, February 13, 1952, Folder 4, Box 1, SWEC.

⁴⁵ Patricia Brown, quoted in Lois Cress, “Women Engineers: We Need More,” *Sunday Denver Post*, June 16, 1963, 5; Amy Sue Bix, “From ‘Engineeresses’ to ‘Girl Engineers’ to ‘Good Engineers’: A History of Women’s U.S. Engineering Education,” *NWSA Journal* 16, no. 1 (Spring 2004):27-32.

presented yet another challenge to the recruitment of female students. Thus, SWE's mission depended largely on its ability to recast the engineering field as a suitable one for women. SWE recognized the cultural constraints facing women in the field and sought to dismantle them through a broad program of education and example.

The Society believed that the depiction of women engineers in educational and vocational literature deserved particular attention. Distributed to counselors, teachers, students, and parents, guidance materials enjoyed widespread readership and potential influence. Often, however, these materials either ignored or discouraged engineering as a field for women. Such was the case with the 1942 booklet issued by the prominent Engineers' Council for Professional Development (ECPD), the accrediting agency for engineering programs. As suggested by its title, *Engineering as a Career: A Message to Young Men, Teachers, and Parents*, the publication promulgated a very masculine image of engineers and engineering. It included, on page eighteen, just one paragraph on "Women in Engineering," which explained that physical requirements excluded women from most engineering fields and that those women who did succeed in engineering generally possessed "unusual ability" and "extraordinary...skills."⁴⁶ Still in circulation nearly a decade after publication, the booklet was brought to the attention of SWE President Beatrice Hicks, who promptly contacted the ECPD regarding its inaccuracies and inadequacies. Hicks contested the ECPD's assertion regarding the physical requirements of engineering, noting that few present-day engineers handle heavy objects. She also argued that the ECPD's statement

⁴⁶ Engineers' Council for Professional Development, *Engineering As A Career: A Message to Young Men, Teachers, and Parents* (New York: Engineers' Council for Professional Development, 1942), 18.

about women engineers' exceptional qualifications bolstered separate standards of achievement for men and women in the field. The requirements of engineering work, she added, should not vary by sex.⁴⁷

Hicks then elaborated on the broader implications and cultural obstacles presented by the kind of information contained in the publication. She explained, "Many women who have the basic aptitudes to become excellent engineers never enter the profession because they have not recognized engineering as a possible career or because they have been discouraged by teachers, parents, or by untutored professional counselors." After pointing to the shortage of qualified engineers, Hicks identified women as "the richest unused source of engineering ability" and called on the Council to revise the booklet. "It is my belief," Hicks wrote, "that the Engineers' Council for Professional Development could make a worthwhile contribution through a special effort to encourage and help young women to analyze their aptitudes and obtain the necessary education to enter engineering." She concluded her letter by offering to assist the ECPD with revisions and enclosed a copy of the *Journal of the Society of Women Engineers*.⁴⁸

After several rounds of follow-up correspondence with Hicks, the ECPD issued a revised version of the publication in 1953. In addition to dropping the word "men" from the title, the booklet (now called *Engineering: A Creative Profession*) noted recent changes in the field that facilitated the employment of women, namely, the move away from strenuous physical labor. The publication also excerpted from one of Hicks' letters a list of subfields

⁴⁷ Beatrice A. Hicks to Engineers' Council for Professional Development, July 6, 1951, Series 8, SWEC.

⁴⁸ Ibid.

that frequently employed women engineers.⁴⁹ This victory, however, was a limited one for SWE insofar as references to women remained infrequent and problematic. Even though the ECPD had expanded its discussion of women engineers from one paragraph to three, the revised version took up only one third of one page. Moreover, the booklet featured no pictures of women engineers. While images of male engineers abounded, only three scenes even included women: one depicted a secretary taking notes for her boss, a male engineer; one showcased a hair-netted woman working at a food processing facility while a male engineer tended to machinery in the background; and the third featured a woman wearing high heels and vacuuming her spotless, modern kitchen above the caption “Today—Engineers’ application of scientific principles have released many of us from daily drudgery.”⁵⁰ In spite of the ECPD’s concessions to Hicks’ remarks, the revised publication reinforced traditional gender roles, upheld the image of engineering as a masculine enterprise, and provided little actual encouragement for women engineers.

The scarcity of information on engineering as a profession for women led SWE to conduct a survey of women in the field. The results, SWE believed, would reveal a more nuanced picture of women engineers than could be found in publications such as the ECPD’s. In 1953, the new SWE President, Lillian Murad, announced that the Society had secured the assistance of the Women’s Bureau of the U.S. Department of Labor, which

⁴⁹ Engineers’ Council for Professional Development, *Engineering: A Creative Profession* (New York: Engineers’ Council for Professional Development, 1953), 27; Hicks to Willis F. Thompson, December 4, 1951, Series 8, SWEC.

⁵⁰ Engineers’ Council for Professional Development, *Engineering: A Creative Profession*, 3, 4, 22.

agreed to tabulate the survey results.⁵¹ Afterwards, the Women's Bureau publicized the findings in its 1954 bulletin, *Employment Opportunities for Women in Professional Engineering*. Because the survey canvassed women already involved with SWE or on the Society's mailing list, its sample set was small and admittedly not representative. Conceding these points, the bulletin's authors nevertheless asserted that the SWE survey yielded important—and otherwise unavailable—information about women engineers. The majority of the respondents were in their twenties or thirties, had attended college, and were employed in full-time jobs. Furthermore, almost half were married and a fair number had children.⁵² The survey presented a very different—and much more well-rounded—image of women engineers than the one projected by the ECPD. It provided an overview of successful women in the field, but did not cast women's success as unusual or extraordinary.

SWE must have viewed the Women's Bureau as a logical ally, given the Bureau's historical concern with the employment of women. The Bureau had, after all, expressed considerable interest in women engineers (and scientists), as indicated by the series completed by Marguerite Zapoleon in the late 1940s. But the Bureau's interest in this particular survey and in collaborating with SWE more generally also reflected the growing national anxiety over the possible shortage of engineering personnel. The Women's Bureau bulletin in which the survey results appeared contained repeated references to the perceived emergency, including a statement on the cover page from President Dwight D. Eisenhower. Likewise, the first chapter, "Engineering Manpower and Women's Prospects," opened with a

⁵¹ Lillian Murad to "Colleague," June 17, 1953, Series 8, SWEC.

⁵² Women's Bureau of the United States Department of Labor, *Professional Engineering: Employment Opportunities for Women* (Washington, DC: Government Printing Office, 1954), 19.

1953 quotation from the Director of the Office of Defense Mobilization, Arthur S. Flemming, advocating the use of women to ease the engineering shortage.⁵³ The Cold War relationship between engineering and national defense, as articulated by these prominent federal officials, supported the Women's Bureau interest in SWE and facilitated its collaboration.

In 1955, SWE released its own publication, *Women in Engineering*, which further recast the image of the profession. Intended as a resource for students, teachers, counselors, employers, and SWE members, the forty-page guidebook included a list of scholarships for women, a directory of accredited engineering curricula, prerequisites for engineering programs, statistics on women in the field, and suggestions for further reading. The bulk of the booklet, however, consisted of articles written (and previously presented as conference papers) by members of the Society. One of the five essays, written by mechanical engineer Margaret Ingels, chronicled the lives of thirty-six pioneering women engineers from the late nineteenth and early twentieth centuries. The short biographies included information about the women's education, careers, and marital status. This information, as well as the article's title, "Petticoats and Slide Rules," highlighted the compatibility of engineering and femininity.

The other four articles focused more explicitly on the current demand for women engineers. In her essay on "Our Untapped Source of Engineering Talent," SWE's first president, Beatrice Hicks, once again invoked the Cold War engineering shortage and denounced the "waste of graduating less than 100 women engineers per year in all of the United States." After detailing contemporary workforce trends, she criticized those

⁵³ Ibid, title page and 1.

organizations (which presumably included the Engineers' Council for Professional Development) that associated engineering with heavy manual tasks unfit for women. Hicks believed that such outdated and inaccurate advice, "composed ten years ago from the limited experiences of one individual," posed a particular threat when disseminated by an organization "financially able to provide wide distribution for its printed material." Overall, however, Hicks was optimistic and predicted that because of the shortage and because of the work of the Society, "[women's] engineering talent will not long remain dormant."⁵⁴

Other SWE presidents Katharine Stinson (1953-1955) and Lois Graham McDowell (1955-1956) called attention to the dire need for improved educational and vocational counseling of women. They also provided concrete suggestions for identifying, advising, and encouraging female students with engineering aptitudes. Like the editors of the Women's Bureau bulletin, both Stinson and McDowell quoted the Director of the Office of Defense Mobilization, Arthur S. Flemming when relating their concerns to national defense. Stinson pointed to the same 1953 speech referenced by the Women's Bureau in which he asserted, "There is no question at all but that more women should be enrolled in our engineering schools. This is one of the ways of dealing adequately with the present and potential shortages in this area....Colleges and high schools have got to do a better job of counseling [young women]."⁵⁵ McDowell cited a *U.S. News and World Report* interview when Flemming remarked, "[W]e haven't got a chance in the world of taking care of that deficit of

⁵⁴ Beatrice Hicks, "Our Untapped Source of Engineering Talent," in *Women in Engineering*, ed. Patricia L. Brown, (New York: Society of Women Engineers, 1955), 2-6.

⁵⁵ Arthur S. Flemming, quoted in Katharine Stinson, "Some Facts About Engineering as a Career for Women," in *Women in Engineering*, ed. Patricia L. Brown, (New York: Society of Women Engineers, 1955), 22.

engineers...unless we get women headed in the direction of engineering schools.”⁵⁶ By this point, Flemming had emerged as an outspoken promoter for women engineers and it is hardly surprising that individuals and organizations concerned with the place of women in the field would invoke his authority.⁵⁷ By using the words of the Office of Defense Mobilization to justify their cause, however, SWE ascribed to the guidance of female students a sense of urgency and national responsibility.

The Society distributed *Women in Engineering* to colleges, industrial corporations, government committees, engineering societies, and 455 high schools throughout the country.⁵⁸ The response was overwhelmingly enthusiastic. Letters poured in thanking SWE for the booklet, proclaiming its usefulness, and requesting additional copies. Among those lauding the publication were high school and college guidance counselors, deans of engineering, the Sperry Rand Corporation, Du Pont, General Motors, the United States Chief for Engineering Education, and the President’s Committee on Education Beyond the High School. Vida Grace Hildyard, the Educational Counseling Chairman (and the only female member) of the Wichita Council of Technical Societies, could hardly believe the positive response she received from the men on the council after sharing the booklet and recommending that they pay particular attention to counseling female students. She wrote, “This suggestion was received with enthusiasm far surpassing my wildest expectations. In fact, the men all thought every counselor in each of our members’ societies should have a

⁵⁶ Flemming, quoted in Lois G. McDowell, “Educating Women for Engineering,” in *Women in Engineering*, ed. Patricia L. Brown, (New York: Society of Women Engineers, 1955), 7.

⁵⁷ Rossiter, *Women Scientists in America*, vol. 2, 52-53.

⁵⁸ Spreadsheet documenting distribution of *Women in Engineering*, 1956, Series 8, SWEC.

supply of booklets, so that he might not only have them to pass on to our five high schools and the girls he might be counseling, but also for his own information. They requested me to ask if it would be possible to obtain 200 of the booklets at once, and I hope that is only a start!”⁵⁹ Before long, the demand for the booklet had outrun the supply, and in February 1957 SWE announced that it would release a revised edition in 1958.⁶⁰

Most of the work behind *Women in Engineering* had been conducted by SWE’s Professional Guidance and Education Committee. Established during the 1951-1952 year, the Professional Guidance and Education Committee would become one of the primary vehicles through which SWE carried out its mission. As indicated in its title, the Committee concerned itself exclusively with encouraging female students, working with parents and schools, and educating the public about engineering as a career for women.⁶¹ On the national level, the Professional Guidance and Education Committee undertook projects, such as the *Women in Engineering* booklet, that were aimed at the broad dissemination of educational and vocational information. In 1953, for example, the Committee compiled and distributed a list of coeducational engineering colleges and technical schools. The Cleveland Board of Education’s director of guidance and placement, Mildred Hickman, was so thrilled about receiving the information that, over her spring vacation, she wrote to SWE requesting additional copies for each of the district’s twelve high schools. The Professional Guidance and Education Committee also created a centralized Speaker’s Bureau, which schools, clubs,

⁵⁹ Vida Grace Hildyard to Brown, October 30, 1955, Series 8, SWEC.

⁶⁰ Gerla, “President’s Report,” *SWE Newsletter* 3, no. 6 (February 1957): 3.

⁶¹ Beatrice Hicks, “Annual Report of the President of the Society of Women Engineers, July 1, 1950 to July 1, 1951,” *Journal of the Society of Women Engineers* 2, no. 1 (September 1951): 7.

and event organizers could contact when looking for someone to speak about women engineers. Additionally, the Committee fielded and directed hundreds of inquiries from students, parents, advisors, educators, and the general public regarding women in engineering.⁶²

The majority of the Committee's activities, which involved making contact with female students, their parents, their teachers, and their guidance counselors, were carried out at the local level. Recognizing the importance of individual encouragement, a number of these activities sought to further women's interest in engineering by celebrating and rewarding their academic accomplishments. After securing the necessary information from the University of Detroit Dean of Engineering, for example, members of the Detroit Section's Professional Guidance and Education Committee wrote letters of commendation to female students with high engineering aptitude scores. The Detroit Section also presented corsages to those high school girls with the highest grades in science and mathematics who were recognized at the Engineering Society of Detroit's annual dinner.⁶³ SWE members across the country regularly judged science fairs in their local communities and awarded female winners with special certificates or prize money.⁶⁴ In addition to supporting

⁶² Mildred M. Hickman to Hicks, March 31, 1953, Series 4, SWEC; Emma C. Barth, "Report of the Board of Directors to the Membership of the Society of Women Engineers Covering the Period from March 1952 to March 1953," (report delivered at Annual Convention, March 29, 1953), 2; Series 2, SWEC; McDowell, "Professional Guidance and Education," *Journal of the Society of Women Engineers* 4, no. 1 (September 1953): 3; Catherine W. Eiden, "Replies to Questions Asked in U.S. Treasury Dept. Letter of June 16, 1959," 4, Series 3, SWEC.

⁶³ E. Elise Hosten, "Annual Report of the Professional Guidance and Educational Committee for Year 1952-1953: Detroit Section Society of Women Engineers," 1, Folder 2-1, Box 2, Society of Women Engineers-Detroit Section, Walter P. Reuther Library, Wayne State University (hereafter cited as SWEC-Detroit).

⁶⁴ Eiden, "Replies to Questions Asked in U.S. Treasury Dept. Letter of June 16, 1959," 4, Series 3, SWEC.

individual women with demonstrated interest and ability, this strategy enabled SWE to showcase “scientific womanpower.”

Many Professional Guidance and Education Committee activities served the dual purpose of calling attention to the engineering shortage and projecting a positive image of women engineers. In April 1952, the Professional Guidance and Education Committee of SWE’s Pittsburgh Section sponsored a symposium for high school girls, their parents, and student counselors. The Committee mailed notices to about 150 schools within thirty miles of Pittsburgh. Held at the Mellon Institute, the symposium featured addresses by SWE members as well as representatives from Westinghouse Electric Corporation and the University of Pittsburgh and covered such topics as “The Engineering Shortage and the Place of Women in the Engineering Field,” “The Success of Prominent Women in Engineering,” and “Why I am Glad I Studied Engineering.” In addition to sharing their experiences and situating themselves as desirable role models, SWE members informed the audience about course requirements and the availability of scholarships. Afterwards, the conveners learned with satisfaction that several of the women who attended enrolled in engineering colleges.⁶⁵

In Detroit, members of the Professional Guidance and Education Committee met with high school counselors from the city’s Board of Education in March 1953. At their meeting, SWE members reminded the group about the possible shortage situation and “outlined the role of women in engineering in the present demand for engineers.” After reiterating the purpose of Society and the Committee, SWE members provided the counselors with a copy

⁶⁵ “Activities of the Sections: Pittsburgh Section,” *Journal of the Society of Women Engineers* 2, no. 4 (June 1952): 10; McDowell, “Professional Guidance and Education,” *Journal of the Society of Women Engineers* 4, no. 1 (September 1953): 2-5.

of the points covered at their meeting as well as contact information for the Detroit Section chair. Later in the year, members of SWE's Detroit section worked with one of the high school counselors in preparing a vocational guidance recording to be presented in the local high schools. The question and answer program would include several SWE members discussing their experiences in the profession and further increase the visibility of women engineers.⁶⁶

SWE's Detroit Section also participated regularly in the semi-annual Engineering and Science Vocational Meetings held for local high school students. Sponsored by the Engineering Society of Detroit, the meetings provided students with the opportunity to interact with professionals in the field. While the December meetings targeted seniors contemplating their college plans, the May meetings were geared toward sophomores and juniors "in the hope that it would be possible to reach the students before their high school studies were ended and there was still a chance that they could gain the necessary credits to enter engineering school." The May meetings in particular reflected one of SWE's strongest concerns: that not enough women pursued engineering in college because they were poorly advised in high school or altogether discouraged from taking those science and math courses required for admission to engineering programs. These meetings provided an avenue for SWE members to provide high school girls with guidance and encouragement that they might not have otherwise received. Through the 1956 meetings alone, SWE advised almost

⁶⁶ Hosten, "Annual Report of the Professional Guidance and Educational Committee for Year 1952-1953: Detroit Section Society of Women Engineers," 1, Folder 2-1, Box 2, SWEC-Detroit.

fifty “interested girls” in the Detroit area.⁶⁷ Margaret Eller, a member of SWE’s Detroit section and chair of the Professional Guidance and Education Committee, later recalled of the gatherings, “That’s how we got girls to go into engineering.”⁶⁸

Similar outreach efforts took place across the country. Houston members regularly addressed audiences of high school girls on “Women in Engineering” and “Engineering as a Career for Women.”⁶⁹ In Los Angeles, Professional Guidance and Education Committee member Marie Scully gave the keynote speech at a 1956 luncheon attended by seventy female students and professionals in the field. That same year, she took part in a half-hour NBC-TV panel show designed to interest high school and college students in technical careers. Additionally, almost all SWE sections participated in the panel discussions held for high school students as part of Engineers Week, which itself was a Cold War creation. Established in 1951 by the National Society of Professional Engineers, Engineers Week typically included meetings, public addresses, and proclamations lauding engineers’ contributions to American society (and national defense), lamenting the engineering shortage, and urging the recruitment of bright students to the field.

SWE members realized that they were often the first (and perhaps only) female engineers with whom teachers, counselors, parents, and students would come into contact. They also realized their unique, self-imposed responsibility to recast engineering as a suitable field for women. As one member recounted, “No male engineer can really do this job for

⁶⁷ Maxine V. Janczarek, “Detroit Section PG&E Committee, 1956,” Series 8, SWEC.

⁶⁸ Margaret Eller, interview by Lauren Kata, June 11, 1003, transcript, 29, Box 1, Profiles of Women Engineers, SWEC.

⁶⁹ Houston Section SWE, “Report,” February 1956, Series 8, SWEC.

us—we represent the living, breathing evidence when we go before a high school audience, a PTA meeting, or a counselors' conference.”⁷⁰ In addition to making themselves visible examples of successful women in the field, SWE members both understood and articulated the cultural deterrents to women's engineering achievement. Whether judging science fairs or writing guidance literature, SWE members sought to dismantle these obstacles and encourage female students. Their agenda attracted the most interest and support, however, when couched in the language of national defense.

Taking Stock of SWE

In February 1957, SWE President Miriam “Mickey” Gerla (1956-1958) asked Society members to evaluate the organization's progress. “But how do we measure the extent to which we are fulfilling our aims?,” she inquired. “Are we encouraging women with suitable aptitudes and interests to enter the engineering profession, and guiding them in their educational program?...And how do we know whether our Professional Guidance and Education programs have specifically contributed to the increased enrollment in the colleges—now numbering over 500 women?” Gerla reflected: “There is much to be done in this area, but we should ask ourselves if we have progressed from where we were two or five or seven years ago, rather than be disturbed because there is so much still undone.”⁷¹ Overall, Gerla and other SWE members agreed, the Society's early years were successful ones. The small group that gathered at Camp Green, for example, had already expanded to more than 500 members. The Society had expanded geographically as well: local sections could be

⁷⁰Lydia Pickup to SWE Members at Large, [1960], Series 8, SWEC.

⁷¹ Gerla, “Taking Stock of SWE,” February 27, 1957, Series 11, SWEC.

found across the country, including Los Angeles, Chicago, Houston, Atlanta, New York, Washington D.C., Boston, and the Pacific Northwest. The budding organization quickly commanded the attention of other engineering and scientific societies, most of which were significantly older and male-dominated. By invitation, SWE took its place alongside these groups at such events as the 1952 “Centennial of Engineering” and the 75th anniversary of the American Society of Mechanical Engineers held three years later. SWE’s inclusion signified to members a certain level of acceptance among their colleagues.

Still, these examples of perceived progress existed alongside the reality that SWE members and other female engineers remained a small fraction of the profession. SWE President Patricia Brown (1961-1963) would later remark of the 1952 “Centennial of Engineering” that “we were accepted and yet not quite accepted...[W]e were off in our own little group most of the time.”⁷² The tenacity of gender conventions and stereotypes, moreover, proved particularly troublesome for SWE. From the outset, SWE recognized that it would have to show not only that women could be engineers, but that engineers could be women (and womanly). While challenging and improving public perceptions of women engineers comprised a critical part of SWE’s agenda, it also took up more time than the Society probably would have liked. This constant battle was fought on a number of fronts. Sometimes it involved visual cues—such as wearing lipstick, dainty pumps, and figure-flattering frocks. In other instances, it required written or spoken statements proclaiming engineering’s compatibility with womanhood. Several sections even distributed talking

⁷² Patricia Brown, interview by Lauren Kata, April 16, 2003, transcript, 13, Box 1, Profiles of Women Engineers, SWEC.

points and stock answers to which SWE members could easily refer when addressing anxious audiences. One Professional Guidance and Education Committee document, for example, reminded members to “Assure the girls, and particularly their parents, that engineering is a perfectly respectable occupation for a woman.” Not only is engineering “a nice clean office job,” but “a woman can be an engineer, take time out to raise her family, and return to engineering.” The SWE member who penned this document readily admitted, “Yes, some of these items were written with tongue-in-cheek.” “But,” she added, “take another look. Don’t you agree that these represent questions which need to be answered, parental fears which need to be allayed, self-evident (to us) truths which need to be iterated?”⁷³ In order for SWE to project a more positive—and more feminine—image of women engineers, it had little choice but to address and often invoke traditional gender conventions.

SWE’s necessary insistence on the compatibility of engineering and womanhood sometimes attracted *too* much attention. While the Society seemed generally pleased with the growing publicity given to the organization and to women in the field, public interest often focused more on members’ qualifications as women rather than as engineers. In 1952, SWE member Margaret Kearney wrote to Beatrice Hicks, “I have detected a note of flippancy in the attitude of the supervising principals who have phoned for program speakers. It is obvious to date that they are interested in knowing whether the engineer is blonde or brunette, whether than if her degree is Chemical or Electrical.”⁷⁴ Hicks herself also faced similar challenges. Although her feminine qualities provided evidence of the compatibility of

⁷³ Pickup to SWE Members at Large, [1960], Series 8, SWEC.

⁷⁴ Margaret A. Kearney to Hicks, December 10, 1952, Series 8, SWEC.

womanhood and engineering, they also drew disproportionate attention from the public and the press alike. One news reporter, for instance, even exclaimed, “Honestly, you’d never know it (that she was an engineer) to look at her...She wears flowers and earrings and polka-dot linen pumps.”⁷⁵ Although comments such as these reinforced SWE’s conviction that engineers could be women and that women could be engineers, they also served to belittle women in the field and to cast them as curiosities.

The Cold War climate limited the extent to which the Society could openly attack gender conventions and the condition of women. In this era of witchhunts and red-baiting, the Society took great pains to not appear “subversive.” Under the advice of its lawyer, it even included in its constitution a non-political affiliation clause in order to “remove ourselves from any suspicion of subversive activity.” The clause, which renounced the Society’s ability to lobby for legislative change and to endorse political programs, was a point of contention for many years. While officers encouraged individual members to take stands on issues pertaining to women, the Society found it necessary to remove itself from the political arena in order to keep below HUAC’s radar. To be sure, the Society believed in gender equality and would later go on to publicly support the ERA. But during the 1950s, the Society realized it needed to demonstrate first and foremost how its aims meshed with those of the nation. As a result, the Society’s broader interests in the advancement of women were quietly subsumed under the rubric of national defense.

The Society realized that it had a tight space in which it could maneuver but it felt positive about what it had accomplished given those restrictions. It measured its success in

⁷⁵ “Beatrice Hicks, Society’s first president, dies,” *SWE Newsletter* (November/December 1979): 5.

small yet significant steps, such as membership growth and increased requests for speakers. Although less tangible, the encouragement provided by members to girls and women in the field also represented an important achievement. As one member recounted, “I know from my own experience that our organization can be of great help to wavering girls who meet with discouragement at home as well as at school.”⁷⁶ Another member remarked of the Society’s early activities that “We believe that we should be satisfied this year if we do nothing more than increase the knocking on the local college doors by women who indicate increased engineering interests.”⁷⁷ These early victories—both small and large—were a source of pride for SWE members and set the groundwork for subsequent activities. The Society realized that the road ahead would be a long one, but approached new challenges with enthusiasm and determination.

Throughout the 1950s, SWE’s outlook was very much optimistic and for seemingly good reason. With public praise for female engineers coming from all corners of the country, prospects for women seemed promising and showed little evidence of subsiding. Despite the limitations of technocratic discourse, the perceived engineering shortage became a rallying cry for women in the field. SWE membership materials from the mid-1950s reminded female engineers that “[t]he critical engineering manpower shortage places upon us a responsibility to see that all young women who are suitable are informed that engineering is open to them, and can be a satisfying and rewarding career....Individually we can accomplish little along

⁷⁶ Virginia Tucker to Gerla, December 5, 1957, Series 3, SWEC.

⁷⁷ Kearney to Hicks, December 10, 1952, Series 8, SWEC.

these lines, but in a united effort much can be done.”⁷⁸ The Cold War concern with trained personnel also helped SWE to recruit less likely allies, such as educators, parents, industry representatives, and government bureaucrats. Finally, it expanded the Society’s sense of possibility and sustained its activities throughout the postwar period.

⁷⁸ Dot Merrill, “Membership in the SWE,” [1954], Series 6, SWEC.

CHAPTER 5

“Scientific Womanpower” Enters the Sputnik Era

On October 4, 1957, the Soviet Union triggered what would become known as “the Pearl Harbor of the Cold War” when it launched into orbit the world’s first artificial satellite. The 184-pound device, named Sputnik by the Soviet news agency Tass, circled the earth once every 96 minutes, emitting short, eerie “beeps” as it flew overhead. Although the satellite itself was no bigger than a basketball, its entry into space made evident that the Soviet Union possessed the launching capacity to send nuclear missiles from one continent to another. Stunned Americans gathered around their radios and in their backyards, eager to witness this remarkable feat. One month later, the Soviet Union flexed its technological muscles again when it launched Sputnik II, a substantially heavier satellite weighing 1,120 pounds and carrying a dog, which aroused speculation that a human would be next to orbit the earth. By twice-lapping the United States in the space race and actualizing the threat of nuclear warfare, the Sputnik launchings generated much anxiety about the seemingly superior state of Soviet science.¹

In the aftermath of the Soviet Sputniks, the apparent deficiency of American science and science education attracted both interest and despair. Educators, politicians, and scientists alike were convinced that the United States had been outpaced by its Cold War adversary and needed desperately to “catch up.” But doing so would be no easy task, as the

¹ Barbara Barksdale Clowse, *Brainpower for the Cold War* (Westport, CT: Greenwood Press, 1981), 5-16.

United States graduated less than one-fourth the number of scientists and technological personnel produced by the Soviet Union each year. To take the lead in the space race, the United States would have to increase its production of “scientific manpower” both quickly and drastically. And education would be key in this endeavor.²

In 1958, Congress responded to this perceived crisis by passing the monumental National Defense Education Act (NDEA). The NDEA, as Margaret Rossiter argues, epitomized the manpower analysts’ message. Explicitly drawing on Cold War themes, the legislation boldly proclaimed that “the security of the Nation requires the fullest development of the mental resources and technical skills of its young men and women.”³ Authorized by the act, Congress immediately allocated one billion dollars across ten programs designed to improve and expand training in “defense disciplines” such as science, math, and foreign languages. Its initiatives included a federal loan program for aspiring teachers, as well as a new graduate fellowship program that would be even larger and broader than the one run by the National Science Foundation. Although the NDEA legislation would later expand to include other fields such as area studies, its original provisions targeted those areas made most vulnerable by the Soviet Sputniks.⁴

² William L. Laurence, “Soviet Success in Rocketry Draws Attention to Need for More Students in Science,” *New York Times*, October 13, 1957, 19.

³ Margaret W. Rossiter, *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995), 63; National Defense Education Act quoted in Rossiter, 63.

⁴ Rossiter, *Women Scientists in America*, vol. 2, 63; Linda M. Eisenmann, *Higher Education for Women in Postwar America, 1945-1965* (Baltimore: Johns Hopkins University Press, 2006), 18-19; Arthur S. Flemming, “The Philosophy and Objectives of the National Defense Education Act,” *Annals of the American Academy of Political and Social Science* 327 (January 1960): 134. For a fuller treatment of the National Defense Education Act, see Clowse, *Brainpower for the Cold War*.

By including women as a source of expertise, the NDEA benefited female as well as male students. But even as it made graduate fellowships available for scientific study and brought more women into the university, the shortage of “scientific womanpower” persisted, especially when compared with Soviet society. As several early Cold War surveys had found, the U.S.S.R. graduated approximately 13,000 women engineers per year.⁵ More recent statistics furnished by Soviet scientists (and based on current enrollments instead of graduation rates) revealed that women made up one third—or 203,000—of the country’s engineering students. Despite their methodological discrepancies, both figures indisputably dwarfed the annual U.S. graduation rate of fewer than 100 women engineers.⁶ The Soviet Union’s evident success at attracting women in scientific and technical fields led to much public consternation as policy makers, educators, and scientists alike latched onto these findings. Across the country, ominous headlines claimed that “Soviets are Ahead with Womanpower,” “Women Add Much in Soviet Science,” and “Red Engineering Schools Loaded with Women.”⁷ As if to egg these naysayers on, the *Washington Post*’s January 1959 article entitled “Talents of U.S. Women Being Wasted, 3 Soviet Scientists Say” featured first-hand observations from members of a recent Soviet delegation to the United States. The

⁵ National Manpower Council, *Womanpower* (New York: Columbia University Press, 1957), 262.

⁶ *Ibid.*; Konstantin T. Galkin, quoted in “Red Engineer Schools Loaded With Women,” *Washington Post*, February 28, 1958, L5.

⁷ “Soviets Are Ahead With Womanpower,” *Star*, February 9, 1958, no page, clipping in folder EC83, carton 12, records of the American Council on Education’s Commission on the Education of Women (hereafter cited as CEW), Schlesinger Library, Radcliffe Institute for Advanced Study, Harvard University (hereafter cited as Schlesinger); “Women Add Much in Soviet Science,” *New York Times*, February 16, 1958, no page, clipping in Series 12, The Society of Women Engineers Collection, Walter P. Reuther Library, Wayne State University (hereafter cited as SWEC); “Red Engineering Schools Loaded With Women,” *Washington Post*, February 28, 1958, L5.

Post's interview with Alla Masewich, a "woman astronomer" who had coordinated the physical observations on the Sputniks, seemed to confirm that the Soviets' lead in the space race had been clinched by female talent.⁸

The insinuation that the outcome of the Cold War hinged on the utilization of women had real resonance as the post-Sputnik panic set in. The Sputnik saga dramatized the importance of "scientific womanpower" to national security and exposed the United States' failure to promote women's scientific participation. It also reinforced earlier warnings issued by the Society of Women Engineers and others regarding the dangers of "wasting" female intellect. Other women and women's organizations soon took up these arguments as well and embarked on their own initiatives to encourage girls and women with scientific interest and aptitude. In doing so, they frequently called attention to the distinct advantage enjoyed by the Soviet Union as a result of its willingness to educate and employ female scientists and engineers. As Ethaline Cortelyou of the Armour Research Foundation remarked in her June 1958 *Chemical Bulletin* article, "The successful launchings of Sputnik I and Sputnik II indicate what can happen when a people realize that brains have no sex!"⁹

This logic, however, proved tricky. Certainly, the high participation of women in Soviet science helped to refute still prevalent perceptions that women lacked the ability to succeed in these fields. It also supported claims that the United States could no longer afford to discourage its women from engaging in scientific and technical pursuits. But even as they

⁸ Edward Gamarekian, "Talents of U.S. Women Being Wasted, 3 Soviet Scientists Say," *Washington Post*, January 25, 1959, B6.

⁹ Ethaline Cortelyou, "Utilizing Chemical Womanpower to Combat the Alleged Shortage of Chemists," *The Chemical Bulletin* (June 1958): 18-19, clipping in folder EC83, carton 12, CEW, Schlesinger.

applauded the Soviet Union's "utilization" of womanpower, both Cortelyou and her like-minded colleagues had to avoid drawing too much attention to Soviet women themselves. Although some Soviet scientists such as Alla Masewich were deemed "attractive" by the *Washington Post*, many more were depicted by the press as tough, manly, severe, or at best, plain—the very stereotypes that the Society of Women Engineers struggled to dismantle.¹⁰ Likewise, the "hard-working" nature of female Soviet scientists was generally cast as the inevitable and undesirable result of what one Connecticut woman called "frantic attempts on the part of the Soviet Government to badger the populace into record production."¹¹

Thus, Soviet women's scientific servitude seemed antithetical to American values. The thought of forcing women into the workforce (scientific or otherwise) repulsed many middle-class Americans, who regarded the supposedly comfortable lifestyle of the American housewife as emblematic of their own country's affluence and cultural superiority. Nowhere was this more apparent than in the 1959 "kitchen debate" between U.S. Vice President Richard Nixon and Soviet Premier Nikita Khrushchev, held at the American National Exhibition in Moscow. In the model kitchen of a full-scale, six-room, ranch-style home, Khrushchev and Nixon quarreled over the symbolic merits of washing-machines and electric ranges. While Nixon extolled the virtues of these time-saving devices, pointing out that they had been "designed to make things easier for our women," Khrushchev condemned that

¹⁰ Gamarekian, "Talents of U.S. Women Being Wasted," B6; See also "Top Soviet Woman" *New York Times*, February 28, 1956, 8 for a discussion of Ekaterina A. Furtseva, who is described as "Slavic-looking," tough, and reknowned for her "Communist zeal." The main caption under her photo simply says "outranks her husband."

¹¹ Fannie M. Pious, letter to the editor, *New York Times Magazine*, November 16, 1958, 17; Gertrude Samuels, "Why Russian Women Work Like Men," *New York Times Magazine*, November 2 1958, 22.

“capitalist attitude” and retaliated with pride in his country’s hard working-women. That the Soviet system had little use or regard for full-time homemakers only bolstered Nixon’s conviction that American superiority very much rested on Cold War domesticity and sharply-defined gender roles.¹²

Individuals and organizations interested in expanding women’s scientific participation struggled to balance these competing concerns. Even as female activists urged the “utilization” of female intellect, they also carefully avoided denigrating women’s roles as mothers and wives. Nor did they suggest that American women give up their domestic dreams in order to pursue scientific endeavors. Instead, they attacked the broader cultural climate that devalued women’s intellectual contributions and rendered undesirable any attempt to combine scientific and domestic endeavors.

Encouraging “Scientific Womanpower”

In December 1958, the women’s scientific fraternity Sigma Delta Epsilon teamed up with the American Association of Scientific Workers, the National Federation of Business and Professional Women’s Clubs, and three other groups to sponsor what would become one of the first major post-Sputnik discussions of “scientific womanpower.” The “Conference on the Participation of Women in Science,” held in conjunction with the American Association for the Advancement of Science’s annual meeting in Washington, D.C. drew women and men from across the country. In the Congressional Room of the Willard Hotel, crystallographer Elizabeth Wood of Bell Labs gave a sardonically titled opening address,

¹² Elaine Tyler May, *Homeward Bound* (New York: Basic Books, Inc., 1988), 16-20; Richard Nixon quoted in May, *Homeward Bound*, 18.

“Sugar and Spice and Everything Nice,” in which she lambasted the cultural curbing of women’s scientific talent. The two most insidious constraints facing women, she claimed, were the widespread assumptions that “mechanical gadgets and scientific things are the province of men” and that “the right thing to do for universal approval is to marry and have a family.” She cited the National Manpower Council’s *Womanpower* findings regarding married women’s increasing workforce participation (as evidence of their ability to combine scientific work and domestic duties) and she advocated that female students receive similar levels of scientific encouragement as their male peers, especially at the critical secondary school level.¹³

Subsequent speakers elaborated on these and similar themes. In a paper on “Women’s Attitudes Toward Careers,” Hofstra College psychologist Anne Steinmann reported on her three-year study of fifty-one female college students and their parents, concluding that the present American mood was “an unrealistic, hysterical back-tracking” of career women into the home. The University of Maryland’s Annabelle Motz expounded on “The Multiple Roles of the Woman Scientist” while the panel discussions that followed revealed support for government-sponsored maternity leave, nurseries, home-making services, and tax deductions for working wives.¹⁴ By most accounts, however, the highlight of the afternoon was the

¹³ Program, “Conference on the Participation of Women in Science,” December 29, 1958 and Notes, from “Conference on Participation of Women in Science,” December 29, 1958, both in folder 20, Box 1, Sigma Delta Epsilon Records (hereafter cited as SDE), Rare and Manuscript Collection, Carl A. Kroch Library, Cornell University (hereafter cited as KLCU); Elizabeth Ford, “Engineers Must Ditch Double Standard,” *Washington Post*, December 30, 1958, C13; Rossiter, *Women Scientists in America*, vol. 2, 347-348.

¹⁴ Program, “Conference on the Participation of Women in Science,” December 29, 1958, folder 20, Box 1, SDE, KLCU; Elizabeth Ford, “Engineers Must Ditch Double Standard,” *Washington Post*, December 30, 1958, C13.

keynote address by Arthur S. Flemming, the recently appointed Secretary of Health, Education, and Welfare. During the 1940s and 1950s, Flemming had emerged as one of the few men in the federal government to advocate the education and employment of female scientists and engineers. Groups such as the Society of Women Engineers frequently invoked his authority and his support and it is not surprising that the president of Sigma Delta Epsilon announced that she was “elated” when he agreed to participate in the conference.¹⁵

Nearly 150 women (and several men) attended Flemming’s address, which explicitly and repeatedly linked women’s scientific participation to the fate of the “free world.” Highlighting dire “manpower” shortages in scientific and technical fields, Flemming criticized those “engineering schools [that] do not put out a welcome mat for women.” He also denounced what he identified as a “double standard” in education and employment practices whereby women were denied the same level of encouragement or compensation as men. Admitting to his predominantly female audience that “you know this better than I do,” he detailed the continued discrimination faced by women seeking graduate admission, struggling to complete their programs, and finding work commensurate with their training. He urged listeners to help make educators and employers aware that this “double standard” not only lacked justification but also jeopardized the national security and the expanding civilian economy. All individuals interested and invested in these matters, Flemming added, “have a definite obligation to keep turning the spotlight on our manpower problem.”¹⁶

¹⁵ Mary Louise Robbins to Members of the National Council and Board of Directors [of Sigma Delta Epsilon], December 11, 1958, folder 20, Box 1, SDE, KLCU.

¹⁶ Arthur S. Flemming address at the Conference on Participation of Women in Science, December 29, 1958, folder H-8, Box 4, SDE; KLCU; Ford, “Engineers Must Ditch Double Standard,” C13; Bess Furman, “Flemming Backs Women in Science,” *New York Times*, December 30, 1958, 18.

As if to take up his charge, Betty Lou Raskin did precisely that in her charismatic evening address, “American Women: Unclaimed Treasures of Science.” The thirty-four year old Raskin, described by the press as blue-eyed and petite, headed Plastics Research and Development at the Johns Hopkins University Radiation Laboratory. A Goucher College chemistry major and a Johns Hopkins M.A., Raskin had begun her scientific career in the midst of World War II and regarded “manpower” shortages as a powerful tool for opening doors to women. She now pointed out to her audience the current waste of female talent in the United States, recalling a recent conference of 2,000 plastics engineers at which she was the only woman. “If a Russian meeting of that kind were held,” Raskin noted, “more than 600 women would be present.” “Thousands more female engineers are graduated in one year in the U.S.S.R. than we have graduated in our entire history!”¹⁷

With surprising boldness and disarming wit, Raskin issued a scathing indictment of the cultural barriers to American women’s scientific success. “For generations,” she argued, women “have been brought up on the theory that the scientific world is for men only. They think it abnormal for a woman to be a geophysicist or, heaven forbid, a chemical engineer.” Even when not explicitly told this information, girls and women learned it in other ways. “Just look at almost any electronics kit,” Raskin noted. “You’ll see a picture of a boy and his father on the cover.” Alongside this practice of reserving the most intellectually stimulating

¹⁷ “Betty Lou Raskin, “American Women: Unclaimed Treasures of Science,” paper presented at the American Association for the Advancement of Science Annual Meeting, Washington D.C., December 1958, reprinted in *Goucher College Bulletin*, 25, no. 4 (January 1959): no page numbers given, folder EC83, carton 12, CEW, Schlesinger. “U.S. Wasting Female Brains, Scientist Says,” *Los Angeles Times*, December 30, 1958, 3; Ford, “Engineers Must Ditch Double Standard,” C13. Raskin also gave the same speech in Chicago several months earlier. See Nicholas Shuman, “Girls Are Urged to Enter Science,” *Chicago Daily News*, September 10, 1958, 45, clipping, Series 12, SWEC.

toys for boys, she continued, “[t]he media, aided and abetted by Madison Avenue, have made the mink coat, not the lab coat, our symbol of success. They’re praised beauty, not brains. They’ve emphasized leisure time, not hard work and originality. As a result, today’s schoolgirl thinks it far more exciting to serve tea on an airplane than to foam a new light-weight plastic in the laboratory.”¹⁸

The general climate of anti-intellectualism only exacerbated this problem, as did the public’s misgivings about scientists themselves. While admitting the importance of modern science to the national economy and security, forty-one percent of Americans polled by the Rockefeller Foundation in 1958 considered scientists to be “odd and peculiar people.” Yet most Americans had never even met a scientist, as Raskin found out after conducting another study of junior high school students. *Life* magazine confirmed her findings when it reported that only 10 percent of Americans could even *name* two living scientists. “It’s time for America to know its scientists as well as it knows its stars of the stage, screen, sports and society,” Raskin argued. Agreeing with comedian Bob Hope that “N.B.C. stands for Nothing But Cowboys,” she lamented the paucity of intellectual programming on T.V and proposed a nation-wide “Meet the Scientist” campaign to illustrate that “women who wear lab coats are normal, happy people.” “If there were half as much public information about the more human phases of science and people in them,” Raskin argued, “I think that we would have little difficulty in disproving the myths and attracting the cream of the crop of our scientifically-talented young women into technical careers.”¹⁹

¹⁸ Raskin, “American Women: Unclaimed Treasures of Science,” no pages numbers given.

¹⁹ Raskin, “American Women: Unclaimed Treasures of Science,” no pages numbers given.

These themes received additional attention the following afternoon when Ethaline Cortelyou addressed the "Luncheon for All Women in Science," an annual event at the American Association for the Advancement of Science meetings sponsored by Sigma Delta Epsilon. Born in 1909, Cortelyou had earned her bachelor's degree in chemistry from Alfred College in New York in 1932. Her marriage to a male chemistry professor both helped and hurt her search for employment during the Great Depression when she ended up stringing together several positions in industry and teaching. After the war broke out, she found work as a technical editor on the Manhattan Project at the University of Chicago, where she assisted in the preparation of the classified table of isotopes.²⁰ Perhaps owing to her experiences during the Great Depression, when many female chemists embraced similar kinds of scientific "women's work" as alternatives to unemployment, Cortelyou continued in the field of technical writing and editing after the war had ended. (Although it was less feminized than other "hybrid" fields such as chemical librarianship, technical editing still claimed a high share of women, who made up 32.14 percent of the field in 1941 and 38.85 in 1955).²¹ Believing that women would encounter less resistance in these positions where "men have not become so firmly entrenched as to resent feminine competition," she advocated careers in technical editing for female chemistry majors and urged educators to do the same.²² But as the Sputnik panic set in, she quickly lost much of that depression-era

²⁰ Ruth H. Howes and Caroline L. Herzenberg, *Their Day in the Sun: Women of the Manhattan Project* (Philadelphia: Temple University Press, 1999), 76-77.

²¹ Rossiter, *Women Scientists in America*, vol. 2, 264.

²² Ethaline Cortelyou, "Counseling the Woman Chemistry Major," *Journal of Chemical Education* 32 (April 1955): 196, folder EC83, carton 12, CEW, Schlesinger.

mentality and, by 1958, was publicly criticizing science teachers and departments who followed her earlier advice.²³

One of Cortelyou's boldest critiques of scientific women's work can be seen in her June 1958 *Chemical Bulletin* article on "Utilizing Chemical Womanpower to Combat the Alleged Shortage of Chemists." While she did not oppose women's personal decisions to pursue these fairly feminized fields (at the time, she was working as a literary analyst), she condemned the practice of limiting women to those positions. She linked the automatic funneling of women into technical editing and other "science-related fields" to the broader problem of "wasting" female talent through both subtle discouragement and blatant discrimination. Other examples of this practice included refusing to hire women out of fear they would be "employment risks," paying them less than their male counterparts, and assigning female chemists and chemical engineers to mundane laboratory tasks. Cortelyou reminded her readers that "It does not require a bachelor's degree to "instrument sit"—to record instrument readings, to order chemicals and equipment, to wash apparatus, to follow "cookbook" directions for routine operations, or to proofread a report typed from a typed copy." "Certainly," she argued, "the prospects of 'serving as another pair of hands' for some man chemist is not sufficiently alluring to interest a girl in four years of hard work needed to obtain a bachelor's degree in chemistry."²⁴ Thus, the better "utilization" of female chemists would be just as important to meeting scientific shortages as the encouragement of new ones.

²³ Ethaline Cortelyou, "Utilizing Chemical Womanpower to Combat the Alleged Shortage of Chemists," *The Chemical Bulletin* (June 1958): 18-19, folder EC83, carton 12, CEW, Schlesinger.

²⁴ *Ibid.*

During the spring and summer of 1958, Ethaline Cortelyou elicited much attention as she repeatedly posited that “Brains Have No Sex.” Several major newspapers such as the *Washington Post* and *Chicago Sun-Times* carried feature articles on her and Sigma Delta Epsilon, of which she was an officer, lauded her “highly refreshing and provocative opinions of the role of women in science” as well as her “missionary zeal.” The women’s scientific fraternity agreed that Cortelyou would make the perfect speaker for its December 1958 “Luncheon for All Women in Science” and widely promoted her slated address.²⁵

Cortelyou did not disappoint. Her address on “The Status of the American Woman Scientists” proved insightful and inspiring even as it reiterated many of the same themes tackled the previous day by speakers such as Betty Lou Raskin. Like Raskin, Cortelyou highlighted Soviet women’s scientific participation, urged the greater encouragement of female science students in the United States, and criticized the potency of anti-intellectualism. “It is truly paradoxical,” Cortelyou remarked, “that the scientist who has made this Space Age possible is not a hero to the American public although the Space Age itself and its many advantages are exceedingly popular.” “To the American public whose mildest label for ‘the thinking man’ has been ‘egghead’...the thinking woman is even less desirable.” Although “it would only be wishful thinking to imagine that the popularity of the thinker will ever approach that of the athlete,” she admitted, “but anything we can do to

²⁵ “Brains Have No Sex,” *Sigma Delta Epsilon News* 22, no. 2. (November 1958), 1; Virginia Kachan, “Distaff Brains Are Equal,” *Washington Post*, May 26, 1958, B3.

promote the acceptance of brains as an asset to the nation will also improve the status of American professional women and, therefore, of women scientists.”²⁶

Convincing the American public that “brains have no sex” was, for Cortelyou, the first order of business. She urged her audience to help persuade colleges and universities “to do more than merely pay lip service to the possibility of women as a source of badly needed scientific and technical workers.” “Many departments,” Cortelyou charged, “actually try to make science courses into obstacle courses for the few girls hardy enough to attempt science majors.”²⁷ Industrial firms were no better, since few offered maternity leave or any other kind of support for working mothers. When women left the scientific workforce temporarily to have children, they found themselves at a distinct disadvantage when seeking reentrance since rapid technological advances rendered much of their scientific and technical knowledge obsolete. To enable women to keep up with recent developments in their fields, Cortelyou recommended making available part-time work, work that could be done in the home, and refresher courses. While not ideal (refresher courses, for example, were often expensive and part-time work was often poorly-paid), these initiatives would ease women’s return to full-time scientific work. They would also facilitate the labor force participation of older women and married women, which recent “manpower” studies had identified as critical to the national economy and the national defense.²⁸

²⁶ Ethaline Cortelyou, “The Status of the American Woman Scientists,” (address, Luncheon for All Women in Science, sponsored by Sigma Delta Epsilon at the American Association for the Advancement of Science meeting, Washington, D.C., December 30, 1958), mimeographed copy in stacks, Schlesinger.

²⁷ Ibid.

²⁸ Ibid.

Cortelyou ended her talk by stressing the importance of female solidarity. “Give other women a break when you can,” she argued. “If you are in a supervisory position, hire women and do what you can to eliminate inequalities of salary. If you have a woman supervisor, support her.” And when a job can be done on a part-time basis, “do you what you can to have it assigned to a capable woman who would welcome such a diversion from some of the humdrum routines of housework and raising a family.” In all, she concluded, “Be a woman and be glad of it. Lipsticks and slipsticks are entirely compatible, and a pretty hat does not mean that the head under it is empty.”²⁹

Cortelyou’s captivating talk nicely wrapped up the main themes and goals of the “Conference on the Participation of Women in Science,” a major outcome of which was the formation of the “National Council on the Participation of Women in Science.” Sigma Delta Epsilon was well-represented in the new organization and its president, Mary Louise Robbins, served as the council’s first chair. Within a few months, the council had secured two-hundred dollars in startup funds from the American Association for the Advancement of Science (with which Sigma Delta Epsilon was affiliated) and had submitted a grant proposal to the National Science Foundation and the National Institutes of Health for additional assistance. The requested \$7,300 promised to advance the council’s goals by supporting a center dedicated to expanding women’s scientific participation, improving attitudes toward female scientists, and ending discriminatory education and employment practices. Council members were also toying with the idea of sponsoring a White House conference on women in science when their grant proposal was rejected on unspecified “technical grounds.” The

²⁹Ibid.

seemingly baseless rejection must have felt like a slap in the face, given that one of the council's active members, Ernestine Thurman, actually worked in the grants division of National Institutes of Health and was most certainly familiar enough with her division's technical regulations to prepare a properly formatted proposal. This incident not only decimated the council's agenda, but also revealed the fragility of support for "scientific womanpower."³⁰

These fault lines revealed themselves a second time that spring when the *New York Times Magazine* published an essay by Betty Lou Raskin. Raskin's article, "Woman's Place Is in the Lab, Too," was based loosely on her conference address and reiterated many of the same themes, such as scientific shortages, wasted womanpower, and pernicious cultural influences. A revised conclusion touted current efforts to address these issues, such as the formation of the National Council on the Participation of Women in Science. But unlike the glowing response she had received from her largely female audience just a few months earlier, Raskin now encountered both skepticism and hostility from several male readers who rejected the very idea of a scientific shortage. It is significant that when men such as Arthur Flemming (whom Raskin even cited in her essay) made similar recommendations regarding Cold War "manpower" needs, they rarely encountered such opposition. And while educators, industrialists, and government officials certainly questioned the severity of the shortage situation, few denied it as vehemently as those men now responding to Raskin's remarks. Arthur Kahn of New York went so far as to say that even if there was a shortage of engineers

³⁰ Rossiter, *Women Scientists in America*, vol. 2, 348-349; "The Conferences on Encouraging Women to Enter Science," Box 5, SDE, KLCU; Betty Lankford McLaughlin, "American Council on Women in Science," November 9, 1959, Folder 2-3, Box 2, SWEC.

and scientists (which he doubted), “there is a much greater and more dangerous shortage...of women.” “Of females we have a plentitude,” Kahn conceded, “but a pitiful scarcity of women prepared and able to use the peculiarly feminine potential for creating, and disseminating grace, joy, warmth, beauty, and happiness.”³¹ Kahn’s remarks not only reinforced traditional gender roles, but also revealed the limits of public acceptance for “scientific womanpower.”

Disappointed but undaunted, members of the National Council on the Participation of Women in Science reorganized themselves into the American Council of Women in Science in June 1959. They quickly embarked on a new fund-raising campaign and secured contributions from a variety of individuals and organizations. Their council and their objectives each received additional publicity in August when *Reader’s Digest* reprinted Betty Lou Raskin’s *New York Times Magazine* article (despite, or perhaps because of, the strong reaction that it had elicited). That fall, the council’s new chair, Sigma Delta Epsilon secretary Betty Lankford McLaughlin, reported being pleased with the “considerable interest” expressed in the council, such as a proposal from a Washington D.C.-area civic organization to help administer a \$500 graduate scholarship. The scholarship, which was designed for a woman desiring “refresher courses” in order to resume a scientific career after temporarily retiring to raise a family, clearly combined the council’s interest in encouraging women’s scientific participation with broader “manpower” concerns.³²

³¹ Betty Lou Raskin, “Woman’s Place Is In the Lab, Too,” *New York Times Magazine*, April 19, 1959, 17, 19-20; Ph.D. Research Chemist (Male) of Wilmington, Delaware, letter to the editor, *New York Times Magazine*, May 3, 1959, 6; Arthur H. Kahn, letter to the editor, *New York Times Magazine*, May 3, 1959, 6.

³² Rossiter, *Women Scientists in America*, vol. 2, 349; McLaughlin, “American Council on Women in Science,” November 9, 1959, Folder 2-3, Box 2, SWEC.

The council's other major initiatives involved national conferences on women's scientific participation, such as the one from which it had sprung. In December 1959, the council co-sponsored with Sigma Delta Epsilon the "Second Conference on Encouraging Women to Enter Science," which was held in conjunction with the American Association for the Advancement of Science's annual meeting in Chicago. Chaired by Ethaline Cortelyou, the conference featured a keynote address by Alan T. Waterman, the director of the National Science Foundation, who discussed "Scientific Womanpower—A Neglected Resource." Much like Arthur Flemming, Alan Waterman was a government leader and potential ally who (publicly at least) regarded the "utilization" of women as critical to meeting overall "manpower" needs. In his address (which was most likely written by his female assistant, Lee Anna Embrey), Waterman offered much rhetorical support for encouraging women's scientific participation and warned that "as a nation, we cannot afford this serious waste of intellectual resources."³³ After identifying discriminatory hiring practices and discouraging cultural attitudes, he lamented that "women are being wasted in science because of an immature attitude on the part of society that it is unattractive for a woman's brain to be showing."³⁴ Although Waterman failed to provide any real solutions or concrete directives for change, he nevertheless delighted his audience with his seemingly strong support for their

³³ Alan T. Waterman, quoted in Ethaline Cortelyou, "Encouraging Women to Select and to Advance in Scientific Careers (X2)," *Science* 131 (1960): 548; "The Conferences on Encouraging Women to Enter Science," Box 5, SDE, KLCU; McLaughlin, "American Council on Women in Science," November 9, 1959, Folder 2-3, Box 2, SWEC; Mary Louise Robbins, ed. *A History of Sigma Delta Epsilon, 1921-1971* (S.L.: Graduate Women in Science, 1971), 18; Cortelyou to Waterman, October 5, 1959, Folder 19, Box 1, SDE, KLCU; Rossiter, *Women Scientists in America*, vol. 2, 349-351.

³⁴ Alan T. Waterman, quoted in Ernestine B. Thurman, "Women in Science," paper presented at the National League for Nursing Convention, Cleveland, Ohio, April 14, 1961, Box 1, SDE, KLCU.

goals. He also provided them with new fodder: Ernestine Thurman, for example, would repeatedly cite Waterman's remarks in her own addresses on encouraging women's scientific talent.³⁵

Thurman would also chair the third and last "Conference on Encouraging Women to Enter Science" which, like its predecessor, was co-sponsored by Sigma Delta Epsilon and the American Council on Women in Science. Held in December 1960 in New York City, the event featured a keynote address by Margaret Mead as well as several panels and workshops on improving women's scientific participation. Although the conference generated much interest and enthusiasm—a testament to both the importance of the topic and hard work of its organizers—it would be the last time that Sigma Delta Epsilon and the American Council on Women in Science would collaborate. By the following year, the council had dropped out of sight.³⁶

The circumstances surrounding the council's disappearance are not known, although in August 1961, the new national president of Sigma Delta Epsilon, Delaphine G.R. Wyckoff, did inform Sigma Delta Epsilon secretary and former council chair Betty Lankford McLaughlin that, to her knowledge, Sigma Delta Epsilon had never officially sanctioned the council, nor the participation of Sigma Delta Epsilon officers and members in council activities. This information came as a surprise to both McLaughlin and Ernestine Thurman, who had not only been instrumental in the council's organization and administration, but who

³⁵ Cortelyou, "Encouraging Women to Select and to Advance in Scientific Careers (X2)," 548; Thurman, "Women in Science."

³⁶ "The Conferences on Encouraging Women to Enter Science," Box 5, SDE, KLCU; Robbins, *A History of Sigma Delta Epsilon*, 18; Raymond L. Taylor, "A Report of the Eighth New York Meeting," *Science* 133, no. 3451 (February 17, 1961): 476; Rossiter, *Women Scientists in America*, vol. 2, 350-351.

now responded that they had been advised differently by past Sigma Delta Epsilon officers. Ultimately, however, McLaughlin conceded that Sigma Delta Epsilon had “effectively conducted” such programs long before the council’s formation and that “these programs should be continued by the Fraternity.”³⁷

The American Council on Women in Science most likely folded, then, because its main supporters realized that they could just as easily pursue their objectives through the older and more established Sigma Delta Epsilon. The evident success of the fraternity’s own “Committee on Encouraging Women to Enter Science,” which had been created just one month before the council, would have reaffirmed this belief. Although Sigma Delta Epsilon members had helped to establish the council in the first place, they probably did so with the hope that a separate organization would attract new supporters. But when the council ended up drawing most of its members and officers from Sigma Delta Epsilon, both groups must have recognized the unnecessary duplication of their efforts.

Despite its short life span, the American Council on Women in Science remains significant because it reveals a growing impatience among female scientists to improve their lot. In the aftermath of the Soviet sputniks, women who were already involved in a women’s scientific society found it expedient to form a new organization that could capitalize on the ubiquitous calls for “womanpower.” The resistance that they faced in this endeavor is also significant, as it made visible some of the ambivalence surrounding the “utilization” of

³⁷ McLaughlin, Minutes of the National Council Meeting, August 28-31, 1961, Purdue University, Lafayette, Indiana, 2, Folder H-8, Box 4, SDE, KLCU.

female intellect. Thus, while the council's run was a brief one, it nevertheless reveals much about the opportunities and obstacles posed by "space age" science.³⁸

Sigma Delta Epsilon and the "Committee to Encourage Women in Science"

Like the American Council on Women in Science, Sigma Delta Epsilon's "Committee To Encourage Women to Enter Science" can be viewed a deliberate response to the Sputnik scare. Just two months after the first launching, Sigma Delta Epsilon president Mary Louise Robbins directed her organization's attention to new and alarming trends in women's scientific participation. A recent National Science Foundation report, as well as the current edition of *American Men of Science*, revealed a decline in the number of women entering scientific fields, especially at the graduate level. Given the international climate as well as Sigma Delta Epsilon's own interest in these issues, Robbins inquired, "should not our organization be thinking about this and do something about it?"³⁹ Sigma Delta Epsilon members answered with a resounding "yes" and with this mandate, Robbins established a "Committee for Encouraging Women to Enter Science" in the fall of 1958.⁴⁰

To chair the committee, Robbins selected Meta Ellis of the Aerojet-General Corporation of Sacramento, California. Ellis struck Robbins as a perfect fit for the position, as she was the one who had suggested establishing such a committee in the first place. Ellis also impressed Robbins with her enthusiasm for encouraging women's scientific

³⁸Rossiter, *Women Scientists in America*, vol. 2, 350-351.

³⁹ Helen Borton Parker, "Minutes of the Grand Chapter Meeting," December 27, 1957, Indianapolis, IN, 3, Folder 22, Box 1, SDE, KLCU.

⁴⁰ Robbins, "The President's Column," *Sigma Delta Epsilon News* 22, no. 2 (November 1958): 2.

participation, an enthusiasm that was obviously influenced by her own experiences in the aerospace industry. As an employee of what *Time* magazine dubbed “the General Motors of U.S. Rocketry,” Ellis clearly understood the significance of the Soviet feat and sought to capitalize on the recent upsurge of interest in “scientific womanpower.” While Ellis realized that Sigma Delta Epsilon had always been concerned with women in science, she also believed that recent space race developments made evident that “today, a special, urgent need is felt in this direction.” She called on the organization to redouble its efforts by supporting the new committee, adding that “It is both favorable and timely that Sigma Delta Epsilon should choose to act now.”⁴¹

The “Committee to Encourage Women to Enter Science” was deeply rooted in Cold War anxieties, which Meta Ellis invoked at every turn. She eagerly revealed to other Sigma Delta Epsilon members her committee’s intent “to spotlight our nation’s need for increased scientific manpower resources and to suggest the wider use of scientific womanpower,” as Arthur Flemming had suggested.⁴² Her primary interest, however, lay in improving women’s scientific participation. Certainly, Ellis explained, “We hope to influence public opinion by persuading students, parents, school administrators, and employers alike that women trained in science are necessary to alleviate our nation’s personnel shortages.” But the committee also sought “to impress the public with the variety of interesting careers there are for women in the science” and “to lower the resistance of school administrators and employers.”⁴³

⁴¹ Ibid.; Meta Ellis, “SDE Committee,” *Sigma Delta Epsilon News* 23, no. 1 (May 1959): 1, 2.

⁴² Ellis, “SDE Committee,” 2.

⁴³ Ibid.

Although Sigma Delta Epsilon was a graduate organization, committee members realized that many women were steered away from scientific careers long before they reached that stage. As a result, much of the committee's early work targeted women in the secondary schools. By the spring of 1959, the committee had formulated a broad agenda which included providing young women with information about careers in science and encouraging women's scientific participation through "science fairs" and "career days." While some of the committee's activities were national in scope, such as its "clearinghouse" function for gathering and disseminating news stories about Sigma Delta Epsilon members, most of its work was conducted by chapters at the local level.⁴⁴ Much like the Society of Women Engineers' "Professional Guidance and Education Committee," Sigma Delta Epsilon's "Committee to Encourage Women to Enter Science" relied heavily on individual members for what it considered its most important job: providing personal encouragement to young women.

Sigma Delta Epsilon's committee regarded science fairs as "an excellent opportunity to encourage girls of aptitude to pursue scientific careers" and urged local chapters to become involved in any way they could. Meta Ellis suggested that members write congratulatory letters to female winners and send copies to their science teachers and high school principals. She also recommended that they invite the girls to a Sigma Delta Epsilon meeting or some other gathering in their honor. These activities, Ellis believed, would provide female students

⁴⁴ Ibid.; 2; Ellis, quoted in Helen Borton Parker, "Minutes of the Grand Chapter Meeting," Cosmos Club, Washington, D.C. December 29, 1958, 1, Folder 21, Box 1, SDE, KLCU; Ellis to All Chapters of Sigma Delta Epsilon, May 1959, Folder 2, Box 2, Sigma Delta Epsilon Alpha Chapter records (hereafter cited as SDE-Alpha), KLCU.

with recognition of their accomplishments as well as an opportunity to meet “successful women in such a variety of scientific disciplines.”⁴⁵

Individual chapters eagerly embraced Ellis’ recommendations. In 1958, Penn State’s Nu chapter helped high school girls set up their exhibits and awarded twenty-five dollars to the girl with the best project. The chapter also feted female science fair participants at its next meeting.⁴⁶ Meanwhile, the University of Illinois’ Gamma chapter began holding an annual breakfast to honor girls who won awards at the Westinghouse Science Talent Search. The University of Minnesota’s Xi chapter established an annual tea for blue-ribbon winners, which was followed by a tour of the university laboratories “to show these young women—and perhaps future scientists—what opportunities there are.”⁴⁷ The Xi chapter also participated in regional activities, such as the 1960 Junior Minnesota Academy of Science meeting in St. Cloud, where ninety-one award winning girls displayed their projects. After speaking with the female students to determine their specific interests, Xi representatives Agnes Hanson and Marie Berg matched them up with individual Sigma Delta Epsilon members “to sustain the girls’ scientific curiosity through correspondence.”⁴⁸ Other chapters participated in science fairs by sending members to judge exhibits and distribute guidance materials.⁴⁹

⁴⁵ Ellis to All Chapters of Sigma Delta Epsilon, May 1959, Folder 2, Box 2, SDE-Alpha, KLCU.

⁴⁶ Barbara Benson, “Supplemental History Nu Chapter,” June 10, 1967, Folder NU, Box 5, SDE, KLCU.

⁴⁷ Hazeltene S. Parmenter, “Short History of Gamma Chapter Sigma Delta Epsilon,” July 1968 and Almut Detmers, “Sigma Delta Epsilon—Xi Chapter,” December 1966, Box 5, SDE, KLCU.

⁴⁸ Committee on Encouraging Women in Science, “Encouraging Women in Science,” *Sigma Delta Epsilon News* 24, no. 2 (November 1960): 6.

⁴⁹ Sigma Delta Epsilon, welcome letter to new members, [1960], Folder 17, Box 1, SDE, KLCU.

Sigma Delta Epsilon members did not limit their activities to science fairs and competitions, however. In 1959 the University of Wisconsin's Beta chapter began its annual "High School Program" for girls in the Madison area. Selected by their science teachers, participants attended an evening "kick-off" event which included a Sigma Delta Epsilon meeting, a short lecture on scientific subject, and a "social hour" for mingling with female scientists. The next day, the girls toured the university laboratories, where they were exposed to various areas of research in biology, chemistry, physics, and mathematics. On two separate Saturdays, they "worked" in the laboratory of their choice under the supervision of a Sigma Delta Epsilon member. "In this way," the chapter reported, "the girls can get a better understanding of a research program, have the opportunity to use some of the equipment, and...help with some of the demonstrations." The chapter also helped to place many of its participants in summer laboratory jobs following high school graduation.⁵⁰ The "High School Program" was enthusiastically received by students, many of whom continued their scientific pursuits at the college and graduate level and eventually pursued careers in the field. By 1965, Beta chapter had even inducted at least one former participant as a full-fledged graduate member.⁵¹

Participation in "Career Days" was another popular activity for many chapters, whose members frequently addressed student assemblies and gave scientific demonstrations at local

⁵⁰ Committee on Encouraging Women in Science, "Encouraging Women in Science," *Sigma Delta Epsilon News* 24, no. 2 (November 1960): 6; Maryilyn Koering, "Sigma Delta Epsilon Beta Chapter," [n.d 1965?], Box 5, SDE, KLCU; Dorothy I. Fennell, "President's Report Sigma Delta Epsilon—Beta Chapter 1964-1965," July 1965, Folder 10, Box 1, SDE, KLCU.

⁵¹ Fennell, "President's Report Sigma Delta Epsilon—Beta Chapter 1964-1965", Maryilyn Koering, "Sigma Delta Epsilon Beta Chapter," [n.d 1965?], Box 5, SDE, KLCU.

high schools. They also led laboratory tours and science-related field trips for interested students, often in collaboration with other educational and professional organizations. In 1959, Meta Ellis announced that the Northern California Section of the Instrument Society of America had solicited the participation of Sigma Delta Epsilon in its “Spend a Day in the Career of Your Choice” program for high school students. Ellis urged all local members to take part in the program and all far-away members to implement similar programs in their home towns.⁵²

Ellis also sought to extend Sigma Delta Epsilon’s influence and aims through “Inter-Society Councils,” which drew together educators, counselors, scientists, and teachers interested in improving science education. Although one of the oldest ones, the Mid-Hudson Science Advisory Council, had been established in 1955, these councils became increasingly popular after the Sputnik launchings and appeared in such far-flung places as New England, Washington D.C., southern California, and Hawaii. In 1960, Ellis helped to establish such a council in Sacramento, where representatives of thirteen professional societies agreed to form a central group “to stimulate scientific and technical education among students.”⁵³ The Sacramento council, as well as similar ones nationwide, provided additional avenues for Sigma Delta Epsilon to encourage female students through career days, science fairs, and individual counseling.

⁵² “SDE: One Look Backward and One to the Future,” [n.d. 1966?], Box 5, SDE, KLCU; Meta Ellis to all chapters, May 15, 1959, Folder 3, Box 2, SDE-Alpha, KLCU.

⁵³ William Irving, quoted in minutes, Inter-Society Educational Council, Sacramento, CA September 30, 1960, 2, Folder 3, Box 2, SDE-Alpha, KLCU; Meta Ellis and Eunice Bonow, annual report of Committee on Encouraging Women in Science, December 1960, Box 1, SDE, KLCU; Meta Ellis, “Excerpts from Our Responsibilities as Working Women,” *Sigma Delta Epsilon News* (December 1961): 9; Meta Ellis, Summary, Inter-Society Meeting, May 5, 1960 SDE Alpha, Box 2.

Although most of Sigma Delta Epsilon's vocational guidance activities targeted high school students, some did take place at the college level. Several chapters held "Research Days" for undergraduate women which, like the Wisconsin program for Madison-area girls, were designed to cultivate female students' scientific aspirations. In 1960, for example, members of Purdue University's Pi chapter led laboratory tours and equipment demonstrations for undergraduate chemistry majors "in an effort to stimulate an interest in graduate study and research."⁵⁴ Other chapters, such as the University of Missouri's Delta chapter, presented undergraduate research awards to college women. Each year, members recognized one outstanding college senior, who received a certificate, a cash prize, and the honor of having her name engraved on a permanent plaque in the library.⁵⁵

Taken together, these activities fulfilled several functions. First and foremost, they provided young women and girls with encouragement that went well beyond the broad proclamations espoused by various government and industry officials. While Sigma Delta Epsilon officials often invoked Cold War rhetoric and "manpower" statistics regarding the "waste" of female intellect, they agreed that much more needed to be done. In order to encourage women's scientific participation in any meaningful way, Sigma Delta Epsilon President Delaphine Wyckoff realized, "We need to do work on the grass roots level with high school girls, and even college undergraduates, to show them what scientific work is

⁵⁴ Sigma Delta Epsilon, welcome letter to new members, [1960], Folder 17, Box 1, SDE, KLCU; Committee on Encouraging Women in Science, "Encouraging Women in Science," *Sigma Delta Epsilon News* 24, no. 2 (November 1960): 6.

⁵⁵Ellis and Bonow, annual report of Committee on Encouraging Women in Science," December 1960, Box 1, SDE, KLCU.

like.”⁵⁶ At the same time, these activities afforded Sigma Delta Epsilon members the opportunity to share with younger women their own passion for scientific subjects. “As members of SDE,” Wyckoff explained, “we are enthusiastic about our life work in the sciences, its opportunities, and its challenges.” “The kinds of projects that some of our chapters are engaged in...can have a two-fold benefit. Besides showing girls what goes on in a science laboratory, our own members can have the exciting experience of presenting science as a stimulating quest for knowledge.”⁵⁷ Lastly, these activities enabled Sigma Delta Epsilon to expand its influence and generate new support for its goals. Insofar as they meshed with broader “manpower” concerns, these activities offered a shared solution to otherwise uninterested audiences and facilitated collaboration with unlikely allies.

Confronting the Fear of “Feminine Fallout”

Even as groups such as Sigma Delta Epsilon encouraged girls and young women to enter science, they gradually incorporated other activities to assist older female scientists who had temporarily “retired” to raise children or who struggled to combine domestic and scientific pursuits. In doing so, they aimed to combat what *Wall Street Journal* reporter Arthur Lack had reproachfully dubbed “feminine fallout,” or women’s tendency to abandon scientific training and careers after marriage. The Cold War reference made its lexiconic debut in a January 1958 front page story, “Science Talent Hunt Faces Stiff Obstacle: Feminine Fallout,” in which Lack panned current congressional proposals to fund science education. His objections were based not on the threat of federal control but rather on the

⁵⁶ Delaphine G.R. Wyckoff, “The President’s Column,” *Sigma Delta Epsilon News* 25, no. 2 (December 1961): 3.

⁵⁷ *Ibid.*

squandering of tax-payer dollars on female students. He noted with alarm that federal officials expected women to receive at least one third of the 10,000 math and science scholarships to be offered annually under the proposed aid-to-education plan. “Hence it’s inevitable,” he quipped, “that some Government money will go to train scientists who experiment only with different household detergents and mathematicians who confine their work to adding up grocery bills.”⁵⁸

To illustrate the severity of “feminine fallout,” Lack cited a recent AAUW survey of its fellows in which one-sixth of respondents reported being currently unemployed. Although the survey also revealed that most planned on returning to professional work as soon as family obligations let up, Lack nevertheless took these findings as proof positive that “the ladies weren’t making gainful use of their advanced training.”⁵⁹ He consulted several leading educators—ostensibly to validate his claim—but must have been disappointed when they argued that most professional women who take time out of the paid labor force to raise children returned once their domestic duties diminish. (Indeed, nearly every “manpower” study of college-educated women’s workforce participation corroborated this trend.)⁶⁰

Persisting in his skepticism, Lack turned his attention to women’s education patterns and intellectual abilities and noted with interest that “there’s apparently some foundation for the widespread masculine notion that ladies are deficient in mathematics,” such as women’s tendency to specialize in the humanities and to score lower on college entrance exams. The

⁵⁸ Arthur Lack, “Science Talent Hunt Faces Stiff Obstacle: ‘Feminine Fallout,’” *Wall Street Journal*, January 16, 1958, 1; Rossiter, *Women Scientists in America*, vol. 2, 61.

⁵⁹ Lack, “Science Talent Hunt Faces Stiff Obstacle,” 1.

⁶⁰ Lack, 1. See, in particular, National Manpower Council, *Womanpower*.

contributing cultural influences seemed to escape him, even though he did acknowledge that female students generally earned better grades, made up the majority of high school honor students, and were less likely than men to drop out of the college at which they originally enrolled. Yet instead of interrogating these discrepancies, Lack held fast to his belief that federal scholarships would be wasted on women. He even suggested that restricting the number of female recipients would be desirable, but suspected that doing so “would probably embroil the Government in a great controversy with the many ‘equal rights’ advocates among the ladies.”⁶¹

Predictably, Lack’s article caused quite a stir. Two weeks later, the *Wall Street Journal* published a letter to the editor from Susan Spaulding, inquiring “What Feminine Fallout?” Spaulding, an AAUW member and executive assistant to the president of New York University, sharply criticized Lack’s “confusing barrage of extraneous statements concerning housewives and professional work, obstacles to employment, comparative performance of boys and girls in mathematics and in general scholarship, and other matters.” She charged that his article “proves nothing as to the advisability of awarding scholarships to scientifically minded girls, but unfortunately contrives to give the impression that scholarships to such girls would represent a loss.”⁶² While Spaulding recognized that professional women often suspended their education or careers to raise children, she argued that “feminine fallout” was nowhere as insidious or insurmountable as Lack insisted.

⁶¹ Lack, “Science Talent Hunt Faces Stiff Obstacle,” 1; Rossiter, *Women Scientists in America*, vol. 2, 61.

⁶² Susan Spaulding, letter to the editor, *Wall Street Journal*, January 29, 1958, 8; Rossiter, *Women Scientists in America*, vol. 2, 62.

To substantiate her claim, Spaulding provided a healthy mix of anecdotal and statistical evidence. She first related the details of her recent visit to a women's college where she learned from the male physics department chair that even when his students married, they generally continued on with science in some way. Many, for example, married other scientists, continued subscribing to scientific journals, and returned to professional work as soon as circumstances allowed.⁶³ Spaulding also cited statistics from her own university's Institute of Mathematical Science which, she noted, had contracts for basic research with all branches of the Defense Department, the Atomic Energy Commission, and the National Science Foundation. The Institute's staff of 190 included twenty-three women, eleven of whom were married and seven of whom had children. One of the mothers was even on the faculty. Regardless of marriage or motherhood, Spaulding reasoned, "the trained scientific mind... finds it hard to stay away from the laboratory."⁶⁴

For Spaulding then, there was little reason to fear that fellowship money would be squandered on female students, as all available evidence indicated that most women scientists would, at some point, use their training. The bigger problem was that most fellowship programs failed to account for intermittency in women's education and employment and only awarded funds to full-time or traditional-aged students. As a result,

⁶³ Spaulding, letter to the editor, 8; Rossiter, *Women Scientists in America*, vol. 2, 62.

⁶⁴ Spaulding, letter to the editor, 8; Rossiter, *Women Scientists in America*, vol. 2, 62. For more on Kathleen Morawetz, the mother and faculty member, see Margaret A.M. Murray, *Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America* (Cambridge: MIT Press, 2000).

women who delayed their education or took time away from school in order to raise children were often ineligible.⁶⁵

Recognizing this dilemma, Sigma Delta Epsilon revamped its own fellowship program in 1959. The organization did away with its one large award in favor of several smaller “grants-in-aid” to assist in the continuation or completion of a specific project, with preference being given to women thirty-five years of age and older. “In this age group,” explained fellowship chair Ruth Dippell, “there is frequent demand...but little opportunity to secure [such stipends].” Thus, “while we should encourage women to enter science, we should also consider the means by which they might be encouraged to remain in science.”⁶⁶

Sigma Delta Epsilon widely advertised the new program using the mailing lists of the National Science Foundation, the American Chemical Society, selected professional journals, and its own chapters. It sent out more than 950 announcements, over half of which included duplicate announcements with “the request to post the latter in a conspicuous place.” Although the publicity costs ran significantly higher than in previous years, Sigma Delta Epsilon believed that “the new plan must be given maximum opportunity to ‘sink or swim.’” The gamble paid off and, within the first week, the organization received more requests for applications than it had in either of the last two years it awarded fellowships.⁶⁷

⁶⁵ For more on challenges faced by part-time female students, see Eisenmann, *Higher Education for Women in Postwar America*, 212-213.

⁶⁶ Ruth V. Dippell, “Annual Report of the Fellowship Awards Board,” December 1960, Folder 18, Box 1, SDE, KLCU.

⁶⁷ Ibid.

The new grants-in-aid program attracted not only a record number of submissions, but much general interest as well. Patricia Grinager, a Ph.D. candidate and mother of four, wrote to Ruth Dippell expressing her “appreciation for the apparent philosophy of Sigma Delta Epsilon grantors.” Even though Grinager was not applying since she was not in a science program, she nevertheless recognized the award’s broader significance. As she explained to Dippell, she had “inched her way up past the B.S. (1956, Columbia, Anthropology) and Master’s (1957, Columbia, Anthropology) toward the Doctorate (Social Foundations of Education, Stanford, hopefully 1962) against sometimes almost superhuman odds with top honors throughout.” “All along the line I have felt the built-in academic blindness toward women, who, like myself, ‘gave’ ten years getting a family started only to discover later that these years are not considered in most scholarship age limitation statements.”⁶⁸

Most of the women selected for the grants-in-aid shared much in common with Grinager. Judith Williams, for example, struggled to combine her graduate work at Texas Christian University with her family responsibilities. “Although she is married and has two young children,” the fellowship board reported, “she is anxious to continue her work.” Forty-three year old Joy Burcham Phillips, who had earned a Ph.D. from NYU in 1954, used her award to resume her study of pituitary function. The industrious JoAnne Mueller, who held a master’s degree from Indiana University, even set up a laboratory in the basement of her

⁶⁸ Patricia Grinager to Ruth V. Dippell, August 24, 1961, Folder 17, Box 1, SDE, KLCU. Grinager would later write a biography of Margaret Mead, who was one of her mentors. See Patricia Grinager, *Uncommon Lives: My Lifelong Friendship with Margaret Mead* (Lanham, MD: Rowman and Littlefield, 1999).

house. Working from home, which her award made possible, enabled Mueller to tend to her one-year old child while still fitting in forty hours of research a week.⁶⁹

Throughout the early 1960s, Sigma Delta Epsilon increasingly focused on combating “feminine fallout” by assisting women who wanted to combine scientific work with homemaking activities. In addition to the grants-in-aid program, which was administered on a national level, local chapters devised their own initiatives. The University of Wisconsin’s Beta chapter held a statewide conference on “Women in Science—Opportunities and Obstacles” which explored the promises and pitfalls of combining domestic and scientific endeavors. Targeting undergraduate and graduate women, the conference drew more than 100 participants and enjoyed “excellent newspaper coverage.” More importantly, it signaled a growing recognition that, in addition to encouraging scientific talent, Sigma Delta Epsilon needed to address the unique challenges faced by women once duly encouraged.⁷⁰

The enlarged mission of Sigma Delta Epsilon also breathed new life into nearly defunct chapters, such as the one at Cornell University. After reassessing and reformulating its goals, Cornell’s Alpha chapter was reactivated in 1964.⁷¹ Its officers explained that the decision to seek reinstatement stemmed from their recognition that “the need for women in science is greater than ever. The problems of adjustment to graduate study, the dual role of homemaking and a scientific career, competition for jobs—all these and others—remain.”

⁶⁹ Sigma Delta Epsilon Fellowship Board, Annual Report, November 27, 1964 and Joanne Mueller, info sheet [1964?] Folder 11, Box 1, SDE, KLCU.

⁷⁰ Margaret K. Seikel, “Report on ‘Women In Science—Opportunities and Obstacles,’” March 19, 1966, 1-5, Folder 8, Box 1, SDE, KLCU.

⁷¹ Natalie Miller, unknown article title, June 18, 1971, *Ithaca Journal* clipping in Box 4, SDE-Alpha, KLCU; Rossiter, *Women Scientists in America*, vol. 2, 351.

The Alpha chapter's proposed projects included not only encouraging Ithaca area high school girls to enter science, but also helping "married graduate students keep on with study for advanced degrees or hold a job in scientific work and still maintain a home and family." The chapter also proposed supporting or sponsoring a program that "would enable women to return to graduate study or scientific work after family duties diminish."⁷² Although it took several years to get off the ground, the Alpha chapter finally carried out this plan with its job roster for trained women in the area. After identifying more than 100 interested and available women, the "Dial a Lady Scientist" program placed many young mothers in part-time positions that could be combined with homemaking duties. The program proved such a success that the national Sigma Delta Epsilon tried to replicate it. But in its hands, the roster quickly became associated with advertising federal civil-service positions and by 1968, with finding female panelists for governmental advisory committees.⁷³

These initiatives reflected Sigma Delta Epsilon's obvious interest in fighting "feminine fallout," which the organization agreed was a serious threat to the "utilization" of scientific talent. But unlike Arthur Lack, who had argued that financial assistance would be wasted on female scientists, Sigma Delta Epsilon believed that more, not less, support was needed. Indeed, some members even questioned whether their organization was doing *enough* to assist wavering women. In a 1964 letter to national secretary Hazeltene Parmenter, Margaret Stone of Ithaca wrote that, after having given "a good deal of thought" to the

⁷² Acting Officers and Members of the Reactivation Committee to Member, [1964?] Reactivation Correspondence folder, Box 5, SDE-Alpha, KLCU.

⁷³ "Report of Interim Meeting," Sigma Delta Epsilon National Council and Board of Directors. Fort Washington, Pennsylvania July 29, 1967, Folder 6a, Box 1, SDE, KLCU; Rossiter, *Women Scientists in America*, vol. 2, 351.

purpose of the fraternity, “I believe we have not begun to realize its full potential.” Stone believed that even more assistance should be offered to women seeking to re-enter scientific careers and graduate study. Likewise, she felt that more could be done to help married graduate students continue with their work while raising children. “Should we sponsor nurseries?” Stone inquired. “Are we putting pressure on colleges to accept women who wish to resume studies or bring their knowledge up to date in courses designed for this need?” Given the recent spate of interest in “scientific womanpower,” she found it remarkable that “at last people have begun to think about these things as possibilities...as though we had just discovered that women have brains!”⁷⁴

These themes had also received attention at a 1959 conference on “Women and Education” sponsored by New York University. Among the attendees was Leona Baumgartner, who had earned her Ph.D. and M.D. at Yale during the 1930s. In addition to raising two children, Baumgartner held the distinction of being New York City’s first female Health Commissioner. Baumgartner, who was married to a chemical engineer, was well aware of the challenges faced by women juggling childcare responsibilities with scientific work. During the open discussion period, Baumgartner questioned whether a “full-time campus experience” is the only way to learn and advocated experimenting with less-traditional arrangements. “If we need to have dormitories for married women students,” she argued, “let’s have them.” “If we have to allow women students to come to college at thirty”

⁷⁴ Margaret Stone to Hazelteene S. Parmenter, October 1, 1964, Box 5, SDE-Alpha, KLCU.

or “we have to have them come part-time, let’s have them come.” This kind of flexibility, Baumgartner argued, was critical to educating and retaining more female scientists.⁷⁵

Baumgartner’s remarks provoked further discussion of “feminine fallout” among the panelists and audience members, including crystallographer Elizabeth Wood of Bell Labs, who had addressed the audience earlier that day on “The Encouragement of Scientific Talent.” (Wood had also addressed the first “Conference on the Participation of Women in Science,” held four months earlier). Wood agreed with Baumgartner’s remarks, adding that they indicated how “we are creating a pressure situation that is going to come to a head.” Wood predicted that in the coming decades, there would be “more and more distress because of the conflict of our society, which on the one hand really disproves of a woman...being in a profession, and on the other hand says, ‘We need more professional trained people. Why aren’t we training more women?’” Even as she worked to encourage women’s scientific participation, Wood realized full well that, in the end, “those two things are going to come together with a bang.”⁷⁶

Mary Ingraham Bunting and the “Climate of Unexpectation”

These dilemmas and contradictions were also recognized by Mary “Polly” Ingraham Bunting, a microbiologist turned women’s college administrator. Born in Brooklyn, New York in 1910, Bunting and her three siblings grew up in a family that placed a premium on education and activism. Her father, Henry Ingraham, was a successful Wall Street attorney

⁷⁵ Leona Baumgartner, cited in William S. Willis, ed., “Women and Education: A Mutual Responsibility,” April 29, 1959, 50-51, folder EC35, Box 10, CEW, Schlesinger.

⁷⁶ Elizabeth Wood, cited in William S. Willis, ed., “Women and Education: A Mutual Responsibility,” April 29, 1959, 52-53, folder EC35, Box 10, CEW, Schlesinger.

with a penchant for writing, drawing, gardening, and fishing. For many years, he served as a trustee of Wesleyan University, where he had earned his bachelor's degree in 1900 before picking up his law degree from New York Law School two years later. Bunting's mother, Mary Shotwell Ingraham, was a Vassar College graduate and untiring activist. Even as she ran two households and raised four children, she threw herself into various social organizations, such as the YWCA. She first became involved with the Brooklyn branch in 1908, following her college graduation and marriage to Henry. She served as its president from 1922 until 1939, when she was elected president of the national board. For more than six years, she presided over the national YWCA and was a driving force in its decision to adopt racial integration in the 1940s.⁷⁷

Polly developed an early interest in science and the natural world. As a child, she spent her summers at her family's country house in Northport, Long Island, where she rode horses, watched birds, and collected plant specimens. Back in Brooklyn, she attended the Packer Collegiate Institute, a private, all-girls school with a rigorous science curriculum requiring much laboratory work. Her experiences there cemented her interest in the physical sciences, which she continued to study at her mother's alma mater, Vassar College. Vassar proved an ideal fit for Polly, as its scientific course offerings rivaled those of the best men's

⁷⁷ "Biographical Brief: Mary I. Bunting, President of Radcliffe College," Folder 11, Box 1, series 4, RGII, Office of the President, Mary Ingraham Bunting, Radcliffe College Archives (hereafter cited as MIB-RCA), Schlesinger; "Henry Ingraham, Lawyer, Is Dead," *New York Times*, September 20, 1962, 34; "University Planner, Mary Shotwell Ingraham," *New York Times*, December 14, 1960, 49; Peter Hihss, "Mary S. Ingraham is Dead at 94," *New York Times*, April 20, 1981, D10; Elaine Yaffe, *Mary Ingraham Bunting: Her Two Lives* (Savannah: Frederic C. Beil, 2005), 8-12; Susan Lynn, *Progressive Women in Conservative Times* (New Brunswick: Rutgers University Press, 1992), 48-49, 55; Mary Ingraham Bunting, "Oral Memoir," interview by Jeannette Bailey Cheek, September-October 1978, transcript, 3-5, Schlesinger. Polly Bunting later remarked that while her mother "[talked] all the time about the importance of integration...it was all at arm's length." "I was not comfortable with the fact that Mother could work so hard for the cause of integration and never invite any blacks in the house." See Yaffe, *Mary Ingraham Bunting*, 12.

colleges. She sampled a variety of subjects and decided to major in physics, which she regarded as fundamental to any line of scientific work. It was not until her junior year, however, that she encountered bacteriology and realized that she had found her calling. The study of microorganisms fascinated her and she “knew very quickly that that was it.”⁷⁸

After graduating from Vassar in 1931, Polly headed to the University of Wisconsin and earned her Ph.D. in agricultural bacteriology in 1934. There, she met her future husband, Henry Bunting, a medical student whose father had taught their pathology class. While Henry finished his medical degree at Harvard and an internship at Johns Hopkins, Polly stayed on at Wisconsin as a research assistant before becoming an instructor at Bennington College in Vermont. Because the terms of Henry’s internship forbade him from marrying, the couple delayed their wedding until 1937, at which point Polly joined her husband in Baltimore and taught at Goucher College. After a year, they moved to Connecticut when Henry joined the faculty at Yale Medical School. The chair of Yale’s bacteriology department arranged a research assistantship for Polly, which gave her free reign of the laboratory for her own experiments. In addition, she enjoyed the privilege of using the university libraries, auditing courses, and sharing her ideas with other scholars. Although the job itself paid only \$600 a year (which was subtracted from her husband’s salary once the university learned that she was working), it conferred on her “legitimate status” and a way to integrate herself into the Yale bacteriology department. For Polly, these perquisites more than made up for the job’s low pay and prestige and she delighted in the rather unusual opportunity to resume her own research. She realized full well that her arrangement provided

⁷⁸Bunting, interview by Cheek, 17-20; Yaffe, *Mary Ingraham Bunting*, 14-21, 30-33.

what most scholars needed and what so few (especially women) had, namely time, freedom, and support. Her experience at Yale would also greatly influence her later thinking about professional women's intellectual development.⁷⁹

Polly Bunting continued at Yale until her first child was born in the fall of 1940. She had three more children over the next seven years and spent most of that time at home with them. Meanwhile, she kept active in various community affairs, such as the school board. She returned to part-time teaching and research in 1946, first at Wellesley (while Henry spent a year at Harvard and M.I.T.) and later back at Yale. But life as she knew it took an unexpected turn when her husband died suddenly from a brain tumor in 1954. Left to support four children, Bunting stayed on a Yale for another year while she looked for full-time work. The chair of the microbiology department tried to cobble together a position for her there, but with little luck. Although she had given lectures, conducted research, and published papers, Yale was unwilling to appoint her to the faculty. She later reflected that she had mixed feelings about such a situation anyway and would have been reluctant to accept a "sympathy" position. But the fact remained that she needed to find some way of sustaining herself and her family.⁸⁰

When Bunting received an invitation to become the next dean of Douglass College—the women's college at Rutgers University—she was both pleased and surprised. As a widow, she wanted very much to maintain her independence, and this position would allow

⁷⁹ Karen W. Arenson, "Mary Bunting-Smith, Ex-President of Radcliffe, Dies at 87," *New York Times*, January 23, 1998. D20; Bunting, interview by Cheek, 31-34; Eisenmann, *Higher Education for Women in Postwar America*, 179-80; Yaffe, *Mary Ingraham Bunting*, 64.

⁸⁰ Arenson, "Mary Bunting-Smith," D20; Bunting, interview by Cheek, 35, 40, 50; Yaffe, *Mary Ingraham Bunting*, 101-107.

her to do just that. But it would also require that she give up her scientific research and embark on a new career. She had never before considered academic administration, nor did she have any experience with it. While she viewed herself an unlikely candidate, she later learned that it was her friend and former Bennington College colleague, Barbara Jones, who had recommended her for the job. Jones, who was married to the president of Rutgers University, had paid Bunting a visit in the fall of 1954 under the pretense of being in the area. “It was years before I realized that she had come to see what shape I was in,” Bunting later reflected, “and would I be a good person to put on the list at Douglass College.”⁸¹ Although Bunting had no idea that Douglass was looking for a dean, her interest in educational issues evidently impressed Jones, whose husband passed along Bunting’s name to the search committee. Several months later, Bunting met formally with the Douglass trustees and toured the campus. When the offer arrived shortly thereafter, the job—and the financial stability it promised—seemed very attractive, even though it would involve another major life change. After much deliberation, Bunting accepted the position and, in March 1955, was formally named the third dean of Douglass College.⁸²

News of Bunting’s appointment revealed much fascination with her status as a widowed mother of four. Publicity photos routinely featured the new dean surrounded by her children while headlines drew attention to her multiple roles. One paper boiled down her credentials to “Yale lecturer” and “mother.” Another one announced “New [Douglass] Dean Able to Combine Raising Family and Career.” And Rutgers University President Lewis

⁸¹ Bunting, quoted in Yaffe, *Mary Ingraham Bunting*, 106; Bunting, interview by Cheek, 49-50.

⁸² Yaffe, *Mary Ingraham Bunting*, 106-111.

Webster Jones lauded Bunting as “one of the rather rare individuals who have successfully combined a distinguished career in research and scholarship with the responsibilities of her family.”⁸³ Bunting’s ability to juggle home and professional life roused her students’ interest as well, especially after she and her family moved into the stately dean’s residence nestled in the heart of campus. The sight of children piling out of her tan-and-cream station wagon parked in front of the red brick mansion enthralled onlookers. So too did glimpses of the new dean on her morning walks, usually with at least one child and one dog in tow. Seniors attending her Friday night buffets had the opportunity to dine with Bunting and her family, as did other students who occasionally dropped by. Without setting out to be, Bunting quickly became a highly visible example of what her students could achieve. As the class of 1959 wrote in its yearbook dedication to her, “Mother, scientist, and educator; she may well be our pattern.”⁸⁴

This kind of attention was new to Bunting, as was the “deaning business” more generally. Indeed, the first faculty meeting over which she presided at Douglass was the first faculty meeting she had ever attended.⁸⁵ But Bunting proved to be a quick study and she set about her job in the way that she knew best: as a scientist. She stated early on that she would make no pronouncements until she had a chance to “look and learn” and she spent the

⁸³ Lewis Webster Jones quoted in Kimberly Dolphin Wheaton, “Challenging the ‘Climate of Unexpectation:’ Mary Ingraham Bunting and American Women’s Higher Education in the 1950s and 1960s” (Ed.D. dissertation, Harvard University, 2001), 22.

⁸⁴ Yaffe, *Mary Ingraham Bunting*, 115, 118, 120-121, 137; photo number 15; Class of 1959 inscription quoted in Yaffe, *Mary Ingraham Bunting*, 137.

⁸⁵ Rutgers historian Richard McCormick referred to Bunting as “a neophyte at the deaning business,” quoted in Yaffe, *Mary Ingraham Bunting*, 122.

summer of 1955 actively collecting information about the college.⁸⁶ For months, she pored over reports, consulted with her predecessor, and met with trustees, faculty, students, and alumnae. By the time the academic year opened in the fall, she had already “investigated every nook and cranny of the campus,” as the alumnae magazine reported.⁸⁷ In the little brown notebooks where she used to record bird sightings and beehive conditions, Bunting now dashed off thoughts about education or copied interesting passages from books. She relied on these observations to put forward ideas or “hypotheses” and launch programs that she labeled “experiments.” Her empirical approach to the deanship of Douglass College not only lent her credibility in the space age, but also eased her transition from scientist to administrator. Yet she never saw these two roles as entirely separate. In one of her first speeches as dean, she told the college assembly that the “supposed choice” between research and administration “is not between activities but between problems.” “And the problems of higher education today seem to me at least as absorbingly interesting and challenging as the love-life of bacteria.”⁸⁸

It was the subject of education in general, rather than women’s education in particular, that first captured Bunting’s imagination. Necessity, after all, had landed her at Douglass and she viewed her position in terms of self-support and service to the state. She came to the deanship with no real interest in “women’s issues,” although she did

⁸⁶ Wheaton, “Challenging the ‘Climate of Unexpectedness,’” 23; Bunting quoted in Wheaton, “Challenging the ‘Climate of Unexpectedness,’” 23.

⁸⁷ “New Dean for Douglass,” *Douglass Alumnae Bulletin* (Fall 1955): 16-17; Yaffe, *Mary Ingraham Bunting* 113.

⁸⁸ Yaffe, *Mary Ingraham Bunting*, 122-123; Wheaton, “Challenging the ‘Climate of Unexpectedness,’” 23-24; Bunting quoted in Wheaton, “Challenging the ‘Climate of Unexpectedness,’” 23.

acknowledge early on that “anyone taking a job of this sort must obviously and necessarily believe as I do in the essential importance of higher education for young women.”⁸⁹ But women’s organization’s made her uncomfortable and she shied away from such groups as the National Association of Deans of Women and the AAUW. When she finally ventured onto the national scene in 1956, it was to assist the American Council on Education set up its Office of Statistical Information and Research. Appointed by ACE President (and metallurgist) Arthur S. Adams, Bunting served for two years on the oversight committee, which collected higher education data and established policies for the new office. Adams, whose interest in women’s education was well known, urged the committee to break down its statistics by sex, which few organizations did at the time. This assignment proved “enlightening” for Bunting, who along with the rest of the committee, meticulously documented and evaluated “the involvement of women in all the different levels and fields of learning.”⁹⁰ Although she still resisted aligning herself with “women’s issues,” she became increasingly interested in quantifying them through extensive data collection and rigorous analysis.⁹¹

Bunting’s committee experience is significant because it prompted her to view the study of women’s education as a legitimate area of academic inquiry. At the same time, it introduced her to influential educators, many of whom came to know Bunting as an astute and articulate colleague. These two developments help to explain why she was approached

⁸⁹ Bunting, quoted in Wheaton, “Challenging the ‘Climate of Unexpectation,’” 18.

⁹⁰ Bunting, interview by Cheek, 64.

⁹¹ Wheaton, “Challenging the ‘Climate of Unexpectation,’” 76.

(and why she agreed) to participate in the American Council on Education's October 1957 invitational on "The Present Status and Prospective Trends of Research on the Education of Women," held in Rye, New York. Chaired by Bryn Mawr College President Katharine McBride, the "Rye Conference," as it became known, drew together deans of women, college presidents, and other individuals interested in women's education. It also represented the first time that Bunting took part in such a narrowly focused event, even though she continued to express discomfort with targeting female students.⁹²

Despite her own misgivings, Bunting was establishing a reputation for herself as an authority in the field of women's education. She participated actively in the discussions, and was both deferred to and cited by other conference participants. As one of the twelve invited speakers, she joined the ranks of such luminaries as Anna Rose Hawkes, AAUW president; Nevitt Sanford, coordinator of the Vassar study on high-achieving young women; and Kate Hevner Mueller, author of the 1954 sensation, *Educating Women for a Changing World*. In her own address, which drew on her observations at Douglass as well as her work on the statistical information committee, Bunting identified several areas in the field of women's higher education that she believed warranted further attention (such as determining motivation and sustaining intellectual momentum). She also pointed to possibilities for continuing education after college and faulted the current educational structure for being nearly impossible for women to pursue education and family life at the same time. Although

⁹² Ibid., 76-80.

she did not advocate for any clear cut solutions, the questions that she raised at Rye would influence her later initiatives in the field of women's higher education.⁹³

The Rye conference brought Bunting into the inner circle of women's education leaders. It also precipitated her involvement in the American Council on Education's Commission on the Education of Women, which had carried out most of the preparations for the fall gathering. In 1958, she joined the commission at the urging of council president Arthur Adams. But enlisting her was no easy task, as Adams recalled a few years later in a speech in honoring Bunting. Adams remembered that "she questioned me closely as to whether or not this was a group which would make special pleas for women as women in a sort of neo-feminist fashion."⁹⁴ Bunting agreed to participate only after Adams had satisfactorily convinced her of the group's more moderate tone.

The Commission on the Education of Women, which had been established in 1953, served primarily as a national research agency and clearinghouse for information about women's education and educated women. It relied heavily on contemporary "manpower" studies regarding the workforce potential of older women and married women workers as it began investigating women's work and education patterns. That the absolute number of women entering colleges and universities increased steadily throughout the 1950s seemed encouraging. But women's failure to pursue and complete higher degrees in the same percentages as men led the commission to wonder whether women were reaching their full

⁹³ Ibid., 78-80.

⁹⁴ Arthur S. Adams, Address on the occasion of the Inauguration of Mary I. Bunting, Radcliffe College, May 19, 1960, Folder 11, Box 1, MIB-RCA, Schlesinger; Wheaton, "Challenging the 'Climate of Unexpectation,'" 80-81.

potential. The commission suspected that they were not. Instead of simply faulting American women for some vague lack of motivation or determination, however, the commission investigated the widespread social attitudes and practices contributing to this problem.

The first major outcome of these explorations was the commission's 1955 publication, *How Fare American Women?*, which identified a discrepancy between women's education and societal expectations. In spite of (or perhaps because of) the Cold War demand for female talent, women's escalating enrollment was accompanied by a sense of uncertainty about the purpose of their schooling, resulting in what the commission termed "an unrest about American women."⁹⁵ "Apparently," the commission noted in its 1955 report, "we have not yet decided in this country whether women in their functions are to become first-class or second-class human beings. Is it any wonder then, that the education of women, wavering between the primary and secondary roles and some vague ideas of compromise, presents a confused and confusing picture?"⁹⁶

By the time that Polly Bunting joined the commission in 1958, she had already encountered on her own much evidence to corroborate these phenomena (and to offset her initial reluctance). She distinguished herself with her keen observations and active participation and, within a year, had been named chair. Bunting's involvement with this organization afforded her an additional avenue for investigating women's intellectual motivation and the "utilization" of female talent. It also focused her attention on

⁹⁵ Althea Hottel, *How Fare American Women?* (Washington D.C.: American Council on Education, 1955), 1-2.

For a fuller treatment of the Commission on the Education of Women, see chapter 3, Eisenmann, *Higher Education for Women in Postwar America*.

⁹⁶ Hottel, *How Fare American Women?*, 14-15.

understanding women's educational trajectories, how they differed from those of men, and what specific initiatives such as continuing education and part-time study might help sustain their intellectual momentum. Finally, it solidified her reputation as a leader in the field of women's education.

Bunting's membership on the Commission on the Education of Women coincided with another national appointment that would prove even more influential in her own intellectual development. In December 1957, not long after the second Soviet Sputnik, Bunting received an invitation to serve on the National Science Foundation's Divisional Committee for Scientific Personnel and Education. As the federal government geared up to allocate millions of dollars for expanding science and engineering education, the nine-member divisional committee found itself responsible for devising policies to ensure the maximum production of highly trained scientists, engineers, science teachers, and scientific workers. It carried out this task through various means, such as establishing summer programs for high school students, expanding the foundation's pre-existing fellowship offerings, and compiling data on the country's "scientific manpower" supply.⁹⁷

Bunting, who gravitated toward this kind of work, read over the available "manpower" reports with much interest. In doing so, she came across a study done for the President's Committee on the Development of Scientists and Engineers by Donald Bridgman, who had broken his data down by gender. What Bridgman's study revealed was

⁹⁷ Alan T. Waterman to Bunting, December 24, 1957, Folder NSF 1957-1958, Box 27, Douglass College Records of the Dean (hereafter cited as DCRD), Special Collections and University Archives, Rutgers University Library (hereafter cited as RUL); Bunting, interview by Cheek, 65; Yaffe, *Mary Ingraham Bunting*, 146-147; Wheaton, "Challenging the 'Climate of Unexpectation,'" 87-89.

that, in the top ten percent of high school graduates, women made up at least ninety-percent of those not continuing to college.⁹⁸ Bunting remembers being surprised that this number was so high. But she remembers being even more surprised that her colleagues appeared unfazed. According to Bunting, “nobody on the Advisory Committee or the National Science Foundation staff proposed to do anything about this loss of talent. Nobody seemed to think it important.” “They even seemed to wish to conceal the facts,” she added, “as if they didn’t want the country to know that almost all the bright males were continuing beyond high school.”⁹⁹ Bunting was too baffled by this incident to respond right away. Instead, she mulled it over, replaying it in her mind. “The truth,” she finally realized, “is that nobody values what women can do in the sciences, and therefore it doesn’t seem of any importance in terms of scientific manpower if they don’t go beyond high school.” “If American knew that all the bright boys were going to college, no one would think there was a problem in the schools,” she explained. But the same did not hold true for smart women, who “are not expected to do anything important later.”¹⁰⁰

Bunting relied on her own observations and conversations to make sense of this “waste” of female talent. Gradually, she began to formulate her theory about what she would later call “the climate of unexpectation” surrounding women’s talents and training. Supported by a number of “hidden dissuaders,” this phenomenon served to discourage women from

⁹⁸ Rossiter, *Women Scientists in America*, vol. 2, 60-61.

⁹⁹ Bunting, “From Serratia to Women’s Lib and a Bit Beyond,” New Brunswick Lecture given at a meeting of the American Society for Microbiology, Minneapolis, Minnesota, May 5, 1971, 4, Folder 735, Box 46, MIB-RCA, Schlesinger; Bunting, interview by Cheek, 67-68.

¹⁰⁰ Bunting, interview by Cheek, 68-69.

academic success and limit their educational opportunities. For example, the “climate of unexpectation” helped to account for “why education didn’t bother setting up part-time programs for married women, and why so few women bothered to go on in the sciences.”¹⁰¹ Although Bunting did not publicly use this phrase for several more years, the idea was brewing and was undoubtedly clarified through her involvement with both the National Science Foundation and the Commission on the Education of Women.

Back at Douglass, Bunting combined these interests and ideas in what would become one of the first educational programs targeted at “mature” women. Her plan for retraining college-educated housewives in the field of mathematics reflected her overarching interest in encouraging women’s intellectual interests on schedules that accommodated their domestic duties. But in her conversations with the officials at the Ford Foundation, which agreed to sponsor the program in 1959, she emphasized instead their mutual interest in “utilizing” female brainpower.¹⁰²

The initial phase of the program involved distributing a questionnaire to college-educated women residing within commuting distance of Douglass. The survey posed three questions: 1) Have you had 2 or more years of college mathematics?; 2) Would you be interested in taking a refresher course?; and 3) Would you be interested in obtaining full or part-time work requiring mathematical training within the next 4 or 5 years? More than six

¹⁰¹ Bunting, interview by Cheek, 69; Bunting, “Commencement Address,” delivered at Woman’s Medical College,” Philadelphia, Pennsylvania, June 7, 1966, 2, Folder 504, Box 32, DCRD, RUL.

¹⁰² Carl W. Borgmann to Bunting, 1, March 5, 1959, Folder Mathematics Study Program, 1959-1962, Box 67, DCRD, RUL.

hundred women answered yes to all three questions. Moreover, when some of those six hundred failed to return the follow-up questionnaire, the project's staff contacted them to see what had happened. As Bunting explained, "A surprising number of them had just gone ahead and found courses or even jobs of the kind we had suggested." "They didn't need a job or some program, just a prod," she continued, "But they did need to be brought together some, to have a place where they could go to get encouragement, and a little guidance... They did need that sort of assistance very much."¹⁰³ The mathematics project illuminated the importance of guidance, schooling, and work that allowed for the realities of women's lives. Bunting's program not only "tap[ped] a large reservoir of skill," as it had initially promised to do, but it also tapped a desire among college-educated women for broader academic and occupational opportunities.¹⁰⁴

Bunting realized, moreover, that the undervaluation of women's intellectual contributions was not limited to the sciences. Rather, it ran rampant in all areas of education and society. After five years at Douglass, Bunting assumed the presidency of Radcliffe College, where she embarked on another ambitious endeavor—the creation of the Radcliffe Institute for Independent Study. She envisioned the Institute as a vehicle through which to counter the prevailing anti-intellectualism that restricted women's life choices, stunted their growth, and fostered "sheer frustration." The Institute would serve as a haven for what Bunting called "intellectually-displaced women" by providing them with stipends,

¹⁰³ Helen M. Marston, "Report to the Ford Foundation of the Mathematics Study Project at Douglass: A Survey of the Potential Professional Utilization of Mathematically Trained College Women," no date, 2, Folder Mathematics Study Program, 1959-1962, Box 67, DCRD, RUL; Bunting, interview by Cheek, 73-74.

¹⁰⁴ Rutgers News Service, news release, October 2, 1959, 2, Folder Mathematics Study Program, 1959-1962, Box 67, DCRD, RUL.

workspace, and, above all, time to pursue academic projects of individual interest. Open primarily to women who had already earned advanced graduate degrees, the Institute targeted two distinct audiences. The Associate Scholars component, which comprised the nucleus of the Institute, sought to reclaim and reinvigorate “gifted but not necessarily widely recognized women” whose careers had been interrupted by family responsibilities. While Associate Scholar awards were limited to women in the Boston area, the Resident Fellows component was open to women worldwide, and aimed to encourage the continued productivity of women who had already distinguished themselves in their respective fields.¹⁰⁵

Clearly, the Institute represented an attempt to provide a space where women’s intellectual contributions would be valued and where the “climate of unexpectation” would fail to flourish. Likewise, the Institute reflected Bunting’s concern that American women were not reaching their personal potential and that something had to be done about it. But Bunting also justified the Institute in terms of a wider societal need for “trained brainpower.”¹⁰⁶ “The purpose of the Institute,” she explained: “is to assist able and educated women who wish to participate more effectively in the intellectual and social advances of our times. Too often in the past their talents have been ignored. This is a waste that can no longer be tolerated....By opening up possibilities for achievement at the top, Radcliffe hopes to make a significant change in the climate affecting women’s education and thus ‘tap the

¹⁰⁵ “The Radcliffe Institute for Independent Study,” November 1960, 1-5, Folder 120, Box 7, MIB-RCA, Schlesinger.

¹⁰⁶ “The Radcliffe Institute for Independent Study,” November 1960, 2, Folder 120, Box 7, MIB-RCA, Schlesinger.

vast reservoir of unused talent that lies hidden in the wasting educations of intellectually idle women.”¹⁰⁷

Bunting’s announcement of the Institute in November 1960 was well-publicized and well-received. Telephone calls and letters poured in from women all over the country. Educators expressed interest in starting similar programs at their institutions. The *New York Times* featured the program on its front page.¹⁰⁸ An editorial in *Newsday* predicted that Radcliffe’s plan cannot “help but serve the best interests of the country.”¹⁰⁹ And the *Harvard Crimson* proclaimed, “If the Institute for Independent Study is a success, it does not seem overly optimistic to prophesy that Radcliffe will have the honor of initiating a nationwide effort to salvage potentially effective women from intellectual stagnation and to use their talents for the benefit of all.”¹¹⁰

Although it was open to women in all fields, the Radcliffe Institute certainly benefited women in science who struggled to combine domestic and intellectual pursuits. So did the various other programs concurrently carried out by women’s scientific societies, such as Sigma Delta Epsilon. These initiatives, which emphasized and accommodated female scientists’ dual roles under the guise of national defense, struck all the right notes in an era that clamored for “scientific brainpower” while prizing American domesticity. But it also

¹⁰⁷ Bunting to Robert A. Maes, Executive Secretary of the Donner Foundation, December 7, 1960, Folder 121, Box 7, MIB-RCA, Schlesinger.

¹⁰⁸ Fred M. Hechinger, “Radcliffe Pioneers in Plan for Gifted Women’s Study,” *New York Times*, November 20, 1960, 1, 60.

¹⁰⁹ “Radcliffe’s Fine Plan,” *Newsday*, November 21, 1960, 49.

¹¹⁰ “Advance in Woman’s Education,” *The Harvard Crimson*, November 21, 1960, Folder 120, Box 7, MIB-RCA, Schlesinger.

prohibited them from questioning women's primary roles as wives and mothers. At the same time, however, both Bunting and her like-minded colleagues refused to limit women to these roles and criticized the forces that did. They illuminated the everyday frustrations faced by female scientists and sought ways to provide for the complexities of women's lives. Likewise, they identified the discontent and the general restlessness experienced by a growing number of such women and sought ways to alleviate it. Ultimately, they raised questions as well as expectations that would reemerge with the second wave of American feminism.

EPILOGUE

In October 1964, the Association of Women Students of the Massachusetts Institute of Technology sponsored a two-day symposium on “American Women in Science and Engineering.” While “a conference at M.I.T. on science and engineering is hardly a novelty,” quipped the Institute’s President, Julius Stratton, “a symposium about women, on a campus...thought to be a man’s preserve, may well have appeared....as something remarkable.”¹ This observation was confirmed by the nearly 900 participants, whose attendance well-surpassed the expectations of the planning committee. Initially conceived as a local gathering to discuss the career problems of M.I.T. “co-eds,” the symposium drew 260 student delegates from 140 colleges, as well as 600 college deans, guidance counselors, female scientists, high school seniors, and members of the Cambridge community. As the guest list expanded, so did the organizers’ objectives. Thus, conference chair and M.I.T. senior Carol Van Aken explained, what began as a “modest informational effort” quickly became a major investigation of scientific careers for women.²

The goals of the symposium, as outlined by Van Aken, were three-fold. First, it aimed to acquaint female students with the myths and the realities surrounding scientific work for women, in the hope of encouraging them in these fields. In bringing together both men and women already established in education and industry, it also sought to reveal to potential

¹ Julius A. Stratton, “Welcoming Remarks,” in *Women and the Scientific Professions: The M.I.T. Symposium on American Women in Science and Engineering*, ed. Jacquelyn A. Mattfeld and Carol G. Van Aken, xi (Cambridge: M.I.T. University Press, 1965).

² Carol G. Van Aken, “Foreword,” in Mattfeld and Van Aken, *Women and the Scientific Professions*, v-vi.

employers some of the concerns harbored by female students and to stimulate shared solutions. Finally, it wished “to attract the favorable attention of industry, other educational institutions, and the public at large...to the desirability of decreasing the present barriers that now prevent maximum utilization of the abilities of qualified women in these areas.”³

This interest in expanding and improving women’s scientific participation by drawing on broader “manpower” concerns was well-worn territory for many program speakers, such as Polly Bunting and the Society of Women Engineers’ esteemed Lillian Moller Gilbreth. Likewise, CUNY Dean of Graduate Studies Mina Rees expressed a desire to encourage female mathematicians “particularly in view of the shortage” and mentioned how, to this end, she had made financial aid available to her female students for child care. Although Rees had never personally benefited from this kind of program, she had benefited from technological shortages more generally when she worked for the Office of Scientific Research and Development during World War II and when she headed up the mathematics branch of the Office of Naval Research in the immediate postwar period. As a married woman, moreover, she recognized some of the challenges faced by professional female scientists struggling to balance home and work.⁴ Another speaker, Columbia University physicist Chien-Shiung Wu, also juggled domestic and scientific pursuits. The Chinese-born wife and mother had completed her Ph.D. at Berkeley in 1940 (under J. Robert Oppenheimer and Ernest Lawrence) before joining the Manhattan project at Columbia in 1944. After the war, she

³ Van Aken, “Foreword,” in Mattfeld and Van Aken, *Women and the Scientific Professions*, vi.

⁴ Mina Rees, remarks at panel on “The Commitment Required of a Woman Entering a Scientific Profession,” in Mattfeld and Van Aken, *Women and the Scientific Professions*, 34-36; Kathleen Broome Williams, *Improbable Warriors: Women Scientists and the U.S. Navy in World War II* (Annapolis, MD: Naval Institute Press, 2001), 154-199.

stayed on at Columbia as part of a three-person research team that, in 1956, shattered the principle of parity in physics. The two men on the team won the Nobel Prize for this achievement, while Wu was passed over. At the M.I.T. symposium, she made it a point to outline the achievements of other Nobel-prize winning women and called for “fundamental improvements and changes in our attitudes toward women in science.” Wu, who was a contemporary of Virginia Gildersleeve, evidently shared her disdain for the “terrible waste of potential talent” arising from the marginalization and mistreatment of female scientists.⁵

Sociologist Alice Rossi drew on similar themes in her meticulously-documented paper on the barriers to women’s scientific participation. While Rossi’s extensive research on sex roles and occupational choice provided most of her evidence, her broader interest in these subjects came from personal experience. After graduating from Brooklyn College in 1947 and escaping a stifling first marriage, Rossi remarried in 1951 and juggled a variety of temporary jobs while pursuing graduate work at Columbia. She completed her Ph.D. in 1957 and managed to combine raising three young children (born between 1955 and 1959) with a series of lectureships and research associate positions around the University of Chicago, where her husband worked. Initially, her tenuous status there did not bother her, as it was a fairly common and accepted arrangement for two-career couples. But her outlook changed in the early 1960s when a male faculty member deliberately exploited her situation. Because university regulations prohibited research associates from submitting grant proposals in their

⁵ Chien-Shiung Wu, remarks at panel on “The Commitment Required of a Woman Entering a Scientific Profession,” in Mattfeld and Van Aken, *Women and the Scientific Professions*, 44-48; Rosalind Rosenberg, *Changing the Subject: How the Women of Columbia Shaped the Way We Think About Sex and Politics* (New York: Columbia University Press, 2004), 185-186; William Dicke, “Chien-Shiung Wu, 84, Dies; Top Experimental Physicist,” *New York Times*, February 18, 1997, B7.

own names, Rossi had to enlist faculty support. She fumed when she learned that the anthropology professor who had agreed to send in her (successful) National Science Foundation proposal kept the funding for himself, fired her from the project, and attempted to carry out her research.⁶

Outraged, she embarked on several large-scale investigations of sex roles and inequality and quickly became an authority on the topic. In 1963, she was solicited by the editor of the prestigious journal *Daedalus* to submit an essay for its special issue on American women. After presenting a draft at that year's American Academy of Arts and Sciences annual meeting and revising it six times, her "Equality Between the Sexes: An Immodest Proposal" was published in the spring of 1964. Rossi's "proposal," which called for the obliteration of narrowly defined sex roles, more involved parenting from fathers, the provision of day care, the expansion of re-entry programs, and the replacement of suburban homes with apartment buildings in close proximity to both parents' work, caused quite a stir.⁷ Not only was she charged with being a "monster," an "unfit mother," and an "unnatural woman," but her husband even received an anonymous condolence card for the "loss" of his wife.⁸

At the M.I.T. symposium held that following fall, Rossi elaborated on some of the themes contained in her provocative "proposal." Focusing this time on women and science,

⁶ Margaret W. Rossiter, *Women Scientists in America*, vol. 2, *Before Affirmative Action, 1940-1972* (Baltimore: Johns Hopkins University Press, 1995), 365.

⁷ *Ibid.*, 365; Alice S. Rossi, "Equality Between the Sexes: An Immodest Proposal," *Daedalus* 83 (1964): 607-52.

⁸ Alice S. Rossi, "The Biosocial Side of Parenthood," *Human Nature* 1 (June 1978): 72-79.

she detailed the cultural constraints hampering women's career choices and called for greater flexibility in women's education and employment. But in urging the encouragement of women in scientific and technical fields, Rossi also invoked familiar "manpower" references even as she extricated the various forces contributing to this push. Although "there seems to be wide agreement on the desirability of a greater proportion of women in these fields," she argued, "reasons for this agreement...vary." According to Rossi, female students and professionals wanted to increase their numbers so that they felt less out of place and were less likely to be singled out on account of sex. This interest in "personal satisfaction" was balanced by two others: a "national interest in manpower utilization" and "a radical transformation of the relations between the sexes as part of an ideology of sex equality." Yet she refused to favor (openly) any one reason over another, insisting that "In my own view, all three reasons are of equal importance."⁹

Rossi's claim might seem strange, given her obvious and overwhelming interest in sexual equality. But it also serves as a conspicuous reminder of why advocates of women's rights were willing (if not eager) to cloak their feminist agenda in technocratic discourse. Rossi's recommendations for reforming women's education and employment, after all, elicited nowhere near the kind of criticism ignited by her "immodest proposal." (Nor did her husband receive any condolence cards after she shared her recommendations for "utilizing" female intellect.) In the absence of such outright opposition, this strategy enabled Rossi and others to circulate their ideas widely and to generate new support along the way.

⁹ Alice S. Rossi, "Barriers to the Career Choice of Engineering, Medicine, or Science Among American Women," in Mattfeld and Van Aken, *Women and the Scientific Professions*, 51-53.

As we have seen, much of this support came from unlikely and often reluctant allies. During World War II, Virginia Gildersleeve persuaded Columbia's School of Engineering to admit women by invoking the wartime demand for "trained brains." Employing similar logic, she and Lillian Moller Gilbreth collaborated with industry officials and government bureaucrats to establish short-term science and engineering training programs for women. Throughout the 1950s and early 1960s, organizations such as the Society of Women Engineers and Sigma Delta Epsilon worked with government officials, educators, industrialists, guidance counselors, and even parents to hold conferences, publish guidance materials, and to encourage women to enter what they all regarded as the much-needed scientific and technical fields. Increasingly, they turned their attention to assisting older women and married women combine domestic and scientific pursuits in a purported attempt to recover "lost talent" and combat "feminine fallout." Polly Bunting's ability to procure funding on these grounds for her mathematics retraining program at Douglass and her institute at Radcliffe epitomizes this strategy.

While female activists' strategic appeal to national defense made possible these initiatives, it also hindered their liberatory potential. The identification of women as an "untapped" source of scientific talent precluded any serious critiques of their subsequent commodification and "utilization." Indeed, the pretext that "womanpower" was available (and exploitable) rested at the heart of this technocratic discourse, and helps to account for why otherwise implausible allies expressed any desire to cultivate female intellect. A reliance on national defense needs also helps to explain why women were so easily pushed out of scientific positions once demand subsided. That this strategy did drum up support for

women's scientific participation remains significant. But activists' professed interest in churning out experts, maximizing "brainpower," and minimizing "waste" did little to challenge women's subordinate status in schools, work, and society more generally.

Tethering women's scientific participation to the "manpower" (and "womanpower") needs of the nation also elided feminist claims to equality. Through activists' own maneuvering, "women's rights" were relegated to second place. The use of efficiency, not equity, as the basis for encouraging women's scientific participation left existed little room for a radical restructuring of sexual relations or scientific life. Nor, with the exception of efforts to help women combine scientific and domestic endeavors, did most female activists seriously contemplate any such undertaking. Most instead regarded scientific schooling and work as areas where properly-counseled women could be readily inserted. This underlying assumption failed to identify or combat systemic discrimination. When discussions of exclusion and marginalization did come to the fore, they were usually disguised as critiques of squandered talent. But technocratic discourse and national defense concerns could only advance a feminist agenda so far. Even sympathetic allies who were willing to "utilize" women were not willing to liberate them.

Likewise, the denial of sexual difference embedded in these attempts to expand women's scientific participation left intact the masculinist underpinnings of science itself. Although female activists realized full well that men made up the overwhelming majority of scientific practitioners and that certain cultural stereotypes had facilitated that phenomenon, they failed to interrogate how and why scientific knowledge and scientific culture had been gendered male. That science was a masculine enterprise seemed to be an unfortunate but

ultimately reversible circumstance once more women enter the field. And in order to encourage girls and women to do so, these advocates found that they had to deny any associations between masculinity and scientific success. Thus, instead of uncovering the gendered construction of scientific authority, they continually insisted that “brains have no sex,” that scientific work and motherhood could be seamlessly combined, and that bright girls need not fear the loss of their femininity. While these implorations provided otherwise hard to find encouragement and support, they could not satisfactorily account for women’s scientific subordination.

Despite their inability to comprehend the breadth and depth of women’s oppression, these female activists were well aware that change was needed. Their own experiences and observations had taught them that women, if not formally barred from science education and employment, were definitely discouraged and disadvantaged. Refusing to accept the popular premise that women lacked either the interest or the ability to succeed in scientific and technical fields, they honed in instead on the cultural conventions and social stereotypes that limited their participation. As long as girls and young women were socialized to believe that engineering was for men only, or were advised against taking college preparatory courses in math and science, the number of women enrolling and working in scientific and technical fields would remain low. That the structure of university life and scientific work was based on a male-model that left little room for child-bearing or child-rearing activities further discouraged women’s scientific success.

Throughout the 1950s and early 1960s, advocates turned these insights into initiatives, which set the groundwork for later feminist reform. As Polly Bunting suggested,

the smashing success of Betty Friedan's *Feminine Mystique* in 1963 had in many been precipitated by these earlier efforts. As new feminist groups of the 1960s and 1970s such as the National Organization for Women, the Women's Equity Action League, and more radical women's liberation groups extended, altered, and adapted earlier advocates' core ideas, they also made feminist politics front page issues.

Older women's organizations such as the Society of Women Engineers certainly benefited from this upsurge in feminist agitation and were emboldened to take a more outwardly activist approach. The society not only endorsed the Equal Rights Amendment, for example, but also refused to hold its conventions in states that had not ratified the legislation.¹⁰ Meanwhile, Sigma Delta Epsilon expanded its work under a new name that more accurately conveyed its membership and interests: The National Organization of Graduate Women in Science. The change came about shortly after the 1969 American Association for the Advancement of Science meeting in Boston when a group of female students presented a list of demands for women's equality in science. Sigma Delta Epsilon members, who were present at the gathering, were surprised that the protestors were "obviously unaware that we represented the one organization concerned most with this problem" and decided that "it was time we made more use of our name in English rather than our Greek letter name of SDE, so we would not be confused with a social sorority."¹¹ By

¹⁰ Dianne Williams Hayes, *Five Decades of the Society of Women Engineers* (New York: Society of Women Engineers, 2000), 13-14.

¹¹ Margaret Stone, "The National Organization of Graduate Women in Science," [1971?], Folder 50th anniversary meeting, Box 5, Sigma Delta Epsilon Alpha Chapter Records, Sigma Delta Epsilon Alpha Chapter records, Rare and Manuscript Collection, Carl A. Kroch Library, Cornell University.

clearly identifying itself as a women's organization, the group found a new audience and potential membership base amidst the growing women's movement.

The late 1960s also saw an explosion of new women's groups and caucuses that drew their membership base from older women's scientific societies as well as the new pool of "scientific womanpower" made possible by National Science Foundation and NDEA fellowships. These women benefited from both Cold War anxieties and the burgeoning feminist movement (the former offering new educational opportunities and the latter providing tools and language to critique gender-based oppression). The Association for Women in Science, for example, had grown out of series of "champagne mixers" that had been held in Atlantic City each year since 1966 at the Federation of Scientific and Experimental Biology annual meetings. As their conversations turned toward the status of women in science, attendees recognized the importance of a formal organization and banded together in 1971.¹² One of its earliest undertakings involved establishing a job roster (much like Sigma Delta Epsilon's "Dial a Lady Scientist" program) to connect employers with professionally trained women.¹³ Meanwhile, in 1969, several female mathematicians and mathematics graduates students in the Boston area began to meet regularly to discuss their shared problems. Within two years, they had organized themselves into a national Association for Women in Mathematics, which conducted consciousness-raising sessions at mathematics conventions, exposed unfair practices in graduate education and employment,

¹² Rossiter, *Women Scientists in America*, vol. 2, 379-381.

¹³ Rossiter, *Women Scientists in America*, vol. 2, 379-381.

and sought solutions for balancing mathematical work and study with marriage and motherhood.¹⁴

As their activities suggest, these younger women and organizations shared many similarities with earlier advocates. Others commonalities soon surfaced, especially in the wake of Title IX. Both old and new scientific societies lauded the 1972 legislation, which offered a formal and legalistic mechanism for combating the sex-based discrimination that they had long identified. Title IX broke down old barriers and swept new women into universities. But, it failed to address the broader cultural attitudes and conventions that fostered such discrimination in the first place. As earlier groups had done (and continued to do), the newer organizations looked toward combating these less tangible obstacles to women's scientific success. Familiar initiatives included providing fellowships, sponsoring career days, and working with school counselors.

Indeed, it is quite likely that this younger cohort had taken a page out of earlier activists' book. In the spring of 1970, Sigma Delta Epsilon member Margaret Stone observed that, at the most recent American Association for the Advancement of Science meeting, bound copies of the 1964 M.I.T. symposium proceedings "were going as fast as though it were fresh off the press." The edited volume, entitled *Women and the Scientific Professions*, Stone acknowledged, "did not make the best seller list like Betty Friedan's *The Feminine*

¹⁴ Margaret A.M. Murray, *Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America* (Cambridge: MIT Press, 2000), Lenore Blum, "A Brief History of the Association for Women in Mathematics: The Presidents' Perspectives," *Notices of the American Mathematical Society* 38, no. 7 (September 1991): 738-774; Anne M. Briscoe, "Phenomenon of the Seventies: The Women's Caucuses," *Signs* 4, no. 1 (Autumn, 1978): 152-158.

Mystique, but is far more valuable to women in science.”¹⁵ Despite being nearly six years old, the addresses by such women as Alice Rossi (who had, incidentally, become one of N.O.W.’s founding members) and Polly Bunting still resonated, as did their critiques of differential sex role socialization, education and work patterns that failed to accommodate the realities of women’s lives, and outright discrimination. But younger readers were ready to tackle these same issues in more explicit feminist language. In the context of renewed feminist activism, “womanpower” had acquired a radically new meaning.

¹⁵ Margaret H. Stone, “Book Review Corner: Women and the Scientific Professions,” *SDE News* Vol. 34, No. 1, Spring 1970, 7.

BIBLIOGRAPHY

American Association of University Women Archives, Washington, D.C.
AAUW Records 1893-1976, microfilm

Barnard College Archives, Columbia University, New York, New York.
Dean's Office/Departmental Correspondence, 1940-1941
Dean's Office/Departmental Correspondence, 1941-1942
Dean's Office/Departmental Correspondence, 1942-1943
Dean's Office/Departmental Correspondence, 1943-1944
President's Office
Personal Papers of Virginia Crocheron Gildersleeve

Columbia University Archives, Columbian Library, New York, New York
World War II Collection

Columbia University Rare Book and Manuscript Library, New York, New York
Virginia Gildersleeve Collection

Institute Archives and Special Collections, Massachusetts Institute of Technology, Cambridge Massachusetts
Dorothy Bowe Papers
Dorothy Weeks Papers
Records of the Dean of Student Affairs
Records of the Office of the President, 1938-1958 (Compton-Killian)

National Federation of Business and Professional Women's Clubs Archives, Washington, D.C.
Records of the National Federation of Business and Professional Women's Clubs

National Archives II, College Park, Maryland
Record Group 12, Records of the Office of Education
Record Group 86: Records of the Women's Bureau of the U.S. Department of Labor
Record Group 211, Records of the War Manpower Commission
Record Group 287, Records of the National Science Foundation

Rare and Manuscript Collection, Carl A. Kroch Library, Cornell University, Ithaca, New York
Sigma Delta Epsilon Records
Sigma Delta Epsilon Alpha Chapter Records

Schlesinger Library, Radcliffe Institute for Advanced Study, Harvard University, Cambridge, Massachusetts

American Council on Education's Commission on the Education of Women Records

Mary Ingraham Bunting Papers

Frieda Miller Papers

Esther Peterson Papers

Elizabeth Reynard Papers

Special Collections and University Archives, Rutgers University, New Brunswick, New Jersey.

Records of the Dean

Records of the Secretary of the Faculty

Walter P. Reuther Library, Wayne State University, Detroit, Michigan.

Records of the American Society of Women Engineers and Architects

Records of the Society of Women Engineers

Profiles of SWE Pioneers

Women in Science and Engineering Archives, Iowa State University, Ames, Iowa.

Records of the Curtiss-Wright Engineering Cadettes

Records of Iota Sigma Pi

Women in Chemistry Oral History Project

Newspapers, Serials, and Periodicals

Association of American Colleges Bulletin

Barnard Alumnae Magazine

The Cadetter

The Chemical Bulletin

ChemiCAL Science and Engineering

Chicago Daily News

The Christian Science Monitor

Denver Post

Douglass Alumnae Bulletin

The Harvard Crimson

Higher Education and National Defense

Independent Woman

The International Altrusan

The Iotan

Ithaca Journal

Journal of the American Association of University Women

Journal of Chemical Education

Journal of the Society of Women Engineers

Los Angeles Times

New York Herald Tribune
New York Times
New York Times Magazine
Newsday
Science
Scientific Manpower
SDE News
Sigma Delta Epsilon News
Smith College Associated News
Star
SWE Newsletter
U.S. Woman Engineer
Wall Street Journal
Washington Post
The Woman Engineer

Interviews

Irene Peden, interview by Brian Schoemaker, May 8, 2002, transcript, Polar Oral History Project, Ohio State University.

Mary Ingraham Bunting, interview by Jeannette Bailey Cheek, September-October 1978, transcript, Schlesinger Library, Harvard University

Primary Sources

American Council on Education. *Organizing Higher Education for National Defense*. Washington, D.C.: American Council on Education, 1941.

Armsby, Henry H. *Engineering, Science, and Management War Training Final Report*. Prepared for Federal Security Agency Bulletin, 1946, no. 9.

Baker, R.H. and Mary L. Reimold, "What Can Be Done to Train Women for Jobs in Engineering," *Mechanical Engineering* 64, no. 12 (December 1942): 853-855.

Baumgartner, Evelyn and Nancy Petersen, eds. *Quair*. New Brunswick: Rutgers University, 1944.

Baxter, James Phinney, III. *Scientists Against Time*. Boston: Little, Brown and Company, 1946.

Bush, Vannevar. *Science The Endless Frontier*. Washington D.C.: United States Government Printing Office, 1944.

- Capen, Samuel P. "The Effect of the World War, 1914-1918, on American Colleges and Universities," *Educational Record XXI* (January 1940): 40-48.
- Carmichael, Leonard. "The National Roster of Scientific and Specialized Personnel." *Science* 92, no. 2381 (August 16, 1940): 135-137.
- Clarke, Edward H. "Sex in Education, or A Fair Chance for Girls." Address. New England Women's Club, Boston, 1873.
- Comeforo, Jean and Jay Comeforo. eds. *Douglass Class of 1945 50th Reunion*. New Brunswick: Rutgers University, 1995.
- Committee on Educational and Vocational Guidance for Women. *UNC Women Train for War and Postwar Work*. Chapel Hill: University of North Carolina, 1943.
- Compton, Karl T., Robert W. Trullinger, and Vannevar Bush. *Scientists Face the World of 1942*. New Brunswick: Rutgers University Press, 1942.
- Cortelyou, Ethaline. "The Status of the American Woman Scientists." Address. Luncheon for All Women in Science, sponsored by Sigma Delta Epsilon at the American Association for the Advancement of Science meeting, Washington, D.C., December 30, 1958.
- Engineers' Council for Professional Development. *Engineering As A Career: A Message to Young Men, Teachers, and Parents*. New York: Engineers' Council for Professional Development, 1942.
- *Engineering: A Creative Profession*. New York: Engineers' Council for Professional Development, 1953.
- Filene, Catherine. *Careers for Women*. Boston: Houghton Mifflin, 1934.
- Flemming, Arthur S. "Some Personnel Needs of the Government War Agencies." In *Higher Education and the War: The Report of a National Conference of College and University Presidents, Held in Baltimore, Md., January 3-4, 1942*, ed. American Council on Education, 96-107. Washington DC: American Council on Education, 1942.
- "The Philosophy and Objectives of the National Defense Education Act." *Annals of the American Academy of Political and Social Science* 327 (January 1960): 132-138.
- Friedan, Betty. *The Feminine Mystique*. 1963. Reprint, New York: Dell, 1984.

- Gilbreth, Lillian M. "Women In Engineering." *Mechanical Engineering* 64. no. 12 (December 1942): 856-859.
- Gildersleeve, Virginia Crocheron. *Many a Good Crusade*. New York: Macmillan Company, 1954.
- Goff, Alice C. *Women Can Be Engineers*. Ann Arbor, Michigan: Edwards Brothers, Inc., 1946.
- Hicks, Beatrice. "Our Untapped Source of Engineering Talent." In *Women in Engineering*, ed. Patricia L. Brown, 2-6. New York: Society of Women Engineers, 1955.
- Hottel, Althea. *How Fare American Women?* Washington D.C.: American Council on Education, 1955.
- Institute of Women's Professional Relations, ed. *War Demands for Trained Personnel: Proceedings of the Conference Held at the Mayflower Hotel, Washington, D.C., March 20 and 21, 1942*. New London: Institute of Women's Professional Relations, 1942.
- *War and Post-War Demands for Trained Personnel, Proceedings of the Conference Held at the Mayflower Hotel, Washington D.C., April 9 and 10, 1943*. New London: Institute of Women's Professional Relations, 1943.
- *War and Post-War Employment and Its Demands for Educational Adjustments, Proceedings of the Conference Held at the Mayflower Hotel, Washington, D.C., May 4 and 5, 1944*. New London: Institute of Women's Professional Relations, 1945.
- Kandel, I.L. *The Impact of the War Upon American Education*. Chapel Hill: University of North Carolina Press, 1948.
- Mattfeld, Jacquelyn A. and Carol G. Van Aken, eds. *Women and the Scientific Professions: The M.I.T. Symposium on American Women in Science and Engineering*. Cambridge: M.I.T. University Press, 1965.
- McDowell, Lois G. "Educating Women for Engineering." In *Women in Engineering*, ed. Patricia L. Brown, 24-27. New York: Society of Women Engineers, 1955.
- Morgan, Agnes Fay, ed. *A History of Iota Sigma Pi: National Honor Society for Women in Chemistry*. Berkeley: Iota Sigma Pi, 1953.

- Agnes Fay Morgan, ed., *A History of Iota Sigma Pi*. 1953. Reprint, Berkeley: Iota Sigma Pi, 1963.
- Morriss, Margaret S. "College Women Students and the War." *The Educational Record* XXIV, no. 1 (January 1943): 35-43.
- Moxon, Rosamond Sawyer and Mabel Clark Peabody. *Twenty-five Years: Two Anniversary Sketches of New Jersey College for Women*. New Brunswick: Rutgers University Press, 1943.
- National Manpower Council. *A Report on the National Manpower Council*. New York: Columbia University Graduate School of Business, 1954.
- *Womanpower*. New York: Columbia University Press, 1957.
- National Science Foundation. *Scientific Manpower—1956: Significant Developments, Views, and Statistics*. Washington, D.C.: National Science Foundation, 1957.
- Rossi, Alice S. "Equality Between the Sexes: An Immodest Proposal." *Daedalus* 83 (1964): 607-52.
- "The Biosocial Side of Parenthood." *Human Nature* 1 (June 1978): 72-79.
- Rush, Benjamin. *Thoughts upon Female Education, Accommodated to the Present State of Society, Manners, and Government in the United States of America*. Philadelphia: Prichard and Hall, 1787.
- Steele, Evelyn. *Careers for Girls in Science and Engineering*. New York: E.P. Dutton & Company, Inc., 1943.
- *Wartime Opportunities for Women*, New York: E.P. Dutton & Company, Inc., 1943.
- Stinson, Katharine. "Some Facts About Engineering as a Career for Women." In *Women in Engineering*, ed. Patricia L. Brown, 21-23. New York: Society of Women Engineers, 1955.
- Tallmadge, Frances M. "Engineering Training for Women." *The Journal of Higher Education* 15, no. 7 (Oct. 1944): 379-382.
- Weinberg, Alvin. "Impact of Large-Scale Science on the United States," *Science* 134 (July 21, 1961): 161-164.
- Wofle, Dael. *America's Resources of Specialized Talent*. New York: Harper & Brothers, 1954.

Women's Bureau of the United States Department of Labor. *The Outlook for Women in Science*, Bulletin 223. Washington, D.C.: Government Printing Office, 1948-1949.

-----, *Professional Engineering: Employment Opportunities for Women*. Washington, DC: Government Printing Office, 1954.

Zook, George F. "Foreword." In *Organizing Higher Education for National Defense*, ed. Francis J. Brown, iii-v. Washington, D.C.: American Council on Education, 1941.

-----, "The President's Annual Report," *The Educational Record* XXIV, no. 3 (July 1943) 211-212.

Secondary Sources

Anderson, Karen. *Wartime Women: Sex Roles, Family Relations, and the Status of Women During World War II*. Westport: Greenwood Press, 1981.

Beadie, Nancy. "Emma Willard's Idea Put to the Test: The Consequences of State Support of Female Education in New York, 1819-67." *History of Education Quarterly* 33, no. 4 (Winter 1993): 543-562.

Bergen, Summer Chick. "Women in Engineering, 1940-1970: Struggle Against the Gender System." Master's Thesis, The University of Houston Clear Lake, 1998.

Bix, Amy Sue. "Engineering National Defense: Technical Education at Land-Grant Institutions during World War II." In *Engineering in a Land-Grant Context: The Past, Present and Future of an Idea*, ed. Alan I. Marcus, 105-133. West Lafayette: Purdue University Press, 2005.

-----, "From 'Engineeresses' to 'Girl Engineers' to 'Good Engineers': A History of Women's U.S. Engineering Education." *NWSA Journal* 16, no. 1 (Spring 2004): 27-49.

-----, "Hicks, Beatrice Alice." In *Notable American Women: A Biographical Dictionary Completing the Twentieth Century*, ed. Susan Ware, 295-297. Cambridge: Belknap Press, 2004.

-----, "Supporting Females in a Male Field: Philanthropy for Women's Engineering Education." In *Women and Philanthropy in Education*, ed. Andrea Walton, 320-345. Bloomington: Indiana University Press, 2005.

- Blum, Lenore. "A Brief History of the Association for Women in Mathematics: The Presidents' Perspectives." *Notices of the American Mathematical Society* 38, no. 7 (September 1991): 738-774.
- Briscoe, Anne M. "Phenomenon of the Seventies: The Women's Caucuses." *Signs* 4, no. 1 (Autumn, 1978): 152-158.
- Bruce, Robert V. *The Launching of Modern American Science, 1846-1876*. New York: Alfred A. Knopf, 1987.
- Campbell, D'Ann. *Women at War with America: Private Lives in a Patriotic Era*. Cambridge: Harvard University Press, 1984.
- Candel, Marjorie Dent, ed. *Current Biography Yearbook*. New York: H.W. Wilson, Co., 1957.
- Cardozier, V.R. *Colleges and University in World War II*. Westport: Praeger, 1993.
- Chafe, William. *The Paradox of Change: American Women in the Twentieth Century*. New York: Oxford University Press, 1991.
- Clowse, Barbara Barksdale. *Brainpower for the Cold War*. Westport, CT: Greenwood Press, 1981.
- Cole, Charles C., Jr. *Encouraging Scientific Talent: A study of America's able students who are lost to college and of ways of attracting them to college and science careers*. New York: College Entrance Examination Board, 1956.
- Cooke, Miriam and Angela Woollacott, eds. *Gendering War Talk*. Princeton: Princeton University Press, 1993.
- Cott, Nancy F. *The Bonds of Womanhood: "Woman's Sphere" in New England, 1780-1835*. 1977. Reprint, New Haven: Yale University Press, 1997.
- Dickson, Paul. *Sputnik: The Shock of the Century*. New York: Walker and Co., 2001.
- Diedrich, Maria and Dorothea Fischer-Hornung, eds. *Women and War: The Changing Status of American Women from the 1930s to the 1950s*. New York: St. Martin's Press, 1991.
- Dupré, J. Stefan and Sanford A. Lakoff. *Science and the Nation: Policy and Politics*. Englewood Cliffs: Prentice-Hall, Inc., 1962.

- Dupree, A. Hunter. *Science in the Federal Government: A History of Policies and Activities to 1940*. Cambridge: The Belknap Press of Harvard University Press, 1957.
- Eisenmann, Linda M. *Higher Education for Women in Postwar America, 1945-1965*. Baltimore: Johns Hopkins University Press, 2006.
- Elshtain, Jean Bethke. *Women and War*. New York: Basic Books, 1987.
- and Sheila Tobias, eds. *Women, Militarism, and War: Essays in History, Politics, and Social Theory*. United States of America: Rowman and Littlefield Publishers, Inc., 1990.
- England, J. Merton. "Dr. Bush Writes a Report: 'Science—The Endless Frontier.'" *Science* 191, no. 4222 (January 9, 1976): 41-47.
- Enloe, Cynthia. *Maneuvers: The International Politics of Militarizing Women's Lives*. Berkeley: University of California Press, 2000.
- Etzkowitz, Henry. "Beyond the Frontier: The Convergence of Military and Civilian R&D in the U.S." *Science Studies* 7, no. 2 (1994): 5-22.
- Flemming, Bernice. *Arthur Flemming: Crusader at Large*. Washington D.C.: Caring Publishing, 1991.
- Galison, Peter and Bruce Hevly, eds. *Big Science: The Growth of Large-Scale Research*. Stanford: Stanford University Press, 1992.
- Geiger, Roger L. *To Advance Knowledge: The Growth of American Research Universities, 1900-1940*. New York: Oxford University Press, 1986.
- , *Research and Relevant Knowledge*. 1993. Reprint, New Brunswick: Transaction Publishers, 2004.
- Glazer, Perina Midgal and Miriam Slater. *Unequal Colleagues: The Entrance of Women into the Professions, 1890-1940*. New Brunswick: Rutgers University Press, 1987.
- Gluck, Sherna Berger. *Rosie the Riveter Revisited: Women, the War, and Social Change*. New York: Meridian, 1987.
- Goldin, Claudia. *The Meaning of College in the Lives of American Women: The Past One-Hundred Years*. National Bureau of Economic Research Working Papers Series,

- Working Paper No. 4099. Cambridge, Massachusetts: National Bureau of Economic Research, Inc., 1992.
- Graham, Patricia Albjerg. "Expansion and Exclusion: A History of Women in American Higher Education." *Signs* 3.4 (1978): 759-773.
- Green, Rosalie E. "A Historical Study of Arthur S. Flemming: His Impact on Federal Education and Training Programs Relating to Aging During the Period 1958-1978." Ed.D. diss., Virginia Polytechnic Institute and State University, 1985.
- Greenhill, Kelly M. "Skirmishes on the 'Endless Frontier': Reexamining the Role of Vannevar Bush as Progenitor of U.S. Science and Technology Policy." *Polity* XXXII, no. 4 (Summer 2000): 633-641.
- Grier, David Allen. *When Computers Were Human*. Princeton: Princeton University Press, 2005.
- Grinager, Patricia. *Uncommon Lives: My Lifelong Friendship with Margaret Mead*. Lanham, MD: Rowman and Littlefield, 1999.
- Gruber, Carol S. *Mars and Minerva: World War I and the Uses of the Higher Learning in America*. Baton Rouge: Louisiana State University Press, 1975.
- Hanson, Sandra L. *Lost Talent: Women in the Sciences*. Philadelphia: Temple University Press, 1996.
- Haraway, Donna J. *Simians, Cyborgs, and Women*. New York: Routledge, 1991.
- Harding, Sandra. *The Science Question in Feminism*. Ithaca: Cornell University Press, 1986.
- , *Whose Science? Whose Knowledge? Thinking from Women's Lives*. Ithaca: Cornell University Press, 1991.
- Harris, Barbara. *Beyond Her Sphere: Women and the Professions in American History*. Westport, Connecticut: Greenwood Press, 1978.
- Harrison, Cynthia. *On Account of Sex: The Politics of Women's Issues, 1945-1968*. Berkeley: University of California Press, 1988.
- Hartmann, Susan M. *The Home Front and Beyond*. Boston: Twayne Publishers, 1982.

- . *The Other Feminists: Activists in the Liberal Establishment*. New Haven: Yale University Press, 1998.
- Hayes, Dianne Williams. *Five Decades of the Society of Women Engineers*. New York: Society of Women Engineers, 2000.
- . "Women's Employment and the Domestic Ideal in the Early Cold War Years." In *Not June Cleaver: Women and Gender in Postwar America, 1945-1960*, ed. Joanne Meyerowitz, 84-100. Philadelphia: Temple University Press, 1994.
- Higonnet, Margaret Randolph, Jane Jenson, Sonya Michel, and Margaret Collins Weitz, eds. *Behind the Lines: Gender and the Two World Wars*. New Haven: Yale University Press, 1987.
- Honey, Maureen. *Creating Rosie the Riveter: Class, Gender, and Propaganda During World War II*. Amherst: University of Massachusetts Press, 1984.
- Horowitz, Helen Lefkowitz. *Campus Life: Undergraduate Cultures from the End of the Eighteenth Century to the Present*. Chicago: The University of Chicago Press, 1987.
- Howes, Ruth H. and Caroline L. Herzenberg. *Their Day in the Sun*. Philadelphia: Temple University Press, 1999.
- Hughes, Jeff. *The Manhattan Project: Big Science and the Atom Bomb*. New York: Columbia University Press, 2003.
- Kaledin, Eugenia. *Mothers and More: American Women in the 1950s*. Boston: Twayne Publishers, 1984.
- Keller, Evelyn Fox. *Reflections on Gender and Science*. New Haven: Yale University Press, 1985.
- Kerber, Linda K. *Women of the Republic: Intellect and Ideology in Revolutionary America*. Chapel Hill: University of North Carolina Press, 1980.
- Kevles, Daniel J. *The Physicists: The History of a Scientific Community in Modern America*. 1977. Reprint, Cambridge: Harvard University Press, 1995.
- . "The National Science Foundation and the Debate over Postwar Research Policy, 1942-1945." *Isis* 68, no. 1 (March 1977): 5-26.

- Kindya, Marta Navia. *Four Decades of the Society of Women Engineers*. New York: Society of Women Engineers, 1990.
- Kohlstedt, Sally Gregory. "Knowledge and Gender. Women in the History of Science: An Ambiguous Place." *Osiris* v. 10 (1995): 39-58.
- Kolbe, Parke R. *The Colleges in War Time and After*. New York: D. Appleton and Company, 1919.
- Lancaster, Jane. *Making Time: Lillian Moller Gilbreth—A Life Beyond "Cheaper by the Dozen"*. Boston: Northeastern University Press, 2004.
- Leloudis, James L. *Schooling the New South: Pedagogy, Self, and Society in North Carolina, 1880-1920*. Chapel Hill: The University of North Carolina Press, 1996.
- Leslie, Stuart W. *The Cold War and American Science: The Military-Industrial: The Military-Industrial-Academic Complex at M.I.T. and Stanford*. New York: Columbia University Press, 1993.
- Levine, Susan. *Degrees of Equality: The American Association of University Women and the Challenge of Twentieth-Century Feminism*. Philadelphia: Temple University Press, 1995.
- Light, Jennifer. "Programming." In *Gender and Technology*, Nina E. Lerman, Ruth Oldenziel, and Arwen P. Mohun, eds., 295-326. Baltimore: The Johns Hopkins University Press, 2003.
- Lowen, Rebecca S. *Creating the Cold War University: The Transformation of Stanford*. Berkeley: University of California Press, 1997.
- Lynn, Susan. *Progressive Women in Conservative Times: Racial Justice, Peace, and Feminism, 1945 to the 1960s*. New Brunswick: Rutgers University Press, 1992.
- May, Elaine Tyler. *Homeward Bound: American Families in the Cold War Era*. New York: Basic Books, Inc., 1988.
- Mazuzan, George T. *The National Science Foundation: A Brief History*. Washington, D.C.: National Science Foundation, 1988.
- McCandless, Amy Thompson. *The Past in the Present: Women's Higher Education in the Twentieth-Century American South*. Tuscaloosa: University of Alabama Press, 1999.

- McEnaney, Laura. *Civil Defense Begins at Home: Militarization Meets Everyday Life in the Fifties*. Princeton: Princeton University Press, 2000.
- McIntire, Natalie Marie. "Curtiss-Wright Cadettes: A Case Study of the Effect of the World War II Labor Shortage on Women in Engineering." Master's Thesis, University of Minnesota, 1993.
- Meyerowitz, Joanne, ed. *Not June Cleaver: Women and Gender in Postwar America, 1945-1960*. Philadelphia: Temple University Press, 1994.
- Milkman, Ruth. *Gender at Work: The Dynamics of Job Segregation by Sex during World War II*. Urbana: University of Illinois Press, 1987.
- Mosch, Theodore R. *The GI Bill: A Breakthrough in Educational and Social Policy in the United States*. Hicksville, New York: Exposition Press, 1975.
- Murray, Margaret A.M. *Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America*. Cambridge: MIT Press, 2000.
- Newcomer, Mabel. *A Century of Higher Education for American Women*. New York: Harper and Brothers Publishers, 1959.
- Oldenziel, Ruth. *Making Technology Masculine: Men, Women, and Modern Machines in America, 1870-1945*. Amsterdam: Amsterdam University Press, 1999.
- , "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, 11-49. Australia: Harwood Academic Publishers, 2000.
- Olson, Keith W. *The GI Bill, the Veterans, and the Colleges*. Lexington: The University Press of Kentucky, 1974.
- Peiss, Kathy. *Hope in a Jar: The Making of America's Beauty Culture*. New York: Metropolitan Books, 1998.
- Robbins, Mary Louise, ed. *A History of Sigma Delta Epsilon, 1921-1971*. S.I.: Graduate Women in Science, 1971.
- Roland, Alex. "Science and War," *Osiris* 2, vol. 1 (1985): 247-272.
- Rosenberg, Charles E. *No Other Gods: On Science and American Social Thought*. Baltimore: The Johns Hopkins University Press, 1976.

- Rosenberg, Rosalind. *Beyond Separate Spheres: Intellectual Roots of Modern Feminism*. New Haven: Yale University Press, 1982.
- . *Changing the Subject: How the Women of Columbia Shaped the Way We Think About Sex and Politics*. New York: Columbia University Press, 2004.
- . "Virginia Gildersleeve: Opening the Gates," *Barnard College Magazine*, Summer 2001. <http://www.columbia.edu/cu/alumni/Magazine/Summer2001/Gildersleeve.html>.
- . "'The Woman Question' at Columbia: From John W. Burgess to Judith Shapiro." Address. Columbia University Seminar on the History of the University, New York, February 17, 1999. http://beatl.barnard.columbia.edu/cuhistory/archives/Rosenberg/woman_question.htm
- Ross, Davis R. B. *Preparing for Ulysses: Politics and Veterans During World War II*. New York: Columbia University Press, 1969.
- Rosser, Sue V., ed. *Teaching the Majority: Breaking the Gender Barrier in Science, Mathematics, and Engineering*. New York and London: Teachers College Press, 1995.
- Rossiter, Margaret W. *Women Scientists in America. vol 1. Struggles and Strategies to 1940*. Baltimore: Johns Hopkins University Press, 1982.
- . *Women Scientists in America. vol. 2. Before Affirmative Action, 1940-1972*. Baltimore: Johns Hopkins University Press, 1995.
- Rupp, Leila J. *Mobilizing Women for War: German and American Propaganda, 1939-1945*. Princeton: Princeton University Press, 1978.
- Saltman, Kenneth J. and David A. Gabbard, eds. *Education as Enforcement: The Militarization and Corporatization of Schools*. New York: RoutledgeFalmer, 2003.
- Schiebinger, Londa. *The Mind Has No Sex? Women and the Origins of Modern Science*. Cambridge: Harvard University Press, 1989.
- . *Has Feminism Changed Science?* Cambridge: Harvard University Press, 1999.
- Schwager, Sally. "Educating Women in America." *Signs* 12.2 (1987): 333-372.

- Sherry, Michael S. *In the Shadow of War: The United States Since the 1930s*. New Haven: Yale University Press, 1995.
- Simpson, Christopher, ed. *Universities and Empire*. New York: The New Press, 1998.
- Skolnick, Joan, Carol Langbort, and Lucille Day. *How to Encourage Girls in Math and Science*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1982.
- Solomon, Barbara Miller. *In the Company of Educated Women: A History of Higher Education in America*. New Haven: Yale University Press, 1985.
- Stewart, Irvin. *Organizing Scientific Research for War: The Administrative History of the Office of Scientific Research and Development*. Boston: Little, Brown, and Company, 1948.
- Stricker, Frank. "Cookbooks and Lawbooks: The Hidden History of Career Women in the Twentieth Century America." *Journal of Social History* 10.1 (Fall 1976): 7-10.
- Stohlman, Martha Lou Lemmon. *The Story of Sweet Briar College*. Sweet Briar, VA: Sweet Briar Alumnae Association, 1956.
- Terzian, Sevan G. "Science World, High School Girls, and the Prospect of Scientific Careers, 1957-1963." *History of Education Quarterly* 46, no. 1 (Spring 2006): 73-99.
- Tolley, Kim. "Science for Ladies, Classics for Gentlemen: A Comparative Analysis of Scientific Subjects in the Curricula of Boys' and Girls' Secondary Schools in the United States, 1794-1850." *History of Education Quarterly* 36, no. 2 (Summer 1996): 129-153.
- , *The Science Education of American Girls: A Historical Perspective*. New York: RoutledgeFalmer, 2003.
- Trescott, Martha Moore. "Women in Engineering in History." In Gabriel Kass-Simon and Patricia Farnes, *An Intellectual History of Women*. Stanford, Calif.: Stanford University Press, 1981.
- Tryon, Ruth Wilson. *Investment in Creative Scholarship: A History of the Fellowship Program of the American Association of University Women, 1890-1956*. Washington, D.C.: American Association of University Women, 1957.
- Turner, Edna May. "Education of Women for Engineering in the United States, 1885-1952." Ph.D. diss., New York University, 1954.

- Veysey, Laurence R. *The Emergence of the American University*. Chicago: The University of Chicago Press, 1965.
- Wang, Jessica. *American Science in an Age of Anxiety*. Chapel Hill: University of North Carolina Press, 1999.
- Wasserman, Elga. *The Door in the Dream: Conversations with Eminent Women in Science*. Washington DC: National Academy Press, 2000.
- Weitekamp, Margaret A. *Right Stuff Wrong Sex: America's First Women in Space Program*. Baltimore: The Johns Hopkins University Press, 2004.
- Wheaton, Kimberly Dolphin. "Challenging the 'Climate of Unexpectation:' Mary Ingraham Bunting and American Women's Higher Education in the 1950s and 1960s." Ph.D. diss., Harvard University, 2001.
- Williams, Kathleen Broome. *Improbable Warriors: Women Scientists and the U.S. Navy in World War II*. Annapolis, MD: Naval Institute Press, 2001.
- Wilson, Jane S. and Charlotte Serber, eds. *Standing By and Making Do: Women of Wartime Los Alamos*. Los Alamos: The Los Alamos Historical Society, 1988.
- Woody, Thomas. *A History of Women's Education in the United States*. vol. 1. New York: Science Press, 1929.
- Yaffe, Elaine. *Mary Ingraham Bunting: Her Two Lives*. Savannah: Frederic C. Beil, 2005.