# American Women Mathematics PhDs of the 1950s

## Margaret A. M. Murray

### Introduction

In the summer of 2022, Ukrainian mathematician Maryna Viazovska was awarded the Fields Medal. The Fields Medals, among the most prestigious awards in mathematics, are awarded every four years to mathematicians age 40 or younger to recognize both past achievement and future promise. Since the first Fields Medals were awarded in 1936, the prize has been awarded to 62 men—and only two women. Maryam Mirzakhani became the first woman to win a Fields Medal in 2014, three years before her premature death ([13]). Viazovska is now the second, and the only living, female Fields Medalist.

Both inside and outside the mathematical community, Viazovska's award has enlivened the ongoing cultural discussion about women in mathematics—a discussion that has, in the past, tended to emphasize the rarity of female mathematicians, particularly at the highest levels of achievement. Indeed, though women are still underrepresented when it comes to awards such as the Fields Medal ([5]), we live in a time when women are more visible participants in the mathematical community than ever before. Moreover, women have long been present in the mathematical community and, in various times and places, have made substantial progress in gaining recognition for their achievements. Even so, this progress has been by no means linear, and has been repeatedly punctuated by setbacks and reversals.

For many years I have made a careful study of historical patterns in the awarding of mathematics PhDs to women by institutions of higher education in the United States and Canada, with a primary focus on those women who earned PhDs during the years 1940–1959 ([15]). In an earlier article, I considered the American[1] women mathematics PhDs of the 1940s ([16]). In this article, the focus is on the American women mathematics PhDs of the 1950s—the decade in which women's share of US mathematics PhDs descended to its lowest level since the 1890s.

In the United States, we are living through a time when women's hard-won rights seem increasingly precarious. With this in mind, it behooves us to consider a time in history when women had fewer rights and were far less welcome in the mathematical community than they are now, and to understand how the women of that era were nevertheless able to persevere and to thrive as mathematicians.

### Historical Context

Yale University has the distinction of being the first university in the United States to award the PhD in mathematics—and, indeed, the first PhD in any subject—in 1862 ([23]). In the decades that followed, other American universities followed suit. In 1882, Christine Ladd-Franklin completed all requirements for a PhD in mathematics at Johns Hopkins University—but, famously, Hopkins refused to actually *award* the degree she'd earned until 1926 ([8, p. 5]). It was not until 1886 that Columbia became the first US university to award a mathematics PhD to a woman, Winifred Edgerton (later Merrill) ([8], [9]). In the decade of the 1890s, women earned nearly 10 percent of US mathematics PhDs. In each of the next five decades, from 1900–1909 to 1940–1949, the proportion of mathematics PhDs awarded to women by US institutions remained consistently between 10 and 15 percent ([8], [14]). But in the 1950s, women's share of US mathematics PhDs

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[1]*For the purposes of this article,* American *refers primarily to the US, though my research also includes women who earned PhDs in Canada.*

| Years | Total PhDs awarded | Women | |
|---|---|---|---|
| | | Number | Percent of Total |
| 1920–1929 | 352 | 49 | 13.9 |
| 1930–1939 | 780 | 113 | 14.5 |
| 1940–1949 | 835 | 87 | 10.4 |
| 1950–1959 | 2,325 | 109 | 4.7 |
| 1960–1969 | 6,407 | 363 | 5.7 |
| 1970–1979 | 10,877 | 1,086 | 10.0 |
| 1980–1989 | 7,356 | 1,159 | 15.8 |

Source: [14, Table 1.2], compiled from data in [11] and [22]

**Table 1.** Mathematics PhDs in the United States: Total and Share to Women, by Decade, 1920–1989.

dropped precipitously—just as the total number of PhDs awarded began a dramatic upward surge. Table 1 provides data, by decade, from the 1920s through the 1980s.[2] As the table makes clear, the raw numbers of women earning PhDs in mathematics actually increased slightly from the 1940s to the 1950s—but at the same time, the corresponding numbers of men nearly tripled.

As has been well documented, many social and political factors combined to shape the decline in women's share of US math PhDs in the 1940s and 1950s—as well as the gradual recovery during the 1960s, 1970s, and 1980s (for example, [8], [14], [24]). Arguably, World War II was the single most decisive event in shaping the American mathematical community in the 20th century. Prior to the war, US government investment in mathematics research and education was essentially nonexistent. But during and after World War II, mathematics (both pure and applied) came to be seen as essential to national security. In the war's immediate aftermath, federal funding of science and mathematics increased dramatically, with the creation of agencies such as the Office of Naval Research in 1946 and (especially) the National Science Foundation in 1950. At the same time, the Servicemen's Readjustment Act of 1944, commonly known as the GI Bill, helped to fuel a massive postwar expansion of the size and scope of higher education in the United States.[3]

One of the most striking effects of this postwar expansion was the spectacular dilution of women's representation in male-dominated fields—a dilution all the more striking given how robustly women had been recruited

to work in such fields during wartime. During the war years, when men all but vanished from US college and university campuses, women were welcomed as both graduate students and instructional faculty in order to keep those institutions afloat. But at war's end the tables were turned: as campuses filled with surging numbers of returning GIs—nearly all of them male—fields like mathematics became much more competitive and increasingly attractive to young men. And in the US cultural milieu of the late 1940s and 1950s, the message to women was that their proper place was neither on campus nor in the workforce, but in the domestic sphere at home.

The factors that suppressed women's share of US mathematics PhDs persisted, to some degree, into the 1960s and 1970s. But at the same time, there were countervailing forces at play that led to a gradual and steady increase in women's representation—while at the same time facilitating professional advancement, albeit belatedly, for some of the women who'd earned PhDs in the 1950s. The first and most dramatic of these countervailing forces was the Cold War between the US and the Soviet Union. Events including the Soviet nuclear bomb tests of the 1940s and 1950s; the 1957 Soviet Sputnik launch, initiating the space race; and the Cuban Missile Crisis of 1962 all contributed to an increased sense of urgency about the need to develop research talent in the mathematical sciences. In specific response to the launch of Sputnik, Congress passed, and President Dwight D. Eisenhower signed, the National Defense Education Act (NDEA) and the National Aeronautics and Space Act, creating NASA, in the late summer of 1958 ([21], [20]). The NDEA helped to fuel graduate study for a new generation of students, while the establishment of NASA further stimulated an efflorescence of research in applied mathematics.

A second countervailing force was the movement for racial and gender equality of the 1960s and 1970s. Major gains for women came from the Equal Pay Act of 1963 and Title VII of the Civil Rights Act of 1964, prohibiting discrimination on the basis of sex in employment ([7], [19]). But women's rights activists continued to work for stronger

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[2]*Table 1 presents data from the annual Survey of Earned Doctorates, formerly conducted by the National Research Council and now under the aegis of the National Center for Science and Engineering Statistics of the NSF. These numbers often differ somewhat from statistics compiled in the annual survey of doctorates published annually in the* Notices *([1]). The discrepancy between different sets of statistics stems from shifting definitions of what constitutes a PhD in mathematics, particularly with the rise of separate departments of statistics, computer science, and other mathematical sciences.*

[3]*For a recent, accessible discussion of the impact of the GI Bill on higher education in the US, see [4, Chapter 2]. For more nuanced discussion of the impact of the GI Bill on women, see [12] and [19].*

protections. In the arena of higher education, their efforts culminated in Title IX of the Educational Amendments Act of 1972, which effectively prohibits discrimination on the basis of sex in any educational program receiving federal funding ([24], [25], [26]). I would argue that the passage (and subsequent enforcement) of Title IX was the single most potent driver of increased representation of women, not only in mathematics, but across all STEM fields.

Thus, although American women who earned their PhDs in mathematics during the 1950s started their careers in an inauspicious time, the women's movement of the 1960s and 1970s and after—in which many of these women played key roles—helped to open up professional opportunities for them and (especially) for generations of women that followed. Indeed, in contrast to the data in Table 1, in the 1990s women's share of US PhDs in mathematics exceeded 20% for the first time, and that share has remained consistently near 30% in the first two decades of the 21st century ([1], [8, p. 118]). Thus the mathematics PhDs of the 1950s, despite their comparatively small numbers, represent a decisive generation in the history of American women in mathematics.

## The List

Since the early 1990s I have been working on a database of all the women who earned mathematics PhDs from US and Canadian universities during the 1940s and 1950s. I have been able to identify 106 such women who earned their PhDs in the 1950s; basic information about these women is presented in Tables 2–4 below. For each individual, I've provided the year in which her doctorate was awarded, the most complete version of her name that I've been able to identify, her years of birth and death, and the institution from which she earned the PhD.

As of early September 2022, twelve of the 106 women are apparently still living, ranging in age from 87 to 100. Among those who have died, the median age at death was 87; across the entire group, at least 43 individuals lived into their nineties. Three of these have lived to age 100 and beyond: Elizabeth Wetherell Ferentz (Syracuse 1959), still living at age 100; Susan Gerber Hahn (NYU 1957), who lived to age 101; and Evelyn Kinney Wantland (Illinois[4] 1958), who lived to age 104. Ferentz, a student of Lipman Bers, worked at NYU, IBM, and Hunter College. Hahn, a postwar refugee from Hungary, earned her PhD under Peter Lax and had a lengthy career at IBM. Wantland, a student of Waldemar Trjitzinsky, taught for a number of years at Illinois Wesleyan University. As with the women PhDs of the 1940s, this is a surprisingly long-lived group.

Proceeding chronologically through Table 2 (1950–1953), we encounter individuals, both familiar and unfamiliar, whose lives and careers are historically significant. Marjorie Lee Browne (Michigan 1950) was the third African-American woman to earn a PhD in mathematics— and the only Black woman to do so in the 1950s. A student of George Y. Rainich, she served for 30 years on the faculty of North Carolina Central University, including 19 years as department chair. Margaret Alice Waugh Maxfield (Oregon 1951), a student of Ivan Niven, appears to have been the first woman to earn a PhD in mathematics from the University of Oregon; she enjoyed a long and varied career as both mathematician and statistician, inside and outside academia. The distinguished applied mathematician Cathleen Synge Morawetz (NYU 1951), a student of Kurt O. Friedrichs, enjoyed a lengthy career at the Courant Institute; among her many honors, she was the first female mathematician to receive the National Medal of Science, in 1998. Mary-Elizabeth Hamstrom (Texas 1952), a student of R.L. Moore, supervised 10 PhD students during her 38 years on the mathematics faculty at Illinois. Gertrude Ehrlich (Tennessee 1953) escaped from Vienna after the *Anschlüss* and settled with her family in Atlanta. Ehrlich, who studied ring theory with J. Wallace Givens, became the first woman to earn a PhD in mathematics from the University of Tennessee and, for nearly four decades, served on the mathematics faculty at the University of Maryland.

The first name we encounter in Table 3 (1954–1956) is Lida Baker Kittrell Barrett (Pennsylvania 1954), whose varied career included numerous leadership positions, including chair of the mathematics department at the University of Tennessee (1973–1980); dean of the College of Arts and Sciences at Northern Illinois University (1987–1991); and president of the MAA (1989–1991), the second woman to lead that organization. Proceeding through the table, we come to Phyllis Ann Fox (MIT 1954) who, when denied admission to MIT's doctoral program in electrical engineering, pursued a doctorate in applied mathematics (fluid dynamics) with C.C. Lin instead. Fox subsequently had a long and varied career as a computing pioneer.[5] Elvy Lennea Fredrickson (Oregon State 1954), a native of Oregon and the first woman to earn a PhD in mathematics at Oregon State University, chaired the mathematics department at Lewis & Clark College in Portland for nearly three decades. Anneli Cahn Lax (NYU 1955), who escaped her native Germany in 1935, completed her PhD with Richard Courant and went on to an interesting and varied career at NYU's Washington Square College. From 1958 to 1999, Lax was the technical editor of the MAA's New

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[4]*Here and in the sequel, the term* Illinois *refers to the University of Illinois Urbana-Champaign.*

[5]*I corresponded with Phyllis Fox but was, regrettably, unable to interview her myself. Fortunately, however, Thomas Haigh conducted a fascinating interview with Fox in 2005 (*[10]*).*

| Year | Name | PhD-granting institution |
|---|---|---|
| 1950 (11) | Felice Hilda Davidson Bateman (1922–2013) | Michigan |
| | Marjorie Lee Browne (1914–1979) | Michigan |
| | Geraldine Alma ("Jerry") Coon (1913–2008) | Rochester |
| | Helen Frances Cullen (1919–2007) | Michigan |
| | Joanne Elliott (1925– ) | Cornell |
| | Violet Grace Hachmeister Larney (1920–2016) | Wisconsin |
| | Alice Winzer Lytton (1923–2001) | Brown (Appl) |
| | Margaret Owchar Marchand (1925–2014) | Minnesota |
| | Sister Mary Ferrer McFarland RSM (1913–1993) | Notre Dame |
| | F(lorence) Virginia Rohde (1918–2008) | Kentucky |
| | Wanda Montlak Szmielew (1918–1976) | California/Berkeley |
| 1951 (11) | Leila Ann Dragonette Bram (1927–1979) | Pennsylvania |
| | Elizabeth ("Betty") Heinemann Cuthill (1923–2011) | Minnesota |
| | Flora Dinkines (1910–2006) | Chicago |
| | Sister Mary Seraphim Gibbons CSJ (1913–2003) | Minnesota |
| | Violet Bushwick Haas (1926–1986) | MIT |
| | Margaret Alice Waugh Maxfield (1926–2016) | Oregon |
| | Cathleen Synge Morawetz (1923–2017) | NYU |
| | Sister Marie Jesse (Sister Edith) Morrison SSJ (1915–2008) | Catholic |
| | Elsie Temple Church Ozley (1918–1982) | Kentucky |
| | Jean Marie Boyer Porter (1923–2013) | Maryland |
| | Ruth Bernice Lind Potter (1922–1990) | Washington/St. Louis |
| 1952 (5) | Mary-Elizabeth Hamstrom (1927–2009) | Texas |
| | Emilie Virginia Haynsworth (1916–1985) | North Carolina |
| | Augusta Louise Schurrer (1925–2015) | Wisconsin |
| | Sister Mary Stephanie Sloyan RSM (1918–2007) | Catholic |
| | Joan Elizabeth Robinson Westlake (1925– ) | Bryn Mawr |
| 1953 (13) | Margaret Frances Conroy (1923–2005) | Brown (Appl) |
| | Alice Elisabeth Braunlich Dickinson (1921–1987) | Michigan |
| | Jean Lee Blaney (Feidner) Durfee (1926–1988) | Buffalo |
| | Gertrude Ehrlich (1923– ) | Tennessee |
| | Herta Taussig Freitag (1908–2000) | Columbia |
| | Lillian Gough (1918–2006) | Buffalo |
| | Lila Peck Walker McRae (1922–2001) | North Carolina |
| | Mabel Delores Montgomery (1919–2007) | Buffalo |
| | Marian Alease Moore (1907–1995) | Purdue |
| | Anne Barbara Carples (Davis) Morel (1919–1984) | California/Berkeley |
| | Pauline Chisholm Mann Nachbar (1927– ) | Brown (Appl) |
| | Anne Elizabeth Scheerer (1924–2013) | Pennsylvania |
| | Rosedith Sitgreaves (Bowker) (1915–1992) | Columbia |

**Table 2.** Women Mathematics PhDs from American institutions, 1950–1953.

Mathematical Library, now known as the Anneli Lax New Mathematical Library and jointly published by MAA and AMS. Also from the class of 1955, Jean Estelle Hirsh Rubin (Stanford 1955) studied with J.C.C. McKinsey (and, after his 1953 suicide, Patrick Suppes); she published widely in mathematical logic—with a particular focus on set theory and the Axiom of Choice—right up until her death in 2002.

Table 4 lists the doctoral classes of 1957–1959; again, every name has a story to tell. For example, Vera Stepen Pless (Northwestern 1957), who wrote her dissertation in ring theory with Alex Rosenberg, became a leading expert in error-correcting codes during her time at the Air Force Cambridge Research Laboratory in the 1960s and, not long after Title IX, was hired as a full professor of mathematics at the University of Illinois at Chicago—her first serious academic position, which she held for over 30 years.

| Year | Name | PhD-granting institution |
|---|---|---|
| 1954 (12) | Lida Baker Kittrell Barrett (1927–2021) | Pennsylvania |
| | Elsa Emilie Keitzer Boyce (1929–2019) | Carnegie Tech |
| | (Kumari) Anna Chandapillai (1912–?) | Wisconsin |
| | Jacqueline Lydie Penez Criscenti (1924–2015) | Minnesota |
| | Jacqueline Pascal ("Jill") Evans (1923–2006) | Harvard/Radcliffe |
| | Phyllis Ann Fox (Sternlieb) (1923–2017) | MIT |
| | Elvy Lennea Fredrickson (1921–2008) | Oregon State |
| | Sister Mary Andrea Johnson SCL (1921–1911) | Catholic |
| | Sister Christine Françoise Marie (Sister Irène) Morvan DHS (1912–1995) | Catholic |
| | Rose Mary Ring-Carroll (1924–2002) | Brown (Appl) |
| | Evelyn Mary Bender Vaskas (1928–2015) | MIT |
| | Joyce Lenore White Williams (1929– ) | Illinois |
| 1955 (13) | Barbara Jean Beechler (1928–2003) | Iowa |
| | Helen Bozivich (1916–2008) | Iowa State |
| | Thelma Mae Chaney (1926–2004) | Washington/Seattle |
| | Ruth Margaret Davis (Lohr) (1928–2012) | Maryland |
| | Patricia Ramsay James (Ruml Wells) Eberlein (1923–1998) | Michigan State |
| | Kathryn Lucille Powell Ellis (1921–2011) | Iowa |
| | Lillian ("Lila") Rose Elveback (1915–2004) | Minnesota |
| | (Anna) Elizabeth Vaughan Holmes (1910–2001) | Stanford |
| | Anneli Cahn Lax (1922–1999) | NYU |
| | Jean Estelle Hirsch Rubin (1926–2002) | Stanford |
| | Ruth Rebekka Struik (1928–2022) | NYU |
| | Sister M. Ferdinand Torline CSJ (1902–1995) | St. Louis |
| | Eleanor Sylvia Weiss (1915–1977) | Harvard/Radcliffe |
| 1956 (9) | (Olive) Jean Hoover (Ballou) Dunn (1915–2008) | UCLA |
| | Sister Barbara Ann (Catherine H.) Foos SSJ (1926–2016) | Notre Dame |
| | Marguerite Josephine Straus Frank (1927– ) | Harvard/Radcliffe |
| | Vivienne Esta Brenner Morley (1930–2013) | Chicago |
| | Barbara Ann Cotter Morrison (1924–2016) | Brown (Appl) |
| | Mary Frances Muskoff Neff (1930–2021) | Florida |
| | Elvira Rapaport Strasser (1913–1998) | NYU |
| | Joan Eliot Raup Rosenblatt (1926–2018) | North Carolina |
| | Lily Hanna Matthew Seshu (1925–1986) | Illinois |

**Table 3.** Women Mathematics PhDs from American institutions, 1954–1956.

Marian Boykan Pour-El (Harvard/Radcliffe 1958) studied logic at both Harvard and Berkeley, creating a thesis largely independent of any advisor; a world-renowned expert in computability theory, she spent much of her career on the faculty of the University of Minnesota. And Alexandra Bagdasar Bellow (Yale 1959), a student of Shizuo Kakutani and an expert in ergodic theory and probability, spent most of her career at Northwestern University. There, in the late 1960s, she became the first female full professor in the mathematics department.

## Patterns in the PhDs of the 1950s

Perhaps the most striking difference in the demographic makeup of the American women mathematics PhDs of the 1950s, as compared to previous decades, is in their national origins. Of the 106 women listed in Tables 2–4, 17 were born in Europe; the majority of these came to the US as refugees, reflecting the spectacular dislocations brought about by anti-semitism, the Holocaust, and global war. In addition, five were born in Canada, three in India, and one in the Philippines. While some of these women eventually returned to their countries of origin, most did not.

A total of 42 schools are included among the degree-granting institutions in Tables 2–4. In a notable change from previous decades, the institutions that awarded the greatest number of PhDs to women in the 1950s were NYU (10) and Brown (6), displacing older institutions like the University of Chicago and Catholic University ([14, Chapter 2]). Their emergence as the top grantors of PhDs to

| Year | Name | PhD-granting institution |
|---|---|---|
| 1957 (10) | Betty Jane Gassner (1934– ) | NYU |
| | Susan Gerber Hahn (1914–2015) | NYU |
| | May Ella Risch Kinsolving (1926–2022) | Syracuse |
| | Edith Hirsch Luchins (1921–2002) | Oregon |
| | Vera Stepen Pless (1931–2020) | Northwestern |
| | Mary I. Hanania Regier (1926–2020) | California/Berkeley |
| | Sara Louise Ripy (1924–2020) | Kentucky |
| | Lena Sharney (1909–1975) | NYU |
| | Mary Catherine Bishop Weiss (1930–1966) | Chicago |
| | Maria Josefa Wonenburger Planells (1927–2014) | Yale |
| 1958 (9) | Ellen Correl Lehner (1930–2020) | Purdue |
| | Judith Ann Richman (Blankfield) Gumerman (1931–1972) | Illinois |
| | Dorothy Evelyn Mussman Levy (1932– ) | NYU |
| | Christina Perlas Parel (1917–2011) | Michigan |
| | Marian Boykan Pour-El (1928–2009) | Harvard/Radcliffe |
| | Doris Grove Skillman Stockton (1924?–2018) | Brown |
| | Sister Mary Paul James Villemure OP (1928– ) | Notre Dame |
| | Evelyn Douglas Kendrick (Kinney) Wantland (1917–2022) | Illinois |
| | Dorothy Jean Christensen Williams (1930–2003) | Washington/Seattle |
| 1959 (13) | Kathleen Ethel Baxter (O'Keefe) (1923–2012) | California/Berkeley |
| | Alexandra Bagdasar (Ionescu Tulcea) Bellow (1935– ) | Yale |
| | Yvonne Germaine Marie Ghislane Cuttle (1932– ) | Oregon |
| | Diane Mary Johnson Dowling (1935–2005) | Toronto |
| | Elizabeth Harriet Wetherell Ferentz (1922– ) | Syracuse |
| | Sister Catherine Josephine Gillis SND (1900–1988) | Boston University |
| | Carol Ruth Vander Velde Karp (1926–1972) | Southern California |
| | Halina Ladavicias Montvila (1917–1997) | NYU |
| | Sister Mary Rose Rauen OSB (1929–2021) | St. Louis |
| | Elizabeth Anna Shuhany (1925–2010) | Boston University |
| | Rosemarie Margarete Gabriele Scheerer Stemmler (1930–2011) | Illinois |
| | Sister Mary Alberta Uzendoski OSF (1911–2001) | St. Louis |
| | Tilla Savanuck (Klotz Milnor) Weinstein (1934–2002) | NYU |

**Table 4.** Women Mathematics PhDs from American institutions, 1957–1959.

women reflects the emerging significance of applied mathematics in the postwar years. At Brown, five of the six degrees were awarded by the relatively new Graduate Division of Applied Mathematics, established in 1946 ([3]). At NYU, the degrees were evenly split between pure and applied mathematics, reflecting the dual mission of the Institute for Mechanics and Mathematics, also established in 1946 and later to be known as the Courant Institute for the Mathematical Sciences ([6]).

In keeping with this increased emphasis on applied mathematics, many of the 1950s women pursued PhDs and careers in the statistical sciences, including Rosedith Sitgreaves (Columbia 1953), Helen Bozivich (Iowa State 1955), Lila Rose Elveback (Minnesota 1955), Elizabeth Vaughan Holmes (Stanford 1955), Olive Jean Dunn (UCLA 1956), Joan Raup Rosenblatt (North Carolina 1956), Christina Perlas Parel (Michigan 1958), and Elizabeth Anna Shuhany (Boston University 1959). In particular, Christina Parel served as Dean of the Statistical Center at the University of the Philippines, where she developed the graduate program in statistics. Sitgreaves (1960), Rosenblatt (1967), and Parel (1971) were all elected Fellows of the American Statistical Association ([2]).

A number of women of the 1950s generation took advantage of career opportunities outside academia made possible by increased federal investment in mathematics. In 1955, for example, one year before completing her PhD, the statistician Joan Rosenblatt joined the National Bureau of Standards as a mathematician. After several promotions—and the rechristening of the agency as the National Institute for Standards and Technology—Rosenblatt retired 40 years later as NIST's Director of the Computing and Applied Mathematics Laboratory ([17]).

Elizabeth Vaughan Holmes, the first woman awarded a PhD in statistics at Stanford, subsequently worked as a statistician for the Department of Fisheries, the Department of the Interior, and the US Navy.

Outside the statistical sciences, Leila Dragonette Bram (Pennsylvania 1951) began work for the Office of Naval Research upon completing her PhD and, at her untimely death in 1979, was director of ONR's mathematics program. Elizabeth Heinemann Cuthill (Minnesota 1951) had a lengthy career with the US Naval Surface Warfare Center. Ruth Margaret Davis (Maryland 1955) held a succession of positions in the federal government, culminating in her appointment as Assistant Secretary of the Department of Energy in the Carter administration (1979–1981). And Phyllis Fox did much of her groundbreaking work in computing while on the staff of Bell Laboratories.

Even so, the most common profession for women of the 1950s generation was teaching. This was the career route for all twelve of the Roman Catholic sisters (commonly referred to as nuns) whose names appear in Tables 2–4. The letters that appear after each sister's name denote the religious order to which she belongs (e.g., OSF denotes the Order of St. Francis; OP denotes the Order of Preachers, *Ordo Praedicatorum*, founded by St. Dominic and also known as Dominicans). Many of these sisters were already teaching—sometimes at the college level—when their order sent them to graduate school to pursue PhDs. As a result, the sisters' average age at completion of the PhD, 39, is somewhat older than the rest of the group. Indeed, the oldest PhD recipient among the 1950s women, Sister Catherine Josephine Gillis SND (Boston University 1959) was born in 1900, joined the Sisters of Notre Dame de Namur in 1919, began teaching at Emmanuel College in Boston in 1942, earned her PhD in the same year she turned 59, and immediately thereafter became chair of the Emmanuel math department.

Of course, the vast majority of the 1950s women who pursued careers in teaching had to deal with the vicissitudes of the academic job market. While postsecondary teaching positions were plentiful in the 1950s and 1960s, many women—especially married women—experienced discrimination in pursuit of these jobs. As in previous generations, a large share of the 1950s women math PhDs married fellow academics, often fellow mathematicians. In the years prior to Title IX, the anti-nepotism practices of colleges and universities posed the greatest barrier to employment for these women. Anti-nepotism practices, ostensibly designed to prevent conflicts of interest in employment, often prevented women from working in the same department or even the same college as their spouses (see [14], [24]). But both women and departments benefitted when an institution was willing to set aside these practices, as Purdue University did in 1967 when they offered tenured full professorships to both Jean Rubin and her husband, statistician Herman Rubin.

Not surprisingly, many of these 1950s PhDs played an active role in advocating for greater equality for women—in mathematics, in academia, and in society at large. Many of these women were among the founding members of the Association for Women in Mathematics (AWM)—most notably, Vera Pless, who was among a small group of Boston-area mathematicians who helped establish the AWM in 1971. Lida Barrett—who'd been barred from a regular faculty position in the mathematics department at Tennessee while her husband, mathematician John Barrett, was alive—was named full professor and head of the department within just a few years of his death in 1969. She was among the first women to head a department of mathematics at a major research university. As a result of her own, highly personal experiences of discrimination, Lida Barrett became an outspoken advocate for women and other underrepresented groups—at Tennessee, in her subsequent administrative positions, and in the wider community of academia.

Certainly, many of the women PhDs of the 1950s experienced family-related career disruptions and blatant discrimination, most acutely in the first couple of decades post-PhD. But—thanks to individual and collective advocacy, and the prospects opened up by federal legislation like the NDEA, the Civil Rights Act, and Title IX—some were also able to benefit from a wider range of professional opportunities, especially later in their careers. By virtue of their efforts, the 1950s generation of women mathematics PhDs have served, and continue to serve, as role models for subsequent generations of women in mathematics.

## A Repository for the Future

Much of what I've written here relies on the database I've compiled on the 192 women who earned mathematics PhDs from American institutions during the years 1940–1959. Some of the material from the database is currently published on the *Women Becoming Mathematicians* website ([18]), to which I continue to add information on a regular basis. I plan to make all my research materials—not only the database, but all the documents associated with my research on the women PhDs of the 1940s and 1950s—accessible to other researchers. To this end, I am currently in conversation with the Archives of American Mathematics at the Dolph Briscoe Center for American History at the University of Texas at Austin. It is my hope that the lives and experiences of these pioneering mathematicians will provide inspiration and guidance as we move into an uncertain and perilous future.

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