

## Preface

During the joint mathematics meetings in January 1978 in Atlanta both of the authors attended a session on the history of American mathematics organized by Uta C. Merzbach, then curator of the Division of Mathematics, National Museum of History and Technology, Smithsonian Institution. Judy Green, then on the faculty of Rutgers University in Camden, New Jersey, was giving a talk on American women who had earned PhD's in mathematics before 1911; some of her material was based on interviews with a daughter of one of these women, Mary Winston Newson. In connection with her own interests in this area, Jeanne LaDuke, on the faculty of DePaul University in Chicago, had spoken with Newson's other daughter. During the meetings the authors had extensive conversations with Merzbach, who had already begun to compile a database on Americans active in mathematics before 1940. By the time the meetings were concluded it was decided that we would attempt to identify all American women who had earned PhD's in mathematics before 1940 and contribute the information relating to those women to the database. We eventually determined that 228 women fit the definition of those in the study, namely, those women who received PhD's from US institutions or US-born women who received foreign degrees. The first such degree was granted by Columbia in 1886. At the time of the January 1978 mathematics meetings, 118 had died, the first in 1907. Thus, techniques for the investigation would rely heavily on archival sources as well as communication, when possible, with the women who were still living. As of June 2008, three of the women are still living and are in their nineties.

Over the course of a number of years, we decided that we would attempt to reconstruct as complete a picture as possible of this community of women. It soon became the goal to identify each woman fitting the definition and attempt to trace each from birth to death by gathering biographical and bibliographical information. The biographical information includes material about family background, education, work history, special contributions, extracurricular interests, and professional recognition. We also tried to identify each woman's publications and professional presentations. We hoped to discover how each of these stories revealed insights into the larger mathematical, scientific, educational, and cultural communities, primarily in the United States, but also in a broader international setting when possible. Three decades later, although such a project has no natural end (there remain various elusive pieces of information), we now consolidate our understandings of this community of women.

We approached the project with no preconceived ideas about what we would find, but hoped to determine answers to questions, many of which are of importance today. Usually we cannot answer why a woman chose to do mathematics, but we can often tell something about her motivation from the choices that were made about the path of education and career. We can frequently surmise which factors appear

to have been helpful and which were harmful in the course of study and work. Here we are dealing with those women who were persistent enough and fortunate enough to attain a doctorate; it is much harder to determine why various other individuals chose not to continue their studies or were unable to do so.

While we will describe our findings in some detail below, certain conclusions stand out. First, there were many more women who obtained PhD's in mathematics before 1940 than was generally thought. They came from a variety of backgrounds, not just families who were well-educated or well-to-do. Women's colleges played a prominent role in the undergraduate education of the women, most of whom taught at the high school or college level before receiving their doctorates. One school, the University of Chicago, stood out as a granter of PhD's in mathematics in the period in question. The women in the study typically were in strong graduate programs with respected advisors, but these degree-granting schools were generally reluctant to hire women. Thus, women's colleges and coeducational liberal arts colleges figured most prominently as employers. Most of the women had academic careers, but a few made important contributions while working for the government or in industry. A few women made significant research contributions to mathematics, but many did not, largely because they were in academic settings that emphasized teaching rather than research. The Great Depression created problems for obtaining jobs, apparently more for women than for men. Also, marriage presented its own set of difficulties, primarily because of anti-nepotism policies. On the other hand, several of the women had close female friendships. Finally, we find that the women lived much longer than would be expected from standard life tables.

This book contains a lengthy essay elaborating on many of our basic findings. In addition, there are concise biographical entries for each of the 228 women. Since we have gathered information that is much too detailed for a book of this sort, the American Mathematical Society is hosting a website that contains this additional material. The address of this website is on the copyright page and on the back cover of this book.

For each of the 228 women there is a much fuller biographical narrative than is possible here along with a list of publications by, and references to, the person. The individual bibliographies contain not only a complete description of the items authored but sources of reviews for the items when available and talks presented to professional meetings.<sup>1</sup> In addition, the expanded entries will contain detailed citations to sources. The material on the website is freely available and is searchable. Our hope is that the brief sketch we are able to provide in the book will prompt a visit to the website for a fuller picture. Furthermore, we will be delighted if the detail available on the website proves a source for further scholarship and insights into various aspects of this community of women.

In addition to the essay and the biographical entries in the book, we have included a bibliography and a list of archives and manuscript collections consulted. The bibliography contains primarily those items that have relevance for the essay. The list of archives and manuscript collections, however, is a list of all that were used in the preparation of the biographical entries. We have not included particular collections used at each of these depositories since this information will be available on the website.

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<sup>1</sup>In a few cases the bibliographies are so wide-ranging that only selected publications are listed.

As we indicate in the introduction, a study of American women who held PhD's was undertaken by Helen Brewster Owens in the late 1930s. In 1937, and again in 1940, she sent questionnaires to American women mathematicians asking for basic biographical and bibliographical information. This material was invaluable in the early stages of our study. Where possible, the authors also used questionnaires to collect biographical and bibliographical information from the women themselves or from relatives and friends. Many other sources were necessary, however, in order to achieve the level of detail we wanted. The published sources we consulted include standard reference works, mathematical journals, and scholarly historical works. Particularly useful sources were *American Men of Science* and *American Men and Women of Science*, the *American Mathematical Monthly* and the *Bulletin of the American Mathematical Society*, and the reviewing journals *Jahrbuch über die Fortschritte der Mathematik*, *Revue Semestrielle des Publications Mathématiques*, *Zentralblatt für Mathematik*, and *Mathematical Reviews*.

Other sources include college and university archival and alumni records, mathematics departmental papers, various public records such as birth and death certificates and US census reports, and private materials. In the early years of the study, almost all of our research involved working in archives, reading through journals, going through college catalogs in the stacks of the Library of Congress and at the Center for Research Libraries, searching through volumes of the *National Union Catalog*, and scrolling through microfilms of census records at the National Archives in Washington, D.C., and in Chicago. In later years, many but not all of these resources have become available online. Archival records that have not been digitized still form the core of much of our work. However, library catalogs and online census records have lightened the load for checking facts. Similarly, the digital archives of JSTOR and Project Euclid have been used to verify most of the publication data listed in the individual bibliographies on the website. These sources have also provided some new information on the professional activities of the women in our study. Genealogical sites, especially Ancestry.com, have added to our ability to learn more biographical information about the women in the study and their families. We have had additional extensive correspondence and personal interviews with many of the women themselves, their family members, and other friends and associates when possible.

We have so many people to thank that we would exceed our page limitation were we to attempt to name them all. First, of course, we thank Uta C. Merzbach for the initial direction, ongoing support, and very concrete help throughout the years. We could only hope to approximate her high scholarly standards. Many of the women in the study and their friends and family have gone to great trouble to provide us with detailed information about their lives. Our results would have been much the poorer without the incredible help of dozens of public and college librarians and archivists. We cannot sufficiently express our gratitude for their knowledge and helpfulness. Many of our friends and relatives have gone off on fact-finding expeditions for us. We also wish to express our gratitude to the Smithsonian Institution for the utilization of numerous resources, especially when we were honorary research associates there.

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