

M. B. W. TENT

Emmy Noether



The Mother of Modern Algebra

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Preface

This is the life story of Emmy Noether, the most important female mathematician who ever lived. In 1973, Irving Kaplansky wrote “... it is surely not much of an exaggeration to call her the mother of modern algebra,” and his assessment still stands. Because no one expected Emmy to grow up to be an important scientist, the records of her early life are sketchy. After all, it was assumed that she would grow up to be a wife and mother. Instead, she was a genius who chose her own distinctive path. However, we should forgive her parents for not foreseeing her remarkable future given the limited options available to women at the time.

The story that I have written is based on the scraps of information that we have, but of themselves those tidbits do not present a coherent story. I wove the story of her life around the events that appear in the oral and written records, fleshing out the story with what I know of life in Germany at the time and what I know of how bright children explore mathematics. In other words, although this is a biography of Noether, it has an element of fiction as well. I hope her irrepressible charm and keen intellect come through.

In the story, I have incorporated a few German words and expressions, which appear in the glossary at the end of the

book, along with explanations of mathematical terms. When you encounter words that you don't know, you should consult the glossary.

There are some tantalizing hints of Emmy Noether's childhood that are part of the historical record. For example, we know that she went to a birthday party where the children were asked to solve puzzles that only Emmy was able to solve. We don't know whose birthday it was, how old Emmy was, or what puzzles were presented. We know that the family had musical evenings in their home in which a guest played the violin and Emmy's mother played the piano beautifully, but we don't know that they played Brahms's Sonata in G Major, op. 78, for violin and piano or who the violinist was. This sonata would have been current at that time and would have fit in to an evening in a home setting, and my great aunt took great pleasure in playing this sonata in 1918. We know that the only piano piece that Emmy could play well was "The Happy Farmer." We know that Emmy's mother complained about the water bill that they had to share with the Wiedemann family downstairs, but we don't know exactly what she said, or how Emmy's father responded. We don't know specifically what games Emmy and her brothers played, but Nine Men's Morris has been played throughout Europe for many centuries, and it is still a popular game with German children. (The set-up and the rules for the game are in the appendix at the end of this book.) Since we know none of the details of these and other events, my only option was to construct plausible scenes of her childhood in a way that I think they might have happened, working with the facts that are available.

The records of her activities as an adult are better documented, but even there the details are scanty. Since no one knows exactly what people said in private conversations, I have created dialogues as I think they could have happened. However, we do know that in 1915, when Emmy was denied her *Habilitation* on her first try, Hilbert asked his colleagues (all professors) if they realized that it was a university—not a bathing establishment—that they were talking about, and the professors were scandalized. They were unwilling at that time to bestow the title of professor on a mere woman. We also know that for years Emmy went swimming every day with Nina Courant and that the water was often muddy. We do not know that Emmy cheered as her students kissed the goose girl in the city hall square, but I think she must have. That would have been decidedly Noether-like.

Emmy Noether's experiences facing discrimination form a central part of her story. As a female and a Jew, she encountered daunting obstacles. I do not know that her father told her the stories of Hypatia, Kovalsky, and Young, but I think it is possible, and the parallels are poignant. Young women of today do not face the obvious barriers that Emmy Noether and others faced, yet they still must contend with stereotypes and the many demands and limitations on women in our society. I hope with Noether's example, a few more young women will discover the magic of mathematics.

I became very fond of Emmy Noether as I constructed her story—each time I read the tributes at the end of her story, I am moved once more. She was warm and lively, utterly selfless, and became passionate about mathematics as she matured. She gives new meaning to the expression “pure mathematics.”

Acknowledgments

Although I had wonderful help from many people as I prepared this book, I should start by thanking Klaus Peters at A K Peters, Ltd., who originally suggested the project to me. It was an excellent idea, and I have had fun doing it. I have long worried about why I, as a math teacher, couldn't convince more girls to go on to study higher mathematics, and writing this book seemed like a concrete step in that direction.

Next, I would like to thank Dr. Heinrich Hirschfelder and his wife, who helped my husband and me so generously as I began my research in Erlangen in June 2006, and even entertained us regally for coffee and a wonderful meal in their garden. Dr. Hirschfelder showed us around Erlangen and introduced us to his brother who located an antique algebra textbook in the university library from which Emmy probably first learned algebra with her father. Dr. Hirschfelder also expedited my research in the Erlangen *Stadtarchiv* and has continued to provide me with materials from his research into the history of Erlangen. It would have been difficult to complete this project without his help. I also want to thank Barbara Fischer at the Erlangen *Stadtarchiv* for her patient and competent help.

Also in Erlangen, Laura Baxter located a copy of Ilse Sponzel's work on the Jewish cemetery in Erlangen, which provid-

ed the only concrete information I have found on Emmy's youngest brother Robert. I met Laura through my neighbor Jane Spann in Birmingham, Alabama, and I am most grateful for their help.

I want to thank several people in Göttingen. Dr. Axel Wittmann's help was invaluable once more: introducing me to people, arranging meetings, providing me with resources, and escorting my husband and me to Dr. Cordula Tollmien's lecture on Emmy Noether at the Mathematical Institute on June 13, 2006. Dr. Tollmien's excellent talk that evening helped me as I started on this project. It was she who suggested that Emmy probably would have used a Dr. Oetker mix to make her pudding—I hadn't realized that such packaged foods were available in the 1920s. I also appreciate the help of the firm Dr. August Oetker Nahrungsmittel KG in providing me with a picture of the pudding package from 1922 and allowing me to use it. Thanks also to Helmut Rohlfing at the University Library at Göttingen for providing photos from the library's collection and for his permission for me to use them.

Dennis Wittmann took several photographs at the Mathematical Institute in Göttingen for me. His eye is good and the quality of his photos is excellent. Thank you, Dennis.

I also greatly appreciate Professor Israel Kleiner's confirmation that Irving Kaplansky was probably the first person to call Emmy Noether "the mother of modern algebra" in his paper on commutative algebra in 1973 in the report of the 1972 *Conference on Commutative Algebra*, published by Springer-Verlag on page 155: "... it is surely not much of an exaggeration to call her the mother of modern algebra."

I made extensive use of two books that have been published on the life of Emmy Noether. Auguste Dick's *Emmy Noether 1882-1935*, published in 1981 by Birkhäuser in Boston, and James W. Brewer and Martha K. Smith's *Emmy Noether: A Tribute to Her Life and Work*, published in 1981 by Marcel Dekker, Inc. in New York. Both provide a compilation of the writings about and tributes to Emmy Noether. The quotations in the last two chapters of my book are found in both those volumes.

Drs. Sabine and Christian Koch in Berlin have once again contributed to this project, providing helpful suggestions over the years, as well as wonderful hospitality over and over again. I thank them most heartily.

I want to thank the station master of the Berner Oberland Bahn at Zweilütschinen, Switzerland, for allowing me to photograph Swiss railroad cars from the 1930s.

I also want to thank my father, Raymond Wyman, for posing in the picture of the cat ladder in an Alpine village and for introducing me to the town of Wengen many years ago. My brother John Wyman and I enjoyed walking up the slopes of the Eiger from Wengen, where we, like Emmy Noether, found ourselves out of breath as we hiked the steep uphill path beginning at 1250 meters above sea level. I thank John for humoring me in that.

The Altamont School in Birmingham, AL, was intimately involved in the preparation of this book. The mathematics department was supportive as I juggled teaching classes with writing. The student body was helpful as they listened to my lectures on great mathematicians over the years. In the fall of 2006, they experimented most effectively with the German

academic tradition of shuffling their feet before and after I gave an illustrated lecture on Emmy Noether. Jennifer Grisom was so accommodating as to serve “Emmy Noether’s Famous Pudding” in the lunchroom the day of my lecture. The math team gamely learned to play Nine Men’s Morris, which they continued to happily play whenever I allowed it. I appreciate Anna Stalker’s willingness to read the manuscript at the same time that she was considering whether she wanted to follow Emmy Noether’s footsteps to Bryn Mawr. Faculty members Mary Martin, Caroline Collins, and Sim Butler all gave me excellent feedback on the manuscript as well. Mary Martin was also willing to practice Nine Men’s Morris with me. Lizanne Gray has made some wonderful photographs for me, including the picture of the Nine Men’s Morris game that appears in this work. She is a skilled photographer with whom I feel privileged to work.

Mary Gray Hunter, Altamont’s talented photography teacher, took the portrait of me that appears on the jacket of this book. She made me look reasonably attractive, and she did it with grace. Thank you, Mary Gray.

I also appreciate Catalina Herrera’s careful and intelligent editing.

Eve Graham was especially helpful as I constructed the story of Emmy Noether’s youngest brother Robert, explaining to me how a mentally disabled child would develop. As a professional psychometrist, she was able to provide me with specifics that I couldn’t have known otherwise.

My editors at A K Peters, Charlotte Henderson and Ellen Ulyanova, as well as Carolyn Artin and Christine Horn were able to help me transform a rough manuscript into a book that

I hope is a good finished project. Along with Klaus Peters, they helped me clarify some of the difficult mathematics.

I especially thank my family for supporting me in this project. My children, John and Virginia, read the manuscript carefully and made timely suggestions. John picked up on historical inconsistencies, and Virginia focused on the human aspects of the story. When they were school children in Hannover, Germany, in 1983, we all learned to play Nine Men's Morris in the city park. I also could not have completed this project without help from my husband Jim, who found himself teaching me 1920s and 1930s German history over dinner many evenings and editing sections of manuscript from time to time. He always protests that he doesn't know math so he can't help me, but his help was invaluable, as always. His support of me in my early retirement from teaching has made this whole project much easier.

There are certainly many other people whom I have neglected to mention who helped me on this project, and I apologize for not mentioning them all. This was a huge project, and I could not have done it without help from friends and family.

Part I

Childhood

