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DAVID ROWE, *A RICHER PICTURE OF MATHEMATICS: THE GÖTTINGEN TRADITION AND BEYOND*, SPRINGER, 2018, XIX + 461 PP, 127.50

It is probably no exaggeration to say that the Göttingen mathematical school of the nineteenth and early-twentieth centuries shaped much of modern mathematics. The list of prominent mathematical figures who have been associated with Göttingen either as students or as teachers is certainly a long one: CF Gauss, B Riemann, PGL Dirichlet, S Kovalevskaya, F Klein, D Hilbert, H Minkowski, E Noether, R Courant, O Neugebauer, to name just a small selection. In its later years, the school became associated with a particular style of mathematics: one concerned very much with rigorous foundations and general principles. In the decades since its demise at the hands of the Nazis, a mythology has grown up around the Göttingen mathematical school, its members, its arguments, and its traditions.

For many years, David Rowe has been chronicling aspects of the history of mathematics in his well-researched contributions to the 'Years Ago' column in *The Mathematical Intelligencer*. The book under review is a 450-page collection of those articles, formed almost entirely of pieces pertaining to Göttingen mathematics, although as Rowe acknowledges in his preface, the volume, which emerged from a symposium held in his honour in Mainz in 2016, makes no claims to be a complete history of this topic.

The book is divided into six parts, each containing articles that are grouped loosely by theme, with the six being arranged in a roughly chronological order. Rowe has provided each part with a newly-written introduction that serves to link the following articles together.

Part I begins the book with a series of chapters connected at least loosely with the infamous but little-studied rivalry between the Universities of Göttingen and Berlin during the nineteenth century, a rivalry with both mathematical and political roots, as Rowe describes (Chapter 4). Also in this part, we find a chapter dealing with a fragment of a draft letter from Kovalevskaya to Weierstrass (Chapter 5), and also much on Gauss: for example, his contributions (along with those of Dirichlet) to the search for a law of biquadratic reciprocity (Chapter 3), and a study of the various myths that have come to surround him (Chapter 2), the latter chapter deriving from an assignment that Rowe set for his students.

In Parts II and III, the focus turns to the two most prominent Göttingen mathematicians of the end of the nineteenth century and beginning of the twentieth, namely Felix Klein and David Hilbert. In the case of the former, a great deal of attention is given to the previously overlooked early parts of his career: for example, his early exposure to the mathematical models of Plücker, Brill, and others (Chapter 8). Elsewhere, we learn about his correspondence with both Sophus Lie and Henri Poincaré (Chapters 10 and 11), and his debate with Victor Schlegel over Grassmann's ideas (Chapter 9). The stories that are told of Hilbert are similarly from the lesser-known early parts of his career. One chapter deals, for example, with the background to his famous Paris lecture of 1900 on mathematical problems (Chapter 15); another steps away from Hilbert somewhat in order to consider the broader issue of the so-called 'Jewish question' in nineteenth-century German academia (Chapter 14).

Part IV is constructed around a primarily mathematical rather than biographical topic: the growth of General Relativity, to which, as Rowe notes in his introductory chapter, we may be surprised to find contributions from several mathematicians, including some from Göttingen. We learn, for example, of the work of Hermann Minkowski (Chapter 18), and also of that of the physicist Max von Laue (Chapter 19). Other chapters deal with the competition between Einstein and Hilbert to derive the Gravitational Field Equations (Chapter 22), and look more broadly at the development of non-Euclidean geometry (Chapter 20).

In Part V, we arrive at the Göttingen of the 1920s and 1930s: "the era of Hilbert and Courant". This part of the book covers the period of the exclusion of German mathematicians from international conferences and associations following the First World War, the emergence of Springer as a big academic publisher, and the rise to power of the Nazis, with its effect on German mathematics. Moreover, we are introduced to the younger figures of this new era: for example, Hermann Weyl (Chapter 27), Richard Courant (Chapter 28), and Otto Neugebauer (Chapter 29).

The final part of the book is a little more of a miscellany than any of the previous parts: it leaves Göttingen behind to consider other places where the Göttingen influence was strong. One chapter, for instance, looks at the mathematical views of Donald Coxeter (Chapter 35), whilst another considers the place of the 1946 Princeton Bicentennial Conference within the development of American mathematics.

On the practical side, this is a rather large book, produced in the same format as the articles from *The Mathematical Intelligencer*, so it is not one that can easily be taken on train journeys. For this reason, it perhaps best viewed as a useful and nicely produced (colour-illustrated) reference book. It is very handy to have all of these articles collected together into one place, where they can still be approached individually or as part of the whole. The use of the word "richer" in the title is fitting — this does indeed feel like a very rich collection of essays, which cover a far greater range of topics than the Göttingen link would perhaps initially suggest.

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