This book, compiled by Stefan Roß, is an annotated source publication together with appendices (an overview of C. Schmidt's manuscripts, a summary of his life and work, and an extensive list of publications), bringing the whole bulk of Schmidt's preserved manuscripts to readers and researchers. The book was published as the seventh volume of the series *Deutsch-russische Beziehungen in Medizin und Naturwissenschaften*. It contains Schmidt's diary entries from 1842, his correspondence and his travel reports. The correspondence includes his letters to Liebig, Wöhler, Max von Pettenkoffer, Karl Ernst von Baer and others, and also some letters sent to him by, among others, his students Hermann Benrath and V. Lieven. All his letters are concerned with scientific subjects and problems. They give information about his research work and his discussions of scientific problems with his colleagues. The letters are interesting to read, not only because they reflect their era and historical events, but also because they are written in a colourful personal style.

The most valuable part of the book contains Schmidt's voluminous and precise reports of his visits to Germany, France and Great Britain. Two longer visits are documented here — a three-month trip starting in May 1857, and another trip of about the same length, starting in June 1864. Unfortunately, there are no records of Schmidt's other numerous travels. During his trips, he met with many renowned chemists and studied the work organisation of different universities. He was interested in laboratory equipment and in the achievements of the chemical industry in different countries, describing in great detail all he saw. When observing the work organisation of his colleagues, he was, naturally, keen on the aspects that could have been applied in Tartu as well. Travelling in western Europe, he acquired apparatus and other equipment for the University of Tartu. Other professors of the University of Tartu only rarely wrote similarly detailed and interesting travel reports. The work done by Stefan Roß is even more valuable, since the handwriting of Schmidt is extremely difficult to read.

Since an extensive overview of Schmidt's biography is still lacking, this new publication is a valuable addition to fill this gap.

Tartu Ülikool HAIN TANKLER

Gasentladungsforschung im 19. Jahrhundert. By FALK MÜLLER. Pp. 300, illus. GNT-Verlag, Verlag für Geschichte der Naturwissenschaften und Technik: Berlin und Diepholz. 2004. €35.00. ISBN: 3-928186-76-0.

Nineteenth-century research on the conduction of electricity in gases was marked by a series of brilliant and intensely visual experimental investigations by German and British experimentalists. The two most outstanding investigators were Johann Wilhelm Hittorf (1824–1914) and William Crookes (1832–1919), whose research is analysed in minute detail in Müller's fine history by using publications, correspondence and (in Crookes's case) laboratory notebooks. The author's main point is that none of this research would have been possible without the innovations and improvements in glass-blowing and vacuum pump technology instituted by the Bonn instrument maker, Johann Geissler (1815–1879).

Hittorf, a Catholic bachelor and physical chemist, trained as a mathematician before joining Julius Plücker at Bonn to investigate how gas spectra altered under changing pressure. This astronomically influential work, published by the Royal Society in 1864, was based on the glass and vacuum pump technology provided by Geissler. Soon afterwards, Hittorf moved to a catholic Academy at Münster, where he spent the rest of his rather cheerless and isolated life. During the 1850s, he explained the findings of the electroplating

industry that concentrations of electrolytes did not stay constant in terms of different transport rates of anions and cations. His interest in electrolysis was then applied to gaseous conduction or discharge, using Geissler's tubes. It was during his experiments to map gaseous discharge and to quantify the variation of electric force and temperatures that he discovered shadows on the phosphorescent patches glowing on the discharge tubes. From this, he inferred that ions were emitted from the cathode, although he left it to Eugen Goldstein to develop the notion of cathode rays. Unable to see how Maxwell's electromagnetic theory fitted his experimental findings, Hittorf more or less abandoned research.

By then (1879), Hittorf's work had been completely overtaken by the Spiritualist and uxorious Crookes, who had approached gaseous discharges from a completely different direction, namely the puzzle of what went on inside the radiometer that he and his dextrous young research assistant Charles Gimingham had devised in 1875. This fascinating instrument had been developed bizarrely through the convergence of Crookes's investigation of mediums and his accurate measurement of the atomic weight of thallium. Although Gimingham, like Geissler, brilliantly refined Sprengel's mercury drop vacuum pump to further Crookes's investigations, Müller shows the crucial significance of the 1876 Special Loans Exhibition of Scientific Apparatus in London. It was this event that revealed Geissler's technique for evaluating the quality of a vacuum by residual glow during conductivity and allowed Crookes to interpret his work as evidence for a fourth state of matter that he called "radiant matter."

Müller makes it clear that, although Hittorf and Crookes neither met nor corresponded, they were connected in more ways than one by instruments and the vacuum, both of which shaped and guided their exploration of microchemistry and microphysics. However, as Müller demonstrates from his analysis of correspondence and notebooks (quoted in German or English as the source dictates), both men relied to a considerable degree on partially hidden collaborators and partners — in Hittorf's case (until 1868), Plucker and Geissler, and in Crookes's, Gimingham and the dialogue he had with the theoreticians George Stokes and Clerk Maxwell.

Müller's exciting monograph works on many levels. It is an important contribution to instrumental studies and to the literature on investigative pathways. It also contributes to the sociology of science by seeing the events as exemplifying Hans-Jörg Rheinberger's argument that science progresses by a series of continual simplifications during the course of which items of apparatus devised for experiments whose outcome is unpredictable become demonstration experiments and apparatus. Readers must not be put off by the fact that there is no index, that several citations are missing from the bibliography, or that the book tends to fall apart after its initial reading.

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Fritz Haber: Chemist, Nobel Laureate, German, Jew. By DIETRICH STOLTZENBERG. Pp. xxiii + 326, illus., index. Chemical Heritage Press: Philadelphia. 2004. $40.00 (hbk). ISBN: 0-941901-24-6.

The need for a biography of Fritz Haber is self-evident: few chemists have had such an impact on both pure and industrial chemistry, or indeed on the development of chemical warfare. For many years, the only biography available was the brief semipopular account by Morris Goran (*The Story of Fritz Haber*, 1967), which was rather weak on the facts. The 1990s saw the publication of two major (and lengthy) biographies in German, by Dietrich