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Book and Media Review

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Review of *The Matter Factory: A History of the Chemistry Laboratory*

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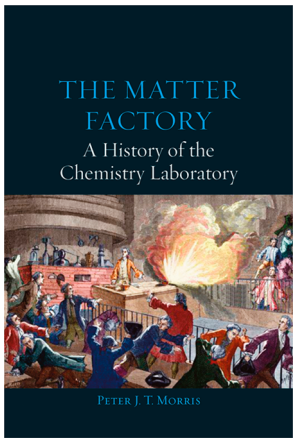
The Matter Factory: A History of the Chemistry Laboratory, by Peter J. T. Morris. Reaktion Books: London, 2015. 416 pp. ISBN: 9781780234427 (hardcover). $45.00.

Chemistry laboratories are the homes away from home for chemists, chemistry teachers, and chemistry students. Labs are the places where chemists do chemistry: they have features that mark them unmistakably as sites of chemistry. Would a chemist of 50 years ago recognize a modern lab? 100 years ago? 200? How did these quintessential chemical workplaces evolve?

Anyone who has wondered about matters such as these would enjoy *The Matter Factory*. Peter Morris, an award-winning historian of chemistry and longtime curator at London's Science Museum, had more than historians in mind when he wrote this book. He set out to describe how laboratories and the buildings that house them have developed over the last 400 years to meet the needs of chemists and chemistry, as well as how these workplaces enabled developments in the practice of chemistry. By describing milestones in these material manifestations of the infrastructure of chemistry, Morris also sheds light on the institutional, economic, and cultural milieus in which chemistry was and is practiced.



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Readers of this *Journal* would be particularly interested in the portions of the book that describe connections between labs and education. Morris describes the development of large lecture halls with space for demonstrations, connected to and supplied by laboratories where the demonstrations were prepared. The example of this arrangement presented in great detail in the book is the Royal Institution in London, where the curious and the fashionable went to hear the likes of Michael Faraday and, before him, Humphry Davy. A prep room connected to the lecture hall became common in university laboratory buildings built in the 19th century.

Justus Liebig's laboratory at the University of Giessen is the principal subject of one chapter. After an overview of Liebig's research accomplishments and after alluding to his new methods of training chemists (which have been described and analyzed elsewhere), Morris turns to descriptions and illustrations of the laboratory where this training occurred, concentrating on its state in the 1840s after a major expansion. Fume hoods (or fume cupboards, as he usually calls them, following British usage) appear in an 1842 illustration of the Giessen lab. Morris documents how this piece of safety equipment spread during the second half of the 19th century, usually on exterior walls of the lab and often on the exterior walls of the building. The Giessen lab also has cabinets built under the work surface for equipment storage, exhibiting sets of doors and drawers that would still be recognizable today.

Utilities that 20th- and 21st-century chemists take for granted include gas, water, and electricity. The focal point of Morris's treatment of these "modern conveniences" is Robert Bunsen's new lab at the University of Heidelberg, opened in 1855. This building incorporated into its labs water and gas supplied from the municipal services—which, one must remember, could happen only when and where such services were available. Bunsen's lab is an appropriate focus for the innovation of water and gas utilities because Bunsen invented pieces of apparatus that made the services even more useful to chemists. Every student of introductory chemistry knows Bunsen's name from one of these devices, namely the burner that produces a hot and stable flame of low luminosity. The water aspirator used to power vacuum filtration is hardly less widespread, although its connection to Bunsen is not so widely known.

By the last third of the 19th century, a university chemistry laboratory would be recognizable as such by an early 21st-century chemist, chemistry teacher, or chemistry student. Morris devotes a chapter to the construction of monumental buildings to house these laboratories and all of the associated infrastructure of academic chemistry. These "chemical palaces" included large lecture halls, laboratories, and associated specialized rooms (such as for balances or polarimeters), museums, and often residences for the professor and his family. They reflected the prestige of chemistry as a discipline, and were often used as lures for top chemical talent.

Thus far, this review has highlighted parts of the book readers of this *Journal* would find of particular interest. Teaching and training of chemists has a significant place in the book; however, that is not its main subject. So from this point, the review treats the overall structure and organization of the book.

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The Matter Factory is organized into 12 chapters, mainly in chronological order. Each chapter has a key laboratory or building as a focus, along with a particular individual closely associated with that lab and a feature or small set of characteristic features of the lab. The development of these features is typically traced through time. The volume is richly illustrated, containing 139 numbered images, of which the vast majority show buildings, labs, or equipment.

The first chapter focuses on early chemical workshops as influenced by alchemy and metallurgy and dominated by furnaces of various sorts. Antoine Lavoisier and pneumatic chemistry are at the forefront of the second chapter. Among the innovations in the labs in which pneumatic chemists labored were the work tables required for table-top equipment such as pneumatic troughs. Several of the images in this chapter are those prepared by Marie-Anne Lavoisier to illustrate her husband's work. Chapters 3−6 contain the examples highlighted earlier in this review. Those chapters highlight Faraday and the Royal Institution, Liebig and Giessen, Bunsen and Heidelberg, and Wilhelm Hofmann and Berlin, respectively. Chapter 7 investigates the diffusion of the "German model" laboratory throughout Europe and North America to a greater or lesser extent.

Each of the next three chapters traces specialized aspects or applications of the chemical laboratory through about the same period of time, centered on the 1890s. Chapter 8 examines a feature of academic chemistry buildings that arose in Germany but was particularly popular in the United States: the chemical museum. Chemical museums were collections of artifacts (minerals, chemical specimens, products of chemical industries, etc.) used in teaching; they all but disappeared over the course of the 20th century. Chapter 9 briefly surveys labs in chemical industry, including workplaces for quality control and for applied research and development. Chapter 10 treats government labs and their principally analytical work in support of enforcing regulations for revenue and safety.

Chapters 11 and 12 jump to the late 20th and early 21st centuries, respectively, to the Stauffer Chemistry Building at Stanford and the Chemistry Research Laboratory (CRL) at Oxford. The first of these chapters focuses on the onset of the "instrumental revolution" in chemistry (NMR in particular) and the need to segregate many of the supporting instruments and their specialized operators from the portions of the building where wet chemistry was done. Instrumentation and specialization are taken still further in Oxford's CRL; however, even its less specialized workspaces have "clean" and "dirty" areas physically separated but visually connected by glass partitions.

In sum, *The Matter Factory* is a history of the chemical laboratory structured around 12 selected labs or lab buildings, but with supporting examples taken from a large number of other sites. Although the material artifacts are in the foreground, key people who worked in the labs and social and economic contexts are never far away. The book would reward either a systematic reader or a random sampler with a wealth of information about our homes away from home.

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Notes

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