

# II

## Three Centuries of the Chemistry Set

### Part I: The 18th and 19th Centuries

#### 1. Introduction

A few caveats before I begin (1). The history of the chemistry set is more of an exercise in the history of popular culture than in the history of science proper. One simply doesn't go to the library and look up the relevant monographs and journal articles. Most of what I have discovered has been fortuitous and haphazard – the result of accidentally stumbling on an advertisement in an old magazine or in the back of an old textbook, or the result of happening on an old chemistry set at a garage sale or in a second-hand shop. Most of the companies that produced the chemistry sets we will be talking about no longer exist, and the same is equally true of the company's records. As a result, I cannot guarantee that what follows is a complete history. Important gaps may be present, but at least it is a beginning. Also, for obvious reasons, most of what I have to tell you will involve British and American chemistry sets, though there is doubtlessly an equally rich history for continental Europe and for Australia and New Zealand.

#### 2. 18th-Century Chemistry Sets

The earliest chemistry set I have been able to locate dates back to the years 1789-1790 and was designed by the German chemist and pharmacist, Johann Fredrich August Götting (1755-1809). Its official title was "A Portable Chest of Chemistry or a complete collection of chemical tests for the use of chemists, physicians, mineralogists, metallurgists, scientific artists, manufacturers, farmers, and cultivators of natural philosophy." The set contained 35 chemicals, a balance and weights, a blowpipe, a mortar and pestle, a funnel, and a booklet of 150 tests or experiments (2). In 1801, John Maclean, Professor of Chemistry and Natural Philosophy at Princeton University, recommended that Benjamin Silliman buy one of Götting's kits to teach himself chemistry before taking up his position as the newly appointed Professor of Chemistry at Yale University (3).

A French version of Götting's kit, now in the Smithsonian Institution in Washington DC, is shown in figure 1. When I and Jon Eklund, the keeper of the chemical apparatus at the Smithsonian, inspected this kit several years ago, we discovered about \$900 worth of platinum foil in one of the drawers, so the often



Figure 1. A French version of Götting's Portable Chest of Chemistry now in the Smithsonian.

heard complaint that they don't make chemistry sets like they used to, has a certain validity after all.

Why this counts as a chemistry set rather than as just a professional chemist's testing kit is the fact that, besides its use for testing materials, Götting also indicated that it could be used for "chemical instruction and amusement." In order not to overburden his instruction booklet, Götting recommended that users interested in this aspect consult the "chemical tricks and deceptions described in Wiegleb and Rosenthal's *Natural Magic*"(4). The term "natural magic" used in this title signified the use of natural means and deception to create the illusion of magic for purposes of entertainment. This contrasted with black magic, which employed supernatural means and was illegal, not to mention blasphemous. The Wiegleb-Rosenthal book was part of a tradition dating back to the 16th century and the first appearance of popular books on natural magic containing collections of mathematical puzzles, optical and pneumatic curiosities, and a few chemical tricks, such as the famous volume by della Porta shown in figure 2 (5). The term was used as late as 1832 in the

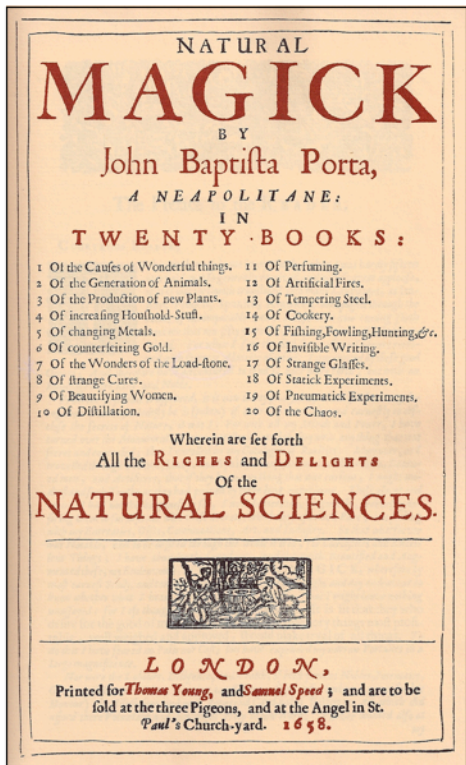


Figure 2. Title page of the 1658 English translation of Giambattista della Porta's 1558 book *Magiae naturalis*.

title of a book of popular optical, acoustic, mechanical, and chemical illusions written by the Scottish physi-



Figure 3. An advertisement for a Chemcraft Chemical Magic Set, c. 1929.

cist, Sir David Brewster (6). The “chemical magic” tradition which evolved out of this older natural magic tradition has remained an important component of the chemistry set ever since, as may be seen in the 1929 ad for a “Chemcraft Chemical Magic Set” shown in figure 3.

The second component of the modern chemistry set – educational self instruction – also dates back to the 18th century and the chemistry set designed by James Woodhouse in 1797. Woodhouse (1770-1809) was Professor of Chemistry at the Medical School of the University of Pennsylvania (7, 8). His “chemical chest” contained 20 reagents and powders, a blowpipe, a scale and weights, a mortar and pestle, a glass measure, a siphon, and a funnel, and was sold by William Woodhouse – most likely a relative – at No. 6, Front Street, Philadelphia. The chest was also accompanied by a booklet of 56 pages, whose title page is

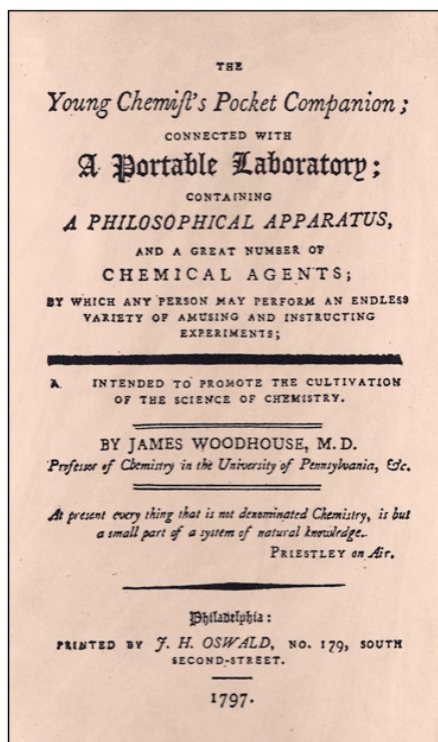


Figure 4. Title page of the 1797 booklet written by James Woodhouse to accompany his “Portable Laboratory.”

shown in figure 5, describing “100 experiments to accompany a standard course of lectures in chemistry,” so it is also likely that Woodhouse recommended its purchase to the students attending his chemistry course.

In passing, it is interesting to note that both Götting and Woodhouse recommended the use of wine glasses to carry out color and precipitation reactions not requiring heating. No test tubes are mentioned in

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either kit. Indeed, test tubes do not appear in the chemical literature until around 1810.

#### 3. 19th-Century British Chemistry Sets

Table 1 lists some early 19th-century British chemistry sets. The dates given reflect only the dates of the earliest ads which have been located so far and do not necessarily represent the actual dates of manufacture (9). Unhappily we know very little about most of these concerns. The first set on the list was advertised in the

**Table 1. British Chemistry Sets 1800-1850**

Name	Time Period
Henry's Portable Laboratory	1799-1808
Accum's Chest of Chemical Amusement	1811
Newman's Chemical Amusement Chest	1827
Cary's Chemical Amusement Chest	1827
West's Chemical Amusement Chest	1831-1836
Ede's Youth's Laboratory	1835-1845
Macfarlane's Chemical Museum	1838
Palmer's Chemical Amusement Chest	1839-1845
Statham's Students' Chemical Laboratory	1839-1900

back of William Henry's textbook, *An Epitome of Chemistry*, for use by his readers in repeating the experiments described in the text. The manufacturer of the third set in the list – John Newman – was the instrument maker at the Royal Institution and sold his sets to the children attending Faraday's famous Saturday lectures. Newman was also responsible for Faraday's arrival at the Royal Institution. Some defect in his personality had caused Humphry Davy's lab assistant, Robert Payne, to punch him out. As a result, Payne was sacked and Davy, desperate for a replacement, hired a young untried book binder's apprentice named Michael Faraday.

The fifth name on the list – Francis West – was an instrument maker in Fleet Street, London, who also made and sold an entire line of so-called "intellectual toys." The seventh – Macfarlane – was a druggist. His kits are mentioned in Reid's *Manual of Chemistry* and consisted of a sort of semi-microchemistry carried out on flat glass plates rather than in test tubes. The last

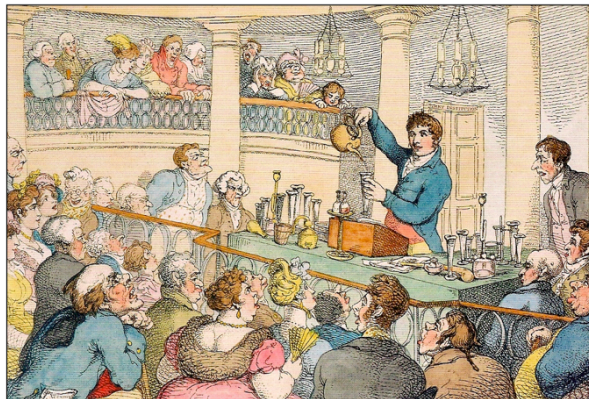


Figure 5. A colored caricature by Thomas Rowlandson of Accum lecturing on chemistry at the Surrey Institution, c. 1810.

name on the list – William Statham – made some of the best known 19th-century British kits and was active until the end of the century. I will say more about him in a bit. But of all these chemistry sets, it is the second on the list – Friedrich Accum's "Chests of Chemical Amusement" about which we know the most (10).

Accum (1769-1838) was a German emigre and sometime lecturer at the Surrey Institution – where he is depicted in the famous caricature shown in figure 5 by the British political cartoonist, Thomas Rowlandson. He also wrote an important exposé on food adulteration. But more significant for our purposes, he was a

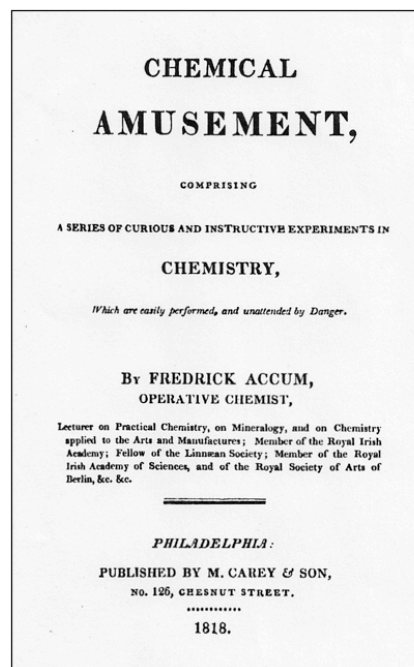


Figure 6. Title page to the 1818 American edition of Fredrick Accum's *Chemical Amusement*.

major London dealer in chemical apparatus and chemicals. Indeed, he outfitted many early American professors of chemistry, including Benjamin Silliman at Yale, James Dana at Dartmouth, and John Gorham at Harvard.

Accum's chemistry sets were produced as a sideline to his business as a dealer in professional chemical apparatus and chemicals. We know something about them because he wrote a popular book of experiments entitled *Chemical Amusement* (figure 6) to accompany the kits (11, 12). This was also sold separately and many copies have survived in libraries. And in the back of his book, Accum included advertisements for his chemistry sets and other products (13):

*Chests of Chemical Amusement ..... 10ℓ.10s. to 18ℓ.18s.*

*THE object of this chest is to blend chemical science with rational amusement. The pleasing appearances which chemistry affords, whilst they amuse, by presenting to the observer striking phenomena and unexpected results, are well calculated to diffuse mirth and surprise through a friendly circle. But that this chest might be rendered of greater value than the mere amusement of a leisure hour, the rationale of each experiment has been given in the publication which accompanies the chest (*Chemical Amusement; Comprising Minute Instructions for Performing a Series of Striking and Instructive Chemical Experiments, 1811*). And with regard to the striking experiments which chemistry affords, such only have been selected on the present occasion, as may be performed with ease and safety by those who are moderately tinctured with chemical knowledge. It is presumed they will be found well calculated to rivet attention, and display that fascinating character for which the science of chemistry has higher claims than any other branch of knowledge. Indeed, so singular and curious are the phenomena produced by this science, that to be welcomed and cultivated, it needs only to be known.*

Note Accum's amusing use of chemical metaphors – “diffuse mirth and surprise,” “moderately tinctured with chemical knowledge,” etc.

Table 2 lists some late 19th-century British and American chemistry sets (9). Again we know very little about most of these dealers, but note the delightful names – Midgley's Portable Chemical Museum, Pike's Youth's Chemical Cabinet, Tutton's Chemical Box, etc. Figure 7 shows an actual surviving example of a “Statham's Students' Chemical Laboratory” dating from about 1880. This specimen belongs to Robert Anderson, who is the Director of British Museums. He tells me that he bought it at a garage sale. The manufacturer, William Edward Statham, advertised himself

**Table 2 British & American Chemistry Sets 1850-1900**

Name	Time Period
Statham's Students' Chemical Laboratory	1839-1900
Midgley's Portable Chemical Museum	1855
Pike's Youth's Chemical Cabinet	1856
Tutton's Chemical Box	1862
Griffin's Portable Laboratories	1866
Kingley's Primus Chemical Magic and Practical Chemical Cabinet	1900

as a druggist and supplier of toiletries to the Royal Household. As we saw in Table 1, he began selling these kits as early as 1839 (14).

Figure 8 shows one of several portable chemical cabinets sold by John Joseph Griffin (1802-1877) (15). Like Accum, Griffin was not only a chemist but a dealer in chemical apparatus and chemicals (16). Our short or common form of the beaker is named in his honor. Also, like Accum, Griffin wrote a book of popular experiments entitled *Chemical Recreations* to accompany his kits (figure 9). This was also sold separately and went through many editions in the period between 1824-1870 (17). Griffin's book also had sev-

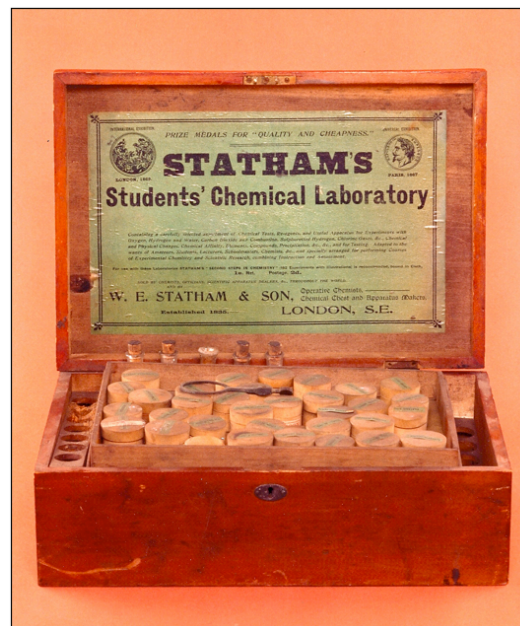


Figure 7. A surviving example of a 19th-century Statham chemistry set.

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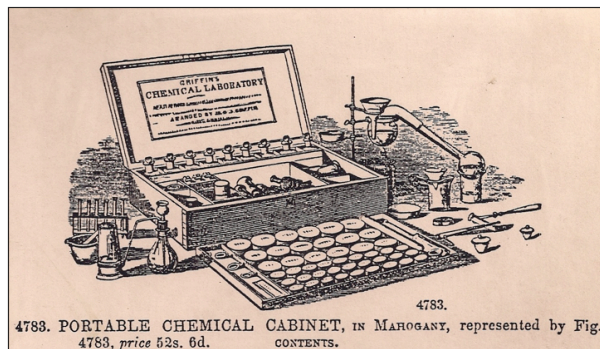


Figure 8. One of several portable chemical cabinets sold by the apparatus dealer, J. J. Griffin, during the second half of the 19th century.

eral imitators, including an 1850 example of similar title (*Recreations in Chemistry* rather than *Chemical Recreations*) by one Thomas Griffiths – not Griffin (18). The plate (figure 10) facing the title page of this book shows Griffith’s rather exaggerated idea of the contents of a typical home laboratory of the period.

Figure 11 shows a chemistry set from the same period, but not mentioned in Table 2 – “Taylor’s Students’ Guinea Set of Blowpipe Apparatus and Pure Chemical Reagents.” This particular example is located

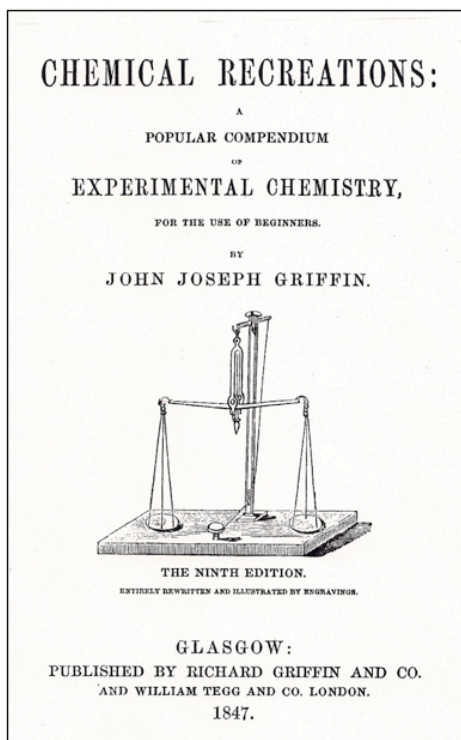


Figure 9. The title page to the 1847 edition of Griffin’s *Chemical Recreations*.

in the Science Museum in London (19). These kits were probably designed more for students taking specific university courses of laboratory instruction in chemical analysis than for the home laboratory enthusiast.

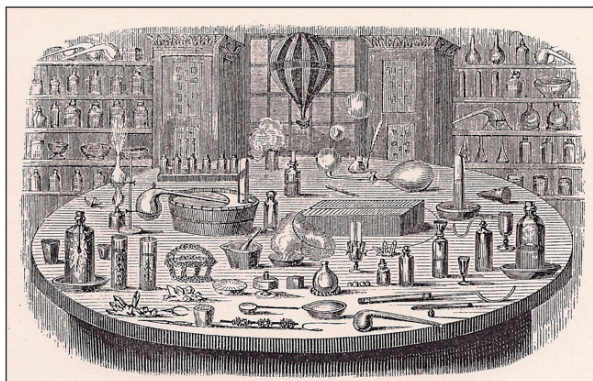


Figure 10. Thomas Griffith’s exaggerated view of a typical home laboratory, c. 1850.

Finally, figure 12 shows a British example from the turn of the century - “Kingsely’s Primus Chemical Magic and Practical Chemistry Cabinet.” Note the selection of chemicals in the first row: sulfur, potassium nitrate, charcoal, potassium chlorate, and zinc powder – a veritable pyromaniac’s dream come true (20).



Figure 11. Taylor’s Students’ Guinea Set of Blowpipe Apparatus and Pure Chemical Reagents.

### 4. 19th-Century American Chemistry Sets

19th-century American chemistry sets are relatively rare, as the American market, such as it was, apparently was dominated by imported British chemistry sets. One of the few examples I have been able to locate – “Pike’s Youth’s Chemical Cabinet” – is shown in figure 13 (21). Benjamin Pike Jr. was an optician and dealer in scientific instruments with a shop on Broadway in New York City. Of particular interest



Figure 12. Kingsley's Primus Chemical Magic and Practical Chemistry Cabinet, c. 1900.

is Pike's rather quaint concept of the terms "dangerous" and "deleterious," as one of the first items listed under the contents for the kit is a bottle of yellow phosphorus dissolved in oil.

Figure 14 shows the oldest chemistry set in our collections at Cincinnati. From the oak cabinet work we would date it as being from the late 1890s. As can be seen, it opens out to reveal a setup not unlike the earlier kit sold by Pike. From the labels on the few remaining original bottles, we know it was made in Philadelphia, but beyond that we have no further information.

### 5. Some Early German Chemistry Sets

Though almost all of my information on chemistry sets deals with British and American examples, I have also uncovered some data on early German chemistry sets in addition to the Götting kit mentioned earlier. Thus

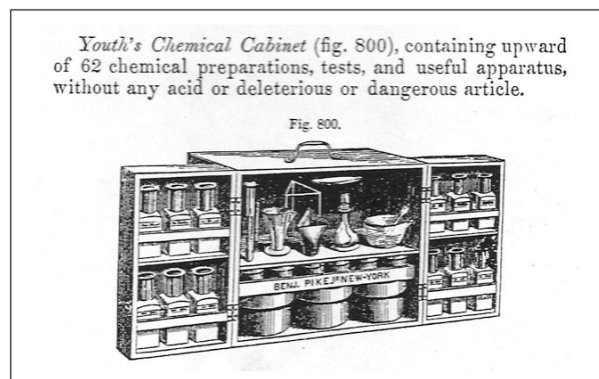


Figure 13. Pike's Youth's Chemical Cabinet, c. 1856.



Figure 14. Restored 19th-century American chemical cabinet of unknown origin.

figure 15 shows a plate taken from the catalogs of the firm of Georg Hieronimus Bestelmeir of Nürnberg, who, between 1793 and 1807, made and sold toys, games, tricks, models, novelty items and scientific toys – most of the latter being either optical or electrical in nature (22). However, as figure 15 testifies, at least one plate offered a set of chemical apparatus for the home laboratory buff.

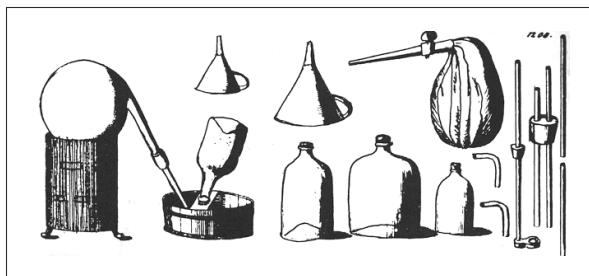


Figure 15. Plate of chemical apparatus from the catalogs of the Bestelmeir Novelty Company of Nürnberg, c. 1800.

As you may imagine, very few 18th- and 19th-century German chemistry sets have made it to the United States. The same, however, is not true of various books intended for the home chemist. An example from 1859 entitled (in translation) *Chemical Experiments for the Instructive and Amusing Entertainment of Everyone who is Concerned with Chemistry and Especially for Mature Youths* (i.e., Adolescents) is shown in figure 16 (23). Its author – one Dr. Natron – apparently wished to remain anonymous, since "natron" is the name for naturally occurring sodium carbonate and is obviously a pseudonym.

A second example from 1910 entitled (in translation) *The Young Chemist* is shown in figure 17 (24). That the illustration on the cover is not totally inaccurate is apparent from actual photographs (figures 18-19) from this period and slightly later of some amateur

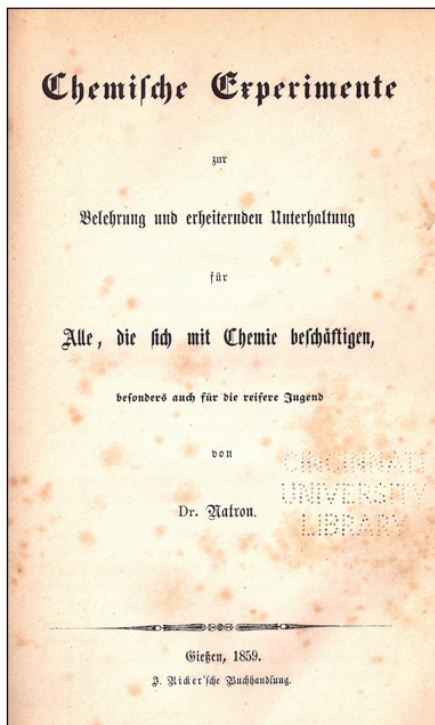


Figure 16. Title page of an 1859 German book of experiments for the home chemist.

chemists who eventually became well-known European chemists, including the famous natural products

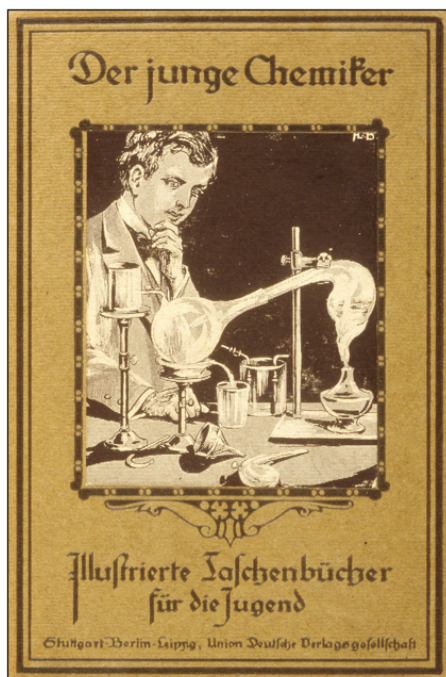


Figure 17. Cover of an anonymous German booklet for the home chemist, circa 1910.

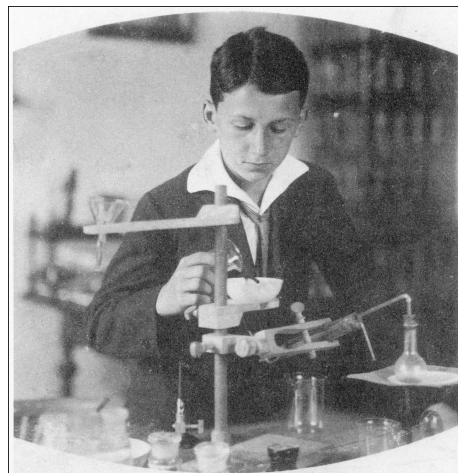


Figure 18. Vladimir Prelog at age 12 in his home laboratory, c. 1918.

chemist and Nobel Prize winner, Vladimir Prelog (1906-1998), and the German organic chemist, Wolfgang Langenbeck (1899-1967) (25).

*Continued in Part II*

## 9. References and Notes

1. First presented at the "Symposium on the History of the Chemistry Set," held at the 11th Biennial Conference on Chemical Education, Georgia Institute of Technology, Atlanta, GA, 05-19 August 1990 and on many occasions since.

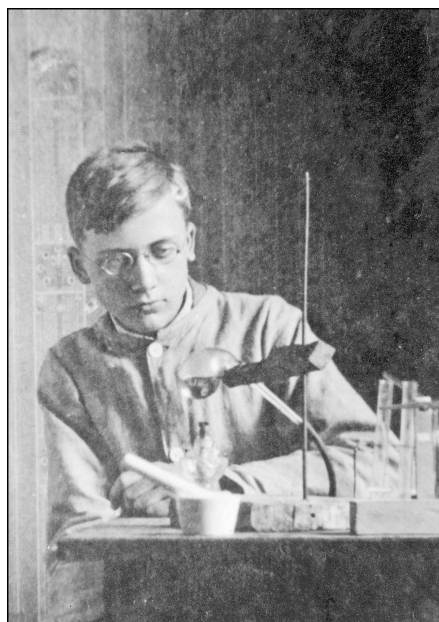


Figure 19. Wolfgang Langenbeck at age 15 in his home laboratory, c. 1914.

The original talk used 53 slides. Consequently, in producing a printed version, I have had to drastically cut the number of illustrations and, in order to make the file size reasonable, have also had to divide the talk into two parts – the first dealing with the chemistry set in the 18th and 19th centuries and the second dealing largely with 20th-century American chemistry sets. In preparing the written account I have also added relevant references which have appeared since 1990.

2. W. A. Smeaton, "The Portable Chemical Laboratories of Guyton de Morveau, Cronstedt, and Götting," *Ambix*, **1966**, *13*, 84-91.

3. W. Foster, Ed., *Considerations on the Doctrine of Phlogiston and the Decomposition of Water by Joseph Priestley and Two Lectures on Combustion and an Examination of Doctor Priestley's Considerations on the Doctrine of Phlogiston by John Maclean*, Privately Printed: Princeton, 1929, pp. 6-7 of the introduction.

4. J. C. Wiegand, *Unterricht in der natürlichen Magie*, 2 Vols, Nicolai: Berlin 1779. This was a reworking by the German chemist, Johann Christian Wiegand (1732-1800), of the earlier volume J. N. Martius, *Unterricht von der Magia Naturali*, Nicolai: Frankfurt, 1751. However, the most extensive 18th-century treatment of natural magic found in the Oesper Collections is J. S. Halle, *Neufortgesetzte Magi, oder Zauberkräfte der Natur*, 17 Vols., Pauli: Berlin, 1784-1802. Wiegand also published the *Natürliches Zauber-Lexicon*, 3rd, ed., Raspischen Buchhandlung: Nürnberg, 1784.

5. J. P. Porta, *Natural Magick*, Basic Books: New York, NY, 1957. A reproduction of the English translation of 1658.

6. D. Brewster, *Letters on Natural Magic*, Murray: London, 1832.

7. E. F. Smith, *Chemistry in America*, Appleton: New York, NY, 1914, Chapter 4.

8. E. F. Smith, *James Woodhouse: A Pioneer in Chemistry, 1770-1809*, Winston: Philadelphia, PA, 1918, pp. 77-84.

9. I had discovered several of the items in both of these tables as a result of reading various books and journals. Others were graciously provided through correspondence with Dr. Brian Gee in June of 1988, who did his doctoral thesis on early 19th-century British chemistry sets. His work has since been published as B. Gee, "Amusement Chests and Portable Laboratories: Practical Alternatives to the Regular Laboratory," in F. James, Ed., *The Development of the Laboratory*, Macmillan: London, 1989, Chapter 3.

10. A. B. Browne, "The Life and Chemical Services of Frederik Accum," *J. Chem. Educ.*, **1925**, *2*, 829-851, 1008-1034, 1140-1149.

11. F. Accum, *Chemical Amusement: Comprising a Series of Curious and Instructive Experiments in Chemistry*, Boys: London, 1817.

12. Not only were there American editions of Accum's book, there was also a French translation, see F. Accum, *Manuel de chimie amusante ou nouvelles récréations chimiques*, Roret: Paris, 1825.

13. F. Accum, *A Descriptive Catalogue of the Apparatus & Instruments Employed in Experimental and Operative Chemistry*, Accum: London, 1817, pp. 44-47.

14. A selection of ads for Statham chemistry sets may be found in the book *Nineteenth Century Games & Sporting Goods*, Pyne Press: Princeton, NJ, 1975, which is a reproduction of the 1886 catalog for the firm of Peck & Snyder Sporting Goods of New York.

15. B. Gee, W. H. Brock, "The Case of John Joseph Griffin. From Artisan-Chemist and Author-Instructor to Business-Leader," *Ambix*, **1991**, *38*, 29-62.

16. J. J. Griffin, *Chemical Handicraft: A Classified and Descriptive Catalogue of Chemical Apparatus*, Griffin & Sons: London, 1866, pp. 403-426. The identical kits are offered in the 1877 edition.

17. J. J. Griffin, *Chemical Recreations: A Series of Amusing and Instructive Experiments*, Griffin & Co: Glasgow, 1824.

18. T. Griffiths, *Recreations in Chemistry*, Parker: London, 1850. Gee (reference 9) reports that Francis West also produced a booklet with the title *Chemical Recreations* to accompany his chemistry cabinets.

19. C. Cooper, *Witness Science: Matter*, Dorling Kindersley: New York, NY, 1992, p. 32.

20. Kingsley

21. B. Pike Jr., *Pike's Illustrated Descriptive Catalogue of Optical, Mathematical, and Philosophical Instruments*, Vol. 1, Pike: New York, NY, 1856, p. 384.

22. D. S. Jacoby, Ed., *The Amazing Catalog of the Esteemed Firm of George Hieronimus Bestelmeir*, Merrimack: New York, NY, 1971. Unfortunately this source reproduces only the illustrations and not the complete catalogs, so it is not possible to pinpoint the date for the selection of chemical apparatus within the time period (1793-1807) covered by the selection.

23. D. Natron, *Chemische Experimente zur belehrung und erheiternden Unterhaltung für Alle, die sich mit Chemie beschäftigen, besonders auch für die reifere Jugend*, Ricker: Giessen, 1859.

24. Anon., *Die junge Chemiker, Illustrierte Taschenbücher für die Jugend*, Union deutsche VA: Stuttgart, c. 1910.

25. Portraits are from the Oesper Collections in the History of Chemistry.