III

Three Centuries of the Chemistry Set

Part II: The 20th Century

1. 20th-Century Chemcraft Chemistry Sets

As we saw in Part I, in the 19th century chemistry sets were produced as a side-line by pharmacists, instrument makers, and laboratory supply houses (1). The hallmark of the 20th-century American chemistry set, on the other hand, is that its manufacture was largely dominated by toy and hobby companies – a fact which is coupled with a corresponding decline in both the quality of the apparatus and the selection of chemicals.

The earliest, and by far the most successful, 20th-century American chemistry set was the Chemcraft Chemistry Set, produced by the Porter Chemical Co. of Hagerstown, Maryland. Begun in 1914 by two brothers – John Jermain Porter (figures 1) and Harold Mitchell Porter (figure 2) – Porter Chemical produced its first chemistry set in 1916 (2, 3). Though John, who was already a well-established chemical engineer, provided the initial capital for the company, it was Harold who actually managed it and whose name became most closely associated with the chemistry sets. The company manufactured a wide variety of chemistry sets and related science toys until it was bought out by Gabriel Toys in 1969 and discontinued by Gabriel sometime in the 1980s (4).

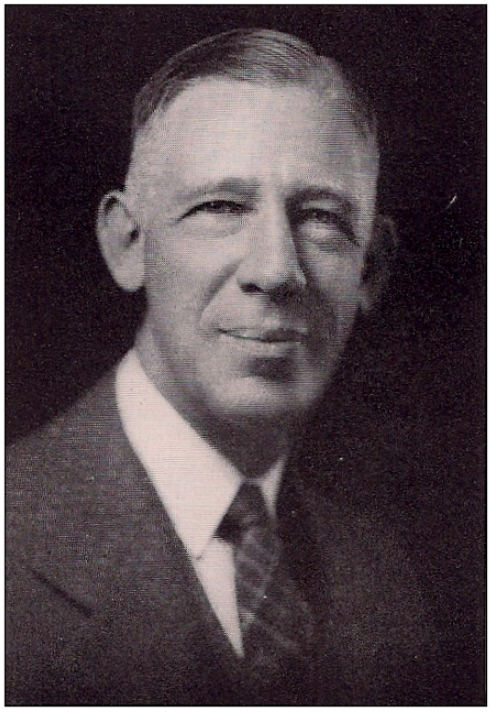


Figure 1. John Jermain Porter (1883-1956).

Figure 2. Harold Mitchell Porter (1893-1963).

Though the Oesper Collections do not own an example of a surviving Chemcraft set from the period 1916-1920, they do own a small set from the mid-1920s, as shown in figure 3. Likewise, figure 4 shows

Figure 3. A small Chemcraft chemistry set, circa 1925. (*Oesper Collections*)

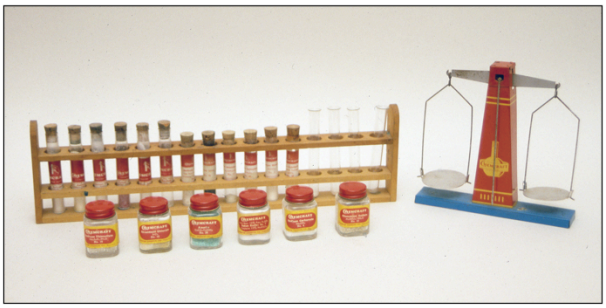


Figure 4. Fragments of a Chemcraft chemistry set, c. 1950s. (*Oesper Collections*)

some fragments of a Chemcraft set from the late 1950s, also from our collections, and figure 5 shows a period photograph of the actual assembly line in Hagerstown from roughly the same period.

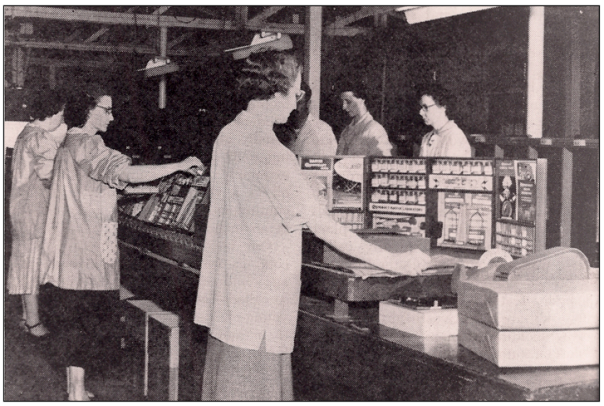


Figure 5. The assembly line at the Chemcraft factory in the late 1950s.

Figures 6 and 7 show the exterior and interior of a complete Chemcraft set from our collections dating from the mid 1960s and which was obviously manufactured sometime after the Porter Chemical Company's 1961 merger with the Lionel Train Company of New York. Note the emphasis on friendly uses of radioactivity as indicated by the booklet inside the left-hand panel and by the black, plastic spinthariscope standing next to the alcohol lamp in front of the center panel. This same emphasis is also apparent in the earlier advertisement from the 1950s in figure 8, showing a boy peering into a spinthariscope composed of a lens, a small radioactive source, and a zinc sulfide screen. This is obviously intended to be stored in the circular opening at the top of the center panel labelled "Atomic Energy" and is apparently connected with the packet in front of the boy labelled "Radioactive Screen." Can you imagine the paranoid parents of today allowing their children near anything radioactive – however benign? After all, we don't live in the age of

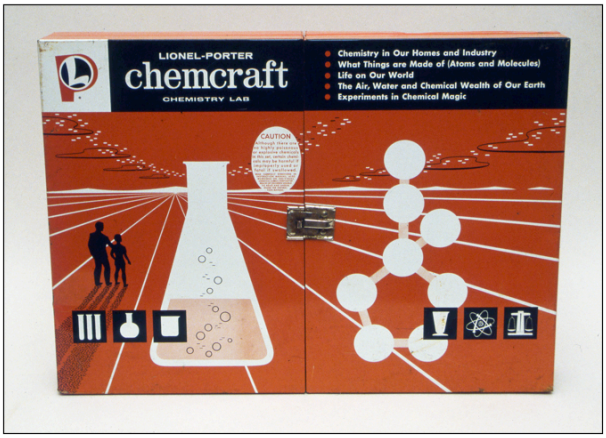


Figure 6. Exterior of a Lionel-Porter Chemcraft chemistry set, c. 1962. (*Oesper Collections*)

Figure 7. The interior of the Chemcraft set shown in figure 6. (*Oesper Collections*)

Figure 8. A Chemcraft advertisement from the period 1945-1955 showing a boy peering into a spinthariscope in order to observe the scintillations produced by the impact of the radioactive emissions on a ZnS screen.

Figure 9. A typical Chemcraft chemistry set from the mid 1970s. (*Oesper Collections*)

magnetic imaging rather than nuclear magnetic imaging for nothing.

Figure 9 shows a typical Chemcraft set from our collections dating from the mid-1970s, after the company was purchased by Gabriel Toys. Note the experiment by numbers approach on the plastic snap-top bottles and the baking soda-vinegar rocket on the far left – a far cry from the pyromania of the Kingsley Primus Magic Set mentioned in Part I.

Finally, figure 10 shows a recent and seriously flawed attempt to cash in on chemistry-set nostalgia in the form of a Madison Avenue reconstruction of a circa-1950s amateur chemist and his trusty Chemcraft Chemistry Set. Unhappily the date on the calendar in the background and the chemistry set in the foreground are out of phase by almost a decade and, to add insult to anachronism, the few bottles resting on the top of the Chemcraft chemistry set are actually from a Gilbert rather than a Chemcraft set.

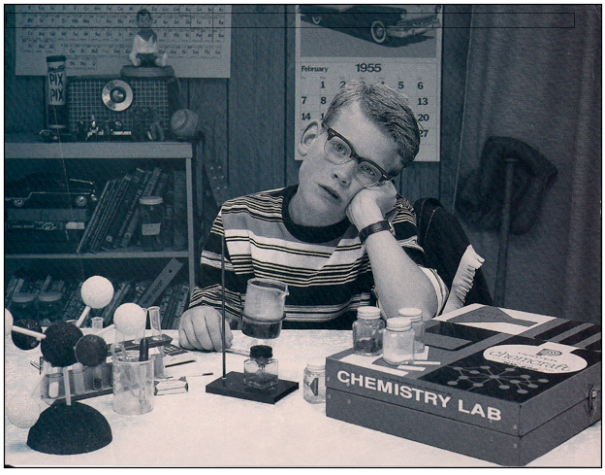


Figure 10. A modern retro-ad featuring a Chemcraft chemistry set

2. The Chemistry Club Rage

In addition to its chemistry sets, the Porter Chemical Co. also attempted to cash in on the Chemistry Club rage which swept through American schools after World War I, largely as a result of an intensive propaganda campaign conducted by the Chemical Foundation in an attempt to make Americans more aware of the economic importance of chemistry (5). This lesson had been brought home by the War itself, which had caught Americans off guard and revealed their almost total dependence on Germany for the importation of dyes, pharmaceuticals, and other fine organic chemicals.

With the purchase of a Chemcraft Set you could write to the company and become an official Chemcraft Chemist and member of the national Chemcraft Science Club (figure 11). Even more important, as the company repeatedly emphasized in its advertising, you could join with your friends and form your own local chapter.

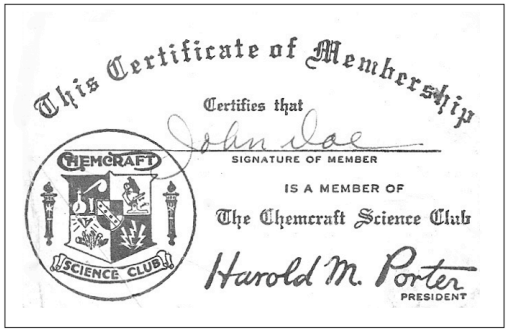


Figure 11. A membership card for the Chemcraft Science Club.

The company also published a magazine for the members of the Chemcraft Science Club called, quite naturally, *The Chemcraft Chemist*. This was largely a catalog of additional chemicals and equipment you could purchase to supplement your chemistry set – much of which, unlike the scaled-down toy versions in the set itself, corresponded to real professional apparatus. However, there were also short articles on recent advances in chemistry, a copy of the by-laws for the chemistry club, and occasional short stories by the members – mostly of the Tom Swift - Horatio Alger variety. Thus the issue from 1934, shown in figure 12,

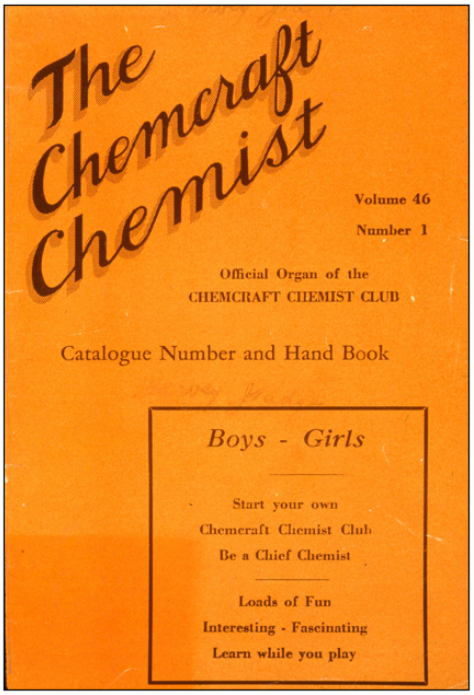


Figure 12. Cover of the issue 1 of the *Chemcraft Chemist* for 1934.

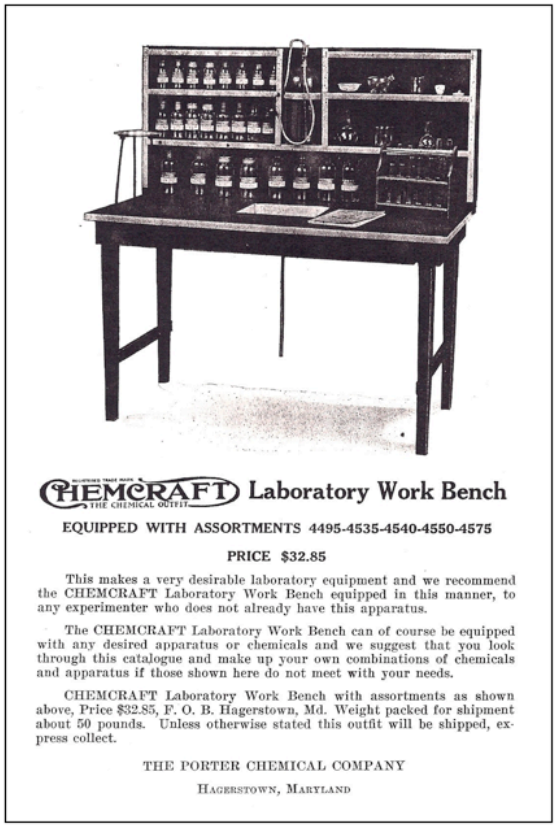


Figure 13. A complete home laboratory bench for the serious amateur sold by Chemcraft for only $32.85, c. 1937.

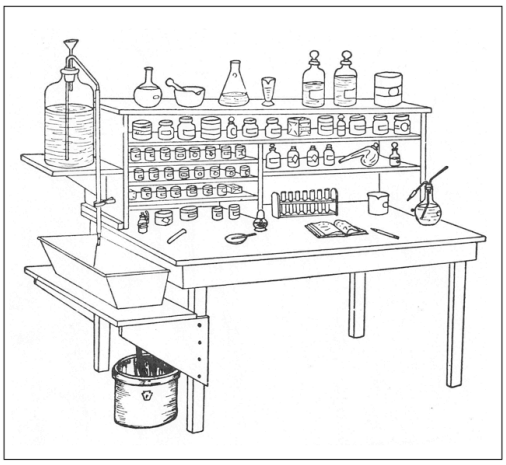


Figure 14. Amateur plans for a home laboratory, c. 1937.

contained articles on the chemistry of cloth and nitrogen and a story by Milton Burdick, reprinted from the 1921 issue, entitled "The Boy Chemist Life Saver."

One day the hero of the story happens to be walking down by the local railroad yard when he see a crowd gathered around an open boxcar. When he asks what is going on, he is told that two men were unloading tanks of chlorine gas when one of the tanks tipped over and the valve broke off, releasing chlorine into the car. Both men were now laying unconscious on the floor of the car and the crowd was unable to reach them because of the toxic fumes. However, the boy chemist life saver remembers from experiment 20 of his Chemcraft Chemistry Set that hypo or sodium thiosulfate absorbs chlorine. He dashes across the street to the drug store, which also happens to sell photographic chemicals, and yells, "Quick! A bag of hypo." He moistens this, claps it over his nose and

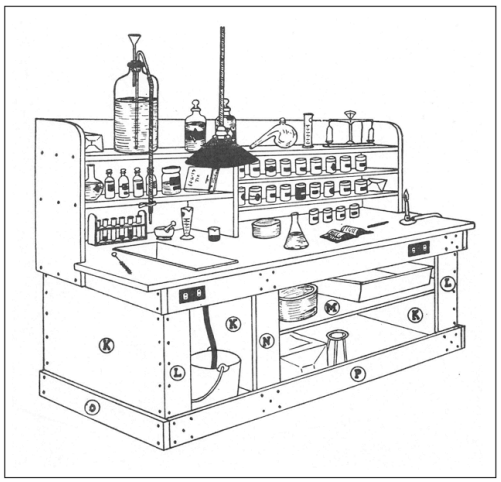


Figure 15. Amateur plans for a home laboratory, c. 1937.

mouth, and then leaps into the boxcar, where he succeeds in dragging both men to safety. And, as a reward for his heroism, the railroad company gives him – surprise, surprise! – a No. 25 Deluxe Chemcraft Set.

Chemcraft also offered various handbooks for its club members – again roughly 80% catalog and 20% information. Not only could you buy additional equipment and chemicals, you could also buy an entire laboratory (figure 13) complete with lab bench and sink, the latter having a rubber hose attached for drainage into a conveniently-placed waste crock. Or you could trade blueprints for building your own laboratory bench with fellow Chemcraft chemists throughout the country, as shown in the examples in figures 14 and 15, taken from the 1937 booklet *Chemcraft Glassblowing and the Construction of Laboratory Apparatus*.

3. Gender Issues

It has probably not escaped the attention of a sizable portion of the audience that there is a rather blatant sexual bias to all this advertising. You are admonished to become not just an "Amateur Chemist" but a "Boy Chemist." Books of popular chemistry experiments (figure 16) show parents contentedly watching their sons, but not their daughters, push back the frontiers of chemical knowledge in the middle of their very own living rooms. And what was conveyed implicitly in the cover illustration often appeared explicitly in the title (figure 17). However, if there was no Chemcraft for girls, there was at least – as advertised in figure 18 – Sachetcraft!

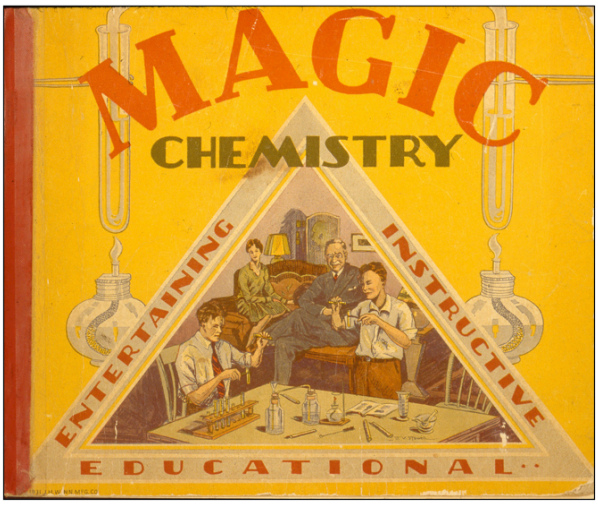
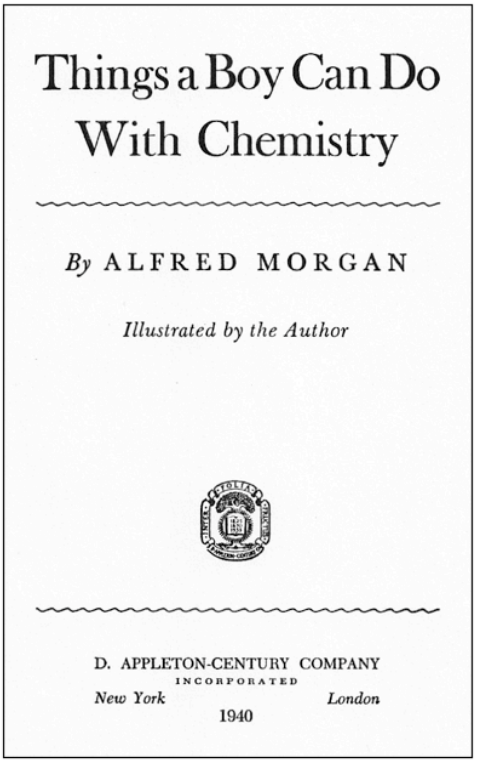


Figure 16. A popular book of chemistry experiments showing parents watching their sons perform chemical experiments in the living room, c. 1932.


Things a Boy Can Do With Chemistry

By ALFRED MORGAN

Illustrated by the Author

D. APPLETON-CENTURY COMPANY
INCORPORATED
New York *London*
1940

Figure 17. Chemistry for boys but not girls, c, 1940.

Of course, our trouble with all of this is just that – our trouble – and comes from projecting our current set of mores back to a time when they do not apply. You cannot – or rather you should not – rewrite or suppress history to suit your current biases. Instead you should try to understand how it is different from the present and why. The young women in the audience should come to understand just how recent are many of the changes in our society which affect them, and when they encounter a woman scientist in her late 60s and 70s, appreciate the enormous societal barrier which

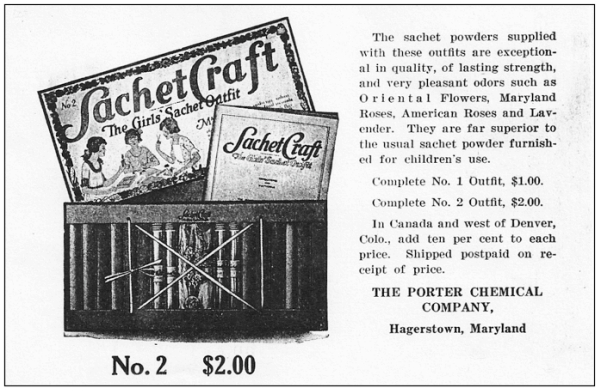


Figure 18. Chemcraft's alternative for girls - Sachetcraft, c. 1928.

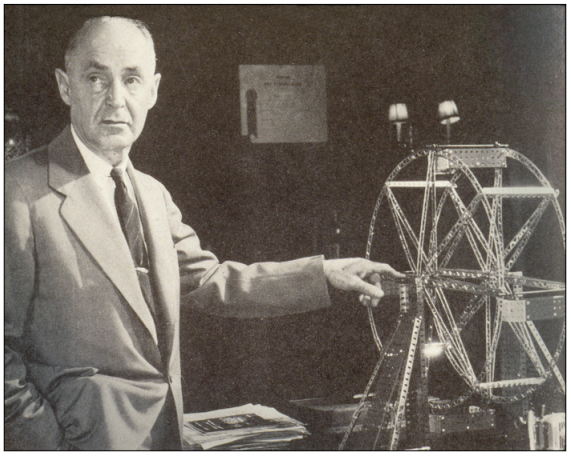


Figure 19. Albert Carlton Gilbert (1884-1961).

this woman had to overcome just to conceive of the idea of a career in science in the first place.

4. 20th-Century Gilbert Chemistry Sets

The second great line of 20th-century American chemistry sets was started by Albert Carlton Gilbert (figure 19). A graduate of Yale, Gilbert was a former Olympic Pole Vaulting champion whose hobby was magic. He began his manufacturing career in 1909 by producing Mysto Magic Sets. In 1913 he added the famous "Erector Construction Kits" to his growing line of hobby toys, and in 1917 also added a line of chemistry sets with a manual edited by Treat B. Johnson, his former chemistry teacher at Yale (6, 7). Like Chemcraft, Gilbert was bought out by Gabriel Toys in 1967 and its line of chemistry sets was discontinued (4).

Figures 20 and 21 show a very early Gilbert Set dating from the early 1920s. The heavy wooden box with brass handles is unusual for an American chemistry set. As with the early Chemcraft sets, the solid

Figure 20. The exterior of a Gilbert Chemistry Set, c. 1920.

Figure 21. Interior of the Gilbert set shown in figure 20.

chemicals came in either cylindrical wooden containers or corked glass vials.

Figure 22 shows a small Gilbert set in a cardboard box from our collections at Cincinnati which dates from the late 1930s or early 1940s. Since Chemcraft

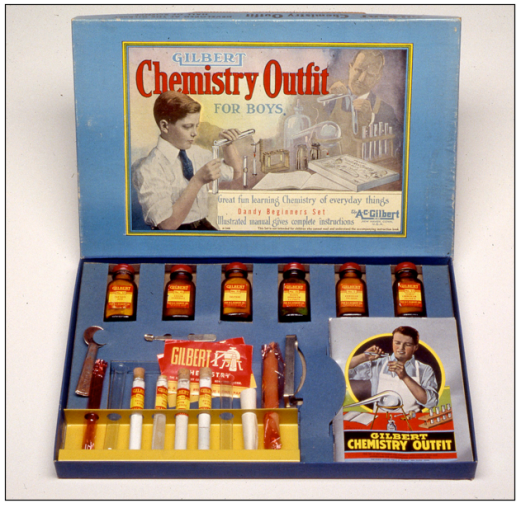


Figure 22. A small Gilbert Chemistry Set, c. 1938-1942. (*Oesper Collections*)

had used red as the signature color for it sets, Gilbert had, by this time, switched to blue for its signature color and had replaced the wooden containers with brown glass bottles. A similar switch from wood cylinders to glass bottles occurs at about the same time for the Chemcraft sets.

Figures 23 and 24 show the exterior and interior of a typical Gilbert set from the late 1950s or early 1960s – again from our collections at Cincinnati. By this time the wooden and cardboard boxes had been replaced by foldout metal boxes with the advertising stamped directly on the front, and the brown glass bot-

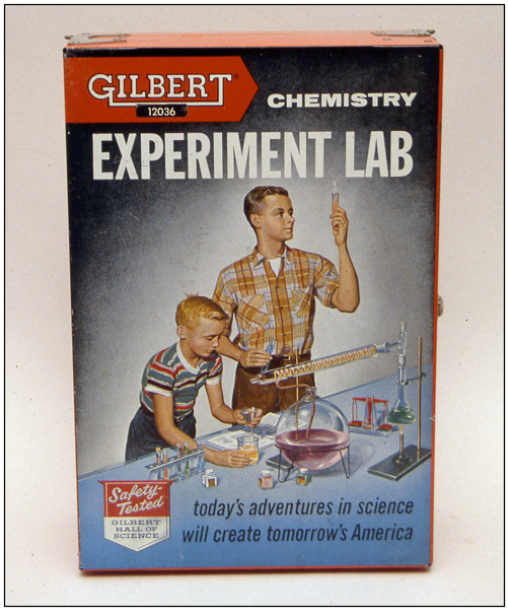


Figure 23. The exterior of a typical Gilbert chemistry set from the late 1950s or early 1960s. (*Oesper Collections*)

tles had been replaced by smaller square, clear-glass bottles. The molecular model kit shown in the upper corner of the right-hand panel really consisted of toy plastic beads which automatically placed all bonds in the same plane – i.e. carbon was square-planar – thus defeating the entire purpose of molecular models in the first place. In addition, 90% of the examples given in the booklet which went with the model kit consisted of models of nonexistent molecules for what were, in reality, nonmolecular solids – i.e. sodium chloride is represented as a diatomic molecule, sodium carbonate as a discrete hexatomic molecule, etc. - again all of them with a planar geometry.

Figure 24. Interior of the Gilbert set in figure 23. *(Oesper Collections)*

Figure 25. The Gilbert "Atomic Energy Lab" set, c. 1959. (*Oesper Collections*)

From these examples it is apparent that Chemcraft and Gilbert closely monitored one another's products and generally imitated one another. This is further illustrated by the fad in the late 1940s and 1950s concerning atomic energy and radioactivity. As we saw earlier, Chemcraft sets from this period contained pamphlets on this subject, as well as a small metal or plastic spinthariscope. Gilbert, however, went one better and actually offered an entire "Atomic Energy Laboratory" (figure 25) containing not only a spin-

Figure 26. The Gilbert cloud chamber in operation.

thariscope, but a crude Geiger counter and the means to assemble a complete cloud chamber, which is shown in operation in the advertisement in figure 26.

Though both Chemcraft and Gilbert produced a wide variety of science and hobby toys, the chemistry set remained the centerpiece of the Chemcraft line while the Erector Set remained the centerpiece of the Gilbert line. This difference in emphasis was reflected in the fact that, while the Chemcraft Science Clubs and the *Chemcraft Chemist* magazine focused on chemistry, the Gilbert equivalent – the Gilbert Institute of Engineering – focused on engineering and mechanics instead. Indeed, it even granted "degrees" to boys who had successfully completed a prescribed number of projects with their Erector sets, radio sets, etc.

During the 1920s Gilbert also sponsored a private "demonstration" train car which toured cities along the eastern sea board. Besides a complete display of Gilbert's educational toys, the car featured a live magician doing magic tricks with Mysto magic sets, an engineer explaining the construction and operation of moving models built with the Erector set, a person doing chemistry experiments with Gilbert chemistry sets, and a radio operator who received periodic broadcasts on his Gilbert crystal radio set supposedly beamed directly from Gilbert's headquarters in New Haven, though in reality they were being broadcasted from a closet located inside the car itself.

Figure 27. The Gilbert Train Car.

5. Other 20th-Century Chemistry Sets

There were, of course, other American companies besides Chemcraft and Gilbert that produced chemistry sets, though I have come upon few surviving examples. Thus the Lionel company, of electric train fame, produced a chemistry set in the 1940s and 1950s, but discontinued production after its acquisition of Chemcraft in 1961 (4). I have also come across stray bottles from the same period from a so-called "Handy Andy Chemistry Set."

Figure 28. A large Skilcraft Chemistry Set, c. 1975.
(Oesper Collections)

But perhaps the biggest competitor for Chemcraft and Gilbert, prior to their being swallowed by Gabriel Toys, was the Chicago-based Skilcraft Chemistry Set, which began production in 1963 (4). Figure 28 shows the interior of a typical example in our collections dating from the early 1970s. Note the total lack of any resemblance between the plastic containers and the equipment in this set and the corresponding items found in an actual chemical laboratory.

Figure 29 shows a Scottish-made chemistry set from the early 1980s manufactured by Thomas Salter Toys and Sports – again from our collections. This is, without a doubt, the best chemistry set I have seen in recent years and contains chemicals, such as potassium chromate, potassium permanganate, and zinc powder, that would no longer be allowed in American sets, as well as a much larger selection of apparatus – albeit still of the undersized toy variety.

And last, but not least, figure 30 shows a recent chemistry set purchased for our collections in downtown Cincinnati during the Xmas season of 1989 for

Figure 29. A Salter chemistry set from the 1980s
(Oesper Collections)

Figure 30. A recent chemistry set, c. 1989. *(Oesper Collections)*

$39.00. Note that there are very few chemicals, all of them in small plastic vials. Also note the plastic balance, the plastic test-tube racks, and the plastic safety glasses on the far right, whose effectiveness in an actual accident is dubious to say the least. In short, this is an expensive and pitiful ghost of its 19th century predecessors.

Figure 31. The "virtual" chemistry set of the future?

6. The Decline of the Chemistry Set

In 1970 50% of all science toys sold in the United States were chemistry sets (4). In 1990 we could find only one chemistry set for sale at the peak of the annual Christmas toy saturnalia. Why? One obvious reason is the growing obsession with so-called safety in our litigation-mad society, which makes the manufacture of chemistry sets a risky business, and which makes those that are produced increasingly boring.

However, a more important reason may be found in the advertisement shown in figure 31 – namely a major change in the public's image of what science is and how it is done, brought about by the advent of the home computer. More and more the public, not to mention many so-called chemical educators, are of the opinion that science can be done solely on a computer without actual experimentation, without any contact with real phenomena, without messy chemicals or stinks. As the ad says, "experiment on your own, without the worry of blowing up the house or dissolving yourself" – a parent's dream, no doubt, but I ask you, would there have been any point to wanting a chemistry set as a kid if there hadn't been the slim possibility of blowing up the house or dissolving yourself?

This change also permeates the image of science presented in movies and on television and is best illustrated by the Walt Disney movies "The Absent Minded Professor" and "The Son of Flubber." In the original movie versions which I saw as a kid, Fred McMurry creates his antigravity polymer using experimental chemistry – wonderful arrays of boiling flasks and distillation columns. In the recent television remake, on the other hand, flubber is created by a talking McIntosh Computer.

7. Acknowledgements

I've come to the end at last. This is the point in a normal seminar talk when the speaker shows a slide of his graduate students and thanks his funding agencies. I, alas, have only my mother to thank. And I do thank her for putting up with the stinks and bangs, the damaged sinks, and for not killing me on that January day in the middle of a freezing Wisconsin winter when we had to vacate the house because the family cat had broken a quart of formaldehyde in my basement lab (figure 32).

8. 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 32. The author in his basement laboratory, c. 1963.

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, I 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. D. Myles, R. F. Gould, Eds, *American Chemists and Chemical Engineers*, Vol. 2, Gould Books: Guilford, CT, 1994, pp. 226-229.

3. J. Tyler, *The Chemcraft Story: The Legacy of Harold Porter*, St. Johann Press: Haworth, NJ, 2003.

4. "Chemistry Sets Lead Science Toy Market," *Chem. Eng. News*, **1970**, *48*(14 Dec.), 22-24.

5. D. J. Rhees, "The Chemist's War: The Impact of World War I on the American Chemical Profession," *Bull. Hist. Chem.*, **1992-1993**, *13-14*, 40-47.

6. A. C. Gilbert, M. McClintock, *The Man Who Lives in Paradise*, Rinehardt: New York, NY, 1954.

7. B. Watson, *The Man Who Changed How Boys and Toys Were Made*, Viking: New York, NY, 2002.