Techniques and Innovations

Prussian Blue

It was the desire of the Royal Academy that the green colour which I observed during my experiments on arsenic might be made more generally known, together with the mode of preparation... I have found the colour useful both in oil and water painting and... it has not undergone the slightest alteration in the course of three years.


How does the search for a new color begin? It might begin with recognition of the need for improvement in a color source, material or technique, and the offer of a prize for that improvement. Or, an inventor might credit a less clearly-directed investigation as the source of inspiration, in which the new color was a by-product of the search for something else. Such narratives highlight the discoverer's recognition of society's needs and understanding of production techniques. Claims of accidental discoveries turned to advantage were a particularly common narrative in the invention of new colors during the eighteenth century. The Swedish chemist Carl Wilhelm Scheele explained development of the color called Scheele's green in this way. When announcing the invention, he stated that he came across the substance by accident while studying arsenic compounds. Scheele recognized the potential of this coloring material and refined the production process for several years before publishing a recipe and chemical description. Serendipity may have been a starting point, but the application of scientific principles was important to its further development.

One of the best examples of serendipity turned to advantage is the history of the coloring material Prussian blue. Accounts of its invention and subsequent development were familiar to readers of all interests, discussed along with descriptions of the process. Prussian blue—including its history—was both an intellectual and a practical model for several colormaking practices at the time. The story proved the close relationship between sciences and practices, and highlighted the opportunities each could provide the other.

As the chemist Georg Stahl told it, Prussian blue was the laboratory invention, initially accidental, of a Berlin-based colormaker and an alchemist. Retracing their steps when a process expected to yield Florentine lake, a red color, produced blue, they immediately recognized a value for their "mistake." Further experiment led them to offer the discovery as a pigment that was less expensive than ultramarine, more stable than copper-based blues, and more versatile than indigo. Prussian blue was an immediate success among painters and its composition was subject to considerable speculation. The recipe remained a secret until 1724, when it was published in the Philosophical Transactions. Once
available, instructions to make Prussian blue quickly spread throughout Europe and beyond. Prussian blue was described in public lectures on chemistry and the arts and was included in journals, compilations of practical instructions, dictionaries, and encyclopedias both specialized and general. Furnishing the pigment to colormen became a subspecialty of the color trades.

Le rouge de Prusse est une substance donnant un rouge imitant le vermillon, qui sert communément aux Peintres d'impression, à mettre les carreaux en rouge, & aux Peintres à talens, pour leurs tableaux. Il est plus beau, plus vif que le brun-rouge d'Angleterre: Selon les uns, c'est une terre calcinée; selon d'autres, dont je crois l'opinion fondée, c'est le colcothar ou caput mortuum des eaux fortes qu'on réduit en poudre fine, après avoir bien lavées.


Eighteenth-century descriptions and discussions give the impression of considerable interest in the chemical foundations of Prussian blue—how it was created and how to use that information to make the color less expensive, more predictable, less likely to turn green with time, easier to work. Other investigators explored its possibilities as a key to chemical combination for other painters' pigments. In the 1790s, Thomas Henry read a letter to the Manchester Literary and Philosophical Society, announcing the discovery of some colors similar to Prussian blue. Henry's chemical analysis of those new colors employed contemporary chemical language and techniques, but his description of the processes of discovery more closely resembles the story recounted by Stahl sixty years earlier. Other "Prussian" colors appeared, some involving production processes similar to that of Prussian blue, others merely relying on this designation to suggest a connection to this familiar and successful scientific novelty.

Interest in Prussian blue extended beyond its possibilities as a painters' pigment. In 1749, Pierre-Joseph Macquer deposited at the Paris Academy of Sciences a sealed envelope: This pli cachète was opened not long after and its contents, a mémoire by on the use of Prussian Blue as a dyestuff, was read to and subsequently published by the Academy. This episode suggests Macquer's concern that he be recognized as the inventor of this new dyestuff; there were other scientist with an interest in crossing the boundaries of techniques with this coloring material.

The use of Prussian blue for textile painting and printing and for such related tasks wallpaper-making was also a preoccupation of mid-century experimenters. Prussian blue was often the blue coloring material of eighteenth-century indiennes, as indigo was difficult to manipulate in these techniques. Few written documents exist to prove the extent of early use of Prussian blue on textiles, but evidence from objects suggests that it was neither rare nor the standard for silk, and that it was used somewhat less for wool cotton and linen. Later publication of prizewinning essays on Prussian blue as a dyestuff
furthered its use in this way and added to general understanding of textile
coloration. When blockades limited supplies of indigo, the French government
sponsored a reward for new or revived manufacturing methods to extract blue
colors from native woad and to locate improved processes to use Prussian blue for
textiles. Following the established pattern, the coloring processes for the
prizewinning samples were printed and distributed to appropriate manufacturers.

Prussian blue is an excellent example of a successful manufactured color and of
the successful adaptation of a coloring material to different uses. For consumers
of ideas and objects in the eighteenth century, its history confirmed that the
application of chemistry could improve practice. But the nature of Prussian blue
led to some commercial problems. As a manufactured color, Prussian blue, like
Naples yellow, Turner's yellow, and Scheele's green, involved materials and
production methods that crossed the traditional boundaries of several groups:
colormakers, apothecaries, drysalters, and manufacturing chemists. Production
rights were frequently in dispute. In France, sale of painters' materials was a
responsibility of the painters' guild (the Académie de St-Luc). Manufactured
colors, when they did not use traditional coloring materials or did not use them in
traditional ways, threatened this closely guarded right. In 1764, masters from the
Académie de St-Luc seized the Prussian-blue factory of sieurs Gly and d'Heure. The
owners turned to the Paris Academy of Sciences, asking for a determination
of the nature of Prussian blue. Gly and d'Heure argued that theirs was a chemical
factory with no connection to the art of painting, even though painters used their
product. Jean Hellot examined the problem on behalf of the Academy, and agreed
with the manufacturers. Prussian blue is a product of chemistry and should not be
controlled by the painters' guild. The factory in the faubourg Saint-Marcel was
allowed to reopen and continued to make Prussian blue through the next four
decades; theirs was often considered the best that was made in Paris.

In less than fifty years, the potential of an accident had been recognized,
extended, and recombined. As a well-known series of events, this accident offered
an endorsement of participation in scientific-based investigations into color,
investigations that highlighted serendipity directed toward specific goals of
improvement, broadly disseminated.

Notes:

Note 1: Carl Wilhelm Scheele, "Method of Preparing a New Green Colour. 1778," in The
Chemical Essays of Charles-William Scheele: Translated from the Transactions of the

206–11. See also Christoph Schümann, Der Anteil deutscher Apotheker an der
Entwicklung der technischen Chemie zwischen 1750 und 1850 (Frankfurt am Main, 1997), 230–37; Stefan Jacob, Chemische Vor-und Frühindustrie in Franken die vorindustrielle Produktion wichtiger chemikalien und die Anfänge der chemischen Industrie in fränkischen territorien des 17., 18. und frühen 19. Jahrhunderts (Düsseldorf, 1968), 189–90.

Note 3: Georg Stahl, Experimenta, Observationes, Animadversiones, CCC Numero Chymicae et Physicae (Berlin, 1731), 281.


Note 5: See, e.g., [Étienne-François] Geoffroy, "Observations sur la Preparacion de Bleu de Prusse ou Bleu de Berlin," in Mémoires de l’Académie royale des Sciences année 1725 (1727), 153–72. Peter Shaw’s Chemical Lectures . . . (1734), Dossie’s Handmaid to the Arts (1758; 2d ed., 1764), and Dictionnaire portatif des arts et métiers of Philippe Macquer (1766) are three other sources.


Note 8: "Nicholas Croiset entrepreneur d'un Manufacture de rouge appelée rouge de Prusse, en Pourain, petitioné pour un privilege exclusif de six ans. . ." (five documents), May–December 1777, AN F/12/1506 #4.


Note 10: "An Entire New Method of Manufacturing Paper for Hanging and Ornamenting of Rooms, and Other Purposes, and That the Same Will Be of Greate Use and Benefit to the Publick," English Patent No. 685 issued to Edward Deighton (2 September 1753); "Composition Called "British Smalts, or Powder Blue," English Patent no. 1562 issued to Thomas Simpson (10 October 1786).

Note 12: Documents concerning nineteenth-century efforts in France to improve Prussian blue for textiles can be found in AN F/12/2252.

Note 13: Description du procédé de M. Raymond, . . . pour teindre la soie avec le bleu de Prusse . . . , 1811, AN F/12/2252.


Note 15: Requête des directeurs de l'Académie de St-Luc à Paris concernant un arrêt du Parlement du 26 février 1760, à la bienfait de la communaute des épiciers . . . , 14 April 1760, AN F/12/103 #129.

Note 16: Mémoire lu par Hellot écrit par sieurs Gly et d'Heure concernant son bleu de Prusse, 6 and 9 February 1765, AdS pochette.