The Discovery of Phosphorous

Perhaps nothing better typifies the strange and often accidental nature of chemical science in its early days than a discovery made by a German named Hennig Brand in 1675. Brand became convinced that gold could somehow be distilled from human urine. The similarity of color between gold and urine seems to have been a factor in his conclusion. He assembled fifty buckets of human urine, which he kept for months in his cellar. By various processes, he converted the urine first into a noxious paste and then into a translucent waxy substance.

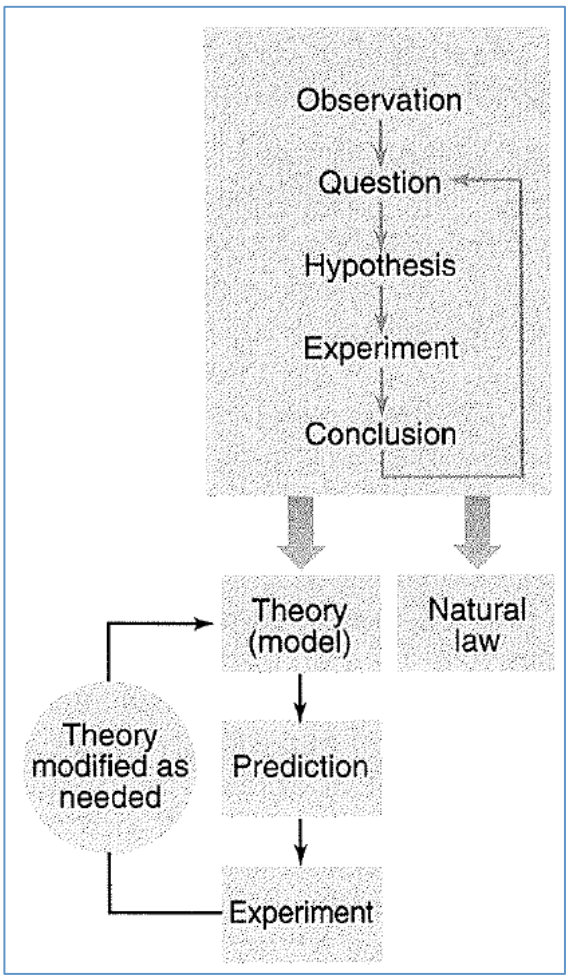
None of it yielded gold, of course, but a strange and interesting thing did happen. After a time, the substance began to glow. Moreover, when exposed to air, it often spontaneously burst into flame. The commercial potential for the stuff—which soon became known as phosphorus, from Greek and Latin roots meaning "light bearing"—was not lost on eager businesspeople, but the difficulties of manufacture made it too costly to exploit. An ounce of phosphorus retailed for six guineas—perhaps five hundred dollars in today's money—or more than gold. At first, soldiers were called on to provide the raw material, but such an arrangement was hardly conducive to industrial-scale production. In the 1750s a Swedish chemist named Karl Scheele devised a way to manufacture phosphorus in bulk without the slop or smell of urine. It was largely because of this mastery of phosphorus that Sweden became, and remains, a leading producer of matches.

Scheele was both an extraordinary and extraordinarily luckless fellow. A poor pharmacist with little in the way of advanced apparatus, he discovered eight elements—chlorine, fluorine, manganese, barium, molybdenum, tungsten, nitrogen, and oxygen—and got credit for none of them. In every case, his finds were either overlooked or made it into publication after someone else had made the same discovery independently. He also discovered many useful compounds, among them ammonia, glycerin, and tannic acid, and was the first to see the commercial potential of chlorine as a bleach—all breakthroughs that made other people extremely wealthy.

Scheele's one notable shortcoming was a curious insistence on tasting a little of everything he worked with, including such notoriously disagreeable substances as mercury, prussic acid (another of his discoveries), and hydrocyanic acid—a compound so famously poisonous that 150 years later Erwin Schrödinger chose it as his toxin of choice in a famous thought experiment Schrodinger's Cat. Scheele's

rashness eventually caught up with him. In 1786, aged just forty-three, he was found dead at his workbench surrounded by an array of toxic chemicals, any one of which could have accounted for the stunned and terminal look on his face.

Were the world just and Swedish-speaking, Scheele would have enjoyed universal acclaim. Instead credit has tended to lodge with more celebrated chemists, mostly from the English speaking world. Scheele discovered oxygen in 1772, but for various heartbreakingly complicated reasons could not get his paper published in a timely manner. Instead credit went to Joseph Priestley, who discovered the same element independently, but latterly, in the summer of 1774. Even more remarkable was Scheele's failure to receive credit for the discovery of chlorine. Nearly all textbooks still attribute chlorine's discovery to Humphrey Davy, who did indeed find it, but thirty-six years after Scheele had.



Discussion

1) How does the model of the scientific method distort how science actually works? Use an example from the story to support your idea.

2) How does the model of the scientific method accurately portray aspects of how science works? Use an example from the story to support your idea.

3) Do you think science is embedded in society and culture or is it absolute and objective? Use an example from the story to support your idea.