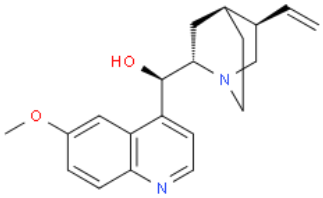
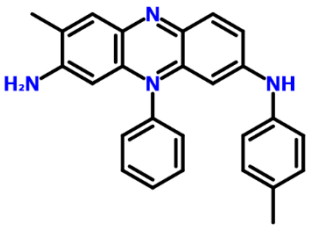
Stories of Science: William Perkin

The story about how the father of the synthetic organic chemical industry

William Perkin (1838-1907) was the youngest child of George and Sarah Perkin, and lived in London. He showed early talent for the sciences, and entered the Royal College of Chemistry in 1853 at only 15 years old. Chemistry in those days was a rather rather a hit and miss affair. While chemists knew about chemical elements and aspects of synthesis (making new substances) and analysis (working out what substances are made of), progress relied a lot on luck and persistance.



Perkin's mentor, von Hofmann, was attempting to synthesise quinine (left), a naturally occuring substance used to treat malaria. Malaria is a disease prevelant in tropical regions, causing flu like symptons and possible death. At the time, Britian controlled over a third of the world through the British Empire, including India and Burma, where malaria was endemic. Being able to synthesise quinine cheaply would find a ready market, and lead to significant profits.



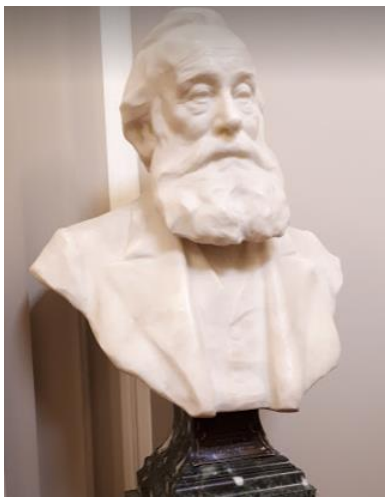
Perkin carried out a series of experiments, including reacting together substances such as aniline and tolidine. When he carried out a purification of one crude product, he discovered a purple substance that he called mauveine (right). Perkin tested the new substance as a dye for silk, and found it to be colour and light fast – i.e. it didn't wash out and was stable in light. Mauveine is a very intense dye – one gram of the substance makes up many litres of dying solution.

Perkin immediately saw a potentially lucrative commercial business. At the time, all dyes came from natural substances, and so were expensive and hard to produce. Perkin filed for a patent for his method for producing mauveine and sent samples to dye works. Commerical dyers expressed interest, so Perkin built a factory to produce mauveine dyes, working with his father and brothers.

Perkin had to work very hard to make a commerical success of his discovery. Building the factory, developing the machinary to mass-produce the substances, and promoting and distributing it to the dye houses meant many years of long working days. Perkin was also lucky. The major raw material for mauveine was coal-tar which was available in large quantities and cheaply. Similar colours to mauve were also popular with royalty in Britian and France, leading to high public demand.

Perkin also didn't stop at just one dye. He discovered many other similar dyes and chemical substances (mordants) to make the dyes fast to cotton, a cheaper material than silk.

Despite the commercial success of his factory, Perkin decided to sell up at 36 years old. With the profits, he effectively retired from the chemical industry he had started. He built a new home, called The Chestnuts, and returned to research. He became involved with the local church and raised his family. He maintained his connections with the Royal College of Chemistry, which went on to become a world leading university, Imperial College, London.



Perkin is honoured amongst chemists. The Perkin Medal is awarded annually in America for "innovation in applied chemistry resulting in outstanding commercial development". His bust is displayed at the London headquarters of the Royal Society of Chemistry, alongside other greats of Chemistry, including Sir Humphry Davy, John Dalton, and Michael Faraday.

Image sources: https://www.stockfreeimages.com/19196739/Pink-orchid.html; David Paterson. http://www.chemspider.com/Chemical-Structure.84989.html

Comprehension and Reflection Questions

1. What similarities are there between quinine and mauveine?
Discuss the elements involved and the types of bonding.

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2. Explain the factors that lead to Perkin's mauveine dye being such a commercial success.

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3. Discuss how important Perkin's family was in his development as a scientist and a businessman.

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4. How important do you think Perkin's contributions to society is? Imagine what life would be like without cheaply available dyes

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Extension Activities

Ideas for things to do next:

Read about the synthesis of quinine here - https://en.wikipedia.org/wiki/Quinine_total_synthesis.

How long was it between Perkin's attempt and the full synthesis? What factors inhibited Perkin's attempt from working?

Mordants and azo dyes: Read here about azo dyes, and why mordanting isn't required: https://www.britannica.com/science/azo-dye

Further Reading

Ideas for things to read next:
A full history of Perkin's work on dyes is available in 'Mauve' by Simon Garfield, Faber and Faber Ltd: London 2000, ISBN 9780571209170

A detailed examination of the historical synthesis of mauveine was published in Nature (2017) by Cova, Pias and de Melo (https://www.nature.com/articles/s41598-017-07239-z)