Feature

Some Unremembered Chemists

A series of articles that explores the lives and work of selected chemists who have made a significant contribution to the advancement of the discipline, the profession and well-being of mankind, yet who are little remembered.

John Mercer FRS, FCS, MPhS

Part I. The formative years

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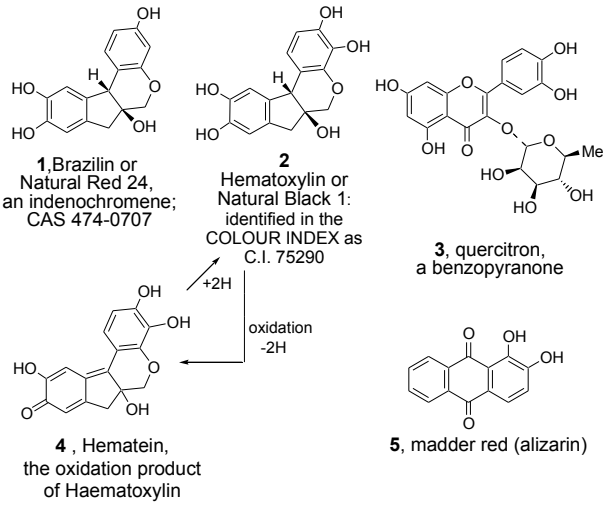
John Mercer (*http://commons.wikimedia.org/wiki/File:John_Mercer_(Chemist).jpeg*)

John Mercer was born on 21 February 1791 in the town of Great Harwood in Lancashire, England, the second son of a Lancashire cotton spinner.[1] At the time of his birth his father ran a cottage industry spinning mill by the side of Dean Brook, the stream that feeds the Clayton-le-Moors and Great Harwood reservoir. The advent of machinery and the formation of large cotton mills led his father to alter tack and he leased '*The Stoops Farm*' to the east of the small township off the road to Whalley. In 1799, there was a major crop failure in the district and the virulent epidemic that followed that claimed many lives, including that of John's father; he died on 7 August, 1802 when John was eleven years old. By then John was in his second year of work as a bobbin winder, subsequently to become a hand weaver. The family was very poor. John's mother, Betty, remarried in 1806, and he became half-brother to William, who was born that year. John lived with various relatives over the years. However, when John was 10 years old Mr Blenkinsop, a neighbour and pattern designer at the nearby Oakenshaw Print–Works in Clayton-le-Moors (where cotton calico[2] cloth was dyed) started to teach John to read and write and introduced him to long division in mathematics before he moved away.[3,4] John continued his education himself and gained a reputation as 'adept at figures';[3] he also became a self-taught musician and played several instruments and formed a choir and a band.[3] Later, John Lightfoot, who was the Excise surveyor at the same calico dye works (each square yard of printed calico was levied with threepence excise duty) and known to visit Harwood frequently, befriended John and taught him higher mathematics, teaching him with his own sons who were calico dyers at the works.[4,5] Mercer was a keen learner and soon became even more recognized for his aptitude with figures and the skill he had from his self-taught music. The wars of the era required John to join the militia, something that he found uncongenial as he was inept and too clumsy. He was put in the "awkward squad" that led to his nickname of *Awkward John*; subsequently, he was transferred to the band and music.[3]

On one occasion, when visiting his mother he saw his half-brother, William, seated on her knee and wearing an orange dress. That single vision changed his life forever as he decided that he should become a dyer. As quoted in the book by his nephew Edward Parnell,[3,4] John Mercer was "all on fire to learn dyeing", but he had had no instruction in the subject, no books, nor the means to obtain them. However, he found that the dyers of the area bought their supplies from a druggist in Blackburn, a larger town some eight kilometres away. He went there and asked for dyestuffs, but had no idea what it was he needed.

The druggist gave him the names of the common materials then in use: peach wood (*Caesalpinia echinata*) from a tropical tree with a prickly trunk and Brazil wood (another form of *Caesalpinia echinata*, which is a dense, orange-red heartwood that takes a high shine and is the premier wood used for making bows for stringed instruments), which yield the red pigment Brazilin known as Natural Red 24 (**1**); alum [potassium alum, the potassium double sulfate of aluminium often designated, $KAl(SO_4)_2\ 12(H_2O)$ but correctly $Al_2(SO_4)_3.K_2SO_4.24H_2O$], which when added to water clumps the negatively charged colloidal particles together into flocs; copperas [iron(II) sulfate, $FeSO_4\ 7H_2O$], which dissolves in water to give the the blue-green $[Fe(H_2O)_6]^{2+}$) complex; logwood (*Haematoxylum campechianum*) from which hematoxylin or Natural Black 1 (**2**) is extracted, and the oxidation product of which is hematein (**4**); and quercitron, the yellow natural dye (**3**) obtained from the bark of the Eastern Black Oak (*Quercus velutina*), a forest tree indigenous to North America.[6]

Mercer checked his money and found that he could afford to pay threepence for each dyestuff. He purchased the materials available. He was very fortunate in being allowed a suitable place to begin his experiments where he had the necessary equipment for his trials, which were carried out



Scheme 1

as rule-of-thumb experiments. Thus, it was by close observation and the maintenance of accurate records that he acquired considerable knowledge of the properties of the dyestuffs and the way in which to provide the colours used in dyeing then in vogue. Some mineral dyes such as Prussian blue, manganese bronze, chrome yellow, antimony orange, and iron buff pigments were fixed to cotton with the use of egg albumen or blood, but wheat gluten or milk lactarine (casein) were also used. Heat and acid were also needed to make them colourfast. Brazilin had been used since at least the Middle Ages to dye fabric, and in the formulation of inks as well. The specific color produced depends on the manner of preparation: in an acidic solution it is yellow, but in an alkaline preparation it is red. In contrast, alum was added to the water so that the negatively charged colloidal particles clump together into flocs.

By the age of 16 years Mercer was a hand-loom weaver and, following his experiments with the Blackburn dyes, he vowed to become a dyer and in this he was successful. He formed a business with a partner using the remnants from the Great Harwood loom weavers and gained success to the extent that his experiments with dyestuffs attracted the attention of the Fort brothers, the owners of the Oakenshaw Print Works. In September 1809, when he was 18 years of age, he was offered an apprenticeship in the colour-shop at the works.[3,4] However, the old foreman there felt threatened by John and offed him no useful information, giving him instead duties more becoming an unskilled labourer;[3] the foremen of colour-shops tended to keep their dyer's art a secret and their mixes empirical.

By 1810, Napoleon's decrees on trade (1793-1810) had reached the point where all printed calico and other British manufactured goods arriving in France were burnt and no more were permitted to be imported. The impact of this at the Oakenshaw site was so severe that the owners offered for surrender their apprentice indentures to those who chose to leave. So it was that after ten months of apprenticeship John Mercer accepted the offer and returned to the hand loom.

At about this time John gained lodging with the Wolstenholme family and stayed with them for some time. In 1813 he converted to "the truth of Christian religion", and had resumed work as a dyer as well as weaving and again he was successful. However, it was not until 1814 that he was able to gain more chemical knowledge. By then he had become engaged to Mary Wolstenholme, some six years his senior, and described as "a very superior woman".[3] A licence to marry could not be obtained in Great Harwood but required attendance at the office in Blackburn and, whilst there, John visited a second-hand bookstall on the market where, it appears, he devoted more attention to securing *The Chemical Pocket Book* or *Memoranda Chemica: arranged in a Compendium of Chemistry* (James Parkinson, 3rd edn., 1803) than to gaining the marriage licence. This was not his first chemistry book as John Lightfoot had presented him[3] with a copy of the 1787 *The Table of New Nomenclature* proposed by De Morveau, Lavoisier, Bertholet, and De Fourcroy. However, on its own the *Table* was of little help. The Parkinson book, however, opened up a new world, especially when coupled with the *Table*. From his earliest experiments, John adopted the view that that is was only through a thorough knowledge of the properties of the dyeing materials and their behaviour under a variety of conditions that the operation of the dyer could be performed intelligently. The books convinced him that all this knowledge depended upon chemical science and that it was on chemistry that the extension of his art rested.

John Mercer married Mary Wolstenholme on 17 April, 1814 and their first child, Mary Mercer, was born on 27 November that year, but survived a mere 17 days. It was not until 1817 that his second child, Mary Clayton Mercer, was born; she was the first of a further five children (three girls and two boys), none of whom married. John continued in his chemical quest and his first major discovery came in 1817. It related to the orange coloured clothes that he had seen his step-brother wearing.

Given the short account of 'the sulphide of antimony' in the chemical pocket book, Mercer performed a series of experiments and then tested his resultant formulations on calicos available. The results gave rise to his "antimony range" of dyed calico. He found that the alkaline sulfantimonates (salts of the hypothetical sulfantimonic acid, H_3SbS_4) provided an excellent medium to give a bright orange colour on calico – he fixed antimony sulfide (Sb_2S) to produce orange calico prints, something that had previously been unattainable. At that time, orange colours were provided from mixes of quercitron yellow (**3**, Scheme 1) and madder red (**5**), but Mercer's antimony orange more appropriately supplied the need. Moreover, it was capable of combination and interspersion to give a good variety of styles unlike the madder-quercitron combination.

Mr Lightfoot advised John to make his discovery known and available to Hargreaves, Dugdale and Co., the proprietors of the Broad Oak works in Accrington, which he did. On his way to Accrington to provide the necessary instruction to Mr Hargreaves' dyers he happened to meet Mr. John Fort, his former employer at the Oakenshaw works. Fort had heard of the Mercer "antimony orange range" and took the opportunity to offer him the job of experimental chemist at his works at an initial salary of 30s ($NZ3) per week,[3] something that Mr Hargreaves had omitted to do. This led to Mercer being re-employed by the Fort brothers,

by then 1818, when formally he became a chemist in the colour shop. His successes were such that he was offered and accepted a partnership in the company in 1825, and he remained associated with the firm until its dissolution in 1848, at which time he elected to retire, by then a rich and famous man.

.... to be continued.

References and Notes

1. Lancashire Lantern: *Lancashire Pioneers*: www.lancashirepioneers.com (accessed Dec 2012).
2. Calico is a plain-woven textile made from unbleached, and often not fully processed, cotton.
3. *The Life and Labours of John Mercer, F.R.S*, E.A. Parnell, London: Longmans Green, 1886, xiv, pp.342.
4. The Palissy of Calico-Printing, a review of Parnell's book by T.E. Thorpe, *Nature*, **1866**, *35*, 145-14.
5. *The Oxford Dictionary of National Biography: John Mercer*; see: www.oxforddnb.com/view/article/18573?docPos=3 (accessed Dec 2012).
6. Lancashire Lantern: *Lancashire Pioneers*: www.lancashirepioneers.com (accessed Dec 2012).