MAUVE AND ITS ANNIVERSARIES*

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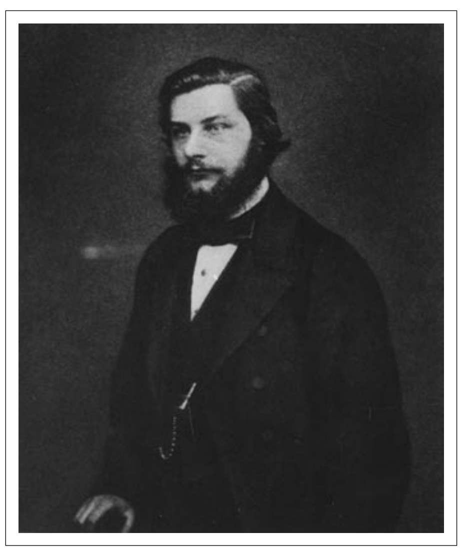
Introduction

In 1856, William Henry Perkin in London prepared the first aniline dye, later known as mauve. The eighteen-year-old inventor sought, but failed, to find a licensee for his process, and then embarked on manufacture, with the backing of his father and a brother. The opening of their factory and the sudden demand for mauve in 1859 foreshadowed the growth of the modern organic chemical industry. The search throughout Europe for novel colorants made scientific reputations and transformed the way in which research was conducted, in both academic and industrial laboratories. Accordingly, the sesquicentennial of mauve provides an opportune moment to review the early years of what became the first science-based industry and examine how its foundation has been celebrated through commemorative events in 1906, 1956, and 2006.



William Henry Perkin (1838-1907), in 1860. Heinrich Caro (1834-1910), technical leader at BASF, 1868-1889.

Background of Mauve

The story of aromatic amines begins at the Giessen laboratory of Justus Liebig, who in the 1830s investigated the chemical constitution of the natural dye indigo, as well as other natural products. Of particular interest, however, were the components of, and possible uses for, the vast amount of coal-tar waste available from coal-gas works and distilleries. Around 1837, Liebig's assistant A. Wilhelm Hofmann extracted several nitrogen-containing oils from coal tar and showed that of these bases the one present in greatest abundance was identical with a product earlier obtained from indigo as well as from other sources. It was soon known as aniline.

In 1845 Hofmann moved to London to head the new Royal College of Chemistry (RCC). There he continued his studies into aniline and its reactions. At that time, there were no modern structural formulae to guide chemists, only so-called type formulae. These indicated chemical constitutions and were used as a system of classification. The related derivatives were drawn by stepwise replacement of hydrogens. Hofmann extended this to organic bases in general, by comparing aniline with ammonia. He suggested that the three hydrogens of ammonia could be replaced to give primary, secondary and tertiary amines, respectively. From this he developed what in 1850 he would call the ammonia type theory. It was now possible to classify organic bases using a formula, that, as with the other type formulae, separated one atom, in this case nitrogen, with a bracket from other atoms and groups of atoms. Thus aniline was an ammonia derivative in which one hydrogen was replaced by what we now call an aryl group. This was the state of knowledge in 1853 when William Henry Perkin (1838-1907) entered the RCC. Within two years, Perkin was undertaking chemical research and was appointed honorary assistant to Hofmann. In a laboratory set up at his home, Perkin undertook, with fellow student Arthur H. Church, further experimental work.

A. Wilhelm Hofmann and students, Royal College of Chemistry, around 1855. William Henry Perkin is in the back row, fifth from right.

Mauve: The Discovery

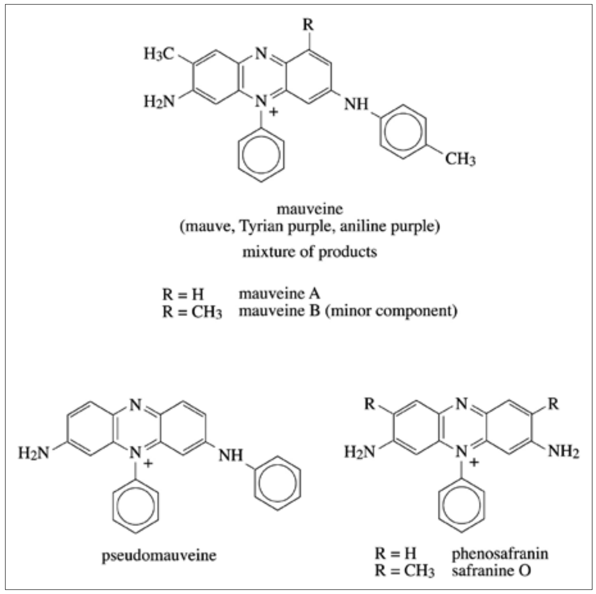
Hofmann introduced to the RCC a new method for reducing nitrobenzene to aniline, based on the use of iron and glacial acetic acid as the source of reducing hydrogen, as described by André Béchamp in 1854. It was put to good use by several of Hofmann's students, including Perkin, whose interest in aromatic amines enabled him to create the first successful synthetic dye from aniline. This arose from interest in a synthetic quinine, much needed to control malaria among the British colonists. Hofmann had reasoned that quinine might be synthesized from coal-tar naphthalene. Perkin decided, instead, to start with the aromatic amino compound allyltoluidine, through oxidative condensation. The reaction, undertaken at home during the 1856 Easter vacation, failed. However, he wisely decided to repeat the experiment using aniline, the simplest aromatic amine. The result of treating it with dichromate was a mixture from which an alcoholic extract colored silk a brilliant purple that could not be removed by washing or exposure to sunlight. Perkin quickly recognised the potential as a dyestuff for fabrics. Samples were sent to the prominent dyer John Pullar & Sons, of Perth, Scotland, from where Robert Pullar, the son of the founder, wrote on June 12, 1856 (1):

> If your discovery does not make the goods too expensive it is decidedly one of the most valuable that has come out for a very long time, this colour is one which has been much wanted in all classes of goods and could not be had fast on Silk, and only at great expense on cotton yarns.

By all accounts, purple was the supreme color of fashion in the high street just after the mid-1850s. The newer products, the semi-synthetic murexide and archil-derived French purple, were heralded as sensations in both the fashion world and scientific circles, even though the former colorant was not well suited to city atmospheres, and the latter was monopolized by a firm in France. These disadvantages would contribute to the success of the outstanding purple made from the waste of the coal-gas industry.

From late in 1858, the aniline purple was employed in calico or cotton printing, particularly in France. This was far more important than silk dyeing, but required the development of novel mordants (fixing agents), based on albumen or lactarine, as originally devised by Perkin and Pullar. Unlike the French, the British calico printers showed considerable resistance to the introduction of the aniline dye. Only after Perkin visited their factories and instructed them in the use of his colorant, at first named Tyrian purple, and its applications, was it quite generally adopted. By early 1859, it was gaining in popularity with the printers in Lancashire and Scotland. This enabled the aniline-derived colorant to become the main, if not overwhelming, color of fashion among the ladies of Britain and France. The English gave the aniline purple a new name, mauve. Perkin in 1863 called the major component mauveine. Its correct structure was established only in 1994 (2) (*See box*).

In 1859 an aniline red was discovered, also by treating aniline with an oxidizing agent. The preferred reagent was arsenic acid. The red colorant was known as fuchsine in France and magenta in England; and, following his

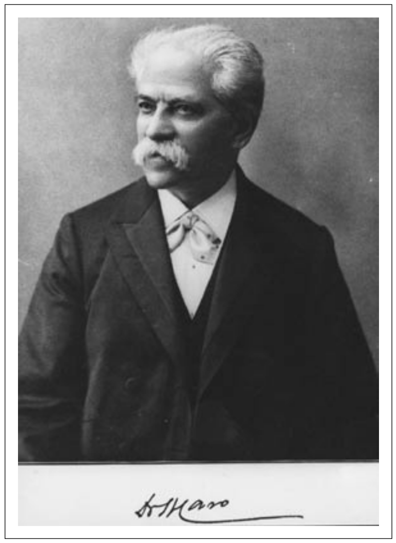


Structures for Mauveine A and Mauveine B.

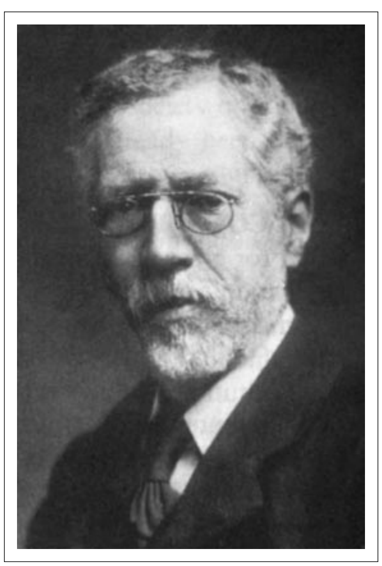
In 1863, Perkin gave his purple colorant a more scientific name, mauveine. He subsequently demonstrated that it consisted of a major and a minor component. Perkin established that the commercial dye was produced from a mixture of starting aromatic amines, and identified the major product as a derivative of *p*-toluidine and aniline. The minor component, according to Perkin, was from *o*-toluidine and aniline. The product from aniline alone he called pseudomauveine. Its structure was established by Otto Fischer and Eduard Hepp (1888, 1892, 1893), and by Rudolf Nietzki (1896). Remarkably, the early published structures for mauveine were not questioned until around 1990, when samples prepared according to Perkin's original recipe, perhaps dating from around 1906, were analyzed and shown to consist of what are now known as mauveine A (major component) and mauveine B (minor component), both derived from aniline, o- and p-toluidines. Otto Meth-Cohn and Mandy Smith published their structures, methylated homologs of pseudomauveine, based on comparisons with safranine and safranin O, in 1994 (Ref. 2) . However, more recent studies by Micaela Sousa, M. J. Melo, A. J. Parola, and J. Seixas de Melo, in Portugal, in collaboration with Peter Morris at the London Science Museum, and Henry Rzepa at Imperial College, have led to the identification of at least one more component. Their investigations should enable further unravelling of the mystery of exactly what was the composition of Perkin's original mauve, and of the blue and red varieties that he and Heinrich Caro independently developed.

academic studies at the RCC, Hofmann gave its free base the scientific name rosaniline. The colorant-forming reaction worked because toluidines were present in the commercial aniline. In 1861, aniline red was converted into aniline blue; and in May 1863, Hofmann, working by analogy, transformed the red into violet dyes soon known as Hofmann's violets. In the meantime an aniline black colorant was isolated from the residue of a mauve reaction developed by the German colorist and chemical inventor Heinrich Caro, who worked in Manchester during 1859-1866.

At first the synthetic dye industry was based mainly in England and France, though the new discoveries were quickly copied in Germany and Switzerland. The outcomes of patent litigation in London and Paris led to the decline of the British and French industries, and, because of the absence of a comprehensive patent system in the German states, assisted the growth of the German dye industry (3). Patent suits and environmental difficulties did, however, encourage new ways of making aniline dyes. Thus from 1866, the hydrogen atoms of the amino group in aniline were replaced in industrial processes by alkylation and phenylation to provide intermediates, the *N*-alkylated and *N*-phenylated anilines, respectively, that were to become important in dye manufacture. They enabled the circumvention of patent monopolies, since they could be converted directly into violets and blues, respectively. The processes also avoided the use of toxic arsenic acid to prepare aniline red, the original intermediate from which the blues and violets were obtained. Severe environmental problems arising from the use of arsenic acid brought about its replacement by nitrobenzene, which led to the discovery of the black colorant called nigrosine. John Lightfoot developed a process whereby a black was printed on cotton by applying aniline to the rollers of printing machines. Another aniline black was Frederick Crace-Calvert's emeraldine, which though a poor colorant is the basis of modern polyaniline chemistry.



From 1865, the industry that had originated in England and flourished for a time in France moved to Germany. The eventual leader was Badische Anilin & Soda-Fabrik, better known as BASF, founded in 1865 in Mannheim to manufacture aniline red and its derivatives, as well as other coal-tar dyes. Heinrich Caro had returned to Germany from England at the end of 1866 and acted as a consultant to BASF, before joining that firm in the fall of 1868. It had relocated to Ludwigshafen, on the west bank of the River Rhine, and the river served as both a waste sink and a means of transport for raw materials and finished products. Early in 1869, Caro became involved in industrialization of a process for synthetic alizarin, the commercially important colorant obtained from the root of the madder plant. The starting point was coal-tar anthracene, which was converted into anthraquinone, followed by sulfonation, then fusion with alkali under pressure to afford alizarin, as well as various coproducts, some that also became commercial dyes. Perkin independently discovered an almost identical process. Caro and co-inventors Carl Graebe and Carl Liebermann, who made good use of the Kekulé benzene ring theory in their studies on alizarin, filed a patent in London in June 1869, as did Perkin (4).



Raphael Meldola (1849-1915), president of the Chemical Society, and organiser of the 1906 mauve jubilee events in London.

During the mid-1870s, Caro developed azo dyes, such as chrysoidine, and similar products he had worked with in Manchester, such as Bismarck brown and induline. These were based on coal-tar derived amino compounds. German chemists established the constitutions and structures of many of these compounds, including, in 1878, the aniline red. The latter was found to be a derivative of triphenylmethane, and once this was known numerous new products became possible, most of them invariably protected by the new German patent law of 1877. The *N*-substituted anilines became important intermediates in the manufacture of both triarylmethane and azo dyes, which also expanded with the industrial availability of naphthylamines. In 1884 azo dyes based on the aromatic intermediate benzidine and its congeners were invented. These were the first synthetic dyes that adhered to fabrics without the need for a mordant. For this reason they were known as direct or substantive dyes.

Caro also introduced the industrial research laboratory as a formal business unit at BASF. Academic consultants, particularly Adolf Baeyer, played important roles as inventors for BASF and other German firms. Early collaboration between Caro and Baeyer led to the elucidation of the structure of alizarin (1874), and their joint interests in indigo enabled Baeyer to draw its structure in 1883. At the end of the 1880s, Caro oversaw the construction of a central research laboratory at Ludwigshafen, dedicated to research and development, and the important protection of BASF patents.

In 1897 BASF and Hoechst in Germany were the first firms to manufacture synthetic indigo. Four years later, René Bohn at BASF applied the indigo reaction conditions to an anthraquinone derivative and discovered the first of the anthraquinone (more correctly anthraquinonoid) vat dyes, also known as indanthrene dyes. The market for these relatively expensive vat dyes, noted for their resistance to fading under strong sunlight, was far greater in the United States than in Europe.

Toward the end of the 19th century, the German dye industry had embarked on diversification based on its coal-tar intermediates. These became important medicinal products, including Bayer's aspirin, which was made from the intermediate salicylic acid. Dyes were also used as models for products that attacked sites of infection within the body. By the turn of the 20th century, the dye industry, under German leadership, was acknowledged to be the leading science-based industry (5).

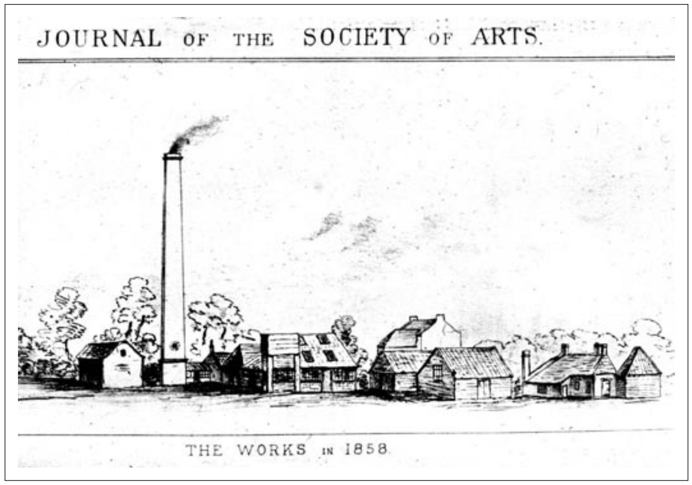
The banquet held on July 26, 1906 at the Hotel Mètropole, London, in connection with the jubilee celebrations for the discovery of mauve by William Henry Perkin. Standing at the top table are Perkin (with beard) and next to him Raphael Meldola.
M56Announcement for the Perkin Centenary Celebration, held in London during May 1956. Reginal Schoental Archive, Edelstein Center.

Anniversaries for Mauve 1906

In 1906 the importance of Perkin's discovery, particularly its far-reaching consequences, was widely acknowledged, with major commemorative events held in London and the United States. The leading figure in the organization of the jubilee events in London, called an international gathering, was Professor Raphael Meldola, president of the Chemical Society. It is interesting to consider for a moment how this came about. Though a great deal of archival material survives, it is not clear when the decision was made. The records of the Chemical Society are not very illuminating. We do know, however, that in February, 1906 various prominent and distinguished persons met in London and agreed that the occasion was worthy of celebration (6). However, well before that date, Meldola was already preparing the ground.

Raphael Meldola, dye chemist, educator, and lobbyist for science, was the grandson of a leader of the Sephardic Jewish community in London and well connected in English society (7). His many acquaintances were the elite of accomplished Englishmen and dominated the sciences and arts. They included Charles Darwin, the writer Israel Zangwill, the artist Solomon J. Solomon, and William Henry Perkin. He was also on friendly terms with leading chemists elsewhere in Europe, particularly Heinrich Caro, who had retired from BASF at the end of 1889 (8). What is relevant here, at least from the perspective of celebration, is that Meldola was an active member of the Maccabaeans, a British Jewish society of professional men founded in 1891 to engage in philanthropic and cultural activities. Meldola was the only prominent professional scientist.

On December 16, 1905, at Meldola's instigation, the Maccabaeans hosted in London a remarkable event, a "Science Dinner" to which several leading non-Jewish scientists were invited. The almost two hundred guests included the chemists William Henry Perkin, Sir Henry Roscoe, Sir William Ramsay, Sir William Crookes, Professor Henry Edward Armstrong, and representatives of other areas of science, as well as the Chief Rabbi, and the Archdeacon of London, Canon Samuel Augustus Barnett (9). Toasts were drunk to "Science Institutions" and "Pure Science," and, among the various responses, Roscoe advised the audience that "Scientific men of the Jewish race had recently distinguished themselves in the world of Chemical Science (10)." He was, no doubt, referring to an illustrious cohort of German industrial and academic inventors that included Heinrich Caro, Adolf von Baeyer, and Carl Liebermann, all of whom had contributed to the emergence of the German dye industry. A few months earlier, Baeyer had received the Nobel Prize for his achievements in coal-tar color chemistry.



The factory of Perkin & Sons, at Greenford Green, northwest of London, in 1858. From a sketch by William Henry Perkin.

Meldola's gathering, a grand celebration of science, included representatives of the press, which meant extensive media coverage. Its success enabled Meldola over the following weeks to garner strong support for the coal-tar dye jubilee celebrations, aided by the fact that he possessed the gift of persuading those involved in pure and industrial science and affairs of commerce that it would be a memorable occasion. In this endeavor, he was soon corresponding with colleagues abroad, particularly Heinrich Caro, who was placed in charge of the German contingent. It was Caro who in a new year's card reminded Perkin that 1906 was the jubilee year for mauve. Within a few weeks Perkin was advised that proposals for the jubilee celebrations had been adopted.

On July 26, 1906, the English and foreign guests participated in the formal mauve proceedings, held in the theater at the Royal Institution, in London, and chaired by Meldola, who, along with many other gentlemen, wore a mauve necktie. Several wives of participants were dressed in mauve. Meldola, with due ceremony, unveiled a portrait by Arthur Stockdale Cope of the newly knighted Sir William Henry Perkin. Then greetings were read out from representatives of science and industry: Caro, on behalf of the German chemical industry association, presented a short address of congratulation to Perkin; Lord Kelvin, on behalf of the Royal Society, and others, also offered recitals of congratulation. Leo Baekeland, inventor of the new polymer bakelite, spoke for the United States. Meldola read out cablegram greetings received from all over the world, including from the American Perkin Committee, represented by Charles Frederick Chandler of Columbia University; Hugo Schweitzer, of the Continental Color and Chemical Co., agent for German dyes; Adolf von Baeyer, in Munich; Otto N. Witt, in Milan; Carl A. von Martius, who had worked with Hofmann in London and Caro in Manchester, and co-founded in 1867 the forerunner of AGFA; and Rufus Pullar, of the dyer in Perth that had first encouraged Perkin in 1856 (11). Scientific addresses were given by August Bernthsen, of BASF, and Carl Liebermann, of the Technische Hochschule, Berlin. The praises and addresses of congratulation to Sir William Henry Perkin included presentation to him by Emil Fischer of the Hofmann Medal (12).

In the evening a "large and distinguished company" of around two hundred gentlemen, including representatives of the press, attended a banquet held at the Hotel Métropole. Caro, the acknowledged most inventive genius in the realm of industrial organic chemistry, was among the guests of honour, sitting at the top table, close to Perkin and Meldola. Meldola, the master of ceremonies, proposed a toast to The Coal-Tar Colour Industry. (When Perkin lifted his glass it is not recorded what he drank, since he abstained from alcohol.) Roscoe saluted the foreign guests, particularly Caro (13).

The following day, the former Perkin works at Greenford Green, northwest of London, was visited by around 150 participants. Its total dereliction must have driven one point home more vividly than many of the speeches: in the first decade of the 20th century the chemical might of Germany was invincible. Maybe the visit appealed to Meldola through another of his great interests, namely, ancient monuments.

For Meldola and other English chemists, no doubt, Perkin fulfilled a deeply felt need to have at least one outstanding British hero from the glorious era of that new frontier, research-based industrial chemistry. This was particularly relevant in 1906, when the successor to Perkin's company, once Meldola's employer, collapsed. The British dye industry, it seemed, was in disarray, relying mainly on the struggling Holliday firm in Huddersfield, Levinstein, founded by the German immigrant Ivan Levinstein in the 1860s, and Clayton Aniline, established by Alsation chemist Charles Dreyfus in the 1870s, both in Manchester. The mauve jubilee at least had some morale-boosting publicity value, even if it did not beget any profound improvement. It was an occasion for retrospect, with newspaper and journal reports often dominated by opinions on why the British dye industry had declined.

In October 1906 William Perkin, having "braved the perils of a long ocean voyage," was hosted by American chemists and industrialists, first by 400 at Delmonico's restaurant, in New York, "a banquet of unusual proportions and completeness of detail," that included "Saddle of Lamb Aromatic" and "Brussels sprouts with Chestnuts." Prominent among the organizers of the event were, in addition to Schweitzer, US agents for German dye firms (14). A medal was founded "bearing Perkin's name to be annually awarded to an American chemist (15)." William Perkin received the first gold impression. Then he went to Boston, where as Louis A. Olney later remembered, "we planned to outdo New York in our entertainment and celebration (16)." From Boston, Perkin, traveling with his wife and daughters, took a train to Washington, where they received an audience with President Roosevelt. America's adulation could hardly be checked. The nation was clearly captivated with William Perkin, this modest individual—family man, teetotaler, and churchgoer—recalled from tranquil retirement to receive: a knighthood, that he declined at first; several medals, honorary doctorates, and accolades; and a silver tea service, engraved with the incorrect chemical structure for mauve. He was also compared with the likes of Thomas A. Edison. The white-bearded, aging scientist was now a larger than life international celebrity, commanding public respect and admiration (17). Newspapermen reported on his achievement with a mixture of sensation and fantasy, blended with some truth and a little alchemy. Mauve was a headline story, an epic to inspire and excite, the benefits of which were summed up by the *Detroit Sunday Times* (18):

> Rainbows and Riches from Refuse: The Story of Coal Tar. How Chemical Wizards have drawn from a discarded product the most beautiful coloring, valuable drugs and given employment to Armies of Men.

Science and Industry in the United States

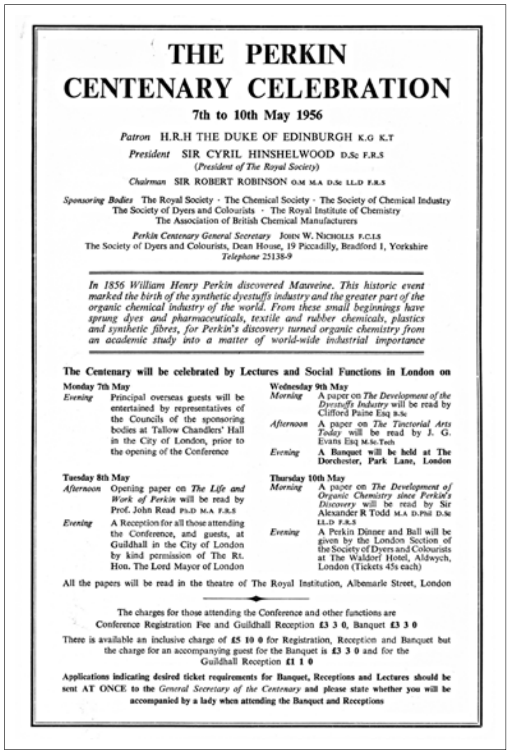
Unlike the British, the Americans were not celebrating a past glory, but the triumph of applied chemical science. However, dyes were not part of the equation, since aggressive marketing and control of patents enabled Germany, and to a lesser extent Switzerland, to dominate the supply in colorants. More significant in 1906 America was the application of science in other areas of industry, particularly the electrical technologies, including electrochemistry and steel manufacture. There the Americans had made massive headways and were not only a threat to Britain, but also to Germany. Tellingly, American electrochemists scheduled their October 1906 meeting in New York so as to enable participants to join in the festivities at Delmonico's.

Advertisement for Calco Chemical Company, Bound Brook, New Jersey, 1925

The US entry into large-scale industrial aromatic chemistry took place almost a decade later as a result of the outbreak of war in Europe in 1914. Then, the United States, as a major consumer of dyes for its vast textile industry, was faced with severe shortages, since Germany requisitioned dyes for military uniforms, and the British blockaded transatlantic shipping. This forced the Americans to establish intermediate- and dye-making firms, such as Calco Chemical Company, at Bound Brook, New Jersey, founded in 1915 (19).

In May 1917 four chemical firms created the National Aniline & Chemical Company, later part of Allied Chemical & Dye Co. In the same year Du Pont at Deepwater Point, New Jersey, began production of indigo. Meantime, Hugo Schweitzer, co-organiser of the jubilee events in New York, disappeared from the scene after sending the German ambassador, Count von Bernstoff, a secret report on US tariffs introduced in 1916 and other matters related to the supply of dyes. Later he was variously described as the "head of every American German activity in this country and was the best chemist in the whole business," by Joseph H. Choate, Jr., of the office of the Alien Property Custodian, and "chief secret-service agent of the German government, chief cook and bottle washer of the German government in this country" by American Chemical Society past president Charles Holmes Herty. Choate even cited Schweitzer's secret service number, 963192637, though when asked about its significance wondered "whether it was a number of an automobile (20)."

One of the most important outcomes of the American response was the organization of sophisticated, well equipped and well staffed research facilities dedicated to dye research. From the late 1920s the industrial research laboratories enabled diversification into synthetic resins and polymers, and in the 1930s into sulfonamide and other drugs. The development of synthetic fibers and massive expansion in printing on paper after the 1920s led to the modification of existing synthetic dyes to suit new needs and applications. During the 20th century the most important dyes classes were azo and vat dyes. Only one new structurally novel class of dye appeared, the phthalocyanine class, introduced by Britain's ICI in the 1930s.



THE PERKIN CENTENARY CELEBRATION

7th to 10th May 1956

Patron H.R.H THE DUKE OF EDINBURGH K.G K.T

President SIR CYRIL HINSHELWOOD D.Sc F.R.S

(*President of The Royal Society*)

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Sponsoring Bodies The Royal Society · The Chemical Society · The Society of Chemical Industry
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Perkin Centenary General Secretary JOHN W. NICHOLLS F.C.I.S
The Society of Dyers and Colourists, Dean House, 19 Piccadilly, Bradford 1, Yorkshire
Telephone 25138-9

In 1856 William Henry Perkin discovered Mauveine. This historic event marked the birth of the synthetic dyestuffs industry and the greater part of the organic chemical industry of the world. From these small beginnings have sprung dyes and pharmaceuticals, textile and rubber chemicals, plastics and synthetic fibres, for Perkin's discovery turned organic chemistry from an academic study into a matter of world-wide industrial importance

The Centenary will be celebrated by Lectures and Social Functions in London on

Monday 7th May
Evening Principal overseas guests will be entertained by representatives of the Councils of the sponsoring bodies at Tallow Chandlers' Hall in the City of London, prior to the opening of the Conference

Tuesday 8th May
Afternoon Opening paper on *The Life and Work of Perkin* will be read by Prof. John Read Ph.D M.A F.R.S
Evening A Reception for all those attending the Conference, and guests, at Guildhall in the City of London by kind permission of The Rt. Hon. The Lord Mayor of London

Wednesday 9th May
Morning A paper on *The Development of the Dyestuffs Industry* will be read by Clifford Paine Esq B.Sc
Afternoon A paper on *The Tinctorial Arts Today* will be read by J. G. Evans Esq M.Sc.Tech
Evening **A Banquet will be held at The Dorchester, Park Lane, London**

Thursday 10th May
Morning A paper on *The Development of Organic Chemistry since Perkin's Discovery* will be read by Sir Alexander R Todd M.A D.Phil D.Sc LL.D F.R.S
Evening A Perkin Dinner and Ball will be given by the London Section of the Society of Dyers and Colourists at The Waldorf Hotel, Aldwych, London (Tickets 45s each)

All the papers will be read in the theatre of The Royal Institution, Albemarle Street, London

The charges for those attending the Conference and other functions are
Conference Registration Fee and Guildhall Reception **£3 3 0**, Banquet **£3 3 0**

There is available an inclusive charge of **£5 10 0** for Registration, Reception and Banquet but the charge for an accompanying guest for the Banquet is **£3 3 0** and for the Guildhall Reception **£1 1 0**

Applications indicating desired ticket requirements for Banquet, Receptions and Lectures should be sent AT ONCE to the *General Secretary of the Centenary* **and please state whether you will be accompanied by a lady when attending the Banquet and Receptions**

Announcement for the Perkin Centenary Celebration held in London during May 1956. Regina Schoental Archive, Edelstein Collection.

1956

The Perkin centenary festivities in England took place during May 1956, with Sir Robert Robinson acting as chair of the Perkin Centenary Celebrations Committee (21). The Science Museum in London, in collaboration with ICI's Dyestuffs Division, arranged a special Perkin Centenary Exhibition in the Industrial Chemistry Gallery that included among the several dioramas a superb model of Perkin's factory (since lost in a flood). The exhibition, which ran from May 8 until July 17, was opened by Reginald P. Linstead, rector of Imperial College, who had established the structures of phthalocyanine dyes. ICI chose the centenary to announce the introduction of the first fiber-reactive (Procion) dyes that bond directly with the fabric. W. H. Cliffe, of ICI, and Laurence E. Morris, editor of *The Dyer*, produced the most detailed accounts yet of the history of Perkin & Sons. From the perspective of recording and publicizing chemical history, it is interesting that Morris expressed regret that "so little is being done to erect plaques on some of the buildings connected with Perkin." This included the site of his home in Sudbury, near Wembley, not far from Greenford Green. However, he noted, "Certain private citizens…acting through the Wembley Historical Society, have, however, decided that a plaque should be inserted in the wall (or set in a cairn in the grounds) of Sudbury Methodist Church, which stands on the site of the New Hall, which Perkin built as a centre for some of his non-denominational religious activities (22)." Prominent among those engaged in the endeavor to establish a suitable plaque was keen historian of chemistry and of the locality, Harold Egan, the Government Chemist during 1970-1981 (23). It was through Dr. Egan that in the late 1950s this author was introduced to the history of Perkin's enterprise.

As was the case in 1906, the 1956 celebrations for mauve included high on the agenda the union of pure and applied science, though in 1956, in London at least, this was hardly directed toward novel dye discovery. Significantly, the 1956 festivities for mauve in New York surpassed those in England. The reason: by World War II, the United States had embarked on production of aromatics from petroleum, and after 1945, with the German chemical industry facing great difficulties, emerged as the world leader in dye manufacture, a position it would hold for over two decades.

During the week commencing September 10, 1956, several hundred leading scientists, industrialists, and other invited guests gathered at New York's Waldorf-Astoria Hotel to attend what was called the "Perkin Centennial 1856-1956," an event sponsored by the American Association of Textile Chemists and Colorists and memorialized in a substantial commemorative volume (24). The main historical papers were given by Sir Robert Robinson, Hans Z. Lecher, former research leader at American Cyanamid's Calco Division, and Sidney Edelstein, who two weeks earlier had published in the association's journal an account of the life of Sir William Henry Perkin (25). We may surmise that the celebrations and the prominence given to historical accounts of the rise of the dye and organic chemical industry, particularly at the US meeting, played a not insignificant role in Sidney Edelstein's decision to inaugurate also in 1956 the Dexter

Award (Dexter Chemical Corporation Award in the History of Chemistry), now the Edelstein Award.

2006

William Perkin's pathbreaking discovery of mauve was remembered in 2006 through a series of gatherings organized by the Society of Chemical Industry (including a lecture at London's University College on March 23, believed to be the day and month in which Perkin made his discovery), the Royal Society of Chemistry, the Society of Dyers and Colourists, and the American Association of Textile Chemists and Colorists. Despite the various events, including Innovation Day at Chemical Heritage Foundation in September, when the SCI's Perkin Medal was awarded exactly a century after its inauguration, none of the festivities could compare to 1906, or to 1956, for that matter. In October, the RSC organized a special ceremony, appropriately at a community hall in Sudbury almost next to the site of Perkin's New Hall, before which the 1956 plaque had been set in the cairn. The National Portrait Gallery, in connection with its own sesquicentennial, placed on display the 1906 portrait of Perkin along with those of other prominent 19th-century British scientists and engineers. A few historical studies were stimulated by the 150th anniversary for mauve. Thus Peter Morris was encouraged to undertake an investigation into the provenance of various surviving samples of mauve and dyed fabrics, some stated to date from the time of Perkin's first experiments or the opening of his factory. Since only a piece dyed fabric (probably from 1856) and a scarf (around 1862) could be reasonably accurately dated, this called into question the labeling of museum artifacts, in this case samples of the colorant, suggesting that the Science Museum's "hitherto iconic specimen…[might need to be] relegated to the second division of chemical relics (26)."

Until the 1980s the anniversaries for both mauve and Perkin's birth had attracted great attention, as well as extensive participation from the chemical industries. Thus in 1988, on the occasion of the 150th anniversary of Perkin's birth, ICI sponsored widely publicized educational and commemorative programs under the title "Born to the Purple" (27). That this was not the case in 2006 is largely due to the fact that the dye industry founded by Perkin, the world's first high-tech science-based industry, has so little presence in Europe and North America. Environmental problems arising from the manufacture of colorants and the shift of the textile industry to Asia have caused the great dye firms to reinvent themselves as agrochemical and pharmaceutical corporations, casting off long heritages that sometimes go back to the 1860s. Today the centers of production are India, China, Japan, and eastern Europe, while the main use for aniline is in the manufacture of polyurethane. Maybe that is why the SDC's Lahore Region annual conference "The Era of Colour 1856-2006" no doubt attracted at least as much attention as the events in Europe and North America.

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