

Johnson, Matthey and the Chemical Society

Two hundred years of precious metals expertise

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The founders of Johnson Matthey – Percival Johnson and George Matthey – played important roles in the foundation and running of the Chemical Society, which was founded in 1841. This tradition continues today with the Royal Society of Chemistry and Johnson Matthey Plc.

The nineteenth century brought a ferment of discovery and research to all branches of chemistry; for example some twenty-six elements were discovered between 1800 and 1850, ten of them by British chemists, including rhodium, palladium, osmium and iridium. In 1841 the Chemical Society – the oldest national chemical society in the world still in existence – was established. Both Percival Johnson (**Figure 1(a)**) and George Matthey (**Figure 1(b)**) were prominent members, Johnson being one of its founders.

The Origins of the Chemical Society

Although there had been an earlier London Chemical Society in 1824 it lasted for only a year (1). The Chemical Society of London ('of London' was dropped in 1848) was founded at a meeting held on 30th March 1841 at the Society of Arts in John Street (now John Adam Street), London, UK; Robert Warington (1807–1867), an analytical chemist later to become resident Director of the Society of Apothecaries (2), was instrumental in setting it up and his son, also Robert Warington, later wrote an account of its history for its 1891 Jubilee (3). There were 77 founder members, of whom Percival Johnson was one: others included William Cock (**Figure 2**) (later to join Johnson in his new firm – see below), Thomas Graham (Professor of Chemistry at University College and the Society's first President), Lyon Playfair, John Daniell and Warren de la Rue (4). Michael Faraday joined in the following year (5).

The aim of the new Society was "*The promotion of Chemistry and those branches of Science immediately connected with it...*" The annual subscription was to be £2 or £1 for those living twenty or more miles outside London. It gained a Charter of Incorporation in 1848

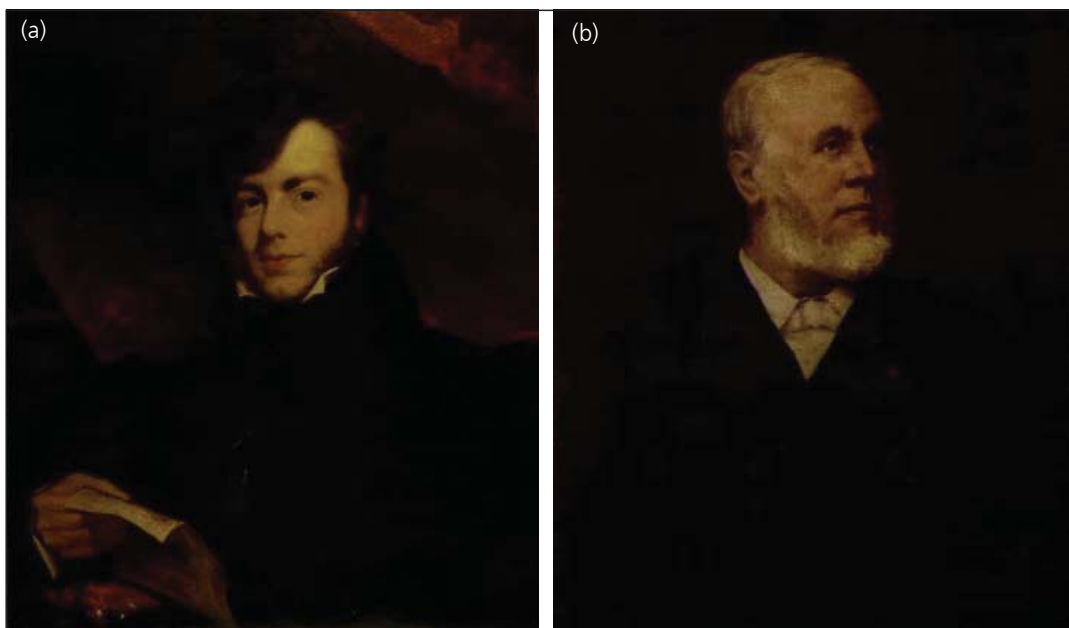


Fig. 1. (a) Portrait of Percival Johnson (1792–1866); (b) Portrait of George Matthey (1825–1913)

and occupied a series of premises before its Jubilee in 1891. The original accommodation at the Society of Arts in John Street became too cramped for the successful enterprise; having failed to rent rooms at the newly instituted Royal College of Chemistry at

Hanover Square (3) it moved in 1849 to No. 142 Strand. In 1851 it moved to share premises with the Polytechnic Institution at 5 Cavendish Square and then in 1857 relocated to Old Burlington House (3,6). The latter had been built in 1664–1667 for the Earl of Burlington, a brother of Robert Boyle; Henry Cavendish lived there in his early years (7). The accommodation was shared, rather uneasily, with the Royal and Linnaean Societies and comprised two back rooms on the east side of the ground floor. In 1873 the Society moved to better premises in 'New' Burlington House, an extension built (1868–1873) in the Eastern part of the courtyard by Richard Banks and Charles Barry (7). Here it has remained, albeit with various room changes (7–9).

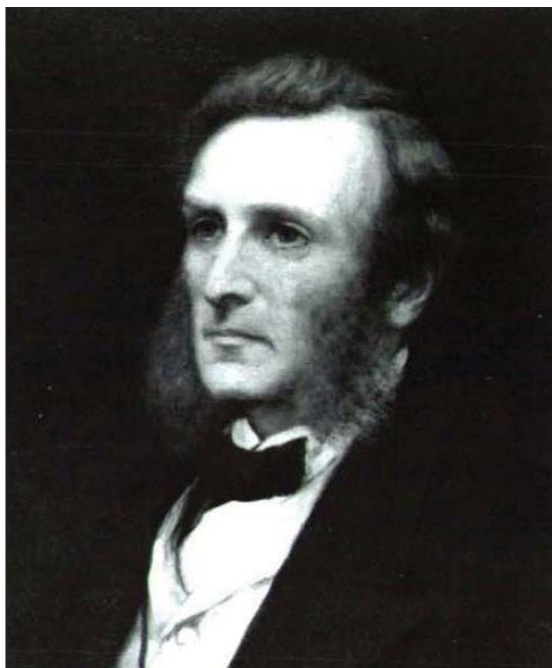


Fig. 2. Portrait of William Cock (1813–1892)

The Foundation of Johnson Matthey

The involvement of the Johnson family in the platinum metals industry dates back to John Johnson (1765–1831), whose father (also John Johnson) had been an assayer of ores and metals at No. 7 Maiden Lane, London, in 1777 (10–12). On his father's death in 1786 his son John became the only commercial assayer in London and was involved in the rapidly developing platinum trade (11, 12). He supplied William Hyde Wollaston (1766–1826) with large quantities of platinum ore from which Wollaston was to establish an efficient process for isolation of pure platinum metal (11); Wollaston also discovered and isolated rhodium and palladium (13).

In 1807 John Johnson's son Percival Norton Johnson (1792–1866) (11, 12, 14) was apprenticed to the firm – he already had good scientific credentials, having published a paper on 'Experiments which prove Platina, when combined with Gold and Silver, to be soluble in Nitric Acid' (15) (reproduced in (16)). This showed that small quantities of platinum mixed with gold and silver in nitric acid facilitated a separation of pure gold from the solution. He became a partner in 1817, the year often regarded as that in which the firm, later to become Johnson Matthey, was established (11, 17).

By happy chance, 1817 was also the year in which Sir Humphry Davy showed that a platinum wire catalysed the combination of hydrogen with oxygen in the air and became white-hot in the process (18) and he observed a similar effect when a coil of platinum (or palladium) was placed within his wire gauze safety lamp (19). These were really the first observations of heterogeneous oxidation catalysis (20, 21). In 1822 the business moved to 79 Hatton Garden and in 1826 Percival Johnson employed an assayer, George Stokes, taking him into partnership in 1832. The firm was now called Johnson and Stokes. On the death of Stokes in 1835 another assayer, William John Cock (1813–1892) (11, 22), the son of Johnson's brother-in-law Thomas Cock (also an expert in platinum metallurgy), joined Johnson in 1837 and the firm was now called Johnson and Cock (22). Like Johnson, William Cock was a founding member of the Chemical Society in 1841 and had devised a process for making platinum more malleable. He wrote a paper in the first volume of the *Memoirs of the Chemical Society of London*, the Society's first journal, titled 'On Palladium – Its Extraction, Alloys, &c.' (23), a remarkable summary of the preparation and major properties of palladium. The firm of Johnson and Cock, amongst much other business, provided platinum for a commemorative

medal for Queen Victoria's coronation (**Figure 3**) and 100 ounces of the metal for the new Imperial pound weight standards in 1844. Cock resigned in 1845 through ill-health, though he continued to help Johnson until much later.

George Matthey (1825–1913) (11, 24, 25) was taken on as an apprentice by Johnson and Cock in 1838 at the age of thirteen and quickly became interested in platinum refining, William Cock becoming his mentor. Matthey was an excellent chemist, having spent some time at the Royal College of Chemistry in the late 1840s with August Wilhelm von Hofmann (26). His younger brother Edward later studied chemistry and metallurgy at the sister institution the Royal School of Mines and later became a partner in the company (11). George had a shrewd business mind and he persuaded a rather reluctant Johnson to show samples of platinum, palladium, rhodium and iridium at the Great Exhibition of 1851: these exhibits were awarded a prize (24). Johnson made him a partner in 1851 and thus the firm of Johnson and Matthey was finally established in that year (17, 27). It was very largely Matthey who transformed the firm from a largely laboratory-based enterprise into a fully commercial business.

Johnson and Matthey were elected Fellows of the Royal Society in 1846 and 1879 respectively; Johnson's election was supported by Michael Faraday amongst others. Faraday had many connections with Johnson and, in particular, Matthey (28). Faraday mentions having ingots of platinum, which he describes as "*this beautiful, magnificent and valuable metal*" in his celebrated lecture-demonstration 'On Platinum' at the Friday Discourse at the Royal Institution in Albemarle Street on 22nd February 1861. He acknowledged "*Messrs. Johnson and Matthey, to whose great kindness I am indebted for these ingots...*" (29). Matthey published a number of papers, mainly in mining journals, but a key one concerns 'The Preparation



Fig. 3. A commemorative medal for Queen Victoria's coronation in 1838. A number of these medals were struck by the Royal Mint in platinum

in a State of Purity of the Group of Metals Known as the Platinum Series and Notes upon the Manufacture of Iridio-Platinum'. This presented a new method of refining the platinum group metals (pgms) in which lead was used to remove rhodium and iridium (30).

The "New Oxford Dictionary of National Biography" has articles on Johnson (14) and Matthey (25). Obituaries of Johnson (31,32), William Cock (33) and George Matthey (34) were published; McDonald (12) has established that both the Johnson obituaries (31, 32) were written by George Matthey, albeit in edited forms. The full original version has been given (12). Sir William Crookes was probably the author (22) of Cock's obituary (33).

Early Collaborations of Johnson, Matthey and the Chemical Society

Percival Johnson (listed as of 38 Mecklenburgh Square) appears in the list of the original members of the Chemical Society of London in 1841, together with other famous names (4). He was one of the early members of the Council of the Society, serving from 1842–1844 (Michael Faraday joined him on the Council in 1843) (3,5). William Cock also appears on the list of founder members of 1841 (4) and was one of the few who gathered informally, prior to the official formation of the Society, to consider setting up such an institution. He served on the Council of the Society in 1845 (3), giving in that year a specimen of palladium to the Society's Museum. In 1868 the Society established a Faraday medal and this was, for its first six issues, cast in palladium, donated by Johnson Matthey. An item in the Society's minutes says that "a letter was read from Messrs. Johnson and Matthey containing an offer to present to the Society an amount of palladium to form

the Faraday medals for the next ten years of the value of £200. The offer was accepted and a vote of thanks to Messrs. Johnson and Matthey carried by acclamation" (3). The first six recipients of this palladium medal (later medals were cast in bronze after the palladium had run out) were all still-famous chemists: Jean-Baptiste Dumas, Stanislao Cannizzaro, August Wilhelm von Hofmann, Charles-Adolphe Wurtz, Hermann von Helmholtz and Dmitri Mendeleev (3).

George Matthey was prominent in the Society: he joined in 1873 and served on its Council from 1877–1878 (3). He was present at the Jubilee dinner of the Society on 25th February 1891 (at which eleven courses, five wines, brandy and port were served) and gave a speech after the dinner in his capacity as Prime Warden of the Goldsmiths' Company. In the afternoon preceding the dinner there was an exhibition at which Matthey showed samples of all six pgms and other related objects, including a platinum snuff-box made by Percival Johnson in 1816 and used by Johnson until his death (3).

The Royal Society of Chemistry in the Twentieth Century

In 1972 the process of unification began of the Chemical Society, the Royal Institute of Chemistry (established 1877), the Faraday Society (established 1903) and the Society of Analytical Chemistry (established 1874). The Queen signed a Royal Charter for the new Royal Society of Chemistry (RSC) on 15th May 1980 (9). That and subsequent periods saw continued collaboration with Johnson Matthey, as the following examples show.

The Badge of Office of the President of the RSC (Figure 4) was originally presented in 1979 to the President of the Royal Institute of Chemistry (35) and

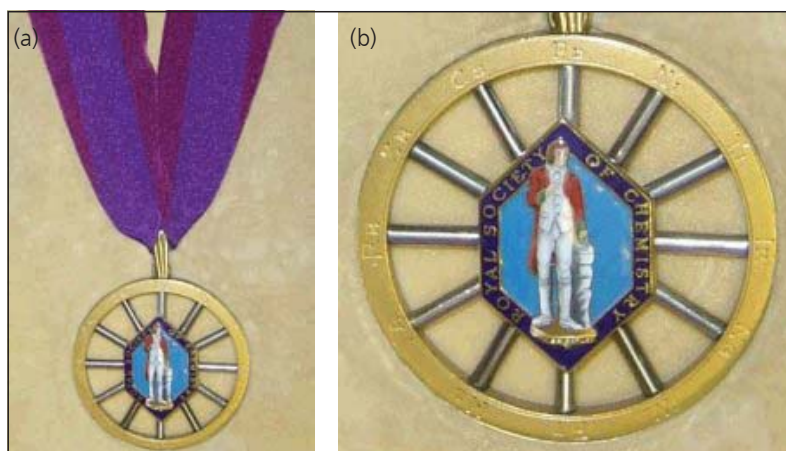


Fig. 4. (a) The badge worn by the President of the Royal Society of Chemistry. It was inherited from the Royal Institute of Chemistry and modified to carry the name of the RSC; (b) The badge is in the form of a spoked wheel, with the standing figure of Joseph Priestley depicted in enamel. The rim of the wheel is gold and the twelve spokes are of non-tarnishable metals with catalytic importance: palladium, nickel, titanium, iridium, niobium, tungsten, platinum, molybdenum, tantalum, rhodium, zirconium and cobalt

the materials for it made and donated by Johnson Matthey. The firm's Chief Chemist at that time, A. R. Powell FRS (1894–1975) (37), gave a detailed account of the fabrication of this unique and remarkable object (38). In the centre is an enamelled medallion of Joseph Priestley, set within a hexagon to symbolise benzene. In the circular rim of gold surrounding the medallion are set, like spokes in a wheel, twelve metals of catalytic importance. Four pgms mark the cardinal points (north is palladium, south platinum, east iridium and west is rhodium); in a clockwise direction after palladium lie nickel and titanium; after iridium there are niobium and tungsten; after platinum we have molybdenum and tantalum; and finally after rhodium lie zirconium and cobalt. The synthetic fibre ribbon of nylon, viscose and cellulose acetate is dyed with mauveine, discovered by Sir William Perkin (1838–1907) in 1856 (35, 36, 38).

Collaborations in the Twentieth and Twenty-First Centuries

In 2001 Johnson Matthey received the first RSC National Historic Chemical Landmark award (Figure 5); it was unveiled at the Johnson Matthey Technology

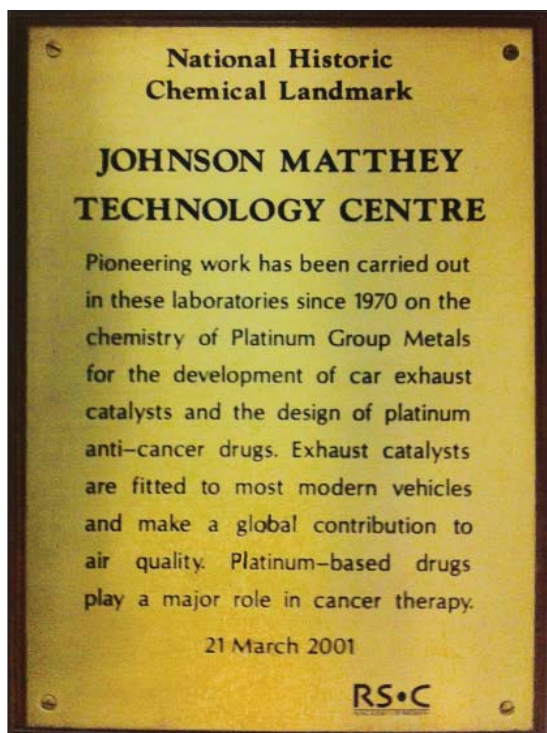


Fig. 5. The first Royal Society of Chemistry National Historic Chemical Landmark award at Johnson Matthey Technology Centre, Sonning Common, UK

Centre in Sonning Common, UK, on 21st March 2001, for “*Pioneering Work in Platinum research..... which led to the development of car exhaust catalysts and the design of platinum-based, anti-cancer drugs*” (39). The manufacture of the first autocatalysts is also commemorated by a plaque at the company's manufacturing premises in Royston, UK (Figure 6).

The company has sponsored or co-sponsored a number of RSC events. Among these, the triennial International Conferences on Platinum Group Metals meetings from 1981 to 2002 were a major feature. They were sponsored jointly by the Dalton Division of the RSC and Johnson Matthey and brought together many experts on pgm chemistry, dealing in particular with aspects of organometallic, catalytic and coordination chemistry. These were held in July at the following universities and from 1981 were reviewed in *Platinum Metals Review* (references given in parentheses):

- Bristol, 1981 (40)
- Edinburgh, 1984 (41)
- Sheffield, 1987 (42)
- Cambridge, 1990 (43)
- St. Andrews, 1993 (44)
- York, 1996 (45)
- Nottingham, 1999 (46)
- Southampton, 2002 (47)

A more recent meeting was held at York University on 30th November 2011 to mark the 250th anniversary of the birth of Smithson Tennant (1761–1815), discoverer of osmium and iridium (48), sponsored by the RSC and Johnson Matthey Catalysts.



Fig. 6. A plaque commemorating the manufacture of autocatalysts by Johnson Matthey in Royston, UK

In 2008 Johnson Matthey sponsored the new biennial RSC Lord Lewis Prize, awarded “for distinctive and distinguished chemical or scientific achievements, together with significant contributions to the development of science policy” (49). The first awardee was Lord Robert May of Oxford, FRS, OM (born in 1938), President of the Royal Society from 2000 to 2005, former Government Chief Scientific Advisor, Professor of Zoology at the University of Oxford and Fellow of Merton College. In 2010 the Prize went to Sir John Cadogan CBE, FRS (born in 1930), formerly Chief Scientist at the BP Research Centre and President of the RSC from 1982–1984. The most recent winner, in 2012, was Sir David King FRS (born in 1939), from 2000–2007 the Government’s Chief Scientific Advisor and the founding Director (2008–2012) of the Smith School of Enterprise and Environment at the University of Oxford.

Other joint RSC–Johnson Matthey projects have included a book and workshop on teaching of pgm separations created in 1998 (50). Teachers spent two to three days at the Johnson Matthey Technology Centre in Sonning Common, UK, with the late Phil Smith of the RSC at the invitation of David Boyd, Technology Manager at the Centre. Boyd gave a series of presentations and workshops on the chemistry, extraction, refining and uses of platinum. These were turned into teaching aids, with a variety of exercises, games, questions and experiments.

Johnson Matthey also partnered with the RSC on its ‘Faces of Chemistry’ initiative, a series of short videos aimed at bringing to life careers in industry for young people (51). Johnson Matthey scientists explain the chemistry of pgm-based emission control catalysis in three short films, which were made available *via* website and social media links from 2011.

The company also contributed materially to the RSC Roadmap objectives (‘Chemistry for Tomorrow’s World’) prepared in 2009 (52). Dr David Prest, Managing Director for the European Region in the firm’s Emission Control Technologies division and a member of the RSC Council, chaired the steering group – a cross section from industry and academia – which prepared the Roadmap. The aim of their report was to identify the role of the chemical sciences in helping to solve major global challenges. The Roadmap was developed *via* expert workshops and extensive online consultations; many challenges were identified, with specific objectives with timescales of up to 15 years.

In 2010 Dr Martyn Twigg, then Chief Scientist of the firm, won the RSC Applied Catalysis award “for his

pivotal and innovative role in creating new catalysts and catalytic processes for use in the automotive industry” (53) and in 2012 Dr Thomas J. Colacot, of Johnson Matthey Catalysis and Chiral Technologies, USA, won the same award “for exceptional contributions to the development and availability of ligands and catalysts crucial for the advancement of metal-catalysed synthetic organic chemistry” (54, 55).

Thus Johnson Matthey and the RSC have collaborated over many years, continuing into the twenty-first century, making use of the firm’s expertise in chemistry and catalysis, with particular emphasis on their unrivalled experience with the precious metals.

Conclusions

This article has sought to show that Percival Johnson and George Matthey, in effect the founders of Johnson Matthey Plc, were closely associated with the Chemical Society (of which Johnson was a founder and Matthey a prominent member) since its inception in 1841 and that this tradition has been continued to the present with Johnson Matthey Plc and the Royal Society of Chemistry.

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