

WILLIAM WITHERING (1741–1799): A BIRMINGHAM LUNATIC

M.R. Lee, Emeritus Professor of Clinical Pharmacology and Therapeutics, Edinburgh University

William Withering (Figure 1) died in Birmingham, aged 58, in October 1799 as the old century ebbed away.¹ Two hundred years on, most physicians are aware of his pioneer work on the foxglove, *Digitalis*, but few know of his other distinguished efforts in botany, geology and chemistry.² He was an active member of the Lunar Society, a group based in the Midlands, and he contributed substantially to the many and varied activities of its members known as the Lunatics or the Festive Philosophers.³ In a determined way he struggled to continue with his work through the ravages of consumption, and the turbulent times of the American Rebellion and the French Revolution. He was truly a man of the Enlightenment.

HIS EARLY LIFE AND EDUCATION IN EDINBURGH

Withering was born at Wellington in Shropshire on 17 March 1741 (or possibly on 28 March; the records are in conflict!). He was recorded in the parish register as Witherings but the final 's' was soon dropped. He was educated at first at home and later was apprenticed to a local medical practitioner.

In 1762, at the age of 21, he went to Edinburgh University, then at the height of its power and influence, to study anatomy and chemistry. Like many of his contemporaries, he joined both the Freemasons and the Student Medical Society. He also attended the Episcopal Church and, after the service on Sunday evenings, he would go to the house of Professor Cullen to take part in discussions on subjects of theological and scientific interest. In 1763 he was instrumental in starting a society for the increase of knowledge and conversation in Latin. One essay of his in this classical language 'concerning inflammation of the pericardium' was praised by Cullen. Further essays followed on diet and exercise, rickets and historical aspects of anginal inflammation of the throat.

At this time, he had no drive to study botany, which he called 'disagreeable!' He may have been turned off the subject by the lectures of Dr John Hope, the Professor of Medical Botany. Withering declined to enter for the gold medal in this discipline – an ironic decision for the man who was later to be known as the 'English Linnaeus'. In his final year at Edinburgh (1765/66) he wrote his graduation thesis entitled *De Angina Gangraenosa or Malignant Putrid Sore Throat* which was dedicated to his uncle, Dr Brooke Hector of Lichfield.⁴ It contains an excellent description of scarlatina but, as with similar works of that period, did not clearly differentiate the condition from diphtheria.

Following the custom of the time, he then undertook a trip to the Continent which included a journey to Paris where he visited the Hôtel-Dieu with its 3,000 patients. However, the stay in Paris was blighted severely by the death of his travelling companion, Mr Townshend, from complications of an abscess around the shoulder. After vexing delays in settling the affairs of his deceased friend,

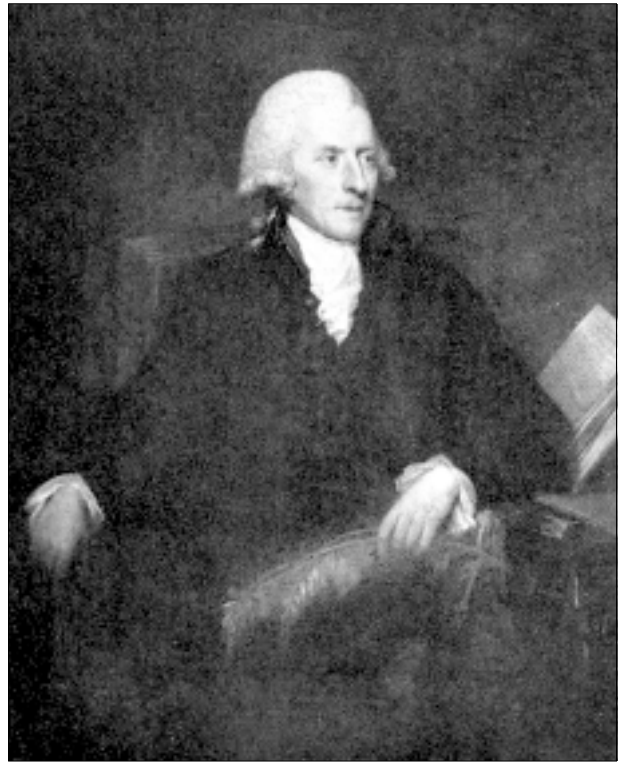


FIGURE 1

Portrait of William Withering by von Breda. Note the foxglove.

he eventually arrived at his home in Wellington just in time for Christmas.

In the new year, after considering competing offers from Chester and Coventry, Withering decided to set up medical practice in Stafford, the county town of Staffordshire. This had a number of advantages: first, it was only 20 miles from the family home in Wellington; second, the new Stafford Infirmary opened its doors in 1766, and he and Dr Archibald Campbell were the first physicians to be appointed to the staff. Initially, Withering's duties did not prove onerous and he had time for social activities which included amateur dramatics and bowling. He also met Helena Cooke, at first as his patient; later, they were betrothed and married. This was fortunate in several senses as she was a noted botanical artist and was able to help him later with his major work on botany.

BIRMINGHAM

Practice in Stafford was not very rewarding in a financial sense, generating only about £100 per year. Withering, conscious of his new responsibilities as a married man, began to look for another opportunity. Unexpectedly, this arose in Birmingham in 1775, when Dr William Small, a distinguished physician (and member of the Lunar Society) died. Erasmus Darwin wrote to Withering to invite him

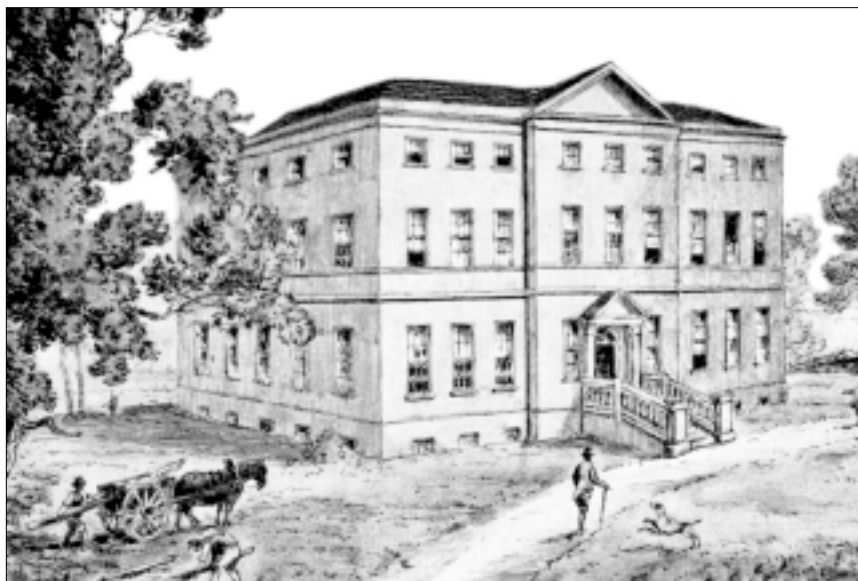


FIGURE 2
The General Hospital, Birmingham, 1799.

to move to the Birmingham General Hospital and, after wavering for a time, he decided to accept, and he joined Dr John Ash there in May 1775. From this time on his professional advancement was rapid. In 1776, only one year later, he earned more than 1,000 guineas, a very considerable sum for those days. One indication of the extent of his practice was that in an average year he travelled about 6,000 miles; at an average carriage speed of eight miles per hour this was a considerable investment of time!

As Birmingham expanded in manufacture, the population grew rapidly and a new hospital became an urgent need. Money was raised by public subscription and in 1779 the new General Hospital was opened (Figure 2). Withering joined Drs Ash, Smith and Johnstone as the new team of physicians. He was to work there over the next 13 years, until 1792, when he was forced to retire due to ill health. Many of the patients who formed the basis for his clinical studies on dropsy, the foxglove and scarlatina came from these wards. A serious outbreak of scarlatina occurred in the city in 1788. Withering published a classic description of the disease, differentiating it clearly from diphtheria and establishing that it was sometimes followed by nephritis.⁵

THE LUNAR SOCIETY

When Erasmus Darwin invited Withering to transfer from Stafford to Birmingham, he did not seek simply a competent physician but an individual capable of replacing Dr Small in the deliberations of the Lunar Society. The Society had been founded in 1766 and was to last about 30 years; it is now regarded as the epitome of the eighteenth century learned society for the exchange of ideas. Joseph Priestley wrote later that they met at each others' houses once every month on the Monday nearest to the full moon (hence Lunar) to have the benefit of some light on their homeward journeys (in the days of highwaymen and footpads). Members were invited to dinner at two of the clock and dispersed about eight, which left ample time for discussions of general scientific interest. Priestley also wrote that 'the members have nothing to do with religious or

political principles of each other' and also that 'we were united by a common love of science which we thought to bring together persons of all distinctions whether Christians, Jews, Mahometans and Heathens, Monarchists and Republicans'. No agenda was set or minutes kept.

Members of the Lunar Society included Erasmus Darwin, William Small, James Watt, John Baskerville, Matthew Boulton, and later on Withering and Priestley. Most of them had private laboratories and they suggested experiments to one another; when Priestley moved to Birmingham, they helped him to set up his laboratory by gifts of money. Those members who were Fellows of the Royal Society (and other learned bodies) would promote articles for publication. Each member was allowed to bring a friend (or fellow scientist) to the meetings, and visitors included Sir William Herschel, the distinguished astronomer and Benjamin Franklin, the American philosopher. They also corresponded widely in Europe with the eminent scientists of the day, in particular with Antoine Lavoisier.

Withering blended into this group with great ease. Essentially a nonconformist, he valued the freethinking atmosphere of the Lunar Society greatly and proceeded to organise a small laboratory in his home. Subsequently he also built a private menagerie! He soon adopted the view that a philosopher should know everything that there is to be known, the classic attitude of the Enlightenment, and his work ranged very widely.

BOTANY AND THE 'ENGLISH LINNAEUS'

The story starts in Stafford where Withering's medical practice was undemanding and he had time to indulge in plant collecting, perhaps stimulated by his future wife's skill in botanical illustration. Much of his leisure time during this period was taken up by this activity and in 1776, shortly after his arrival in Birmingham, he published *The botanical arrangement of all the vegetables naturally growing in Great Britain*. The book comprised two volumes, 836 pages in total, together with 12 illustrated plates. It contained much new information on plants as foods and on those plants that are poisonous to livestock such as cattle and pigs.⁶ There was



FIGURE 3
Witheringia solanacea 1788. After l'Heritier de Brutelle.

also an introduction to techniques for the drying and preservation of specimens. This was the first British publication using the Linnaean system and it was widely welcomed. His analytical approach concludes with a broadside against superstition in the passage where he states 'we shall sooner obtain the end proposed if we take up the subject as altogether new and, rejecting the fables of the ancient herbalist, build only upon the basis of accurate and well considered experiments'. As we shall see, he took his own advice to heart in his work on the foxglove.

The reaction to the first volume of his work was excellent and there was a sustained demand for a second edition. Withering was so busy with his multifarious activities in Birmingham that he was unable to satisfy his public until 1787, some 11 years later, when a second edition appeared for which he enlisted the help of Dr Jonathan Stokes, a fellow member of the Lunar Society. In 1792 the third volume of the second edition appeared. It described the Cryptogams of which Withering had made a special study. Notably, he had developed a new chemical method for the preservation of agarics, mosses and lichens which involved the use in combination of a mixture of copper sulphate (blue vitriol) and lead acetate (sugar of lead).⁷ Withering apologised to his readers for the tardiness of all three volumes blaming variously 'an unsettled state of health and other unforeseen circumstances'. As will be seen later, Withering resigned from the General Hospital in 1792 when he realised that he had developed consumption and that his disease was progressive.

Freed from his hospital duties but struggling against illness he was able to proceed to a third edition and this appeared in 1798 (one year before his death). After his death his son, William Withering Junior, produced four further editions and the book continued to appear, under

separate authorship, until 1877. That it had lasted for about 100 years, in its various editions, is a mark of its continued popularity. On the strength of his sustained record in botany he was elected to the Fellowship of the Linnaean Society in 1784. Subsequently the plant *Witheringia solanacea* was named after him and appears on his epitaph (Figure 3). Withering was meticulous, almost obsessional, in his observation and recording of plants. His work on the flowering plants was largely derived from others, but on the algae and agarics he did break new ground. His painstaking approach (and careful note taking) we will now see repeated in his work on the foxglove.

TREATISE ON THE FOXGLOVE

The story of the foxglove is too well known to be repeated in detail here; several excellent accounts are available, in particular the commentary by Aronson.² A few points are worth reiterating in order to highlight the specific contributions made by Withering.

The plant *Digitalis* had been known and used in medicine for centuries. Classic descriptions were given both by Dioscorides and Galen. Leonard Fuchs named the plant *Digitalis* in his book *Historia stirpem* in 1542 and recommended it for the scattering of dropsy. Withering knew of Fuchs' work but encountered the plant again when he met a 'wise woman' in Shropshire who used the foxglove as one component of her medicine for the dropsy. The concoction contained at least 20 different herbs but Withering states 'it was not difficult for one conversant in these subjects to perceive that the active herb could be no other than the Foxglove'. Withering's colleague, Dr John Ash, had also used it for the Principal of Brazen Nose College, Oxford, who had *hydrops pectoris*. Further evidence came from the work of Mr Saunders, an apothecary, of Stourbridge in Worcestershire, who was also employing it regularly in the treatment of dropsy.⁸

Withering's specific contribution was to place *Digitalis* on a proper scientific footing, and thereby eliminate much of its folklore and superstition. He established that the dried powdered leaf of the plant was five times as effective as the fresh leaf. The powder was also better than a decoction, as boiling seemed to destroy some of the active principle. He then went on to study 163 patients with dropsy, and recorded his results carefully.

From this protracted study he realised, for the first time, the paramount importance of dose, and also that a brisk diuresis of several quarts of urine often heralded the patient's recovery. Also for the first time, he described clearly the important side-effects of *Digitalis* which included nausea, vomiting, diarrhoea and green/yellow vision. The onset of side-effects should lead to an intermission of dose followed by restarting at a lower level. Some patients who appeared similar in clinical presentation did not respond to *Digitalis*, for example those with tight ascites (who may have had cirrhosis), hydrocele and unilateral dropsy (who may have had post-phlebotic leg). Claims had also been made that the plant was effective in phthisis and epilepsy but Withering was sceptical about such statements.

He had no clear idea how the drug worked to 'scatter' the dropsy but he suspected that the diuresis it produced might play a part. He also thought that it might improve 'tumultuous action of the heart' (which was probably atrial fibrillation) but did not make a clear connection between the heart, dropsy and fluid retention. As a result of these

uncertainties, other physicians were to use *Digitalis* inappropriately, in too large a dose or in conditions where it was ineffective. These problems could not be resolved for a further 100 years until histopathology and electrocardiography became established. Nevertheless, the *Treatise on the foxglove* was a notable advance based entirely on careful clinical observation and it changed the face of medical practice forever.



FIGURE 4
Witherite (barium carbonate, or 'the heavy ore' from Alston Moor).

MINERALOGY AND WITHERITE: THE HEAVY ORE FROM ALSTON MOOR

Withering also developed interests in geology and mineralogy, first aroused in 1773 when he published work on the different kinds of marle existing in Staffordshire,⁹ analysing chemically 12 different sorts of marle to determine their calcium content and to establish how much quicklime each would generate on heating, and thereby their suitability for the improvement of agricultural land. He translated two important works by Sir Tobern Bergman into English; first *De analysi aquarum* (the analysis of water) and *Sciagraphia regni mineralis* (outlines of the mineral kingdom). He further analysed two local minerals, the Rowley Rag-stone and the Toad-stone,¹⁰ and these results were transmitted by Joseph Priestley to the Royal Society in London.

Perhaps Withering's major contribution to mineralogy was his work on the heavy ore from Alston Moor in Cumberland.¹¹ Withering noticed its great weight and conjectured that it might contain a new element, and he embarked on a series of experiments to characterise its constituents, but was unable to isolate it. Following further work by Berzelius, it was left to Humphrey Davy in 1808 to isolate barium from it by electrolysis at the Royal Institution in London.

The famous German geologist, Werner, named the mineral Witherite in 1789 in honour of Withering (Figure 4). This form of barium carbonate is an orthorhombic crystal which forms in hydrothermal veins in association with quartz, calcite and barite; it burns in the flame to give a beautiful apple green light. Richard Kirwan, the Irish scientist, introduced Withering's paper on the heavy ore to the Royal Society of London in 1784, and in the following year he was elected to the Fellowship.

CHEMISTRY WITH JOSEPH PRIESTLEY

In May 1780, Priestley retired from the service of Lord Shelburne. He settled in Birmingham in October of the

same year. For the next ten years, until the riots of 1791, the Lunar Society bore the imprint of the great chemist. Withering and he became firm friends.

Priestley, an active advocate of the phlogiston theory, tried to fit his experimental results into this strait-jacket; Withering was more sceptical, and indeed wrote a satirical work about it. Nevertheless, he was eager to support Priestley with financial help in furnishing his laboratory and later by acting as an apprentice for some of his experiments. Examples of their co-operation include work on 'the principle of acidity, the decomposition of water and phlogiston'. They also worked together on the dangerous substance 'Black Wadd', also known as the Derbyshire Mineral, and now known to be manganese dioxide (or pyrolusite), a very strong oxidising agent capable, when mixed with other substances, of spontaneous combustion.

In the winter of 1774, in Paris, Lavoisier repeated some of Priestley's experiments in which he heated mercuric oxide and demonstrated that oxygen was released and metallic mercury was formed. The reaction was stoichiometric and did not require the invocation of phlogiston! Priestley refused to accept this and a vigorous correspondence ensued, brought only to a close by his exile in America and Lavoisier being guillotined by the Revolutionaries in 1794.

Withering pursued other miscellaneous interests including the manufacture of stainless steel for scalpels, the history of Stonehenge,¹³ the effects of lightning,¹⁴ methods for inhaling volatile substances¹⁵ and for making arsenical compounds more soluble. Fowler used this in his famous treatise on arsenic published in 1786.¹⁶ Arsenic was becoming prominent in the treatment of syphilis and skin diseases.

The Lunar Society and Withering reached their apogees in the period from 1781 to 1790. Things were about to change.

PERSONAL DISPUTE

Withering was, by nature, a methodical, organised man, often deliberate to the point of obsessionism. He was polite to his colleagues but insisted that they gave him proper recognition. These attitudes drew him into two acrimonious personal disputes, one with Erasmus Darwin and a second with Jonathan Stokes.

The first major dispute arose from the work on the foxglove.¹⁷ On two separate occasions, Darwin tried to claim primacy for his own observations on *Digitalis*; his claims may have been coloured by professional jealousy over patients, as the two physicians had 'co-operated' in the care of Mrs Greasley and Mrs Houlston. Withering's diagnoses and advice were superior to those of Darwin and this may have rankled with the older man. The publication of the *Treatise on the foxglove* in 1785 effectively demolished any claim Darwin may have had to scientific priority in this area, although the controversy rumbled on until 1789. After this dispute the two men ignored each other and Darwin's attendances at the meetings of the Lunar Society became infrequent.

Withering then became embroiled in a dispute with Jonathan Stokes.¹⁸ They had been friends for many years and Stokes had given some help to Withering with the first edition of the *Botanical arrangement*. When it came to the second edition trouble blew up. Stokes claimed that



FIGURE 5
The ruins of Priestley's house at Fairhill in July 1791.

this edition had been completed entirely under his aegis and called it 'his book'. Withering objected to this and offered Stokes a fixed sum of money to end their agreement. Stokes refused, claimed a part of the profits and attempted to copyright his portion of the book.

Withering reacted very badly. On 23 January 1790 he sent a formal demand to Stokes insisting that he return books, specimens of plants and letters relating to the *Botanical arrangement*. When the books were returned some time later, many were mutilated or damaged beyond use (or repair). The rift between the two men continued for some years and after Withering's death his son took up the cudgels on behalf of his late father.

No doubt there was fault on both sides. Stokes moved, first to Shrewsbury and then to Kidderminster, and was effectively excluded from the Lunar Society both by distance and by the hostility of Withering's friends. The dispute does not reflect well on either party and it also suggests that Withering had become very jealous of his professional standing (and financial interests), perhaps conditioned by the argument with Darwin in relation to the foxglove.

REVOLUTION AND RIOT

Worse was to come for the members of the Lunar Society (and Withering). Late in 1788, King George III developed serious mental illness, now known to be a manifestation of porphyria cutanea tarda. The country was agitated by the prospect of a Regency Government; a few months later, the French Revolution began on 14 July 1789 with the storming of the Bastille. Initially, some members of the Lunar Society sympathised with the aims and ideals of the revolutionaries but objected to the violent means employed to attain them. Some, like Priestley, were open in their approval; others, like Boulton, were worried about the effects on trade and free movement to and from the Continent. In general all the members favoured an extension of the franchise, and an end to the 'Old Corruption'. In Birmingham unrest bubbled away beneath the surface for two years, with speeches and pamphleting on both sides. The Dissenters on the whole supported

the overthrow of the French king, whereas the Anglicans feared danger to George III and the British Government.

The situation boiled over violently in July 1791 with the so-called Church and King riots.¹⁹ The immediate provocation was a dinner at a hotel in Temple Row to mark the anniversary of the storming of the Bastille. A number of bystanders hissed at the diners as they arrived, but the event closed peacefully enough at six o'clock. However, as the evening passed the crowd increased considerably and became uncontrollable. All the windows in the hotel were broken. The rioters then marched to Dr Priestley's church, the New Meeting House, and burned it down. At about the same time the Old Meeting House in Digbeth was attacked and also destroyed. As soon as all this was accomplished, a large mob ran down the Stratford Road to storm the house of Dr Priestley, which was about two miles away. Priestley managed to escape but his house, library and laboratory were destroyed and then set on fire (Figure 5). Many other houses in the vicinity were also attacked and some were destroyed.

Withering, as a close friend of Priestley, was an obvious target and he was warned of the impending assault. Acting promptly, he instructed his servants to strip the house of fixtures and fittings; these were then hidden in the local church. A pitched battle took place in and around the house between Withering's men, servants and hired prizefighters and the incendiaries, who numbered about 30. After several hours of hard fighting the rioters were driven off and went to seek an easier target. Withering had remained, in safety, at his other house in the city.

The civic authorities were tardy in responding; only after widespread destruction had taken place was the Light Horse summoned from Nottingham. When they arrived, about 48 hours later, they soon restored order. Some of the offenders were tried at the Warwick Assizes in August 1791, just six weeks later. Of the hundreds of rioters only 12 came to trial; four were convicted and sentenced to death but in fact only two were hung. The cases were poorly prosecuted as there was widespread sympathy for the rioters and against the Dissenters.

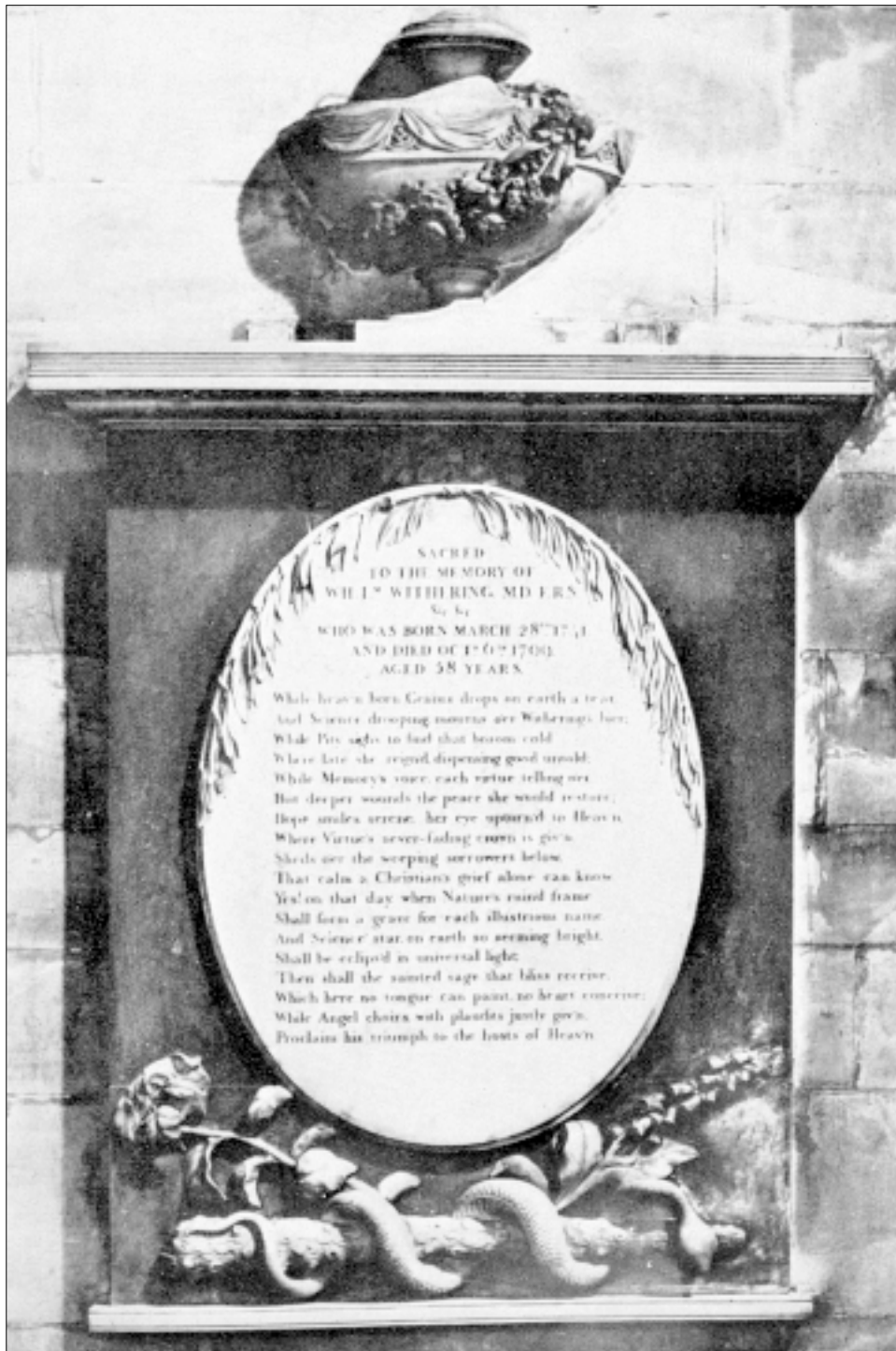


FIGURE 6
Withering's epitaph at Edgbaston Old Church. Note *Digitalis* (bottom right) and *Witheringia* (bottom left).

Priestley left Birmingham, never to return. He subsequently went into exile in the US, dying there some years later. He felt keenly his separation from the Lunar Society and said later that his times in Birmingham had been the most happy and productive of his life.

THE DECLINE OF THE LUNAR SOCIETY

The Lunar Society declined after 1791 and by 1800 it had, in effect, dissipated, although it was never formally wound up. Wedgewood died in 1795, Withering in 1799 and Darwin in 1802. Families were weakened by consumption

and deaths included Edgeworth's daughter (1790) and Watt's two children Jessy and Gregory (1794 and 1803 respectively). The war with France resulted in a fall in trade and there was less money available for the 'Festive Philosophers' to indulge their scientific hobbies.

THE WITHERING OF WITHERING

Withering first took ill in 1776 when, at the age of 35, he developed an irregular fever. From this time on he found every winter a trial and his next 20 years were punctuated by attacks of coughing, breathlessness and fever. In 1784

he spent several of the summer months at Boulton's house on Handsworth Heath in 'the hope of finding air more salubrious than that which could be found in the centre of Birmingham'. For similar reasons in 1785 he acquired Edgbaston Hall, on a 15 year lease, trusting that living there might improve his health. He kept monkeys at the Hall and one of them died of phthisis in 1788, perhaps acquiring the disease from its owner. Withering's health deteriorated markedly in the spring of 1790 when he developed a 'peripneumony', which we would now call pneumonia with pleurisy. He then realised that he had contracted phthisis and that his disease would be progressive and remorseless. Following this serious illness and depressed by the Church and King riots of 1791, he retired from the General Hospital in 1792. He considered moving to a warm climate permanently but decided instead to overwinter in Portugal. He visited Portugal again in the winter of 1794.

On the whole, Withering was not very impressed by the beneficial effects of residence in Portugal.²⁰ He noted, with his usual scepticism, that there were many cases of consumption in Lisbon. The mild climate of Portugal was more pleasant than that of Birmingham in the winter but he suggested that the south of England (particularly the Isle of Wight) might be just as effective and less costly! During his stay in Portugal in 1793/4, he made an analysis of the medicinal hot springs at Caldas da Rainha, for which piece of work he was elected to the Fellowship of the Royal Academy of Sciences at Lisbon.²¹

After his return to England in the spring of 1794 his health declined inexorably. He had frequent attacks of haemoptysis and secondary pulmonary infection with the result that he became so breathless that he could not maintain a conversation. On Boulton's advice, central heating was installed at the Hall and this made him more comfortable. He struggled on to finish, in 1798, the revision of the *Botany*. Working for as long as he could, perhaps six to eight hours a day, he became exhausted. The final straw was the move to his new house, the Larches, on 28 September 1799. Four days later he became very ill with fever and delirium. He died on Sunday 6 October after, it is said, 'speaking quietly and earnestly to his children'. He was buried at Edgbaston Old Church on 10 October in the presence of a large congregation. Prayers were led both by Anglican and Dissenting ministers.

Later, a magnificent epitaph was erected (Figure 6). The verse inscribed begins:

*While heaven born genius drops
on earth a tear,
and Science drooping mourns
o'er Withering's bier.*

At the base of the epitaph on the right is the foxglove *Digitalis* and on the left *Witheringia*, a fitting tribute to his work both in medicine and botany.

CONCLUSION

Medicine needs its heroes, even though flawed, and Withering is one of mine. This quotation from Milton's *Lycidas* to me sums up Withering's life:

*To scorn delights and live laborious days.
But the fair guerdon when we hope to find*

*And think to burst out into sudden blaze
Comes the blind Fury with the abhorred shears
And slits the thin spun life.*

Withering fought the Blind Fury for as long as he was able but eventually it got the better of him.

ACKNOWLEDGEMENTS

This short article would not have been possible without the help of three major works: Peck and Wilkinson; Aronson; and Schofield (References 1, 2 and 3). They should be consulted by any serious student of the life and work of Withering. I would also like to thank: the Library staff at the College for help with the bibliography and illustrations; Jane Hutcheon, Librarian at the Royal Botanic Garden, Edinburgh, for the illustration of *Witheringia solanacea*; and Peder Aspen of the Department of Geology and Geophysics at the University of Edinburgh for the photograph of Witherite, and his analysis of my specimen of the mineral.

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