The Foxglove, "The Old Woman From Shropshire" and William Withering

DENNIS M. KRIKLER, MD, FACC
London, England

Though he received his medical education in Edinburgh, William Withering was born and bred, and conducted his practice, in the Midlands of England, where he collaborated closely with medical and nonmedical colleagues who were pioneers of intellectual thought during the industrial revolution. Because of his profound botanical knowledge, he was able to identify Digitalis purpurea as the essential ingredient in a prescription dispensed by a herbalist, and systematically proceeded to show its value in patients with cardiac failure. He identified the cardinal symptoms of digitalis intoxication and worked out effective rules for the prescription of an infusion of digitalis. Withering's careful observations were also extended to botany and geology, and he was a key figure in the intellectual and scientific life of his area, a man whose legacy is not only the agent he identified but also the scrupulous way in which he evaluated it.

The Background

To understand the role of William Withering and the importance of his discovery, we must consider him in the context of both his time and the area in which he lived and practiced, and in relation to the individuals with whom he worked and shared knowledge. His family background was medical, and in those days sound knowledge of plants was important because these provided the source of medications used. It is clear that he recognized the importance of this science in his profession as well as more generally, and he first acquired international fame because of his botanical research.

His immediate identification of the foxglove from among a potpourri of other herbs led to the series of systematic observations that culminated in the publication of An Account of the Foxglove. But Withering also grew up and lived at a time of great social and intellectual ferment as the industrial revolution got under way in the Midlands of England. Energy, raw materials and intellect all combined in and around Birmingham, and philosophy was encouraged rather than despised by the leaders among the practical men who developed machines and sought the company of scientists; as we will see, these qualities were all epitomized by the Lunar Society of which Withering was a distinguished member. His enquiring mind also took him into the fields of geology, chemical analysis and social history, and perhaps it was this amalgam that enabled him to make his particular observation at that particular time. When medical diagnosis was based on the limited information available from taking the patient's history and making simple observations at physical examination, before pathologists and bacteriologists had opened the door to better understanding of disease processes and long before it was possible to make recordings of bodily activities, Withering corroborated the belief of the herbalist that some cases of dropsy would respond to the foxglove and sensed the potential importance of this agent's action on the heart.

It has long been said, and for this there is some justification, that more than a century was to pass before digitalis took its rightful place as the prime agent for the treatment of cardiac disease (1), but there were some efforts within a few decades of his discovery that form part of his story. First, however, we must take up the details of his life, his discovery and the milieu in which he worked.

His Life

There is uncertainty about the precise date of his birth: William Withering was born in Wellington, Shropshire, in March 1741, the only son of Edmund Witherings (sic), an apothecary. After education at home, he appears to have been apprenticed to his father for the 4 years beginning in 1758. It was possibly under the influence of his maternal
uncle, Dr. Brooke Hector, a physician in Lichfield in the neighboring county of Staffordshire, that he decided to become a physician and entered the University of Edinburgh in 1762. After graduating with an MD degree in 1766, he settled some 20 miles from his home in Stafford, where he was one of the first physicians appointed to the new infirmary. In 1767, he met Helena Cookes, the daughter of the local town clerk, who had a talent for drawing, which may have helped his burgeoning interest in botany (1) as well as bringing them together, and they were married in 1722.

Withering then sought a better practice, but it was only when Dr. William Small died at the age of 41 that another physician, Erasmus Darwin (Fig. 1), then living in Lichfield, encouraged him to apply for the vacancy. (We can only speculate that they had got to know each other through visits that Withering paid to his uncle in that town.) Darwin is now probably best remembered for two of his grandsons, Charles Darwin, the distinguished naturalist, and Francis Galton, the geneticist. This move, doubtless aided by his association with John Ash, Small’s senior partner, led to immediate professional success: by the following year Withering’s income exceeded £1,100, and he was soon reputed to the “best loved, most learned, and busiest physician in provincial England” (2a). In addition to his clinical practice, he made the observations on the therapeutic value of digi­talis, continued and developed his detailed and exacting botanical work and became an internationally acknowledged mineralogist and chemist. His latter years were dogged by recurrent lung disease. Indeed, it was during the first of these episodes in 1784 that he wrote *An Account of the Foxglove*, which was published the following year (3).

In January 1786, Withering acquired Edgbaston Hall where he maintained a botanical garden and reared animals (4); the foxglove still grows in its grounds. It had been erected in 1717 and was converted into a golf clubhouse in 1930 (Fig. 2). Withering only left Edgbaston Hall for another home 10 days before he died on October 6, 1799. He was buried in a vault in Edgbaston Old Church 4 days later (2b).

**An Account of the Foxglove**

As Withering indicated in his book, digitalis received its name from Fuchsius (Leonhard Fuchs) in 1542; but it is claimed by Cushny (5a) that it was known to Welsh physicians as early as 1250. It had been used not only by ancient physicians but also, more generally, by herbalists, and appeared in various pharmacopeias during the 18th century. Fuchs named it digitalis because of its resemblance to a “fingerhut,” the German for fingerstall. The English word “foxglove” is of longer standing, and the derivation given by Onions (6) is curiously uncertain. He relates the first part of the word to the Old English *foxyng*, deception; in Old English, the rendering for the plant was *foxesglofa*. There is a similar unexplained association with the animal in the Norwegian name *revbjelde*, fox-bell. Other names by which it was known in English, *long purples* and *dead men’s fingers*, were used by Shakespeare in Hamlet.

Though the book only appeared in 1785, Withering had become aware of the therapeutic properties of digitalis (Fig. 3) soon after he moved to Birmingham. The suggestion by Peck and Wilkinson (2c) that it was in the course of the weekly journeys he undertook between Birmingham and Stafford when he was asked to see an old woman afflicted
with the dropsy, is probably no more than an interesting speculation. He gave a poor prognosis, they say, and was much surprised some weeks later to learn that she had made a good recovery, attributed to a herb tea. Withering’s report is factual and to the point (3a):

In the year 1775 my opinion was asked concerning a family receipt for the cure of the dropsy. I was told that it had long been kept secret by an old woman in Shropshire, who had sometimes made cures after the more regular practitioners had failed. . . . This medicine was composed of 20 or more different herbs; but it was not very difficult for one conversant in these subjects to perceive, that the active herb could be no other than the Foxglove.

In republishing a plate suggesting a discussion between Withering and “Mother Hutton,” presumably a rural herbalist, in which she appeared to give him the “family receipt,” Willius and Keys (7) did, however, acknowledge that this was an imaginary depiction. There is no need to improve on the account given by the author; town and country were then still much intertwined, and the crucial aspect is surely Withering’s botanical expertise. He was aware that others like the great Boerhaave had thought of digitalis as a toxin not having therapeutic properties, and he then began to record a series of systematic observations which he incorporated in his work.

Did he wait 9 years before publishing his book to see the drug in perspective? Whatever the reason for his delay, it led to problems. In July 1776, when Erasmus Darwin found that none of his medications was of any avail in treating a patient with dropsy, he consulted Withering, who prescribed digitalis, which proved to be of great benefit. Three years later, Darwin’s younger son Charles (uncle of the pioneer of the theory of evolution) was completing his doctoral dissertation at Edinburgh, but died of an infection contracted in the dissecting room. Erasmus added details of cases and attributed priority in the use of digitalis to his deceased son, but this misapprehension was firmly corrected by Withering (3b).

Although Withering stressed the importance of digitalis as a diuretic, his ninth inference states categorically “that it has a power over the motion of the heart, to a degree yet unobserved in any other medicine, and that this power may be converted to salutary ends” (3c). Had this become the focus for subsequent workers, there might not have been a century-long gap between Withering’s description of the action of digitalis and an understanding of its clinical importance in cardiology (8). While Withering was doubtful, Darwin’s belief in its potential value in the treatment of tuberculosis caused it to be taken up by generations of British physicians starting with Ferriar (9a). Despite this main interest, Ferriar clearly appreciated the action of digitalis on the heart. Two of his statements are worth recalling:

If any man had expressed an opinion, a few years ago, that we should discover a medicine, capable of reducing the pulse, without danger, from 120 in a minute, to 75 or 80, at the will of the Practitioner, he would have been ridiculed as a visionary. Such, however, under proper management, is the power of Digitalis. (9b);

and

. . . the power of reducing the pulse is its true characteristic (9c).

Thus, in Britain, we can see the start of the detour by which digitalis was almost lost to cardiology. It was of course employed in dropsy as a diuretic, but it was also widely recommended for a variety of illnesses including tuberculosis, fevers, migraine, epilepsy, delirium tremens and general paralysis of the insane. In Britain, Lauder Brunton (10), now best remembered for the introduction of amyl nitrate in angina pectoris, almost rescued digitalis and stressed its beneficial properties in heart disease, though he extensively reviewed the “established” uses in his doctoral thesis (11). He dwelt on digitalis toxicity, but did not improve on Withering, who had already described the effects of inadvertent overdosage (3d).
It did not take long for the knowledge of Withering’s observations to become widely disseminated in other parts of Europe. As early as 1778 a German translation appeared in Leipzig and was cited by Kreysig (12), who wrote enthusiastically of the use of digitalis in heart disease, calling it a truly divine substance, behaving in a fashion comparable with that of opium for nerve damage. But even earlier than this, news about the foxglove had reached North America: An Account of the Foxglove was carefully read by Hall Jackson, a physician in Portsmouth, New Hampshire by the end of 1785 (13a). At the beginning of 1786, he wrote to Withering, mentioning his own observations of climatic conditions during the year (1762) that he had spent in England and asked him to provide seeds from which he felt sure he would be able to grow digitalis locally. Withering responded 8 months later and sent some seeds as well as advice on dosage (13b). At the request of Withering, Jackson distributed it “into other provinces.” This may not have been the first introduction of the substance to North America. It may well have reached Williamsburg, Virginia by 1736 (13c).

The most graphic and vigorous advocate of digitalis for certain diseases of the heart was, however, the French physician Jean-Baptiste Bouillaud, better known for his description of acute rheumatic fever. In his treatise published in 1835, Bouillaud waxes almost lyrical as he describes digitalis as the true opium for the heart (14a), and the great moderator and regulator of its rhythm (14b); his debates with Laennec, who did not favor its use, were intense. It is instructive and chastening that neither Cushny (5) nor Terence East (15) was aware of Bouillaud’s observations and recommendations.

**Background and Other Interests**

Withering was the son of an apothecary and, in the first place, an apothecary himself, at a time when apothecaries were, so to speak, the dispensing general practitioners of the age. He was exceptional in that he proceeded to an academic medical training and thus had the advantage of both worlds. For the general population the choice was not so much between seeing an apothecary and a physician, as between seeing an apothecary or unqualified practitioners, including herbalists. Both apothecaries and herbalists needed to know about the natural ingredients from which they prepared their medications. Although apothecaries are no longer recognized in this sense, they accounted for most of the doctors in the North American colonies since university education meant expensive travel abroad (12d). That apothecaries and physicians could work together in amity is clearly displayed in many of Withering’s reports (3e).

Although Withering expressed little interest in botany and was, indeed, somewhat dismissive about prizes in this field when he was a medical student (2d), it became one of his major concerns once he settled in Stafford. There he developed his knowledge, aiming to produce a British Flora on the Linnaean plan. The Botanical Arrangement of all the Vegetables Naturally Growing in Great Britain, comprising two volumes and containing 836 pages and 12 plates, was published in May 1776, only a few months after he had moved to Birmingham. This work led to considerable fame, and was much admired by the great Swedish scientist Linnaeus. Because of this, Carl Fredrik von Breda traveled to Birmingham where, at Edgbaston Hall, he painted the portrait (Fig. 4) that hangs in the National Museum in Stockholm. Two other editions of the botanical work, the second in unhappy collaboration with Jonathan Stokes, appeared in his lifetime. Four more editions were prepared by his son, and reedited versions continued to appear until 1877.

But going back to an earlier stage in his career, when Withering sought to leave Stafford, it is clear that his wider interests and personal qualities were already widely known. Birmingham provided broad scope. In urging Withering to seek the vacancy, Erasmus Darwin indicated that his general qualities would please the leading manufacturer and most influential citizen of that town: “...it occurred to me that if you should choose that situation your philosophical tastes would give you the friendship of Mr. Boulton, which would operate all for you which he did for Dr. Small” (2e). Boulton, Darwin and, later, Withering were to share membership in an intriguing intellectual group, the Lunar Society, with which Small had been much concerned; its ramifications add spice to the developments of the period (16).

For much of our information about Withering’s wider...
interests, we are dependent on the collection of his works and the accompanying commentary on them by his son (17), but even in his lifetime there is evidence of his international acclaim. Two examples will suffice. While still in Stafford, he analyzed samples of different soils including terra ponderosa aerata, which he identified as barium carbonate (BaCO₃); in 1796 this was named Witherite by Werner, the German geologist and chemist (16a). The other is linked with his visits to Portugal in 1792 and 1793 and between 1793 and 1794, which were occasioned by his chronic recurrent lung disease. Although these trips unfortunately did not much aid his health, during the latter stay he was requested to analyze the waters of the medical hot springs at the Queen’s Bath (Caldas da Rainha) (Fig. 5) in the north of the country. The Royal Academy of Sciences at Lisbon made him a Fellow and published his analysis in both Portuguese and English (2f). Though his health steadily failed thereafter, he remained actively interested in scientific affairs, and his son’s memoir attests to the extent of his correspondence on a whole host of other topics (17).

**The Right Man in the Right Place at the Right Time**

Withering’s intrinsic qualities had already demonstrated themselves while he practiced in Stafford, but his career flowered in Birmingham. Here we must turn to his predecessor in practice there, William Small, whose impact on others during his brief life deserves wider recognition. These were also the days of growing development in the British colonies in North America, and there were important intellectual links between them and the leading personalities in the English Midlands. Those who visit Thomas Jefferson’s home Monticello in Charlottesville, Virginia, and see the products of his extraordinarily fertile mind and his inventive genius, will not immediately link Withering with this era, but there is an important connection.

The death of William Small, Withering’s predecessor was instrumental in leading Erasmus Darwin to urge Withering to move from Stafford to Birmingham. He had graduated from Aberdeen in 1755 and 3 years later became professor of natural philosophy at the College of William and Mary, Williamsburg, Virginia (16b). Unlike previous incumbents he clearly gave great satisfaction and started a tradition in the teaching of science that directly influenced Jefferson, whose words tell much:

> It was my great good fortune, and what probably fixed the destinies of my life that Dr. Wm. Small of Scotland was then professor of Mathematics, a man profound in most of the useful branches of science, with a happy talent of communication, correct and gentlemanly manners, & an enlarged & liberal mind. He, most happily for me, became soon attached to me & made me his daily companion when not engaged in the school; and from his conversation I got my first views of the expansion of science & of the system of things in which we are placed. . . .

Small returned to England in 1764, obtained the degree of Doctor of Medicine from Aberdeen the following year and, armed with a letter of introduction to Matthew Boulton, the Birmingham engineer and inventor, from the American philosopher and scientist, Benjamin Franklin, was welcomed into practice.

What was so special about Birmingham? During the second half of the 18th century, the industrial revolution caused it to grow considerably, indeed to become the second city of England. Its leading engineer, Matthew Boulton, took a keen interest in wider subjects, and we have seen that his approval was clearly important when Withering joined Ash. He had warm professional and social relations with physi-
By the beginning of 1775 the Lunar circle had expanded to include nine members: Boulton, Darwin, Day, Edgeworth, Keir, Small, Watt, Wedgwood, and Whitehurst. The group, by itself, was capable of acting as a complete industrial research establishment. Few scientific activities of eighteenth-century England were left out of the interests or capabilities of at least one member of the Lunar group. Electricity, optics, astronomy, mechanics, hydrodynamics, chemistry, metallurgy, medicine, geology, sound, and heat had all been touched upon by their experiments. Members dealt professionally in medicine, metal and glass working, in ceramics, and in instrument making. They were substantial members of their communities and were experienced in the practical workings of applied politics. In addition, the pattern had been established which directed the scientific interests of the various members into channels which promised to be profitable as well as interesting to other members.

The Lunar Society was always small and had no more than 14 members altogether; William Withering joined their number in its first year, and later adherents were Samuel Galton, Jr., Richard August Johnson, Joseph Priestley and Jonathan Stokes. Though not a member, Benjamin Franklin was a frequent visitor, especially in the earlier days of the circle. After 1791, the Lunar Society tended to meet less and less often, and its activities gradually declined, though its members continued to see one another. But these were politically difficult times; both the American and French revolutions had their effects. Joseph Priestley, the chemist, staunchly favored both revolutions, and suffered severely in the Birmingham riots which started on the evening of July 14, 1791 (Bastille Day) and continued for 3 days (16f). Not only his house but also his library and his laboratory were destroyed and he was driven from Birmingham. The meeting houses of religious dissenters were likewise destroyed and even though Withering played no political role, Edgbaston Hall was ransacked. Priestley moved to London and subsequently to the United States where he died near Philadelphia in 1804. In his memoirs, published posthumously, he warmly recalled his friends in the Lunar Society (15g):

I consider my settlement at Birmingham as the happiest event in my life, being highly favourable to every object I had in view, philosophical or theological . . . I had . . . the society of persons eminent for the knowledge of chemistry, particularly Mr. Watt, Mr. Keir, and Dr. Withering.

These with Mr. Boulton, Dr. Darwin . . . Mr. Galton, and afterwards Mr. Johnston of Kenilworth and myself dined together every month, calling ourselves the lunar society because the time of our meetings was near the full moon.

In this note, we sense the vigorous intellectual life of the place and observe the importance accorded to Withering. He, Erasmus Darwin and Jonathan Stokes, physicians, met freely with James Watt, who pioneered the steam engine, Matthew Boulton, Josiah Wedgwood (the potter) and others. Quite clearly, Withering was a peer among the intellectual leaders as the industrial revolution developed. The fullness of his life is reflected in the broad nature of his contributions, but most particularly in his discovery of the therapeutic properties of digitalis.

**Looking Back**

What, then, is Withering's role as we consider the observations that he reported 200 years ago? Though other alternative agents are advocated for the long-term management of atrial fibrillation, and though new positive inotropic agents are currently under evaluation, digitalis remains a cornerstone of cardiologic prescribing. We have seen how Withering unerringly identified it as the active agent responsible for the benefit produced by an amalgam of various substances. He noted its efficacy as a diuretic drug, but that it had no role in the management of localized collection of fluids like ovarian cysts. He observed its effect on the pulse and inferred its potent action in improving cardiac function. True, many other diseases were treated with digitalis, but the fundamental observations of its specific benefits needed more than a century for proper appreciation. It could indeed not have been otherwise.

Withering worked as a physician in the nascent stages of modern clinical medicine. He could take a history, palpate the patient and possibly use percussion, but he could do no more than feel the pulse. He could not measure the blood pressure, listen systematically to heart sounds and murmurs or even envisage graphic recordings of the pulse, all of which were yet to come. What we can say with considerable confidence, but no proof, is that his series of patients must have included those with atrial fibrillation and rheumatic heart disease. Without such patients, could the benefits of digitalis have been so clearly appreciated? Others were soon to point out how quickly it could reduce rapid heart rates to normal, and indeed improve irregular rhythm, using evocative phrases, but the original observation was that of Withering, and the credit belongs to him. Most important, he...
reported on all his patients and included the adverse as well as the beneficial results. He criticized the London physicians, led by Lettsom, and indeed others for overgenerous dosage and for selecting patients inappropriately. He stressed the need to find the correct dose for each patient and the importance of avoiding toxicity.

His ninth inference, reflecting his belief that digitalis had so powerful an effect in favoring the heart, must surely lead us to believe that he had formulated his ideas as far as they could reasonably then be taken. It was impossible for him to have been any more specific about the type of cardiac disorder or underlying pathologic changes at a time when it was impossible to define them. By having found an agent that could help the heart, Withering at least made it practical for these developments to follow. He had found the remedy long before the requirements for it could be defined. As we recall him and his contribution, we should reflect on how an individual working in an environment that encouraged research found a potent remedy whose actions still remain incompletely understood.

References
2. Peck TW, Wilkinson KD. William Withering of Birmingham MD, FRS, FLS. Bristol: John Wright & Sons, 1950:2a,vii; b, 212; c, 70; d, 45; e, 1–2; f, 391–2.
3. Withering W. An Account of the Foxglove, and Some of its Medical Uses: With Practical Remarks on Dropsy, and Other Diseases. London, GGJ and J Robinson, 1785: a, 2; b, 12–6; c, 192; d, 184–8; e, 9.