Lee MR (2005). William Withering (1741-1799): a biographical sketch of a Birmingham Lunatic.

Withering was born in Wellington, in Shropshire, England, in March 1741, the son of a surgeon. After a period as an apprentice to a surgeon there, he moved in 1762 to Edinburgh, Scotland, to study medicine, and qualified MD in 1766 after submitting a thesis entitled *De Angina Gangraenosa* (*Malignant putrid sore throat*). Withering moved back to England in 1767, and established a private practice in Stafford, and also worked as a physician at the Stafford Infirmary. Unexpectedly, in 1775, he was invited to go to Birmingham to join the staff of the General Hospital there, where he was to work for the next seventeen years.

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During his time at Birmingham, Withering published his major work on the foxglove (*Digitalis*) - *An account of the foxglove and some of its medical uses* (Withering 1785) - but also made notable contributions to botany, geology, chemistry and archaeology. He was forced to retire in 1792 as a result of a progressive chest illness and died seven years later in 1799.

Withering and Digitalis

The story of Withering and the foxglove has been told in detail elsewhere - for example, by Aronson (1985) - and Tröhler has drawn attention to the important methodological features of Withering's *An account of the foxglove... i* n his commentary on the *James Lind Library* . However, a few points are worth reiterating here in order to highlight Withering's specific contributions to the story of *Digitalis*. The plant *Digitalis* had been known and used in medicine for centuries. Classic descriptions were given both by Dioscorides and Galen. In particular, Leonard Fuchs (1501-1566) named the plant *Digitalis* in his book *Historia stirpium* in 1542 and recommended it for "the scattering of dropsy" (Fuchs 1542). 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 Brazenose College, Oxford, who had *hydrops pectoris* (pulmonary oedema). 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 (Peck and Wilkinson 1950).

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 the occurrence of 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-phlebitic 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 the foxglove 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.

Withering and botany, geology and chemistry

Withering's recognition of the foxglove as the active principle of the various witches' brews that had been used to treat dropsy (oedema) was primed by his extensive botanical studies and investigations. In 1776 shortly after his arrival in Birmingham, he published the work entitled *The botanical Aarangement of all the vegetables naturally growing in Great Britain.* This was an immediate and sustained success and indeed it would run to many editions. As a result of its widespread acceptance, Withering was elected a Fellow of the Linnaean Society (in 1784) and following this he was honoured by the naming of the plant *Witheringia solanacea* to commemorate him. Even after his death his son continued to publish the *Botanical Arrangement* for some years and his reputation on the Continent of Europe was so high that he was given the sobriquet of the `English Linnaeus'!

His studies in geology and chemistry were no less distinguished. At various times he performed useful work on the chemical composition of marl (a soil improver); the spontaneous inflammability of black wadd (a manganese compound) and methods for the solubilisation of the oxides of arsenic. The work on arsenic was in response to a plea for help from Thomas Fowler who was in the process of developing *liquor arsenicalis* (Fowler's solution); later used with good effect in the treatment of disorders of the skin before its long-term toxicity became apparent.

Perhaps his major work in the field of chemistry was in relation to the Heavy Ore from Alston Moor in Cumberland. He conducted a series of experiments on this *Terra Ponderosa* and was drawn to the conclusion that it contained a new, hitherto undescribed, element (or earth). Unfortunately he was unable to characterise the element further and it was left to Sir Humphrey Davy early in the 1800's to isolate the metal barium from this (and similar ores). The heavy ore from Alston Moor was in fact barium carbonate and some years later the great German geologist Werner named it *Witherite* to recognise the Birmingham physician. The work on the *Terra Ponderosa* was communicated to the Royal Society of London and Withering was subsequently elected as a Fellow in 1785.

Withering the Lunatic

Through all these endeavours, Withering was encouraged by his membership of the Lunar Society of Birmingham, which met once every month on the Monday nearest to the full moon (hence 'Lunar'), so that the members would have the benefit of some light on their homeward journeys (in the days of highwaymen and footpads). Withering and his fellow members of the Lunar Society (the 'lunatics') epitomized the 18th century learned society in the English Enlightenment, which followed hard on the heels of developments in Scotland (Schofield 1985). Members of this group included Matthew Boulton, Erasmus Darwin, Josiah Wedgwood, James Watt and many others who were equally distinguished. This extraordinary group acted as a ferment to the Industrial Revolution, both locally in Birmingham and nationally in the United Kingdom. They corresponded with Lavoisier in France and Franklin in America.

Moreover, in 1780, they persuaded the great chemist Joseph Priestley to move from Bowwood in Wiltshire to Birmingham to set up his house and laboratory there. In fact Withering (and others) raised a subscription to fund Priestley's laboratory and equip it with the latest scientific apparatus. Here the great Unitarian philosopher would continue his famous series of experiments on phlogiston; together with the fixed and volatile airs (or gases as we would now say). Under Priestley's tuition, Withering would carry out parallel experiments on these topics although he was never completely convinced as to the existence of phlogiston.

This happy scientific idyll continued for several years and was not greatly disturbed by George III's illness or by the French Revolution in 1789. In general the Lunatics welcomed the overthrow of the `ancient regime' in France and hoped for a similar liberalisation in England. However, in 1791 the 'Church and King' riots in the city brought this peaceful and tranquil existence to a sudden and violent end. The local mob identified the Lunatics (and in particular Priestley) as a threat to the Monarchy and the Established Church. A violent group sacked Priestley's house, burnt his library and destroyed his laboratory. Withering's residence was also attacked. After a pitched battle between his servants (and hired pugilists) on the one hand and the mob on the other, the assailants were driven off after several hours of hand to hand combat and retreated to attack easier targets! Priestley fled to London and later went into lifelong exile in America. The golden period of the Lunar Society was over and as it declined so did the members both from age and infirmity.

Withering's chest complaint, which was probably chronic bronchitis (and may have had a consumptive element), began to progress. In the year following the Birmingham riots (1792), he resigned from his post at the General Infirmary. From then on he fought a losing battle against the disease for seven years until this culminated in his death in 1799. Nevertheless he continued to write even until the end when he could no longer draw enough breath to speak! He spent several winters in the milder climate of Portugal but this did not delay significantly the inevitable progress of his disease. He died in 1799 at the early age of 58. The funeral procession to Edgbaston Old Parish Church was accompanied by several thousand mourners. His epitaph there shows on one side *Digitalis* (the foxglove) and on the other Witheringia (his eponymous tribute). Certainly a luminary of the Enlightenment had been extinguished

prematurely!

In this brief vignette, I cannot represent adequately the scope and depth of Withering's contribution to natural philosophy in the last thirty years of the eighteenth century. The interested reader requiring more detailed information on this scion of the British medical scene is referred to a short account by Lee (2001) and to a full-length and extensive treatment by Peck and Wilkinson (1950). These accounts should enable them to gain a true appreciation of this remarkable physician and natural philosopher who, with his Fellow Lunatics, contributed so much to Birmingham and to the World.

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