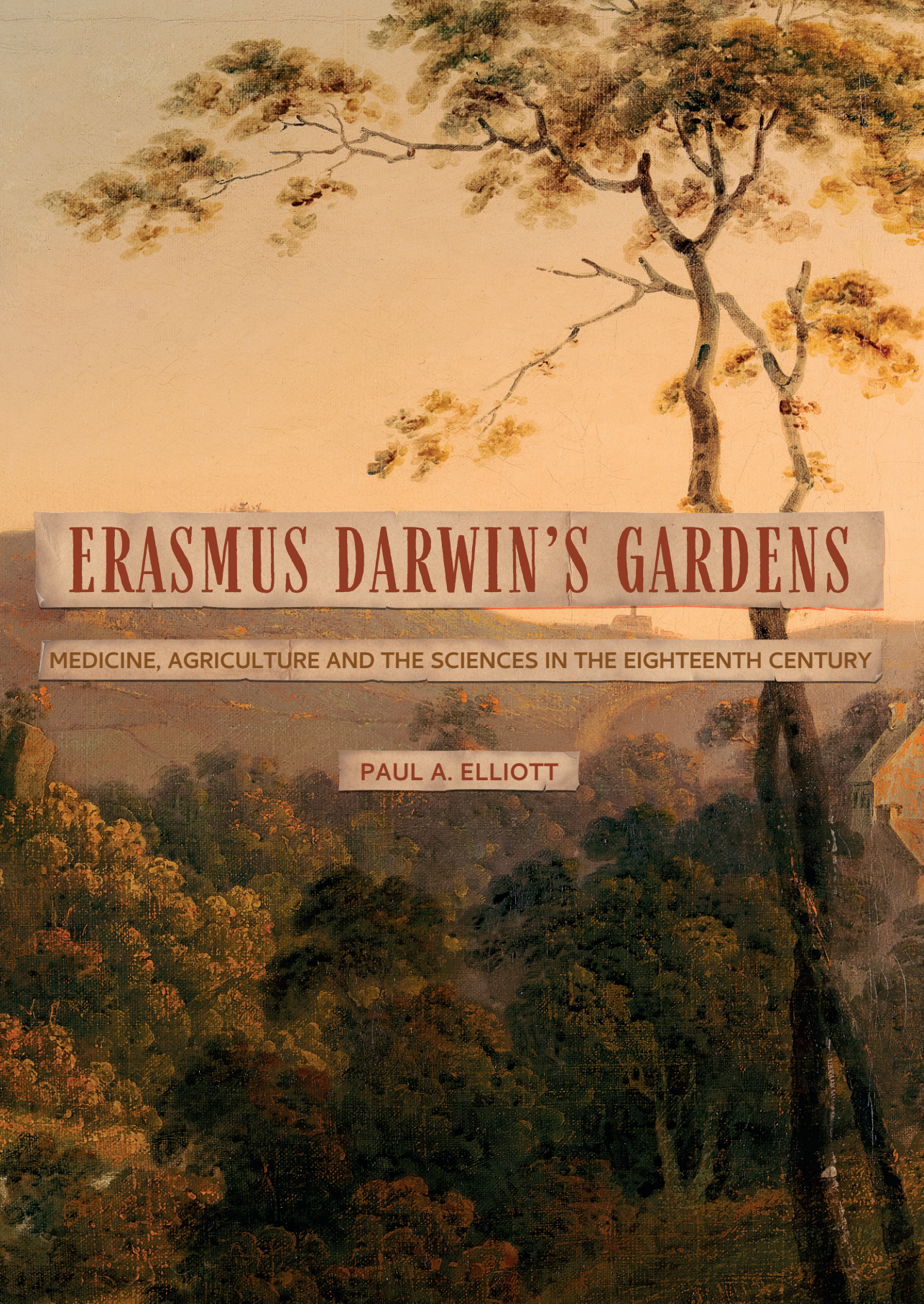

ERASMUS DARWIN'S GARDENS

MEDICINE, AGRICULTURE AND THE SCIENCES IN THE EIGHTEENTH CENTURY

PAUL A. ELLIOTT

Garden and Landscape History

ERASMUS DARWIN'S GARDENS

Garden and Landscape History

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ACKNOWLEDGEMENTS

I would like to pay tribute to Desmond King-Hele FRS before anyone else, because his support over many years has been an important source of inspiration. I was fortunate to have his advice with my doctoral research on the Derby Philosophers during the 1990s and beyond, and I will always appreciate the effort he took to send encouraging letters and copies of his publications. It was heartening to have someone of his eminence as scientist, writer and historian of science (who already had a distinguished career as a space scientist at Farnborough) taking an interest in my own research, and I was pleased to help in a small way with the updated edition of Darwin's correspondence. Anyone who investigates Erasmus Darwin and the Lunar Society circle knows how much we are all indebted to him for his enthusiasm and for the painstaking and industrious research he conducted over many decades, as his biographies – *Doctor of Revolution* (1977) and *Erasmus Darwin: a Life of Unequalled Achievement* (1999) – edition of the *Collected Letters of Erasmus Darwin* (2007) and other works make abundantly clear. As unfortunately I did not manage to complete this book in his lifetime, I would like to dedicate it to his memory.

I won't spell out the main academic inspirations in detail here as this will be fully evident in each chapter. However, as regards Darwin himself I would single out, in addition to Desmond, the work of Roy Porter and Maureen McNeil, particularly for showing me the value of taking his medical practice and theories seriously in period context (and using the larger third edition of *Zoonomia*, 1801), and I have tried to apply and extend this insight further here by exploring how Darwin applied these to the treatment – and understanding of – animal and plant diseases. Another key academic inspiration generally has come from the work of historical geographers and historians of science such as Stephen Daniels, Charles Watkins, Charles Withers, David Livingstone, Jan Golinski and Vladimir Jankovic, who have taken a cultural-geographical approach to the history of the sciences, gardens, parks, agriculture and woodland. Research in the history of gardens and agriculture has also, not surprisingly, offered many insights, and I would particularly highlight the research of Tom Williamson and John Dixon Hunt in this respect. John Beckett's writing and encouragement have been another great help, particularly in relation to east midlands history, the histories of the aristocracy and agriculture – as have our discussions concerning the history of science and green spaces.

The book has also benefited from discussions with colleagues in geography and history at various universities, especially Charles Watkins, Stephen Daniels, Susan Seymour and Mike Heffernan of the School of Geography, Nottingham University. Discussions with Emily Sloan about her research and the completion and publication of her book *The Landscape Studies of Hayman Rooke (1723–1806): Antiquarianism, Archaeology and Natural History in the Eighteenth Century* (2019), in the same series as this volume, helped encourage me to complete this work as well as providing useful points of comparison between two rather different Georgian natural history enthusiasts. The current volume grew out of an essay on Darwin's gardens that I wrote for *Enlightenment, Modernity and Science* (2010) and a short chapter on 'Erasmus Darwin's trees' that I contributed to Laura Auricchio, Elizabeth Heckendorn Cook and Giulia Pacini eds, *Invaluable Trees: Cultures of Nature, 1660–1830* (2012), and I am grateful to the editors and peer reviewers of these for critical comments. Some of the material on Darwin's farm and animals was delivered at the 'Lunarticks, Linnaeus and Lichfield' conference at The Old Stables, Cathedral Close in October 2016, and I am grateful to the staff of Erasmus Darwin House Museum, my fellow presenter Jeremy Barlow and other participants for fruitful critical observations and discussion. Although not directly related to the Darwin book, I have also learnt much generally about the cultural history of landscapes and environments from involvement in the Arts and Humanities Research Council-funded Social World of Nottingham's Historic Green Spaces community history project (2013–14, 2016), and would like to thank the other members of the academic team, John Beckett, Judith Mills and Jonathan Coope, and the many contributors and partners for providing such a rewarding experience.

This book was largely written during my time at the University of Derby and I am very grateful to friends and colleagues for their support. This has included those in history – Ian Barnes, Robert Hudson, Ruth Larsen, Ian Whitehead, Tom Neuhaus, Cath Feely, Oliver Godsmark and Kathleen McIlvenna – and others in Humanities, Arts, Education and elsewhere. My work has benefited too from encouragement and criticism from members of our eighteenth-century research group, Erin Lafford, Freya Gowerly, Joe Harley, Ruth Larsen and Paul Whickman, and also help from our Research Impact Officer, Victoria Barker, and Research Support Officer Christine Selden. Another constant source of inspiration has come from undergraduate and postgraduate history students at Derby, especially those who have taken my courses on landscape and environmental history, the history of medicine and our co-taught Enlightenment option, and likewise my doctoral students, especially Luke Schoppler, Mark Knight and Matt Winfield. Likewise, I'm pleased to acknowledge sustained support and encouragement from successive Deans at Derby – Huw Davies, Malcolm Todd and Keith McLay – and also from Neil Campbell, my predecessor as Head of Research for Humanities and Journalism. The University of Derby has provided financial support too for research visits to archives, for which I am grateful. I'd also like to show my appreciation for the stimulation provided by Dennis Hayes, Ruth Mieschbuehler, Vanessa Pupavac and other regular contributors to the East Midland Salon, who offered comment and criticism on talks I have given in the convivial atmosphere of Derby's characterful Brunswick Tavern on Darwin and the Derby Philosophers, the

Enlightenment and landscape and environmental history, in true Georgian clubbable fashion. Jonathan Powers, whose series of 'mini monographs' provides a scholarly and approachable introduction to writers, philosophers and scientists with Derbyshire connections, has also been helpful.

The experience of giving public talks on Darwinian topics has been another continuing fount of ideas and stimulation. I would like to thank the dedicated and enthusiastic staff, volunteers and audiences at the brilliant Erasmus Darwin House Museum in Lichfield, Derby Museum and Art Gallery, Buxton Crescent and Thermal Spa Heritage Trust and Derby Local Studies Library for making my various presentations so rewarding. My involvement in co-designing and co-curating an exhibition on the 'Moonstruck Philosophers' with Mark Young, Mandy Henchliffe and Victoria Barker at Derby Local Studies Library as part of the Being Human Festival funded by the British Academy in November 2019 – and leading associated events such as public walks around the city – was likewise a fulfilling and enjoyable experience that made me think differently about the relationship between places, practices and ideas associated with Darwin and the Derby Philosophers.

I am very grateful to Tom Williamson, Caroline Palmer, Elizabeth McDonald, the anonymous peer reviewers and publishers Boydell and Brewer for commissioning the book and for their patience despite the completion taking much longer than initially expected. Thanks to Nick Bingham, Senior Production Editor and Sarah Harrison as Copyeditor, who guided it through the production stage, contributed ideas, helped resolve ambiguities and saved me from some errors (any that remain of course, are my sole responsibility!). Colleagues and friends associated with the Centre for Urban History at Leicester University and the Urban History Group conference, particularly Roey Sweet, Richard Rodger, Bob Morris and Barry Doyle, have also provided support and help over the years. The book has also greatly benefited from assistance provided by the staff of many library and record offices, especially those in Nottinghamshire, Derbyshire, Staffordshire (in Stafford and the now unfortunately closed Lichfield branch) and Birmingham, and I would particularly like to thank Sarah Chubb and colleagues at Derbyshire County Record Office, Lucy Bamford and the staff of Derby Museums, Ros Westwood and colleagues of Derbyshire museums and Mark, Mandy and colleagues at Derby Local Studies Library past and present for the dedicated and enthusiastic support they have provided for my research over many years. My involvement with the Derwent Valley Mills World Heritage Site Research and Research Framework committees has provided insights concerning Enlightenment and industrialisation more broadly, and I am grateful to David Knight of Trent and Peak Archaeology and the members of these for their encouragement. Similarly, my experience serving on the board of the innovative *History West Midlands Magazine* supplied other perspectives concerning Darwin, the Lunar circle and their regional milieu, and I am grateful to Malcolm Dick and those associated with the Centre for West Midlands History at the University of Birmingham in different ways for these experiences.

From a personal perspective, my friends Dan, Katy, Arthur and Lawrence have offered enthusiastic support. The microbiologist Martha Clokie of the University of Leicester and Julian Clokie provided helpful advice when I had great difficulty finding

much academic work on the history of phytopathology, which remains a neglected subject. I am also very grateful to my mother Kathleen and other members of my family: Magdalen, Christian, Nikki, Harry, Jack, Bernadette, Nick, Jude, Marcus, Joe, Beverley, Peter, Matthew, Hollie, Ashley, Molly, Christian, Eleanor and, especially, Stuart for their love and encouragement.

A NOTE ON PLANT NAMES AND IDENTIFICATION

I have retained the original botanical or vernacular tree and plant names from sources such as Erasmus Darwin's works and the published Linnaean translations of the Lichfield botanical society and sometimes the fifth edition of William Withering, *Systematic Arrangement of British Plants* (1812), unless it seems to me that this would be too confusing. I have also used the herbals of John Hill and Robert Thornton, John Lindley's *Flora Medica* (1838) and other texts to help identify medicinal plants.

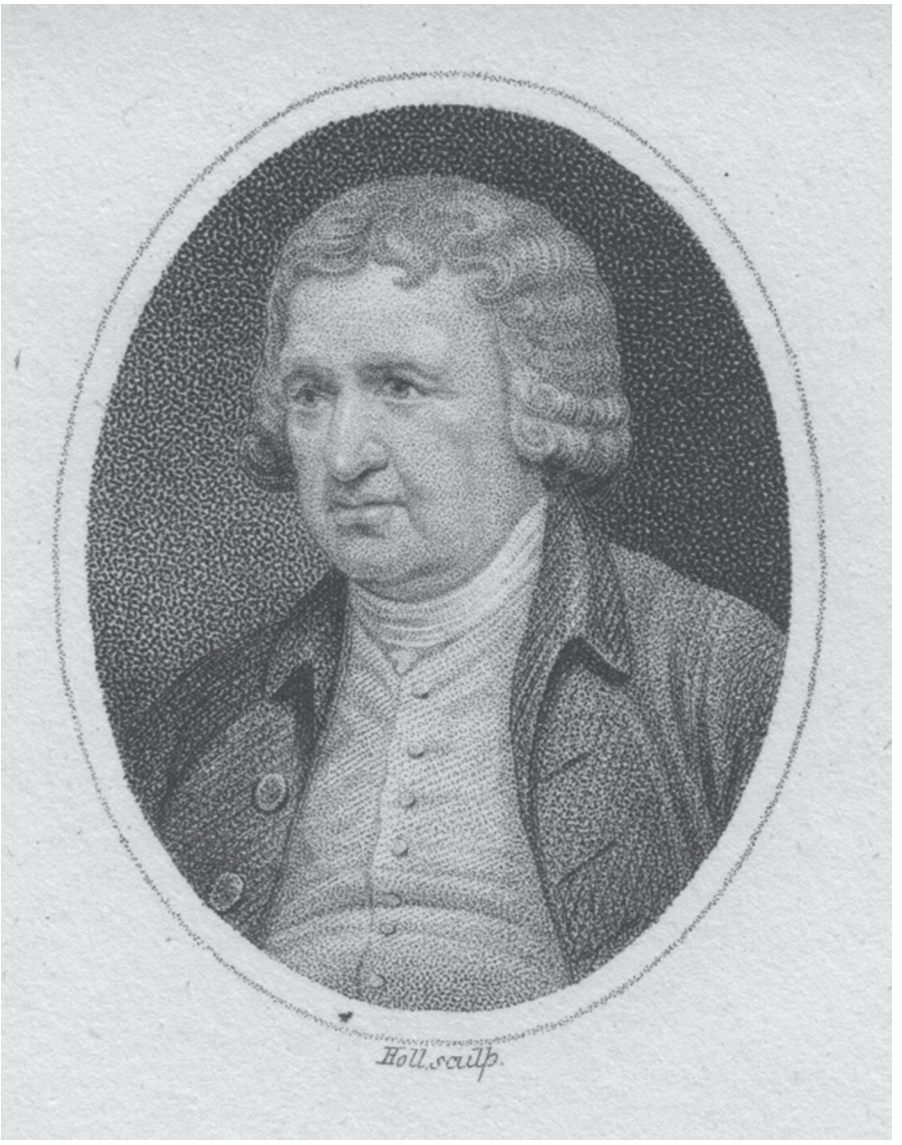

Figure 1. Stipple engraving of Erasmus Darwin by J. Joll, after Joseph Wright of Derby.

INTRODUCTION

The physician Dr Erasmus Darwin (1731–1802) (Figure 1) is still most well known as Charles Darwin's grandfather, a major evolutionary thinker and a natural philosopher whose ideas partly prefigured those of his grandson. A genuine larger-than-life character of robust physical size and generous but sometimes sarcastic humour, whose medical practice took him travelling around the midland counties for decades, Erasmus Darwin obtained fame in his own lifetime as the author of *The Botanic Garden* (1791), an epic poem with lengthy philosophical notes published in two parts, *The Loves of the Plants* (1789), which amused Georgian society with its poetic portrayal of vegetable amours, and the longer *Economy of Vegetation* (1791). Darwin also published *Zoonomia* (1794/96), a major study of human physiology and medicine, *The Temple of Nature* (1803), a grand epic poetical celebration of the wonders of life with philosophical notes, and *Phytologia* (1800), on the philosophy of agriculture and gardening. He came from Nottinghamshire but spent most of his life in Lichfield, Staffordshire and Derby.

Darwin grew up on the low-lying family estate in Elston in east Nottinghamshire, close to the river Trent and its tributaries (Figure 2). The family were gentry who also owned land in other parts of the county and in Lincolnshire, some of which Darwin inherited on his marriage to his first wife Mary Howard (1740–1770) in 1757. His father Robert (1682–1754), a lawyer, and his mother Elizabeth (Hill) (1702–97) had six other children: Elizabeth (1725–1800), Anne (1727–1813), Susannah (1729–1789), William Alvey (1726–1783), John (1730–1805), rector of Elston, and Robert Waring (1724–1816), a lawyer and botanist who inherited Elston Hall (Figure 3). Darwin attended Chesterfield school, Derbyshire, when it had a strong reputation under William Burrow (1683–1758), which conjured up memories of 'a thousand pleasing circumstances' and where his classmates included the antiquarian Rev. Samuel Pegge (1733–1800) and Lord George Cavendish (1728–94), second son of William Cavendish, 3rd duke of Devonshire.[1]

After receiving a medical education at St John's College, Cambridge, and Edinburgh University during the 1750s and unsuccessfully trying to practise at Nottingham in 1756, Darwin quickly built up a reputation and income as a physician at Lichfield and Derby, travelling around the midland counties tending to patients and thriving in the highly competitive, burgeoning medical marketplace of Georgian England (Figure 4).[2]

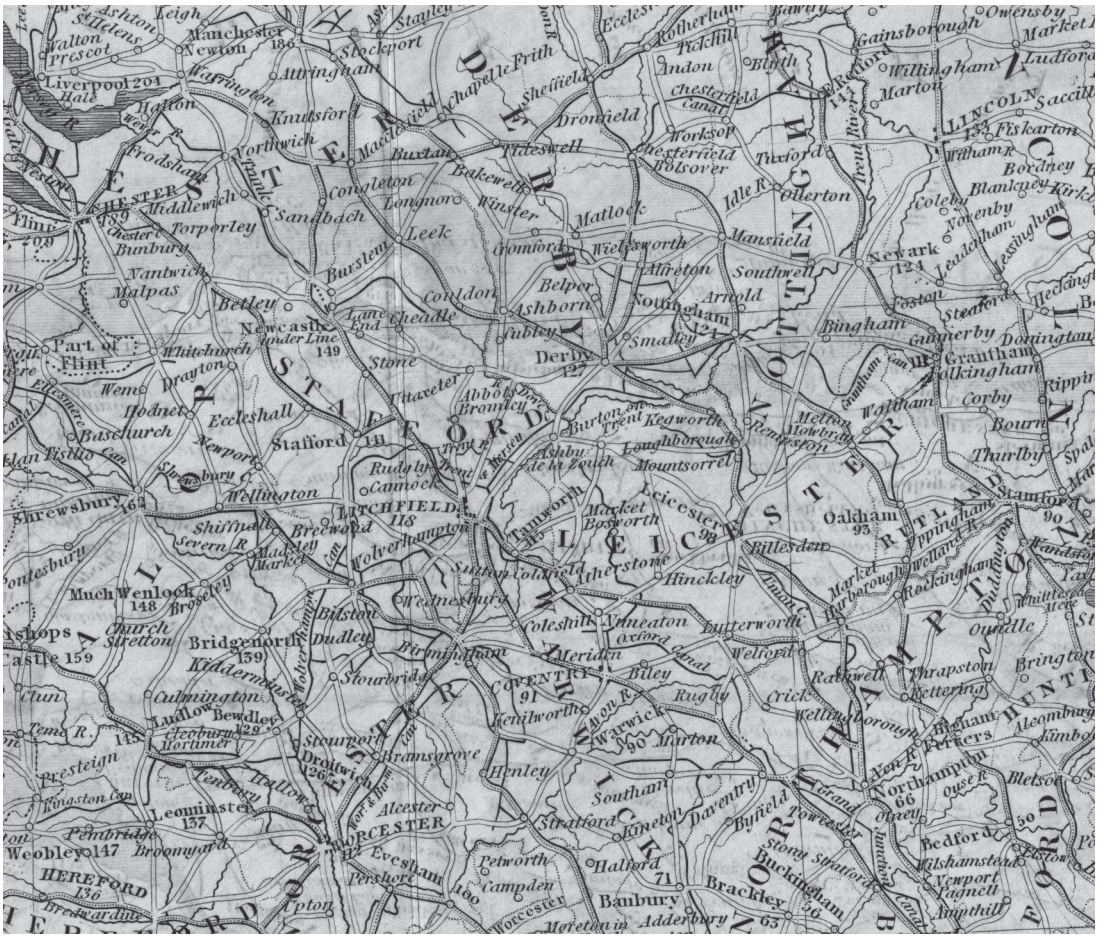

Figure 2. The midland counties, showing roads, canals and towns before the coming of the railways, from J. Bell, *A New and Comprehensive Gazetteer of England and Wales*, 4 vols (1834), vol. 1.

According to one of its Georgian historians, John Jackson, Lichfield was a 'place of very little mercantile business' situated in a 'pleasant and healthful valley' in central England and surrounded by moderate hills with 'fine springs'. It was 'chiefly inhabited by gentry' and 'ancient and numerous' families. Overseen by the graceful spires of its cathedral, known as the 'Ladies of the Vale' and visible for miles around, its buildings had 'assumed the air and taste of modern times' and embodied the 'improving spirit of the age' (Figure 5). As a market town, diocesan capital and coaching centre, Lichfield's prosperity depended upon local trade, agriculture, leisure, travel and church society, with coteries formed of professionals such as diocesan clergy, lay officials and lawyers, although the bishop did not reside in the palace during the eighteenth century, but at Eccleshall castle. Although it functioned in some respects as a second Staffordshire county town, the city remained fairly small, with a population of 3,088

Figure 3. Pen and ink sketch of Elston Hall, from K. Pearson, *The Life, Labours and Letters of Francis Galton*, vol. 1 (1914).

in 1695 rising to 4,842 in 1801.[3] With its gentry and 'ancient' families, bookshops, charitable institutions, clubs and associations, Lichfield also had pretensions to polite society and learned culture. In a much quoted jesting remark to James Boswell (which tacitly acknowledged that the city was being left behind by its burgeoning, industrious neighbour), Samuel Johnson (1709–1784) claimed that Lichfield was a 'city of Philosophers' who worked 'with our heads, and make the boobies of Birmingham work for us with their hands'.[4] It was here that Erasmus and Mary Darwin had five children: Charles (1758–1778), Erasmus junior (1759–1799), Robert (1766–1848) (who became Waring after the death of his uncle), William Alvey (1767–1767) and Elizabeth (1763–1764), who both died in their first year. Darwin's near neighbour, his close friend and biographer the poet Anna Seward (1742–1809) (Figure 6), who will feature much in these pages, believed that his 'talents and social virtues' had from his family home in The Close 'shed their lustre' over the city, and it was 'to this *rus in urbe*' that a 'knot of philosophic friends' often 'resorted', some of whom were to become members of the three philosophical associations Darwin was largely responsible for founding: the Lunar Society of Birmingham, the Derby Philosophical Society and Lichfield Botanical Society. He nurtured these groups as a highly enthusiastic socialite, conversational wit,

Figure 4. Timeline of Erasmus Darwin.

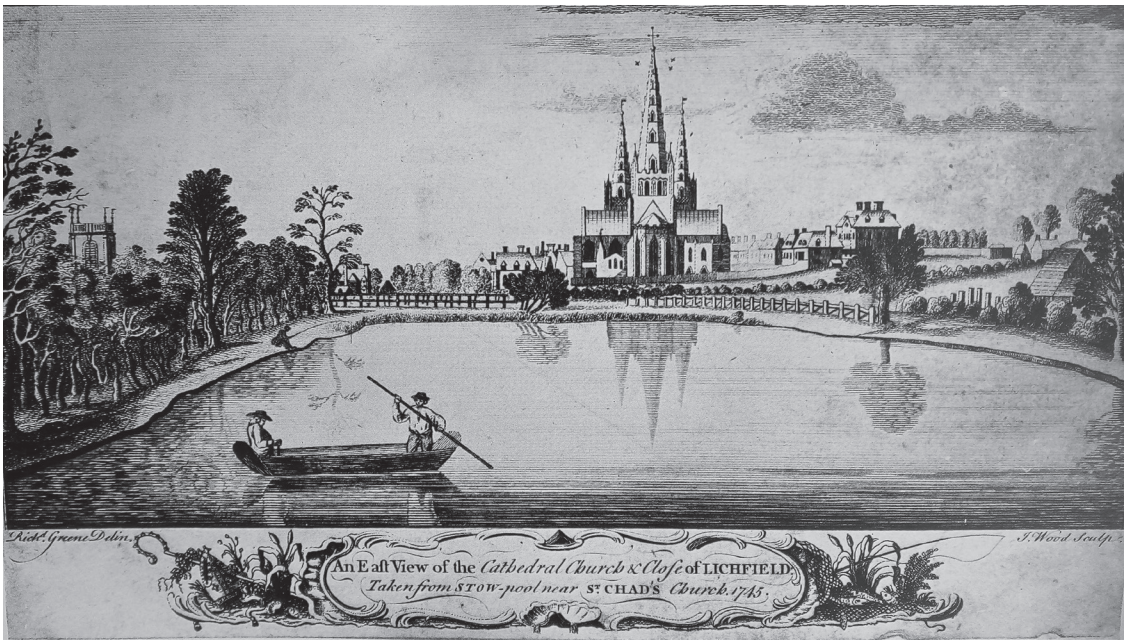

Figure 5. (above) Engraved view across Stowe Pool towards Lichfield cathedral (1745), with the bishop's palace, the residence of Anna Seward, to the right; from A. S. Turberville ed., *Johnson's England* (1933), vol. 1.

Figure 6. (left) Anna Seward, engraving by A. Cardon after painting by T. Kettle (1762).

omnivorous reader and inveterate writer. As we will see, the scientific organisations that Darwin helped to found and lead and his circles of philosophical friends provide an excellent demonstration of the centrality of sociability and clubbability to the intellectual excitement that characterised the British Enlightenment.[5]

Darwin experienced two major tragedies during the 1770s. The first of these was the death of his wife Mary in 1770 after a long and painful illness which her husband had only been able to alleviate with opium but never cure. The second was the death of their son Charles as a student at medical school in Edinburgh in 1778 after a cut acquired during the dissection of a dead child's brain became infected. We know from his correspondence how devastated Darwin was by both these events. Following his return from Edinburgh he composed or part-composed an elegy in memory of Charles and in 1780 published his son's prize-winning essay on pus and mucus in a volume with a biographical memoir.[6] However, after the death of Mary and an affair with Mary Parker resulting in the birth of two daughters, Susan and Mary Parker (junior), Darwin became close to Elizabeth Pole (1747–1832), the wife of Colonel Edward Sacheverell Pole (1718–1780) of Radburn Hall, Derbyshire. When the colonel died Darwin married Elizabeth and came to live at the hall in 1781, after which he acquired a townhouse on Full Street in the centre of Derby just off the market square the next year. The Darwins took up residence in summer 1783 after undertaking some improvements and stayed there for nearly twenty years before moving to the Priory near Derby in 1802 (at Breadsall).[7]

By the later eighteenth century Derby was a flourishing medium-size county town and agricultural and manufacturing centre with brewing, textile and china industries. Its population grew from 8,563 in 1791 to 10,828 in 1801. The transformation brought by the eighteenth-century urban renaissance was strongly evident in the town's neo-classical buildings, such as the reconstruction of All Saints Church (designed by James Gibbs), the fashionable residences of Friargate and elegant inns, as well as improved roads and pavements, although a growing concentration of poorer folk lived in more overcrowded conditions beside Markeaton Brook.[8] The town also benefited from the improvements occurring in road, river and canal communications during the 'long' eighteenth century, which connected it to national networks and major centres such as Birmingham and ports like Gainsborough, Kingston-upon Hull and Liverpool.[9] There were also mills for slitting and rolling iron, a copper smelting and rolling works, china-making and mineral and spa industries, while coal- and lead-mining brought wealth, business and mechanical knowledge.[10] John and Thomas Lombe's original silk mills remained a tourist attraction, but local textile industries underwent major innovation and expansion from 1771, especially at Derby and along the Derwent Valley at Darley Abbey, Cromford, Milford and Belper. Moving from Richard Arkwright's spinning frame and carding engine, the Arkwrights, Strutts and other textile manufacturers demonstrated how a range of mechanical processes could be accomplished in one location with improvements in water power technologies, use of steam power to improve water supplies and directly power the machinery, innovations in stove-vent heating systems and experiments with fire-resistant building methods for floors and roofs, including the use of hollow pots and iron plates to cover wooden beams, tiled

floors placed upon brick jack-arches, cast-iron beams and iron columns.[11] There were also major developments in the formation of industrial communities in Derbyshire and the Derwent Valley through provision of domestic houses, public buildings, gardens, allotments, plantations and farms.[12] Local lead-mining was at its most productive between 1600 and 1800, and there were associated spa and petrifaction industries that produced worked objects such as ornaments, vases and urns from materials such as gypsum and blue john, which were originally by-products of mining. Demand increased, encouraged by visiting tourists, collectors and natural philosophers in search of Peak wonders, picturesque prospects, mysterious subterranean caverns and the healing waters of springs at Matlock, Buxton and other county locations.[13]

While living in Derby, Darwin continued his scientific and mechanical experiments alongside medical practice; in this he was supported by the members of the Philosophical Society, producing his scientific and poetical works with the aid of the society's library. Inspired by experimental observations of trees and shrubs, *The Botanic Garden* included long additional notes on vegetable perspiration, placentation (provision for the nourishment of young buds, bulbs or seeds), circulation, respiration, glandulation (glands for nutriment of seeds, bulbs and buds) and impregnation that were to grow into much longer equivalent chapters in *Phytologia*, his study of the philosophy of agriculture and gardening. Darwin's botanical work was importantly shaped by his experiences translating the *Systema Vegetabilium* and *Genera Plantarum* of Swedish naturalist Carl Linnaeus, published under the auspices of Lichfield botanical society in 1783. Encouraged by philosophical friends, he also published *Zoonomia*, a major study of human physiology and medicine, and *The Temple of Nature*, a poetical celebration of the wonders of life. *The Botanic Garden* and *The Temple of Nature* adopted aspects of fashionable pastoral, epic and mock epic poetry exemplified by Alexander Pope's *Rape of the Lock* (1714), which turned everyday trivial occurrences into ostensibly momentous triumphs and tribulations. Darwin used his epic poems to convey scientific or 'philosophical' ideas, distinguishing between poetic language and prose that was more appropriate for presenting and analysing scientific ideas and likening the scenes that he painted in them to those of a landscape artist. In the interlude of *The Loves of the Plants* he self-deprecatingly and humorously used an imagined conversation between the bookseller and poet to distinguish between the 'pure description' of poetry and the 'sense' of the notes. While the poet was a 'flower painter' or 'landskip' artist, the principal distinction between poetry and prose was that the former 'admits of but few words expressive of very abstract ideas, whereas prose abounds with them'; poets, with their personifications and allegories, write 'principally for the eye', while prose writers employ 'more abstracted terms'. Hence in 'graver' philosophical works for instruction rather than amusement it became 'tedious' if too many descriptive pictorial words were employed.[14] While some poetry could be didactic, 'science' was 'best delivered in prose' because 'its mode of reasoning is from stricter analogies than metaphors or similies'.

Since 2000 Darwin's residence in Cathedral Close, Lichfield, has been opened as the Erasmus Darwin House museum and study centre, celebrating his life and achievements, while a wealth of new manuscript material that has been uncovered

and preserved at Cambridge is transforming our understanding of his work. While *The Botanic Garden* has received much academic scrutiny in, for instance, literary and gender history, there has never been a systematic study of the landscapes, environments, animals and plants that inspired Darwin's work or a full attempt to reconstruct and analyse his gardens and plantations using evidence from manuscript papers and other historical sources. It is well known that *The Botanic Garden* was partly inspired by a botanic garden that Darwin created near Lichfield and informed his efforts to translate the works of Linnaeus into English, aided by the members of the botanical society at Lichfield. This book, therefore, explores the relationships between the landscapes that Darwin encountered at various stages of his life and his medical, scientific and literary activities, trying to reconstruct, for instance, what the Lichfield botanic garden and Derby garden and orchard were like as places, examining how encounters with plants and trees challenged Darwin's understanding of Linnaeus's 'artificial' system of plant classification and demonstrating how these shaped his works on natural history, including *The Botanic Garden*, *Phytologia* and his Linnaean translations. Inspired by his medical practice, he saw many parallels between animals, plants and humans, which informed his work on vegetable anatomy and physiology. From observations of subterranean caverns to the use of plant 'bandages' and electrical machines to hasten seed germination to what were seen as philosophically and ethically controversial studies of vegetable 'brains', nerves and sensations, Darwin's landscape and garden experiences had a profound impact upon his career. They provided him with insights into medicine, taxonomy, chemistry, geology, soil creation, evolution, the 'economy' of the natural world and much more. His medical practice and ideas as well his industrial interests encouraged him to perceive and experience landscapes in dynamic terms and he took a close interest, for instance, in the application of natural philosophy to agriculture, especially in *Phytologia*.

In these publications, and encouraged by his medical practice, Darwin presented what could be regarded as a biological, geological and cosmological developmental theory in which, as we shall see, constant analogies were made between the animal and vegetable worlds. Although he is often described as an evolutionist, this was not a term employed by Darwin and it risks 'whiggish' anachronism, conflating him as it does with nineteenth-century naturalists, including his grandson, and seeing his work as part of an inevitable progression towards 'modern' Darwinian evolutionary scientific consensus when in fact many of his ideas looked as much backwards as forwards. Exploring the question of the relationship between the evolutionary ideas of Erasmus Darwin, his grandson Charles and Jean Baptiste Lamarck, Howard Gruber suggested that it would be more accurate to describe the elder Darwin's 'general world view' as one of 'pan-transformism', because of his emphasis upon the changes of individual growth rather than species transmutations.[15] Erasmus Darwin does refer, however, to 'progressive improvement' and the gradual acquisition of 'new powers' by animal life to 'preserve their existence', considering that 'innumerable successive reproductions for some thousands, or perhaps millions of ages, may at length have produced many of the vegetable and animal inhabitants which now people the earth'.[16]

The places in which Darwin lived, worked and socialised helped to shape the content and character of his philosophical work. His approach to professional practice was in many ways traditional and retained elements of neo-humoural medicine, with its emphasis upon individuals having particular 'temperaments' or dominant characteristics and illnesses being caused by imbalances in the 'humours' arising from external environmental changes, which was believed to have originated in the work of ancient Greek philosopher and physician Hippocrates of Kos, active during the fifth and fourth centuries BC. Darwin's medical practice was likewise fairly traditional by eighteenth-century standards, as evidenced by the range of treatments it utilised, such as bleeding, purging and vomiting, although, as we will see, he could be sparing in employing such methods, rather allowing recovery to take place on its own. Drawing upon the education he received at Edinburgh, Darwin's medical theory combined elements drawn from the physiology of Swiss anatomist Albrecht Haller (1708–77), especially the notion of sensory and nervous stimulus and response, combined with the synthesis of associationism, moral psychology and physiology detailed by the English physician and philosopher David Hartley (1705–1757). The general developmental theory that Darwin explored in his major works drew upon his medical practice and natural philosophy, emphasising the degree to which life engaged in dialectical interplay with its environment, having a difficult – even adversarial – but ultimately useful relationship with its situation. He asserted that life was governed by the 'spirit of animation', an ethereal force of energy acting through the nerves on the muscles, which had some apparent similarities with electricity. Promulgated especially by the natural philosopher Isaac Newton (1642–1727), the concept of ethers was much used during the eighteenth century as a means of seeking to explain how phenomena in the universe and natural world acted at a distance upon each other. Ethers were considered to be fluids that were composed of very small, fine or subtle particles invisible to the eye, which could be known by their effects, such as light, heat, sound, electricity, magnetism and gravity. The operation of gravity, for example, seemed to explain both the positions and motions of planets, comets and other heavenly bodies and why objects fell to earth from above.[17]

According to Darwin, with every contraction of each 'fibre' (that is, muscle or sense organ) there was an 'expenditure of the sensorial power' and, where this power had been increasing and the 'muscles or organs of sense' were therefore operating with 'greater energy', the 'propensity to activity' was therefore reduced in proportion because of the 'exhaustion or diminution' in the amount that had occurred. What he called the 'sensorium' or totality of brain, organs, muscles and living spirit had four 'faculties', which produced all bodily motions through 'irritation' caused by 'external bodies', through 'sensation' caused by feelings of pain or pleasure, through 'volition' occasioned by 'desire or aversion' and through 'association', which was caused by other 'fibrous motion' and the powers of irritation, sensation, volition and association. Darwin believed that understanding the spirit of animation to be ethereal enabled him to combine psychology, or the philosophy of the mind, with physiology, the understanding of how the body worked, and cross the barrier between mind and matter, thoughts and actions, sensory information and how it was understood

by living beings. However, because he tried to do this, as we will see in this book, his ideas were attacked for mechanical reductionism, infidelity and the interpolation of unnecessary principles. Nevertheless, Darwin's concept of the spirit of animation served a crucial psychological, physiological and heuristic (theoretically illuminating) purpose underpinning his developmentalism and emphasis upon life as responsive, tenacious and above mere laws of motion, animal chemistry or hydraulics. Although 'sensorial motions' perhaps comes closest, no single word or short phrase adequately encapsulates Darwin's efforts to interlock psychology with physiology, and so, even though there was no such term in the eighteenth century, the term 'psychophysiology' will be generally used as a convenient shorthand to represent his endeavour.[18]

Largely forgotten during the nineteenth and early twentieth centuries once his poetry had gone out of fashion, Darwin regained fame posthumously as a precursor or anticipator of his grandson's evolutionary theories. For Desmond King-Hele, who did more than anyone else to reinvigorate Darwin's reputation, he was an enlightenment polymath, successful physician, mechanical genius and robust character who anticipated numerous modern inventions and inspired those around him.[19] While much Darwin scholarship has continued to be fascinated by his evolutionary ideas, attempts have been made in recent decades to provide different and less 'whiggish' perspectives.[20] Robert Schofield, Maureen McNeil, Jenny Uglow, Peter Jones and this author have situated Darwin within the industrialising intellectual communities of the English midlands, focusing upon his leading role in the Lunar Society of Birmingham and enthusiastic friendships with industrialists such as Matthew Boulton (1728–1809), James Watt (1736–1819), Josiah Wedgwood (1730–1795) and William Strutt (1756–1830). McNeil has argued that Darwin was also, to some extent, an apologist for industrialisation, who 'celebrated the powers of scientists, industrialists, and machines over nature', while, in a classic essay, Roy Porter refocused attention upon his medical career, emphasising how much he provided an original secularised 'physician's vision' of Hartley's psychophysiology (summarised above).[21]

At the same time literary scholars, gender historians, historians of science and others have taken a keen interest in Darwin's poetry and ideas, including their impact on the romantic poets and the gender aspects of his interpretation of the Linnaean botanical system.[22] Janet Browne and Londa Schiebinger have argued that, by privileging the stamens as 'male' sexual characters above the 'female' pistils within the flower as definers of classes, Darwin's poetic personified presentation of the Linnaean system in *Loves of the Plants* reflected and reinforced late Georgian gender perceptions and differences.[23] Martin Priestman authoritatively situates Darwin's poetry in relation to Enlightenment concerns such as Rosicrucianism and his literary and scientific networks, exploring his relationship with fellow-poets Richard Payne Knight (1751–1824) and Thomas Jones in particular and the reasons why his work attracted such hostility in the revolutionary period.[24] Patricia Fara, likewise, in her entertaining and refreshingly candid account of her encounters with Darwin, reminds us how influential his ideas were and – like Priestman, especially – how concerned political opponents became at some of the ideas, even those in the apparently playful *Loves of the Plants* as well as the more serious *Economy of Vegetation* and *The Temple of*

Nature, as the satirical poem 'Loves of the Triangles', ostensibly written by 'Mr. Higgins' but in fact by George Canning, John Hookham Frere and George Ellis, and published in the *Anti-Jacobin* (1797–8), clearly demonstrates.[25] The essays in Christopher Smith and Robert Arnott's *Genius of Erasmus Darwin* (2005) explore some of these themes too while also providing more information about his professional, medical, scientific and midlands context.[26]

Despite the amount of academic attention that Darwin has received, the geographies of his career and the impact of landscapes and environment upon his medical and intellectual development have received much less analysis. For example, while McNeil's stimulating academic analysis of Darwin's intellectual development is adept at resituating him within some key Enlightenment discourses, such as industrialisation, progress and agricultural improvement, she pays much less attention to the geographical dimensions of his work or the landscapes and environments that shaped his ideas and practices, leading him to come across as a placeless intellectual entity – ironically so, as Darwin was particularly attuned to the impact of landscapes and environment upon the development of the individual and the interface between human beings and their surroundings, and all his works are replete with references to landscapes and places as evidence for his arguments. While his mind traversed the globe through reading and communications with philosophical friends such as the Lunar brethren, however, his experience of place was largely confined to an English midland triangle between Nottinghamshire to the east, the Derbyshire Peak in the north-west and Birmingham in the south (see Figure 1).[27]

Encouraged by the medical potential of botany as well as the aesthetic enjoyment it provided, and particularly after 1778 by his second wife Elizabeth, a keen gardener, Darwin owned and developed a series of gardens, advised his friends on green matters and enthusiastically utilised and promoted plant-based medicines. The first two chapters of this book explore the relationships between Darwin's gardens at Lichfield and Derby and his employment of herbal medicines and work on natural history, primarily represented by *The Botanic Garden* and *Phytologia*. Botanic or physic gardens were originally planted as a resource for medical practitioners and others to supply the plant materials needed for healing, but during the seventeenth and eighteenth centuries they increasingly became places where plants were collected (and often labelled) for education, study and experimentation too. It is well known that Darwin's *Botanic Garden* poems were partly inspired by one such place that Darwin created near Lichfield. However, as we shall see, Darwin's encounters with this and his other gardens and orchards in Lichfield and Derby and his use of vegetable-based substances in medical practice challenged his understanding of the botanical system of Carl Linnaeus and encouraged him to try and adapt or improve it to take better account of the complexities of plants growing in the ground. In effect, he undertook three Linnaean translations: an initial attempt to represent the Linnaean system in an English picturesque botanic garden; the translation of the works of Linnaeus into English prose; and, finally, the translation of the Linnaean system into epic popular poetry. Darwin's gardens were more than just places where plants grew, however, and provided him with insights into geology (such as the principles behind artesian wells

bubbling up by natural pressure), rock formations and soil creation and composition; hence it was the creation of the Lichfield botanic garden that inspired the second two translations. Through the various studies they encouraged and the combination of physic garden with landscape beauty, Darwin's gardens aspired to be, as Anna Seward maintained, places that combined 'the Linnean science with the charm of landscape'.[28]

Encouraged by medical practice, including his employment of plants in treatments and the botanical interests of friends in the Lunar Society such as William Withering (1741–1799), Darwin immortalised his Lichfield botanic garden in his epic scientific poems *The Loves of the Plants* and *The Economy of Vegetation*. He also, as noted, founded a small Lichfield botanical society with local friends Brooke Boothby and Andrew Jackson, which worked to produce the Linnaean translation and make it more accessible for gardeners, nurserymen and planters who did not read Latin. Through his poetical successes, Darwin's Lichfield creation became one of the most influential botanical gardens in British history. Fed by various springs, the garden featured a 'mossy fountain' and a cold bath developed by a previous local physician, Dr John Floyer. Most importantly, Darwin strove, as Seward emphasised, to take full advantage of the natural topography of the site to help him combine science with beauty, planting trees, shrubs and flowers to adorn the vale. Weighing Seward's laudatory descriptions against the poems themselves and other manuscript and published evidence, the first chapter of this book attempts to recreate Darwin's original botanic garden as it really was and assesses its significance as a place in his own career and intellectual development and in that of his friends, especially Seward.

The 'long' eighteenth century, from around the restoration of the monarchy after the civil wars and Cromwellian Commonwealth onwards, has been seen in Peter Borsay's memorable phrase as a period of 'urban renaissance' in which the built environment and economic, social and cultural life of towns were transformed in an age of comparative stability.[29] Darwin was a strong supporter of urban improvement and believed that it fostered social, economic, political and intellectual progress. He became a keen advocate of the enclosure of common lands (with shared rights) on the periphery of Derby, which drew him into significant political controversies and forced him to articulate his vision of the relationship between progress and urban improvement. Darwin nurtured his garden at Full Street and kept an orchard across the river and, fortunately, a list of trees and plants in both still exists in a notebook, which includes descriptions of other garden features and indications of where everything was positioned. The notebook shows that Darwin delighted in plants such as delphiniums, phlox, saxifrage, antirrhinums, peonies and cistus, and lists changes where some plants had died or been changed. The sections are not defined according to botanical categories but by situation – for instance: 'beyond the shed', 'beyond the fish pond' and 'turn up towards the summer house' – meaning that the plan can be reproduced. Using the copious notebook information, correspondence and other sources, such as maps and Linnaean botanical works, the first chapter tries to reconstruct Darwin's Derby garden as it would have been experienced by him and his family and assesses its significance in his work.

The eighteenth century was the age of improvement, particularly in terms of agriculture, which saw and celebrated the application of new techniques and technology to farming and the breeding of many new varieties of trees, plants and animals. This was supported by philosophical and agricultural societies, including the Royal Society and the Society of Arts, which offered prizes for agricultural and horticultural improvement, and, especially from the second half of the eighteenth century, the county agricultural societies. From the 1790s county surveys were published by various investigators under the auspices of the government's Board of Agriculture. Darwin's love of plants and gardens is manifest in the interest that he took in agriculture and his most detailed work on this subject, *Phytologia*, drew upon a detailed knowledge of midlands horticulture as well as voracious philosophical reading and plant observations. Darwin took much inspiration from the burgeoning British literature on gardening, horticulture and farming, which included works such as Philip Miller's *Gardener's Dictionary* and Jethro Tull's *Horse Hoeing Husbandry*. He was also able to converse with numerous landowners over decades, including gentry and aristocracy, many of whom were patients and friends, and took a keen interest in the impact of disease upon plants and animals, drawing parallels with his medical work and using his garden to make observations. For instance, he grew different cereal crops to observe the impact of different factors upon growth and was able to observe the effects of flooding on plant growth after the Derwent burst its banks and inundated his garden. The third and fourth chapters explore Darwin's contribution to agriculture and horticulture, including his analyses of agricultural experiment, land drainage, breeding, soil improvement and cultivation, arguing that agricultural improvement and practical horticulture were central to his progressive enlightenment worldview.

Darwin's medical practice and understanding of the interface between psychology and physiology also played an important role in shaping his agricultural philosophy and frequently encouraged him to draw parallels between humans, animals and plants, and the fourth, fifth, sixth and seventh chapters examine how this shaped the character of his recommendations for improvement. His renown as a medical practitioner and emphasis upon environmental factors as causes of disease encouraged him to apply his ideas and practices to crops and livestock, which was why he believed, as he emphasised to Joseph Banks (1743–1820), the president of the Royal Society, that *Phytologia*, his 'philosophy of agriculture and gardening', was a 'supplement' to *Zoonomia* that applied his theories of the 'animal economy' to the vegetable world.[30] Coming from a gentry family, Darwin moved in close proximity to other landowners, including the 'new' landed wealth of prosperous traders, manufacturers and industrialists as well as the more established aristocracy, gentry and farming communities. Through such connections and his own observations he gained much information concerning farming practices, which was supplemented by his voracious reading on the subject and experience keeping livestock on his own orchard and allotment in Derby, which he designated his 'farm'. Darwin sought to apply medical ideas and practices to his own animals and plants as well as those of friends, patients and family, closely observing how all living creatures in his gardens interacted with each other and coped with the struggle for existence. One manifestation, as chapters 6 and 7 maintain, was a

keen appreciation of the agency, vitality and fecundity of animals, which he was able to utilise when devising treatments for diseases that commonly plagued them and which led him to appreciate the dangers and opportunities presented by inter-species parallels and transmissions.

Despite the central importance of Darwin's many different encounters with trees, there has never been a study of his arboriculture, which is explored in the eighth and ninth chapters. Many of his tree investigations were inspired by the economic utility of agricultural and horticultural improvement, but Darwin was able to unite, as Anna Seward claimed, practical botany with picturesque landscapes by creating and experiencing both planted and poetical botanic gardens. His romantic appreciation of landscape beauty was partly founded upon the picturesque qualities of trees and plants as well as his psychological and physiological theories, and it was local woodland (and amorous joy) that inspired Darwin to express himself poetically for the first time since his student days as he personified the spirits of a grove of trees in his garden under threat from the axe. Darwin's love of trees also stemmed from a general interest in their qualities, beauty and botany that was widespread within his intellectual circle, represented by the work of close friends such as Seward, Brooke Boothby (1744–1824), Thomas Gisborne (1758–1846), the artist Joseph Wright of Derby (1734–97) and Francis Noel Clarke Mundy (1739–1815) of Markeaton, Derbyshire, a landowner, magistrate and writer. Mundy's poem on 'Needwood Forest' in Staffordshire, for instance, inspired Darwin to compose an 'Address to Swilcar Oak', which he inserted into the chapter on the production of leaves and wood in *Phytologia*. Furthermore, the trees in Darwin's orchards and gardens from Lichfield to Derbyshire and his knowledge and experience of local woodland strongly informed his analyses of vegetable physiology and anatomy. The size and longevity of trees provided the scale necessary for Darwin to observe vegetable physiology in detail, encouraging parallels with animal physiology. Observations of local estate and forest trees informed his suggestions for the improvement of timber production, which he believed were vital to strengthen the defence of the country against foreign invasion. Visits to local estate plantations such as those at Shugborough Hall and important woodlands such as Needwood, Staffordshire and Sherwood Forests demonstrated where trees flourished best and underscored their cultural status as 'monarchs of the forest' in the economy of nature. Observations of estate woodlands on the edge of the Staffordshire moors suggested that large coniferous plantations might be nurtured on exposed mountainous and boggy moors such as those of the Pennines for the benefit of the economy, industry and navy. In *Phytologia* Darwin provided detailed recommendations concerning the most efficacious means of growing, nurturing, straightening, curing, transplanting and felling trees.

While revelling in the beauty and peace afforded by plants, following in the footsteps of enterprising British plant experimenters such as Nehemiah Grew and Rev. Stephen Hales, Darwin also used them as a means to observe vegetable physiology, anatomy, respiration and nutrition and to conduct experiments. The final two chapters explore how Darwin used his arboricultural observations to try to determine the optimum conditions for growth, which he hoped would lead to improvements in agriculture

and horticulture. Having accepted the French chemist Antoine Lavoisier's concept of oxygen in preference to his friend Joseph Priestley's phlogiston theory, which posited the release of a universal combustable material by burning substances, Darwin explored plant physiology, respiration and nutrition. He also tried to determine the types of soil and manure, moisture and other factors that best enabled trees to thrive. Darwin drew constant analogies between humans, animals, trees and plants, believing that their bodies and senses functioned in similar ways, operating through what he called the 'spirit of animation', a very subtle 'fluid' akin to electricity that mediated between brains, nerves, senses and muscular fibres. For this reason he was fascinated with the idea that applying electricity might facilitate plant growth and conducted experiments on plants with electrical machines, suggesting that the erection of numerous metallic points in gardens or fields might cause 'quicker vegetation' by providing plants 'more abundantly with the electric ether' and increasing rainfall. However, the constant analogies that Darwin drew between plants and animals, encouraged by his medical experience, attracted hostility and sometimes ridicule in the fraught political climate of the revolutionary 1790s, which we will explore further. Despite praise for his work from Sir Joseph Banks and Sir John Sinclair, Darwin and his 'Jacobin' or revolutionary plants were satirised in publications and prints as the tranquillity of the garden, woodland and country vale were shattered by the noises of industrial and political upheavals.

This book shows how Darwin, as passionate about nature as his contemporary Rev. Gilbert White of Selbourne (1720–1793) or his grandson Charles, was intrigued by everything from swarming insects and warring bees in his gardens through domestic pets, pigs and livestock on his Derby 'farm' to fungi growing from horse dung in local tan-yards. His landscape and garden experiences, from investigations of plant bodies and the use of vegetable 'bandages' in his orchard and electrical machines to hasten seed germination to provocative speculations concerning plant 'brains', nerves and sensations, transformed his understanding of nature. They offered insights into medicine and the environmental causes of diseases, taxonomy, chemistry, evolution, potential new medicines and foodstuffs and mutual rivalry and interdependency in the economy of nature. Like the erotic vegetables of *The Loves of the Plants* (1789), which appalled and delighted his readers, the multifarious living beings of Darwin's works were real, dynamic, interacting and evolving creatures rather than merely poetic abstractions, who reacted to their external environments and internal stimuli. The chapters of this book provide a grand tour of Darwin's gardens, horticulture and agriculture, demonstrating how his plants and animals wrestled with adversity, experiencing pleasures and pains, loving, competing, adapting and combatting disease (or succumbing to their mortality), taking nourishment from earth and air which was transformed within their organs and tissues into vital fluids that propelled their lives and loves.

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CHAPTER 1

LICHFIELD AND DERBY GARDENS

Erasmus Darwin loved seeing, touching, smelling, using, studying and celebrating plants and wanted others to share in his enjoyment, from members of his family to his patients, who utilised their virtues or powers as drugs to combat their illnesses and improve their lives. In *Phytologia*, his treatise upon agriculture and gardening, he exclaimed that 'the beautiful colours of the petals of flowers with their polished surfaces' were 'scarcely rivalled' by those of shells, feathers or 'precious stones'. Many of these 'transient beauties' that gave such 'brilliancy to our gardens' delighted 'the sense of smell with their odours' and were employed extensively 'as articles either of diet, medicine, or the arts'.[1] Knowledge of plants was always important for Darwin, given that vegetable products were the basis of so much of the *materia medica* (substances prescribed as treatments), and botany was taught in the medical schools in order that practitioners could distinguish useful from useless or even dangerous plants.

During the 1770s and 1780s, however, botany and gardening assumed greater significance in Darwin's life, encouraged by a community of plant enthusiasts and what Sylvia Bowerbank has described as literary 'defenders' of 'environmental stewardship' who were centred upon Lichfield and invested it with 'deep feeling and value' as a multilayered 'storied place'.[2] Among them were the poet Anna Seward, Rev. John Saville (1736–1803), Darwin's future wife Elizabeth Pole and the members of the botanical society that Darwin formed, as noted above, with Brooke Boothby and William Jackson (1743/5–1798), who were engaged upon a project to translate some of the works of Carl Linnaeus (1707–1778) from Latin into English. Encouraged by his medical and scientific botanical concerns, his growing love of gardening and his experience of the countryside around Lichfield and the local coterie of plant lovers, Darwin developed a botanic garden in a small well-watered valley near the city, which inspired the two parts of his epic poem *The Botanic Garden* (1791). The formation of the Lichfield botanical garden was a crucial moment in both Darwin and Seward's poetical careers. Through the success of the *Botanic Garden*, which, as the poet Samuel Taylor Coleridge (1772–1834) remarked, was 'for some years greatly extolled, not only by the reading public in general' but by poets of his generation, Darwin's Lichfield creation became one of the most influential British botanical gardens.[3] After moving to Derby, he made full use of his back garden and an 'orchard' on the opposite bank of the River Derwent to observe how plants grew and undertake experiments, while his

botanic garden remained in place much as he left it for nearly twenty years, managed by Jackson.[4]

Much recent work in literary criticism and the history of science has focused on the sex and gender dimensions of Darwin's *Botanic Garden* and less on the relationship between poem and place. Analysis of his gardening practices and gardens at Lichfield and Derby, however, demonstrates that the materiality of place and the practical lived experience of designing and planting gardens and then nurturing, observing, harvesting and minutely comparing plants in their changing environments helped to inspire both his poetical works and earthen green places. These experiences created stimulating tensions between abstract Enlightenment systems and messy, dirty realities on the ground, encouraging Darwin to challenge his understanding of Linnaean botany and devise more 'natural' systems of taxonomy and undertake a series of experiments and observations on vegetable anatomy. Adherence to the Linnaean system remained, however, a central guiding inspiration as he sought to realise it as a picturesque botanic garden, accessible English-language tool and epic, poetical vestibule to the temple of scientific knowledge. Darwin's gardens were much more than repositories for living plants. Just as medical science and his own observations shaped his professional practice and understanding of human bodies and behaviours, so his gardens were collective social and cultural creations that informed his insights into the economy (interdependency) of the natural world, medical botany, vegetable and animal diseases, horticulture, geology, mechanics, hydrostatics (the study of water), meteorology, the principles of landscape beauty and much more.[5] Using Darwin's published works and manuscript materials and a variety of other sources, this chapter seeks to uncover what the Lichfield and Derby gardens were like as living, dynamic, material and social places and explore the ways in which they inspired his medical and scientific work.

TWO BOTANIC GARDENS

Darwin's Lichfield house on Beacon Street had small gardens to the front and rear and was separated from the road at the front by 'a narrow, deep dingle' that had originally formed part of the moat protecting The Close but was now largely drained of water and 'overgrown with tangled arbours and knot grass'. Darwin placed a bridge across this ditch from the front of the house to the road and planted the area with trees and bushes. Later he sacrificed two parts of his front garden to support local road improvements, providing a further inducement to develop other gardens.[6] The Close was enclosed within a wall and the 'deep dry ditch, on all sides, except towards the city', where it was 'defended by a great lake, or marsh, formed by its brook', and contained the large bishop's palace, where Anna Seward and her father Thomas Seward (1708–90) resided; the dean's residence and prebendaries' houses were 'in a court on the hill', with the bishop away at Eccleshall.[7] According to Anna Seward, Darwin added a 'handsome new front' to his dwelling, with 'Venetian windows, and commodious apartments'. The new front faced towards Bacon Street, but did not go straight onto the road, and the 'tangled and hollow' moat bottom was 'cleared away into lawny smoothness, and made a terrace on the bank', making it 'level with the floor of his

apartments', while the planting of the 'steep declivity' with lilacs and rose bushes provided screens from 'passers-by and the sunshine', enabling him to observe a fine, extensive prospect across the road through an opening of 'pleasant and umbrageous fields'.[8]

However, it was the opportunities presented by developing a botanic garden on a new site that provided the greatest inspiration for Darwin. The fullest descriptions of how the Lichfield botanic garden appeared are found in *The Botanic Garden* and Seward's *Memoirs of the Life of Dr. Darwin* (1804). Although she was understandably keen to magnify her role in his life, and the Darwin family were angry at some of the calumnies and falsehoods they believed she promulgated, as a close friend and, as Sylvia Bowerbank has convincingly argued, 'defender of local environments' and proponent of Lichfield's 'storied' beauty against the 'contemptuous assaults of London-based criticism' (including those from fellow-townsman, lexicographer and metropolitan literary colossus, Samuel Johnson), Seward was an enthusiastic supporter of the botanic garden as interlinked place and poem, helping invest it with meaning and mystique.[9]

In striving to combine the British naturalistic gardening style with systematic planting, Darwin's botanic garden was a major development in landscape gardening as well as a source of poetic inspiration. In this he was encouraged by a small community of passionate Lichfield-focused garden enthusiasts, especially Seward, John Saville, Brooke Boothby, Francis Noel Clarke Mundy and William Jackson, a proctor in the cathedral jurisdiction and fellow member of the botanical society. Just as this 'Lichfield coterie … worked and re-worked each other's texts' while recognising that the 'declared author' was 'generally the originator and main author', as Teresa Barnard has argued, so their gardens and the writings inspired by them were likewise partly collaborative ventures, although, as Seward admitted, she was herself rather 'ignorant of horticulture' and botany and more interested in the beauties of plants and gardens, though growing more interested in the former later in life.[10] The practice of co-authorship is clearly articulated by Seward in the case of Mundy's 'Needwood Forest' (1776), for example; in a letter of 1777 to her close friend Mary Powys of Shrewsbury and later Clifton the contributions of Darwin and Seward are specified but the attribution of Mundy as the public author of the work is unquestioned.[11]

Although gardening and botany were not a primary concern, some members of the Lunar Society circle around Darwin also had green interests that likewise encouraged the development of the botanic garden, but the knowledge of plants Darwin gained in his medical practice and his efforts to translate the Linnaean botanical system into English were more important factors in shaping its creation. Just as the Linnaean system provided a model and inspiration for the medical system propounded in Darwin's comprehensive medical treatise *Zoonomia*, so he saw it as a useful tool for medical practitioners to help identify and utilise plants in their treatments. Vegetable identification was required for medical education and the prescription of many medicines, and Darwin was taught aspects of botany at Edinburgh University, using and developing this knowledge for treating patients in his midlands medical practice. The dramatic expansion in global trade, the spur of international rivalries with other

European powers and activities of the East India Company and other merchant concerns during the seventeenth and eighteenth centuries, greatly increased the availability and variety of imported plant knowledge and vegetable-based drugs such as senna and Jesuit's bark in the medical marketplace, but much remained home-grown.[12]

The botanic garden was developed from the original conception of a physic garden as living medical resource that was more useful than a dried herbarium of preserved plants or plant parts, which often failed to preserve vegetable virtues (the active and useful qualities or ingredients). Darwin utilised Linnaean taxonomy in the arrangement of his botanic garden, combined with picturesque planting and landscaping. Plant-based treatments were essential in his neo-humoural medical practice, which aimed to return the body to what he called the 'natural state', where all the 'irritative motions' were behaving normally, and though, as Roy Porter argued in his transformative essay on Darwin's medicine, it might appear somewhat arcane or esoteric, it is worth taking time to understand his nosology and treatments sympathetically and with sensitivity to period context.[13]

The interventions that Darwin utilised are detailed in a series of articles summarised in the *materia medica* of *Zoonomia* that had existed in drafts since the 1770s, when the botanic garden was being created. These treatments were varied and included recommendations for changes in diet and behaviour, medicines to be applied internally and externally (often based upon organic substances) and treatments such as venesection or bleeding. For 'Nutrientia', or things that preserved 'in the natural state the due exertions' of all irritative motions by producing 'growth' and restoring the vigour of the bodily system, Darwin recommended various animal and vegetable products, water, fresh air and oxygen. He believed that these were effective because the nourishment from animal flesh such as venison and beef, as well as fish, shell fish, dairy products, fruit and vegetables, stimulated the 'absorbent and secerning [secreting] vessels', thus inducing feelings of warmth and strength.[14] Treatments utilised by him to increase the 'exertions of all the irritative motions' towards a more 'natural state' or 'Incitantia' included alcohol or the 'spiritous part of fermented liquors' and various plant substances, many, including opium, tobacco and Indian berry (*Menispernum cocculus*), procured by apothecaries through international trade networks; other substances used exhilarated the 'passions of the mind', such as joy, love, play (even anger), and external applications of 'heat, electricity, ether, essential oils, friction and exercise' were also thought beneficial. Darwin thought that these worked by promoting 'secretions and absorptions', increasing the 'natural heat' and removing pains caused by 'defect of irritative motions' or 'nervous pains' and their associated 'convulsions'.[15] Treatments that increased the irritative motions by promoting secretion and stimulating glands 'into action' or 'Secerentia' worked in various ways to increase bodily heat and relieve suffering, which Darwin believed originated from 'a defect of motion' in secretion vessels. These treatments operated diversely as diaphoretics (inducing perspiration), sialogogues (increasing saliva production), expectorants (bringing up mucous from the lungs, bronchi and trachea), diuretics (increasing urine production) or cathartics (purgatives), or through stimulating mucus production in the bladder, rectum, cellular membranes, nostrils or tear ducts. Plant-based examples procured from around the