

Conservative politicians, radical philosophers and the aerial remedy for the diseases of civilization

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ABSTRACT

This article examines the development of pneumatic medicine as practised by Erasmus Darwin, Thomas Beddoes and Joseph Priestley, and the support for their experimental trials by other Dissenting doctors and industrialists including Boulton, Watt and Wedgwood. The article examines their belief that if one could create the conditions under which 'good air' could be manufactured – where the work of Dissenting chemists and doctors was embraced rather than condemned, supported rather than attacked – then conditions, political and medical, under which a healthy country will flourish will prevail. *Contra* the claim made by Roy Porter that doctors, such as Erasmus Darwin, were 'profoundly troubled by what they saw as the counterproductive impact on health produced by the spread of progressive ideas, refined culture, and modern, commercial, urban values', I believe that it was *precisely* those progressive values that led Dissenting doctors and pneumatic chemists to believe that by applying the same principles that led to the phenomenal industrial and commercial success of their friends like Boulton, Watt and Wedgwood, they could improve population health by attempting to reform simultaneously politics and therapeutics.

Key words diseases of civilization, 18th-century doctors, industrial health, pneumatic medicine

THE PROBLEM OF 1797

At the beginning of the parliamentary season in 1797, the Prime Minister, William Pitt the Younger, was drowning his sorrows with spirits. War with France was dragging on and dragging the country into debt. More depressing still was the cost of human life. In the French West Indies alone, battlefield losses and diseases had killed 40,000 British soldiers and that many again were rendered unfit for service (Watson, 1960: 370). The country also faced a cash crisis: payments from the Bank of England were suspended; continental trade was stifled and bread prices were still high from recent droughts. To top it all, it was no longer just the king who was going mad: MPs were growing increasingly melancholic and a few had just killed themselves (Colley, 1992: 151). The year 1797 was not a good one.

At least London was not under siege. The sedition Acts apparently quelled the rumbles of radical societies in the metropolis, but the provinces were always more difficult to police. From Westminster, suspicious eyes turned toward the Midlands, where Dissenting doctors and industrialists had a tradition of holding secret, subversive meetings. They were the ones to watch out for, cried the once liberal MP Edmund Burke. In 1790 he warned of a revolutionary spirit menacing the English countryside in his *Reflections on the Revolution in France*. But fellow MPs, he felt, were not yet convinced, and worse still, he told a friend, 'the principles of a new, republican, frenchified Whiggism [were] gaining ground' (Burke, 1993: xi). So one day in 1792 during an impassioned speech he was making in the House of Commons, he brandished a dagger and threw it on the House floor, declaring that it was part of a weapons order placed in Birmingham by the French and that 'it is my object, to keep the French infection from this country, their principles from our minds, and their daggers from our hearts' (Kramnick, 1977: 156). It was an overacted performance, but Burke's message was still ringing in the ears of nervous patriots during that terrible year of 1797.

In July of that year, the defenders of the English establishment suffered yet another sad event. 'There is only one piece of news', announced a 27-year-old George Canning, William Pitt's new protégé, 'but [it] is news for the world. Burke is dead' (Petrie, 1946: 44). Canning was one of those in the Whig Party who had listened closely to what Burke was saying, and as a consequence, he adopted a strong 'anti-frenchified' political stance and migrated to Pitt's Tory Party, where he was made Under-secretary to Foreign Affairs.

Depressed, and looking anxiously at Prime Minister Pitt, who seemed desperate for measures to improve morale, Canning had an idea that would at

least breathe some fresh life into the spirit of the campaign against France. In honour of Burke's journalistic propaganda, Canning, in collaboration with George Ellis and John Hookham Frere, launched *The Anti-Jacobin; or, Weekly Examiner*, a newspaper published during the parliamentary season 1797–8. Geared as a counter-attack against the *Monthly Magazine* and other journals identified as promoting 'Jacobin' sympathies, the *Anti-Jacobin* was published after 'a number of men of brilliant talents and high connection [in Pitt's circle] . . . determined to establish a weekly paper, for the purpose of exposing to deserved ridicule and indignation the political agitators by whom the country was then inundated'. While embracing the spirit of political satire that so characterized the Georgian era, the editors by no means belittled the sense of urgency shared by their conservative colleagues – that is to say, those identified with William Pitt's party who supported the established order in Church and State – to defend Britain at a time when 'Faction and Impiety had grown insolent and menacing, and those principles which our Church and Constitution support . . . had scarcely any advocates' (Montluzin, 1988: 21, 1 respectively).¹

The aim of the editors of *The Anti-Jacobin* was to reaffirm the warning that England was at risk from the 'French contagion' of irreligious, free-thinking philosophical thought that lurked abroad. From Paris, the 'centre of infection', wrote one contemporary commentator, the 'potent disease soon spread itself nationally and individually over the greater part of Europe' (Berry, 1828–31: I, 267). One year after Burke's death, his first biographer, Robert Bisset, lauded Burke for recognizing the disease of Jacobinism and for having 'stopped the infection from spreading in his own country' (Bisset, 1798: I, 8). Now it was Canning's turn to play doctor to society.

In 36 short issues of *The Anti-Jacobin*, Canning and his colleagues summarized what the Tories thought of a host of their fellow countrymen whom they branded revolutionary sympathizers – those who propagated views about the 'perfectibility of man' in what were considered terms designed to undermine social stability. One subject of their attack was Erasmus Darwin.

'WHATEVER IS, IS WRONG'

In the 23rd number of *The Anti-Jacobin* (published in April 1797), Mr Higgins, a fictional correspondent, contributed a didactic poem called 'The Loves of the Triangles', a parody of Darwin's *The Loves of the Plants*, which had appeared in 1789 (Darwin, 1991[1789]). The spoof was intended to expose the warped ideals that Canning and his co-authors detected in works, such as Darwin's, which ostensibly offered serious scientific lessons about the natural organization of life, but which, in Darwin's famous phrase, were written in verse to 'inlist Imagination under the banner of Science'. The

fictional Mr Higgins was not satisfied that botany was a serious enough science, and so he offered 'The Loves of the Triangles' in an attempt to reach 'the sublimer sciences; – at the husk and shell of which we are now nibbling', adding that it was his desire to 'enlist the Imagination under the banners of Geometry' (Canning, 1797, ed. Stones, 1999: 166).

In the mock editorial that prefaced 'The Loves of the Triangles', Canning declared in unambiguous terms what it was that Mr Higgins stood for: 'the usual pretexts of humanity and philanthropy, and fine feeling . . . [are] now being worn out, or exploded' and the new principle to which one must now adhere was:

'Whatever is, is wrong': – that Institutions civil and religious, that Social Order . . . and regular Government, and Law, and I know not what other fantastic inventions, are but so many cramps and fetters on the free agency of man's *natural intellect* and *moral sensibility*; so many badges of the degradation from the primal purity and excellence of his nature. (Canning, 1797, ed. Stones, 1999: 165)

Playing on the language of Darwin's evolutionary theory, *The Anti-Jacobin* parodied the idea that civilization was diseased – its constitution corrupt – and that it was leading to the degeneration of humanity.

But, as 'The Loves of the Triangles' was going to show (keeping up its false pretence to seriousness), there was hope on the horizon. 'By the mere exertion of our own *energies*', continued Mr Higgins, humanity had evolved 'to our present comparatively intelligent and dignified state of existence', and it was possible that our path would lead to the 'eternal and absolute Perfectibility of Man'. But this was conditional; we would reach perfectibility only 'if these *energies* were not repressed and subdued by the operation of prejudice, and folly, by KING-CRAFT and PRIEST-CRAFT, and the other evils incident to what is called Civilized Society'. Thus, in an act of Rousseauvian rebellion, overthrow the government, shake off the chains of oppression, and one will be free to evolve naturally. However, Darwin, it seemed to them, was not theorizing about enjoying a state of primitive complicity, but rather thought that true perfectibility meant shedding one's body and entering a spiritual realm. In time, the Tory interpretation of Darwin's theory read, man would raise

. . . from his present biped state, to a rank more worthy of his endowments and aspirations; to a rank in which he would be, as it were, *all* Mind; would enjoy unclouded perspicacity and perpetual vitality; feed on *Oxygene*, and never die, but *by his own consent*. (Canning, 1797, ed. Stones, 1999: 165)

Nowhere in *The Loves of the Plants*, which was written to explain Linnaeus' sexual taxonomy and 'the remarkable properties of many particular plants',

does Darwin elaborate on his evolutionary views, though he had discussed them elsewhere. Besides putting *E conchis omnia* ('everything from shells'), referring to primordial microscopic filaments, on his family arms (which conveniently is adorned by three shells), Darwin had dedicated a chapter of *Zoonomia* (1974[1794]) to musing about the evolution of species. And while *The Loves of the Plants* does discuss plant respiration (for instance, pp. 145–6), it is in Chapter 39 of *Zoonomia* that Darwin wonders if

... it would be too bold to imagine, that all warm blooded animals, have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality, with the powers of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations; and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements by generation to its posterity, world without end! (Darwin, 1974[1794]: I, 509)

The satirists purposely reconfigured Darwin's views not only to impose an uncomfortable association between an avowed materialist and the notion of the immortality of the mind but also to turn on its head the notion of animal improvement 'by its own inherent activity' to condone suicide.

Intriguingly, 'The Loves of the Triangles' leaves us with the curious circumstance that pure minds floating in a spiritual realm – the closest one could get to putting the word 'heaven' into the mouth of alleged atheists – were required to breathe oxygen to sustain immortality. But this was included as a condition of perfectibility for a particular reason, which was meant to underscore how *practical* was the threat that people such as Darwin posed to society. On the one hand, Darwin is here being linked to the research of radical chemists such as Joseph Priestley, who (as further discussed below) suggested that human welfare was a consequence of an aerial economy, an argument that played on puns of 'breathing spirits' (Schaffer, 1987). On the other hand, associating Darwin with any mention of 'oxygen' worked to reaffirm his association with French revolutionary principles.² (The differences between Priestley's and Lavoisier's chemical conceptions were irrelevant to critics who believed that both approaches to studying nature were geared to undermine Establishment values.) This was because not only did the French Revolution provide a model for overthrowing king-craft and priest-craft, but the French chemical revolution, in which Lavoisier isolated different gases and coined the term 'oxygene', provided the means to condition a healthy environment in which people could freely breathe – or, to rephrase, the body politic could now breathe in an atmosphere of freedom. While it would be wrong to assume that Darwin's own chemical concepts of gases embraced Lavoisier's taxonomy *tout court*, it is much easier to understand how critics of natural philosophy came effortlessly to associate it with subversive political ideology, not least

since Lavoisier declared his own chemistry 'revolutionary' in his *Traité élémentaire de chimie* ['Elementary Treatise on Chemistry'], published in 1789 (Donovan, 1993; Bensuade-Vincent and Abbri, 1995).

Throughout the 1780s and 1790s, the British government's attempts to promote 'the scientific service of the public' resulted in the establishment of new legitimate positions for natural philosophers to advise on the implementation of 'useful' programmes, such as applying the chemical techniques of measuring the specific gravity of spirits for determining excise duty, the most active state advisor being Sir Joseph Banks, President of the Royal Society and Privy Councillor from 1797 until his death in 1820 (for discussion of the wider context of the relations between science and state in Britain in this period, see Gascoigne, 1994 and 1998). But one of the many controversial things that linked science to politics in the 1790s was the way that some chemists were associated with revolution. This was something that piqued the frustration of social critics who resorted to mocking or attacking natural philosophy. *The Anti-Jacobin* was by no means unique in this respect, and in fact Canning was taking a leaf out of an earlier work by his hero, Edmund Burke, when he drew attention to chemists' seditious work on gases. It was in his *Reflections on the Revolution in France*, of course, that Burke identified science as a threat to the pillars of English society: the Church and the crown. For Burke, among others, the French Revolution was the consequence of the dangerous ideas propagated by free-thinking *philosophes*, and natural philosophers in Britain were continuing to sow the seeds of revolution by continually referring to the idea that they were creating revolutions in knowledge. 'The present revolution in France', Burke wrote in 1790, 'is a revolution of doctrine and theoretic dogma'; in short, it was a 'philosophic revolution'. Natural philosophers, like political revolutionaries, were 'people who attempt to reverse the very nature of things' (Crosland, 1987: 281). One group was an inspiration to the other.

One of the leaders of the natural philosophical group in Britain was Joseph Priestley, who, coeval with Lavoisier, was analysing the properties of isolated gases and investigating their role in respiration. In gruesome detail, Priestley described his experiments on animals that were forced to breathe carbon dioxide ('fixed air'), noting the different times it took for the life to expire in mice, frogs and even flowers. In 1782, after a decade of laboratory work, Priestley sent a barrage of letters to friends and colleagues announcing that he was now able to convert 'pure water into permanent air'. One of his letters was sent to Edmund Burke, who 'seemed to give some attention to the object of my experiments', said Priestley, who also thought that he would be interested to learn that this new air could be purified in such a way so as to 'prepare it for respiration'. What Priestley was ultimately suggesting was a way to manufacture a new aerial environment.

In 1782, Burke had little reason to be concerned with his philosopher

friend's findings, or with Priestley's ongoing efforts to use his chemistry to throw light on public health by measuring the 'goodness' (capacity for respiration) of air (Schaffer, 1990; Levere, 2000; for contrast to Lavoisier's approach to 'public health' issues, see Duveen and Klickstein, 1955). But in 1790, when Burke took a break from penning his *Reflections* and thumbed through the latest edition of Priestley's *Experiments and Observations on Air*, which had just been published, he was alarmed to see that Priestley had announced new implications of his work. Enlightened, experimental inquiry, he said, was 'putting an end to all undue and usurped authority in the business of religion, as well as of *science*; and all the efforts of the interested friends of corrupt establishments of all kinds'. Lest anyone miss the point, Priestley spelled it out: 'the English hierarchy, if there be anything unsound in its constitution, has equal reason to tremble before an air pump, or an electrical machine' – the most familiar instruments found in a chemist's laboratory (Priestley, 1790: I, preface). For anyone who knew Priestley – the Unitarian champion of both the American Revolution and the French one – there was little doubt that he already detected something constitutionally 'unsound' in the English hierarchy.

An agitated Burke quickly returned to writing and launched his *Reflections* with allusions to Priestley, where the aerated 'spirit of liberty' was likened to 'the wild *gas*, the fixed air [that] is plainly broke loose' (Burke, 1993: 8). For Burke, the consequences were clear, and in a 1796 publication he sounded one more warning: 'These philosophers', he wrote, referring to the likes of Priestley, Darwin, Beddoes, and other pneumatic chemists, 'consider man in their experiments no more than they do mice in an air pump, or in a recipient of mephitic gas' – referring to the poisonous gases they experimented with to extinguish animal life (Burke, 1796: 12). The next year, Canning was carrying the baton.³

Before 'The Loves of the Triangles' was printed, Canning had already launched an attack in *The Anti-Jacobin* on the idea that either climatic conditions or monarchical rule and the laws that bound one to society were detrimental to the prospect of 'perfectibility'. He was irked by the publication of *The Progress of Civil Society*, a six-volume history of humanity that began with the creation of the world and suggested that progress had culminated in modern France, written by the gentlemanly dilettanti and Whig MP, Richard Payne Knight. In Canning's answer, *The Progress of Man*, he condemned philosophers' arrogant attempts to challenge faith in laws, priests and kings, let alone divine order. 'Man, only, – rash, refined, presumptuous Man', he wrote, would dare claim to be a 'slave' in God's creation. It was a line of criticism that resurfaced in his parody of Darwin's evolutionary ideas expressed in *Zoonomia* or the *Economy of Vegetation*, where – according to 'The Loves of the Triangles' – Darwin presented a world-view in which vegetables were unhappy with their God-given position and grew wings since they favoured

an aerial existence, where lungs were considered uneconomical to life, and striking a match was no longer understood as 'burning' but 'sulphur attracting oxygene' (Canning, 1797, ed. Stones, 1999: 171, 176, 177; cf. for instance, Darwin, 1991[1789]: 53, 'Bear on broad wings your Votress to the skies . . .').

The ageing Erasmus Darwin – he was 66 when 'The Loves of the Triangles' was published – was a likely victim of Canning's campaign. Priestley, who was friends with Darwin since the early days of his involvement with the Lunar Society from about 1780, was rather out of the picture having emigrated to America following the 'Church and King' riots of 1791 that resulted in his house and laboratory being burned down. Darwin, though, was still publishing – the second volume of his massive medical tract, *Zoonomia*, was published in 1796, *The Economy of Vegetation* was in its third edition and *The Loves of the Plants* was in its fourth (these poems being parts one and two of the poem known as *The Botanic Garden*).

Like Priestley, Darwin was also outspoken about his French views. He was an open advocate of the French chemistry, embracing Lavoisier's concept of oxygen even when his 'Lunatick' friends, including Priestley, adhered to the older paradigm of phlogiston (Schofield, 1966: 200; King-Hele, 1999: 225). In letters to experimentalists such as the engineer James Watt, the physician James Keir, or even Josiah Wedgwood, Darwin actively tried to persuade them 'to be converted to the true faith in chemistry'. Darwin, as Desmond King-Hele pointed out, 'was the public champion of oxygen in England' (King-Hele, 1999: 246). Whatever the differences of opinion between Darwin and his friends regarding fundamental chemical concepts (changing from a theory of phlogiston to oxygen involved relying on new types of instruments and experimental practices which people like Priestley resisted), agreement was more easily reached when it came to direct political events (Golinski, 1992: 147–8). 'I know you will rejoice with me in the glorious revolution which has taken place in France', Wedgwood wrote to Darwin just after the fall of the Bastille and the publication of *The Loves of the Plants*. Darwin did rejoice.

Despite the sympathies of radical chemists toward the two revolutions, American and French, and the direct association that was made among them with their own chemical revolution, it was, ironically, the Tories who seemed more intent to make the radical political implications of chemistry appear a convincing threat than did the radical chemists. Where the conservative *British Critic* or the Tory and Anglican *Critical Review* merely dismissed Darwin's science as 'almost wholly erroneous' (Garfinkle, 1955), Canning was so determined to expose the threat that science posed to politics, that he ended 'The Loves of the Triangles' with Pitt dying at the guillotine:

Ye Sylphs of DEATH, on demon pinions flit
Where the tall Guillotine is rais'd for Pitt:
To the pois'd plank tie fast the monster's back,

Close the nice slider, ope th' expectant sack;
 Then twitch, with fairy hands, the frolic pin –
 Down falls th' impatient axe with deafening din;
 The liberated head rolls off below,
 And simpering Freedom hails the happy blow!
 (Canning, 1797 ed. Stones, 1999: 193)

It is somewhat surprising that Pitt wasn't killed off with mephitic gas, like one of Priestley's frogs. But it symbolically – if also inadvertently – reveals the point that chemists' experiments on gases were directed less toward manufacturing a poison for killing off their enemies than toward producing oxygen with which they hoped to manufacture a better environment.

In other words, for Dissenting experimentalists such as Priestley or Darwin, the study of air *was* a study that impacted life and politics, but, contrary to what Burke and Canning encouraged others to believe, the 'contagion' which caused the diseases of civilization was not coming from abroad. Quite the opposite. There, one found 'the happy contagion of Liberty', as Darwin said to Benjamin Franklin, who, he added in complimentary terms, helped deliver his countrymen 'from the house of bondage, and the scourge of oppression' (King-Hele, 1999: 221). The contagion was to be found in England, where people suffered from a contaminated atmosphere that Darwin and a host of pneumatic chemists hoped to purify.

'LIFE IS A FORCED STATE'

Whereas Burke, Canning, and other Tory critics wrote figuratively of foreign influences inciting a revolutionary atmosphere in Britain ('Fir'd with new hopes, the exulting peasant sees/The Gallic streamer woo the British breeze'; Canning, 1797, ed. Stones, 1999: 193) and, more specifically, the 'suffocating' consequences of pneumatic researches, the Dissenting chemists and physicians who were the subject of their attack were speaking *literally* of the potential benefits that the manufacturing of gases, especially oxygen, could have for English society.

Joseph Priestley had drawn specific attention to the deleterious effects that local environmental conditions were having on England's intellectual centres – Oxford and Cambridge – which suffered from being surrounded by stagnant, miasmatic waters. In 1787 he wrote a letter to Prime Minister Pitt explaining that 'While your universities resemble pools of stagnant water secured by dams and mounds, and offensive to the neighbourhood, ours are like rivers, which, while taking their natural course, fertilize a whole country'. This was no loose metaphor suggesting that 'our' centres of education – referring to the Dissenting academies like Warrington, where Priestley had

previously taught – were more intellectually fertile than Oxford or Cambridge. It was certainly true for Priestley that Dissenting academies were governed on more equitable and encouraging terms since they did not exclude students based on religious denomination as did the English universities, but Priestley also meant that the academies were staffed by people who could literally manufacture a better environment. As with other institutions, including hospitals, factories, and even naval ships, schools were also subject to aerial improvement. Just as everyone should have equal access to education, so everyone should be entitled to equal access to health. But while Oxford and Cambridge were pointed to as failing on both counts, Dissenting doctors and pneumatic chemists in the provinces had not yet escaped one disease.⁴

In the early 1770s, Erasmus Darwin turned his attention to the study of gases which gradually he aligned to epidemiological concerns. In July 1772, when he bathed in a pond near his Lichfield home, Darwin brought with him an apparatus (bladder and funnel) constructed by Benjamin Franklin to collect ‘unmix’d Air, that rose from the muddy Bottom, and tying it up, brought it Home’ where he analysed it, thus beginning pneumatic experiments that continued for the next 20 years (King-Hele, 1981: 63).⁵

Nearly a decade later, in January 1781, he entered a debate with James Watt and other members of the Lunar Society regarding speculations born from Priestley’s recent experiments on air purification and on the decomposition of water, which Darwin confidently posits ‘is composed of aqueous gas’, a substance distinct from the general concept of ‘atmospheric air’ which was created due to the expansion of liquids by heat, akin to what Lavoisier (in his *Traité élémentaire*) discussed in relation to ‘the formation of elastic aeriform fluids’, when deciding to use the term ‘gas’ (King-Hele, 1981: 104; for concepts of gas, see Crosland, 2000; Brock, 1992: 124–5).⁶ This was something – as was mentioned earlier – Priestley himself announced with confidence the following year. By that time, Darwin was making oblique references to different kinds of aerial environments in terms that would have arrested Burke’s or Canning’s attention had they intercepted his correspondence. In a letter to Matthew Boulton, Darwin referred to how people live in a ‘dense, heterogeneous atmosphere’ while they ‘crawl upon this miry globe’, but when they die can expect to find themselves either ‘breathing inflammable air below; or dephlogisticated [what Lavoisier called ‘pure air’ or oxygen] above’ (King-Hele, 1981: 120).⁷ Here, in January 1782, Darwin was already associating the salubrity of place with the kind of air that filled it.

One specific place of concern was Britain’s industrial heartland, where the analysis of the aerial environment questioned the limits of scientific and medical claims to improvement. Frustratingly, to a number of experimentalists, it was precisely where wealth was being created based on scientific innovation allowing previously marginalized groups to forge an equal status in propertied society that the scourge of environmental disease persisted. In

other words, among the Dissenting communities who worked to manufacture a more equitable society by harnessing the powers of nature through scientific application, it appeared the ability to manufacture a physically *healthier* environment – with conditions favourable to attaining perfectibility – still eluded them. For critics, once again, this was proof that those provincial radicals who experimented with the powers of nature were destroying the natural order of things.

The idea that society was prone to contract diseases of its own creation was familiar to medical commentators in late 18th-century Britain. As Roy Porter has pointed out, this is captured in the various meanings of the word ‘consumption’, which reveal the paradoxes of the perceived healthiness of civilization (Porter, 1991 and 1994). Possessing enough wealth to consume products was the sign of a strong, healthy economy, but one which was easily corruptible. Consuming habits were prone to degenerate into bad habits, and physicians such as George Cheyne pointed to the obese and gouty aristocracy – those over-consumers of beef and beer and wearers of unsuitable clothing in draughty mansions – as a representation of an unfit, diseased state on the verge of economic and imperial collapse. But the people upon whose labour the consumers relied for future products and economic progress also suffered. Consumption is here linked to the sites of production, where diseases of the lungs were considered an occupational hazard for potters, metalworkers and others who worked in powdery or vaporious environments. The physician William Withering, whose work on standardizing the preparation of foxglove was eagerly used in the Midlands to cure consumption (as well as its much more well-known uses for treating dropsy and heart disease), recorded his observations of the aerial aetiology of disease:

Japanners are constantly breathing the vapours of refinous substances, but I never could observe that they were more or less subject to phthisis than others; casters of fine brass work very often die consumptive, much more so than any other set of artists in Birmingham. They dust their moulds with powdered rosin, the vapour of which rises copiously when the melted metal is poured in. But the mischief can hardly be attributed to this vapour, otherwise the Japanners would be affected; nor yet to the flowers of zinc, which are copiously diffused through the work-shops, because the casters of large brass work are not peculiarly liable to become consumptive. I suppose the Phthisis in these instances to be caused by the mechanical action of the powdery matters which float in the air in great quantities in these fine casting shops, and are necessarily taken in with the breath. Whilst flints for the potteries were pounded in mortars, the people so employed universally died consumptive, and the grinders of needles now often experience the same fate. (Withering in Beddoes, 1794: 12–13)

Critics of industry, such as Thomas Robert Malthus – a Cambridge-educated Whig who ‘hated Dissenters’ and argued passionately against utopian philosophy – therefore later condemned people such as Boulton and Wedgwood not only for manufacturing unnecessary goods for a profligate consumer class, but also for manufacturing disease (Dolan, 2000; James, 1979).⁸

It was urgent that something be done not only to remedy this kind of perspective, but more importantly to remedy the causal link between ‘bad air’ and lung diseases, which by the 1790s was beginning to replace predominate medical perceptions that ‘diseases of civilization’ were manifest in the corruption of the stomach or spleen. This marked the separation of the medical concern over the production and purification of ‘manufactured’ air – what came to be identified as an area of occupational health – and the prevalent 18th-century study of medical climatology, where general atmospheric and environmental conditions were analysed in relation to the spread of epidemic diseases (for the former, see Scott, 1975; Buer, 1926: 251–2; Blanc and Nadel, 1994; the literature on 18th-century ‘medical climatology’ is now substantial, but see in particular Riley, 1987). Consumption was, in Erasmus Darwin’s 1793 phrase, a ‘giant malady’ which ‘like war, cuts off the young in their prime of life, sparing old age and infirmity’ (King-Hele, 1981: 228). Soon, it was a disease that gained the attention of the leading pneumatic chemists, encouraged by Darwin, who were personally affected by it. The sons and daughters of at least three of Darwin’s closest friends suffered from consumption: Joseph Priestley’s daughter, Josiah Wedgwood’s son (Tom), and James Watt’s daughter (Jessie). On top of that, Darwin’s own daughter (Emma) had developed a ‘nervous cough’.

Oxygen therapy was, they hoped, the cure. The lungs were increasingly seen as the ‘sovereign’ of the body after the 1788 publication of Edmund Goodwyn’s *Connexion of Life with Respiration*, which analysed the effects of different proportions of nitrogen and oxygen on diseases such as consumption, giving pneumatic researches a specific agenda for the 1790s. One experimentalist was Thomas Beddoes, who became, in Desmond King-Hele’s phrase, ‘Darwin’s most ardent disciple’, following his failure to obtain the Regius Chair of Chemistry in the ‘stagnant atmosphere’ of Oxford due to his enthusiasm for French politics (King-Hele, 1999: 220; for Beddoes, see Levere, 1981; for the continuation of Beddoes’s pneumatic research, see Knight, 1998; Fullmer, 2000).

In 1793, Beddoes wrote to Darwin inquiring after observations he had made of consumptive patients. Darwin answered that ulcers on the lungs caused pulmonary consumption, which could arise spontaneously or as a result of a previous infection. Some cases were hereditary – meaning that some victims were constitutionally ‘predisposed’ to acquire the disease – but it was also contagious. ‘And hence lastly the reason’, wrote Darwin to Beddoes, ‘why ulcers of the lungs are so difficult to heal, viz. because they

are perpetually exposed to a current of air. What part of the atmospheric air is hurtful to ulcers, whether it be the oxygene in too large a quantity . . . or too great a proportion of azotic air [nitrogen], I hope your cautious experiments and your particular attention to consumptive patients will soon decide' (printed in Beddoes, 1793: 66).

Beddoes had James Watt build him an apparatus, called a 'living machine' by contemporaries, with which he administered pure oxygen to consumptive patients, after having completed a trial of self-experimentation (a replica of Watt's machine is on display in the Wellcome wing of the Science Museum, London) (Cartwright, 1967). Knowing that he was free from any hereditary predisposition to consumption and not having anything like 'phthisical conformation', 'I thought I might venture very far in oxygenating myself without any great risque' to observe in detail its effects.

I accordingly respired air of a much higher than the ordinary standard, and commonly such as contained almost equal parts of oxygene and azotic air for near seven weeks with little interruption. I breathed it upon the whole sometimes for twenty minutes, sometimes for half an hour, and sometimes for an hour in the day, but I never continued breathing for above four or five minutes at any one time. I felt, at the time of inspiration, that agreeable glow and lightness of the chest, which has been described by Dr Priestley and others. In a very short time I was sensible of a much greater flow of spirits than formerly, and was much more disposed to muscular exertion. (Beddoes, 1793: 50–1)

From the knowledge gained by performing such experiments, Beddoes went on to list all the diseases he thought would be cured by taking oxygen, which provided vital energy, lacking in most diseases, concluding with the optimistic note that 'In a future letter I hope to present you with a catalogue of diseases in which I have effected a cure' (Beddoes, 1793: 57–9). But his even more ambitious plan – shared by a host of grossly understudied pneumatic medics (such as Richard Pearson or even Thomas Trotter) – was to install one of these machines in every hospital room, factory, ship and academy. It was, they thought, only through such measures that diseases of the lungs would be eradicated, that the new concept of 'antiseptic air' would cleanse the environment (removing miasma and damaging particles from the air), and the constrictions on the evolutionary perfectibility of future generations would be removed (for associated discussion of 'genetic perfectibility of man', see Hilts, 1984).

By the time Erasmus Darwin published the second volume of *Zoonomia* in 1796, he could devote different sections to discussion of the developments in pneumatic therapy (Darwin, 1974[1794–6]: 288–90). But it was not happening fast enough. In June 1796, Darwin was told that his good friend James Watt's only surviving daughter, Margaret, had died. 'Life is a forced state!' wrote

Darwin, clearly upset by the continued helplessness facing humanity in its struggle for perfection. 'I am surprised that we live, rather than that our friends die.' Darwin was despondent, wondering 'What is there in the world' that makes anyone 'wish to continue in it'? Worse was yet to come. The following year saw the death of friends including Wollstonecraft, Joseph Wright, Elizabeth Edgeworth (of consumption), his childhood friend Richard Dixon, and others in what King-Hele calls 'a year of mortality' (King-Hele, 1999: 309–11). Indeed, 1797 was not a good year for Erasmus Darwin.

‘THE END WILL BE GLORIOUS AND PARADISIACAL’

Six months before he died in 1797, Burke declared to a friend that 'we hate Jacobinism as we hate the Gates of Hell' (Kramnick, 1977: 143). Those he attacked, of course, saw things in completely the opposite way. They loved Jacobinism because they loved the idea that it would open the gates of utopia. The millennial goal for Darwin and his friends was to create heaven on earth, to create conditions favourable to the perfectibility of humanity, so that, in Priestley's words, however problematic the world was at present, 'the end will be glorious and paradisiacal, beyond what our imaginations can now conceive' (ibid.: 68).

In attacking the utopian philosophy, the Tories knew they needed to attack the practical work the Dissenters were doing in an effort to re-create paradise – to mention specifically air pumps, pneumatic devices, galvanic batteries, and other instruments which critics portrayed as instruments of destruction, but which natural philosophers saw as instruments for improvement. Potential improvement, at least. Four years after Darwin's 1793 plea to Beddoes to 'Go on, dear Sir, save the young and the fair of the rising generation from premature death; and rescue the science of medicine from its greatest opprobrium' no more lives were yet being rescued. It was the difficulties they faced in wiping out disease that, as Darwin's chief biographer has stated, 'gradually sapped [Darwin's] faith in a benevolent God' (King-Hele, 1981: 105). The lack of any tangible success, the silence of a proclamation of a therapeutic revolution in medicine, provided antagonists with the salt to rub in the wounds of natural philosophers who held such high hopes for science.

The Anti-Jacobin satire on the natural philosophical ideas of Darwin, among others, was exaggerated political propaganda, 'a gadfly to the Opposition politicians in Parliament' (Montluzin, 1988: 21). It emphasized if also distorted the hypothetical – allegedly dangerous – conclusions of 'Frenchified', secular, anti-establishment theorizing. But the 'radical philosophers' I have discussed saw their work, grounded in experimental enquiry and practical medical trials, as having potential political as well as philosophical consequences.

Their failure to accomplish the eliminating of disease was seen as a failure of their values and beliefs, and all references to oxygen by Tory critics were intended to remind them of that. Suggestively, it appears as if the parodies of their hopes for perfectibility were not answered. Democrats such as Darwin were growing increasingly despondent due to the political turn of events in France, where the Republic was now subjected to Napoleon's tyranny. Just two months after the last instalment of 'The Loves of the Triangles', Darwin once again resorted to what he called the 'power of the imagination' to offer a picture of an improved political circumstance, where Napoleon was to have his evil spirit exorcized by being 'laid in the red Sea; from which no spirit can return, as I am inform'd, till all their earthly stains, and metaphysical contagions, are perfectly washed out, and they return white as snow, and pure as oxygen' (King-Hele, 1981: 309).

It looked indeed as if the 'aerial' campaign for equality in Britain, which hoped to use the experimental revolution in chemical practices and knowledge rather than a violent revolution in politics, would need to wait for a new generation to put the wind back in its sails. The premise in the 1790s, was that if one could create the conditions under which good air could be manufactured – where the work of Dissenting chemists and doctors was embraced rather than excluded, supported rather than attacked – then conditions, political and medical, under which a healthy country will flourish will prevail. An enlightened, democratic, non-sectarian culture would yield a more salubrious environment. The sentiment was addressed in part by William Buchan, who had an aim to wrest specialized knowledge from the few – the elite physicians – and to 'lay medicine open' before the people. The medical monopolies, concentrated in the hands of the selective Royal College of Physicians, had wrongly profited by selling natural cures to an ignorant public, he argued.

For a long while air, water, and even the light of the sun, were dealt out by physicians to their patients with a sparing hand. They possessed for several centuries the same monopoly over many artificial remedies. But a new order of things is rising in medicine, as well as in government. (Buchan, 1796: 26)

Establishing such a 'new order' was exactly the campaign that those Dissenting doctors and provincial radical philosophers who have been discussed here were involved with.

What I have been suggesting is that the cures to what were perceived as the 'diseases of civilization' changed through the 18th century. In the 1730s there was an idealized desire to see a retreat to Rousseauvian primitivism, or, at least – in George Cheyne's formulation of the 'English Malady' – to recognize that 'these monstrous and extreme tortures', melancholy or consumption, 'are entirely the Growth of our own madness and Folly, and the Product

of our own wretched Inventions' (Cheyne, 1991[1733]: 34; Riddell, 1922). In the 1790s we see the emergence of an aggressive campaign to eliminate those diseases, not by blaming them on over-indulgence, but by reforming the environment. This change of approach is 'embodied' in the shift from the pre-dominant consideration that the stomach was the monarch of the body, to the 1790s view that the lungs were more instrumental in regulating certain diseases that plagued the population.

Contra the claim made by Roy Porter that doctors, including Erasmus Darwin, were 'profoundly troubled by what they saw as the counterproductive impact on health produced by the spread of progressive ideas, refined culture, and modern, commercial, urban values' (Porter, 1991: 178), I have here argued that it was precisely those progressive values that led Dissenting doctors and pneumatic chemists to believe that they could apply the same principles that led to the phenomenal industrial and commercial success of their friends like Boulton, Watt, or Wedgwood, to improve their health. As Isaac Kramnick has argued, the likes of Burke or Canning attacked the Dissenting radicals more from a dislike of the 'bourgeois spirit' – that 'hot spirit drawn out of the alembic of hell' (as Burke said) – than a hatred of Catholicism and the fears of the philosophical 'contagion' emanating from abroad (Kramnick, 1977: 150–1, 182). But it was that bourgeois spirit which fuelled the Dissenters' desires to generate medical reforms and *manufacture* paradise on earth.

NOTES

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- 1 *The Anti-Jacobin; or, Weekly Examiner* that is referred to here should not be confused with a subsequent publication of a similar name, *The Anti-Jacobin Review* (1798–1821), though, as Emily Lorraine de Montluzin suggests in her study of the *Review* (1988), the latter can be considered an 'offspring' of the former.
- 2 It might also be noted that Darwin was one of the first in Britain to go into print using the term 'oxygen' in its Lavoisian sense, in Part I of *The Botanic Garden, his Economy of Vegetation* (dated 1791 but appearing in 1792) which, confusingly, was published after Part II of *The Botanic Garden, his The Loves of the Plants*; see *OED*.
- 3 'The Loves of the Triangles' has further associations with Burke's argument as presented in his *Reflections*, toward the end of which, for example, Burke referred to 'a geometrical constitution' and described what he understood as a French project to divide the country into 83 exact squares called Departments (Burke, 1993: 173–5; Crosland, 1987: 297).

- 4 The work of a number of Priestley's predecessors and colleagues had long demonstrated the effects on health of gases found in different environments, from the physician William Brownrigg's research on fire-damps in coal mines and gases escaping from mineral waters in the 1740s, to the work in the 1750s by the President of the Royal Society, Sir John Pringle, on prison-fever, among many others (Beckett, 1977: 258–9; Riley, 1987: 99).
- 5 In 1779 he refers to 'all the new experiments upon *airs*, or gases' that he was involved with (King-Hele, 1981: 96).
- 6 'Air purification' refers to Darwin's query for Priestley as to 'whether a plant insulted in mercury will spoil air'.
- 7 I don't dismiss Desmond King-Hele's interpretation of Darwin's 'jokey' references here, which he thinks might simply be Darwin's way of reiterating his opinion that water is composed of hydrogen and oxygen. However, in light of the context of discussions about respiration and health, it seems also notable that hell is filled with inflammable hydrogen and heaven filled with oxygen – reflecting that Darwin already imagines that good environments are filled with pure oxygen.
- 8 Note should also be made that Bishop Watson, Professor of Chemistry at Cambridge from 1764 to 1771, had, in his popular *Chemical Essays* (5 vols, 1793–6), discussed the dangers of mercury poisoning among workers at Birmingham quick-silver mines; his hope was to see the establishment of 'an Academic Institution for instructing young men of Rank and Fortune in the Elements of Agriculture; in the Principles of Commerce; and in the Knowledge of our Manufactures'. As David Knight notes, 'this was not available at universities but could have been found, though the good Bishop does not say so, at the Dissenting Academies where men like Priestley . . . taught' (Knight, 1992: 98–9).

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