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# 1

## From Enlightenment Philosophies to Victorian Reform, 1790–1846

The definitive beginning of anaesthesia is commonly taken as William Morton's use of ether in Boston during the autumn of 1846. From this point, there is historical consensus on the mode of its diffusion to Britain and Europe and on the alacrity of its worldwide adoption as an efficacious method of pain-relief. But anaesthesia has a curious pre-history, including the explorations of Humphry Davy, Henry Hill Hickman, Crawford Long and Horace Wells. There is agreement amongst historians that such figures are part of the history of anaesthesia but little resolution as to how their work can be integrated with later history; or explanation as to why anaesthesia did not emerge prior to 1846; or why exactly it was a dentist, rather than a surgeon, who succeeded in establishing ether.

Take for example, Bergman's recent account of the genesis of surgical anaesthesia. He describes in great detail the work of Davy and Hickman, yet does not grapple with the reasons as to why their experiments did not popularise anaesthesia.<sup>1</sup> Cartwright had previously analysed Hickman's experiments with 'suspended animation', but he failed to find a connection with later experimenters.<sup>2</sup> Smith concluded that Davy's researches set the stage for anaesthesia 'but the actors went away'.<sup>3</sup> One of the most recent pieces of writing on Davy, by Jacob and Sauter, offers a useful starting point from which to address these issues,<sup>4</sup> but in general the historical treatment of this prelude to anaesthesia, from the 1790s to the 1840s, has been deeply unsatisfying.

This chapter suggests that we can better 'place' the early work of Davy and Hickman *and* the later developments, by recognising how much the configurations of medicine had changed between the 1790s and the 1840s. I shall argue that from the later eighteenth century pain emerged as a key medical problem, partly through the new attention given to

the experience of death. As patient tolerance of pain declined, the use of opiates grew and it was in this context that enterprising doctors were extending the range of operative surgery. This surgical project was increasingly linked to an anatomical view of the body, as a system of tissues and organs that supported each other to maintain life. When one part failed, or links were broken, the body died – but through a process which might be interrupted or even reversed, so life might be reclaimed. By the 1830s, physiologists and elite doctors envisaged a level of unconscious life, linked with the vegetative nervous system but divorced from the higher functions and the mind, including suffering. At the same time, the emergence of more conservative and slower surgery intensified the problem of pain for both patient and surgeon. By the mid-1840s pain no longer seemed physiologically necessary or socially acceptable; but the intensive use of drugs known to diminish surgical pain was dangerous, and new alternatives such as mesmerism were highly contentious.

I do not claim that these shifts in the practice and theory of medicine fully explain why ether anaesthesia entered medicine in the 1840s, but they certainly provide the practical and intellectual context within which that innovation was understood. By exploring the shifts in medicine over the previous century, we can reconstruct the world in which the ‘Yankee dodge’ of an unknown American dentist was accepted and developed by the medical elites of Britain and Europe.

To get a measure of the shifts, we can turn first to the celebrated experiments of the 1790s when Humphry Davy, later a very famous chemist, experimented with nitrous oxide, found it intoxicating and speculated about its possible use in surgery. For many commentators, this was an opportunity missed; for the historian it is a chance to explore how gases and the body were understood at the end of the Enlightenment, amongst England’s most ‘progressive’ doctors, chemists and natural philosophers, just before the political and cultural reaction against the French Revolution. *For us*, Davy can exemplify the physiology of sensibility and enhancement as medical attention began to shift towards man’s biological limitations and to seeing life through the window of death.

### **Davy, gases and the enhancement of life c.1790**

From the 1750s onwards, a series of discoveries had placed the nervous system at the centre of the body’s capacity to experience both health and disease.<sup>5</sup> That stimulation of living bodies gave rise to sensations and motion was commonplace, but it was the experiments of Swiss

physician, Albrecht von Haller, in 1752 which located sensibility as an exclusive physical property of the fibres of the nerves, and it was the work of Edinburgh physician, Robert Whytt, on the spinal cord and involuntary movement which grounded sensibility as a physiological function.<sup>6</sup> The emphasis upon the nervous system was reinforced by those such as William Cullen, medical doyen of Edinburgh University, who understood its qualities to be 'vital', visible and beyond mechanical explanation.<sup>7</sup> The immaterial soul furnished the nervous power or energy which drove the material body, and thus the body and soul were unified by sensibility. Heightened sensibility was perceived as the means of the 'perfectibility' of individuals and societies – a means of realising Enlightenment aspirations for progress.<sup>8</sup> This new physiology drew upon John Locke's philosophy of the mind – that all individuals were born with a mind which stored and shaped the data acquired through the senses, thus creating empirical knowledge of the world, which in turn gave individuals the power to transform their environment.<sup>9</sup> Within Enlightenment culture this monistic understanding of the person forged connections between sensibility and the aspirational values of 'polite' society; consumerism took hold, not least in the form of health and well-being, and health emerged as a new commodity.<sup>10</sup>

Bodies – constituted from solid fibres and numerous fluids – were understood by both patients and doctors to possess an individual and natural equilibrium. Disease or sickness caused an imbalance or disharmony to this equilibrium. The role of the doctor was to listen to the patient's narrative of his/her illness and observe the symptoms.<sup>11</sup> It was a relationship in which both participants accorded pivotal importance to the individual experience of illness and spoke the same language of sickness and disease. The weighting that was given to the whole body, rather than its parts, was reflected in the status accorded to physicians and surgeons. Physicians, by virtue of their university education, were deemed to be custodians of an elite knowledge which they used to treat elite patients.<sup>12</sup> Surgeons with their craft origins treated parts of the body – they let blood, drained abscesses, cut off tumours, pulled teeth and trussed ruptures. But the major operations of lithotomy or amputations were rare because the risks of haemorrhage or sepsis were high.<sup>13</sup>

Enthused by the prospect of discovering medical laws like those of Newton's in physics, doctors sought unitary explanations of disease that mirrored the 'idea of perfectibility' articulated in many Enlightenment writings.<sup>14</sup> The new stress on the nervous system was reinforced by Cullen's claim that 'almost the whole of diseases of the human body might be called NERVOUS'.<sup>15</sup> His work was extended by several of his

students, particularly John Brown and Benjamin Rush.<sup>16</sup> Brown explained sickness in the body as an imbalance of irritability, which he described as excitability; in his 'Brunonian' medicine, sickness and disease were the consequences of this disequilibrium, and harmony could be restored in the individual using a straightforward set of therapeutic principles.<sup>17</sup> These were exemplified in his thermometer, which used temperature to ascertain the exact degree of under- or over-stimulation of the body, and thus the dose of therapy required.<sup>18</sup> Depressants such as bloodletting, emetics or cathartics reduced excessive excitability and stimulants such as opium or alcohol cured those whose excitability was depleted.<sup>19</sup> Life and health were inextricably bound with the external environment of the body. Brunonian medicine became far more popular on the Continent, particularly in Italy and Germany, than in Britain.<sup>20</sup> But it is of particular significance for our discussion because it was the theory which underpinned Thomas Beddoes and Davy's work on the therapeutic use of gases.<sup>21</sup>

Beddoes was very much a man of his time.<sup>22</sup> Trained in Edinburgh, he understood substances like airs or metals to be simple or compound by virtue of their 'elemental' qualities which resisted decomposition.<sup>23</sup> Chemistry was perceived as the epitome of Enlightenment values: 'I regard every experiment that Priestley made in chemistry as giving *wings* to his more sublime theological works', wrote his friend Samuel Taylor Coleridge.<sup>24</sup> Beddoes' support of the philosophies of the French Revolution – liberty, the rights of man, freedom from state oppression – forced him to leave a highly promising position as chemical lecturer and experimenter at Oxford in 1793 and to set up practice in Bristol. He took the opportunity to put into practice his dreams that chemistry could transform medicine.

Beddoes had been inspired by the chemical revolution, spearheaded by the French chemist Antoine Lavoisier, which isolated nitrogen, hydrogen and oxygen and brought about a new understanding of the 'different kinds of air' which made up the atmosphere. His intention was to use these newly discovered respirable gases to develop therapies for lung conditions such as tuberculosis. His connections to the Edgeworths, the Wedgewoods and the Watts through the Lunar Society provided support, funding and apparatus and in 1799 he opened the Pneumatic Institute in Clifton, Bristol.<sup>25</sup> The city housed some of the most outspoken radicals of the period and during its short existence the Institute became a magnet for enlightened thinkers like Coleridge, Robert Southey and Davies Giddy – later President of the Royal Society. Chemistry, philosophy and poetry were soulmates within its walls.

Davy's nitrous oxide experiments formed part of Beddoes' wider enquiry into the therapeutic use of gases. Beddoes' recruitment of the brilliant young chemist has been well-told,<sup>26</sup> but what needs to be stressed is the way in which Beddoes and Davy's radical understandings of natural philosophy gelled as strongly as their belief that chemistry was the means of discovering the powers and forces of life. Prior to joining Beddoes, Davy had undertaken experimental work on the nature of light and heat and concluded that the oxygen breathed by living beings was composed of oxygen gas and light – phoso-oxygen. Through respiration, the light was diffused through the nerves and provided the essential stimulation for the vitality of all bodies. For Davy it was a convincing explanation of materialism, a way in which 'one law alone may govern and act upon matter... the law of animation, tending to produce the greatest possible sum of perception, the greatest possible sum of happiness'.<sup>27</sup> And because Davy understood light to be a chemical, he claimed that chemistry 'in its connection with the laws of life' was 'the most sublime and important of all sciences', a view shared by Beddoes.<sup>28</sup>

At the Pneumatic Institute, Davy investigated the therapeutic potential of a range of gases – nitrogen, hydrogen, oxygen and hydrocarbonates. The first stage, using animals, was to ascertain if a particular gas was capable of sustaining life, and if so, did it stimulate or depress vitality? Through respiration, the gas was understood to enter the blood and travel to all parts of the body. It thus had the potential to rebalance, through stimulation or depression, the body's equilibrium. Davy's investigations showed that all gases apart from atmospheric air had the power to destroy life but in different ways.<sup>29</sup> Nitrogen and hydrogen gases, of themselves, caused no changes in the venous blood of animals; they died from a 'disease produced by privation of atmospheric air, analogous to that occasioned by their submersion in water'.<sup>30</sup> When he breathed hydrogen, Davy noted, it was 'the pain of suffocation' that compelled him to leave off the gas.<sup>31</sup> Oxygen, and gases made from compounds of hydrogen and carbonates, however, destroyed life by changing the blood in a way which made it 'incapable of supplying the nervous and muscular fibres with principles essential to sensibility and irritability'.<sup>32</sup> Nitrous oxide's mode of action was different; Davy found it could be respired for longer than any other gases except air and oxygen. Its effects on animals were to cause an initial period of excitement which was followed by exhaustion. If the animal stopped breathing gas before complete exhaustion was reached, then it was possible to restore 'healthy living action' by letting the animal respire atmospheric air.<sup>33</sup>

The 'peculiar changes' in the blood and organs of animals then were reversible – but Davy certainly understood them as a process of death, although different to that caused by the privation of air.<sup>34</sup>

The conception of death as a process, rather than an absolute, was very recent. The debate had begun in 1740 when Jacques-Benigne Winslow, Professor of Anatomy in Paris, had suggested that the state of death was potentially uncertain. An absence of pulse or a cessation of breathing were not irrevocable states. Only when the flesh of the body began to rot, claimed Winslow, was an irreversible state of death reached.<sup>35</sup> By 1792, James Curry in Liverpool noted that 'the happy discovery of an essential difference between absolute and apparent death' had lately changed the previously universal belief that 'life quitted the body in a very few minutes after the person had ceased to breathe'.<sup>36</sup> Death, viewed as a process, sustained the possibility of new medical roles and attention began to focus on resuscitation and the various techniques of hot/cold baths, galvanism and physical manoeuvres that might be used to restore an apparently dead body to life. In Amsterdam, a society had been founded in 1767 for the recovery of drowned persons and London followed this example in 1774, by establishing an institution for affording immediate relief to persons apparently dead from drowning.<sup>37</sup> It later became the Royal Humane Society.<sup>38</sup> Its objective was to teach resuscitation techniques, particularly in cases of water accidents, many of which occurred in the Serpentine Lake in Hyde Park as well as in the Thames. John Hunter, London's leading surgeon of the time proposed the use of two-chamber bellows to artificially ventilate the lungs; he also drew on the recent discovery of oxygen and its stimulant properties by suggesting that the gas could be administered rectally using a small pair of bellows.<sup>39</sup> Davy's suggestion that nitrous oxide could be used to restore life in drowned or suffocated bodies shows his absorption of these new understandings of death.<sup>40</sup>

And for these understandings, nitrous oxide had a peculiar importance. Joseph Black and Joseph Priestley had isolated nitrous oxide in the 1770s,<sup>41</sup> and Davy's attention had been drawn to the subject by the claim of Samuel Mitchill, professor of chemistry in New York, that the gas was produced in the body by the decomposition of food. In healthy bodies the gas was simply excreted but in illness it promoted fever and was lethal if inhaled.<sup>42</sup> Fever, and its links with confined spaces and rebreathing, was another major issue of the day. When Davy succeeded in isolating pure nitrous oxide, he used animals to test its action, and then, believing that it was respirable, proceeded to inhale the gas himself. And thus his attention was turned from disease and death

towards the enhancement of life. After a couple of attempts he breathed enough to experience a 'highly pleasurable thrilling...the objects around me became dazzling and my hearing more acute...the thrilling increased, the sense of muscular power became greater'.<sup>43</sup> His immediate extension of these experiences to Beddoes and friends underlines the profound intellectual importance he attributed to the state of altered sensibility. For him it was a life-affirming process: 'vivid ideas passed rapidly through the mind', 'sublime emotions connected with highly vivid ideas', 'I existed in a world of newly connected and newly modified ideas; I theorised, I imagined I made discoveries', he noted during his trials.<sup>44</sup> Breathing nitrous oxide brought about physical changes in the body – muscular power, tingling skin – but most striking for Davy and others were the altered intellectual sensibilities. The sensations created by the gas were beyond existing experience. 'Davy has invented a new pleasure for which language has no name', gloried Robert Southey whose breathings had produced a vision of 'a paradise wholly immaterial – trees of light growing in a soil of ether – palaces of water refracting all with colours'.<sup>45</sup> And James Thomson complained that the English language was so 'defective' that to comprehend the effects of 'this extraordinary gas' one had to respire it and then 'either invent new terms to express these new and particular sensations, or attach new ideas to old ones'.<sup>46</sup> The way in which nitrous oxide intensified individual engagement with the world dovetailed neatly with Enlightenment aims of self and social improvement. It struck a chord with Brunonian theory that vitality depended on stimulation – and the greater the stimulation, the higher the state of perception.<sup>47</sup> It was, noted Davy, the 'intellectual pleasure, or hope' induced by the gas which made many so strongly inclined to breathe it again.<sup>48</sup>

During one of his trials of nitrous oxide, Davy was suffering from the 'intense physical pain' of toothache. He noted that it 'always diminished after the first four or five inspirations' of gas. As he breathed in, he experienced a 'thrilling' which 'swallowed up in pleasure' the unpleasant sensations of his pain.<sup>49</sup> When he later published his work, he concluded that the powers of nitrous oxide 'may probably be used with advantage during surgical operations in which no great effusion of blood takes place'.<sup>50</sup> His suggestion was not taken up in any of the contemporary reviews of his work and a satisfactory explanation of why Davy or his contemporaries did not pursue the possibility has so far eluded historians. I want to suggest that some light can be shed on the question by examining Davy's understandings of bodily sensibility and by linking them to the wider social and political context of the late 1790s.

For Davy, the nervous system was the very self of the individual body; it was supplied through the blood with the principles essential to sensibility and irritability. He explained the mechanism of nitrous oxide through his understandings of sensibility. 'Reasoning from common phenomena of sensation, particularly those relating to heat', he wrote, 'it is probable that pleasurable feeling is uniformly connected with a moderate increase of nervous action; and that this increase when carried to certain limits, produces mixed emotion or sublime pleasure; and beyond those limits occasions absolute pain'.<sup>51</sup> Davy supported the use of opiates and alcohol to ameliorate physical pain; nevertheless he understood pain to fulfil a physiological function as its presence marked the return of vitality to the body after illness. 'By whatever cause the exhaustion of organs is produced', he remarked, 'pain is almost uniformly connected with their returning health'.<sup>52</sup> Certainly Davy, Beddoes and their circle embraced the Enlightenment quest to diminish human suffering. They held fast to the hope that 'at some period' physiology would 'become a branch of philosophy... interested in teaching the means of procuring pleasure and removing pain'.<sup>53</sup> But in 1800, it was a means that they did not believe they possessed.

Nor too was the social context conducive of further explorations into nitrous oxide gas. During the 1790s, whilst Beddoes was establishing his institution, fear had grown amongst British conservatives that the anarchy of the French Revolution would spread across the channel.<sup>54</sup> A revulsion against all things French caused many areas of natural philosophy to become politicised;<sup>55</sup> gas chemistry was particularly susceptible, partly because Lavoisier was perceived as the pioneer of the 'new' chemistry and partly because of the materialistic implications of the subject.<sup>56</sup> The publication of Edmund Burke's *Reflections on the Revolution in France* in 1790 had marked the beginning of a scathing condemnation of Enlightenment philosophies by conservatives and placed particular emphasis upon the dangers of the 'new chemistry'.<sup>57</sup> Beddoes had not moderated his radical views since leaving Oxford; for him, medicine, society and politics were interdependent and the new gas chemistry was redolent of the 'perfectibility' of society. Burke argued that such claims were not only false, but most dangerously threatened the moral basis of humanity. Thus by the turn of the nineteenth century the Pneumatic Institute and the nitrous oxide experiments, in particular, were ripe for criticism and satire in conservative publications such as the *Anti Jacobin Review*.<sup>58</sup> Chemistry was not the only area of concern. Mathematics too was considered to be open to dangerous French influences. In 1801 John Robison, a conservative

professor of physics at Edinburgh, wrote new articles for the 3rd edition of the *Encyclopaedia Britannica*; he specifically rejected French algebraic methods and spoke of the ‘seeds of Anarchy and Atheism’ which were spread through the French *Cyclopaedie*.<sup>59</sup> Animal magnetism and mesmerism were also sidelined because of their close associations with France.<sup>60</sup> By 1801, the Bristol experiment had come to an end; Davy had departed to the Royal Institution and Beddoes converted the Pneumatic Institute into a Preventive Institution ‘for the benefit of the sick and drooping poor’.<sup>61</sup>

The Royal Institution to which Davy moved had been founded in 1799 as a philanthropic venture – the Society for Bettering the Condition of the Poor. Berman has shown how it was established by a group of landowners who were concerned that the intense rural poverty of the 1790s would create social unrest. The intention was to improve the social and working conditions of the rural poor through improved husbandry techniques, the building of cottages and soup kitchens.<sup>62</sup> When Davy joined the Institution in 1801 he took up research into tanning and agriculture, combining chemical investigation with analysis of current practices, and it is evident that his patrons expected his experiments to produce economic paybacks for the tanning industry.<sup>63</sup> The nature of the project was far more utilitarian than the gas research undertaken at the Pneumatic Institute, and Golinski has convincingly argued that Davy came to see himself as an expert instructing an audience.<sup>64</sup> It was worlds away from the collective experiences at the Pneumatic Institute.<sup>65</sup> Davy’s lecture notes suggest that the shift was already clear by 1802:

we do not look to distant ages, or amuse ourselves with brilliant though delusive dreams concerning the infinite improveability of man, the annihilation of labour, disease, and even death, but we reason by analogy from simple facts, we consider only a state of human progression arising out of its present condition.<sup>66</sup>

The British rebuttal of radical Enlightenment philosophies and the revitalisation of conservative values during the early 1800s can also be seen in literature, for example in Jane Austen’s *Sense and Sensibility*. Written between 1797–98, although not published until 1809, the novel juxtaposes Elinor’s ‘coolness of judgement’ and her ability to control her ‘strong feelings’ against Marianne’s lack of moderation and excessive sensibility. Marianne’s success in eventually taming and reordering her excessive sensibilities was signalled by a new social order in which she became matriarch of new domestic and social duties.<sup>67</sup> So too at the

Royal Institution, Davy succeeded in controlling and refocusing the excessive sensibility of the nitrous oxide experiments. Beddoes was not so fortunate. He died aged 48 years in 1808, depressed and possibly suffering the effects on heart and lungs of his self-experimentation.<sup>68</sup>

It is indisputable that Davy's work on nitrous oxide has a place in the history of anaesthesia; his was the unequivocal demonstration of the power of gases to alter bodily states. That neither Davy nor his contemporaries pursued the possibilities of nitrous oxide is understandable *if* we place his work within the context of his 1800s understanding of the body and its processes. For Davy, pain and pleasure were polarities of sensibility grounded in the nervous system. Nitrous oxide had the power to transform painful sensations to pleasurable ones by increasing the nervous energy within the body, but he did not conceive of a way in which sensibility could be disassociated from the body without adversely affecting its living principles. For these reasons, his suggestion that nitrous oxide might serve a purpose during surgical operations should be read as a means of using its stimulant qualities to counter the depressive and painful ones of surgery, as he had experienced during toothache and headache. Davy understood the suspension of sensibility to be a form of suffocation which ended in death, or at the very least, caused intense pain during its return.<sup>69</sup> Intervening into the body's processes to artificially suspend sensibility was a hypothesis that was physiologically unsupportable, despite his clear support for the humanitarian mission to remove pain at all levels of human experience.

### **The control of pain**

No one continued Davy's work on enhanced sensibility, but many continued the late eighteenth-century interest in opiates and pain reduction. Though several historians have suggested that researches before 1840 failed to establish anaesthesia because the amelioration of pain was not then a social objective, this argument cannot be sustained.<sup>70</sup> We can accept that the experience of pain is not a constant, that it is always shaped and defined by its cultural context, but we have good evidence that from Greek times onwards societies have variously sought to understand and ease the pain of chronic disease, surgery and childbirth.<sup>71</sup> Moreover, it is now clear that the last decades of the eighteenth century saw a burgeoning in the use of opiates. In the words of Porter, it would appear that the very pain threshold of society was becoming lowered.<sup>72</sup> And unlike the Bristol cavortings, opiates for the sick and

dying chimed well with strengthening evangelical concerns over the manner of one's death.

For most of the eighteenth century, the priest rather than the doctor had held sway over the deathbed, reflecting the cultural dominance of the religious rituals of preparing the soul for death. But in parallel with the novel techniques of artificial respiration which had grown out of the new view of death as a process, doctors began to provide comfort to the dying.<sup>73</sup> Thomas Percival, physician at the Manchester Infirmary, called for doctors to 'smooth the bed of death' 'by alleviating pain and soothing mental anguish'.<sup>74</sup> Management of death became part of the definition of a 'good' doctor: from the 1800s, the London physician, Henry Halford, became 'a master in all that concerned the management of dying', not just through the use of pain-relief but through his sympathy and the hope he inspired.<sup>75</sup> This new medical role at the deathbed was bolstered by the philosophies of evangelicism which emerged as a decisive engine of social, political and medical change over the first decades of the nineteenth century.<sup>76</sup>

Because evangelical doctrine supported the possibility of individual salvation right up to the final moment of death, the final hours and days of life were charged with great significance; a rapid death was feared because it allowed no time for spiritual repentance. Publications such as the *Evangelical Magazine*, published between 1793 and 1892, dwelt on true experiences of deceased evangelical Christians.<sup>77</sup> If doctors were able to ameliorate or at least palliate physical pain, then the dying patient could remain lucid enough to make final repentances, and family and friends could mourn them in the knowledge that they had been truly saved. A lady's maid who died from a rupture of the stomach in 1838 was attended by Suffolk surgeon Edward Crowfoot who observed how the use of opium kept her 'perfectly sensible to the last, suffering but little pain'.<sup>78</sup> It certainly appears that one of the most valued qualities of opiates was their effect upon the mind; opium 'affords to the mind a peculiar energy, elevation and tranquility', noted Prussian physician, Christian Hufeland.<sup>79</sup>

The idea that pain could be avoided broke sharply from established understandings which believed that pain performed a vital function within the body's systems. Pain was an 'unpleasant sensation or irritation' noted *Hooper's Medical Dictionary* in 1820. It was a 'voice of nature', a protective device which could warn of internal inflammation or disease in advance of visible symptoms.<sup>80</sup> The physical discomfort created by many therapies – bleeding, emetics, purging – was understood as 'pain for gain' and, as Davy had noted, the return of vitality to the body was

usually accompanied by unpleasant sensations.<sup>81</sup> Therapeutic practices reflected the functional nature of pain.

John Hunter's principles of healing, for example, were based on the understanding that diseases and wounds caused 'irritability' which disrupted the 'universal sympathy' within the body. By employing the principle of counter-irritation at a different site on the body, healing would be encouraged in the primary inflammation or irritation. For this reason, techniques such as blisters, cautery and acupuncture were used, either at the site of wounds after injury or operation, or on other parts of the body in cases of chronic disease such as neuralgia or rheumatism. Stanley details the acutely painful nature of many of these therapies but there is no question that surgeons promoted such techniques and patients bore them because they were understood to offer the best chance of recovery and return to health.<sup>82</sup>

But by the 1830s the radical view that pain was purposeless began to emerge. An 1838 treatise by the Dublin doctor, James Macartney, suggested that the healing of wounds could take place without any need for counter-irritation of the site. It was the 'most original medical work' since the time of John Hunter, pronounced the *Lancet*. Macartney understood his theory to reflect 'the humane spirit of the present age'. The practice of promoting inflammation of wounds came to us 'from those dark ages of the world', he noted:

in which insanity was treated by the whip and chains, when people were forced to profess their belief or impossibilities by the rack or the fagot, when the punishment of death was awarded to almost every crime.<sup>83</sup>

New strategies of employing opiates to palliate the pain of childbirth began to be adopted. Brentford practitioner F. A. B. Bonney found them useful in the early stages of labour to quiet the 'tedious pains which appeared to be useless,' as well as employing them in the post-natal period. It was a notably different understanding to that of J. Paterson of Aberdeen, who claimed the 'after-pains' of labour should be encouraged because 'such pains are doing good somewhere'.<sup>84</sup>

Patients too grew to have different expectations of therapeutics. Witten has shown how German patients in the 1820s and 1830s were keenly receptive to the gentle homeopathic therapies of Samuel Hahnemann.<sup>85</sup> And Parssinen suggests that the increased use of opiates in the 1830s was an attempt by orthodox practitioners to compete with unorthodox practitioners who were offering patients less painful and

more palatable remedies.<sup>86</sup> Opium was without doubt the jewel in the *materia medica* and by the 1840s was the mainstay of therapeutic practice.<sup>87</sup> Indeed, as Berridge and Edwards have noted, it is almost easier to list the conditions where its use was excluded, rather than vice versa.<sup>88</sup> The use of opiates therefore empowered doctors to effectively lessen the pain of chronic disease, the suffering of death and that of childbirth. What remained problematic and appeared increasingly so in the context of the growing complexity and range of surgical procedures was the pain of the knife. To understand that growth in surgery, we return again to the period of the French Revolution.

### **Revolutions of the body**

As Fissell and Jacyna have shown, Britain had its own surgical tradition, which blossomed from the later eighteenth century, especially in the new teaching hospitals and in the military.<sup>89</sup> Surgeons sought every opportunity to extend their skills through dissection or operations and such occasions drew crowds of other surgeons and apprentices who were equally intent on expanding their knowledge. But British hospitals were run as charities by lay governors who depended on subscriptions and who were wary of any suggestion that doctors were experimenting on patients, living or dead. And though surgeons were rapidly gaining status, they remained in some ways subordinate to physicians. Surgeons thought of the body as a set of organs and tissues that might be manipulated in various ways, but the reigning view of the patient belonged to the physicians: the body as a holistic system with an individual equilibrium. And in Britain, in medicine as in politics, change was gradual.

By contrast, the Revolution in France, by removing old institutions and setting up a new medical school, encouraged a bold new construction of the body which, during the first decades of the nineteenth century, was taken up by keen young doctors in Britain and America.<sup>90</sup> A new state-controlled medical system reformed the large hospitals in Paris, offered salaried posts to surgeons and physicians, supported clinical teaching on the wards and facilitated the dissection of corpses. Thus the surgical view of the body could be extended and built into the new curriculum. Pathology and anatomy became the key disciplines: post-mortems allowed doctors to locate tissue lesions – inflammation, tumours, sepsis – which could then be correlated to the symptoms observable in the sick. The large hospitals facilitated comparison and grouping of patients; the use of statistics – the numerical method – was introduced, and the relationship between patient and doctor was changed. Physical

examination of the patient, using new methods of diagnosis such as the stethoscope, became the mainstay of the consultation, displacing the patient's account of their illness.<sup>91</sup> The objective was to classify the symptoms of each and every patient within a universal pathology and for this reason from the 1820s onwards the benchmark of 'normal' rather than 'natural' began to be applied to bodily phenomena such as the pulse, urine output or heartbeat.<sup>92</sup> The new approach derived heavily from surgery and it supported the extension of surgical practices. If many diseases, fundamentally, were local lesions of tissues, then in principle they might be susceptible to surgery.

In Britain, a new surgical elitism based on the expanding fields of anatomy and pathology was already evident by the early nineteenth century.<sup>93</sup> The College of Surgeons had separated from its craft links with the barbers in the mid-eighteenth century, and the work of the Hunter brothers – the physician, William, who established a medical school in Great Windmill Street and John, the surgeon whose 'principles' became constructed as the foundation of 'modern surgery' – epitomised the way in which pathology and anatomy emerged as the key disciplines.<sup>94</sup> The new emphasis on dissection created a particular problem in Britain; the only legitimate corpses were those of hanged murderers and thus the 1820s saw an intense conflict between the demand and the availability of subjects for anatomists in the medical schools. Richardson's study shows vividly the complex medical and social contest during these years over the availability of bodies, and how this led to the passing of the Anatomy Act of 1832.<sup>95</sup> The focus on anatomy and pathology had produced 'modern practitioners', noted the surgeon Samuel Cooper in his 1822 edition of *Dictionary of Practical Surgery*.<sup>96</sup> In London and Edinburgh, surgeons began to extend the range and complexity of procedures and from around 1820 public interest in operations seems to have increased.<sup>97</sup>

It was during this period that some surgeons began to think of surgical pain in a new way. As elsewhere in medicine, pain had long been understood to perform a critical role during operations by sustaining the body's vitality whilst its systems were being depressed by the action of the knife. But although opiates were efficacious in the treatment of chronic and terminal pain and were used to treat post-operative pain, James Moore, surgeon at St George's hospital in London at the end of the eighteenth century, concluded that 'the strongest dose we dare venture has little or no effect in mitigating the sufferings of the patient during the operation'. For this reason Moore began to consider other ways of effecting insensibility and designed a steel contraption which

was intended to compress the principal nerves, thus diminishing the sensibility of the limb prior to amputation. It achieved little success as patients complained that the pain of compression was considerable.<sup>98</sup> Other novel and localised techniques such as the use of moxa (burning the skin) and acupuncture were recorded but with little success, and attention turned to physical states characterised by the suspension of sensibility.<sup>99</sup>

In 1819, James Wardrop, lecturer at the radical Aldersgate School of Medicine, was consulted by a young woman with a tumour on her head. She was unable to remain still enough for surgery despite being held down, so Wardrop experimented by creating a state of syncope – a low pulse and intermittent consciousness – through bleeding prior to the operation. It was, he later claimed, no different to the state to which patients were frequently brought in severe operations through loss of blood and mental agitation. Operating on a ‘bloodless’ body was analogous to dissection; it improved visibility and removed the psychological pressure exerted by a distressed patient. No matter how courageous the patient before the operation, explained Wardrop, ‘many... often feel disappointed, as regards the degree of pain, and the time occupied in performing it, and the mind becoming fatigued and irritable, the sufferer has no longer the power of controlling himself and is unable to remain steadily in the same position’.<sup>100</sup> He recommended using opiates pre-operatively (specifically laudanum because it lessened the risk of vomiting) but observed that however ‘free’ their use, the ‘mental inquietude’ of the patient tended to negate their effect. Wardrop’s first attempt at inducing syncope was made in 1819 and appears in a later series of lectures on surgery published in the *Lancet* in 1833. Despite his optimism there appears to have been little take-up of his suggestion as a strategic method for operative pain-relief though he noted that the creation of syncope was a ‘common rule of surgery’ before attempting to reduce dislocations or hernias – procedures indeed where there was no fear of blood loss.<sup>101</sup>

Thus from around 1820, surgeons like Moore and Wardrop began to seek ways of avoiding surgical pain. This is also the period when a new breed of experimental physiologists developed the new anatomical view of the body by experimenting on animals to analyse the functions of different parts of the nervous system. It is in this context that we can understand the animal experiments on asphyxia by the Shropshire surgeon, Henry Hill Hickman, and the work in London of the physician and physiologist, Marshall Hall. Both had links to Paris, which was the centre of the new approach to nervous functions.

## Hickman, Marshall Hall and the suspension of life

Trained in Edinburgh at a time when the medical school was at its peak, Hickman had sat the exams of the Royal College of Surgeons and joined the Royal Medical Society of Edinburgh, before establishing himself in practice in Shropshire in the early 1820s. He described himself as a surgeon and there is nothing to suggest that his experience was out of kilter with that of other provincial surgeons whose practice was more likely to consist of treating patients with leg ulcers and chronic infections than performing major operations.<sup>102</sup> The first description of his work on 'suspended animation' can be found in a letter of 1824, addressed to his local 'man of science', Thomas Andrew Knight, Fellow of the Royal Society.<sup>103</sup> Knight was well known for his work on plant physiology and in the early 1800s had collaborated with Davy on research into plants in vegetation, but there is no evidence to show that Hickman's work had been shaped by this connection.<sup>104</sup> Rather, Hickman wanted to ease the suffering of surgical pain. His letter described how he had created an artificial state of 'suspended animation' in animals through the inhalation of carbon dioxide gas, respired air and excluded air. When respiration had ceased, he amputated limbs and removed ears and tails before the animals regained sensibility. He suggested that inflating the lungs with bellows or galvanism could be used to restore the 'powers of life', although the animals he experimented on had all recovered naturally when exposed to fresh air. He also noted that inhalation of carbon dioxide gas appeared to limit haemorrhage and aid wound healing.<sup>105</sup> Later that year he printed a short pamphlet which included a second, slightly fuller letter addressed to Knight, indicating that Knight and others had asked him to present his work formally. It is possible that the intention was for Knight to present it to the Royal Society but its transactions carry no record of this. His letter was published in the Shrewsbury papers and in the *Gentleman's Magazine*, though the editor of the latter was dismissive: 'it may be doubted whether the pain of his operation, and especially in the recovery, would not equal or perhaps surpass that experienced in the usual mode of operation', he wrote.<sup>106</sup>

Four years later, Hickman journeyed to Paris and during the several months he spent in the city, he sent details of his experiments to Charles X, asking for help in pursuing his research in the French schools. His letter was forwarded to the Académie de Médecine and a committee set up, but apart from Larrey, chief surgeon during the Napoleonic wars, no other surgeon expressed interest in the proposal.<sup>107</sup>

This is a slim set of sources certainly, but telling enough to facilitate a sketch of Hickman's model of the body, and the way in which it connects to the earlier model of Davy and the later one of the 1840s. First, and most crucially, it accords no function or purpose to the presence of pain during surgery. Rather, Hickman suggests that the 'best effects' of the process 'would be produced by the patient's mind being relieved from the anticipation of suffering, and his body from the actual suffering of a severe operation'.<sup>108</sup> Whereas Davy's model was monistic, Hickman's is dualistic and supports a separation between the functions of the mind and those of the body. It reflected the new work of the 1800s on the nervous system and the changes this had brought about in understandings of sensibility and the process of death.

In 1800, Xavier Bichat's research into the states of life and death depicted death as the gradual sequential elimination of the functions of the organs of the body.<sup>109</sup> For example, when respiration was suspended chemically – perhaps through breathing non-respirable gases – the functions of the brain would first be interrupted, followed by the cessation of sensation, locomotion, and the working of the lungs, then the action of the heart and the circulation would be annihilated, succeeded by processes like secretion, exhalation and digestion, until finally the body would lose its animal heat and death would be final. His model of the body comprised two types of life: animal life, seated in the brain which supported the higher functions of sensation, perception and volition; and organic life which involved the vegetative nervous system, digestion, circulation and so on. Whereas concussion, haemorrhage or asphyxia would extinguish animal sensibility, organic sensibility would often survive such incidents.<sup>110</sup>

The 1810 atlas of Franz Joseph Gall confirmed the brain as the organ of the mind and construed all mental phenomena as functions of organised matter.<sup>111</sup> But it was the anatomical investigations into the brain during the 1810s – in Britain by Charles Bell, and in France by Francois Magendie – that localised functions and gave rise to the possibility that sensations could be disassociated from the vitality of the body. Bell and Magendie independently linked specific sites to specific functions and distinguished the different sensory and motor functions of the anterior and posterior spinal nerve roots.<sup>112</sup> Rather than all nerves having the power to convey sensation or excite movement, suggested Bell, they were 'as distinct in office, as they are in origin from the brain'.<sup>113</sup> The French physiologist Marie Jean-Pierre Flourens later confirmed the specificity of different nerve fibres in a series of experiments performed on pigeons, published in the same year as Hickman's

experiments. Flourens showed how a pigeon losing both cerebral hemispheres became blind, losing one hemisphere caused blindness in the opposite eye and removing the cerebellum from a bird destroyed its balance although sight and hearing was unaffected.<sup>114</sup> He would later draw on this series of experiments to show the pathway of ether and chloroform through the nervous system, but in 1824 the most crucial aspect of his work for our purposes was the location of sensation and volition in the cerebrum, and not in the spinal cord. Hickman's proposition that the body would become insensible to the sensations of surgery if the mind of the patient could be 'suspended' becomes plausible therefore in this new context.

The second key difference between Hickman and Davy relates to their sense of control over the process of death which reflected the way in which understandings of asphyxia had changed since the 1790s. Hickman interpreted the phenomenon of 'suspended animation' as one example of asphyxia; a state in which the vital phenomena were suspended from some cause interrupting respiration, but in which life was not actually extinct and could therefore be restored. For him asphyxia was a key staging post along a process of death: he was confident that he had the power to halt the process and restore life if necessary. In one experiment lasting 17 minutes, he used bellows to occasionally animate the dog whose leg he amputated. He also suggests the use of galvanism as a restorative of life.<sup>115</sup>

By 1824 then, Hickman felt strongly enough about the negative effects of surgical pain to suggest that a temporary state of asphyxia could be artificially created to suspend the life of the mind and remove sensibility. The mesh with Beddoes and Davy can be found primarily in his overall approach which was descriptive and analogous, rather than analytical. He does not, for example, offer any explanation of the means by which carbon dioxide suspended respiration, nor does he attempt to contextualise his work in the wider fields of chemistry or physiology. Indeed, his distaste for vivisection suggests that he curtailed his practical work as far as possible. Unlike Marshall Hall, his analysis of the animal body was focused strictly on the development of a clinical technique. He failed because the remedy seemed worse than the problem. An anonymous letter to the *Lancet* in 1826 robustly condemned Hickman's proposal for the way in which it suggested that 'a man who was about to have a tooth drawn' should 'be previously hanged, drowned or smothered for a few minutes in order that he may feel no pain during the operation'. The sensations of such a process, continued the correspondent, would be 'far more horrible than the pain inflicted by ordinary operations'

and even if a patient was made insensible of an amputation, the 'inflammatory' healing process would not be ameliorated.<sup>116</sup> Pain, it seemed, was impossible to avoid. Even if it could be stalled, sooner or later the body would have to tolerate the unpleasantness of returning sensations.

Hickman's dislike of animal experimentation was widely shared in Britain. From the 1750s, as part of the broader humanitarian movement, there had been protests against the use of animals on the grounds that frequent repetitions of experiments did not have the power to reveal any new knowledge and were purposelessly cruel.<sup>117</sup> Bell during his work on the functions of the brain showed equal repugnance to the use of animals and argued that many of his findings derived from induction rather than experiment.<sup>118</sup> A public furore broke out in 1824 when Magendie visited London and performed vivisection during public lectures.<sup>119</sup> Of course, such concern about animal pain is in itself further evidence of the new view of all physical pain as unsupportable.

But not all British doctors were dissuaded from animal experimentation. In the decade after Hickman's experiments, similar questions were elucidated by Marshall Hall, whose work joined with French studies to reveal a distinct sub-system of the nervous system which could support life without sensation or volition. Marshall Hall had trained in Edinburgh, Paris and Germany and taught at several of the radical private medical schools in London.<sup>120</sup> He began work on the nervous system and involuntary movements – reflex actions – around 1830, and having first noted the phenomena of reflex action in the tail of a newt, suggested that reflex action was seated in the spinal cord and the medulla oblongata and was independent of sensation. The nervous system might thus be understood at three levels: the brain which supported sensation and volition, the spinal cord which supported reflexes such as swallowing, and the vegetative nervous system which supported respiration, circulation and digestion. The separation of these systems and functions was a matter of much technical debate, but all such work was anathema to those who understood all the body's processes to be dependent on a vital spirit, which in man was related to the soul. Many conservative doctors despised physiological analysis as mechanistic and atheistic, but it was supported by radical practitioners.<sup>121</sup> Robert Grant, professor of comparative anatomy at London University, taught Marshall Hall's theory to medical students during the 1830s using insects to demonstrate reflex actions.<sup>122</sup> Richard Grainger published a study of the function and structure of the spinal cord in 1837, and by 1840, the *British and Foreign Medical Review* could draw attention to the way in which the knowledge of the nervous system had been revolutionised since the 1810s.<sup>123</sup>

By 1840, Marshall Hall's theory had provided the framework for understanding how the functions of respiration and circulation could exist in a body, independent to those of sensation and volition. It did not, however, convey how such a state could be safely and surely attained, and for surgeons this problem was becoming ever more pressing as surgical innovations were exacerbating the problem of pain.

### **Conservative surgery and self-control**

Whereas surgeons practising c.1800 had understood amputation to be the safest form of intervention, from the 1820s onwards there was a shift to preserve limbs and tissues through the excision of diseased or injured bone and tissue. Conservative surgery, as it became known, was a mark of the 'modern' surgeon who regarded amputation as a last resort.<sup>124</sup> Elite surgeons such as James Syme in Edinburgh and William Fergusson in London pioneered new procedures such as the excision of the foot or the elbow in an attempt to retain the remainder of the limb; tumours of the breast were removed using similar techniques.<sup>125</sup> But the consequence of this new approach was that it prolonged considerably the period of suffering. Whereas an experienced surgeon could amputate a limb within seconds, Stanley notes that the removal of breast tumours could last between 30 and 90 minutes.<sup>126</sup> Surgeons were quick to emphasise the utilitarian advantages of conservative surgery. When Robert Liston excised the carious bone from a young woman's foot, at University College hospital in 1844, he drew attention to the way in which the procedure had saved the patient her whole foot; it was 'an unequivocal example of the powers and advantages of true surgery'.<sup>127</sup> Liston was very conscious of the problem of pain and attempted to adapt his techniques, suggesting that: 'The ... parts should be divided by a single incision, rather than that the patient should be tormented... by a slow and tedious procedure, bit by bit... incisions from within outwards... give much less pain than those in the opposite direction.'<sup>128</sup> But the accounts of those who underwent operations during this period suggest that such measures did little to mitigate the acute sufferings of surgery. The experience of George Wilson, who described the operation on his foot by Syme in 1843, has been frequently quoted as evidence of the enormous physical suffering of pre-anaesthetic surgery. But besides the appalling mental and physical sensations he endured during the process, he took the trouble to note that the novelty of the procedure had the benefit of leaving him with a 'more useful limb'.<sup>129</sup>

Surgery for remedial rather than life-saving reasons also began to be performed. In the 15 months between September 1840 and December 1841, new operations for stammering, squinting, club foot and cataract appeared in the *Lancet*, suggesting that contrary to much historical interpretation surgical development was not dependent upon the innovation of anaesthesia.<sup>130</sup> However, although surgeons had the anatomical knowledge and the technical skills to perform more complex and technically demanding procedures than 50 years earlier, and patients were receptive to the benefits of such innovation, operations remained the last resort of surgical practice. Most surgical patients were treated with therapies or local applications – poultices to reduce inflamed joints, or bandaging procedures to heal fractured or diseased limbs. This approach stemmed from the belief that doctors should facilitate and support the body's own powers of healing, rather than intervene and upset the balance of nature; it reflected the seemingly inescapable problems of pain and post-operative infection. Thus by the 1840s, there was a clear tension between surgical ability and patient endurance.

Alongside this emergence of conservative surgery, surgeons adopted a new strategy and sought to shape the patient's response to the pain of surgery through the influence of the mind. In 1818 during a lecture at the Royal College of Surgeons, Anthony Carlisle told his audience that the moment had come for 'the introduction of moral influence to mitigate or arrest the sufferings of surgical patients'.<sup>131</sup> Earlier generations of surgeons had encouraged patients to vocalise sensations as a way of expelling pain, just as purging or bleeding voided unwanted or excessive fluids from the body.<sup>132</sup> In 1811, Henry Cline advised a patient undergoing lithotomy that he should cry out rather than depress his energies by trying to control his reaction and in the same year, Fanny Burney had screamed throughout 'the whole time of the incision' as 'the dreadful steel was plunged into the breast' during her mastectomy.<sup>133</sup> But the shift in the construction of pain from one of physiological purpose to that of needless suffering promoted new tactics. Surgical textbooks depicted the pre-operative meeting between patient and surgeon as a key opportunity for the surgeon to mentally prepare the patient to 'meet the evil' of the operation. Confidence and honesty on the part of the surgeon about the actualities of the forthcoming operation – length of procedure, intensity of pain – were the most effective means of fortifying and tranquillising the patient's mind.<sup>134</sup> However, as Wardrop noted, in many cases, the 'strength' of the mind was not sufficient to control the patient's response to physical pain once the operation had commenced. And it was not uncommon, observed Thomas Curling, surgeon at the

London hospital, for operations to be abandoned 'owing to the impatience and want of self-control of the sufferer'.<sup>135</sup> The new stress upon self-control and fortitude can be discerned in operation reports of the 1830s and 1840s and approbation was given to those patients who were controlled enough to remain as silent as possible during surgery or at least display 'fortitude' by limiting their expressions to moans or groans.<sup>136</sup> In fact, wrote one correspondent to the *Lancet* in 1840, 'when a person chooses to die rather than submit to an operation, it is generally an evidence of deficient fortitude'.<sup>137</sup>

The stress on such qualities in the surgical context mirrored the way in which control of self and society featured high on the agenda of Victorian reform and was integral to all levels of social change. Indeed, I would argue that medical practice had directly reinforced such values through the wide use of opiates which were successful in easing the painful sensations of death, disease and childbirth and thus restoring to both patient and doctor a sense of control over the process. That such control was an aspiration of Victorian society is further emphasised by the broad social use of opiates to control the manifestation of emotions: Prime Minister William Gladstone was amongst many public figures who took laudanum to calm the anxiety induced by public speaking; babies were doped with Godfrey's cordial to prevent them crying; and unruly animals were calmed with opiates before going to market.<sup>138</sup>

It would seem then that the extensive use of opiates throughout British society had reconfigured expectations of the norms of behaviour in a wide range of social and medical contexts. But in the particular context of surgery, there was no effective means of alleviating surgical pain to the extent that by 1840, French surgeon Velveau expressed the view of many doctors that finding a solution to the pain of surgery was a 'myth'.<sup>139</sup>

## Mesmerism

When considering the contexts of major discoveries, we are always at risk of 'presentism'; of doing 'history by hindsight'.<sup>140</sup> Our knowledge that the use of ether in 1846 marked the beginnings of modern anaesthesia makes it all too easy to construct its earlier history as a sequence of events which created a predestined space for ether; to imagine surgeons and others as looking for anaesthesia as the solution to the problem of surgical pain. But this cannot be the story for ether anaesthesia; we know that it was discovered by a marginal practitioner – a dentist, in a marginal country – the United States of America, and we shall consider the reasons

below. And when one man succeeded, others revealed their earlier efforts, and by no means do they add up to a sustained assault on a pressing problem. Yet, as this chapter has argued, the issue of surgical anaesthesia, which in some senses was ages old, had been newly defined and highlighted by the 1840s. The surgical range had increased substantially, and conservative techniques had prolonged operations and the suffering involved. The increased use of opiates was indicative of a decreased tolerance of pain, and the injunctions about self-control suggest a decreased public tolerance of suffering freely expressed. Surgical pain had lost its rationale in medical theorising, and the body could be envisaged as capable of unconscious life, where vital functions would continue in the absence of feeling.

The new prominence of the problem is further evidenced by the debates in the early 1840s over the place of mesmerism in surgery. Few people knew about Hickman's work, and no one was thinking back to Davy, but the whole British medical world knew that the highly controversial techniques of mesmerism had been tried in operations. For the first time, elite surgeons publicly attempted to operate on unconscious patients; indeed it was the mesmerists who gave new meaning to the word 'anaesthesia'.

Anaesthesia was listed in Cullen's nosology of the 1750s and understood to be a cluster of diseases in which the key symptom was the loss of touch. By 1839, anaesthesia was understood as a condition arising from a diminution of the sensible power of the nerves. It could be caused by local conditions – the pressure of a bandage for example – or it could affect the whole body as in cases of palsy, apoplexy and hysteria. And, the return of feeling to the body was accompanied by unpleasant sensations.<sup>141</sup> The *Lancet* had published a series of lectures by the French surgeon, M. Andral in 1833, on diseases of sensation; anaesthesia with its symptoms of diminished sensibility was at one end of the scale, at the other with a heightened capacity to feel was hyperaesthesia.<sup>142</sup> By the 1840s, the new practices of mesmerism and hypnosis endowed anaesthesia with new meaning and it came to stand for a bodily state in which sensation and volition were suspended.

The history of mesmerism in British culture during the mid-nineteenth century has been powerfully told by Winter.<sup>143</sup> An earlier form of the practice – animal magnetism – was popular in the 1790s but had become politicised and marginalised throughout Europe in the wake of the French Revolution. Like Davy's work on gases, it was suppressed in the conservative political climate which accompanied the Napoleonic wars. A revival began in France soon after 1800 and by the late 1830s in

London, individuals such as Herbert Mayo, professor of anatomy and physiology at King's College, and John Elliotson, professor of practical medicine at University College were captivated by the powers of the mesmeric trance to create a bodily state in which volition and sensations appeared suspended. Elliotson was a radical reformer, receptive to all innovation and was particularly keen to explore the contention that a trance could effect the displacement of sensibility to a different part of the body. With the intention of establishing mesmerism as a useful medical tool, he undertook a series of experiments upon the O'Key sisters at University College in 1837 which ended in a debacle when Thomas Wakely, acerbic editor of the *Lancet*, proved that the effects derived from 'mere imagination' and that Elliotson had been duped. From this point, the *Lancet* mounted an intense campaign against mesmerism in which it was constructed as bearing the very worst attributes of quackery and sham. Reports of mesmeric anaesthesia being used successfully in surgery were also dismissed although there had in fact been considerable success with this technique. The first mesmeric operation to gain substantial publicity took place on a 42-year-old labourer, J. Wombell, in 1842. The mesmerist was a reputable barrister, William Topham, who spent several days ahead of the operation putting Wombell into repeated trances. Whilst W. Squire Ward, surgeon at Ollerton Infirmary in Nottinghamshire, amputated Wombell's leg, he remained motionless even as the sciatic nerve to the spine was cut. The dispute which broke out focused on the key area of contention: were the effects real or imagined? The evidence used by opponents such as Wakely, and the surgeon Robert Liston, drew on Marshall Hall's theory of reflex action. They argued that if Wombell had been insensible to the operation, his limb should have shown a reflex jerk at the point when the sciatic nerve was cut. Elliotson countered this point; mesmerism was a 'nervous phenomenon' which negated any usual action in the nerves, such as the reflexes, he suggested.<sup>144</sup> Despite such intellectual controversies, many surgeons, who perceived the pain of surgery to be Bentham's 'inherent evil', were open to experimenting with mesmeric anaesthesia. James Simpson, who was later to become the best-known advocate of chloroform, attempted to use it, as did several of the American dentists who later pioneered nitrous oxide and ether.<sup>145</sup> Despite such receptivity, mesmeric anaesthesia never meshed with British social and medical expectations of surgical pain-relief as ether was to do. The fact that it became a highly effective technique in the colonial context of India, used by the Scottish surgeon James Esdaile, is indicative of the contextual dependency of innovation.<sup>146</sup>

Mesmeric anaesthesia did however provide evidence that it was possible to effect a state in the body in which sensibility and volition could be disassociated from the central functions of circulation and breathing. Nor was it an isolated example of constructing a model of the body in this way, as shown by the work of the Manchester surgeon, James Braid, on hypnotism. After watching the famous French mesmerist, Lafontaine, at work in 1841, Braid began to experiment with its possibilities. He tailored the mesmeric trance to produce a state which he described as 'nervous sleep' and which is historically accepted as the beginnings of the practice of hypnosis.<sup>147</sup> He explained the trance as a consequence of the voluntary suspension of the will on the part of the patient, rather than the enforced suspension through the magnetic passes and powers of the mesmerist. His explanation was more analytical than that offered by the mesmerists and integral to his construction of the phenomenon was the active participation of the patient. Indeed, this may have been the reason why, unlike mesmerism, hypnosis became an established, orthodox technique from the 1870s onwards.<sup>148</sup> Braid understood 'nervous sleep' to be a means through which the nervous system could be thrown into a 'new condition' which could prove useful for the cure of certain disorders. It was a process, he explained, which at first intensified the senses (he compared it to the effects of opium and wine), and consciousness often remained. In the second state, the senses passed into 'the most profound torpor' and there was no sensibility in the body.<sup>149</sup> The state of 'nervous sleep' was used successfully by Braid to provide pain-relief for minor operations, as well as the treatment of chronic diseases such as rheumatism and palsy. It seems likely that Braid had absorbed the implications of Marshall Hall's work on the nervous system which proved that sensation and volition were seated in the mind rather than the spinal cord. His work also suggests a familiarity with the nuances of a debate which broke out between Marshall Hall and Johannes Muller on the manner in which, through the emotions, the mind was capable of overriding certain reflex functions such as respiration; Marshall Hall later accepted that 'the influence of emotion is, indeed, both diffuse and extreme'.<sup>150</sup> For although Braid found hypnosis to be a highly effective method of pain-relief for the extraction of teeth and other minor procedures, he believed that knowledge of the forthcoming event in the patient's mind 'may render it impossible for him to become hypnotised deeply enough to render him altogether insensible'.<sup>151</sup> Practitioners, he advised, should obtain consent from the patient for the operation 'at some unspecified time', rather than allowing them to know in advance that the procedure was going to happen.<sup>152</sup>

For hypnotism, as for opiates, the patient's fear of the operation was a major obstacle to pain control.

By 1846 then, not only had a social receptivity to the control of sensibility at all levels been established through the increasing use of opiates, but the new anatomical and physiological constructions of the body showed how it was perfectly possible for life to be sustained in a body devoid of sensibility. This understanding is vividly expressed in Elliotson's oration to the Harveian Society in June 1846. His aim was to mount a defence of mesmerism but his belief that a bodily state in which sensation and volition were suspended without compromising the functions of respiration and circulation was physiologically sustainable is clear:

A body of facts is presented to us not only wonderful in physiology and pathology but of the very highest importance in the prevention of suffering under the hands of the surgeon and in the cure of disease. The chief phenomena are indisputable: authors of all periods record them, and we all ourselves witness them, some rarely, some every day. The point to be determined is whether they may be produced artificially and subjected to our control: and it can be determined by experience only. The loss of common feeling, – anaesthesia, is but a form of palsy, and in it wounds give no pain. If this condition can be induced temporarily by art, we of necessity enable persons to undergo surgical operations without suffering. Whether the artificial production of these phenomena, or the performance of processes which so often induce them, will mitigate or cure disease can likewise be determined by experience only.<sup>153</sup>

Yet, despite the receptivity of British doctors to the artificial suspension of sensibility, modern anaesthesia did not emerge from this milieu. For the twist in the tale we turn to America, to gas sniffing, money, teeth and pain.

### **'Teeth extracted without pain'**

The fact that it was an American dentist – William Morton – who established the innovation of ether, rather than a surgeon, has attracted little historical attention and has been related as one of the odd quirks of the history of anaesthesia. The focus of enquiry has remained firmly upon the issue of priority of discovery, rather than its context.<sup>154</sup> Pernick draws attention to the disputes over the status of dentistry – was it trade or profession? – and suggests that Morton's attempts to patent his discovery inflamed the debate.<sup>155</sup> But there is more to be said.

Since the 1800s, the power of gases to change the physical and mental states of those who inhaled them had been established as a popular social entertainment in fairgrounds and travelling shows on both sides of the Atlantic. For gases, as for mesmerism, the amusements of the radical elites of the 1790s had become common playthings. Audiences gathered to watch individuals, intoxicated with 'laughing gas', behave in a disinhibited manner with scant regard for the social norms of behaviour. That such a spectacle became construed as social entertainment is highly suggestive of the stress that was placed upon self-control in society; the humour lay in the apparent disregard by such individuals for such norms. So too in medical schools, students were often given the opportunity to breathe nitrous oxide in chemistry lectures and again, the behaviour of exhilarated students was a sight enjoyed by their peers.

It was indeed in this popular culture of amusement that the first surgical operations were performed under ether, without attracting much attention. In the village of Jefferson, Georgia, in the American South, a local doctor was asked to make some nitrous oxide for a group of young men. Not having the apparatus, he gave them ether instead, and this became a local fashion. One of the local ether sniffers then needed a minor operation for the removal of a cyst, but he was unusually fearful. The doctor, Crawford Williamson Long, knew from his own experience that ether often removed the sense of pain, so he suggested the operation be performed after ether breathing. It was successful, and Long continued the practice on the one or two patients a year in which he believed the inhalation of ether to be applicable, one of them a negro child.<sup>156</sup> He did not report his results until others had gained credit for a discovery which by then had swept the world. Why was his work not news?

Ether was first synthesised in 1540 and it became well known as an anti-spasmodic for asthma and as a useful solvent that evaporated quickly, one that could cool and numb the skin. It was known to produce excitation when inhaled, similar to that of nitrous oxide, but could also produce lethargy.<sup>157</sup> For Long it could be substituted for nitrous oxide as an amusement for bored young men, and it joined opiates and alcohol as a possible means of avoiding pain, including the pain of minor or rapid surgical operations. It could be used in patients who were uncommonly fearful, perhaps especially those who were already accustomed to ether breathing. Long was not concerned with physiology or chemistry and sought no financial gain or professional advancement; he was a country doctor far from major medical schools and the professional spectacle of major operations. Most of his patients were stoical Christians

who believed in God's providence and who were no more likely to sniff ether for surgery than they were for amusement. Indeed, he was advised by some of his colleagues to abandon his experiments.<sup>158</sup>

For well-trained doctors, breathing gases was dangerous because beyond the initial stimulating phase they induced a process of death through asphyxia.<sup>159</sup> Medical students were taught that ether and nitrous oxide had narcotic and poisonous properties with the power to destroy sensibility and irritability. They may have tried a few whiffs of gas, they also witnessed the death of animals from asphyxia through their exposure to ether and nitrous oxide. Within this context it is understandable that there would have been little enthusiasm for exploring the further possibilities of gas inhalation. But the Boston dentist Morton was outside this culture. He was enough of a dentist to see considerable financial advantage in the new technique, and close enough to elite medicine to imagine the benefits of medical support for ether.

In 1846, Morton was only 26 years of age but trailed a history of unscrupulous business deals, debts and failed partnerships.<sup>160</sup> With little formal training he had set up in practice as a mechanical dentist specialising in the manufacture and fitting of artificial teeth. He had acquired his dental skills through an apprenticeship and although he had registered for 2 years of medical lectures at Harvard Medical School between 1844 and 1846, this seems to have been largely at the instigation of his future father-in-law, Edward Whitman, who was keen to ensure that his daughter, Elizabeth, should marry a 'regular' practitioner. During this period Morton continued to run his dental practice, so the extent of his attendance at these medical courses is unclear.<sup>161</sup>

By the early 1840s, improvements in dental technology meant that denture bases could be made out of a gold-alloy and this improved the fit of the dentures inside the mouth.<sup>162</sup> But many patients could not bear the pain of having rotten teeth and stumps removed before artificial teeth were fitted. Patients often, 'especially... delicate females', abandoned proceedings halfway through.<sup>163</sup> By the autumn of 1845, Morton's practice had become almost exclusively that of mechanical dentistry.<sup>164</sup> He was not alone in recognising that a method of ameliorating the pain of extractions would give his business a market edge: Horace Wells' motivations for experimenting with nitrous oxide in 1844 were exactly the same, although his attempt to establish nitrous oxide had resulted in a humiliating public failure.<sup>165</sup>

In many ways, dentistry was more supportive of experimentation than surgery. Extractions were not life-threatening procedures, nor did they subject the patient to much loss of blood. Dental culture was also

far more commercial than medicine; it was common for new techniques and discoveries to be protected by patent rights or kept secret and it seems possible that the culture of American dentistry was more akin to commercial practices than British dentistry.

Morton's experiments with ether cannot be explained through a particular skill or interest in chemistry. His choice of ether derived from the suggestion of the chemist and geologist, Charles T Jackson, who also practised dentistry and employed ether as 'toothache drops'.<sup>166</sup> (Jackson later disputed Morton's claim to the discovery.<sup>167</sup>) In 1844, after learning from Jackson of the power of ether to numb the nerve of a tooth, he applied liquid ether to diminish the pain of a filling. This was not a particularly novel use of ether – *Hooper's Medical Dictionary* of 1820 cites the external application of ether as a cure for toothache and headache. Following this success, Morton borrowed Jackson's chemistry and medical books to ascertain that 'there was nothing new or particularly dangerous in the inhaling of ether'. It was, he said, a 'toy of professors and students', well known for its intoxicating and stupefying properties.<sup>168</sup> During the summer of 1846 he carried out some more experiments and determined that sulphuric ether was the most effective form of the chemical. He inhaled ether on a handkerchief and used it on household pets, including a water spaniel whom he held over a tin pan containing ether soaked into cotton wool until the dog 'wilted completely away in his hands'. After two or three minutes the dog became as 'lively and conscious as ever'.<sup>169</sup> On 30 September 1846 Morton was visited by a patient who was hoping to have his tooth extracted under mesmerism; Morton offered him ether and the tooth was extracted without pain. It was therefore a similar experiential model of experimentation, analogous to that of Davy's nitrous oxide work although at a far less sophisticated level. In no sense can Morton's experiments be constructed as part of the new analytical scientific medicine of 1840s Europe.

Morton's discovery of the power of ether to remove sensibility can be explained in part through serendipity; his first trials upon himself and others induced insensibility rather than asphyxia. But it was the strength of his ambition to exploit the commercial advantages of ether which sealed his success. His aim was to benefit from ether through patenting the new technique, not just for dentistry, but in surgical operations. He was canny enough to appreciate that this would only be possible if ether gained the full approbation of the Boston medical elite; medicine was perceived to be a higher authority for dentistry and for this reason dental innovations were frequently underwritten and certified by medical practitioners.<sup>170</sup>

The setting Morton chose to demonstrate the powers of ether was the Massachusetts General Hospital in Boston, a bastion of medical respectability which he would have known as a medical student. The surgeon, John C. Warren, was one of Boston's medical elite with an impeccable professional history. He had trained in Edinburgh and then held posts as Dean of the Medical School and as Professor of Anatomy and Surgery before becoming one of Boston's leading surgeons. He was a founder of the *Boston Medical and Surgical Journal* (later to become the *New England Journal of Medicine*), and had helped establish the Boston Medical Library. Warren had been party to Wells' failed attempt and his accedence to Morton's request suggests a keen receptiveness to the prospect of pain-control. The demonstration was staged before a group of elite individuals whose opinions carried enough weight to sway public and professional opinion. In the audience were Professor Jacob Bigelow, professor of materia medica at Harvard Medical School; his son, Henry Bigelow, surgeon at Massachusetts General Hospital; and Edward Everett, President of Harvard University and former United States Ambassador to London.<sup>171</sup> Morton was fully aware that it would be the approbation of such individuals that would secure ether's acceptance. That it was Morton's marginality to medical culture that freed him to take risks that doctors perceived to be impossible was later expressed by the New York surgeon, Valentine Mott, who commented that not even the most 'bold and adventurous' surgeon would have had the 'temerity' to experiment with ether in the way Morton had.<sup>172</sup>

Ether's acceptance in Boston was largely due to Morton's placing of the technique under the authority of the medical elite and once doctors had established its efficacy, news spread worldwide. Morton proved the bridge between self-experimentation, dental arts, commercial aspirations and the international medical elite. The next chapter will show how, within the context of British medicine, the artificial creation of a bodily state without feeling through the inhalation of ether was sustained and developed into modern anaesthesia.

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