

Frankenstein's Science

Experimentation and Discovery
in Romantic Culture, 1780–1830

Edited by

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ASHGATE

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Chapter 1

Introduction

Christa Knellwolf and Jane Goodall

When Evelyn Fox Keller wrote that '*Frankenstein* is a story first and foremost about the consequences of male ambitions to co-opt the procreative function', she took for granted an interpretive consensus amongst late twentieth-century critical approaches to the novel. Whilst the themes had been revealed as 'considerably more complex than we had earlier thought', Fox Keller concludes 'the major point remains quite simple'.¹ The consensus might be characterised a little more broadly than this – as a view that the novel is about masculinity and scientific hubris – and has led to an enduring use of the title as a byword for the dangerous potential of the scientific over-reacher: It was in this vein that Isaac Asimov coined the term 'the Frankenstein complex' to describe the theme of his robot stories in the 1940s, and *The Frankenstein Syndrome* is the title for a collection of essays on genetic engineering published in 1995.²

This collection takes a very different approach to the novel, seeking to reopen the question of how science and scientific ambition are portrayed in the story by offering a range of historical perspectives, based on detailed accounts of areas of scientific knowledge that are relevant to it. *Frankenstein* was published in 1818, in a cultural and political climate fraught with contrary ideals. The editors of this collection take it for granted that a successful work of literature is always overdetermined and that it is neither possible nor desirable to formulate a precise and conclusive interpretation of any work of fiction. The wealth of debates and controversies that were going on at the time when Mary Shelley wrote *Frankenstein* make it an urgent task to provide a space in which these discourses can be heard once again. If we listen carefully for the contextual arguments into which the assessment of the benefits and dangers of a new discovery were embedded, we may have to relinquish the assumption (implicit in Fox Keller's statement and explicit in the majority of late twentieth-century interpretations) that this is a novel with an anti-Promethean message. In doing so, we can gain a more complex understanding of the cross-fertilisations between radical politics and the dramas of scientific exploration. Of course, not every scientist subscribed to radical politics. But considering that most scientists investigating completely new areas of interest had very little sense of where their discoveries would lead them, questions about their consequences were uppermost in people's minds. In the late eighteenth and early nineteenth centuries, utopian thinking about the vast social benefits made possible by scientific innovation was a powerful force for good. Advances in

anatomy, chemistry, electricity, engineering and the exploration sciences were saving lives and creating vast new economic possibilities, besides giving rise to some of the darker forms of human exploitation associated with the industrial revolution. An intelligent appraisal of these consequences required the kind of analytical vision that strikes us in *Frankenstein*.

*

The end of the eighteenth century is a turning point often called a 'second scientific revolution', which Patricia Fara sees as characterized by new levels of confidence in the commercial and social impact of scientific research.³ One of the definitive influences on this cultural change was Erasmus Darwin (1731–1802). Darwin was a figure larger than life: a pragmatist and idealist, a prolific writer of exuberant verse, a polymathic inventor and a medical practitioner with an uninhibited brief to experiment on his patients. As co-founder and 'recruiting sergeant' for the Lunar Society from the 1760s, he presided over the most formidable powerhouse of scientific talent in eighteenth-century England.⁴ Members included Josiah Wedgwood (1730–95), Mathew Boulton (1728–1809), Joseph Priestley (1733–1804) and James Watt (1736–1819). They made breakthrough discoveries in steam power, chemical manufacture, optics, geology and electricity.⁵ The driving enthusiasms for their world came from the prospect of its immediate application in industry and commerce.

If steam power was the most profitable field of research in terms of its immediate industrial impact, electricity was revolutionary in a more comprehensive and spectacular way. It was electricity that epitomized the Promethean spirit of the age and the American statesman and inventor Benjamin Franklin (1706–90) who 'snatched the lightning from the heavens and the scepter from tyrants', and came to symbolize all that was most inspiring about it. In a now famous letter written in 1787 and addressed simply to 'Doctor Franklin, America', Erasmus Darwin addressed him as 'the greatest Statesman of the present, or perhaps of any century, who spread the happy contagion of Liberty among his countrymen; and ... delivered them from the house of bondage, and the scourge of oppression'.⁶

The declamatory verve of this new scientific rhetoric inspired future generations. Mary Shelley's father, William Godwin (1756–1836), admired Erasmus Darwin and shared his ideals. Her mother Mary Wollstonecraft (1759–97), an incisive social analyst with a passion for the advancement of knowledge, developed her own style of Promethean statement in praising the revolutionary quest for a new order of intellectual life:

But the irresistible energy of moral and political sentiments of half a century, at last kindled into a glaze the illuminating rays of truth, which, throwing new light on the mental powers of man, and giving fresh spring to his reasoning faculties, completely undermined the strong holds of priestcraft and hypocrisy.⁷

Darwin's verses were a strong influence on the early writings of Percy Bysshe Shelley (1792–1822), but the Shelleys and their circle were of a new generation who had to come to terms with the more horrific legacies of revolution in France, and with the reign of virulent backlash politics in England. The backlash began violently, with the gathering of 'Church and King' mobs who targeted those associated with all forms of new knowledge and ideas. Joseph Priestley was the subject of a campaign of public vilification, which culminated in the trashing of his laboratory in July 1791, on the second anniversary of the storming of the Bastille.

The intellectual climate in 1818, when *Frankenstein* was published, was fraught with political agendas and Mary Shelley's place in it needs to be understood in relation to the allegiance of ideals and principles that bound her to her parents (to whom the novel is dedicated) and to a peer group in which the charismatic influence of Shelley and Byron were paramount. A reading of the novel as simply anti-Promethean, which has been fashionable through most of the twentieth century and especially through the influence of some feminist critics in the 1980s and 90s, fails to take account of the implications of anti-Promethean views for someone in Mary Shelley's cultural circumstances, and of many of her own overt pronouncements. To a feminist in Wollstonecraft's era, the idea that bold discovery and the quest for enhanced human power was against the interests of women would have been anathema. In the Romantic period, Prometheus was the hero of all those who sought liberation from oppression.

*

In many respects, *Frankenstein* criticizes an attitude towards knowledge that came to be identified with the Enlightenment. Subsequent views have either eulogized its grand achievements or condemned its megalomaniac aspirations. Neither of these approaches has shed light on the broad palette of different approaches to the study of nature. In order to understand the full complexity of the period we, therefore, need to distance ourselves from a simplistic retrospective view that *the* Enlightenment was a period with a homogenous agenda about technological progress and the advancement of knowledge. The eighteenth century was no doubt dominated by monolithic movements that revised and modernised philosophical theories at the same time as planting the seed for the shared values of a democratic and prosperous society liberated from the shackles of superstition. Scholars like Ian Hunter have convincingly argued for the existence of multiple Enlightenments, whose agendas emerged from strongly conflicting ideas about the nature and purpose of human existence as individuals and members of society.⁸ The secularising influences of the age of Enlightenment tend to be upheld as key achievements. Although it is fair to say that the period radically curbed the Church's direct influence on civic matters, the secularisation of public administration was unable to undermine the Christian foundation of European society. It is true that some members of the Enlightened intelligentsia embraced atheistic principles, but this was by no means a general development. So, it is

possible to subdivide the multiple Enlightenments into the category of the empirical rationalists, on the one hand, and those who explore arcane and occult matters, on the other. Here it has to be noted that it is a response to the weakening of the power of the Church that lay investigators could encroach on its traditional prerogatives when they examined aspects of psyche, mind and consciousness and, by doing so, rejected the idea that those parts of the human being which were traditionally described by the term 'soul' should be excluded from empirical, physiological analysis. Importantly, though, science bridges the divide between sober empiricism and attempts to subject metaphysical issues to the scrutinising eyes of logical analysis. The hybrids between rationality and metaphysical speculation, called into existence by the crossovers between these two types of science, are a fertile backdrop to Victor Frankenstein's introduction to the world of science.

The locations of *Frankenstein* have been chosen with utmost care. Victor's birthplace in Geneva positions him in the stronghold of Calvinism. At the same time, it alludes to the fact that Jean Jacques Rousseau (1712–78) returned to this small republic on Lake Geneva as a refuge from the vices of France. Another significant setting for the formation of Victor's mind is Ingolstadt, a Bavarian town with a recently founded university (1759) that adopted progressive principles and aimed to achieve social reform. Ingolstadt became famous throughout Europe in the early 1780s for a particular brand of Enlightenment: the order of the Illuminati who describe themselves simply by the Latin word for Enlightenment. It is true that *Frankenstein* does not contain any direct references to the Illuminism, or its founder Adam Weishaupt (1748–1811), but it is telling that the dates of Walton's letters to his sister, '17—', refer its action back to an anonymous time of the eighteenth century. It therefore seems to be fair to conclude that the pursuit of superhuman objectives must be located in the decade before the French Revolution, when all of Europe was intoxicated with a heady ferment of reformatory ideas and utopian visions.

Weishaupt had been educated as a Jesuit but rejected this rigid form of Catholicism and became the first layman to be appointed for the chair of canon law at the University of Ingolstadt (1773). The contribution to the intellectual life of his university, though, was not sufficient for him. Sharing Victor Frankenstein's immense craving to better the lot of mankind, he embarked on negotiations with the Freemasons. His unyielding temper rendered such a rapprochement difficult, so that he founded a new secret society, which was, however, modelled on this society.⁹ The joint efforts between Weishaupt and Adolf von Knigge (1752–96) guaranteed the enormous success of the new society between 1780 and 1782. Disagreement between the two leaders, along with public scandals and denunciations that the society was aiming for political sedition rather than the advancement of human welfare and scientific knowledge, caused serious suspicions. In 1787, the Bavarian government went so far as to forbid it under penalty of death.

The stated goals of the society of the Illuminati were to improve society through the cultivation of sensibility and the practice of scientific research. These objectives were shared by most contemporary intellectuals and it, therefore, attracted the leading lights of German intelligentsia, including Johann Wolfgang Goethe (1749–1832), Johann Gottfried von Herder (1744–1803) and Friedrich Nicolai (1733–1811). They joined as a means of dedicating themselves to an organised study and cultivation of human nature. The initiatory oath of new members of the order revolves around humanitarian principles: 'I profess, and also pledge, that I will eagerly grasp every opportunity of serving humankind, will improve my knowledge and willpower, and will make generally available my useful recognitions, in so far as the welfare and statutes of this particular society will demand it of me.'¹⁰

While pursuing similar goals as the *philosophes*, a group of French intellectuals dedicated themselves to the compilation of comprehensive information about the arts and the sciences to be collected in the one reference work of the *Encyclopédie* (1751–72).¹¹ The group of intellectuals around Denis Diderot (1713–84) and Jean D'Alembert (1717–83) aimed to spread knowledge as a means of breaking down privileges and abuses by church and nobility, which is why they advocated a strictly empiricist approach to science. While Weishaupt admired these spokespeople for reason and rationality, his own society embedded the practice of rationality and benevolence in an atmosphere of ritual. He also combined his commitment to pioneering scientific exploration with the exploration of the more esoteric borderlines between material and non-material phenomena.

The emotional dimension to his practice of reason and rationality, for instance, consisted of the adoption of classical names for all members of the society. Weishaupt called himself Spartacus and Knigge was Philo. Weishaupt's taste for secrecy led him to refer even to places by pseudonyms, 'Athens', for instance, standing for Munich and 'Thessalonica' for Mannheim. The veil of mystery also provided a cover for some serious agitations for the 'elaboration and propagation of a new popular religion and ... the gradual establishment of a universal democratic republic'.¹² It was also a fertile environment for the observation of phenomena of psyche and soul.

Although Weishaupt and Knigge are not directly recognisable in Shelley's imaginary depiction of Ingolstadt, there are some revealing links between the heyday of Illuminism and the novel's scientific culture. A striking coincidence is that the jubilant vision of scientific progress expressed by Professors Krempe and Waldheim positions them in the decade of the 1780s, which was also the time when Antoine de Lavoisier (1743–94) ousted the long-established belief that combustion was a process that released phlogiston – a colourless, tasteless and weightless substance believed to be present in every object as a latent principle waiting to be released. Lavoisier demonstrated the inconsistencies of the phlogiston theory in 1783 and published his own theories in 1789, demonstrating that conservation of mass is a fundamental principle not just in mechanical physics but also in chemistry. Lavoisier, importantly, proved the viability of quantitative

approaches to chemical processes, including respiration and other vital processes of the human body.¹³

In *Frankenstein* the clash between the old and the new theories is pitched as a contrast between the 'modern masters' and old alchemists.¹⁴ After Krempe's scornful response to Victor's interest in their 'exploded systems' (29), the benevolent Waldman explains that 'these were men to whose indefatigable zeal modern philosophers were indebted for most of the foundations of knowledge' (31). The key figures in the alchemical tradition mentioned in the novel – Albertus Magnus (c. 1206–80), Cornelius Agrippa von Nettesheim (1486–1535), and Paracelsus (Theophrastus von Hohenheim, 1493–1541) – do not simply feature as scholars who made groundbreaking contributions to the history of science. Once he has lost his fascination for the old alchemists, Victor Frankenstein rationalises his attraction to their ideas as a craving for 'boundless grandeur' (30). Prior to studying at Ingolstadt, he describes his early quests for the 'philosopher's stone and the elixir of life', and goes on to flesh out the moment of success: 'what glory would attend the discovery, if I could banish disease from the human frame, and render man invulnerable to any but a violent death' (23). If he has really studied the writings of these authors, he must have a more complex understanding of the symbolic qualities of key alchemical concepts, like the philosopher's stone. The text of the novel is quiet about whether he ever pondered the capacity of this most cherished of substances to enable a mystic union between self and world. We can, therefore, only speculate if he was initially attracted to the authors of alchemical works because they embraced a holistic view of nature, which foregrounded strong resemblances between physical and metaphysical phenomena.

It should also be noted that many scholars who broadly belong in the alchemical tradition explored the borderlines between mind and matter. Striking investigations of topics as diverse as social deviance, the origin of the Devil, the true skills of magicians, black and white magic, witchcraft, and the power of poisons and remedies are collected in the work of Johann Weyer, Agrippa's most prominent disciple.¹⁵ If stripped of its religious-demonic framework, Weyer's insight into the psychology of delusions, obsessions, sexual deviance, as well as a whole range of ailments that would come to be classified as nervous diseases during the Romantic period, is truly remarkable. It, therefore, is no surprise that Romantic writers had a certain penchant for the works of the old alchemists. Mary Shelley's father, William Godwin, himself embarked on a book-length study entitled *Lives of the Necromancers* (1834),¹⁶ in which he assessed their true achievements in a strictly secular light. As a stolid rationalist, Godwin must have wanted to cool his period's enthusiasm for what he would have described as irrational obfuscation.

Interest in the principles of life – the nervous system, the psyche and the soul – however, provides a connection between Weishaupt's Illuminati, the 'modern masters' and the old alchemists. But as is illustrated by the fact that Weishaupt fell into general disgrace while Lavoisier came to be hailed as the founder of modern chemistry, the line between respectable pursuits and politically and otherwise

suspect explorations of the non-material aspects of human existence was easily crossed.¹⁷ Nowhere was this boundary more richly confused than in the dramas of intellectual adventure conceived by Coleridge, Goethe, Shelley, Byron and other leading poets of the Romantic movement, in whose imaginative company Mary Shelley's story was conceived.

*

There were strong elements of the uncanny about many of the scientific experiments that caught the public imagination during the first two decades of the nineteenth century. The legacy of Luigi Galvani (1737–98) was continued through the work of his nephew Giovanni Aldini (1762–1834), who in 1803 experimented on the corpse of a criminal recently executed at Newgate, to macabre effect. Electrical charges caused one eye to open, the legs to jolt and the hand to raise itself as if in greeting. In the same year, Aldini published a series of descriptions of his experiments, including some work on severed heads:

The first of these decapitated criminals being conveyed to the apartment provided for my experiments, in the neighborhood of the place of execution, the head was first subjected to the Galvanic action. For this purpose I had constructed a pile consisting of a hundred pieces of silver and zinc. Having moistened the inside of the ears with salt water, I formed an arc with two metallic wires, which, proceeding from the two ears, were applied, one to the summit and the other to the bottom of the pile. When this communication was established, I observed strong contractions in the muscles of the face, which were contorted in so irregular a manner that they exhibited the appearance of the most horrid grimaces. The action of the eye-lids was exceedingly striking, though less sensible in the human head than in that of an ox.¹⁸

But for the precision of its laboratory detail, this reads not unlike a scene from Mary Shelley's novel.

At the other end of the vitalist spectrum from the prospect of reanimation was that of spontaneous generation. In the same year as Aldini was engaging in his grisly, jaw-dropping work at the gallows, Erasmus Darwin's imaginings were all light and life:

And quick contraction with ethereal flame
Lights into life the fibre-woven frame –
Hence without parent by spontaneous birth
Rise the first specks of animated earth.¹⁹

The most notorious experiments in spontaneous generation were those conducted by Andrew Crosse (1784–1855) at his house in the Quantock hills in 1836, long after the publication of *Frankenstein*, but a diary entry by Mary Shelley indicates that she and Percy Bysshe Shelley attended one of Crosse's early lectures in London on December 28, 1814. Crosse spoke and gave demonstrations on the topic

of 'electricity and the elements', describing in detail his methods of directing lightning currents in order to employ their power to generate light and motion.²⁰

The early nineteenth century was a time when the magic and mystique of science was crossing paths with an accelerating succession of immediately useful discoveries, and it was impossible to determine which of a range of mind-boggling prospects might become an actuality. The industrial revolution was in its most intensive phase. Human mobility was accelerated beyond all previous imagining, and concepts of geographic distance were correspondingly transformed. Richard Trevithick (1771-1833) built the first passenger steam carriage in 1801 and his steam locomotives were revolutionizing freight transport from 1804. In 1807 the first steamship passenger service to America was introduced. In 1816 the Leeds-Liverpool canal was completed. Work and productivity were likewise accelerated, with double-edged consequences, as the bulk of manufactured goods grew exponentially, but so did the burden on those whose lot it was to operate the 'dark satanic mills'.²¹ A succession of riots and a growing movement of organized protest were features of this timespan, leading up to the Peterloo massacre in Manchester in early 1819.

William Wordsworth, reflecting in 1814 on the transformations he was witnessing, tried to express both sides of the account:

I grieve, when on the darker side
Of this great change I look; and there behold
Such outrage done to nature as compels
The indignant power to justify herself;
Yea, to avenge her violated rights,
For England's bane.

And

yet I do exult,
Casting reserve away, exult to see
An intellectual mastery exercised
O'er the blind elements; a purpose given,
A perseverance fed; almost a soul
Imparted - to brute matter. I rejoice,
Measuring the force of those gigantic powers
That, by the thinking mind, have been compelled
To serve the will of feeble-bodied man.²²

Mary Shelley was part of the Romantic movement, socially and intellectually, and her view of science was accordingly influenced by the heightened perspectives of her contemporaries. Her protagonist, Victor Frankenstein, is a figure torn between the two kinds of vision expressed here by Wordsworth, and there are no easy conclusions to be reached about the inherent values and dangers of his enterprise.

The main objective of this collection of essays is to bring to life the challenges and complexities of science as they are reflected in the novel. We have, therefore, brought together contributors who can offer readings of *Frankenstein* in light of the most relevant areas of the period's scientific knowledge. Rather than focussing exclusively on the individual fields of enquiry which were to establish themselves as the core disciplines of modern science, this book is based on a broader understanding of science. On the one hand, it reminds the modern reader of the controversial aura of, for example, early studies in electricity, and on the other hand, offers a glimpse of the fluid boundaries between pioneering explorations of nervous diseases and esoteric speculations about the existence of analogical resemblances between mind and matter.

The scientific advances of the Romantic period could not have been as far-reaching and rapid without related efforts to disseminate the new knowledge amongst a wide spectrum of interested parties. Women and children, in particular, became a crucial target audience for the numerous publishers attempting to profit from the ever-rising interest in inventions and new insight into the secret workings of nature. Publications about the people, animals, plants and landscapes encountered by naval expeditions were a similarly popular topic of interest. Owing to William Godwin's own involvement in the market of scientific popularisation, Mary Shelley learnt about her period's technological advancements and scientific theories from her earliest years. Much of the knowledge she acquired as an avid young reader with an early penchant for writing was filtered through to her via scientific popularisations and textual hybrids between fact and fiction. Patricia Fara opens this collection of essays with an overview of scientific publications written for a lay audience and available during Mary Shelley's formative childhood years. Considering that early nineteenth-century women could still only really enter the history of science as readers, illustrators and translators, Ludvig Holberg's novel about Niels Klim's journey through a subterranean world (1742) encouraged its female readers to feel at home in the spaces between fact and fiction. Holberg's novel, along with Jonathan Swift's *Gulliver's Travels* (1725), which demonstrated a similar preoccupation with contemporary science, is a revealing early fantasy about the imaginary exploration of alien spaces, mingled with an analysis of double standards and the social objectives behind scientific ventures. Eighteenth-century novels about scientific innovation are, therefore, shown to provide an important foil for Mary Shelley's imaginative portrayal of a scientific hypothesis.

The next chapter, written by Judith Barbour, offers detailed insight into the precise nature of the knowledge disseminated through the *Juvenile Library*, a serialised encyclopaedia published by William Godwin after 1807. Not surprisingly, the household of a writer, publisher and bookseller teemed with intellectual debates about the rationale and implications of new systems of scientific categorisation. Such discussions enthusiastically explored the Linnean order of plants along with other attempts to revise the long-established 'great chain of being', a rigid hierarchy that assigned a place to all living beings and embraced beings as diverse as mites and slugs, on the one hand, and God and his angelic

vassals, on the other.²³ Attracting young men with radical sentiments or otherwise unconventional attitudes, Godwin's home was also a hub for discussions about the social changes made possible by the secular perspective of contemporary science, disencumbered by the crippling notions of mainstream morality. Controversies about mankind's purpose were considered in light of, for instance, Georges Buffon's (1707–88) accounts of the resemblances between the human physical frame and that of apes and other primates. The young Mary was, therefore, immersed into a heady intellectual climate that encouraged her to speculate about the reforming potentials of contemporary science. Percy Bysshe Shelley, an influential figure in her father's circle of friends, was intrigued by the roaming imagination of the young Mary – so much so that the couple decided to elope in 1814. The early dialogues between the precocious child and the already established writer were to grow ever more intensive and, as Barbour argues, inspired the dramatic momentum required for transforming Mary's fantasy about an artificially created being into a speculative drama about the consequences of contemporary science.

In the late eighteenth century, the understanding and experience of space began to change in response to the accumulation of a vast bulk of new information about the geography of far-flung places. In parallel with this development, unprecedented efforts to grasp the secrets of the human mind, psyche and soul probed into the inner spaces of human existence. It goes without saying that the attempt to map and chart the phenomena of the mind could not follow equally objective principles. As Christa Knellwolf's chapter explains, the inability to draw an objective map made it difficult to proceed. However, it also provided scope for imagining a vastness of imaginary space that reflects the minute infinities revealed by contemporary microscopes. At issue, however, are not the microscopic dimensions that will be the concern of twentieth-century microbiology, but the limitless nature of consciousness and imagination. The parallels between inner and outer space bears special salience for the setting of *Frankenstein*: The immense distances traversed, particularly in its narrative frame, position the novel's eponymous hero in both an emotional and a geographic desert. The impossible spaces of the narrative and physical setting of the story, then, raise questions about whether the uncompromising realisation of ideals and absolutes is achievable for an ordinary human being.

Contemporary debates on the sanctity of human life are a key concern of *Frankenstein*. Anita Guerrini's chapter argues that early nineteenth-century debates about vivisection were motivated not only by the nascent sensitivity towards the sufferings of animals, but also responded to long-standing, religiously motivated attempts to ban experiments that pried into the mysteries of life – human and animal. The discovery and description of the nervous system, however, critically depended on the possibility of observing the physical locations of pain. Like *Frankenstein* himself, prominent scientists in the field found it difficult to cope with the gruesome aspects of vivisection and were unsure about whether they had a right to proceed with their research. Audiences were still eager to attend public

performances in anatomy but antivivisection debates shed important light on the contested public perception of anatomical-medical experimenters. François Magendie (1783–1855) – a French anatomist who regularly performed public dissections in order to demonstrate the body's sensory functions – was a case in point, who illustrates a growing discomfort with the scientists' wish to spy ever more deeply into the borderlines between life and death. So a further parallel between the real and fictional scientist emerges as an urgent concern of the novel, consisting of the fact that neither the real nor fictional scientist were horrified by the gruesome environment of the charnel house or sufficiently awed by the idea that a dead human body was the receptacle of a recently departed soul.

Frankenstein's creature is frequently referred to as a monster. While this trite stereotype fails to grasp the problems implicit in contemporary fantasies about the perfectibility of the human body and mind, it also ignores the fact that the monster posed enormous problems for the taxonomies of comparative anatomy, which is why teratology – the scientific explanation of the existence of monsters – emerged as an influential branch of contemporary science. Diverging significantly from the characteristics identified by received definitions of a particular species, Melinda Cooper argues that the nature and purpose of these alternative life-forms posed endless problems and questions. Were they simple variants of the normal representatives of a species, were they a sign that the health of a species had been undermined, or were they indications of special transformations waiting to manifest themselves in the imminent future? Such questions need to be raised in regard to Frankenstein's so-called monstrous creation. Their relevance is further documented by the fact that debates about the problematic role of the monster must have occurred between the Shelleys and their friend William Lawrence (1783–1867), a leading figure in the controversy over whether the origin of life was the consequence of materialist or vitalist principles. As regards the philosophical conception of Frankenstein's creature, the context of teratological controversies opens up a new understanding of the novel's analysis of the origin and meaning of different forms of life.

Allan K. Hunter's focus on an evolutionary perspective leads to a very different interpretative approach, exploring the social and political implications of the creature's life course. The evolutionary theories at issue here are those of Erasmus Darwin, whose untempered admiration for the revolutionary energies surfacing in America and France fed into his hypothetical modelling of the future state of life forms. Hunter's essay examines the claim that Enlightenment science enabled a new view of the human condition that comes into existence between a distant past and a distant future, and whose endless transformations generate cultural anxieties about the approach of a new evolutionary phase. Seen through the lens of Darwin's revolutionary optimism and Godwin's doctrine of perfectability, the creature is endowed with preternatural learning abilities, extreme powers of endurance and a body size that makes him dominant in any physical contest. Yet he is also transformable into a force of chaos and a generator of cyclic violence. His creation as a manufacturing process is thus a provocative reflection on the culture of

manufacturing innovation in England at the time. These tensions and provocations are revealed in the novel's controversial reception, which also illustrates a growing anxiety in England about the nebulous and excessive tendencies of French thought, compared to English pragmatism.

With our taken-for-granted attitude towards electricity, it is a challenge for twenty-first-century readers of *Frankenstein* to appreciate the imaginative potency of electrical researches in the Enlightenment period. Mary Shelley's novel capitalizes on the dramatic cultural and psychological impact of electrical discovery as well as its immediately spectacular manifestations. Amongst her contemporaries, electricity was regarded as a life science or, more than that, as the science of life itself.

Ian Jackson emphasizes that the most popular and spectacular forms of electrical experiment involved human and animal bodies. Such experiments promised to unlock forces of unlimited potential that might change the destiny of the species, effecting a transformation of human being in metaphysical as well as material terms. When unseen electrical forces were made to cause visible objects and bodies to move, or emit sparks, or to attract other objects towards them, this created a meeting point between the perceptual frameworks of science and animism. Through Galvanic experiments in which the corpses of recent gallows victims were made to dance, these forces are specifically linked with the fantasy of reanimation.

The agonies of conscience experienced by Victor Frankenstein also reflect the intensity of debates surrounding researches into electricity which, from an orthodox religious point of view, were dangerously impious, because to reveal those things in creation that were hidden from the human senses was to transgress divine intention. If the Creator had wanted them to be known, He would have made them evident in the first place. Against this view, there was the Newtonian defence that the study of nature, with the purpose of revealing the workings of God to man, is essentially pious because it enables fuller human admiration of divine perfection. The unashamed atheism of the Shelley circle, and their embrace of Prometheus as the greatest of mythical heroes, prompted a move away from defensiveness to the lyrical celebration of bold discovery. However, Jackson suggests that in *Frankenstein*, Mary Shelley is offering a more troubled view of scientific aspiration.

Joan Kirkby's analysis of the spiritualist ideas underpinning the story of Victor Frankenstein brings up the question of what was regarded as a 'science' in the early nineteenth century. Mesmerism combined elements from the knowledge domains of astronomy, electricity and magnetism, with interpretative frameworks belonging to the practices of clairvoyance and spiritualism. Major philosophical thinkers such as Immanuel Kant (1724–1804) and Arthur Schopenhauer (1788–1860) interested themselves in the presence of spirits, and many of the works of eighteenth-century scientific writers include serious commentary on the permeability of the boundary between life and death. Leading spiritualists of this time, as Kirkby points out, were also leading scientists. Emanuel Swedenborg

(1688–1772) was led by his sophisticated interests in anatomy and the composition of matter to enquire into the specific location of the connecting point between body and soul. In this light, the anatomical work of Frankenstein, driven by an impassioned commitment to dismantling the boundary between life and death, takes on heightened implications. The themes of the novel can also be seen as closely linked with those of Percy Shelley's major poems, in which a view of matter itself as spirit is expounded with powerful conviction.

The culture of collecting was one of the most significant forms of public engagement with the natural sciences in the late eighteenth and early nineteenth century. As Christine Cheater observes, some of the tensions played out in the novel are reflections of larger cultural tensions exemplified in the design and management of collections. Victor Frankenstein's adventures take him from the extremes of confinement, working day and night in his domestic laboratory, to some of the wildest and most remote landscapes of the world. Similarly, the quest for scientific trophies could lead to travels around the globe but also to the experience of confinement amongst the obsessive and personalised clutter of the cabinet of curiosities. There were tensions, too, between the curiosity driven projects of the private collectors or *virtuosi* and the growing commitment to expertise and professional specialization, with its attendant demands for greater exclusivity in the management and accessibility of collections. Cheater compares the careers of Ashton Lever (1729–88) and John Gould (1804–81) as exemplars of this transition and the tragic personal costs it sometimes entailed, suggesting that the disastrous conclusion of Victor Frankenstein's enterprise shares some symptomatic elements.

Scientific fictions about the existence of different forms of life did not begin with Mary Shelley's *Frankenstein*. Stories embraced in long-standing speculations about whether there are other worlds and, if so, what their inhabitants might look like, date back at least to Bernard le Bovier de Fontelle's (1657–1757) scientific popularisation of Cartesianism. While early fantasies about the appearance of beings living outside or beneath the surface of the earth demonstrate little fear about the implications for their own world, Mary Shelley's novel adds a decisively worrying twist to the theme. Sharing the planet with another species that is their own equivalent (or even superior) may be a prospect for which human nature is not ready, though in her later novel *The Last Man*, Shelley envisaged a world evacuated of the human species as a place of profound metaphysical emptiness. This work points towards a tradition of bleaker fictional renditions of the future. By the end of the nineteenth century, apocalyptic fantasies dominated the imagination of writers, such as H. G. Wells, disillusioned about the promises of science and their period's irresponsible treatment of natural resources. Mary Shelley's *Frankenstein* is often read as a work that stands at the beginning of such dark visions about the barbarities resulting from a science that is used in the service of megalomaniacs wishing to control the world rather than as a tool for the spread of Enlightenment ideas and values. It is time to reengage with the novel as a work

that is filled with the energies of scientific aspiration, as well as misgivings about human failure to realise it.

Notes

- 1 Evelyn Fox Keller, *Secrets of Life, Secrets of Death: Essays on Language, Gender and Science* (London: Routledge, 1992), p. 49. Anne K. Mellor probably offers the most fully developed of such readings in *Mary Shelley: Her Life, Her Fiction, Her Monsters* (London: Routledge, 1988).
- 2 See Isaac Asimov, 'Robots, computers and fear', Introduction to *Machines That Think* (Harmondsworth: Penguin, 1983), p. 1; Bernard E. Rollin, ed., *The Frankenstein Syndrome: Ethical and Social Issues in the Genetic Engineering of Animals* (Cambridge: Cambridge Univ. Press, 1995).
- 3 Patricia Fara, *An Entertainment for Angels* (Cambridge: Icon Books, 2002), p. 22.
- 4 Desmond King-Hele, *Doctor of Revolution: The Life and Genius of Erasmus Darwin* (London: Faber & Faber, 1977).
- 5 Jenny Uglow, *The Lunar Men: The Friends Who Made the Future, 1730–1810* (London: Faber & Faber, 2002).
- 6 Erasmus Darwin, letter to Benjamin Franklin, 29 May 1787 in American Philosophical Society collection of Franklin Papers XXXV, 70; quoted in King-Hele (London: Faber & Faber, 1977), p. 179.
- 7 Mary Wollstonecraft, *An Historical and Moral View of the Origin and Progress of the French Revolution*, in *Mary Wollstonecraft, Political Writings*, ed. Janet Todd (Oxford: Oxford Univ. Press, 1994), p. 292.
- 8 Ian Hunter, *Rival Enlightenments: Civil and Metaphysical Philosophy in Early Modern Germany* (Cambridge: Cambridge Univ. Press, 2001).
- 9 For a historical background of eighteenth-century freemasonry, see Margaret Jacob, *Living the Enlightenment: Freemasonry and Politics in Eighteenth-Century Europe* (New York: Oxford Univ. Press, 1991).
- 10 For a detailed historical analysis of Illuminism, see Richard van Dülmen, *Der Geheimbund der Illuminaten: Darstellung, Analyse, Dokumentation*, trans. Christa Knellwolf (Stuttgart: F. Frommann, 1975), p. 159.
- 11 Denis Diderot and Jean D'Alembert Le Rond, eds, *L'Encyclopédie, ou Dictionnaire raisonné des art et des sciences* (Paris: Le Breton, 1751–72). For a discussion of the cultural context and objectives of the *philosophes*, see David Garrioch, 'The party of the *Philosophes*', in *The Enlightenment World*, eds Martin Fitzpatrick, Peter Jones, Christa Knellwolf and Iain McCalman (London: Routledge, 2004), pp. 426–41.
- 12 Compare the entry for 'Illuminati' in the *Catholic Encyclopaedia* online: <<http://www.newadvent.org/cathen/07661b.htm>> [accessed 10 October 2007].
- 13 Antoine Lavoisier, *Traité élémentaire de chimie, présenté dans un ordre nouveau et d'après les découvertes modernes*, 2 vols (Paris: Chez Cuchet, 1789; repr. Bruxelles: Cultures et Civilisations, 1965).
- 14 Mary Shelley, *Frankenstein or The Modern Prometheus: The 1818 Text* (Oxford: Oxford Univ. Press, 1993), p. 30. All further references are from this text and are cited parenthetically.

- 15 Johann Weyer, *De praestigiis daemonum*, trans. John Shea, in *Witches, Devils, and Doctors in the Renaissance* (Binghamton, NY: Medieval & Renaissance Texts & Studies, 1991 [1583]).
- 16 For the details of Godwin's study, see *Lives of the Necromancers: or, An Account of the Most Eminent Persons in Successive Ages, Who Have Claimed for Themselves, or to Whom Has Been Imputed by Others, the Exercise of Magical Power* (London: Frederick J. Mason, 1834).
- 17 Also compare Robert Darnton, *Mesmerism and the End of the Enlightenment in France* (Cambridge, MA: Harvard Univ. Press, 1968); and Auguste Viatte, *Les sources occultes du romanticism, illuminism, théosophie, 1770–1820* (Paris: Champion, 1965).
- 18 John [Giovanni] Aldini, 'An account of the late improvements in galvanism, with a series of curious and interesting experiments performed before the commissioners of the French National Institute, and repeated lately in the anatomical theaters of London' (London: 1803). Extracts from this document available online at <<http://chem.ch.huji.ac.il/~eugeniik/history/aldini.html>> [accessed 10 October 2007].
- 19 Erasmus Darwin, *The Temple of Nature* (London: J. Johnson, 1803), Canto II, iv, lines 246–51.
- 20 Peter Haining, *The Man Who Was Frankenstein* (London: Frederick Muller, 1979), pp. 56–63.
- 21 William Blake, *Jerusalem*; quoted from *Literature Online* <<http://lion.chadwyck.com>> [accessed 10 October 2007].
- 22 William Wordsworth, *The Excursion*, Book 8, pp. 243 and 244; quoted from *Literature Online* <<http://lion.chadwyck.com>> [accessed 10 October 2007].
- 23 For a historical overview of the concept, see A. O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge, MA: Harvard Univ. Press, 1948).

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Frankenstein's Science

Experimentation and Discovery in
Romantic Culture, 1780–1830



EDITED BY
CHRISTA KNELLWOLF AND JANE GOODALL

'This ably edited volume explores the myriad scientific contexts in which Mary Shelley's *Frankenstein* came into being – her childhood reading; contemporary geographical explorations, especially to the Arctic Poles; debates concerning human and animal vivisection, monstrous births, spiritualism, electricity, evolution, and the mania for collecting specimens of natural history. These essays deeply enrich our understanding of Shelley's novel, its impact on later historical readers, and its continuing relevance to current scientific controversies.'

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