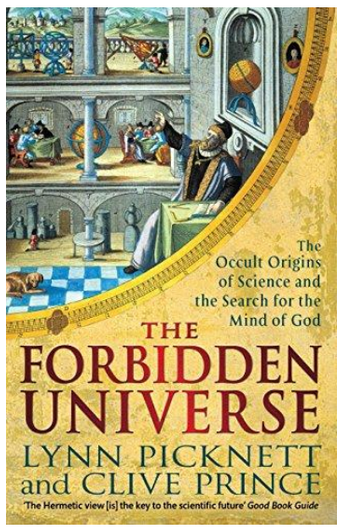


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The Forbidden Universe: The Occult Origins of Science and the Search for the Mind of God

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> The Dawkins/Hitchens school fails to distinguish between, on the one hand, the religious impulse that is innate to human beings and, on the other, the systems of authority and control that the organized religions have become. The debate is almost always portrayed with just two alternatives, scientific atheism and organized, dogmatic religion. But something is missing: the profound sense of the 'Other', or the transcendental – what may be termed the mystical, or even magical – that underpins, but is not the same as, religious sensibilities. And, as this book hopes to demonstrate, this is by no means incompatible with a truly scientific worldview. There has never been a culture – from rainforest tribes to the greatest civilizations such as Rome, ancient Egypt or even the modern West – which did not begin with an understanding of the world based on a belief that it is both purposeful and meaningful, arising from a supernatural ordering of things. It, and everything in it, are here for a reason. This way of looking at the world around us is not learned, but instinctive; it comes naturally to the individual. And this yearning for the transcendental is not rooted in organized religions; they and their priesthoods might exploit this innate impulse, but they did not create it. Ours is the first civilization where a significant number of people have attempted to break away from such a worldview. But, as Richard Dawkins laments, it is a slow and difficult struggle, precisely because such thinking is second nature to our species. It is so universal, so taken for granted, that it seems to be hardwired into us.

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> Similarly, the Dawkins school pays little attention to this mysterious human propensity for a belief in the supernatural and the magical. As it is the very antithesis of scientific, rational thought they don't even give it a nod. But this is dodging a major question. Even if it is all just superstition, surely investigating such a basic instinct with an open – a truly scientific – mind would reveal something important about humanity? If, as Dawkins insists, God is a delusion, why should we be programmed to be quite so delusional? As

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> Copernicus was linking the sun's physical place in the solar system to resolutely transcendental concepts: that the sun is the universe's 'mind' or the seat of the power that rules all creation, or 'Trismegistus' visible God'. And it is in those three words that the greatest clue to understanding Copernicus' theory lies, for they reveal a hint of the real heresy that was to rock the Vatican to its foundations.

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> Pico's Oration is illuminating about the Renaissance for several reasons. It reveals the era's defining characteristic, a dramatic shift in attitudes about humanity: Man suddenly became a being of wonder with limitless abilities and possibilities rather than a miserable creature innately blighted and damned by original sin. It also highlights the clash between two mindsets: the new, open, questioning, eclectic spirit of the Renaissance – in particular its willingness to take seriously sources of wisdom outside the Christian domain – and the old, blinkered, Bible-bound attitude of the Middle Ages. The Church had always been wary of learning for learning's sake, frowning on novelty and intellectual challenge. The frenzy of interest in new ways to explore the universe and humankind's place within it was the direct result of being freed from the old shackles. Effectively, the Renaissance represented a great surge of collective self-confidence.

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> Most of the traditions from which Pico drew his theses were not established works of physics or mathematics, but metaphysical, mystical and what we have come to know as occult sources. Above all it was the works of Hermes Trismegistus that drove Pico with a passion.

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> One of the most important defining factors of the Renaissance, however, was a renewal of interest in the esoteric, specifically the theory and practice of magic. Given the scale of its impact on the Renaissance and the fact that it was hardly hidden away (as Pico's Oration clearly demonstrates), it is astonishing that historians completely ignored the influence of this renewed interest on the period until the 1940s, when studies began to reveal its influence over many of its great figures. It is only really over the last half-century or so that the crucial importance of esoteric, magical philosophies has been properly appreciated, as for example in the work of academics such as British historian Frances A. Yates (1899–1981). In a series of books published in the 1960s and 70s, Yates demonstrated that the Renaissance was largely motivated and driven by the 'occult philosophy', a blend of fifteenth-and sixteenth-century magical and esoteric systems. The term 'occult philosophy' comes from one of the period's most important expositions of the principles of magic, Three Books on the Occult Philosophy (De occulta philosophia libri tres) by Heinrich Cornelius Agrippa, published 1531–33. The Latin occultus simply meant hidden, obscured or, by extension, secret, but not necessarily supernatural. Agrippa's book would have been understood at the time it was published to be about 'hidden philosophy'. Magic's reputation enjoyed a major boost in the Renaissance. From being the exclusive province of reclusive, more than usually malodorous and scary individuals, it very nearly became mainstream, and was widely discussed as a respectable aspect of philosophy and even theology. In his Oration, for example, Pico della Mirandola argues that magic is a valid path to knowledge, but is careful to differentiate between the more odious and hellish magic that utilises demons, and the natural magic that comprises the highest realisation of philosophy.10 In the intellectual explosion that was the Renaissance, magic came to be considered an integral part of all aspects of human knowledge.

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> Over the centuries, and even today, attempts have been made to separate the two, on the grounds that the philosophy itself is sophisticated and coherent, while the astrology and magic is considered primitive and incoherent. (One 1920s edition simply deleted this material.) Some even consider the compilation of the Corpus Hermeticum as an attempt to purge the canon of the most magically inclined texts. Of all the known Hermetica, those in the Corpus are conspicuously the least magical, but even they include some arcane elements – which is hardly surprising given that the philosophy and cosmology are indivisible from an occult worldview.

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> Some thinkers tried hard to find a compromise, accepting the philosophy and cosmology but rejecting the magic, while others, such as Pico della Mirandola, pointed out that the two sides of the Hermetica were inseparable and argued this demonstrated that magic – provided there was no occult nastiness such as conjuring spirits – was a legitimate Christian activity. After all, Moses had engaged in magical contests with the pharaoh's magi and had probably learned magic in Egypt. Some even suggested that Jesus had performed his miracles by means of natural magic. Others went further, seeing Egypt as the origin of the wisdom inherited first by the Jews and then by the Christians. This, they argued, elevated Hermes to at least an equal footing with Moses, who despite not being a Christian, was still deserving of respect for his contribution to the religious tradition into which God had chosen to send his son. The extent to which men in high places accepted this reasoning – even, astonishingly, including the Pope himself – can be demonstrated by resuming the story of Giovanni Pico della Mirandola, who we left earlier languishing in a Parisian prison after his arrest on the orders of Pope Innocent VIII. He didn't languish for long. As Pico was from a well-connected family, his powerful supporters interceded with the Pope on his behalf. One such supporter was Charles VIII of France, and another Lorenzo de' Medici – 'the Magnificent' – who was now one of the wealthiest and most powerful men in Florence. Eventually the Pope allowed Pico to return to Florence, under Lorenzo's guarantee that he would behave himself, although his works remained on the banned list. In 1492 Innocent VIII died and was succeeded

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> The heliocentric theory raised no major theological difficulties anyway. True, there are a handful of implications in the Old Testament concerning the immobility of the world. The First Book of Chronicles, for example, states that, 'The world is firmly established; it cannot be moved',38 and Joshua is said to have convinced God to stop the sun in the sky, which implies that it was the sun, not the Earth, which moves.39 But in the end few churchmen thought Copernicus' theory was worthy of oiling the rack and heating the pincers. Ironically, any religious objections came not from the Vatican but from Protestants, although even the most hellfire-and-damnation regarded the theory as mere folly as opposed to blasphemy. Martin Luther himself ridiculed it, but mainly because he was aghast at the suggestion that astronomy could have got it so fundamentally wrong for so long.

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> This was also largely the position of scholars, who too were disturbed for another reason, which is less obvious today. Proposing that traditional astronomy was profoundly flawed seemed intimidating, since it implied that human understanding of the order of the universe, and the way one part influenced another, was seriously lacking. If Copernicus was right, then everything changed. This was not yet the era of science as we know it in the modern sense. Even learned men such as Copernicus and Johannes Kepler believed that a greater understanding of the movements of the heavenly bodies would improve the accuracy not only of astronomy but also its esoteric twin, astrology. No astronomer at that time believed the workings of the universe were due to impersonal physical forces. To them, God had decreed that the universe should operate in the way it did. As such, discovering how it worked offered an insight into the divine mind, and might also throw light on God's plan for all creation. This mindset drove the likes of Kepler who, building on Copernicus' work, established the laws of planetary motion. Kepler (1571–1630) was another great name of the scientific revolution who was steeped in the Renaissance occult tradition. He believed that the planets, including the Earth, are living entities with their own world souls and that the seat of the anima mundi is in the sun. As an astrologer he wrote that a new star that appeared in 1604 portended major changes on Earth. Unsurprisingly, his writings also reveal a detailed knowledge of the Corpus Hermeticum.

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> Although largely forgotten today, the Dominican monk-turned-heretic Giordano Bruno was regarded as one of the greatest intellects and philosophers of his time. The champion par excellence of the Hermetic tradition, he travelled Europe preaching its virtues and arguing for a root-and-branch reform of society based on its principles. He aimed to be Hermeticism's greatest prophet – even its messiah – but instead became its greatest martyr, ending his days in the searing embrace of the Inquisition. Bruno was messianic, bombastic and stubborn, with a huge ego and belief in his own brilliance and importance. But then a man whose whole philosophy and mission in life centres on the Hermetic adage of magnum miraculum est homo is hardly destined to be a shrinking violet. He saw himself as living proof of just how miraculous a man could get. Where he parted company with most typical egocentrics, however, was that he considered all men and, less usual for the time, all women, as being either actually or potentially as brilliant as himself. The targets of his greatest fury were those who held people back, who told them they were insignificant and worthless. Surely it is difficult for a philosophy to be more diametrically opposed to the Christian doctrine of original sin, the idea that babies are born in a fallen state due to the famous transgression of Adam and Eve.

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> But Bruno also believed that Copernicus' work went way beyond vindicating the Hermetic treatises; he considered it as the key to the prophesied new Hermetic age. The fact that Copernicus had presented his proofs when he did was a portent of the coming changes. But not everybody had yet accepted the new system; it was still being hotly debated. If it could be established beyond doubt and enter into the canon of accepted fact, Bruno thought, then this would literally trigger the new age of Hermetic enlightenment. In turn, this would reveal a new way of comprehending the mysteries of creation, that is by using the intellect to obtain otherwise elusive proof of certain Hermetic magical and philosophical concepts, as summarized

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> Ironically events showed that Bruno was at least half right. Establishing heliocentricity did indeed lead to a revolution that would change academic attitudes to religion, but it was the scientific revolution.

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> As to the purpose of Bruno's mission, it fitted perfectly his agenda of uniting Christianity and averting a catastrophic war in Europe. The idea was to get the Catholic nations to band together under a single monarch and the Protestant nations to unite under another, both of whom would be advised and influenced by Hermeticists who would ensure peace between them. Henri III and Elizabeth I were prime candidates. English esoteric circles, too, had great influence at the royal court, most obviously in the shape of John Dee (1527– 1608), Elizabeth's astrologer and adviser in many areas, including diplomacy, espionage and the expansion of English influence across the globe. Although there is no record of Bruno and Dee meeting, because they had mutual friends and frequented the same court and intellectual circles they almost certainly did. This was especially likely as Dee was not only a champion of the Copernican theory but also a passionate devotee of the Hermetic tradition. Bruno met the Queen herself on the many occasions he accompanied Castelnau to court, declaring himself a fervent admirer of the 'diva Elizabetta' and proclaiming her superior to any man in her heroism, learning and wisdom.9 That fulsome compliment 'diva' was to count against him with the Inquisition, since they took against calling a declared heretic 'divine'. Worse by far, Elizabeth was an illegitimate heretic in Catholic eyes at least. In any case she was female. And she had a sure sign of the witch, being red-haired. But Bruno enthusiastically joined the cult of the Virgin Queen, which lauded her as the potential spearhead of a new age, the bejewelled goddess who would unify Protestant Europe. He seems to have admired the relatively peaceful nature of Elizabethan England when compared to the internal divisions that were then tearing apart the other nations of Europe. The uncompromising Neapolitan took

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> But Digges, too, was part of the Elizabethan esoteric scene, being a protégé of John Dee, himself a great supporter of heliocentricity. Although Dee left no reference to the theory in his own works, he encouraged its first champions in England, urging the astronomer John Field to use Copernicus' system to draw up a table of the positions of the planets in 1557. Dee was also, notably, Digges' mathematics tutor (Digges called Dee his 'second mathematical father').20 In fact, Digges' version comes straight from Asclepius.21 These were not the only anticipations

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> we now know, every cell in our bodies is constantly being replaced throughout successive cycles of seven to ten years. But how did Bruno know? And that is by no means the limit of Bruno's prescience. Peter Tompkins writes:

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> Bruno heavily influenced the English natural philosopher and physician William Gilbert (1544–1603) who British science writer John Gribbin describes as 'the first person to set out clearly in print the essence of the scientific method – the testing of hypotheses by rigorous experiments – and to put that method into action.'24 Gilbert's major work, On the Magnet, Magnetic

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> favours granted to him.37 Bruno's sense of destiny had also been bolstered by other events, and without the grim knowledge provided by hindsight, perhaps it is easy to understand how he might have been so tragically misled. In 1591, Francesco Patrizi, Professor of Philosophy at the University of Ferrara, published a new edition of the Hermetica. In his dedication to Pope Gregory XIV, Patrizi urged him to decree that Hermetic philosophy be incorporated into the heart of Catholic education. Gregory died soon afterwards, but his successor, Clement VIII, rewarded Patrizi for his efforts by bestowing him with the Chair in Platonic Philosophy at the University of Rome. Bruno told Mocenigo that he had taken heart from this, and expected the same kind of treatment from Clement. There was, however, a major difference. Patrizi was advocating the incorporation of Hermeticism into Catholicism, not vice versa like Bruno. And, of course, while ostensibly rewarding Patrizi – or perhaps buying him off – Clement never actually acted on his proposition. It was in this climate that Bruno accepted Mocenigo's suggestion to travel to Venice. Accompanied by his secretary, Jerome Besler, Bruno initially declined Mocenigo's invitation of hospitality, and stayed in his own lodgings. He gave talks at Ciotto's bookshop and frequented intellectual salons in private homes, besides spending three months at Padua, hometown of the eminence grise Gian Vincenzo Pinelli, whom he undoubtedly met. Only in the spring of 1592 did he finally give in and agree to stay with Mocenigo. During his two-month visit his host made notes of their conversations, which no doubt seemed innocent enough, perhaps even flattering at the time, but they were to provide the basis of the case against him. There were other good reasons why Bruno and his network wanted to shift their focus to Venice. The republic was becoming a centre of opposition to the Pope's authority and there were moves to forge a political and religious alliance with England (although this only gathered momentum in the years after Bruno's death). Astonishingly there were even hopes that Venice might adopt Anglicanism, which probably explains why the Pope excommunicated the whole republic in 1606. The key figures in this plan were all associated with Bruno. They included the English ambassador (and former spy) Sir Henry Wotton, who had been at the Italian's controversial lecture in Oxford and was a great friend of Alberic Gentilio, the professor of law who facilitated Bruno's career in Germany. Another was Traiano Boccalini, author of News From Parnassus (Ragguagli di Parnaso), which, modelled on The Expulsion of the Triumphant Beast, called for a 'general reformation of the whole wide world'.38

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> The inexorable endgame for Bruno finally began with the arrival of the newly appointed Cardinal Inquisitor Roberto Bellarmino (1542–1621, canonized in 1930). One of the most formidable intellects of the Church, Bellarmino was a loyal and capable pair of hands trusted by a succession of popes. He was a member of the Society of Jesus – another prong of the Counter-Reformation formed some sixty years earlier. The Society, known commonly as the Jesuits, was and is a notoriously unsentimental brotherhood, zealously committed to the unswerving maintenance of Catholic doctrine. Bellarmino's speciality was combating heresy, about which he knew a great deal, having taken infinite pains to comprehend the mindsets and arguments of heretics (although in his case, studying the subject was unlikely to see him accused of being suspect of a suspicion of heresy). A fierce and clever polemicist, he even engaged in a pamphlet war with James I of England. Bellarmino had been an assistant to the papal emissary sent to negotiate with the Catholic League over the successor to Henri III after they assassinated him, negotiations that were trumped by the accession of Henri of Navarre. So he was aware of the Protestant and Hermetic expectations centred on the French kings. When Pope Clement VIII appointed Bellarmino Cardinal Inquisitor in 1599, he reopened proceedings against Bruno, who asked that he be allowed to write a petition to Pope Clement VIII declaring that he was prepared to defend the beliefs he was charged with, but that if Clement proclaimed them to be heretical, he would abide by his decision. Bellarmino didn't even show the petition to the Pope. According to the Cardinal Inquisitor, when Bruno was presented with a list of specific heresies in his work he abjured them, but then later withdrew this admission. This, as Bruno must have known, was the worst thing he could have done, as the most severe sentences were reserved for relapsed heretics. It was inevitable that he would be burnt at the stake. So had Bruno really changed his mind? No one will ever know. When he was led out to the pyre, his tongue was tied to prevent him speaking. The record of the prosecution in Rome

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> In 1870, when the city of Rome passed from the control of the Pope to secular authorities, there were immediate calls to erect a statue in Bruno's honour in the Campo de' Fiori. Luminaries such as Herbert Spencer, Victor Hugo and Henrik Ibsen supported the petition. This is probably what prompted the Pope of that time, Pius IX, to call for the documents on Bruno's trial that were later found in his personal papers. However, it took until 1889 for the bronze statue, showing a rather sinister Bruno in his monk's robes and cowl, to be erected. The statue is today the focus for a variety of pilgrims even though they tend to be atheists, freethinkers and New Agers. But the original driving force behind the statue was Italian Freemasonry – the sculptor, Ettore Ferrari, was Grand Master of Italy and the statue was unveiled with the Campo 'festooned with flags bearing Masonic symbols'.39 The nineteenth-century adulation of Bruno was based on a serious misconception, which endured because of the gap in the official records. Many had come to believe that Bruno had been put to death solely for advocating the heliocentric theory or the infinity of worlds, making him a kind of forerunner of Galileo. This belief encouraged what one commentator calls 'a misguided interpretation of Bruno as a martyr for science'.40 Bruno was actually a martyr for Hermeticism. Although there was a connection with the Copernican theory, but Bruno was condemned not for preaching heliocentricity, but because of its special significance to him, particularly his vision that proving it would herald the coming Hermetic age.

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> Campanella's major work is City of the Sun (Civitas Solis), written in the first years of the 1600s but not published until 1623, in Frankfurt.6 Basically concerned with a utopian society, the text takes the form of a dialogue between the Grand Master of the Knights Hospitaller and the captain of a ship that had sailed to the New World. The captain relates how, after being shipwrecked, he was found by the inhabitants of the City of the Sun, describing its society in detail to the Grand Master. Clearly Campanella's ideal republic, the kind he had hoped to establish in Calabria, the City of the Sun is designed and run according to magical and astrological principles. It is a Hermetic-Egyptian utopia, derived from the prediction at the end of Asclepius' Lament. George Lechner of the University of Hartford, a specialist on magical and astrological symbolism in Renaissance art says of City of the Sun: 'In it, Campanella developed the notion of a new city-state, led by a philosopher-priest-king, and guided by Hermetic magical principles.'7 And of course it is no coincidence that it was a city of the sun that was being debated, reminiscent of the 'Civitas solis' that Bruno discussed with the librarian of the Abbey of St Victor in Paris, saying that the 'Duke of Florence' planned to build it.8 Even from prison Campanella played an influential role in events surrounding the next great champion of the sun-centred theory: Galileo Galilei. The Hermetic chain remained unbroken.

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> So Galileo was not only in contact with Hermeticists, but was also very aware of just how important they considered his work. But could the connection go much deeper? Was there a more mystical dimension to the whole affair?

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> Another clue suggesting Galileo's familiarity with Bruno comes from a passage in the Dialogue where he lays the foundation for the later theory of relativity. Although the term is popularly associated with Einstein, what he formulated were his special and general theories of relativity, which are in fact highly complex developments of Galileo's original principle (sometimes called 'Galilean relativity'). This argues that physical phenomena can only be properly described according to the context in which they are observed – i.e., the same event can look completely different to observers in different places. This principle underpinned Newton's laws of motion and Einstein's own theories. In The Ash Wednesday Supper, published

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> But what of Campanella? In 1634, the year after Galileo's trial, there was another attempt to organize a revolt in Calabria. Whether Campanella was directly involved is unclear, but the leader was certainly one of his followers. So it was expedient, to say the least, for him to leave Rome for Paris – a well-worn route for fugitive Italian Hermeticists. There he became a favourite of Cardinal Richelieu, who persuaded the king to give him a pension. Encouraged by this, he transferred his hopes to the French monarchy, urging Richelieu to make Paris into his City of the Sun. His big hope settled on the future Louis XIV, born in 1638, who he expected to rule the world in partnership with a reformed papacy. Campanella was the first person to call the infant Louis the Sun King, as an acknowledgement of his great Hermetic potential.25 After Campanella's dizzyingly strange and extreme career, which took him from castle dungeons to the favour of some of the greatest figures in Europe, he died in Paris in May 1639. But there can be no doubt that his legacy lived on.

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> It seems, however, Galileo was by no means as innocent as he tried to appear. There are valid questions, for example, about his relationship to the secret Hermetic reform movement. There is his continued association and correspondence with Campanella to take into consideration, especially his wish to see him in the wake of his warning-off in 1616. What would Galileo get out of such an association? Campanella was a religious, esoteric and political theorist – not a mathematician or scientist. For an ambitious man like Galileo, conscious of his image, Campanella was hardly the kind of company he should have wanted to keep. And then there is Galileo's apparent use of Bruno's The Ash Wednesday Supper – which contains the first mention of the concept of the Copernican sun as the trigger for a new Hermetic age – as a model for his Dialogue Concerning the
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> Two Chief World Systems. Was this merely a belated, and necessarily covert, acknowledgement of Galileo's intellectual debt to Bruno, rectifying the failure for which Kepler had criticized him? Or was it a covert signal to the Giordanisti that he was a sympathizer – perhaps even one of them? It is safe to say that at the very least Bruno's work influenced Galileo's, which yet again places Hermeticism at the centre of the scientific revolution.

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> The Hermetic cause suffered several major setbacks in the early years of the seventeenth century, and for a time it must have seemed as if its hopes for a new golden age had been dashed once and for all. The first setback was, of course, the grisly execution of audacious prime mover Giordano Bruno in 1600, but the second came fourteen years later and was to provide even more ammunition for those opposing the Hermetic movement. When the Corpus Hermeticum was rediscovered in the mid-fifteenth century everybody – whether they supported or opposed Hermeticism – accepted that the texts dated from the most ancient days of the Egyptian civilization. But suddenly a learned work exploded onto the scene that made the startling claim that the texts were of a much later provenance, not being written until the second or third century CE. The bombshell was Of Things Holy and Ecclesiastical (De rebus sacris et ecclesiasticis), by one Isaac Casaubon. Born to refugee Huguenot parents in Geneva in 1559, he was widely regarded as the most learned man in Europe, his speciality being classical languages. After a glittering academic career in Switzerland and France he found himself working at the royal library in Paris under the patronage of Henri IV, the great hope of the Hermetic reformers. In May 1610 Henri, like his predecessor, was assassinated by a Catholic fanatic. This prompted a lurch towards ultra-orthodox Catholicism in France, which made life decidedly uncomfortable for Protestants such as Casaubon, who was more than happy to accept an invitation from James I to move to England.

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> Rosenkreutz, however, was rebuffed when he tried to introduce his idea for a brotherhood of ‘magicians, Cabalists, physicians and philosophers’ into Europe. So, after a few years back in his native Germany, he decided to form a secret fraternity, beginning with just three followers. The order grew swiftly, devoting itself mainly to healing the sick. Christian Rosenkreutz died at the age of one hundred and six – in 1484 or 1485 – and his burial place was considered lost until a long-hidden tomb was discovered in the House of the Holy Spirit, which the order had built as its headquarters. The discovery, which was – judging from the texts’ internal chronology, in 1604 – a vault lit by an ‘inner sun’ with walls covered in geometric shapes, and which contained all kinds of wonderful instruments and devices, and the founder’s body beneath an altar was the sign that the ‘general reformation of the world’ that Rosenkreutz anticipated was finally at hand. The brotherhood declared itself to be Christian, but of a reformed kind, and to follow an alchemical philosophy whose focus was on transmuting base souls into divine gold. They firmly rejected the notion that their practice was ‘ungodly and accursed gold making’.5 The Confessio declared ‘the Pope of Rome Antichrist’ in anticipation that the cooperation of the learned would overthrow His Holiness, and by implication the entire Catholic Church. The coming of the ‘light of truth’ had been heralded by new stars appearing in the constellations of Serpentarius and Cygnus in 1604, which links to the discovery of Christian Rosenkreutz’s tomb in the Fama. (Kepler also thought that these new stars presaged religious and political changes.) In 1614 the Fama and Confessio caused great excitement – and unsurprisingly great hostility from those opposed to such innovations, most obviously Catholics. Tobias Churton calls them ‘one of the most virulent intellectual hurricanes ever to hit Europe’,6 while referring to the Rosicrucian furore as Europe’s ‘first multi-national conspiracy story’.7 The manifestos announced the existence of a secret, elite brotherhood, which was privy to advanced knowledge, and invited applications for membership – but gave no clue about how to do so, implying that only those capable of working it out were worthy of joining. As a result, interested men of learning started writing their own tracts and open letters to the Rosicrucians, appealing for admission. On the other side, pamphleteers denounced the fraternity as subversive and dangerous, no doubt looking over their shoulders as they did so.

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> The underlying esoteric philosophy contained in the manifestos was the Renaissance occult philosophy, which as we have seen had Hermeticism at its core. It also highlighted another tradition that had yet to feature prominently in the Hermetic revival: alchemy. A word derived from 'Al Khem', the ancient Egyptian word for their country, 'alchemy' is also the root of the modern word 'chemistry'. Despite being derived from Hermetic principles – essentially their application in the field of chemistry – alchemy had yet to become a major part of occult philosophy, coming into Rosicrucianism through the works of the early sixteenth century physician and esotericist Paracelsus.11 This is especially fitting given that the Rose Cross' main concern was always healing. Another Hermetic giant whose philosophy heavily influenced the manifestos was John Dee. His masterwork, The Hieroglyphic Monad (Monas hieroglyphica, 1564), presented a new symbol, derived from astrological and other magical glyphs, which he believed embodied the secrets of the cosmos. The significance of Dee's arcane treatise can be deduced fromthe fact that it was the basis of the Latin tract A Brief Consideration of a More Secret Philosophy (Secretioris philosophiae consideratio brevis) that prefaced the Rosicrucian Confessio. Attributed to Philip à Gabella, who was almost certainly fictitious – his surname probably a reference to the Cabala – it presents explanations, complete with handy diagrams, which shed some light on Dee's distinctly abstruse work. The clear suggestion is that the 'more secret philosophy' behind that penned by the Rosicrucians is Dee's, whose importance to the movement is underscored by the fact that Andreae's Chemical Wedding is decorated with his monas hieroglyphica symbol. The legacy of the great English Hermeticist was obviously hugely important to the shadowy occultists behind the Rosicrucian manifestos. This is perhaps not only true in the world of magic, for Dee was a friend of Elizabeth I, besides being her astrologer, spymaster (whose codename was 007) and a major figure behind the explosive expansion of the emerging English Empire. His was a very useful name. Andreae

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> Both Fludd and Maier were dyed-in-the-wool Hermeticists, basing their work firmly on the Hermetic philosophy. This is particularly significant given that they seem to have dismissed Isaac Casaubon's damning historical critique, despite undoubtedly being aware of it. Both moved in the same English intellectual circles as Casaubon, and Maier was even at James I's court when he published his book at the King's instigation. When we look more closely at the traditions behind the manifestos, and their direct connections with the Hermetic reform movement, it becomes very obvious that Rosicrucianism was a repackaging of the not-very-secret agenda of Bruno and Campanella.

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> It is unlikely to be a coincidence that in the same year the Hermetic tradition also came under a sustained onslaught in Paris, from Marin Mersenne, a Jesuit-educated monk. In works published from 1623 he attacked everyone from Pico della Mirandola onwards, reserving special hostility for Robert Fludd, with whom he engaged in a high-profile war of words. He wrote of Bruno that he had 'invented a new way of philosophy in order to secretly fight against the Christian religion'.18 And tellingly, Mersenne was the first to use Casaubon's re-dating of the Hermetica against its devotees.

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> The Invisibles scare and Mersenne's onslaught on Hermeticism also forms the unexpected backdrop to the rise of the arch-rationalist of the time, he who also set the tone for the coming age of science. The philosophy of René Descartes (1596–1650) would ultimately lead to the divorce between the magical and scientific components of the Hermetic tradition. But, importantly, his career also demonstrates how this divorce was due as much to the exigencies of the time as it was to a change in the intellectual direction. Descartes was the Jesuit-educated French philosopher who argued that all physical phenomena could be reduced to, and explained in, purely mechanical terms. 'Cartesianism' represented a 'shift from magic to mechanism'.19 But he also introduced the idea of a duality between mind and body, the consequence of which we are still coming to terms with. Although his work is usually portrayed as a reaction against religion, the target of his argument was actually Rosicrucianism. Descartes was certainly not viewed as an enemy of Catholicism at the time. Quite the opposite – his ideas were actively encouraged by at least one leading Catholic theologian because of the ammunition they provided the Church in its onslaught against Rosicrucianism and Hermeticism. Indeed, in his young days Descartes had been something of a Papist swashbuckler; as a twenty-four-year-old he had fought with the Catholic forces at the Battle of the White Mountain of 1620 that smashed the hopes of the Alchemical Wedding. He entered Prague with the victorious troops. It was when quartering during the long months of the previous winter that he heard talk of the Rosicrucians and – perhaps oddly for a Pope's man – found himself interested in them. Realizing that the Fraternity's ideals and principles chimed with his own developing ideas, Descartes tried to make contact with it. He failed, but while he was holed up at Ulm in the summer of 1620 he met the mathematician Johann Faulhaber, who had tried to approach the Fraternity as a would-be member and had some useful knowledge to share with him.

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> Any search for the source of Leibniz's metaphysical inspiration begins with his devotion to Marsilio Ficino's 'perennial philosophy'5 – Hermeticism. Bruno's influence, too, filters directly through to Leibniz, possibly through the conduit of the Giordanisti. Leibniz's search for a metaphysical explanation for 'ultimate reasons' led him to formulate his theory of monads, which, to put it politely, is a somewhat abstruse idea. His monads are a kind of metaphysical or spiritual equivalent of atoms, the indivisible building blocks from which everything in creation is comprised and which are attached to physical atoms. Monads all originated at the beginning of the universe and, since they can neither be created nor destroyed, all change consists merely of their transformation. Monad is the Greek word for unity, and since the time of the Greek philosophers it has been used to describe basic units and first causes in many different philosophies – it is an important concept in Neoplatonism, for example. Leibniz's concept of monad, however, was directly influenced by Bruno.6 As Frances Yates pointed out: Though Leibniz as a philosopher of the seventeenth century has moved into another new atmosphere and a new world, the Leibnizian monadology bears upon it the obvious marks of the Hermetic tradition.7 In the interests of self-preservation, Leibniz himself was reluctant to acknowledge the influence of the Hermetic tradition. On the one hand, in the volatile new climate after the Thirty Years War Hermeticism was tainted with the whiff of heresy and diabolism, almost entirely because of Bruno. On the other hand – and partly as a consequence of being tainted – the reputation of Hermes' system in scientific and intellectual circles had suffered, and it was beginning to look old-fashioned and misguided.

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> After the collapse of Rosicrucian dreams in Bohemia and Germany and the eruption of the Thirty Years' War that engulfed Europe for a generation, Hermetic hopes for the great reform of society focused on England, which had remained largely uninvolved with the war, if only because Charles I's expedition of the late 1620s had been ignominiously defeated. And when he ran out of funds for another such venture, it was the issue of how to raise money for the army that deeply divided the English. The ensuing Civil War between the king and Parliament convulsed the country from 1641 until 1649, and ended with the public beheading of Charles I in London and the foundation of Oliver Cromwell's Commonwealth. The years of the Commonwealth and the Protectorate under Cromwell's personal rule, although largely miserable (Christmas was cancelled, for example), were relatively stable. But before England endured its own upheavals, a number of scholarly refugees who cherished the Rosicrucian dream arrived. England quickly became the repository of the Hermetic reform movement. The Hermetic tradition had by no means died out in the country. In 1654 John Webster – a Puritan Parliamentary chaplain, astonishingly – wrote a tract proposing that the universities should base their teaching on 'the philosophy of Hermes revived by the Paracelsian school'1 – in other words, Rosicrucianism. He mentioned the Fraternity of the Rose Cross and strongly recommended John Dee's mathematical works, as well as those of Robert Fludd.

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> In his hugely popular book Mathematicall Magick, published in 1648, Wilkins specifically references the Fama Fraternitatis. His book was based – as he freely acknowledged – on mathematical works by Dee and Fludd and even declared that he took the title from Cornelius Agrippa. It was at this juncture that the now-famous references to an 'Invisible College' appeared. These were in letters written in 1646 and 1647 by one of the most eminent founders of the Royal Society, the chemist Robert Boyle (1627–91) – credited with turning alchemy into chemistry – who alluded to a gathering of scholars and philosophers of which he was a part and which called itself by this mysterious name. Not only was the intriguing term 'invisible' used in the Rosicrucian manifestos, but it carried clear echoes of the mysterious, even sinister, 'College of the Brothers of the Rose Cross', otherwise known as the 'Invisibles' in Paris. Boyle's comments were almost certainly a kind of Rosicrucian in-joke. Many writers have seen a connection between this enigmatic group and the founding members of the Royal Society, and hinted at the existence of an anonymous behind-the-scenes cabal. But maybe too much mystery has been read into these connections since the group Boyle refers to is relatively easy to identify. Historian Margery Purver, in Royal Society: Concept and Creation (1967), shows that the Invisible College was the circle centred on Hartlib. The references to the Invisible College appeared in letters that the young Boyle wrote to Hartlib and make the connection between Hartlib and the activities of the college very explicit. On 8 May 1647 he wrote: 'You interest yourself so much in the Invisible College, and that whole society is so concerned in all the accidents of your life …'9 In other correspondence from around the same time, Boyle calls Hartlib the 'midwife and nurse' of the college.10 The Invisible College was Hartlib's Antilia

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> This particular description of Hermes is taken from Marsilio Ficino – which presumably Bacon relied on James not knowing. Bacon's call for a 'fraternity in learning and illumination' may have influenced the authors of the Rosicrucian manifestos, but if so he was also influenced in turn by them. There are clear signs that he was familiar with the Fama Fraternitatis in his utopian New Atlantis, published in 1627, the year after he died, and which was a particular influence on the Royal Society's founders. Bacon seems also to have read and digested Campanella's City of the Sun (published four years earlier) – or maybe it is a coincidence that his plot, too, involves shipwrecked sailors encountering the inhabitants of a perfect society (the preservers of an early, pure form of Christianity, whose officials wear white turbans bearing red crosses)? Given Bacon's unofficial interests, it is rather ironic that he is seen to represent the beginning of the divergence of magic and science. A more elusive and unequivocally arcane

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> Many historians have seen the Brotherhood as a repository of the Hermetic tradition, though this is not to suggest that Freemasonry is only about Hermeticism.19 Significantly, Masonic writer Robert Lomas points out that one of the rituals an initiate undergoes when entering the second degree makes specific reference to the heliocentric theory: 'The sun being at the centre and the Earth revolving around the same on its own axis … the sun is always at the meridian with respect to Freemasonry.'20 Even in the mid-seventeenth century heliocentricity was still not fully accepted – and in Catholic countries was an outright heresy – so the Masons' emphasis is all the more telling.

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> A major component of the magical worldview hardwired into humanity is that specially trained individuals can enter into a state of communion with the gods in which they are given intensely practical information. This idea is also the basis of the Heliopolitan 'return journey', Neoplatonic theurgy, the Hermetic gnosis and the occult art of memory. Such communion is not to be understood as bestowing enlightenment in the Eastern sense of the ultimate goal being the achievement of a purely spiritual state – or at least not exclusively – but as providing an understanding of how the universe works in very practical ways. This practice can then be used to extend human knowledge and induce enlightenment in the western sense, as in the Age of Enlightenment. To judge the results of this communion

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> We saw in the story of the origins of the Royal Society the struggle between the Rosicrucian attitude and the new impersonal mechanistic experimental philosophy. There were good reasons for minimizing the influence of magic, even in Restoration England. A campaign to lose the esoteric gained favour in English academic circles, and this led those of an overt Rosicrucian or Hermetic bent to be branded sinister – and possibly satanic. In 1659 a work based on a hostile editing of John Dee's diaries, A True and Faithful Relation of What Passed for Many Years Between Dr John Dee … and Some Spirits, was published. Written by Méric Casaubon – Isaac's son, so keeping up the family tradition – it uncompromisingly painted Dee as a necromancer in league with the Devil. While it is true that with a dodgy clairvoyant named Edward Kelley, Dee had experimented over a number of years with communications with discarnate entities, they were allegedly angels rather than demons or spirits of the dead. But Casaubon Junior's book effectively trashed Dee's reputation for centuries and also cast suspicion on those who respected and worse, used, the good doctor's mathematical works. This was particularly unfortunate as, whatever one might think of Dee's esoteric studies, his was one of the greatest mathematical minds of all time. The move from the Hermetic studies of the Renaissance to what we recognize today as science, the great intellectual flagship for rationalism and mechanism and all other resolutely non-magicalisms, was the result of the occult philosophy splitting into two parts: the magical view of the universe and its application to the phenomena of nature. Basically the theory was junked in favour of the practice. It

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> Hermeticism survived in other, less expected ways. For example, Romantic poets such as Percy Bysshe Shelley and John Keats breathed Hermetic fire into their works as well as into their remarkably colourful and short lives. And the influential philosopher Georg Wilhelm Friedrich Hegel (1770–1831) – whose thinking inspired Karl Marx among others – was an unashamed Hermeticist. His writings, both published and unpublished, are packed with references to masters such as Bruno – whose brilliance was the subject of Hegel's lectures – and his library included books by Hermeticists and esotericists, including Agrippa and Paracelsus. Yet it took until 2001 for a study to acknowledge his Hermetic passion. Even then Glenn Alexander Magee's Hegel and the Hermetic Tradition was regarded as a radical new view. Many might think that although it is a shame that the old Hermetic influence on certain important historic names is neither properly nor widely recognized, surely the big split between magic and science turned out to be a good thing. After all, it allowed science to develop without the constraints of a metaphysical framework, leading to the explosion of discoveries and world-changing technologies such as steam trains, spinning jennys and telegraphy. Indeed, one could argue that Hermeticism was not necessary to make sense of this kind of scientific progress.

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> Attracted by the gravity of individual atoms, clouds of hydrogen and helium clump together, clumping faster and faster as they grow. The smaller the clumps, the hotter they become, until they are hot enough to kick-start nuclear reactions – and it is at this stage that a star is born, whose deadly beauty masks its true self, a gigantic fusion reactor. Acting as unimaginably massive factories that manufacture more complex elements from hydrogen and helium, stars then disperse these into space where they explode as supernovae. Every atom in every molecule, including those that make us up, was born in a star light years away, millions or billions of years ago, making even the tiniest newborn in some respects old beyond imagining. As the legendary American theoretical physicist Richard P. Feynman observed, 'the stars are of the same stuff as ourselves'.10 And as Paul Davies comments: The life cycle of stars provide just one example of the ingenious and seemingly contrived way in which the large-scale and small-scale aspects of physics are closely intertwined to produce complex variety in nature.11 But contrived and intertwined by whom or what? There are also many instances where a combination of factors has to work together to produce a bio-friendly outcome – almost as if knobs are being twiddled until the balance is exactly right. In his 1999 book Just Six Numbers, Bernard Carr explored six of the fundamental forces, or relationships between forces, on which the universe is built. He found that all of them are very finely balanced, and if they were just slightly smaller or larger they wouldn't produce a life-friendly universe. As he pointed out in 2008:

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> Perhaps the most astonishing example of fine-tuning comes from the most recent to be discovered. In order to describe it, we need to start from the apparently bizarre premise that there is no such thing as ‘empty’ space; even the interstellar vacuum is filled with ‘virtual particles’ that nevertheless possess energy. This has an effect on the rest of the universe, specifically on the rate at which it is expanding. In theory at least, the ‘vacuum energy’ has huge potential significance in terms of the anthropic principle. Some of the particles will be positive, some negative. If the sum total of all the vacuum energy were positive, then the expansion of the universe would be accelerating, and if it were above a certain value then the universe would have expanded too fast for galaxies to form – matter would fly apart faster than gravity could pull it together. On the other hand, if the vacuum energy were negative, the life cycle of the universe – from big bang to big crunch – would be too short for life to evolve. In practice, however, the presence of vacuum energy was not considered too important – at least until the 1990s. The rate of expansion was believed to be constant, neither accelerating nor decelerating, which meant that the vacuum energy played no part in the process. This, in turn, meant it must have a net value of zero – that is, all the energy in the vacuum was neatly balanced, the positive and negative particles cancelling each other out. Cosmologists had no idea why, but that’s what the data suggested. But in the mid-1990s this happy state of affairs suffered a major jolt, as independent research based on new, more accurate data from sources such as the Hubble Space Telescope showed that the rate of expansion is, in fact, speeding up. This means that the vacuum energy has a slight positive value, not all of which is cancelled out by the negative. It is only a tiny imbalance: calculations showed that the positive energy value is 10120 times (that’s 119 zeroes after the decimal point before you even get to the 1) less than the total positive energy in the vacuum. In other words, the negative energy cancels out all the positive – apart from a minute portion. Learned jaws were on the ground

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> According to the fans of this fashionable hypothesis, there are millions or billions, perhaps an infinite number, of universes, co-existing invisibly alongside our own, each governed by its own laws of physics. We just happen to live in one that happens to be bio-friendly. It may appear to have been custom-made for us, but as this universe is, by definition, one that will sustain our sort of life and the only one we can perceive, this is the only one we know about. The multiverse is a concept that turns the virtually impossible into the almost inevitable. To use the lottery analogy again, if your ticket automatically entered you into several million draws simultaneously, it would hardly be surprising if your numbers came up somewhere. The same logic dictates that by positing millions upon millions of universes, the odds that at least one would boast the right conditions for life are drastically shortened. The multiverse theory is the only alternative to design that remains within the bounds of scientific credibility and allows the anthropic conundrum to be debated without professional anxiety. Bernard Carr explains that physicists regard the multiverse hypothesis as the 'legitimization'17 of the anthropic principle. However, unfortunately for its many scientific fans, there are major problems with the multiverse. First, and surely the most damning, is that it is purely a theory with not a shred of solid data to back it up. There are three basic, competing models of the genesis of multiple universes that may keep physicists agog with debate and busy formulating mathematical models of how they might work, but this seems a hollow exercise as none of the models have the remotest hope of ever being proved. In fact, it is impossible to gather evidence because interaction between universes is by definition also impossible. On the other hand, multiverse theory can be used to predict certain features of this universe. But as American theoretical physicist Lee Smolin, founder of the Perimeter Institute for Theoretical Physics in Ontario, Canada, notes: Within the standard model of elementary-particle physics, there are constants that simply don't have the values we would expect them to have if they were chosen by random distribution among a population of possibly true universes … In fact, I know of no successful predictions that have been made by reasoning from a multiverse with a random distribution of laws.18 The theory also violates another highly-prized scientific principle, Occam's razor, expressed by the great twentieth-century physicist Sir James Jeans as, 'We must not assume the existence of any entity until we are compelled to do so',19 or, in other words, the simplest explanation is usually the best. As Paul Davies wryly comments: 'To invoke an infinity of other universes to explain one is surely carrying excess baggage to cosmic extremes.'20 The complete absence of evidence does

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> String theory – often called ‘superstring theory’ in a rather pitiable attempt to make it sound sexier – posits that instead of being single points, subatomic particles are all manifestations of a single type of vibrating one-dimensional string-like entity that expand and contract as they gain or lose energy. As they are beyond tiny, one-trillionth of a trillionth the size of an atom, obviously no one has ever seen one. They only definitely exist within the realm of mathematical formulae. String theory was formulated in the mid-1980s and was quickly recognized as the best hope for the physicists’ dream of a theory that would unify relativity and quantum theories, the grand unified theory or theory of everything. However, it rapidly moved in the opposite direction. As it failed to explain certain things, variations were suggested to account for them, and so every attempt to fix the initial problem ended with another variant of the basic theory – adding new excrescences to the equations. As the number of variations multiplied exponentially, creating new sub-theories, each with its own problems, attempts to fix those led to more variations. And so on. Physicists belonging to the old guard reacted with alarm. Richard Feynman declared: ‘I don’t like that for anything that disagrees with an experiment, they cook up an explanation – a fix-up to say, “Well, it still might be true.”’24 The numbers involved are literally beyond imagining. Based on the currently-understood value of certain cosmological parameters, when all the different variables are taken into account, there are around 10500 possible versions of string theory. That’s 1 followed by 500 zeroes – difficult enough to write down, let alone imagine – about six times the number of atoms calculated to exist in the observable universe. As Smolin points out:

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> In 1995 the term ‘M-theory’ was coined in an attempt to bring order to the chaos. M-theory simply means the single theory that is assumed to lie behind all the variations of string theory and which, once established, will reconcile them all. Although ‘M’ was chosen randomly – like labelling an unknown quantity ‘X’ – those to whom it is the ultimate answer have happily tied themselves in knots trying to work out what it means, suggesting it might stand for ‘magic’, ‘mystery’ or ‘mother’. Those who are undecided about its value suggest maybe it stands for ‘maybe’. Sceptics prefer ‘myth’. Despite the fact that M-theory is simply shorthand for a desperately needed, but currently non-existent solution to the complex problems posed by string theory, many physicists now solemnly make statements like ‘according to M-theory …’ In a seminal paper in 2002, Leonard Susskind

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> But if string theory finally and comprehensively falls, as it shows every sign of doing, then we will be left with Weinberg's reasonable inference that the presence of intelligent life is fundamental to explaining the universe. This would mean that science itself effectively provides overwhelming evidence for the designer universe, which of course means there must be a Grand Designer. We are often told that science is an evolving, self-correcting process, in which its laws and theories are never fixed but merely contingent, the best conclusions that can be drawn from the available data. It is also implicitly understood that future discoveries may completely overturn current thinking and lead to a revision of the theories. But when it comes to the anthropic principle this reasoning suddenly falls by the wayside. The best available data from physics – the hard facts it has amassed, which can then be tested experimentally and empirically – points unequivocally to a universe fine-tuned for intelligent life. However, the majority of scientists argue that one day we will have better data that will show this to be an illusion. But all their supporting 'evidence' is theoretical, speculative and untestable. We can imagine what would happen in any other field of human endeavour if someone admitted they had factual evidence pointing in one direction, but then declared they can think of a hypothetical reason why the opposite, which unfortunately is impossible to test, is true. Why

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> The scientific revolution, we are told, came about when thinkers realized that physical phenomena could best be explained in terms of mechanical processes and laws that are purely a consequence of the way the universe is – without presupposing the existence of a designing and guiding intelligence. However, as we saw in Part One, this is not the way the scientific revolution happened. All of its great figures – Copernicus, Kepler, Galileo, Newton, Leibniz – based their work on the understanding that the universe was intelligently created and that human intelligence plays a key part in its design and purpose. Bruno even anticipated the existence of other, more advanced extraterrestrial intelligences, which fits the strong anthropic principle even more neatly. None of them would have had any problems with the implications of the anthropic principle; they would have taken it for granted. And they certainly wouldn't have tied themselves in theoretical knots to evade the evidence staring them in the face. Opponents of design point out that the hypothesis is just as untestable as the multiverse theory. That is not the case. The hypothesis of creation by deity or deities unknown does allow for the formulation of testable predictions. What predictions? Simply, if the universe is designed for intelligent life then the more our understanding of physics advances, the more we will uncover evidence of such design. Which is, of course, exactly what has happened. The design hypothesis passes that test. A few scientists have at least been open to the notion of some form of design. Fred Hoyle proposed that the 'intelligent universe' (the title of his 1983 book) is a purposeful, creative entity evolving towards some specific end. Hoyle also scathingly dismissed the usual scientific response to the anthropic principle, calling it 'a modern attempt to evade all implications of purpose in the Universe, no matter how remarkable our environment turns out to be'.36 The most high-profile scientific advocate of the design idea now is Paul Davies, who summed his position up in The Mind of God (1992): Through my scientific work I have come to believe more and more strongly that the physical universe is put together with an ingenuity so astonishing that I cannot accept it merely as a brute fact.

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> However, perhaps oddly, the theory that suffers the most from the design interpretation of the anthropic principle is the traditional idea of God as creator, because it exposes the limitations of his divine power. The God of the Judeo-Christian religion, for example, created worlds from his will and word alone, and fashioned Adam out of clay and Eve from a rib bone. This was not metaphorical, but literal. After that particular tour de force tweaking the resonance of the helium nuclei or making a minor adjustment to the strength of the weak nuclear force in order to produce a man and woman millions of years later is something of an anticlimax. This is not properly understood (or perhaps it is, but evaded) by those representatives of organized religions who use the evidence for design in support of their own doctrines. We find ourselves in the unusual position of agreeing with a pope, John Paul II, in his 1985 statement that to dismiss the scientific evidence for design in the universe as being a simple coincidence 'would be to abdicate human intelligence'.38 But we profoundly disagree that such evidence supports the existence of the God of the Bible, and therefore of the Catholic Church. The Cardinal Archbishop of Vienna,

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> He is quite wrong: the evidence of design disproves the Catholic teachings about God, and it is disingenuous to pretend otherwise. However, the 'designer universe' concept does support the cosmology of the Hermetic tradition, as well as the Neoplatonists' and the Heliopolitan theology that we argue lay behind them. Paul Davies notes that the kind of designer suggested by the strong anthropic principle fits the model of the Demiurge – the lesser or, in the words of the Hermetica, 'second god', whose creative power is constrained by matter – rather than the omnipotent God of Judeo-Christian tradition.40 So in this respect at least, science supports the Hermetic tradition. At this point the exact nature of the designer isn't the most important consideration. If we have to use a term that doesn't commit us to any specific image, we suggest Grand Universal Designer – or the good GUD almighty. In this chapter we have only explored the conditions that made the universe ripe for life. If GUD exists, we should be able to see evidence of his or her hand elsewhere in nature, particularly in the emergence and development of intelligent life. On the other hand, other branches of science may utterly demolish poor old GUD by demonstrating conclusively that certain phenomena could only happen through the workings of pure chance and blind forces. But which way does it go? Chapter

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> There is a fundamental Catch-22 situation about the origin of life. In order to replicate, DNA requires certain proteins in the form of enzymes to act as a catalyst, but no protein can be produced without DNA in the first place. At present, there are only theories that seek to explain how this came about, which because of their very nature are untestable. In the mid-1980s a suggestion by British molecular biologist Graham Cairns-Smith that the earliest 'genes' evolved from clays attracted considerable interest. A current favourite is the 'RNA world' theory, which proposes that in the early stages, when only primitive single-celled organisms existed, life was based on RNA rather than DNA. We also mentioned earlier the PAH world hypothesis, according to which polycyclic aromatic hydrocarbons once predominated, leading to the development of RNA. However, although it makes sense that PAHs came first, were followed by RNA and then DNA, this theory is also rather vague. All of these hypotheses, naturally, assume that the process of development from ordinary chemicals to the fully-fledged genetic system was entirely due to blind chemical reactions and chance. But that's just an assumption, and it gets worse: there are only the vaguest ideas about exactly how this happened. As Christian de Duve comments in Life Evolving (2002):

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> Life, and therefore DNA, appears to have been here almost as soon as the planet had reached the right conditions. There seems suspiciously little time for it to have evolved through random events. And there is a further twist: DNA seems to have evolved twice. Until the 1970s it was thought that all life could be divided into two 'domains', depending on their type of cell. These were bacteria and the more complex 'eukaryotes' – everything that isn't bacteria, including all the really complex stuff such as animals and plants. Basically the eukaryotic cell has a nucleus, whereas the bacterial cell doesn't.

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> Most of the problems highlighted above would be solved if there were some way that natural selection could operate at the level of species, or even higher. Something that could see the big picture, in other words. But there is no place in neo-Darwinian theory for this. A species evolves because the individuals within it evolve. Natural selection does not work at the level of the species, or the gene, but the individual.39 We are told, with confidence edging into arrogance, that neo-Darwinism can explain everything in the biological world, and there's no need to invoke anything else. However, as we have seen, it totally fails to explain: The origin of life itself, specifically the origin of DNA. The appearance of the nucleated, eukaryotic cell without which multi-celled life would be impossible. (A 'special case', the result of a process outside the usual neo-Darwinian model.) The origin of sexual reproduction, another thing without which complex organisms couldn't evolve. (Another special case that required a non-Darwinian process.) Not to mention how sex caught on, given all its disadvantages. How ageing, the clearing out of the gene pool without which evolution couldn't advance, came into being. And – irony of ironies – Darwinism can't really explain exactly how species originate.

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> Besides divergent and convergent evolution adapting a species to its environment, there is a third option: no evolution at all, or stasis. Judging by the fossil record, some species – 'living fossils' as Darwin put it – have hardly changed over vast tracts of time, including sharks, crocodiles, horseshoe crabs and horsetail plants. According to Ernst Mayr: 'Some species are extraordinarily young, having originated only 2,000 to 10,000 years ago, while others have not changed visibly in 10 to 50 million years.'44 But why didn't the living fossils change even a tiny bit over such an extraordinary length of time, when most species quite clearly have? Unsurprisingly nobody knows for sure. It is often said that the non-changers are just perfectly adapted to their environment ('evolutionary complacent', as British comedian David Mitchell puts it), but this is simply putting too positive a gloss on it. The evolutionary explanation is rather that it is because these smug species are so finely attuned to their environment that the slightest change means they can't survive in their own little niche, so no changes ever get a chance to get going. They are trapped in an evolutionary dead end they can never break out of.

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> And there's no question that the conditions in which some of these living fossil species exist have changed dramatically during their existence. Fossil dragonflies from 325 million years ago look exactly the same as today's. Dragonflies are considered to be among the first, if not the first, insects – indeed, the first creatures – to develop flight. And they have carried on happily unchanged, seeing the rise and fall of the dinosaurs 230 to 65 million years ago, the appearance of mammals 190 million years ago and birds 150 million years ago.

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> Spiders with the ability to spin suspended webs to catch flying prey only appeared 200 million years ago. But dragonflies nevertheless survived throughout that time, and the appearance of those predators, without ever adapting. In other words, dragonflies 325 million years ago were fully adapted to life in the twenty-first century. This flatly contradicts the conventional notion of evolution being an ‘arms race’ between predators and prey. All these examples demonstrate that evolutionary theory is so flexible that it, too, has the ability to adapt itself to any given situation. If two species in similar environments are different, that’s divergent evolution; if they are the same, that’s convergent evolution; if a species hasn’t changed at all, that’s stasis. It’s all OK. It all fits. Actually it doesn’t, but it will have to. Nothing is as evolutionarily complacent as evolutionary theory itself.