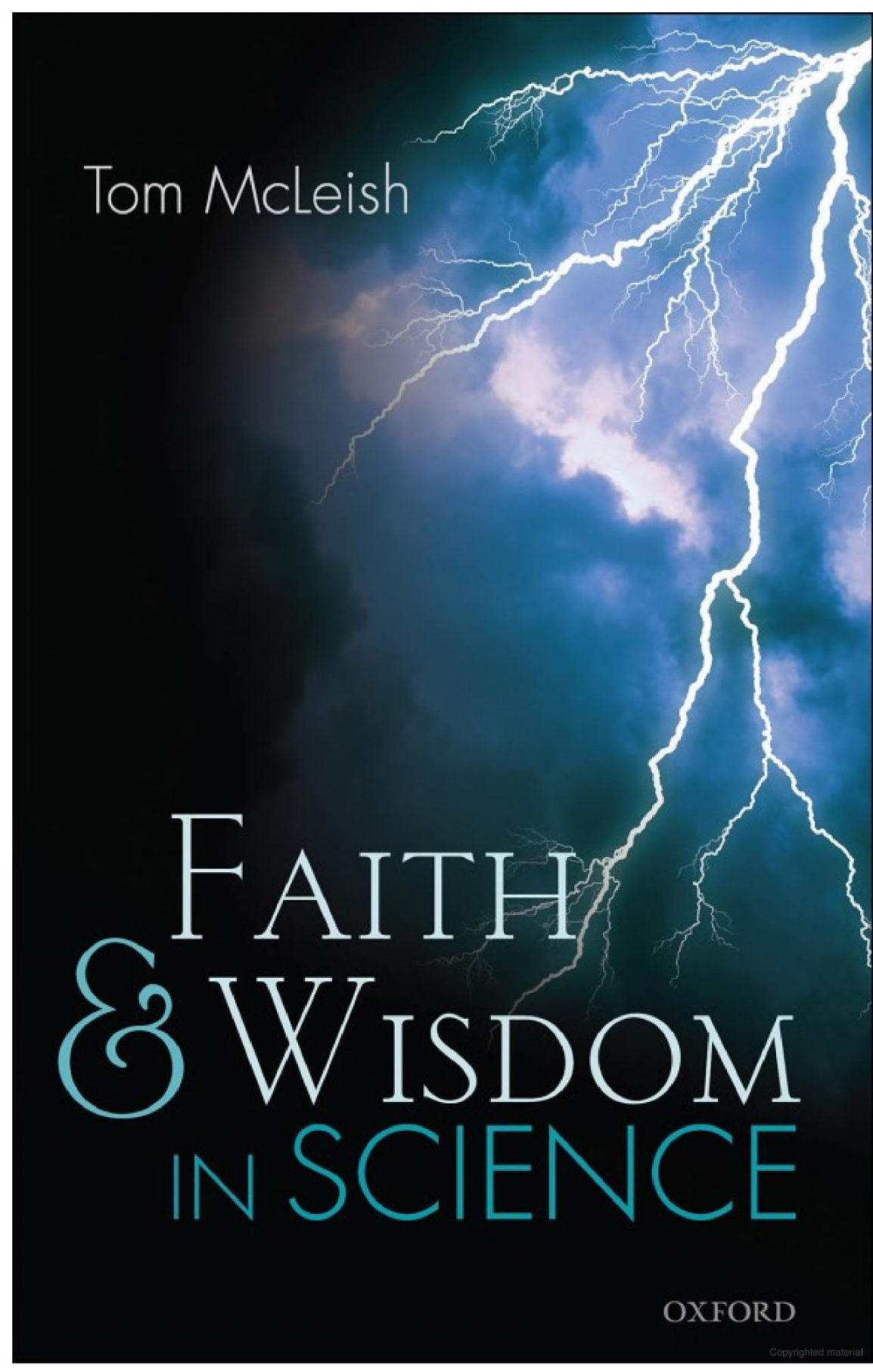

Contents

Introduction

Imagine a world, thankfully not our world, without any music. Well, in this sad, dull nightmare, something like music survives in a technical sense. There are, for example, experts in universities and conservatoires in this world who pursue at a professional level a rarefied academic subject called ‘sonology’ (the word ‘music’ went out of circulation about two centuries ago). Sonological research, according to government policy, is essential for the economic prosperity of the nation within an international community where sonological status is an important element in national prestige and trade negotiations. The skilled sonologists who carry it out would be the odd ones who excelled at high-school examinations in the difficult subject, and went on to teach it at higher level. They tended to become increasingly good at it by employing all the time in study and practice that their ‘normal’ colleagues spent playing sport and socialising. Oddly almost no members of parliament, or of the civil service—those responsible for government policy on sonology—actually studied it at a level beyond high-school themselves.

In addition to teaching students, some sonologists pursue incomprehensible research into the playing of a specialist instrument. Others produce manuscripts in the undecipherable hieroglyphs (undecipherable to ordinary people, that is) of sonological notation. These, the experts assure us, encode real pieces of sonological composition that the highly trained experts’ ears can make sense of at the academic conferences at which the rare performances are given.

Unskilled members of the public do not attend these performances. They do not have the technical background for it. There are some very good documentary programmes on television, however, that have a significant if small public following. These try to give some sense of what the compositions mean to the experts, explained in simple language and sometimes even playing the tune (when there is one), but leaving out the difficult harmony and counterpoint. There is some debate about whether playing just tunes on their own gives a misleading impression of real sonology, even a dangerously simplistic one. There is a school of thought that prefers to explain just the rhythm, but the viewing figures indicate that the level of arithmetic required to follow rhythm programmes puts people off. Tunes, misleading and oversimple though they are, do better. A highbrow public channel once tried broadcasting an entire movement of a full string quartet, but almost no one tuned in.

Current affairs and cultural programming take a different approach. Sonological items never compete with international or

national politics, or even ‘comprehensible’ art forms such as theatre or film. But towards the end of an hour’s serious radio or television, an interview with a sonologist can, it turns out, lighten the tone, providing no great technical concentration is demanded of viewers or listeners. The interviewer, fresh from a deep exploration of boundary rights on the Arctic Ocean floor, seems relieved to take on the easier task of dissuading the dear professor from humming a melody. The essential thing is to be reassured of the economic value to the nation of sonological research—not to be forced to listen to it.

Of course it was not always so in this strange world. Centuries ago music (as it was then called) was, as far as we can tell, a universal good enjoyed by villager, feudal lord and cloistered monk alike. Perhaps in more primitive form, but certainly pipes, drums, strings and whistles indicate musical practice in abundance from the Middle Ages into the Early Modern period. The church was a particularly strong supporter of music and musicians. The discovery of harmony of richer and richer kinds, the setting of ancient texts to music, and the writing of new ones, was central to the worship of the Christian church, and to other faiths as well. The psalms, prophets, history and wisdom books of the Old Testament of the Bible, and the records of the early church in the New Testament, all openly attest to the use of music in praise of God.

So it comes as something of a shock to find that, going into a church today, one finds no music at all. Use of it, then even talk of it, seems to have faded away during the nineteenth century (there had previously been a brief flirtation with the idea of an official ecclesiastical rejection of music during the English Commonwealth). Sonology seems to have become increasingly aligned with a philosophy that insisted on its incompatibility with religious faith and belief. For if humans are able now to create all the sounds that advanced instruments can make, and even write down all possible unheard sounds in sonological notation, what room could there be for a foolish belief that some sort of God was their creator? Not a few of the ‘chatting’ sort of current affairs media have learned that debates on ‘sonology against religion’ is a pretty safe bet for listening figures. It is very argumentative, fun to listen to entrenched positions and, as no one really knows much about either any more, fairly safe territory to broadcast on without any difficult homework.

There are a few voices, not much heard, that point out that all this is very sad—that empty concert halls, forgotten music radio stations, youth orchestras as a history book phenomenon mean that people are missing out on a rich cultural experience. Extreme opinions have it that anyone can enjoy sonology. A further strange claim is that one element of the community that might help here are the churches, if only they could rediscover the theological roots of the music they once breathed life into, and received life from. If only they might grasp the fundamentally healing religious purpose of sonology, the

glorious sound of a full-voiced choir, the old partnership of Faith and Wisdom in its very foundations. If only.…

It is high time to wake up from this nightmarish parable. A world where such a deeply human art as music is marginalised and desiccated to this degree is a profoundly sad one, even to contemplate. But readers will have guessed the topic of the parable. This is indeed our own world—the difference is that with us the problem is not with music but with science. If that sounds strange, then it does so for the same reasons that the suggestion that something was badly wrong with 'sonology' would sound equally odd within that miserable imaginary world.

Yet I want to suggest that science suffers from the same maladies. If it has been marginalised to the orbit of the nerdy expert (or to the media celebrity), if the subtle relationship between science and technology is still widely misunderstood, if urgent public debates on climate, food and disease are repeatedly twisted by misunderstanding of scientific knowledge, if there is no perception that in science there might be sources for contemplation, celebration or culture, then these are signs that we have forgotten the deep, human roots of our minds' search for a bridge into the natural world. We have, simply, forgotten its *story*, and how that story is caught up in the larger narratives of joy, pain, hope, faith and wisdom that make up our religious traditions and cultural heritage.

To unpick and explore the lost currents of faith and wisdom in science it will do no good to jump straight into any form of current 'science and religion' debate (any more than this would have worked in the parable world by looking up 'sonology' in that world's Bible—we, too, are troubled by the words we use). Instead we begin, in Chapter 1, just by listening to the debate's current ebb and flow, the shrill and not so shrill voices. A brief historical survey reminds us of the post-war optimism in an instrumentalist view of science, and the warnings of a nineteenth-century romantic fear of its potential destructive and dehumanising influence. Like the music-starved citizens on their own journey of rediscovery, we need to dig deep into an encounter with the human experiences of science and faith. Only then might we begin to discover what science is *for*.

So in Chapter 2 we try to get around the problems of the troubled associations of 'science' by exploring its older name: 'natural philosophy'. Then we take a journey backwards in time through examples of people 'loving wisdom about nature'. Modern, medieval and patristic examples of doing science by that older name suggest a close look at the biblical material with which their authors would have been familiar. This begins in Chapter 3, but, rather than start with Genesis, we survey the older creation stories of the 'wisdom' literature, and trace some common patterns in their structure and content.

For a scientist, the text that speaks loudest and resonates deepest is found, again not in the contested creation story of Genesis, but in the enigmatic 'book of Job'. So profound is this wisdom book, and so little studied in popular literature, that we spend a whole chapter on it (Chapter 5). Job deals honestly with the chaotic and disorderly phenomena in our world. So we prepare ourselves for the subject of chaos and incomprehension by a look, in Chapter 4, at some current themes in science that link to 'the storm' and 'the earthquake'.

In Chapter 6 our journey through the biblical material on the human relationship with physical creation takes us through the very much shorter time span of the New Testament record. Here, too, we find an infused creation theme, as well as the pain of its troubledness, and visit the only explicit reference in the Bible to the material world without a context of suffering.

Chapter 7 draws together the threads we now hold in our hands: the noise of our public debate, the long history of thinking about the physical world even before this was called 'science' and the biblical material itself. It outlines what a theology *of* science might look like. Finally some practical consequences are teased out in Chapter 8—with some surprises. Doing this sort of 'grass-roots theology' of science turns out not only to open up some creative solutions to our public tangles over science, but also to suggest radical ways of widely embracing its human, poetic, even holy, richness.

It may come as a surprise that the central chapters focus on the science of ignorance and chaos, rather than on cosmology or the mysteries of life, and on the biblical 'wisdom book' of Job, rather than the more familiar ground of Genesis. But people have always asked themselves seemingly unassailable questions—about the origin of the oceans, what animates living things, what causes change, why the stars shine.… I think that this is why scientists are so struck by the torrent of questions about the physical world in the 'Lord's answer' to Job. For one thing, finding the right questions in science, and the faith (there is no other word) that we are able to investigate them, matters so very much more than just finding answers. And *these* ancient questions in Job are full of the chaotic, unpredictable and wild elements of nature. They seem to tease our ignorance at first reading, but then increasingly to hold out the promise of a *story*, a future in which we might understand more than we do now, when our ignorance and fear will be replaced by knowledge and wisdom to use it. *'But where'*, cries a deep voice at the heart of the book of Job, *'where can Wisdom be found?'*

This book is part of one scientist's search for an answer to that question.

1

A Clamour of Voices

What comes to your mind when you hear the word ‘science’? I have played this word-association game with groups of all sorts from school lunchtime societies to local women’s groups and working men’s clubs. I ask for any images, associations or other words conjured up by the idea of science (while requesting that people suppress any unfit for public consumption). Reactions are revealing: ‘experiment’, ‘proof’, ‘difficult’, ‘boring’, ‘test-tube’ and ‘mad scientist’ have all cropped up. If the group does not have any special interest in science the immediate connections are often negative or impersonal. They can also be threatening. Confused and contradictory attitudes often come to light: ‘curing cancer’ is as likely to emerge as ‘atom bomb’. Applying the same game with ‘science’ replaced this time by ‘music’, ‘art’ or ‘song’ elicits very different responses—usually of individual people or personal experiences. The connections are closer, more coherent, more personal and easier to share. Other seed-words tend also to fall into these two classes: (i) those that generate a very mixed response with a clamour of different voices including the critical, the impersonal and hard-edged, on one hand, and (ii) those that attract warm and more coherent associations, tending more towards personal experience. We might call the first class of ideas ‘hard’ and the second ‘soft’. ‘Love’ reveals itself as a soft idea almost everywhere, yet, surprisingly, ‘Faith’ is another example of a hard idea. Like ‘science’, it flips contradictory switches: ‘trust’ and ‘belief’ get mixed with ‘blind faith’, ‘religion’, ‘extremism’. It triggers signals for widely opposing and highly charged themes in the minds of the group, from peaceful contemplation to fundamentalist-incited violence.

On a much larger canvas, the media both reflects and feeds (perhaps it also exploits) our mixed reactions to hard and soft ideas. Recently an annual television award for science programming was withheld by the judging panel because it deemed no programme produced that year to be of sufficient quality to merit it. The ‘entertainment’ value had been increasingly perceived by producers to lie in the projection of science as a threat, raising fears and playing to mistrust, rather than engaging viewers in the process of exploring ideas or discoveries. ‘Can we trust the scientists?’ is a common theme in panel discussions or documentaries. It is a vital question—

new infectious diseases and their treatments, our increasingly powerful control of genes in plants, animals and humans, the effect of technological growth on the Earth's climate—these concern us all. Science has become political. To combine two of the 'hard' ideas from the word-association game, 'faith in science', in the first straightforward sense of trusting the investment of people and resources to scientific research was particularly strong in the post-war decade. Here is Pandit Nehru, first prime minister of India:

> *It is science alone that can solve the problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people.*[1]

In the half-century since then we have learned that science may achieve astonishing things, but arguably without political will it is powerless on its own to achieve Nehru's dream. There is no technical reason why anyone in the world today should starve, go blind with cataracts, have no access to clean water or die of the many preventable diseases. Although science has delivered the knowledge to solve these problems, the wisdom to use it does not seem to come with the package. Even in 'developed' countries there is still no settled political sense of what science is for. In the UK there was no stated political definition of the reasons for state funding of research until the White Paper of 1993:

> *The mission of each research council has been changed to meet the needs of users and to support wealth creation … thereby enhancing the United Kingdom's competitiveness and quality of life.*[2]

We will see that this definition does little justice to the historical story of science. Very few of the great scientific discoveries would, at the time, have cleared the bar of meeting 'the needs of users' or supporting 'wealth creation'. The White Paper mission statement also implies a very common confusion of the *two* very different activities of science and *technology*. But it does project onto the public screen an idolised view of science—in the sense that it is our idols that we perceive will deliver our ideals. Successive administrations in the UK have built on, but not diminished, the political identification of material wealth with the chief justification of doing science. The pattern is similar in other developed nations with dedicated research budgets. Although there is a quiet and downplayed recognition of some value in knowledge for its own sake, even 'pure' science projects such as the particle physics laboratory CERN outside Geneva, Switzerland, are justified first in terms of their technological spin-outs, even when it discovers the

long-sought ‘Higgs boson’. The logical tensions are buried.

The last decade has witnessed at least a desire to engage a wider public in the political debate around science. Funded initiatives with titles such as ‘Public Engagement with Science’ by the research councils, and cross-over exhibitions like the Wellcome Foundation’s ‘Sci-Art’ are indicators of deep concerns that a public disengaged with science is politically dangerous. But can we sustain a reasoned and constructive debate when science itself appears on our public stage only in the alternate guises of entertainer and villain? Just listen to the change in voice-tone and attitude of Radio 4 current affairs presenters when they turn from interviewing a government minister to a ‘filler’ item with an astronomer on the discovery of a new planet. Radio producer and arts graduate Angela Tilby wrote in her book *Science and the Soul* from the perspective of someone with no background in science, yet attuned to the way it is projected:

> *Like priests in a former age, [scientists] seem to guard the key to knowledge, to have access to transcendent truths which the rest of us could never hope to understand. Many people feel that what they do is cut off from everyday life, that it is irrelevant and rather frightening, a form of magic.*[3]

The religious language Tilby employs here is all the more intriguing because the word-association game is played out on the larger canvas of the media when ‘faith’ is the subject. We are carried by the multiple meanings of ‘faith’ from the consideration of trust and reliability to all the religious connotations of the word. But in the media this happens on the media’s terms. Community service, contemporary theology and soup-kitchens do not sell newspaper copy, web-page hits or air-time. The threat of extremism, the debate on homosexuality in the church, the social and educational demands of religious groups and the politicisation of religious belief in the crucial power of the USA are all projected and amplified to much higher levels wherever we tune in.

Small wonder then that the noise of confused debate reaches new heights when the two ‘hard ideas’ of faith and science are brought together, especially when faith now carries its other, religious sense. The debate has become highly political in the sense that quite incompatible positions are held and advocated by people of ostensibly equal authority. One of the most astonishing scientific achievements of the early twenty-first century must be the Human Genome Project—the complete mapping of the DNA code of a human individual that opens a new era of understanding and of medicine. Nearly every one of the trillions of cells making up our bodies contains at its heart a copy of a string-like molecule (this is the DNA) about 2 m long but wrapped tightly into a space 10 000 times smaller than this full stop. Astonishingly, each single

molecular copy contains coded in the sequence of chemical 'letters' of the string—3 billion of them—the entire instruction set for the development and functioning of the individual. We have known this for over 50 years now. We have also known some of the possible consequences for new ways of doing medicine if the code were ever read, but the enormous task of extracting and cataloguing it was an unrealisable dream until the 1990s. By then technical advances motivated the launch of both public and privately funded projects to read every letter of the sequence of human DNA.

This 'Human Genome Project' became a controversial race between two teams, generating high publicity and raising a host of issues that questioned once more the faith we place in science and scientists. Should data describing most intimately the molecular detail of *us* become commercial secrets, would science be putting profit before benefit to humankind? The project eventually became a constructive collaboration between a private consortium led by Craig Venter and the publicly funded project directed by Francis Collins. It would be hard to suggest two individuals more qualified to comment on what today's frontier science means for human beings. The journalistic activity circulating around the Human Genome Project, its leaders and its questions of 'faith in science' never lost the opportunity of exploiting the easy linguistic leap to questions of (religious) 'Faith in science'. Perhaps this was made more natural by the sense that the human genome was somehow 'holy ground'—the secret 'words' that bring life to light. When interviewed in 2007 for a documentary on the future of genetic medicine, Venter was asked about religious belief: 'I do not think that you can be a true scientist and believe in supernatural explanations' was his considered yet clear response, firmly inviting no further question or offering any further comment. Yet Francis Collins has been quite open about his committed Christian belief: 'I can testify that coming to a knowledge of God's love and grace is empowering, not constraining', he wrote in his reasoned book explaining the faith of a scientist, *The Language of God*.[4] Collins sees no contradictions between his essentially traditional form of Christian faith and his equally full-blown scientific world-view. We are left bewildered that two equally informed and intelligent people can express views that at first sight strike us as irreconcilable. Is there an explanation for how these two views can coexist? How can we make up our minds which, if either, is nearer the truth?

Worse is to come, for Venter and Collins represent two of the more moderate voices in the escalating row over science and faith. The zoologist Richard Dawkins of the University of Oxford in the UK has been an outspoken critic of religion and a strong advocate of scientifically motivated atheism for over 30 years. His book *The God Delusion*[5] has poured considerable quantities of carefully extracted

oil onto the flames of the argument. His message is that religious faith closes minds, in direct opposition to the open enquiry of science:

> *I am against religion because it teaches us to be satisfied with not understanding the world.*

His colleague in Oxford's chemistry department, Peter Atkins, also a prolific writer of books on science for the general public, goes further. He advocates a view in which science trumps other ways of knowing:

> *Humanity should accept that science has eliminated the justification for believing in cosmic purpose, … science can illuminate moral and spiritual questions.*[6]

Like Venter, these two voices see religious faith directly competing with science while buying into a view of science itself that exalts it into a unique channel of knowledge about the world (some writers call this an 'epistemology'), including the world of minds and purpose. This claim is part of the reason for Angela Tilby's fear, implicitly comparing today's scientists with former 'gnostic' communities whose priesthoods claimed secret and exclusive routes to truth.

Of course Dawkins, Atkins and others who propose an exclusive role for science as our way of knowing find many equally extreme positions to tilt against within fundamentalist wings of religious traditions. It is one of the great social surprises of the twentieth century that, amid those very nations at the front of the enormous rise of knowledge of our universe's workings and their technological consequences, extremely doctrinaire forms of belief have grown rather than receded. Particularly in the USA there are many relatively mainstream Christian churches in which members are expected to reject an ancient origin for the world, and the gradual evolution of life forms on our planet, for a literal interpretation of one of the (many) creation stories in the Bible. Of course insistence that humans appeared suddenly a few days after the origin of the universe itself makes it impossible for anyone informed about the way we have arrived at our present view of the cosmos, let alone professional scientists, to take this view seriously. The fact that many manage to struggle on in churches like this reminds us of humankind's dangerous ability to live within contradictions. But it is not a happy existence, and it creates easy targets for the invective of those who see science and religion as mutually irreconcilable.

It is instructive for a European readership to see the extreme care that American scientists who are also believers feel they must take

when writing for their congregations. Francis Collins's book, which we glimpsed into above, contains an extended and gentle argument for evolution, treading so carefully through the topic that we suspect that he fears that at any moment his book will be hurled against the nearest wall by his reader, whether they be fundamentalist Christian or atheist. Listen carefully behind the words of another Christian biologist, Darrel Falk, who has written to his evangelical colleagues as one of their number about 'coming to peace with biology':

> *Let us not allow a particular interpretation of a tiny section of God's precious Word to become so central that it creates a gulf blocking the access of any individuals to the experience of God's love in the church. I almost missed out, so wide did the distance seem to me.*[7]

It is worth reminding ourselves that attempts to set up science and religion against each other as competing epistemologies are by no means recent phenomena. Thomas Paine, one of the intellectual fathers of the independence movement in eighteenth-century America, inveighed against what he perceived as the intellectual pretensions of religious faith. He chose to attack not the common religious practices of faith-based communities, but the academic field of theology:

> *The study of theology, as it stands in the Christian churches, is the study of nothing;*
>
> *it is founded on nothing; it rests on no principles; it proceeds by no authority;*
>
> *it has no data; it can demonstrate nothing; and it admits of no conclusion.*[8]

The background to a critique worded in terms such as these must of course be a pattern of disciplines that *do* study 'something', rest on founding principles, admit of (expert) authorities, collect data and make demonstrations of their conclusions. Paine did not have to be explicit: this is the pattern of the sciences of physics and chemistry that over the previous century had been successfully discovering mathematical laws of immense generality and power. Newton's theory of gravity described the motion of the planets and their moons with perfect precision; the new molecular ideas of matter had begun, in the hands of Boyle, Priestley and Lavoisier to explain chemistry and the behaviour of gases, liquids and solids. Venter, Dawkins and Atkins inherit a line of reasoning that gives the period that saw the rise of modern experimental science its name: the 'Enlightenment'—for what is illuminated if not darkness? Dawkins stands in two centuries of tradition when he echoes Paine:

> *What has 'theology' ever said that is of the smallest use to anybody? When has 'theology' ever said anything that is demonstrably true and is not obvious? What makes you think that 'theology' is a subject at all?*[9]

Whatever we might think of the benefits of theology, it is the implication behind this narrative that surfaces in Paine and Dawkins —that science is ***the*** 'subject', ***the*** route to all knowledge—that gives people like Tilby cause for concern. There has been a palpable move from an uneasy coexistence of science and theology to this, more aggressive and public stance in the last decade—writers who align with it have even acquired a label of the 'new atheists'[10] (others often grouped under this heading include Sam Harris, Daniel Dennett and Christopher Hitchens). Reading the corpus of these authors since 2001, it is hard to avoid the conclusion that much of the anger pushing the paragraphs along has been released by the '9/11' terrorist attacks on New York and Washington by Islamic extremists, and subsequent events. It is certainly true that new-atheistic arguments focus increasingly on the actions and statements of extreme (and in most cases unrepresentative) elements of religious faiths. Where Dawkins and Dennett work on the storyline that has science and religious faith at irreconcilable war, Harris and Hitchens focus on the political, cultural and psychological as a starting point:

> *There still remain four irreducible objections to religious faith: that it wholly misrepresents the origins of man and the cosmos, that because of this original error it manages to combine the maximum of servility with the maximum of solipsism, that it is both the result and the cause of dangerous sexual repression, and that it is ultimately grounded on wish-thinking.*[11]

Hitchens is in no doubt that religion is a moral evil, but his evidence —although powerful—is selective and anecdotal. Dennett launches, or re-launches, a call for an ambitious scientific project: thoroughgoing, evidence-based scientific evaluation of the benefits, or otherwise, of religious faith (there have been a number of selective psychological and statistical studies published on, for example, the lifespan of those with or without religious belief). He wants more—to understand religion using all the light that anthropology, psychology, neurology and sociology can throw upon it:

> *So here is the prescription I will make categorically and without reservation: Do more research.… My task was to demonstrate that there was enough reason to question the tradition of faith so that you could not in good conscience turn your back on the available or discoverable relevant facts.*[12]

This is intriguing—taking the bombast and rhetoric out of the conversation, Dennett coolly reminds us that there is no such thing as a 'boundary between science and religion', at least from the viewpoint of science, for its domain of explanation is no less than all that exists. We will have more to say on this later, especially on the question of whether one can support more than one epistemological framework that takes everything as its object. If science can illuminate everything, must it do so exclusively? This is certainly the 'scientistic' view of the new atheists and their movement.

There have been strong reactions to such claims that science is the unique route to knowledge. A persistent voice of caution comes from historians of thought, who remind us that behind all of our current assumptions there is a narrative—a story of ideas running through centuries and across languages and nations. Furthermore, the currents of narrative run in both directions—while our own thinking is influenced by the generations before, so we tend to colour our accounts of history retrospectively. We tell stories of the past in defence of our present positions. So an account of the seventeenth-century 'Enlightenment' from the perspective of twenty-first-century atheism tells a tale of a new and entirely secular empiricism banishing a theologically incarcerated scholasticism left over from the Middle Ages. Science becomes in this story a secular project from the outset—the laws of physics removing the need, for example, for the guiding hand of a Creator. John Hedley Brooke's persistent reminders of the historical evidence tell, however, a different story. He points out, for example, that the emergent mechanistic world-view became, for the seventeen-century thinker Mersenne and others, strong supporting evidence for divine cosmic carefulness.[13]

Furthermore, not a few of the central Enlightenment scientists were explicit in their framings of theological motivations for science. Johannes Kepler, Robert Boyle and Francis Bacon all in different ways saw their projects as answering a Christian call to light up, or even restore, the world. Peter Harrison[14] has argued strongly that the founders of the Royal Society perceived their task as winding back the darkening ignorance brought about by the 'Fall' (of Adam and Eve). He espouses a radical rethinking of the shift from medieval to early modern thought in regard to science:

> *Indeed, surprising as it may seem, what distinguishes seventeenth century discussions on knowledge from scholasticism is not their secular character but rather the fact that they tend to be more explicit in their reliance on the resources of revealed theology than their medieval equivalents.*

So Collins and Falk have historical precedence within modern science for their insistence that a religious commitment raises no necessary conflict with a scientific search for knowledge.

Interestingly the loudest voices in protest against scientistic approaches to knowledge come not from the religious traditions chiefly under attack, but from a much wider circle. Journalist Brian Appleyard sees great danger along the road of scientism:

> *The heartless truths of science … have depersonalized … dehumanized …, we need a humbling of science.*[15]

Voices like this—critical of science today—stand in just as long a tradition as those who would idolise it. The Romantic poets of the nineteenth century resonate with Appleyard's dismay. Take John Keats for example (in *Lamia*):

> *Do not all charms fly*
> *At the mere touch of cold philosophy?*
> *There was an awful rainbow once in heaven:*
> *We know her woof, her texture; she is given*
> *In the dull catalogue of common things.*
> *Philosophy will clip an angel's wings,*
> *Conquer all mysteries by rule and line,*
> *Empty the haunted air, and gnomed mine*
> *Unweave a rainbow.*

Here 'philosophy' stands for the ideas we would now label with 'science'—but we see clearly what impression they made on Keats. His world contains two classes of ideas: 'charms', which excite, delight and cause to wonder, whereas 'common things', which contain no mysteries for us, are all explained, all dull and all mathematised or geometrised. For Keats, science relentlessly moves everything from the first class to the second, it saps nature of all that touches the deeply human within us. He is even nostalgic for the ancient fears of ghosts that science dispels (he need not have worried, but was born more than a century too soon to be comforted by *The X-files*). Even though the existence of the rainbow, unlike that of ghosts or gnomes, is in no way doubted by a scientific explanation,[16] nevertheless that very mode of approach to the beautiful atmospheric phenomenon of refraction represents an 'unweaving' of a beautiful tapestry so that we can no more feel its texture. Only the threads that once made it up lie in a heap upon the floor. It is a dismal metaphor for science.

In visual form the romantic loathing of science as the great desiccator of art and imagination famously finds its greatest

expression in William Blake's painting of Newton bent double over a pair of dividers *at the bottom of the sea*.[17] So consuming is the scientist's act of measuring the dull details of the sandy floor that he never spares a moment to gaze upon the beauty and lustre all around. In more modern setting, the accusation that, in contrast to art, science somehow dehumanises us finds voice everywhere. We have already heard from Brian Appleyard. The artist Georges Braque is more specific:

> *Art is made to disturb. Science reassures. There is only one valuable thing in art:*
>
> *the thing you cannot explain.*[18]

Sometimes I am given the enjoyable opportunity to discuss with high-school groups aspects of their 'general studies' courses in the year before going to university. The differences between the arts and the sciences is a favourite topic; the brighter students who did not choose to study science at that level often explain that they felt that science offered no room for imagination or creativity—that scientific explanation deadens. The objection to science, let alone scientism, that it crushes the spirit of human creativity, and which has no apparent religious source at all, is very much still in circulation.

I do not want to address or defend any of these views at present, just to hear them. We will need to spend some time exploring what science is and what it is not before we can separate truth from impression, or ancient narrative from reasoned argument. Especially within the school educational setting, personal experience weighs heavily. When years spent not arriving at the answers in the back of a worn textbook can be contrasted with the fun to be had in a lively drama studio or mixed-media art class, who could blame a young Keats or Blake? The delightful, if frightening, confrontation with 'the thing you cannot explain' is a deeply human desire—but already those with some experience of the sciences might be wondering why someone like Braque has not realised that they, too, can be paths to this confrontation with the alien and unknown, and as such can be far from reassuring. In a remarkable book *Science, the Glorious Entertainer*, written in the 1960s, but not so well known now, Jacques Barzun touches a nerve that may lead to the source of science's apparent failure to deliver the confrontation with 'otherness' and the world of the imagination that the arts seem to be able to do. 'Science is not with us an object of contemplation' is his telling observation.[19] Perhaps Barzun is right—could I really stand absorbed and focused for half an hour gazing at the idea of an electron? It begins to become clearer why scientism draws such revulsion from so wide a circle of opinion: in spite of its attempt to direct its ammunition at the idea of faith in God, it has been

systematically perceived to be tilting at the idea of faith in humanity.

It is worth reminding ourselves that the tension between science and humanities is by no means confined to books, lecture halls and talk-channel radio. The problem of the impact of science on what it means to be human is currently hotly debated in the relatively new arena of public committees dedicated to ethical and regulatory research practice in medicine, agriculture and nanotechnology. It is not that the science is new, but that when science is applied to the deepest structures within human beings we find ourselves for the first time playing the double role of observers/manipulators and observed/altered. Our current confusion over where and what is 'human' has caused some unexpected decisions. A telling example is cited by Derek Burke, chairman of the UK's Advisory Committee on Novel Foods and Processes (1988–97). His committee was asked to evaluate the public acceptability of a technology to harvest drugs from the milk of genetically modified sheep. A section of DNA that codes for the desired molecule is inserted into the entire DNA of the animal in such a place that the drug would then be expressed in the animal's milk, from where it could be extracted straightforwardly. After the usual process of wide consultation a problem was found—not with the genetic modification as such, but because of the necessity that most such animals would also need to be farmed for meat for the process to be economically sustainable. For the new section of DNA is a copy of a tiny piece of the *human* genome. The committee concluded that a public abhorrence of eating anything that appears traceably human prevented adoption of the entire technology. Unofficially and euphemistically called the 'yuk factor', we find ourselves here coming into contact with a dark stream of fear that goes well beyond the protests of Keats.

Few would consider his friend Mary Shelley's novel *Frankenstein* within the first rank of English literary works, but for giving voice to a deep suspicion of science and for providing an icon to the horrors that might result from turning science onto ourselves, it is matchless. Jon Turney has charted the development of the idea in the century and a half since its creation in his *Frankenstein's Footsteps*.[20] He shows that the monster and its creator came rapidly not only to reflect a public view of science and scientists, but also to frame it for all subsequent generations (recall the 'mad scientist' response of our word-association game). The idea translates very easily between media, and tarnishes by association without debate—think of the opinion we are tempted to form automatically by reading the single tabloid heading 'Frankenstein foods'. The novel also placed implicitly before the public eye an opposition between those who write (and read) literature and those who experiment and theorise about fact. Most especially it threw into moral doubt those who crossed beyond the threshold of measuring nature to changing it.

Some of these confusing literary and social currents that swirl around the idea of science in the public mind resurface, even unconsciously, within a debate now two generations old in the English-speaking world. The idea that our society is structured around 'two cultures' (the artistic and the scientific) was brought into focus in a famous lecture and book by C.P. Snow.[21] Comparing the cultural standing of the works of Shakespeare with the second law of thermodynamics, Snow famously railed against the requirement of a 'cultured' person to know the first but not the second. The claim and the responses of the ensuing public debate, though they now look shallow, have left the legacy of a combative style that we now have to work harder to overcome. A strong echo of the debate resounded around the bitter exchange of books and articles in mainly academic circles during the 1990s that became known as the 'science wars'. Unleashed by the publication of a spoof article in a sociology journal written by physicist Alan Sokal, who was disenchanted with what he saw as meaningless pretensions of some disciplines within the humanities, it drew back the curtain on a clearly territorial battle on truth within our universities. Interestingly it also ignited fires in the French-speaking world (Sokal's later book *Impostures Intellectuelles*[22] was published first in French before an English translation appeared). To many scientists it was a shock to see to what extent they had failed to win any recognition from their academic colleagues in literature and philosophy—that their own 'faith in science' as a route to knowledge of the world was by no means an assumption shared universally across late twentieth-century campuses.

A deeper exploration of the fault-lines between scientific and artistic disciplines has been pursued over many years by the critic and writer George Steiner. One of his paradoxical criticisms of the arts is that they pretend to be sciences. Artists and writers have been mesmerised by the success of scientific research, and too keen to adopt in their academic communities the same customs and structures—this for Steiner turns our universities into 'secondary cities' where commentaries on commentaries are churned out in place of fresh new art. He imagines a 'primary city' where the only form of criticism allowed of a poem is another poem, of a novel another novel. Yet he claims that in the sciences:

> *Today, it is noon-time not in the arts but in the sciences. An estimated ninety percent of all scientists in history are now alive. Whereas the study of the humanities, the editions of the classics, the performance of established western music, … looks backward, science is, by very definition in forward motion.… In the theoretical or applied sciences, even a middling talent is on an upward escalator.… Theorems will be solved, crucial experiments performed, discoveries made*

next week and/or the week thereafter.[23]

Strangely, Steiner reacts to his observations of science in the opposite way to Braque or Blake (or to my disenchanted high-school students). When he looks from one 'culture' to the other he seems to see very green grass in the neighbour's garden—something very like the 'primary city' that he longs to regenerate within the humanities. Oh that it were true! Those of us who work within science know very well that the consequence of many relentless pressures—to publish, to be noticed in a way that contributes to the 'world class' status of our own institutions, to win more and bigger research grants than the university in the next city, not to mention the impoverished state of our own imaginations and insights—give Steiner's words a haunting hollowness. The reason that 'theorems will be solved … next week or the week thereafter' is largely that, if they are not, we lose the eternal race to the top. Perhaps it feels a little like the predicament of Scheherazade: every evening inventing another new story for her Sultan, for if ever the stories dry up she loses her head.

This is surely not what 'science is for'—but in Steiner's critique of the arts, and in his articulated longing for what they might do for people if they were set free from the self-referential treadmill, there is a remarkable clue: at one point he seems to look at the strangeness of the physical world around him with new eyes, and becomes almost frightened at the inhumanity—not of any sort of science or scientific process—but of the universe itself. There is a huge gulf between ourselves as living thinking beings and the unspeaking material forms around us. How should we bridge such a great divide? Steiner's answer comes as a surprise after all he has said before about the failure in his eyes of art to find its way: 'Only art can go some way towards making accessible, towards waking into some measure of communicability, the sheer inhuman otherness of matter …', he writes in his deeply felt discussion of meaning and language, *Real Presences*.[24] 'Only *art*'? To a scientist this comes as a shock—to me as a wake-up call to think what really motivates us at the deepest level to explore the world. If science is not there to establish lines of communication between our minds and the 'sheer inhuman otherness of matter', then what is it doing? Why does Steiner, so sensitive to our human need for some sort of reconciliation with our world, not see science as part of the answer when it surprises us over and over again with our ability to reveal the patterns beneath the things we see, hear, feel and touch by careful observation, imagination and theory? Perhaps in spite of his apparent familiarity with the competition-driven parade of the science community, he speaks for many people when he denies it a role in the inspired contemplation and recreation that he does see in art.

A remarkably similar, though more accessible, reaction to the

'otherness' of the world appears in author Bill Bryson's introduction to his excellent and entertaining history of science *A Short History of Nearly Everything*.[25] He relates the moment when, on a long aeroplane journey, he looked out of the window at some intricate cloud patterns and found himself wondering how and why they formed. This led to a chain of musings on natural phenomena and their causes—and the horrific realisation that he knew nothing about any of these things. He and Steiner use different words, but they speak of the same sort of divorce between ourselves and the world in which we are, paradoxically, so physically embodied. So began a second personal journey for Bryson into science, through extended conversations with people who lead research today in physics, biology, chemistry, astronomy and geology. He became fascinated by the history of science, and above all in a quest for understanding how we know the things we know. His delightfully human account resonates with Einstein's famous surprise that 'the most inexplicable thing about the universe is that it is explicable'.

A friend of mine who graduated in the languages is one of many without any science background who has found Bryson's book a doorway into a new way of feeling a little more at home in the world. This is very telling, because, as its scientific readers will aver, the substantive content of the science is not circumvented. While it may avoid using mathematics, the story does not sacrifice technical depth for the sake of a gripping pace—it manages to weave both together. Is there a clue in the self-realisation of the need to reconcile the human mind with the natural world that might nourish discussions between and within our fragmented world of arts and sciences? And if there is, might the depth at which this structure lies (deep enough to perceive commonalities of cultural purpose between physics and art, for example) also help disentangle some of the noisy debate around science and religion?

Turning once more to Steiner, we find the same concern that our post-modern world is somehow de-humanising us that we saw in the harsh critics of scientism. But in this case we also pick up the strands of someone in sympathy with the excitement of science and who claims at least a ringside seat at its current triumphs. He seems also to be at a safe distance from the confusion with religious faith—a post-holocaust Jew with impeccable humanist credentials. Yet there is a big surprise in store, for Steiner sets his whole discussion of our need for meaning, his fear that language has lost its connection to the physical world, within an explicitly religious referential world. The otherness, or inhumanity of matter, corresponds to a 'broken contract'—we have lost faith in the meaning of language in a way that mirrors our current loss of faith in science. In a 'post-modern' world where my reading of any text is as valid as yours, and carries no assumption about any meaning encoded by a 'writer', whether a writer of a book or a 'Writer' of the physical creation itself, there is

no need to risk anything, no need to trust, no need to put our faith in anything outside our personal worlds. His analysis that we have turned away, or are in danger of turning away, from an obligation to establish the ties of meaning between our minds and the world we inhabit sounds very like an Old Testament prophet warning Israel that it has rejected the Covenant Law that was supposed to guarantee it life. A greater shock awaits: for our present uncomfortable state of tension with our world has a history—and that history a shape that Steiner invokes an explicitly Christian image to convey. It is the shape of Easter, the shape of Friday, Saturday and Sunday. It is worth quoting in full his reasons:

> *There is one particular day in Western history about which neither historical record nor myth nor Scripture make report. It is a Saturday. And it has become the longest of days. We know of that Good Friday which Christianity holds to have been that of the Cross. But the non-Christian, the atheist, knows of it as well.… We know, ineluctably, of the pain, of the failure of love, of the solitude which are our history and private fate. We also know about Sunday. To the Christian, that day signifies an intimation … of resurrection.… If we are non-Christians or non-believers, we know of that Sunday in precisely analogous terms … the day of liberation from inhumanity and servitude.… The lineaments of that Sunday carry the name of hope.… But ours is the long day's journey of the Saturday. Between suffering, aloneness, unutterable waste on the one hand and the dream of liberation, of rebirth on the other. In the face … of the death of love which is Friday, even the greatest art and poetry are almost helpless. In the Utopia of the Sunday, the aesthetic will, presumably, no longer have logic or necessity. The apprehensions and figurations in the play of metaphysical imagining, in the poem and the music, which tell of pain and of hope, of the flesh which is said to taste of ash and the spirit which is said to have the savour of fire, are always Sabbatarian. They have risen out of an immensity of waiting which is that of man. Without them, how could we be patient?*[26]

The writer is by no means a signed up member of any church, but at the centre of our questions of loss of faith in the sciences, and of some scientists' rejection of faith altogether, he draws us back to a powerful story of faith—arguably the most powerful of all. The significance of the 'three-day story' is one we can all recognise within our own experiences, small or great. It has the status of 'myth', not in the sense that it is necessarily make-believe but in the definition of J.R.R. Tolkien—a story that we all know without knowing when we heard or read it[27] (I am reminded of C.S. Lewis's shocking description of the New Testament Easter events as the 'true

own through some science before we can tease out roles for faith, or even ‘Faith and wisdom’, in this highly emotive strand of our culture. What does it feel like to do science? We need to experience it through the work of thinkers both today and in past centuries, before we ought to talk much more about its purpose. Some rolling up of sleeves and ‘contemplation’ of science from within will also prepare us for resonances we will need to be sensitive to in reading wisdom literature from much older cultures.

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