Daniel Garber and Michael Ayers (eds)

The Cambridge History of Seventeenth Century Philosophy
2 vols. xvii + 1616 pp. hb. £90

The editors have drawn together a team of more than thirty specialists to produce this massive and impressive survey of seventeenth century philosophy. This two-volume work is a fitting sequel to the splendid single volume survey of sixteenth century philosophy edited by Charles Schmitt. The two projects are conceived in approximately the same spirit. As the editors explain in their introduction, they are guided by a mission to reform the teaching of the history of philosophy. They rightly point out that knowledge of seventeenth century philosophy (at least in the Anglo-Saxon world) tends to be limited to the selective reading of extracts from canonical works by a handful of those major figures credited with a contribution to current philosophy. The editors self-consciously set out to generate a more faithful historical account of the seventeenth century by extending their frame of reference to embrace the wider range of thinkers exerting substantial influence among their contemporaries. Also, the editors appreciate that philosophy in the seventeenth century was inseparable from the discourse of the natural sciences or theology, as for instance witnessed by the debates over such issues as action at a distance, the infinity of the universe, or the immortality of the human soul. All of these are treated with great sensitivity in this survey.

In outlining their liberal programme, the editors announce their intention to accord greater prominence to previously neglected figures. They specifically mention the English Catholic philosopher, Sir Kenelm Digby, in this context. Digby's Two Treatises: The Nature of Bodies, The Nature of Man's Soul (1644), is typical of the minor classics of philosophy that are brought to life in this volume.

The volume is organised thematically. More than half of the thirty-six chapters relate in some way to the theme of science and Christian belief. Of the seven major sections, one relates to God and another to Spirit. The very high quality of the contributions provides ample testimony to the vitality of research in this field. The articles are scholarly without being pedantic. The editors are therefore to be congratulated on the success of their liberalising mission. There are of course some disadvantages in the style of presentation adopted. The topical organisation makes it difficult to build up a picture of the beliefs of particular individuals, and it is virtually impossible to obtain an idea of the social organisation of knowledge with respect to particular universities, academies, or informal coteries of thinkers. Geographically, the coverage is strongest with respect to England and France, and noticeably thin on Italy, Spain, Germany and Central Europe. Consequently, the volume is less radical in its revisionism than might be expected at the outset. Experts on such areas as Neoscholasticism might well claim that the survey is still too much preoccupied with the great ancestral figures and predominant themes of modern philosophy. The minor players and ultimately discarded philosophical movements receive noticeably thin treatment. Consequently, Digby's contemporary, the famous Sir Thomas Browne and his great classic, Religio medici (1643), receive just one passing mention. Even influential innovators such as Johann Heinrich Alsted, Johann Valentin Andreae, Johann Heinrich Bisterfeld,
Giovanni Alfonso Borelli, Abraham von Franckenberg, or Johannes Marcus Marcell, are scarcely mentioned.

The editors accept that their scheme has tended to underplay the role of women in philosophy and their biographical appendices make some attempt to indicate the identity of women deserving of notice. Equally important, despite the attention to Henry More and Ralph Cudworth, the criteria of selection adopted tend to understate the role of such movements as Neoplatonism, Hermeticism, and Theosophy. However, there is one notable non-conformist, chapter fourteen, 'The Religious Background of Seventeenth Century Philosophy' written by Richard Popkin, which comprises a lively and idiosyncratic tour of the heretical fringes and brings into centre stage such figures as Menasseh ben Israel. The latter is characteristic of the figures who made a big mark at the time, but are now remembered only in specialist studies of Jewish mysticism. Abraham von Frankenberg was not alone in stating that Menasseh ben Israel had definitively unlocked the philosophical secrets of the sacred scriptures and other ancient sources and had thereby acted as a major channel of enlightenment for the philosophers of the seventeenth century.

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James M. Lattis

*Between Copernicus and Galileo: Christopher Clavius and the Collapse of Ptolemaic Cosmology*

University of Chicago Press, 1994, xix + 293 pp. pb. £17.95

While the names of Copernicus, Galileo and Descartes are familiar to those with a minimal knowledge of the history of science, that of Christopher Clavius is likely to have fewer resonances. Traditionally he has had a 'bit part' in the Galileo drama, as the Jesuit astronomer who at the very end of his life conceded that the Ptolemaic system, which he had steadfastly defended, would need modification in the light of Galileo's telescopic observations. Referring to Jupiter's moons and the phases of Venus, he exhorted astronomers 'to consider how the celestial orbs may be arranged in order to save these phenomena'. This cryptic remark, published in the last edition of his Commentary in the 'Sphere' of Sacrobosco, was seized by Copernican proselytes and turned into a story of death-bed repentance, the story of a Jesuit astronomer on the brink of embracing a heliocentric cosmology. In a detailed, well-illustrated and refined study of Clavius's career, James Lattis has greatly enriched our understanding of a mathematician and astronomer who, in his own day, was enormously respected. By carefully analysing successive editions of Clavius's *Sphaera*, he paints a vivid picture of the strains to which Ptolemaic astronomy was subjected during the second half of the sixteenth century. While helping us to understand how Clavius became a posthumous tool of the Copernicans, he argues persuasively that what Clavius meant by a rearrangement of the celestial orbs was merely some further modification of the Ptolemaic system.

Does this mean we can simply dismiss Clavius as a conservative thinker fighting a lost cause? Lattis is eloquent in his rebuttal of such an insensitive approach to history. To appreciate the Copernican transformation and its eventual success, it is vital to immerse oneself in the contrary arguments and their strengths as perceived by contemporaries. This is not, of course, an original point; but Lattis substantiates it by reminding us that Clavius was no also-ran. He was known as the Euclid of his day, his mathematical textbooks were extensively printed, he had a pivotal role in the Gregorian calendar reform and he established an enduring precedent for the cultivation and teaching of mathematical astronomy within the Jesuit College at Rome. He may have been the last important Ptolemaic astronomer but, as Lattis convincingly shows, he was no slave to dogmatism. Whilst
maintaining the disputed view that Ptolemy's astronomy was consistent with Aristotelian cosmology, he was willing to abandon the incorruptibility of the heavens in the light of the famous nova of 1572 and was even prepared to consider, pace Aristotle, that some comets might be generated in the eighth sphere. The fact that he adopted and adapted at least one of Copernicus's innovations (a precessional model for the motions of the fixed stars) simply confirms that labels such as 'conservative' and 'liberal' are too crude when appraising scientific theories. In this respect, Clavius is revealing on issues of epistemology because he shared with Kepler and Galileo the seminal conviction that through mathematical analysis one could uncover the real motions of the heavenly bodies — a stronger claim than the instrumentalist gloss often placed on the Ptolemaic devices.

For those wishing to acquaint themselves with the Western astronomy prior to Galileo, this book would make an excellent introduction. It has the merit of revealing the diversity of astronomical views among Roman Jesuit scholars by the early years of the seventeenth century. It also makes the nice historiographical point that Clavius's defence of Ptolemy should not be seen primarily as a defence against Copernicus, whose thesis of the earth's combined motions he found unacceptable for the multiplicity of physical, philosophical and biblical reasons. As Lattis shows, Clavius had to contend with at least two other alternatives — the homocentric theory of antiquity, represented by Fracastoro, but which was vitiated by an inability to explain variation in planetary brightness; and the idea that heavenly bodies, far from being carried around on solid shells as Clavius believed, were allegedly moving through a continuous fluid. This latter view became more plausible following the cometary observations of Tycho Brahe, but was itself open to censure if it carried the implication that the planets were as unconstrained in their motions as birds in the air or fish in the sea. As Clavius protested, if planets did not move as a result of the motions of their orbs, 'then we can have no certain knowledge about those motions'. Here we learn the fascinating fact that one of the major players in the Galileo affair, Cardinal Bellarmine, favoured this rival concept of heavenly fluidity, confirming yet again a willingness on the part of influential Jesuits to depart from Aristotelian norms and a lack of unanimity among them.

In short, Lattis has written a rewarding book — one that also reminds us how deeply a Christian vision of the cosmos had been grounded in a geocentric base. For Clavius, an immobile empyrean heaven had a physical location beyond the outermost sphere, human reason could comprehend the cosmic geography, the divine will need not be constrained by a principle of parsimony and God might even have created other worlds, though had not done so. In textbook accounts of the Copernican revolution, it is still often said that humankind was diminished in stature once displaced from the centre of creation. Scholars better acquainted with the primary sources know that it was never that simple. In becoming a planet the earth was promoted into the celestial region where all had once been perfect and incorruptible. Clavius emerges as another of those critics of Copernicus for whom such a promotion violated what Lattis describes as a 'deep prejudice concerning humanity's lowly status'.

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Fraser Watts (ed.)
Science Meets Faith: Theology and Science in Conversation
ISBN 0-281-05112-7

Watts has combined four 1996 Gresham Lectures with a later lecture-series given at his own church in Cambridge. Five of the contributions (by Polkinghorne, Alan Cook, Derek Burke, d'Aquili and Newberg, and Watts himself) start from science.
seeking to assess how theology can be seen in juxtaposition to a single scientific subject. The three lectures in the second half of the book – by John Bowker, Mary Hesse, and Dan Hardy – look beyond individual conversations to the overall impact of different types of narrative, scientific and theological, on our understanding of the world.

What is surprising about the book is the range of sophistication presumed in the reader. Watts’ introduction, and the first four chapters, serve as very accessible introductions to the significant territory between science and religion on the one hand and creationism on the other. Generally they are very helpful. Parts of Cook’s chapter, however, on the ‘Uncertainties of Science’ generated by relativity, quantum mechanics and chaos theory, seem unnecessarily technical scientifically and questionable theologically. He is right to point out that the unfortunately-named ‘chaos’ theory does not do away with Laplace’s calculator, and does indeed make more predictable certain types of events which might in the past have seemed like chance, or providence. But the mathematics of chaos do have other epistemological implications more favourable to their interaction with theology, in giving reasons for the non-reducibility of complex systems, and even possible insights into top-down causation. And a statement like: ‘God could have established the conditions that led to the evolution of sentient creatures, but could not have ensured that it happened’ (38) needed a great deal more theological justification.

D'Aquili and Newberg seem to presuppose considerable technical background in mapping out their theory of the neuro-psychology of religion as involving the combination of two ‘operators’ in the brain. Their chapter certainly represents a leap in complexity from Watts’ own lucid essay on ‘Brain, Mind and Soul’. There is little, however, in the first half of the book to stretch a reader familiar with the science-and-religion literature.

But there is plenty in the last three essays. Here are pithy and important analyses. Bowker points out that the most important issue between science and religion has been not the truth of certain propositions, but power. Hesse’s theme is that religion has always been intimately concerned with the questions ‘What should we do?’ and ‘What can we hope for?’. Sciences operate by their own internal answers to these questions, but they cannot develop the authority to solve the questions more generally without giving rise to overarching models and metaphors (such as the universe as finely-tuned machine, or the human as organic information-processing system). These models and metaphors are then as subject to question as any religious myth.

It is Hardy’s essay on wisdom which is the book’s most exciting and important element. He wants to renew a sense of the links between truth and goodness – a sense of the world, ourselves and God in an ongoing relationship which we need to think about both as it is and as it should be. It is worship, he says, which opens us up to new understanding and new participation. This is a rich vein of exploration. Whoever taps it will need to think carefully about what constitutes wisdom in the practice and application of science, and use words like ‘energy’ more carefully than Hardy does. But his scheme seems to offer a glimpse of a dynamic and trinitarian theology in conversation with science, a glimpse which deserves vigorous and prayerful investigation.

There are, then, many things of value in this book for very many different readers, though few will respond equally to every chapter.

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Ian Barbour

Religion and Science: Historical and Contemporary Issues
ISBN 0-334-02721-7

This is a welcome expansion and revision of Ian Barbour’s, Religion in an Age of Science. The major additions consist of three chapters, which form Part One of the book. These deal with physics and metaphysics in the seventeenth century, nature and God in the eighteenth century, and biology and theology in the nineteenth century. Part Two concerns ‘Ways of Relating Science and Religion’, and deals with Barbour’s well known typologies of Conflict, Independence, Dialogue and Integration. It continues with a discussion of models and paradigms, and concludes with a look at the similarities and differences between science and religion. Part Three examines ‘Religion and the Theories of Science’. Under the section on ‘Physics and Metaphysics’ he has added a section on ‘Order and Complexity’ to his discussion of Quantum Theory and Relativity. The next chapter deals with the Big Bang, creation in Judaism and Christianity, design, chance and necessity and the theological implications of all of this. ‘Evolution and Continuing Creation’ is next on the menu, with an outline of evolutionary theories, a look at hierarchies of levels and more on theological implications. Part Four discusses human nature in the light of both our biological and cultural history and relevant religious insights. He devotes 24 pages to Process Thought, and ends with a discussion of the alternative theological models and paradigms available to us to integrate as best we can the sum of knowledge and insight at our disposal. Readers familiar with Barbour’s work will not be surprised at his advocacy of Process theology as the best of the alternatives on offer. The book has comprehensive end-notes, a short but helpful glossary, an Index of Names and an Index of Selected Topics. Regrettably there is no Bibliography. To the credit of the author and the publishers, I could not find a single typographical error anywhere!

There is no doubt that this is a very fine book. It has both the clarity and structure of a textbook on the field. As such it has no comparable rival for scope and accessibility that I know of, with the possible exception of the excellent Routledge collection of essays entitled Religion and Science: History, Method, Dialogue, for which Barbour wrote a foreword! Thus it will be widely used as the backbone of many courses in Religion and Science, and referred to often by both students and teachers. The publisher’s claim that it is ‘a definitive contemporary discussion’ is for once about right. But it should not be treated as the last word, and there are one or two areas where Barbour’s own well-argued position might cause the unwary to think he is portraying a majority reading of the evidence, or indeed the best view. I suspect I am not alone in wanting to take issue on a few matters, but the critical remarks are in the context of an awesome catalogue of pages where I find myself not only nodding in agreement, but also in delight at the lucid expression of yet another facet of this intriguing dialogue.

However, I do think that Barbour’s conclusions are often prefigured in decisions he makes about the importance of certain themes. He is clearly anxious to take pluralism seriously (155). What he need not do, however, is dilute the importance of different claims to truth in different religious traditions. His fondness for Hick and Knitter’s approaches to the problem underplays the importance of, for example, degrees of absolutism embedded in the self-understanding of members of a number of religions. His revisionist tendencies, which to my mind do not always sit well with his advocacy of critical realism, tend to recast the worth of religion in functionalist terms – ‘does it make me a better person?’ He is either unaware of, or chooses not to engage with, critiques of these positions, for example those of Gavin D’Costa or Don Carson. A more honest proposal probably entails the need to argue from within a given position that this or that religious truth claim is simply false.
My second criticism would be that there is a clearly advertised theme running through the book, that the best way to grapple with all of the issues is to opt for Process Thought. This, I suspect, has shaped to a degree the selection of topics and their treatment. A case in point would be the rather surprising lack of engagement with the question of miracles. At times one gets the impression that God simply doesn't get involved in this area: not least because God is characterised as one whose laws of nature are a constraint on his action. Rather than being, 'God's normal habits', they become almost binding regularities that once established cannot be broken, even by their author. Nowhere did I find a discussion of the difference between what we call 'Laws of Nature' and what is in fact the actual behaviour of God or the cosmos, which may include so called violations of the normal regularities. Not that 'miracles' as a category is restricted to this understanding alone. This would be a perfectly laudable case study in our use of models in understanding the world and God's action in it. Elsewhere in the theological dimensions of Process speculation there is little about the Incarnation and Resurrection. For Christians these are pivotal events in history and have traditionally been understood within a Trinitarian theology, which I would argue can adapt itself to the insights of an evolutionary understanding and the rediscovery of the importance of immanence and possibility in God's dealings with us. It may be possible to use a great deal of the apparatus of Process thought to stimulate our search for a better understanding, but at present Barbour's treatment seems to me to lose a grip of central affirmations of credal orthodoxy which do make metaphysical claims contrary to those that are embedded in Process theology. Two key points where I think he deviates from a more traditional theology are denying creatio ex nihilo and under-emphasising the transcendence and omnipotence of a Trinitarian God in his particular resolution of the tensions in affirming the both/and of transcendence/immanence and omnipotence/kenosis. But this is for ongoing debate, and he has done a splendid job of trying to articulate a position which he humbly and generously offers, mindful of the danger of idolatrous use of models and recognising the limited and provisional nature of all of our models of reality (332).

These criticisms aside, this is a magnificent volume. It abounds with engaging observations and enthusiastic advocacy. Barbour drops in delightful references, such as the one from Suchcki to sin as a 'violation of relatedness' (270/299). He coins what I take to be the neologism of 'mechanomorphic' to describe the attempt to describe everything in terms of physics and chemistry. He has clearly listened carefully and respectfully to just about everyone who has written about science and religion. Throughout, Barbour defends a critical realism with enormous scope, measured judgement and scholarly fairness. It would have been interesting to see him engage with Philip Clayton's recent 1997 book on 'God and Contemporary Science' which deals with some of the more theologically exploratory themes in a constructive, and to my mind, more persuasive way. Now that he has retired from Carleton College, I hope that Ian Barbour will continue to write. I for one owe him an enormous debt over the years, not least when rare points of disagreement result in deeper thought and more careful reflection.

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J.M. Templeton & K.S. Giniger (eds.)

Spiritual Evolution: Scientists Discuss Their Beliefs
Templeton Foundation Press. 1998.
136 + viii pp. hb. $18.95.
ISBN 1-890151-16-5

This is a collection of ten personal essays by distinguished scientists describing their

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spiritual journeys. The contributors come from Australia, England, Germany and the United States. They represent quite a wide spectrum of the sciences: astronomy, biology, chemistry, genetics, medicine and physics. Most are members of mainstream Christian churches, from Quaker to Roman Catholic and Anabaptist to Anglican. The editors say that they were unable to find any fundamentalist Christians or non-Christian scientists willing to participate. Notable by their absence from the book are mainstream evangelical Christians (not at all the same thing as fundamentalists), of whom there are a good number among distinguished scientists – as can be seen in Real Science, Real Faith edited by Prof. R.J. Berry.

None of the contributors has had a dramatic conversion experience. This seems to surprise the editors, who comment that ‘The standard description of arrival at believing is a dramatic one’ (vii) and appeal to the conversion of St. Paul on the road to Damascus. They seem unaware that even in the book of Acts this way of coming to belief is rare. Both Christian history and church life today confirm that picture.

This reader found the book fascinating reading, to the point of being reluctant to put it down. The contributors write with an engaging candour about their spiritual journey, and the stories are very varied. Occasionally I was surprised at a writer’s lack of clarity of thought, such as when Jocelyn Bell Burnell says that she is not sure that God is creator of the universe because it seems to have ‘evolved by itself, without the active participation of God’ (23) and because she rejects a ‘God-of-the-gaps theolgy’. She seems unaware that classical Christian theism provides the middle road, belief in a God who is constantly upholding the universe and is at work in and through its ‘natural processes’. Stanley Jaki’s tendency to ‘axe-grind’ was irritating, though his is the most heavyweight contribution. However, in most cases, even when I disagreed with a good deal of what the writer said, I was left feeling that this was a person I would like to meet and talk with at length about how they relate their faith to their science.

There are many phrases in the book that stuck in the mind. Some were humorous, like Arthur Peacock’s comment, ‘I was brought up in a typical Church of England household-typical in the sense that the established Church of England was the church my family stayed away from, except for baptisms, weddings and funerals’ (102). Some beautifully encapsulated important truths, such as Larry Dussey’s recognition ‘that science does not have a God meter; that everything that counts cannot be counted; that some areas of existence lie, in principle, beyond science and are off limits to the dissections of the intellect’. Some were spiritually nourishing, such as the prayer of Sir Thomas Browne, quoted by Arthur Peacocke, ‘Teach my endeavors so thy works to read. That learning them, in thee I may proceed’ (11.2).

This is a book that is both enjoyable and profitable reading.

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Christian de Duve
Vital Dust: Life as a Cosmic Imperative
Basic Books (HarperCollins) 1995

Steven J. Dick
The Biological Universe
Cambridge University Press 1996
xvi + 578 pp. ISBN 0-521-34326-7

Tim Radford, the science correspondent of The Guardian stated, in a review of Paul Davies’ latest book, The Fifth Miracle, ‘The word “miracle” is derived from the Latin miraculum, a thing to be wondered at. In that sense there are a lot of miracles about. One of them is that life happened at all. The universe is quite good at making organic chemicals. Comets distribute
hydrogen cyanide . . . and stars seem to manufacture alcohol, and formaldehyde and even water . . . So the hardware for proteins and even DNA is everywhere. But the next act of faith is a little trickier: you have to believe that somehow this hardware then made the software that turned organic molecules into systems that learn to feed, defend and reproduce themselves. It is, says Davies, like trying to explain how a kite could turn itself into a radio controlled aircraft.'

This quotation sums up the subject of the first of the books reviewed here. Christian de Duve is a distinguished cell biologist, a Nobel Laureate, who at the end of a long and successful career, has written Vital Dust as a kind of personal pilgrimage towards understanding the meaning and purpose of the universe. There is no doubt that the book is a major personal achievement, bringing about a synthesis of chemistry and many different branches of biology, and for that achievement the author is to be commended. The book is divided into seven sections that represent de Duve's analysis of the development of life over the past four thousand million years: 1. The age of chemistry; 2. the age of information; 3. the age of protocell; 4. the age of the single cell; 5. the age of multicellular organisms; 6. the age of the mind; 7. the age of the unknown. With such a comprehensive coverage – and it is certainly that – it is not possible to deal with the book in detail.

The author's main idea which runs like a thread through the text is that, given the chemistry of the universe, life was bound to arise. Thus, in the preface he states 'a lesson from the age of chemistry is that life is the product of deterministic forces. Life was bound to arise under the prevailing conditions, and it will arise similarly wherever and whenever the same conditions obtain. There is hardly any room for "lucky accidents" in the gradual, multistep process whereby life originated'. Having said that, he rejects 'vitalism' but nevertheless endows natural selection/evolution with purpose. Thus, natural selection was 'prudent', 'played with' or 'experimented with' different life-forms, was 'led by the vagaries of mutation to experience the virtues and drawbacks of . . .' and 'natural selection . . . pronounced the final verdict.' His attitude to religion is ambivalent. He clearly has some respect for thinking people who have a religious faith, but his (mis)understanding of the Christian doctrine of a creator God is one of a God-of-the-gaps and his view of miracles is that they are either fables or phenomena that we do not at present understand. Nevertheless, de Duve is anxious to find meaning and purpose. The last two sections of the book are especially relevant here. One of the themes in The age of the mind is the evolution of human society and of ethical values. He discusses at some length the sociobiology of E.O. Wilson but for himself rejects any form of reductionism which implies a lack of free will and moral responsibility. In The age of the future, there is discussion about the impact of human activity on life on earth, speculation about the next five billion (USA usage) years and a chapter devoted to the meaning of life. In this, the author compares the philosophies of Teilhard de Chardin and Jaques Monod. He disagrees with Jaques Monod that we are alone in the universe: 'To Monod's famous sentence "The universe was not pregnant with life, nor biosphere with man." I reply: You are wrong. They were.' This leads de Duve to a sympathetic (but in my view inaccurate) analysis of Teilhard's particular form of pantheism. De Duve's own (slightly confused and confusing) position is best summed up in the following quotation from the end of the book. 'If the universe is not meaningless, what is its meaning? For me, this meaning is to be found in the structure of the universe, which happens to be such as to produce thought by way of life and mind. Thought, in turn, is a faculty whereby the universe can reflect upon itself, discover its own structure, and apprehend such immanent entities as truth, beauty, goodness and love. Such is the meaning of the universe as I see it. What is important in this view is not absolute truth, probably inaccessible at our level of development,
but the search for truth. In the same way, there is no absolute beauty but a shared yearning for beauty: no absolute good, but a shared striving after goodness."

De Duve's view that, given the chemistry of the universe, life was inevitable, leads him to accept that intelligent life must exist on other planets in distant galaxies. Tim Radford's is again relevant: 'To believe in intelligent extra-terrestrial life you have to make an act of faith. You have to believe that because something so far inexplicable happened on Earth, it must have been possible elsewhere. This does not seem such a leap of the imagination: this planet orbits a very ordinary star and there are at least 100 billion stars in this galaxy, and maybe 100 billion galaxies. But it is an act of faith all the same: after all, we have no direct evidence that any planet similar to our own exists, and so far no way of getting any such evidence. If you believe that life is a unique event, a journey into sentience that quite possibly happened only on earth, out of chemical chaos by a series of improbable happenings, then you are also making an act of faith.' This leads me to consider Dick's book, The Biological Universe.

The Biological Universe is about humankind's fascination with the idea of extra-terrestrial life and the search for its existence. The book is divided into eleven sections: the titles of which convey the flavour of the text and the various ways in which the author deals with the topic. These sections are: 1. From the physical world to the biological universe: Democritus to Lowell; 2. Plurality of worlds and the decline of anthropocentrism; 3. Life in the solar system: the limits of observation; 4. Planetary systems: the limits of theory; 5. Extra-terrestrials in literature and the arts: the role of imagination; 6. The UFO controversy and the extra-terrestrial hypothesis; 7. The origin and evolution of life in the extraterrestrial context; 8. SETI: the search for extraterrestrial intelligence; 9. The convergence of disciplines: birth of a new science; 10. The meaning of life: implications of extra-terrestrial intelligence; 11. Summary and conclusions: the biological universe and the limits of science. Dealing with the subject in this way has led inevitably to some overlap and repetition between chapters. Nevertheless, there is a lot here to take in and once again I can only select a few topics for discussions.

Perhaps the most obvious theme is that humankind has been fascinated with the idea of life on other worlds right from the time when it was realised that there might be other worlds. The section on extraterrestrial life in literature and the arts gives an insight into the adoption of the idea right across society. Dick analyses the way in which individual writers portray aliens. His analysis includes authors such as Verne, Wells, C.S. Lewis, Bradbury and Clarke (but surprisingly not Douglas Adams, whose 5-volume Hitchhiker's Guide 'trilogy' has cult status in the UK) and films ranging from early classics including The Thing via 2001 A Space Odyssey, Star Wars, Close Encounters of the Third Kind, ET through to Alien III. In this analysis of literature and films we see portrayals of aliens of many different types, including the hostile and entirely other, the sinister, the benign, the friendly and the messenger from the gods (or even from God).

In the chapters on the scientific search for extraterrestrial life we can see the intermingling of science and politics which influenced the allocation of large sums of public money to this venture (especially in the USA) with the search becoming ever more desperate. I was particularly charmed by the glimpses of the scientists themselves and their commitment to the project. One indication of their humanity is the reference to possible planets orbiting sun-like stars as 'companions' as if the star would be lonely without them! Finally, however, the author admits, in the section on limits to science, that given the size of the universe, we may never know for sure that life exists other than on earth. Dick himself is, like de Duve, convinced that there must be life out there but he states it rather less overtly than de Duve. He recognises that human endeavor may not be sufficient to prove
the hypothesis but still holds out the hope that the evidence may come from the aliens themselves, perhaps because they have overcome the limitations which we mere humans are bound by. Indeed, Dick appears to assume that any alien with whom we make contact will be a 'superior being' (see below).

In several sections of the book, the author discusses the relationship between views on extra-terrestrial life and religious faith; this is especially so in a chapter entitled Astrotheology in the section on The meaning of life. Christianity is discussed quite objectively; Dick mentions in this chapter and elsewhere in the text that some Christian writers have rejected the possibility of life on other planets because, firstly, they believe that God could only deal with other intelligent life-forms in the same way as he has dealt with human-kind, and secondly, that this would mean Jesus Christ undergoing incarnation and sacrificial death on countless planets across the universe. Indeed, this very objection was raised in correspondence in a recent issue of Astronomy Now⁴. However, Dick is even-handed enough to point out that many Christian thinkers over the years (including another contributor to the correspondence pages of Astronomy Now⁵) have not seen this problem and point out that we can have no knowledge of God's 'agenda' for beings in other galaxies. Nevertheless, Dick himself, although sympathetic in his treatment of Christianity, clearly has his own views, thus: 'In the end, the effect on theology and religion may be quite different from any impact on the narrow religious doctrines that have been discussed during the twentieth century. It may be that in learning of alien religions, of alien ways of relating to superior beings, the scope of terrestrial religion will be greatly expanded in ways we cannot foresee. It may even be that, as a search for superior beings, the quest for extraterrestrial intelligence is itself a kind of religion . . . that religion in a universal sense is . . . the never-ending search of each civilisation for others more superior than itself . . . the search for extraterrestrial intelligence may be science in search of religion and astrotheology may be the ultimate reconciliation of science and religion.' So, the author envisages his own particular version of Teilhard's omega point, but I suspect that most of our readers will find this conclusion unsatisfactory.

Finally, a comment on the two books as reading material. I have no hesitation in stating that de Duve's book, Vital Dust, did not live up to the prepublication hype. Even as a biochemist with a professional interest in genes and a necessary working knowledge of chemistry, I found the text heavy going. The book was all too easy to put down, and on several occasions I had to retrace my steps to remind myself of what I had previously read. The author states that the book contains no formula more complex than H₂O or CO₂. This is true, but does not make up for the fact that much of the text will be very difficult for the non-scientist to understand. From time to time, de Duve seems to become suddenly aware of this and explains in straightforward language or in metaphor the immediately preceding text before lapsing back into his normal style. In this context, I presume that his constant use of non-SI units such as gallons and degrees F was an attempt to be friendly to non-scientific readers in the USA. I just found it annoying. There are some minor biological inaccuracies, which admittedly do not affect the author's case. Overall, although I am quite happy to have a copy on my bookshelf, I am not suggesting that our readers rush out to order this book.

Dick's book, The Biological Universe, is more reader-friendly. Indeed, I read most of it during two long-haul flights. I have no qualifications in astronomy and my qualifications in physics and maths are fairly minimal. Nevertheless, I found the treatment of the physical sciences in this book to be quite accessible, symptomatic of the clarity of the whole text. Whether it is 'a major contribution to scholarship', as suggested on the dust-jacket, I am not sure, but it is certainly an interesting book. However, I suspect that Paul's Davies' new book, The Fifth Miracle, will
turn out to be more rewarding and stimulating than either of the texts reviewed here.

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John Cornwell (editor)
Nature's Imagination: The Frontiers of Scientific Vision

Is reductionism necessary to science? Is it the key to science’s success in illuminating the workings of nature? This book is the result of a symposium held in Cambridge where a group of leading scientists, mathematicians and philosophers met to examine these questions. The contributors give a wide variety of answers and judging from the book there must have been some lively debate at the meeting.

Reductionism is the hypothesis that an understanding of a complicated whole may be obtained through a knowledge of the individual component parts. Few would deny that such a methodological tool has greatly contributed to the progress of science. But should it be the only tool? This is where the debate starts, for the question of what constitutes true knowledge is at stake. For extreme reductionists, such as Peter Atkins, the only real explanation is a reductionist explanation: anything else is either wrong or a temporary and unsatisfactory compromise that awaits replacement.

Atkins’ essay, entitled ‘The limitless power of science’, is a curious mixture of a radical skepticism of non-scientific forms of knowledge and a rosey-eyed optimism in the ‘omnicompetence of science’ – ‘science has never encountered a barrier that it has not surmounted or that we can at least reasonably suppose it has power to surmount’. For example, he views science and religion as polar opposites which cannot and should not be reconciled. Therefore, as a Christian I must either be ‘unthinking’, ‘intelligently dishonest’ or unable to ‘come to terms with the prospect of my own annihilation’. He feels such a reduction is prototypical of how reductive science can begin to understand human experience. It would be interesting to know why he thinks a reduction of his own reductionism, as, say, an attempt to avoid the moral force of religion upon his life, is any less valid.

Mary Midgley’s essay is strategically positioned immediately after Atkins’ essay – the title of the essay ‘Reductive Megalomania’ provides a fitting summary of Atkins’ views. In it she emphasizes that reductions are rarely value-free, but are normally part of a larger philosophical project in which the economies of reductionism are often compensated for by undisciplined and extravagant doctrines.

It might be thought that physicists and mathematicians would be the most likely group to be reductionists, but the contributions to the book from these fields are all anti-reductionist in tone. Roger Penrose shows that holistic concepts can be introduced into mathematical subjects, such as topology, in a clear and rigorous fashion, and that in physics non-locality is present in quantum mechanics through the Einstein-Podolsky-Rosen phenomenon. Gregory Chaitin provides a brief introduction into algorithmic information theory. This theory is an extension of the work of Gödel and Turing that caused the downfall of Hilbert’s dream to reduce all of pure mathematics to that of a formal axiomatic system. It shows that mathematics cannot avoid an irreducible randomness. The essay by John Barrow considers some
of the caveats that need to be applied to that ultimate reductionist dream, the Theory of Everything (TOE), which would summarize all of science in a single theory. In particular, he contends that although a TOE is necessary for a full understanding of the Universe, it is far from sufficient. The form of the Universe depends upon the initial condition as well as the laws. Furthermore, knowing a scientific law is very different from knowing the complex outcomes of that law. For example, he suggests that 'No TOE will ever shed any light upon the workings of the human brain'.

This quote brings us to one of the frontlines of the reductionism debate, consciousness and the mind-body problem, and one that features prominently in this book. Both Gerald Edelman and Roger Penrose take issue with those in the artificial intelligence (AI) community who contend that the mind is simply a computer. Edelman, instead, seeks to outline a biologically realistic theory of the brain, which he calls neural Darwinism. On the other hand, Roger Penrose uses Gödel's theorem to try to show that conventional physical theories will never be able to provide an understanding of the mind's unique capabilities because they are algorithmic in nature. Margaret Boden, herself an AI researcher, gives a balanced account of why AI need not deny human autonomy and dignity, but instead can begin to show how it is possible. And finally, the apologists for reductionism in this area, Patricia and Paul Churchland, seek to counter objections to the idea that neuroscience should seek to reduce all of psychology.

The book provides an entertaining and accessible introduction to the status of the reductionism debate through a series of vignettes. This format is both the book's strength and the basis of its limitations; rather than being comprehensive it provides a very individual slice through the debate which reflects the interests of the contributors. In particular, one of the hottest areas in the reductionist debate, genetics and sociobiology, receives little mention except for providing Mary Midgley with a number of fine examples of reductive megalomania.

If this book is representative of the scientific community as a whole, reductionism is losing the battle for the soul of science, despite energetic pockets of resistance. Freeman Dyson suggests that the loss of such philosophical rigidity can only be good for science – to squeeze science into a single philosophical viewpoint is self-defeating because 'Nature's imagination is richer than ours'.

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Polly Eisendrath-Young and Terence Dawson (eds)
The Cambridge Companion to Jung
321 pp. pb. £13.95
ISBN 0-521-47889-8

This volume faithfully reflects Jung's compassion and respect for the human soul, its noble strivings, as well as its many distortions. These he takes as signposts for the transcendent; our neuroses as well as our creativity express the yearning of humanity for connection with the divine. The volume is unique in including applications of Jungian thought into current thinking and culture. It is a feat that required multiple authors addressing different fields. Jungian thought is a slippery eel – who can presume to give the 'final word' on his contribution? So we are given a kaleidoscope of images of Jungian analytic psychology in practice. There is no attempt to reconcile different approaches in this volume: the classical, archetypal and developmental Jungian schools jostle amicably as practitioners from these schools discuss the case of a hypothetical client.

Even so, the early chapters (and helpful glossary) manage to give students of Jung a basic, comprehensible grasp of central ideas. Jung's mysterious concepts of archetypes, the collective unconscious,
the Self, the anima and animus, as well as the concepts of transference and counter-transference, are made clear to the novice. The early chapters provide enough of a historical and theoretic scaffold for Jung’s diverse and unsystematic writings to realise its promise: it is a companion.

The most pleasurable aspect of the volume in my estimation was the moving way three different practitioners wrote about the case of ‘Joan’. Here we get something of a glimpse of the heart of Jungian thought at work. There is a respect for the human person that comes through the sympathetic and honest grappling of these practitioners with this hypothetical case. As a device to give the uninitiated reader a non-intellectualised glimpse into the world of Jungian thought, it works very well. Later, a good-humoured ‘debate’ between a Freudian and Jungian practitioner delineates these two diverse psychoanalytic approaches.

The volume is not restricted to clinical practice. Jung’s impact on thinking about gender, politics, literature, and literary criticism are included. These chapters are a good antidote to the overly individualistic and sometimes vague ‘spiritualities’ that can be associated with Jungian thought. They show some of the real world applications of Jung’s theories, or at least the way his followers have made these applications in the context of late modernity.

More could have been written about Jung’s impact on Christian spirituality. The parallels between Jung’s description of the process of individuation and aspects of the Christian journey have been for many a springboard for a deeper understanding of spiritual growth. Jung himself felt he had discovered the working of God in the human soul. Of course problems arise if a reductionist view is taken of the Christian journey, as if it were ‘only’ psychological. Jung himself was not reductionist, but neither can he be considered to be a Christian pastoral theologian.

A tension remains between these two ways of thinking. The chapter on Jung and religion admirably sets out Jung’s approach to the human soul as profoundly and inherently religious, but the tensions that readers of this journal might be interested in are not explicitly addressed. Christians interested in Jung will find this volume a good beginning, but will want to look further afield for discussions of the ways in which a Jungian approach is deeply illuminating and challenging, and other ways in which it is incompatible with a Christian understanding.

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A.G. Cairns-Smith

Evolving the Mind: On the Nature of Matter and the Origin of Consciousness

329 pp. hb. £17.95
ISBN 0-521-40220-4, pb. £9.95
ISBN 0-521-63755-4

This book does not explicitly consider religious issues at any point. However, it deals, at an accessible and popular level, with questions concerning the biological basis of consciousness which may have important religious implications.

Perhaps the first question that a theological reader will ask is. What is at stake in formulating a biological theory of consciousness? My answer is that the only essential thing is that consciousness should be recognised as a ‘real’ and significant feature of human beings. Strong forms of ‘eliminativism’ are not compatible with a religious view of human nature. However, Cairns-Smith is not an eliminativist, perhaps not even a materialist. Though he eschews philosophical jargon, he is perhaps more of a ‘neutral monist’.

He is persuaded that consciousness does make a difference, citing the similar position of William James, who opposed the
'automata' theory of human nature which held that it was irrelevant whether we were actually conscious of anything. He avoids a minimalist theory of consciousness, and allows that 'feeling' is what comes closest to the essence of consciousness. No problems here for the religious reader. Cairns-Smith does not come up with any very specific theory of what consciousness is for, but then this is a point at which many theorists are floundering. It is a question to which theologians could perhaps suggest answers.

There is no generally accepted theory of consciousness to popularise, so Cairns-Smith is to some extent 'on his own'. Most of the book is spent setting out background rather than delivering a specific theory. He devotes chapters to the nature of matter and life, before getting on to the central nervous system at all. The point of these preliminaries is that he thinks we won't understand how consciousness comes out of matter unless we really understand matter itself. He also endorses the general view that consciousness is a 'whole brain' phenomenon, rather than something that can be precisely localised.

When he does at last get on to theories of consciousness, it is quantum theories that he presents as being particularly promising, taking us briefly through the ideas of Stapp, Penrose, Lockwood, Marshall and others. Considering that this is the heart of the book, it is all rather briefly done. He hardly pauses to explain ideas in detail, let alone to evaluate them. For those who have never considered a quantum theory of consciousness, he provides a helpful first tour of the idea, but he does not really advance the discussion much.

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Andrew Linzey and Dorothy Yamamoto (eds)
Animals on the Agenda: Questions about Animals for Theology and Ethics


The purported objective of this anthology is to place the plight of animals on the agenda of Christian theology and ethics. The principal thesis is that the Christian tradition has largely failed to incorporate animals within its purview, thereby promoting centuries of neglect and cruelty. There are, however, overlooked strands within the tradition which counter this dominant trend. Thus the authors subject the dominant themes of the Christian tradition to severe criticism while expounding and developing these neglected strands in formulating a more responsible perception and treatment of animals.

In pursuing these critical and constructive tasks, the book is divided into four parts concentrating on scripture, history of doctrine, controversial ethical issues, and moral obligations to animals. In many instances, essays are paired in order to illustrate contrasting viewpoints on a common topic. What is particularly noteworthy is the scope of these discussions. Unlike many similar texts, which often confine their theological enquiries to the doctrine of creation, several essays explore how such themes as providence, redemption, and eschatology should inform our understanding and relationship to animals. Some of the most provocative essays address such questions as whether animal have souls and will be redeemed, and what these claims might mean for how animals should be treated. Another series of intriguing discussions focus on problematic claim that nature reflects God's will, especially in regard to perdition as part of the natural order.

Although the essays reflect a variety of theological perspectives, several common critical and constructive threads emerge with sufficient frequency to tie many of them together. A standard denunciation of the traditional Christian account of dominion as domination is frequently invoked, and an anthropocentrism originating in Paul and amplified by subsequent theologians is routinely denounced.
Augustine in particular is often identified as the chief culprit. Modern science is also often condemned for reducing animals to little more than objects of curiosity and exploitation. In overcoming this rather chequered legacy, readers are often urged to recover some selected teachings of Jesus, as well as to turn to Greek rather than Latin patristic writers. Many, though certainly not all, of the authors extol the virtues of process theology for formulating a more responsible ethic, particularly in respect to God’s sympathetic suffering with animals. There is, however, little discussion on how changing an allegedly destructive scientific manipulation and exploitation of animals might be accomplished. Rather, there are some suggestions urging vegetarianism, humane treatment, or banning the use of animals in scientific experiments.

The essays are written in an easily accessible style, although their quality varies. Moreover, this anthology is more a partisan than balanced presentation of the issues and concerns it addresses. This is to be expected given the editors’ purpose of placing animals’ rights and welfare squarely on the Church’s agenda, but does not diminish its value so long as the reader keeps this objective in mind. Linzey’s interpretive essays in the Introduction and subsequent parts provide helpful overviews and summaries.

Animals on the Agenda could perhaps be used most effectively as a supplementary or recommended text in an introductory course in moral theology.

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John Polkinghorne

Beyond Science
131 pp. hb ISBN 0 521 57212 6

Professor John Polkinghorne’s prolific pen continues to pour out books on science and faith which span a broad range from the popular and accessible to those which are more academically heavyweight. This eclectic collection of essays, based on lectures given in Australia and Canada, lies more towards the popular end of the spectrum, but is certainly not lacking in either depth or rigour.

The essays cover a wide spectrum of topics, including a vigorous defence of realism, the inner workings of the scientific community. Prof. Polkinghorne’s own reminiscences about famous scientists that he has known during his long career, musings on the nature of the human mind, a nice summary of the Anthropic Principle and an account of the Christian basis for environmental concern. If the brush-stroke is somewhat broad at times, it is commensurate with the attempt to tackle such a broad range of subjects in a relatively small volume.

Not all the essays are of equal weight. The defence of critical realism in the scientific enterprise (Chapter 2) is particularly effective and the author addresses the concerns of Kuhn, Popper and Lakatos, before opting for Michael Polanyi as a surer guide to the nature of scientific knowledge. The discussion of the human mind (Chapter 5) is also useful and in this case Prof. Polkinghorne rejects Cartesian dualism and instead follows Donald MacKay in propounding a dual-aspect monism in which the reality of both mind and of brain-matter are taken equally seriously, proposing that they ‘might be complementary poles of the single stuff of a dual-aspect monism’ (p. 70). Daniel Dennett’s suggestion that the self is merely ‘a Centre of Narrative Gravity’ is rejected for its failure to give sufficient weight to the reality of personhood. ‘An account of reality without a proper account of mind would be pitifully inadequate’ (p. 72).

It is intriguing that Prof. Polkinghorne thinks that neo-Darwinism is only part of the explanation for biological evolution (p. 78). This may be the case, but the author does not make it very clear as to why this should be the case. ‘Possible teleological laws of nature’ are invoked, but no
attempt is made to explain what these might be, nor how their presence might be tested. One does not have to believe that the desire to understand quantum physics had survival value in order to explain the evolution of a brain complex enough to handle quantum physics. From a biological perspective much of contemporary human activity may be due to behaviours which never contributed to reproductive fitness in the past, any more than they do in the present, but which are by-products of large brains which developed under quite a different set of selection pressures. Only extreme sociobiologists seek adaptive stories for any and every contemporary human behaviour – a fairly useless endeavour anyway in the eyes of most biologists.

*Beyond Science* makes an excellent introduction to the wide scope of Prof. Polkinghorne’s highly influential thinking in the area of science and faith and would be a good book to lend or give to a friend who would like a thoughtful introduction to the science-religion debate from a Christian perspective.

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Michael T. Ghiselin

*Metaphysics and the Origin of Species*

State University of New York Press,
ISBN 0-7914-3468-0

Ghiselin is a research biologist who is also an accomplished philosopher. Biologists who have considered the foundations of their subject will certainly know of him – especially as the author of *The Triumph of the Darwinian Method* which appeared nearly 30 years ago (1969) – but hitherto his work has not received the attention that it deserves. I have no doubt that this book will change that. David Hull – another leading philosopher of biology – rightly describes it as the climax of Ghiselin’s work, integrating it into a ‘single, unified, and impressive whole’ (cover). The book expounds Ghiselin’s early (1966) claim that species are not natural kinds, or classes of things, but individuals – individual wholes composed of parts (organisms). This seemingly peripheral claim actually makes an enormous difference to the understanding of origins and the book explores the ramifications. But in order to do so Ghiselin found that he had to develop an entire system of metaphysics (ix, cf 16).

The heart of Ghiselin’s argument is that only if species are individual things can they evolve or become extinct. Much of the book is taken up with explaining what such an ‘individual’ is, but Ghiselin also explores the implications for our thinking about evolutionary theory, systematics (including the concept of homology), laws of nature, the role of history in the sciences, embryology, macroevolution and the fossil record. Ghiselin dares to suggest that ‘there are not many real evolutionists in this world’ (1) – real evolutionists being those who accept Ghiselin’s individuality thesis (136)! He has truly grandiose ambitions: ‘Classification . . . is the organisation of knowledge. Therefore the revolution that is going on in systematic biology has profound implications for our understanding of everything that is known and is knowable, especially of knowledge itself.’ (17). An appendix provides an overview with explanations of all the key terms and, lightening the book, there are lively critiques of the work of other evolutionists and some touches of humour (as in his passing reference to Gould’s *Blunderful Life*, 279).

The book’s comprehensive treatment of numerous relevant issues, extensive cross-references and citation of much of the crucial literature make it a very valuable text to have to hand. Not, of course, that it is above criticism. While it is gratifying to find a work that recognises the importance of philosophical systematics,
it is frustrating that Ghiselin simply ignores the major problems raised by naturalism (cf. Keith Ward’s God, Chance and Necessity) and makes heavy weather of whole-part relationships and of the pervasive presence of analogies in science. On these matters the richer systematics of Herman Dooyeweerd’s Christian philosophy is much more productive (cf. Roy Clouser’s The Myth of Religious Neutrality). In discussing the roles of natural law and of historical contingencies, I find him too dismissive of modern structuralist perspectives (unlike, surprisingly, Richard Dawkins). The lack of citations here (of the work of, e.g., Brian Goodwin and Stuart Kauffman) indicates a serious gap in Ghiselin’s knowledge.

While registering profound disagreement with much of Ghiselin’s metaphysics, I would nevertheless commend this book to every Christian scholar grappling with the issues of origins. It is an extremely stimulating read that in many areas greatly helped me to test and clarify my own thinking. If I ended up reaffirming many previous conclusions, I can now defend them more effectively. I know that I shall value this book for many years to come.

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Charles Lyell
Principles of Geology

This edition is to be welcomed as it puts the most (in)famous geological work within reach of all – and provides a good read. Lyell suffers from popular mythology: that he single handedly introduced concepts of the great age of the earth and attacked Christian orthodoxy.

The Principles of Geology was originally published in three volumes in 1830, 1832 and 1833. The editor, Jim Secord, has reduced this to a third, and has produced more of a geologists’ Lyell as he omitted both Lyell’s fascinating, but wayward, history of geology and his refutation of the diluvialism of his friends Coneybeare and Buckland. Whatever the pros and cons of Secord’s editing, we now have an accessible Lyell, which at £10 contrasts well with at least £50 for a secondhand copy.

Lyell’s geological reasoning is perceptive, persuasive and feels modern. However Lyell needs to be put in context. Before 1830 most English geologists were (multiple) Catastrophists and accepted the vast age of the earth. These, Smith, Greenough, and the clerics Buckland, Sedgwick and Coneybeare etc effectively worked out most of the geological column. Lyell built on their foundation but challenged their allegiance to multiple deluges. This was the basic theme of volume I, where Lyell challenged the ‘Assumed Discordance of the Ancient and Existing Causes of Change’ replacing the Catastrophism with Uniformitarianism which had roots in James Hutton and the Evangelical Presbyterian Rev. John Fleming. (Fleming had argued strongly against Buckland’s love of Deluges in the 1820’s). After a considerable discussion of climate Lyell devoted half the volume to ‘Aqueous Causes’, ‘Igneous Causes’ and Earthquakes. Those who think that Uniformitarianism means an extreme gradualism ought to read these chapters, as they show that ‘catastrophic’ volcanic events such as Mt St Helens fall within Uniformitarianism.

Volume 2 is on changes in the Organic World with a chapter entitled ‘Theory of the Transmutation of Species Untenable’. To Lyell (until about 1865) Evolution was out. Volume III is largely on the Tertiary Rocks which had defied geologists until then and includes an excellent chapter on the ‘Determination of the Relative Ages of Rocks’ which is a good summary even for today.

The editor provides a useful introduction putting Lyell into historical perspective and explaining the controversy
(hardly serious) with the Catastrophists. Lyell was arguing against his teachers, colleagues and friends, with whom he enjoyed dinner-parties. However Secord errs by putting Chalmers, Sumner, Hitchcock (a leading American geologist) and Wiseman with literalists like Ure and Penn (p xxiv). Lyell was aware of the difference as he approved of Sumner (later Archbishop of Canterbury) tearing Ure's '6-day Geology' to shreds. This reflects the lack of study there has been on the beliefs of the early geologists.

All in all, a very useful edition of Lyell, and ought to be on the shelves of any interested in the historical aspects of science and Christian belief.

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John Carey (editor)
The Faber Book of Science
Faber, 1995. 528 pp. pb £17.50.
ISBN 0-571-16352-1

This is a fascinating and unusual book. It is an account of scientific discovery and scientific speculation given in the words of scientists, but it has been chosen by John Carey, the Merton Professor of English at Oxford, with an eye to the literary quality of the writing. Carey is no scientist but, as an intelligent layman, wishes to understand its approaches and achievements. He goes back to the words of Leonardo da Vinci, Galileo, Isaac Newton, Priestley, Malthus, the Darwins Erasmus and Charles, Lyell, Gould, Gosse, Faraday, Kekule, T.H. Huxley, William James, Becquerel, Curie, Ross, Atkins, Russell, Haldane, Sherrington, Fermi, Dawkins, Asimov, Medawar, Sagan, Crick, Sacks, Jones and more. There are over a hundred extracts of varying lengths, each with a short introduction, and some of which are abbreviated by bridging passages to tell a particular story.

Carey's introduction to the whole book is itself a memorable piece of writing. How do you account for scientific development without scaring off the vast bulk of the population? The chosen pieces are enjoyable as well as informative and broadly speaking tend towards one of two modes, the mind-stretching and the explanatory. The chronological arrangement of the whole, and it includes technological breakthroughs like those associated with the construction of the first light bulbs, makes the book a narrative. One thing leads to another. For a literary critic, sensitive to the enchantments of poetry, the excitement of scientific writing is partly to be found in the persistence and logical deductiveness of the writers (on the basis of the properties of known elements Mendeleef predicts the existence of unknown elements – and is proved right) and partly in the great leaps of imagination which the scientist makes in solving an old problem or conjuring up the implications of a discovery.

The relative positions of science and religion, especially with Darwin, Huxley and Dawkins on board, is an inevitable subtext and Carey points out that the aims of science seem identical to those of theology. 'Science seeks the truth about the physical universe; theology, about God'. And he points out that 'the real antithesis of science seems to be not theology but politics'. Politics is all opinion and preference, personalities and social class. Science is all evidence and co-operation. So, while politics may lead to war, science, despite the bitter arguments it may generate, does not solve its differences this way. Its discoveries are essentially shareable and it works best when it enjoys the context of freely exchanged ideas, a context suited to democracy.

The pieces themselves are excellent. Gilbert White's account of fieldmice is delightful and Lyell's descriptions of geology have a majestic roll to them. Our admiration goes out to the Curies and we relive the excitement surrounding the discovery of photographs. There is often a sense of excitement, even in descriptions, as when Armstrong and Aldrin recount their visit to the moon. Nor are the religious convictions of scientists hidden. James Clerk Maxwell gives glory to God for the universe and Ross writes a poem to celebrate
his tracking down of the causes of malaria.

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**Michael J. Reiss and Roger Straughan**

**Improving Nature? The Science and Ethics of Genetic Engineering**

Cambridge University Press. 1996. 288 pp. hb

This is by far the best book I have read on the ethics of genetic engineering. It is not a specifically Christian book, but it takes on board the main arguments about the subject used by Christians. The trouble about genetics from the naive Christian point of view is that there is nothing explicit on the subject in the bible, nor are there long-standing 'traditions' about genetic manipulation to help our thinking. Consequently most discussions in religious circles depend on speculations about 'unacceptable risks' and 'playing God', i.e. whether manipulation is extrinsically or intrinsically wrong (p. 48). It is therefore good to have a full discussion which takes seriously both science and ethics, setting out the need for 'a balance to be struck between the paralysis of extreme caution and the irresponsibility of uncontrolled experimentation' (p. 57). The authors are right to emphasise that 'it is essential that science and ethics proceed hand in hand' (p. 57).

Michael Reiss is an Anglican clergyman with a doctorate in genetics who teaches at Homerton College, Cambridge: Roger Straughan is a moral philosopher at Reading University with a long-standing interest in the ethics of genetic engineering. They neither prevaricate nor dogmatize. Their stated aim is 'to clarify the biological and philosophical issues involved' so that their readers have the information to make up their own minds (p. 1). I began the book expecting a sort of amalgam of the Thirteenth Report of the Royal Commission on Environmental Pollution, the fears of Jeremy Rifkin and Patrick Dixon, and the radicalism of Peter Singer and Jonathan Glover. I was delighted to be proved wrong. *Improving Nature?* is a fresh and well-written examination of the issues raised by our ability to manipulate DNA which provides a clear 'framework for assessing the concerns that these technological innovations are generating' (p. 48). For example, the authors point out that 'risk and safety become matters of moral concern when they raise further questions about responsibility, accountability and justifiability... But dangerous outcomes are but one of the possible consequences of genetic engineering; others might include the alleviation of world hunger or the exploitation of economically vulnerable individuals and countries' (pp. 53, 57).

Reiss and Straughan might have got bogged down in a complicated cost-benefit utilitarianism, but instead they launch into a discussion of reductionism, natural law and stewardship. They conclude, 'in our view, it is difficult to maintain fundamental theological objections to all aspects of genetic engineering per se. The notion that in some sense to be human, some would say to exist in the image of God, is to be called to participate responsibly in the ongoing work of creation, is a persuasive one, though not to be undertaken lightly' (p. 89). Indeed, 'humans may have a theological responsibility, even a duty, to use genetic engineering to root out imperfections in the natural world, including those found in humans. Viewed in this light, genetic engineering can be seen as a tool with the potential to eliminate harmful genetic mutations, reduce suffering and restore creation to its full glory' (p. 89).

At this point, there will be some who become uncomfortable: What about the Fall? Who are we to remove imperfections from creation? Fair questions which need theological answers, but they cannot be answered in a vacuum: we must build upon the sort of basis helpfully laid by Reiss & Straughan. They should drive us
back to enquiring what we really know about the original creation and not what we assume about it from apocalyptic Scriptures which are always difficult to interpret (e.g. Is. 11:6). Francis Schaeffer opines that 'the creation which God made was at peace with itself and will eventually [at the second coming of Christ] be restored to peace with itself. In other words, there will come a time when all creation once more speaks, not only of the existence of God and his personality, but also of the goodness of God as the original creation exhibited that goodness' (Genesis in Space and Time. p. 64). Does this tell us anything about variation and mutation before the Fall? Does God's repeated declaration that the creation is 'good' reveal anything about creation other than it reflects His goodness? Claus Westermann (Creation, p. 61) asks 'For what or for whom can creation be good? ... It can only mean that Creation is good for that for which God intends it'. This takes us beyond Reiss and Straughn's book, but it faces us with the questions behind the manipulation of genes. Genetic engineering raises deep practical and theological issues. Improving Nature? should be required reading for any wanting to come to grips with them. I am grateful for this book and recommend it without reservation.

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John Habgood
Faith and Uncertainty

Before ordination John Habgood was a research physiologist and throughout his ministry as theological educator and bishop he argued that science and theology have much to learn from each other. His skill in bringing together scientific and religious perspectives on topical issues is illustrated in this collection of lectures, sermons and articles from his later years as Archbishop of York, including sections on politics and economics, the media, education and morality as well as science.

Three chapters focus on evolution. After a warning against misuse of the idea of complementarity, Darwinism and Christianity illustrate how science and religion can be seen as complementary forms of knowledge. Frederick Temple's Bampton Lectures of 1884 showed not merely an acceptance of evolutionary theory but a positive welcome for a unifying and ordered vision of the natural world, and Habgood adds further reasons why Christians should be grateful to Darwin. Theologians are challenged to clarify what they mean by design and purpose, and analogies with monopoly and chess rather than roulette are chosen to speak of the creative activity of God in a universe in which the interplay of ordered structures and chance seems to lead inevitably in the direction of greater complexity. Temple realised the relevance of evolution to the discussion of suffering and Habgood notes a correspondence between fragility and vulnerability in the evolutionary process and the recent theological re-discovery of the vulnerability of God, so that Darwin is responsible indirectly for showing that 'the God who upholds the creative process is also the God who bears its weight in suffering'. Evolutionary ideas have been less helpful in interpretations of social change, as in Social Darwinism and in theories of the development of religion and morality, although there is a sense in which religious beliefs and ethical norms survive and flourish as they are tested against human experience.

In other chapters the possibility of life on other planets is discussed in relation to the incarnation and the incarnation undergirds a sacramental view of nature. The attraction of new age paganism is much diminished when it is realised that as the word was made flesh the trinitarian God may be encountered in nature as well as in history. Developing the work of Schmemann, Habgood emphasises the potential of all things in the purpose of God, the cooperation of humans with natural processes and the need for transformation of suffering by redemption — where once again the cross is linked with creation.
In a collection of this kind readers may pick out chapters that interest them but the introduction is important as it explains how the book as a whole represents an approach to theological reflection, supported in a later chapter by parallels with Ziman's account of science as leading to reliable knowledge. As Christians engage with the complexities of contemporary life and speak of God within the limitations of human language uncertainty is inevitable. The life of faith involves exploration and discovery rather than definitive answers to every question, but uncertainty is compatible with full commitment in faith and the pursuit of truth. There can be reliable knowledge about God, always provisional yet representing a consensus within a community sharing a common tradition and accepted procedures of testing, adequate for guiding practical action and providing a framework of meaning for the interpretation of religious experience.

This book will be valued as a demonstration of how theology can be in meaningful and transforming engagement with issues in science and other areas of contemporary life.

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Sidney Liebes, Elisabet Sahtouris and Brian Swimme
A Walk Through Time — From Stardust to Us: The Evolution of Life on Earth

This most unusual book contains the text and illustrations of a mile-long exhibition, representing, to scale, the 5-billion years of the history of the Earth and the evolution of life. The scientific content is fascinating and will be illuminating to many. Our very notion of what is alive is called into question, and the links between biology and geology are most interesting. Microbial life appears 4000 feet in the past and is the dominant life-form for most of the mile. Sahtouris explains the development of microbial life with passion and fervour, the widespread use of technical terms being backed up by a clear glossary, so that the main thrust of the argument is accessible to the non-specialist. A recurrent theme is the development of whole biological systems, with the different life-forms within it adapting to each other. The authors suggest that feedback and self-organization of DNA enable evolution to proceed far more rapidly than would be expected by natural selection alone, and that crisis provides the opportunity for evolutionary innovation. They trace the rise of life from the coexistence of individual macromolecules into living cells and then ever more complex organisms. Then they discuss the mass extinctions of species that have occurred several times in the past, each followed by a recovery process taking tens of millions of years. The book ends with an impassioned plea to the human race to change our lifestyle, giving care for the living world a sufficiently high priority that we avert the catastrophic species extinction which we are causing.

The authors clearly hope that readers of all religions or non-religious persuasions will be moved by the wonders of the processes of life to take their responsibilities to the living world more seriously. However, there is an implicit rejection of a traditional Christian viewpoint, without any discussion. 'An atom is not put together by some agent outside itself' (15). Words such as 'create' or 'invent' are applied freely to single-celled organisms, and the notion of the Earth as 'Gaia', a self-regulating living organism, generating personal qualities from within itself, is embraced with enthusiasm. While deploiring the greed of humankind, the authors have not addressed the issue of how to curb our selfishness. It would have helped if the authors had made their own worldview clear. Since I am not an expert in biology, having read the book I should like to refer to some of the original papers quoted at the back before accepting all their conclusions.

The illustrations are lavish, though
some are without captions. The text would have been easier to follow if a sentence had finished at the end of each double page, particularly where the pictures are accompanied by text on a different theme.

With these minor criticisms, I found this a most vivid and stimulating book, which would be read with profit by lay readers with a graduate level of education. It is a suitable reference work to appear on many library shelves.

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John Polkinghorne

*Scientists as Theologians: A Comparison of the Writings of Ian Barbour, Arthur Peacocke and John Polkinghorne*

ISBN 00-281-04945-9

The author of this slender, yet thoughtful, volume is well known to the readers of this journal through his distinguished contributions to the current dialogue between science and religion. Dr. Polkinghorne interacts with two other major contributors to this conversation, highlighting points of agreement and difference in their respective approaches. Major points of reference include Polkinghorne’s *Science and Christian Belief*, Barbour’s *Religion in an Age of Science*, and Peacocke’s *Theology for a Scientific Age*, together with their other published works.

The author’s stated purpose (xi) is to present an overview of the scientist-theologians’ respective contributions and to encourage readers who have not yet done so to read some of the books on which the volume is based. In the estimation of this reviewer, Dr. Polkinghorne succeeds admirably on both counts.

All three writers affirm some form of ‘critical realism,’ in which it is understood that the natural sciences give authentic knowledge of the world, albeit in reversible and surpassable forms. All three would subscribe to some forms of a ‘new style natural theology’ that seeks ‘insight rather than proof’ (51). The main difference among the three, as Polkinghorne sees it, is the extent to which the natural sciences might be understood to require substantive modifications of the orthodox theological traditions (25), especially in the area of Christology. Polkinghorne is rather less inclined toward substantive revisionism than either Barbour or Peacocke.

In the author’s view, the issue of the ‘causal joint’ and attempts to understand the nature of the interaction of God with physical world remain at the top of the agenda for science-faith discussions (41). Both Peacocke and Polkinghorne emphasize that God’s creative activity involves a creative interplay between ‘chance and necessity’ (46). This insight concerning the role of the chance in God’s actions in creation and providence needs to be more fully recognized in the still contentious American debates concerning origins. In the chapter on world faiths, the author raises the perceptive questions as to how Eastern views of time as cyclical and the external world as quasi-illusory (62) will affect future Eastern involvement in the science-religion conversation.

It is in the crucial area of Christology that Polkinghorne highlights the differences between his understandings and those of Barbour and Peacocke. A strong incarnational Christology, not merely a functional one (71) is needed to make sense of the New Testament’s teachings concerning life, death, and resurrection of Jesus and the church’s experience. In the resurrected body of Jesus one sees a destiny for matter and not just humanity; the resurrection is the ‘seed from which God’s new creation has begun to grow’ (77). Christian theology, in its Christology and elsewhere, has its own unique categories that can not be subsumed under purely scientific ones, ‘however strange
and counterintuitive they may seem to twentieth-century secular thinking’ (80).

The author concludes with an open invitation for theologians to become more involved in the science-religion conversation (86). It is an invitation which this reviewer heartily applauds. Scientists as Theologians is a lucid and insightful contribution to this conversation, and is to be warmly commended to the readers of this journal.

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**Jon Turney**

**Frankenstein's Footsteps. Science, Genetics and Popular Culture**


Jon Turney is a former science editor for the *Times Higher Education Supplement*, and is now lecturing in science communication at University College London. He has written a book that is a tribute to his craft as a journalist and has practised what he no doubt preaches: good communication. He treats the famous Mary Shelley story of Frankenstein (first published in 1818) as a powerful myth which is deeply embedded into our culture. The central theme of the novel is about the power of knowledge, with the story being that of the scientist, not God or the gods as in creation myths, who is able to create life itself. This Frankenstein myth, with its fears about the dark side of science, extends far beyond those who have read the book. It is retold and recycled in books, plays and films. Indeed, as Turney fairly points out: 'The single word “Frankenstein” is seen constantly as a metaphor in media commentary of all kinds, especially political commentary.' (35.) In essence, it offers the counterpoint to the picture of science as progress, and always for the benefit of humanity. It therefore contributes to the ambivalence with which science, its methods and motives in this age of modernity, is regarded.

Turney uses the historical perspective and fictional portrayals of science in our culture to draw attention the co-existence of hope and fear. The rise of experimental biology and the eugenics movement at the beginning of this century serves as a strategic case study. After all, eugenics with its visions of racial perfection and the improvement became a deadly instrument for fascist purposes and in different ways it could also underlie some forms of utopianism on the left. And, as we now know, it was not only Germany where human beings became part of the eugenics ideology of breeding towards human perfection.

Turney shows that the style of public debate and the role of print media was not so different from the way it is now. It is certainly salutary to be reminded of the writings early in the century from significant figures of the day. Haldane, Russell, Julian Huxley, Aldous Huxley, H.G.Wells and the like. It was Russell, for example, who wrote a book which questioned whether science would promote the power of dominant groups rather than increase human happiness. The connotations of the title, *Icarus – or the Future of Science*, were clear enough. The hubris associated with the pursuit and exercise of power is signalled. As Turney underlines, the implication was clear. 'If the life sciences were potentially so powerful, then their power for abuse was commensurately great.' (102)

So much science, after all, has been pursued and resourced in the context of the great wars of the century. Not only nuclear physics, but biology became part of 'big science' whose findings and directions can be seen in the context of international conflict and, for most of the last fifty years, the Cold War. Yet Turney’s purpose is not to leave us with the dark side of science as the dominant motif. He urges us to go beyond the polarities of either-or debates and come to terms with the complexity of the issues now raised by bio-technology. Therefore, the mutual distrust between scientists and lay people needs to be addressed, which calls for an educational process on all sides.
And, claims Turney we should not be too pessimistic: 'The fact that the National Institutes of Health and the European Commission have both earmarked modest percentages of their human genome research budgets for ethical, legal, and social studies of the new genetics is as much a sign of the times as geneticists complaining that they are being pilloried by a public inflamed by Frankensteinian fantasies.' (221–2) I think the emphasis here should be on just how modest this is. And it is still too easy for the ethical debates to be submerged under what are treated as technological imperatives.

What does have to be stressed in discussions about the new genetics is the importance of trying to sustain, or where necessary build, democratic structures within which forms of accountability are established not only for what scientists do, but what those who finance them – governments and corporations – do. This will involve scrutiny of what is done in the name of commercial secrecy, transparency over issues of patenting, public debate about biological weapons. We could certainly think of setting up an Ethical Commission as an institutional check on corporate power. The establishment of democratic forms of control in a globalised world is never going to be easy. The struggle will involve making visible and accessible what scientists are doing and it will be multi-faceted: cultural, economic and political. This surely is the only way to move beyond pessimism in what now are routinely referred to as risk societies.

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Kirsten Birkett
Unnatural Enemies: An Introduction to Science and Christianity
ISBN 1-876326-01-8

This is a great little book. It is an ideal introduction to the interaction of Christianity and science.

The first of the three parts is devoted to 'science': where it came from, its practice and science as a philosophy. Birkett ably guides us through the history and philosophy of science, in a simple but not simplistic way. She identifies and discusses several different meanings of 'science': as a method, a body of knowledge and as a community. In her first part she admits that the emphasis has been on what science cannot do (p. 50), and as she rightly points out that the strength of science 'must be found in recognizing its valid limits' (51).

In part II the focus is on Christianity. The first two chapters deal with God and his world and humanity's role in it. The most stimulating aspect of this part of the book is her emphasis on wisdom: it is 'perhaps the one biblical word which sums up the orderly, rational, purposeful nature of the created world' (76). The next two chapters take up this focus on wisdom: its limits (ch. 6) and the incarnation of wisdom (ch. 7). The final chapter in this part, 'God and science', pulls together the first two parts. She sees Christianity and science as being compatible and certainly not, when properly understood, in conflict.

The roots of the popularly conceived conflict metaphor – despite much evidence to the contrary – are explored in part III. She sees it in terms of science having 'claimed far too much territory – more than it can sustain' (120). Huxley and Draper – and more briefly Dawkins – as figures who have exerted power over public opinion then come under scrutiny. Her conclusion is that science and Christianity are unnatural enemies.

As an introduction to science and Christianity for some one who is approaching the subject for the first time, I can think of no better book to recommend.

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