J. E. Loader and W. J. Neidhardt
*The Knight’s Move. The Relational Logic of the Spirit in Theology and Science*

The self confessed purpose of this book is to establish, or rather broaden, the dialogue between Christian theology and the physical sciences. In this respect it is primarily an interdisciplinary exercise and one which claims to establish a new arena in which such interdisciplinary engagement might take place:

'... all across this spectrum of possible readers, the book is at work to create a new approach to the theology/science dialogue, and in this sense it is attempting to generate a readership that does not yet fully exist.'

The title of the work refers, at least in part, to the Kierkegaardian use of chess imagery to describe the unique and surprising ability of the ‘knight’ to move around corners, to initiate a non-linear manoeuvre within a highly structured context. The authors wish to suggest that both within science and theology the creative act of the ‘knight’s move’ is not only readily apparent but essential to an adequate understanding of the ‘human game’:

'... the ultimate form of the “knight’s move” is a creative act raised to the nth power by Spiritus Creator, but it still partakes fully in the concrete pieces and patterns that compose the nature of the human game and the game of nature.'

One of the early discussions in the book seeks to demonstrate the distinction between science and technology—a distinction often blurred, maintain the authors. The task of science is that of explanation founded upon observation and interpreted through a particular framework. This interpretive framework is itself open to reflexive modification in the light of the explanation of the universe it helps to provide. Thus science is an open system capable of and indeed necessitating the creative ‘knight’s move’, a surprising act of discontinuity within the context of the continuity with the order of things as understood thus far. Technology on the other hand is understood as a closed system based upon deterministic functionalism. The confusion between science and technology is a confusion between ‘know why’ and ‘know how’; in the distortion that accompanies this confusion technology takes on the status of a dehumanizing mythology which stresses neutrality of observation and ... produces “the normative gaze”:

If the chief distortion of science is seen as a confusion between it and deterministic technology then the primary distortion of theology is to see it as having to do with a self-contained and self-authenticating spirituality which is discontinuous with the so-called realm of science. Other potential distortions take the form of spiritual determinism, where divine law is invoked in an almost magical way against the material world, or neognosticism where the material universe is construed as valueless or actually evil.

This is a work very much rooted in the Polanyi/Torrance tradition of theological and scientific engagement. The authors focus a great deal of attention upon the relational or perichoretic
nature of reality and deploy the model of the ‘strange loop’, graphically represented in the form of the Mobius strip, as a way of exploring what they describe as ‘bipolar-relational unity’.

‘It should be kept in mind that bipolar-relationality understandings arise when inquiry into a situation or object discloses that its nature is manifested in two very different, contextually incompatible (mutually exclusive) perceptual levels—both of which are required in order to gain a comprehensive understanding of the situation or object under investigation. For instance, the nature of light manifests itself as both particle and wave in empirical investigation.’

This is an informative and imaginative book; a real attempt has been made by the authors to enshrine the message in the medium and to a large extent it works. Whether one agrees with the overall project of the work one cannot help but be impressed by the creative enthusiasm of the writers who seem equally at home with post-enlightenment protestant theology and with the philosophy of science. There are forays into the notion of human and divine spirit, the Trinity, relationality and a very substantial section outlining a theoretical engagement between Soren Kierkegaard and Niels Bohr.

If I were called upon to identify a problem area within the argument it would have to be in the over-emphasis on bi-polarity, the suggestion that relationality takes place between two poles. This is in some sense an inevitable problem given the authors indebtedness to Karl Barth, for example, who tends to conceive of relationality in terms of Buber’s I-Thou duality. It seems to me that perhaps an engagement with Derridian reconstruction of binary opposition as manifestations of enforced hierarchy and a metaphysics of presence might shed some light on this matter, as would Moltmann’s critique of Barth’s understanding of Trinity as an at least implied binity. This is not an easy read and certainly does not fulfill the function of an introduction to the theology/science debate. It is rather a highly nuanced contribution to the debate and as such I would most certainly recommend it to both scientists and theologians alike.

Mike Alsford

Mike Alsford is Senior Lecturer in Theology at the University of Greenwich.

Lewis G. Regenstein

Replenish the Earth: A History of Organized Religion’s Treatment of Animals and Nature—Including the Bible’s Message of Conservation and Kindness to Animals


As the subtitle suggests, this volume is the fruit of a very ambitious project. To achieve such a goal would be no mean feat. Sadly but, perhaps, predictably, Regenstein’s attempt is an abject failure.

He organizes his material into three main parts. Part 1 traces ‘The Impact of the Judaic-Christian Ethic’ in six chapters (two each for the biblical background, the church until the Renaissance, and attitudes to animals in the English-speaking world from the sixteenth century onwards). This is followed by five chapters on ‘Contemporary Western Religion: Its Successes and its Failures’. In fact, this section is broader than its title suggests since one of the chapters is a statement of the case for vegetarianism and another tackles the entire history of the Jewish treatment of animals. Finally, he turns to ‘Religions of the East’ devoting a chapter each to Hinduism, Jainism, Buddhism, Islam, and the Baha’i faith. As you might expect, Regenstein has been forced to sacrifice depth in order to achieve this breadth of coverage.

The publisher’s blurb promises that this book is ‘enjoyable to read.’ This
may be true if you enjoy reading a mass of undigested data! There is little evidence that the author has exercised any selectivity in his choice of material. For example, extracts from a sermon by a Mennonite minister in an obscure midwestern town are given as much prominence as the views of Thomas Aquinas (while Luther receives one paragraph and Calvin and Barth are not mentioned at all).

Regenstein appears to have made little effort to analyze all this material (beyond making it clear that, for him, kindness to animals is good and cruelty to animals is bad). We are given statements about how we should treat animals and descriptions of the way animals have been treated—but these are never put in a cultural, philosophical or theological context. He does not attempt to understand why people have responded in particular ways. To take just one example, he cites Hindu statements about care for the nonhuman but never attempts to relate them to other Hindu beliefs (How do they relate to the doctrine of karma? Surely acts of kindness towards animals merely bind us to the cycle of life and death—as do all acts, good or bad).

The book fails to live up to its claims but it is not entirely without merit. Regenstein has obviously spent years gathering this information. By presenting it in this form, he has provided religious conservationists with a useful source. Someone might even be able to use it as the raw material for a history of religious attitudes to animals and nature (though, if so, it would have to be supplemented by reference to a number of important studies of which Regenstein appears to be unaware, e.g., those of Clarence Glacken, Keith Thomas or Paul Santmire).

Lawrence Osborn

Dr. Osborn is a space physicist, and coordinator of 'The Gospel and our culture'.

Lewis Wolpert

*The Unnatural Nature of Science*


Professor Wolpert is a biologist and widely read in many areas. He is an entertaining writer and this book is full of good illustrations of his points. At times he seems to exaggerate so as to be provocative.

His two main aims emerge in the first three chapters. The first is to defend science by explaining why it is so counter-intuitive that it is seen as contrary to common sense. That is why it is often either feared or opposed. The second aim is to draw a sharp distinction between science and technology so that he can claim for science the position of greatest importance. He does not believe that there is one scientific method and he defines science only in terms of a collection of its most prominent features.

In his final chapter he writes: 'If science is so unnatural and leads to misunderstandings about science and even hostility towards it by some of the public, what can be done?' His answer is firstly, better understanding of science and secondly, realization of what science cannot do.

The latter point is a little surprising after we have found that while he is a realist and attacks relativism he is also a reductionist and opposes holistic thinking. Thus: 'Any philosophy that is at its core holistic must be anti-science, because it precludes studying parts of the system separately.' If he does not have his tongue in his cheek in order to be provocative he is surely quite wrong here; holistic studies depend, amongst other things, on the proper study of the parts. This leads him to describe both social sciences and Freudian psychology as not proper science. He proceeds then to say that: 'doctors are not necessarily scientists'. Of course there may be doctors who are purely technologists, but it is surely in this sort of area that science and technology must intermingle and help one another.

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Holistic thinking is an essential part of medical science as we are discovering increasingly. Wolpert's ideal of science is however in the hard and more mathematical sciences.

This position leads him also to a basically anti-religious stance. At the same time he comes round to admitting that Tolstoy was right when he said that science 'does not tell us how to live'. He adds 'it is not for scientists to take moral and ethical decisions on their own: they have neither the right nor any special skills in this area'. If so why is he so dismissive of religious faith and whatever is not science? Clearly science is less important than holistic thinking because we do need to know how to live. He wants ethical questions to be settled by public vote.

The author traces the origins of science to Greece in about 600 BC and underplays the very important contribution made by basic Christian beliefs to the flowering of science in Europe in the sixteenth and seventeenth centuries. Science owes a lot to the holistic thinking that was able to look for unities in the creation because it is the creation of one God, and at the same time to be willing to be taken totally by surprise by what we find (the counter-intuitive?) because, unlike much Greek thinking, God is not bound by what we think ought to be there.

Oliver Barclay

Dr. Barclay is a zoologist and former editor of this journal.

Richard P. Feynman
*The Character of Physical Law*

Richard Feynman was a brilliant and idiosyncratic theoretical physicist who has gained almost equal celebrity for the exuberance of his character as for the fundamental discoveries which led to his Nobel Prize. Penguin have republished lectures he gave in the 1960s, which were recorded by the BBC and published by them in 1965. The material stands being resurrected. Feynman's expository technique was to mix a careful and clear statement of the steps of a scientific argument with his own informal way of expressing himself (his non-technical writing is always a lightly edited transcript of what he had spoken), and his deep physical intuition. Topics covered include gravity, symmetry, the arrow of time, quantum theory, and the role of mathematics. At times he approaches profounder questions of why the physical world is so deeply intelligible, but it was part of his chosen image to recall from philosophical issues with a joke.

John Polkinghorne

Revd. Dr. John Polkinghorne is the President of Queens' College, Cambridge.

British Medical Association (BMA)
*Our Genetic Future: The Science and Ethics of Genetic Technology*

The BMA aims here to draw the attention of a popular readership to the issues raised by the dramatic advances in genetic research during the past twenty years. The book reports the three year deliberations of an expert Working Party consisting of scientists, ethicists and doctors which set itself the dual task of developing a framework of ethics to safeguard the community's interests and of examining the need for legislation relating to social and ethical aspects of genetic manipulation.

Developments in the science of genetics offer the prospect of challenging major causes of illness and premature death in our society. They also offer major opportunities for the discovery of new forms of therapy and the screening of diseases. Applied to plants and animals they could lead to new forms well adapted to hitherto hostile en-
vironments and thereby facilitate food production in deprived areas.

Overall, the book provides a lucid account of the new genetics covering heredity, molecular biology, and the modification of living organisms. Where necessary the text is illustrated with helpful, if simplistic diagrams. In the second half, sensitive areas such as the complex questions posed by the patenting of genetically modified organisms, the use of gene therapy and the implications of the application of genetic modification to people are explored. The latter topic includes a useful synopsis of the advances in the prenatal diagnosis of inherited diseases.

The recommendation of the Working Party, that the scientific community and media have a duty to inform society of these new developments in a responsible and open manner, is laudable and well demonstrated in this book. Secrecy or paternalism can only produce suspicion and fear. The text communicates in a professional and honest manner the speed of scientific developments in modern genetics and shows how they demand an ethical response in a way that is probably unprecedented since splitting the atom. The controversial application of germ-line as distinct from somatic gene-therapy is considered unjustifiable because it causes changes in the genetic make-up not only of the individual but of his/her descendants. Reasons are given why information about a person’s genetic make-up should be treated as confidential. The view is expressed that genetic screening by insurance companies is currently unacceptable because the link between genetic markers and development of the disease is often not sufficiently well established to permit the accurate prediction of risk. Knowledge from the Human Genome Project, part of the ‘collective property of the whole human race’, promises benefits to human health and welfare, and is seen as a legitimate and timely pursuit. The text gives inadequate consideration, however, to the potential of the new genetics as applied to the food demands of people in developing countries, symptomatic of a tendency to assume that application of these advances is the prerogative of the privileged.

Although not addressed directly, questions inevitably arise about whether the scientific and medical community are ‘playing god’, or ‘tampering with the stuff of life’? The book provides necessary background to assess whether this is the case, and acknowledges that whereas it is extremely unlikely that something will go wrong with genetic modification, serious error could be catastrophic. What cannot be ignored is the need for a continuing public debate about the implications of the new genetics, which are here to stay. Christians need to be well informed, and here is a very useful, accessible, unemotive and readable account for those who need to be active in the debate which will probably affect all—in sickness or in health.

R. B. Heap

Professor Heap is former Director of the Babraham Institute, Cambridge.

Manfred Eigen with Ruthild Winkler-Oswatisch (Translated by Paul Woolley)

*Steps Towards Life—A Perspective on Evolution*


For centuries philosophers have sought unsuccessfully for a scientific explanation of life. Some half a century ago the eminent physicist Erwin Schrödinger in his now classic little monograph ‘What is Life?’ (Cambridge University Press, 1944) attempted to explain life in terms of classical physics, but could only conclude that the ‘cogs’ which make up the living organism were ‘the finest masterpiece ever achieved along the lines of the Lord’s quantum mechanics’. In the present, attractive
and very readable little book, another eminent German scientist, the biophysical chemist and Nobel Laureate Manfred Eigen seeks for the explanation of the transformation from inanimate to living matter in modern molecular biology. Using arguments which he describes as 'based on exact mathematical models and experimental studies on biological material' Manfred Eigen takes us through the period from the appearance of deoxyribonucleic acid (DNA) to the emergence of the first cell, a period which he refers to as a 'day of creation' which lasted some five hundred million years.

The book, which was first published in German in 1947, consists of three largely independent sections; Part I, entitled 'What was life?' contains the essential discourse of the book. Part II 'Vignettes from molecular biology' discusses some important molecular biological questions and problems, while the final Part III contains a résumé, an epilogue, notes and reference, a very useful glossary of terms and an index.

In Part I of the book the theme for each of the ten, short chapters is set by a quotation from Thomas Mann's novel Der Zauberberg (The Magic Mountain) which was published in 1924, some thirty years before molecular biology became a recognised area of study. The opening chapter draws attention to the fact that life is not an inherent property of matter but something which appears only under very specific conditions and that we can only expect to understand how life did begin by examining the historical evidence. In the second chapter the author shows how the analysis of the sequence of amino acids in proteins and nucleotide bases in nucleic acids can provide information on the time scale of evolution and provide a best estimate for the appearance of the genetic code of 3800 ± 600 million years ago. Eigen then goes on to consider the problem of complexity in living cells, the development of information and how it is used to organise life as a dynamic state; the argument is then developed by showing that evolution is the optimisation of functional efficiency in an organism. The next chapter asks the question 'What are the natural prerequisites for the origin of life?' and considers the origins of the first self-replicating molecules. Numerous possibilities are discussed but the conclusion must still be that we do not know what really happened under prebiotic conditions, except that it must have followed the laws of chemistry and physics. The penultimate chapter in this part deals with the complex problem of what Eigen calls 'the ladder of organizational levels', and the regulation of self-organisation within a cell by the programme enshrined in the genome, in relation to the much larger area of self-regulation which cannot be under direct genetic control, citing as an example the human nervous system which contains vastly more cells than there are information symbols for in the genome. The final short chapter is entitled 'Uncessing creation' in which the author expresses the view that creation is by no means at an end and that while we do not possess the knowledge at present, human intervention in a creative sense may become possible, but for this to happen the human mind must be mobilised to address both the ethical as well as the scientific problems.

The second part of the book comprises fifteen essays on various aspects of molecular biology ranging from sequence comparison in nucleic acids and proteins through the age of the first life forms, the genetic code, cloning of mutants, viral infections to recombinant DNA. These clearly written short essays provide a very useful 'plain man's guide' to molecular biology.

The résumé which forms the last substantial chapter of the book attempts to bring together all the arguments about how the transition from non-living to living state is to be explained. Physical arguments based on thermodynamics or quantum mechanics cannot alone, at the present time, explain this transition,
or the processes of evolution without postulating a vis vitalis, or a Maxwell's demon at work outside of physical laws. Such a demon would need to be very active and driven by an internal feedback mechanism which searches in a very discriminating manner for the best route to optimal performance, not because of some predestined goal but simply by virtue of its inherent non-linear mechanism which gives the impression of being goal-directed. With the development of information-storing molecules, RNA and DNA, in the chemically rich pre-biotic environment, self-replication of encoded genetic molecules became possible. Selection and evolution thus became a matter of competition between all the individuals that can replicate, leading to internal regulation of the relative numbers of all the mutants until the optimal state for the prevailing conditions has been reached. Mathematically we are told all these ideas fit effortlessly into the new physics of non-equilibrium states.

This is a very well written, thought-provoking book, that presents a very complicated subject clearly and in simple words which should be understandable by specialist and non-specialist alike. Theological discussion is absent since, as the author points out in his epilogue, his arguments are based on scientific knowledge which differs fundamentally from the essential subjectivity of religious experience. However, this absence in no way diminishes the interest of this excellent little book for the Christian reader.

David M. Taylor

Dr. Taylor is emeritus Professor of Radiation Toxicology in the University of Heidelberg.

Lewis Wolpert
The Triumph of the Embryo

This is an excellent book, full of hard science yet easy to follow, spiced with crisp descriptions of classic experiments and well illustrated with clear diagrams. The author is obviously an enthusiast and he carries the reader along as he explains the complicated early stages of development.

The book's origin is the series of Royal Society Christmas lectures and it keeps the freshness and excitement of that type of lecture. But it is by no means 'kids' stuff'. There is up-to-date and interesting information here for all those who want to trace the stages of development from fertilized egg to recognizable creature. It is definitely not a systematic textbook, but experiments on organisms from all branches of the animal kingdom are used to illustrate the various points. Throughout, the author persuasively puts forward his view that despite the enormous diversity of the animal kingdom there is likely to be a parsimony of signals and information systems. As we now know that the same basic genetic code is used by all organisms from yeast to humans so it may well be that there are a few shared basic cell information systems genetically programmed interplay will give rise to either afly or an elephant depending on the genetic information contained in the cell's nucleus, each successive response leading down the cascade appropriate for the creature that is destined to develop.

There are several chapters on early differentiation and then more specific chapters on the nervous system and sex determination. Growth, cell multiplication with malignant change, ageing and evolution all have their own chapters but the most interesting of these specific topic chapters is the one on regeneration. Here the humble hydra and the newt show themselves to have retained useful capacities long lost by higher organisms whose repair arrangements seem decidedly primitive.

Christians can join the author when he starts the final chapter by stating 'no-one who studies development can
fail to be filled with a sense of wonder and delight. Those who prefer the
intricacies of God's working to remain shrouded in mystery may find the book
a disappointment as it points away from complexity and suggests that
development of even specialized organs such as the eye may be governed by
simple 'origami like' tissue folding and chemical gradients. Others will res-
pond by marvelling at the possibility that our complex bodies, with all their
amazing capacities, have arisen in response to basic developmental signals
shared with hydra and sea urchin.

The writer of Psalm 139 acknowledges God's total understanding of him
saying 'You knit me together in my mother's womb'. If God's creative
activity makes use of simple but amazingly elegant systems surely we
too can join the Psalmist's outburst 'I praise you because I am fearfully and
wonderfully made'.

Embryology is at an exciting time in its own evolutionary development. The
descriptive era has shown us the shape of what is made. Now with our growing
knowledge of the genome we must surely be on the verge of answering
some of the 'how' questions.

This book provides an excellent foundation on which to build our under-
standing as these new developments take us into this next exciting
phase.

Caroline Berry

Dr. Berry is Consultant Medical Geneticist,
Guy's Hospital, London.

Nina Hall (Editor)
The New Scientist Guide to Chaos
ISBN 0140 145710

'Chaos, a science for the real world', is
the title of the first article in a series of
eighteen articles first published in the
New Scientist and here collected
together in a highly readable paperback.

Recent years have seen scientists from
all disciplines becoming interested in
the theory of chaos as they find its
relevance to their own area of expertise.

Chaos theory, coined in the early
nineteenth century to describe those
who believed in chaos before the cre-
ation, is now used to label specialists in
chaos theory.

It is some of these specialists who
have contributed to this volume. They
introduce us to the imaginative
mathematics at the basis of chaos theory,
to the chaotic behaviour of systems as
supposedly simple as a conical pendu-

lum and planetary orbits and to the
applications of chaos theory to scientific
areas as diverse as weather forecasting,

the stability of ships, electronic circuit
design and population dynamics in
biology. Ideas from chaos can even be
applied to models of market economics.

An article by Benoit Mandelbrot (well
illustrated with diagrams and colour
plates) presents something of the fas-
cination and the beauty of fractal
g
d

Illustrations that (counter intuitively)
chaos and order are closely linked
and hints that chaos can influence our
ideas about the fundamental structure
of things occur frequently throughout
the book. A final article by Paul Davies
briefly considers implications for deter-


The series of articles are well chosen and
well edited and, in the best tradition of
popular science, are both informative
and stimulating.

John Houghton

Sir John Houghton was, until retirement,
Director of the British Meteorological Office.

E. O. Wilson (Editor)
The Diversity of Life
Allan Lane/The Penguin Press, 1992,
424pp. £22.50 ISBN 0 713 990945

E. O. Wilson (according to Richard
Dawkins on the dust jacket) is '...
today's towering figure in American biological literature... and a latter day 'prophet' according to Stephen J. Gould (who reviewed this book in Nature). This is the same E. O. Wilson who was once described as "a Harvard specialist in ants" who "made a name for himself by pontificating on man". In 'Diversity' he pontificates on the whole biosphere.

The central theme of the book is that an immensely rich and interconnected flora and fauna have developed on Earth. In the early chapters of 'Diversity' the richness of these fauna and flora is explored and the questions it raises tackled. Here Wilson is at his best. Questions such as what biodiversity is and where it comes from are discussed at some length. From speculation to systematics, the reader is swept along in a welter of examples and evolutionary anecdotes. The point, that we are still woefully ignorant of the real diversity and complexity of life on earth, is well made several times over. Only a relatively few favoured (usually physically large) species are known to Science, and the quality of human life on the planet is crucially dependent on many of the most humble of these. Nor is the only point of value the tremendous numbers of species, but the way in which they have evolved to form intricate patterns of ecological inter-relationship. Ecology increasingly grapples with some of these inter-relationships, and Wilson gives a fascinating insight into this.

If the point of all of this is that we are ignorant of much of the biodiversity on the planet, the problem is that thanks to human activity vast amounts of biodiversity are being lost at an appalling and probably increasing rate...

'The sixth great extinction spasm of geological time is upon us, grace of mankind' (p. 342).

Should we bother? Wilson supplies numerous reasons why this has serious implications. There is the familiar argument that embedded in this threatened biodiversity are plants and animals that are of potentially vital significance to man. One example is the Madagascar rosy periwinkle...

'An inconspicuous plant with a pink five petalled flower, it produces two alkaloids... that cure most victims of two of the deadliest cancers...' (p. 283).

There are also less familiar arguments put forward. Without the services that diverse organisms and ecosystems provide for humanity, such as enriching the soil and creating the very air we breathe, Wilson claims: '... the remaining tenure of the human race would be nasty and brief' (p. 347).

Having convinced the reader that biodiversity is both fascinating and of great practical importance, Wilson shifts the emphasis to the means by which biodiversity might be protected, or at least its rate of loss reduced. Some of the suggestions are certainly practical such as strip-logging of the rain forest, which is regulated to allow regeneration of the forest in thirty- to forty-year cycles. Others attack the problem at the political level, urging just and sensible approaches to international agricultural trade. Some are undoubtedly controversial such as the need to control 'the raging monster upon the land', human population growth.

The main problem with Wilson's approach is that while he calls for 'an enduring environmental ethic' he provides no firm basis for it. It seems that biodiversity is only as valuable as its utility, it should be preserved because it is vital and useful. Yet throughout the book the language suggests that Wilson sees underlying value and purpose as distinct from utility, and utility is a famously difficult concept to pin down. Thus the Mexican truck driver who shot one of the last two imperial woodpeckers is quoted by Wilson as saying 'It was a great piece of meat'. Now, if all that matters is utility of the woodpecker, presumably the truck driver cannot be criticized; after all with only two members of the species left the species was
about to be extinguished. Indeed the truck driver probably did the right thing, as he managed to feed himself and possibly his family. However this example illustrates the limit of the utility conflict: an impasse is reached. A far better basis is the Biblical one of stewardship. This does not instantly resolve all the conflicts, but provides a surer basis for resolution. In the final chapter Wilson declares 'We have little grasp of our true nature...' (p. 348).

Until individuals and societies attain such a grasp (surely uniquely provided by the Bible), and begin to work through the implications of holding the natural world in trust, the destruction of the environment and loss of biodiversity will continue.

Despite the ultimate weakness underlying the thrust of 'Diversity', it is well written and well presented. It is well worth a read if only to appreciate anew the Creator's skill, ingenuity and scope.

Paul C. Kneze, Vision Research Fellow, Laboratory for Neuroscience, University of Edinburgh

Michael White and John Gribbin
Stephen Hawking: A Life in Science

It may well be true that Stephen Hawking is the best known scientist alive today. No little of that fame is due on the one hand to the astonishing fact that he is still alive after quarter of a century of amyotrophic lateral sclerosis, which has left him almost totally dependent on nursing for bodily needs and on a speech synthesiser for communication, and on the other to the remarkable piece of self-advertisement that his best seller has become through the skill of his publishers. Whether the almost subliminal hint, both in his own A Brief History of Time, or the book under review, that his immensely important contribution to cosmology sets him alongside Galileo or Einstein it is too early to judge but his popularity as a seminarian and as a public lecturer are phenomenal and his courage and tenacity in achieving a creativity unpromised in his youth are praiseworthy indeed.

If an excellent account of Hawking's work at a level intelligible to the layman is required, then John Gribbin's chapters in this volume (they are easily distinguishable) provide it even better than Hawking himself does in Brief History. If one can stomach a thoroughly journalistic account of the non-scientific side of the great man and a similar newspaper style inflation of the significance of great honours rightly won, then Michael White's equally easily distinguished chapters give this without the penetrating character study typical of a more scholarly biography. This division of the task has given rise to repetition of incidents that less haste would have removed.

What are we to make of the Life in Science presented to us? Hawking is a very great scientist. I would place the seminal impact of his contribution, especially the way in which he brought quantum physics and general relativity gravity together through (astonishingly) thermodynamics, alongside that of Crick and Watson and the DNA double helix. History will have more to say. Cosmology is only very remotely an observational science. Hawking is a man of enormous strength of character. But greatness is a value judgement and the readers of this journal may well, like this reviewer, ask about another kind of greatness.

Muggeridge's famous address to Edinburgh University Another King, One Jesus went to the heart of the matter. Measuring greatness by that standard I perceive why I feel sad about Stephen Hawking. The double stress on Stephen's and Jane's marriage, both from his need for constant nursing and
from his international travel and fame, called for something beyond normal human love and Jane's self-sacrifice. The missing data in Hawking's analysis of the 'Mind of God' is the mind of One 'Who made Himself of no reputation'. Whose love is unconditional and whose 'Name is above every name'. Jane knows Him. If Stephen did too his well deserved fame would be crowned with an unfading lustre.

Robert Boyd

Sir Robert Boyd is a Fellow of the Royal Society and Emeritus Professor of Physics, University of London.

Ian Barbour


This eagerly awaited sequel to *Religion in an Age of Science* possesses all the characteristics that one has come to expect of Ian Barbour's writing. It is a lucid, comprehensive and balanced account of ethical issues as they relate to the world of modern technology.

The book is divided into three main sections: Conflicting Values, Critical Technologies and Technology and the Future.

Under the heading of Conflicting Values, Barbour explores contemporary attitudes to technology, human values (both individual and social) and environmental values. He examines the scientific, philosophical and religious arguments used to justify the competing value systems he describes. In the course of this examination he sketches in what he takes to be a Christian perspective. Three themes emerge as particularly important for contemporary policy decisions involving technology: justice, participation and sustainability.

Turning to Critical Technologies, he offers as case studies agriculture, energy and computers. The ethical dimension of agricultural technology allows him to explore the impact of technology on traditional human communities as well as environmental questions. Energy raises questions of global justice, environmental quality and sustainability. His chapter on computers looks at their impact on working practices as well as on their effect on access to information.

In the concluding section, he addresses the unprecedented powers afforded to a few by recent technological developments. Specifically he examines the threat posed by further environmental depredations, genetic engineering and the continuing proliferation of nuclear weapons. He argues that international action is necessary to deal responsibly with each of these issues. In the penultimate chapter, he maintains that democratic control of technology is still feasible in spite of the difficulties of assessment and regulation. Finally he makes suggestions about possible new directions, assessing the appropriate technology movement and exploring the possibilities of more efficient technologies and simpler lifestyles.

There is an inevitable weakness in seeking to be comprehensive. Every one of the issues raised is worthy of an entire book in itself. It is impossible to avoid over-simplification when the attempt is made to cram such a broad subject into three hundred pages and, moreover, do it without recourse to the kind of technical jargon which would render it impenetrable to the intelligent lay person.

Then there is the question of balance. I couldn't help feeling that he was too balanced at times. In part, this is a result of over-simplification. For example, he divides the world into technological optimists, pessimists, and those who maintain a critical via media. But in his haste to expound the virtues of the *via media*, he fails to do...
justice to some of those he criticises. Thus, technological pessimism is caricatured in a way that completely fails to register the real point of many of the pessimists' complaints: they are not opposed to the artifacts of technology so much as to the mind-set which has produced our society: their complaint is not against technology as such but rather against the dominance of technical reason (or functional rationality) over other forms of reason.

However, his defence of a via media is not just a matter of over-simplification. In the concluding chapters, Barbour offers us a catalogue of anti-democratic tendencies within contemporary technocracy—a catalogue worthy of any technological pessimist! But he does not seem unduly worried by his own assessment. Instead he reasserts his faith in the capacity of western democracy to overcome these tendencies. It might have been helpful to the more pessimistic and cynical of his readers if he had presented a more developed case for his faith in democracy.

Another quibble I have about the book is the way his entire lecture series was structured. Volume 1: religion and science; Volume 2: ethics and technology. It is neat but hardly does justice to the complexity of the relationships between these four subject areas. Does it perhaps also reflect the traditional western tendency to elevate theory above praxis?

Finally there is the question of the relationship of the Christian tradition to ethics and what, if anything, Christians might have to contribute to these debates. Barbour allows Christianity to be one of the players in the development of an appropriate ethic. However, it should be noted that his preferred form of Christianity is much attenuated.

But these are only quibbles. The book does not pretend to be the definitive statement on technological ethics. Rather, it is an extremely valuable introduction to the subject. I suspect that like several of its predecessors from the same pen, it is destined to become a standard undergraduate textbook.

Lawrence Osborn

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Richard Milton

The Facts of Life

(Fourth Estate, 1992, 267pp. £16.99)

Bantam, 1993, pb. £4.99 ISBN 0552 141216

Just when you thought it was safe to believe in evolution another author comes and tries to turn the tide once again. What makes this book different from the average anti-Darwinian tome is that the author has no theological axe to grind. He claims to be open minded about the origin of the earth and life and believes, no doubt rightly, that teleistic views of creation and Darwinian ones, are both based on faith. But although he is not a covert creationist he does quote extensively from creationist literature.

Much of the ground covered is familiar territory. He reviews the criticisms offered of the various radioactive dating techniques and suggests various reasons for believing that their support for a great antiquity of the earth is questionable. He favours catastrophism to uniformitarianism to explain the existence of fossilised trees and the burial of complete dinosaurs and that coal was formed fairly rapidly under pressure and not by the slow decomposition of vegetable matter. He refers to the lack of intermediate fossils and the impossibility of being able to construct sequences illustrating evolutionary development.

In an interesting passage Milton criticises the idea of the survival of the fittest, pointing out that it is not so much those that are best fitted but those individuals who happen to be in the right place at the right time who survive.
Other topics dealt with at some length are mutation and natural selection, vestigial organs, convergence, 'hopeful monsters', life from space and punctuated equilibrium. The weakest part of the book is, as so often the case, that dealing with human evolution. The most fruitful is his critique of Dawkins 'The Blind Watchmaker' and his comparison of evolution to the spellchecker of a computer. His positive contribution to the debate is to tie biological evolution in with quantum physics and to make the cosmos more like an intelligence and less like a cosmic machine. His view of God has little to do with the work of Allister Hardy and, although he does not acknowledge him and presumably has not read him, to the seminal work of Rupert Sheldrake.

The volume is well-researched but the reader needs to beware, because valid insights are mixed up with very questionable presuppositions. Many of the criticisms that he raises have been answered elsewhere not least in books by Christian evolutionists like 'Sam' Berry, Michael Johnson and Davis Young.

Reg Luhman

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A. van den Beukel

*More Things in Heaven and Earth: God and the Scientists*
SCM Press, 1991, 166 pp. £8.50

In this book we are taken on a tour from science to faith by an honest and reliable guide: a physicist and a Protestant. He shows us in the first five chapters what it is like to be a scientist. He can do it, for he (the author) is a professor of physics at the Technical University of Delft, and in fact this book was first published in Dutch in 1990. In the last half of the book he shows us the 'way of faith' and talks about stories in the Bible. He takes issue with science authors Paul Davies and Stephen Hawking in the sense that he feels that it is meaningful and consistent to be both a scientist and a believer.

I found most resonance with the first half of the book, for here van den Beukel opened up a door and let the reader see what it is really like to be a scientist. He speaks of scientific 'output', i.e. papers published in academic journals. He tells one that one has to go to Conferences to advertise one's findings should these lie in the twilight of success: reliable but not outstanding. He speaks of how nice it is for a scientist to have his article quoted by others in the literature. But, alas, half the published articles are never cited at all! Is this an indication that too much is being published, that libraries can save money and space? Our author does not dwell on these matters—he has to move on. Yet I felt this second chapter entitled 'Nothing Human is Alien' is rather unusual, and I retitled it 'Scientists as Salesmen'.

For this part I can strongly recommend the book. In the second part the author proceeds in a more standard manner and may have less to impart. Yet the book is again noteworthy, for example, for the author's uninhibited exclamation after quoting from Hawking regarding the possibility of humans knowing 'the mind of God': Van den Beukel responds in italics 'The boundless arrogance'!

Peter Landsberg

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Richard Fifield (ed.)

*The New Scientist Inside Science*

Since 1987 New Scientist has regularly published supplements aimed at helping science teachers by informing them
about aspects of science 'behind the news'. Each takes the form of a four page detachable insert in the magazine, printed in two colours and with a varied and attractive page layout.

This book is a compilation of these supplements, and is clearly also aimed at science teachers in schools. Putting the collection together has allowed the editor to produce a sensible sequence, in four unequal parts.

Topics in Part 1, 'Physical and Chemical Sciences', range from the Big Bang through the forces of nature to the origin of the chemical elements, radioactivity and the planets. Part 2, 'Earth Sciences and the Environment', includes chapters on the structure of the earth and its magnetic field, followed by acid rain, the ozone layer and the greenhouse effect, finishing with two on plants and their interactions. After dealing with the possibility of life elsewhere in the universe, the third part, 'Life and Cell Biology', includes more conventional chapters on the immune system (2), the new genetics, the nervous system (3), proteins and cancer. The final part, 'Some Chancy Mathematics', consists of a single excellent chapter on the analysis and perception of risk.

Overall the text of the book is successful in its aim of giving science teachers relevant and up to date information. While somewhat variable in level, the chapters all convey in straightforward terms, with very little mathematics, the currently accepted scientific view of particular areas. They assume little beyond basic scientific concepts, which is appropriate since a teacher's specialism could be any of the sciences. The books suggested for further reading are in the main popular scientific classics.

The authors are mostly journalists, but include a few academics. It has to be said that the latter are not such effective communicators as the former, giving significantly less attention to making the subject matter relevant and interesting to the non-specialist.

Certain problems arise from the way in which the book has been created. There are a few minor inconsistencies, such as the date when the idea of a black hole was first suggested (18th or 20th century?), and a small amount of repetition. But there are two serious flaws which could have been avoided.

The first arises from the fact that in the original format of four large pages, separate boxes are commonly used to deal with distinct aspects of the topic. This works very well in a magazine, but does not translate easily to the book format of a dozen smaller pages. The editor has retained these separate elements, but he would have been better advised to edit each chapter into a coherent sequence which could be read straight through.

The most serious problem with the book relates to its illustrations. A curious decision was made to avoid the use of photographs, which would have enhanced several of the chapters a good deal. Instead drawings are invariably used, and the majority have thick lines and large areas of shading. This works well on some occasions, but in many contexts is highly inappropriate. There is also an unfortunate tendency to use a cartoon-like style. One gains the impression that the illustrator did not realise when precision was required, and when a sketch drawing was sufficient. Several of the graphs are distinctly misleading. However the printing and proof-reading are of a high standard.

On a more subtle level, the authors have for the most part failed to convey that scientific ideas change and develop over time, and consequently the impression is left that, while there are unanswered problems, what science tells us is the unquestionable truth. This is unfortunate, although clearly not deliberate. Some Christians will be unhappy with some of the assumptions that are made, for example
that if the conditions for life exist then life will certainly arise. It is also disappointing that so little reference is made to the ethical questions raised by several of the topics considered.

Nevertheless the book fulfils its main purpose well, and will be useful to many teachers of science.

John Bausor

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Editorial note: The 'Inside Science' inserts are available, grouped as Fact Packs which correspond to the chapters of the book. The Packs may be obtained from John Denton Services, Unit 13, Thornham Grove, Stratford, London, E15 1DN.

James Barr

Biblical Faith and Natural Theology (The Gifford Lectures for 1991)

Natural theology is a contentious subject. Barth and Brunner are reputedly to have terminated their friendship over it. The Scottish Old Testament scholar, and author of Fundamentalism, James Barr has chosen this subject for his 1991 Gifford lectures. The choice is apposite and timely; it fully meets Adam Lord Gifford's criteria for his lectureships, and natural theology is at present undergoing a resurgence, particularly among scientists.

Barr offers a 'fairly wide' and 'something vague' definition of natural theology: as humans we have a 'certain degree of knowledge of God and awareness of him, or at least a capacity for such awareness; and this knowledge or awareness exists anterior to the special revelation of God...'. (p.1).

After first mapping out the main concepts (ch. 1) he examines the biblical material that present a prima facie case for natural theology: Acts 17 (ch. 2); Romans 1 (ch. 3) here he notes that Paul's thinking is reliant on Hebrew thinking, notably the Wisdom literature; the Jewish tradition (ch. 4); and the OT (ch. 5). He concludes that natural theology is present in the Bible but as a 'somewhat minor constituent', and that the main source from which this Christian natural theology arose was Hebraic.

The remaining chapters (ch. 6—10) deal with Barth, religion and tradition, the image of God, biblical theology. The penultimate chapter deals with science, linguistics, parables and scripture. The section on science consists of a mere nine pages, and in it he attempts to distance the development of science from the biblical tradition (p. 181).

Disappointing is the lack of space given to the use of natural theology by Polkinghorne, Montefiore et al; neither gets a mention.

More surprising is his ignoring of Paley's classic work. The discussions centre around the scriptural evidence and the erroneous ideas of Barth concerning natural theology. Consequently, this book is only tangential to the concerns of this journal.

My problem with Barr's approach is his too broad and elastic definition of natural theology. He seems to be continually expanding it (cf. p. 41), so that in the end there is no distinction between natural theology and general/creational revelation. Barr's arguments in support of a natural theology in the scriptures are arguments for creational revelation. It is this blurring that is a major flaw in his work. There is no discussion of common grace or general/creational revelation. Had there been, his thesis could have been modified and strengthened.

He asserts, but never shows, that interculturality and interreligiosity point towards natural theology (cf. pp. 5, 84, 92, 176, 187, 204). But this interculturality/religiosity could merely be the result of different
cultures/religions living in God’s world, they are dealing with the same ‘raw data’ of creation as everyone else. It would be more surprising if there were no interculturality!

I can only conclude that Barr’s case for a natural theology in the scriptures is not proven. Nevertheless, this will be an important book to read for all those who see natural theology as a basis for relating science and theology even if, as Barr maintains, it rests upon philosophical rather than biblical foundations.

Steve Bishop

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Arthur R. Peacocke

Theology for a Scientific Age: Being and Becoming—Natural, Divine and Human

Enlarged edition, SCM Press, 1993, 438 pp., £15.00 (0 334 02547 8)

Parts I and II of this book were originally published in 1990 (previously reviewed in Science and Christian Belief, 5, 1 (April 1993), 78f.). This new edition has a new part III consisting of the author’s 1993 Gifford Lectures. Given Arthur Peacocke’s very active role in the dialogue between science and theology, any new work from his pen is of considerable interest. Peacocke rightly insists that Christian theology must interact with the world view which informs modern science. However, his approach to this task is by way of natural theology.

Accordingly, part I introduces us to the world as seen from the perspective of modern science. Peacocke outlines the fundamental entities and processes of our universe as revealed by the scientific method. Embedded in this summary are useful but essentially familiar discussions of the poverty of reductionism, the place of interconnectedness and the nature of causality. He portrays the universe as one in which continuity and development justify our faith in progress. The conclusion of this section is a discussion of personhood from a scientific perspective. Peacocke highlights self-awareness, free agency and the capacity for suffering as key features in this perspective. One might be forgiven for asking in what sense these emerge from our recent scientific understanding of the world; many prescientific Augustinians might have produced a similar list.

Since this is an exercise in natural theology, part II explores what might be said of God in light of this new understanding of the world. Again there is nothing particularly new in what Peacocke has to say. God is the immanent (and transcendent) personal basis for meaning in the cosmos. This God acts through the causal nexus. Peacocke is attracted to the mind-body relationship as an analogy for divine action. However, he recognises the difficulties inherent in a too ready identification of the world as the body of God. Nevertheless, he clearly opts for a panentheistic conception of God as the most satisfactory way of speaking about God in a scientific culture. Unfortunately panentheism is a deeply ambiguous concept. It may be no more than a contemporary restatement of the orthodox doctrine of divine omnipresence. Alternatively it may be an assertion of ontological continuity between the world and God. Peacocke is aware of this ambiguity but chooses to hide his cavets in the endnotes: there he denies that his intention is to suggest such continuity. Sadly the main body of the text is less clear on this important point.

Part III attempts to relate this God of the (scientific) philosophers to the God and Father of our Lord Jesus Christ. It opens with a conventional liberal exposition of the concept of revelation as consisting of general and special
dimensions. The former is the basis for natural theology while the latter is interpreted in terms of religious experience. From there we move to a discussion of human nature informed by his 'scientistic' perspective on personhood. This allows him to redefine sin as alienation and lack of integration.

Turning to Jesus, Peacocke quite rightly insists on his full humanity. Taken with his prior discussion of human nature, this results in a presentation of Jesus as a uniquely integrated human being: a man who was uniquely open to God. The result is a form of adoptionism: 'Jesus, a completely human being, exercised his free will to be entirely open to God to such a distinctive degree that his disciples came to designate him as the "Christ" and their successors to develop an understanding of what was happening in him as the "incarnation" of God' (p. 307).

He goes on to discuss Jesus’ miracles in the light of the scientific world view outlined in part 1. As you might expect, they are either dismissed or explained naturalistically. For example, the virginal conception is dismissed as genetically impossible and theologically offensive. Interestingly, he does not dismiss the resurrection in this way. Instead he affirms the continuing personal identity of Jesus while remaining agnostic about the fate of the body. But why is he agnostic here? One 'assured result' of biology is that dead bodies remain dead. Furthermore, even this attenuated affirmation of resurrection seems to depart from his earlier insistence on consistency with the scientific world view. Having affirmed a mind-body identitarian position (p. 160), he now seems to be suggesting a form of mind-body dualism instead.

What of the work of Christ? Peacocke advocates an exemplary understanding of atonement as the only model which does not offend modern sensibilities. In his view the more objective models fall at the bar of science and progress (p. 327). Jesus is 'the supreme paragon and original archetype of what God intends for all human beings' (p. 318) and to which we can all aspire. Because of his unique openness to God, Jesus’ death reveals the extent to which God shares in our sufferings and thus makes them more bearable (presumably on the basis that a trouble shared is a trouble halved). One wonders whether such a thought would have been of much comfort to the victims of Auschwitz. Implicit in this is a Pelagian concept of Christian discipleship: we do our best to measure up to the standard set by Jesus. Consistent with this, we find that Peacocke reduces grace to God’s forgiveness of our failure to reach that standard.

Finally, the Trinity. In a move uncannily reminiscent of Schleiermacher, Peacocke append a postscript on this subject. The economic trinity may be seen as an expression of divine diversity-in-unity but trinitarian ideas play no organic part in Peacocke’s theology.

As I read this book I was reminded of Barth’s questions about natural theology. Peacocke calls for science and theology to interact. But the way of natural theology seems an entirely one-way interaction: religion within the limits of scientific reason alone (to paraphrase Kant). This is well-illustrated by his treatment of the virginal conception: his theological objections are objections to options predetermined by his understanding of genetics.

As Barth pointed out, the ever-present danger in natural theology is that of importing unacknowledged presuppositions into theology. For example, Peacocke apparently reads the doctrine of progress out of the scientific evidence and, at various points, imposes it upon his theology. It is equally arguable that the gradual progressive view of evolution he favours was read into the scientific

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evidence by Modernity. Thus a foundational myth of Modernity is being used to reshape theology.

Related to this danger is the interesting observation that Peacocke frequently quotes John Macquarrie without, as far as I could see, ever criticising his opinions. It is quite remarkable that a non-scientist like Macquarrie could anticipate so accurately what a theology shaped by science would look like. Or is it a process of rationalisation? Is Peacocke actually offering us a predetermined theological position under the guise of natural theology? Is he justifying his theological perspective (derived from Macquarrie) by deploying what remains one of the weightiest aspects of modern culture, namely, science? If so, one (probably unintended) function of the book is to shore up the cultural hegemony of science by asserting its authority over religion: 'my theology is to be taken seriously because it submits to the authority of science.'

In conclusion, I found this book challenging, interesting, but ultimately unconvincing. It tended to confirm my suspicion that natural theology has an uncanny capacity to confirm the theological positions of its advocates. I agree with Peacocke's desire for dialogue between science and theology but I cannot believe that theology must remain the mute partner in that dialogue. There has to be more open and honest admission of the finitude of the scientific perspective (the days of the scientist as quasi-omniscient observer are over) and of the openness of science to non-scientific presuppositions (e.g. the myth of progress).

Lawrence Osborn

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John D. Barrow
Pie in the Sky, Counting, thinking and being

That this text was first published in boards by Oxford University Press just one year before the Penguin edition is of itself a commendation. Like others of Barrow's books this is profound, captivating, at times calling for very close attention, and liberally sprinkled with apt quotations and epigrams at the head of each section. To give an example (or is it two?) the section on Paradigms in the chapter entitled 'Intuitionism: the immaculate construction' carries the anonymous graffiti 'Brother, can you spare a paradigm'.

The essence of the book might be seen as a wide ranging exploration of Sir James Jeans' famous phrase 'God is a mathematician' with a primary emphasis on both the origins and intrinsic nature of mathematics and God merely symbolised by the Sky of the title.

Most of us in the sciences take the concept and very existence of number as just part of being. Cosmologists, in particular, pursue their researches with rarely a thought as to where the whole logical structure comes from. Does Pi have a primordial metaphysical existence in the sky of some Platonic world of ideals? Or has it a celestial existence which relates it more closely to the Universe as both its raison d'etre and sine qua non? Does it find birth, together with the rest of mathematics it symbolises, as a construct of our minds, and if so was it conceived in an evolutionary process that demands an anthropic correspondence between our brain progeny and external physical reality?

The whimsical chapter headings give only a hint of what is to follow in their sections but each is named in the contents list and there is an extensive bibliography of further reading and a useful index. 'From mystery to history'
and ‘The Counter Culture’ explore primitive counting in man and animals. ‘With form but void’ and ‘The mothers of inventionism’ will introduce those unfamiliar with the philosophy of mathematics to some interesting history and in that context the even more important impact of Kurt Gödel on the formerly apparently unshakable logical structure of mathematics and very much else in science that rests on that foundation.

It is intriguing to find that in mathematics as in physics today the role of the ‘observer’ is crucial and concepts as ultimate as ‘The mind of God’ impinge, even if uncalled, upon the mind of man.

Robert Boyd

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Steven Weinberg

Dreams of a Final Theory


Is there a final theory of physics? Well, it is an ill-defined question. The people who talk about this type of thing, do not, if they are sensible, mean that the whole subject is complete and rounded off; they mean that the theory of the basic particles and force fields is possibly complete, leaving still plenty of work in physics areas like fluid flow, elastic properties of materials, semiconductors, meteorology, etc. Weinberg belongs to this group of ‘sensible finalists’. Of course, some people talk about ‘The End of Physics’ which is much more misleading (in spite of the question mark). Why one does not feel entirely happy with these formulations is that they have the smell of exclusiveness, of superiority, as if such questions MUST refer to particles and fields. In fact one senses that the author regards as beautiful and worthwhile precisely this kind of physics. But what about the rest: statistical mechanics, for example?

The hope (or conjecture) of completed understanding of basic physics is not new. Weinberg quotes an 1894 remark by the American physicist Albert Michelson (of the Michelson-Morley experiment) to the effect that further advances in physics would be found in the rigorous application of known principles and in the determination ‘of sixth decimal places’, and that this is uninteresting physics. Lord Kelvin is often believed to have said similar things—here on p. 9 (and in Science as Salvation by Mary Midgley on p. 89). However, if one looks for a direct quote from Lord Kelvin, one is faced by the problem that he has said and written many things, and to find this quote one has to read a great deal. Having done so, I have concluded that right into his old age he was always looking forward to hearing of new basic discoveries. Unlike Hawking in our own days, he did not seem to envisage ‘the end of physics’.

Turning to the main text, the language is clear and precise and it touches on much basic physics from Newton to the present day, and does so with mastery facility which bears witness to the author’s long and intense preoccupation with these problems. There is no explicit mathematics, but the reader must be willing to think about W particles and imagine the beauty of ‘logical rigidity’ in physical theory (p. 119), and all that sort of thing. It is highly recommended reading.

A 16-page chapter is devoted to God and a 19-page chapter to ‘Against Philosophy’. Simplifying a little, Weinberg has not much to say in favour of religion or philosophy. ‘If there is a God . . . then he has taken very great pains to hide His concern for us. To me it would seem impolite if not impious to bother such a God with our prayers.’ (p.
200). But to his credit Weinberg is explicit in the chapter on God in pointing out that in it 'he leaves behind' any 'claim to special expertise'. He is an expert on physics, not on God.

A thread running through the story, important to the author but probably not to the average reader, is the author’s repeated suggestion inserted at appropriate points, that more big machines should be built (strictly: just the Superconducting Super Collider). The possibility of a government-inspired or a politically necessary slow-down in such big science does not seem to be envisaged by him. This represents a lacuna in his argument.

When one comes to the enjoyable chapter on beauty in physical theories, there is one feature not mentioned by the author, but about which the reviewer feels rather strongly: sometimes familiarity is needed before beauty is recognised. This holds for music as well as for mathematical theories.

On one other point the author’s position seems to me to be not entirely consistent: the problem of infinities. We do not want infinities in physics—that is clear, and Weinberg pays attention to this problem (p. 164). However, he calmly envisages infinite temperatures and densities at the Big Bang (pp. 136, 158), and he does so also in string theory (p. 170). This requires comment in any future edition.

This is no normal popularisation of science. The book reveals an author of considerable stature.

P. Landsberg

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Margaret Donaldson
‘Human Minds’: an Exploration
Allen Lane/Penguin, 1992 314 pp. £20
ISBN 0 713 99013

I once saw scrawled on a wall in a physiology department ‘What is mind: it’s no matter’. In this book, Margaret Donaldson seeks to explore what mind is and how it works. But where to begin? Although ‘different minds develop differently,’ she maintains that ‘there is also commonality’ (p. 10). Her starting point is to distinguish four modes of mental operation in which the ‘locus of concern’ is distinctly different. These four modes

‘come in succession upon the scene as we grow older, but do not replace one another. None of them is ever lost ... But within each mode changes occur over time. They are not static.’ (p. 10)

The first and most basic mode (which can be demonstrated in infants of less than one year) is point mode in which ‘the locus of concern is . . . the here and now’. Interestingly, she suggests that to do science, one has to switch into point mode, to exclude non-relevant factors. This feature of switching between modes, is one of her other great concerns which we will come to below.

Towards the end of the first year of life important changes develop in infant thinking. A new mode is added to the repertoire-line modes. The locus of concern can now shift from ‘here and now’ to ‘then and there’. Line mode brings with it an awareness of options and choices, past and future. Although the onset of line mode is very early, Donaldson is careful to explore how throughout life it widens and among other things ‘makes possible behaviour of the kind we call ethical’ (p. 62).

However it is the other two modes, construct mode and transcendent mode which readers will find most provocative. In construct mode (which begins towards the end of the second year as core construct mode) there is an interplay between thought and emotion, where emotion has the function of ‘value sensing’. It is the development of this mode which allows ‘movement from specificity to generality’ (p. 81). Development within this mode leads to
the distinction of 'intellectual construct mode' where distracting emotions can be relegated to the background and 'thought' predominates and 'value sensing construct mode' where emotion predominates. There is a further intellectual mode, in which 'thought has primacy', but in which

'the mind is ... able to function without contexts derived ... from personal experience if living in the world. The prototypical activities of the intellectual transcendent mode are logic and mathematics' (p. 126)

There is also a value-sensing transcendent mode which is the most difficult to explain. However, Donaldson goes to considerable lengths both to explain what this mode is and its importance. In this mode ...

'the need for a constructed context has gone, so that self-transcending values can now be experienced and responded to ...' (p. 151)

While these ideas are rooted in the development of individual minds, the modes can be detected operating in societies and cultures. At the close of the first millennium in Europe, for example, Donaldson claims, '... the culture overwhelmingly favoured and promoted the value sensing construct mode.' (p. 164). Natural phenomena were studied because they pointed to a deeper reality; they were symbolic of religious truth. However, from medieval times on, particularly thanks to the rediscovery of Greek thought and the influence of Arab scholars, things began to change. The value-sensing construct mode was increasingly challenged by the intellectual construct mode. How did the Church (the dominant institution at this time) respond to this? Did it develop the value-sensing, even transcendent modes, so maintaining a balance? Donaldson argues that it sought to compete, particularly with science, and so emphasized the intellectual side of religion. This was particularly true of the Protestant tradition. So the intellectual modes came to dominate in Europe. Certainly emotion was expressed, for example in the work of Beethoven and Wordsworth, but this hardly redressed the balance.

So is it possible to develop the value-sensing construct and transcendent modes? Not only is it possible, it is probably desirable. Quoting extensively from both Christian (primarily St John of the Cross and Keith Ward) and Buddhist writers, Donaldson shows that both historically and today there have been those who have both sought to cultivate the 'higher' value sensing modes, and to master the discipline of switching between modes. But he also stresses that the cultivation of the value-sensing construct and transcendent modes, with the benefits that they bring, is possible for all, where basic social conditions allow. And indeed she discusses what is necessary in education to bring about balanced development of the person and society.

Reading the book, I sometimes felt that the canvas was a little too broad, and occasionally there was a sense of bare patches emerging as the brush of the argument rushed on. However this is an interesting book that deserves to be widely read for several reasons. Firstly, here is a careful and scholarly consideration of mind, rooted in empirical work in developmental psychology, which takes religious experience seriously. Indeed, it is at least implied that such experience, achieved in the development of the transcendent modes, is of practical importance as it forms part of '... a guide for living—a way of knowing what matters' (p. 237). Surely this is precisely the importance of the Christian's developing relationship with the Living God; transcendent experience rooted in such basic practicalities as how one should live. Secondly, the analysis conducted in the book has a bearing on how we might conceive both Church and secular history, and on contemporary and practical issues in science, education, and social policy. So there is much here for a wide readership, from the
interested lay person (the prose style is very readable) to the sceptical professional. Thirdly, given the continuing controversy of the 'collapsibility' of mental processes down to neurophysiological processes, the whole approach in the book of taking mental experiences, i.e. consciousness, seriously (which is the way most human beings behave anyway) rather than dismissing them out of hand, leads to an intriguing exploration of areas rarely touched today. Mind may not be matter, but in this book Margaret Donaldson shows that it matters, and matters a great deal.

P. C. Knox

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Susan Power Bratton

Christianity, Wilderness and Wildlife: the original desert solitaire


Reading this book might be likened to a wilderness sojourn, which may be seen, of course, as a commendation or a criticism depending on one's view of the wilderness. In my case it is rather a mixture of the two. As in the wilderness there is an awful lot of barren landscape to wander through in this book, with the occasional flash of inspiration confronting one in the midst of the literary desert. The question is, do these insights make the book worth working one's way through? The answer I am afraid, at least for those interested in what the Bible says about wilderness and wildlife from a scientific viewpoint, is 'no'.

Bratton starts encouragingly by saying that the Bible is theocentric rather than anthropocentric or biocentric. Soon however this perspective is lost in a confusion of models proposed of man's interaction with the wilderness. Bratton outlines four major purposes of the book. It aims to trace wilderness motifs through the Bible and show that the wilderness plays an important role as the setting for 'various spiritual events'. In addition it aims to review Christian literature from the end of the Apostolic era to the Reformation. Thirdly, the book aims to evaluate human responsibilities towards wild nature and, fourthly, to relate the lessons learnt through the first two aims to contemporary Christianity.

From then on Bratton proposes a bewildering number of models of man's interaction with the wilderness. The 'Genesis' or 'foundational' model stresses the role played by the wilderness in encounters with God. The 'Exodus' or 'community' model pursues this motif of hearing and seeing God in the wilderness. But we find statements such as 'the stresses of wilderness travel helped to clarify matters of faith and belief' although 'failures in the wilderness were not the level of the environmental stress'. Hearing and seeing what Bratton is trying to emphasise can be taxing in this book but she does show that the wilderness sojourn can increase dependency on God and that the 'lack of cultural clutter' aids a developing communication with God in some cases. Next we go through a 'Davidsic' or 'leadership' model of wilderness experience. Statements such as 'Wilderness training, should thus be quite appropriate to the building of Christian leaders' do appear out of the blue as did theophanies in the middle of the wilderness for Biblical characters from Abraham to Elijah but I am not sure this helps an understanding of how our Biblical reading of the wilderness links to present day use of outward bound schools as Bratton seems to think it should.

Through another five models we cover the wilderness in the prophets and psalms through Christ and John the Baptist to the book of Revelation.

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Through all this Bratton does stress some important points—the importance of solitude and separation which the wilderness provides and the possibility for God to transform in the wilderness away from the hubbub of everyday life. Without a doubt these are important concepts for us in the late twentieth century. What of the link with contemporary issues of care for the wild? Bratton acknowledges that dealing with problems of today by using concepts from the Hebrew nomadic wilderness experiences requires well thought out transitions. I am not convinced that, in the seventy pages she allows herself to discuss modern problems of man’s interaction with the wild, she is able to deal adequately with the problems encountered in such a transition.

Rightly Bratton writes ‘we are mistaking the oxogatinal task when we look for conservation directives in the Scriptures’. But the fourteen biblically-based principles she then seeks to establish have, I fear, been addressed before by a number of writers and bring us nothing new except perhaps Bratton’s emphasis on God’s joy in his creation. The taxing step is the next one—putting such basic principles into practice. Bratton leaves herself three or four pages at the end of this 350 page book to skim the surface of these practical problems. But then such issues can perhaps only be dealt with in a case-by-case manner. Models and principles are a valuable starting block but if you remain on the starting block the race can hardly be said to have begun!

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Phillip E. Johnson

Darwin on Trial

Monarch 1994 195 pp. £7.99

This book was reviewed in its USA edition in Vol. 5, No. 1 1993 of this journal.

This UK edition is unchanged. A USA lawyer argues on scientific grounds against large-scale evolution as an adequate explanation of the biological world. Without God’s total control the present theories are inadequate and evolution has become a substitute fundamentalist faith for many.

Hugh Montefiore (ed. & intr.), The Gospel and Contemporary Culture


In the early 1980’s Leslie Newbigin wrote a book entitled The Other Side of 1984, which considered the problems involved in addressing the gospel to modern western culture. He followed this with a number of books on this theme, including Foolishness to the Greeks (1986) and The Gospel in a Pluralist Society (1989). In these works he analyses the state of modern culture and especially the inheritance of the Enlightenment. One aspect which receives especial attention is the privatisation of religion. In Western culture there is a dichotomy between the public and private realms. The former is the objective realm of facts and knowledge; the latter is the subjective realm of beliefs and values. Religion is relegated to the latter realm, as a matter of private personal opinion. Newbigin is concerned to oppose this relegation of religion to the private realm and devoted to this theme his book Truth to Tell. The Gospel as Public Truth (1991).

In the light of Newbigin’s concerns the British Council of Churches established a campaign programme entitled The Gospel and our Culture ‘to examine how the Christian Church can effectively confess its faith within the public life of the world’. One of the aims of this programme was to organise a large-scale consultation on the theme
of The Gospel as Public Truth. This took place at Swarwick in July 1992, jointly sponsored by the Bible Society. The book here reviewed was published as an introduction to the consultation, as a basis for further discussion there.

The book, like the consultation, is multi-disciplinary. There are chapters on history, science, the arts, epistemology, economics, education, health and the mass media. The aim of the essays, according to Montefiore's introduction, is to examine these disciplines in the light of the Christian gospel, to subject them to the critique of the Christian gospel (pp. 6, 8). How successful are they in that aim?

Like the consultation itself, the book is decidedly mixed. Some of the papers are excellent. Eric Ives' 'The Gospel and history' is a competent defence of a Christian approach to history, Colin Gunton's 'Knowledge and culture: towards an epistemology of the concrete' is a highly compressed critique of modern epistemologies with an outline of a Christian approach to epistemology. These two, and other, chapters are serious and stimulating attempts to approach their disciplines from a Christian perspective.

Some of the other chapters are less satisfactory. One example will suffice. In 'Contemporary culture and the role of economics', Brenda Watson subjects the neo-classical economics of the right to a critique the vast majority of which could have been written by any secular critic from the left. Whether or not one agrees with it will depend almost entirely upon one's political stance, not one's Christian faith. She begins with a theological statement and an affirmation that there is to be no dichotomy between religion and economics. Good and well, but it would not be too difficult for a Christian economist of 'the right' to start with exactly the same introduction and to develop their own economics on the basis of it. In other words, it is not the gospel that determines the particular economic stance being taken.

Throughout the essay the target is 'economism' which she defines as imposing 'the primacy of economic causes or factors as the main source of cultural meanings and values'. But while this might be an accurate charge against Marxism, it is surely a caricature of modern western culture. Even those who place the greatest stress on the importance of economic efficiency do so as means to other ends (e.g. the ability to treat more patients or to teach more students) not as an end in itself. Most of the critique in this paper is based too much on caricature to carry conviction with her target.

The rhetorical nature of the essay can be seen from the two occasions in the main body of the paper where scripture is cited. Twice there is reference to the parable of the vineyard workers (Matt. 20:1–13) (together with other parables) and this parable obviously contains for the author a very important Christian contribution to economics. But it is far from obvious that the purpose of that parable was to teach a lesson about economics and it is hard to conceive of any society this side of the Parousia where those who work one hour are on principle paid the same as those who work all day. If that is the distinctively Christian contribution to economics, it is hardly surprising that the Christian faith is not taken more seriously by intelligent people. One might as well take the story of Jesus walking on the water as the paradigm for handling the exchange rate.

In short, this is a mixed volume of papers, some of which are excellent, others of which leave a lot to be desired.

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